Fine WoodWorking

August 1991, No.89
U.S. $4.95, Canada $5.95, U.K. £2.95

All About Dado Blades

Build a Trestle Table

Water-Base Finishes

Turned Chess Set

Tablesaw Crosscut Box

Building an Open Hutch

READER SERVICE NO. 67

Photo: Gary Weisenburger

Kelly Mehler tells how to build a tablesaw crosscut box on p. 72. Tablesawn moldings and hand-tooled bead add dimension to Ron Layport's maple hutch (article on p. 46). Cover photo by Chuck Fuhrer.

Executive Editor Jim Boesel
Art Director Kathleen Rushton
Senior Editor Dick Burrows
Associate Editor Sandor Nagyszalanczy
Assistant Editors Charley Robinson, Gary Weisenburger
Copy Editor Carolyn Kovachik
Assistant Art Director Aaron Azevedo
Editorial Assistant Alec Waters
Editorial Secretary Claire Warner
Contributing Editors Tage Frid, R. Bruce Hoadley, Christian Becksvoort, Michael Dresdner, Mark Duginske
Consulting Editors George Frank, Richard E. Preiss, Norman Vandal
Methods of Work Jim Richey
Indexer Harriet Hodges

Publisher John Lively
Assistant Publisher James P. Chiavelli
Circulation Manager Brenda Hamilton
Publisher's Assistant Thomas Baker
Associate Art Director Wendy Bowes
Production Coordinator Sherry Duhigg
Telemarketing/Customer Service Lori Moir
Administrative Secretary Susan M. Clark

Advertising Sales Manager Dick West
National Accounts Manager Don Schroder
Associate Accounts Manager Barney Barrett
Senior Sales Coordinator Carole Weckesser
Advertising Coordinator Kathryn Mournian Simonds
Advertising Secretary Betsy Quintiliano
Tel. (800) 283-7252 Fax. (203) 426-3434

Fine Woodworking is a reader-written magazine. We welcome proposals, manuscripts, photographs and ideas from our readers, amateur or professional. We'll acknowledge all submissions and return those we can't publish. Send your contributions to *Fine Woodworking*, PO Box 5506, Newtown, Conn. 06470-5506.

Fine Woodworking (ISSN 0361-3453) is published bimonthly, January, March, May, July, September and November, by The Taunton Press, Inc., Newtown, CT 06470. Telephone (203) 426-8171. Second-class postage paid at Newtown, CT 06470, and additional mailing offices. GST #123210981. **Subscription rates:** United States and possessions, $25 for one year, $45 for two years, $66 for three years; Canada and other countries, $30 for one year, $55 for two years, $80 for three years (in U.S. dollars, please). Single copy, $4.95. Single copies outside U.S. and possessions: U.K., £2.95; other countries and possessions, $5.95. Send to Subscription Dept., The Taunton Press, PO Box 5506, Newtown, CT 06470-5506. For orders only, call (800) 888-8286. Address all correspondence to the appropriate department (Subscription, Editorial, or Advertising), The Taunton Press, 63 South Main Street, PO Box 5506, Newtown, CT 06470-5506. U.S. newsstand distribution: Eastern News Distributors, Inc., 1130 Cleveland Road, Sandusky, OH 44870. List management: The Kleid Co., 530 5th Ave., New York, NY 10036-5101.

DEPARTMENTS

ARTICLES

Postmaster: Send address changes to *Fine Woodworking*, The Taunton Press, Inc., PO Box 5506, Newtown, CT 06470-5506.

A magazine is a clearinghouse for ideas, especially if the journal is reader written like ours. We seek out skilled woodworkers and other experts and give them an opportunity to pass on their special knowledge. Along the way, we often find others with different points of view. Sometimes these new opinions contradict our experts, but mostly they just enlarge our field of vision. The end result is that we all learn more. This learning curve is ensured as long as our readers keep sharing their experiences with us, as they did in the letters cited below.

The mystery of salt-cured gunstock—In the "Q&A" column of *FWW* #87, wood technologist Jon Arno responded to a question from Sinclair W. Chiles III of Bethlehem, Pa., about whether salt-curing could cause a walnut gunstock to swell and split. Arno said he'd never heard of salt-cured wood. As it turns out, several readers have. In response to their letters, Arno called Browning Arms, the maker of the shotgun in question, and here's what he learned about salt-curing.

"Apparently, in the 1960s, Browning Arms and several other firearms manufacturers experimented with drying gunstocks using salt. According to the folks at Browning, the process involved layering green gunstock blanks with salt in much the same way one might salt down a fish. The salt quickly dehydrated the wood, but unfortunately, the wood also absorbed considerable amounts of salt. Although the problem was not discovered until years after the stocks were put into production, the high salt concentration caused some serious difficulties, especially in regard to corrosion of the metal parts, which are in contact with the stock. Although Browning didn't mention it, I suspect that because salt is extremely hygroscopic, it would also cause the stock to have an inordinately high affinity for moisture, and this could cause the wood to swell—the problem described by Mr. Chiles in his original letter to 'Q&A.'

A technical adviser at Browning also said that a water solution of 0.1% ($\frac{1}{10}$ of 1%) silver nitrate could be used to determine if a stock had been salt cured. First, scrape the finish off a small area of the stock, preferably in an inconspicuous place such as under the butt plate, and apply a drop of the solution to the raw wood. If the stock is salty, the spot will turn white. Over the years, Browning has tried to assist customers with corrosion problems due to salt-cured stocks. For information, write Browning Arms, Morgan, Utah 84050, or call (801) 876-2711."

Feedback on tuning your router—Lynwood W. Reed of Manchester, Conn., objected to contributing editor Mark Duginske's article on router tune-ups in *FWW* #86. Reed, a machine designer and engineer by trade and a woodworker for more than 20 years, said Duginske was wrong in recommending abrasive pads for cleaning the plunge router's slides, tapered collet and arbor. Reed states that "abrasive pads remove material, and no matter how minute it may be, over time and with repeated cleanings, this could cause unacceptable slop between the sliding members." He recommends cleaning these parts with a mild solvent on a soft cloth. Secondly, Reed points out that the oil-impregnated, sintered-bronze bushings, upon which the head slides on most plunge routers, should be lubricated "with a light machine oil, wiped on with a soft cloth" instead of with wax or a dry lubricant as Duginske suggested. In addition, he says that cleaning his router baseplates with furniture polish allows them to glide easily. Finally, Reed says that using compressed air to blow chips and dust off a router only tends to blow them into the very places from which you want to remove them. He wipes the outside of the router after use, and allows the router's internal air flow to blow any dust from the housing.

Duginske regrets any confusion caused by his recommendation on abrasive pads, and responded to Reed's letter by saying, "The goal when caring for a router is to clean, but not damage, the machined and polished surfaces. Sandpaper and coarse steel wool can scratch the mating surfaces and remove material from the collet, cone and column, thus compromising the fit. However, the plastic mesh pads that I use to clean these parts are scouring pads found in most grocery stores. These pads are 'teflon safe,' meaning they are designed not to scratch a hard surface." After reading Reed's letter, Duginske bought every plastic mesh pad he could find to see if they would scratch the blade of a steel square, which would be about as hard as the router slides. He found that the scouring pads didn't cause scratches, but that 3M Scotch-Brite brand pads did and should be avoided. "All of these plastic pads look and feel very similar, and so unless the pad is clearly marked teflon safe, you'll need to make the scratch test to tell the difference."

Duginske felt that Reed's other suggestions were acceptable options, except for the one about applying furniture polish to router baseplates. Duginske warns that "furniture polishes and car waxes contain a high percentage of silicones, which can contaminate bare wood and cause problems when finishing." For more information on silicone contamination, see *FWW* #77, pp. 64-67. Duginske said he treats router baseplates, saw tables and plunge-router columns with Behlen's paste wax, applied with a teflon-safe plastic mesh pad, which is just rough enough to remove any accumulation of pitch, dried wax or dirt as the wax is applied. Any excess wax can be removed with a clean rag.

Maple-leaf rag—One last note. A couple readers wrote about the leaf shape that Duginske is sawing in the photo on p. 64 of *FWW* #88 to demonstrate the cutting radius of a $\frac{1}{16}$-in.-wide bandsaw blade. Sandor Nagyszalanczy, the editor of that article, wrote the caption for the photo and called it a maple leaf. Chris Mulcahy from Robbinston, Maine, and Paul Tobler from Sand Lake, N.Y., both questioned that call, insisting Duginske is sawing an oak leaf. Sandor blames the dispute on foreshortening in the photograph, but on behalf of all readers who agree that it is indeed an oak leaf, we'll continue to give Sandor a hard time about it. □

Jim Boesel is executive editor of *FWW*.

TAUNTON PUBLICATIONS

...by fellow enthusiasts

The Taunton Press: Paul Roman, *president*; Janice A. Roman, *vice president*; Carolyn Kovaleski, *administrative secretary*; Roger Barnes, *design director*. **Accounting:** Wayne Reynolds, *controller*; Patrick Lamontagne, *manager*; Jeffrey Sherman, *financial analyst*; Mary Sullivan, *accountant*; Carolyn Stiles, *senior cost accounting clerk*; Carol Diehm, *accounts payable supervisor*; Susan Burke, *accounts payable clerk*; Lawrence Rice, *credit supervisor*; Lydia Krikorian, *senior collections clerk*; Judith Rivera, Victoria Theobald, *collections clerks*; Diana D'Onofrio, Elaine Yamin, *senior accounting clerks*; Dorothy Dreher, *secretary*. **Books/Videos:** John Kelsey, *publisher*; Marcie Seigel, *administrative secretary*; Deborah Cannarella, *editor*; Christine Timmons, *senior editor*; Jeffrey Beneke, *associate editor*; Andrew Schultz, *assistant editor*; Barbara Hudson, *secretary*; Videos: Craig Umanoff, *associate producer*; Thomas Menard, *assistant producer*; Art/Production: Robert Olab, *manager*; Deborah Fillion, *senior book designer*; Henry Roth, *associate art director*; Catherine Cassidy, Jodie Delohery, *assistant art directors*; Iliana Koehler, *production assistant*; Copy/Production: Ruth Dobsevage, *managing editor*; Peter Chapman, Pamela Purrone, *copy/production editors*; Marketing: Jon Miller, *director*; Andrea Ondak, *manager*; Barbara Buckalew, Eileen Hanson, *marketing assistants*; Philip Allard, *promotion services coordinator*; Steven Hunter, *art director*; Fran Arninio, *secretary*. **Folkwear:** Cheryl Clark, *manager*; Carol Gee, *administrative assistant*. **Corporate Marketing:** Dale Brown, *corporate sales director*; Donna Pierpont, *public relations manager*; Diane Patterson, *executive secretary*. **Data Processing:** Drew Salisbury, *manager*; Brendan Bowe, *fulfillment systems manager*; Roger Seliga, *senior programmer/analyst*; Gabriel Dunn, *programmer*; Robert Nielsen, *PC programmer*; Ellen Wolf, *network administrator*; Sherill Kolakowski, *computer support technician*. **Fulfillment & Operations:** Tom Luxeder, *director*; Jane Torrence, *secretary*; Circulation: Patricia williamson, *client services coordinator*; Roxanne Frimmet, *client services representative*; Customer Service (Subscriber): Patricia Malouff, *manager*; Nancy Schoch, *senior customer service rep*; Diane Hurvul, Marylou Thompson; Mail Processing: Joyce McWilliam, *supervisor*; Gayle Hammond, Barbara Lowe; Customer Service (Trade): Christine Cosacchi, *supervisor*; Gloria Carson, Peggy LeBlanc, Denise Pascal, *data entry*; Distribution: Paul Seipold, *manager*; Grace Aumuller, David Blasko, Michael Capalbo, James Chappuis, Linnea Ingram, Mary Ann Costagliola, Fred Monnes, Alice Saxton, Astor Taylor, Robert Weinstein; Purchasing & Facilities: William Schappert, *manager*; Lois Beck, *office-services supervisor*; John Zor, *mail services*; Chuck Hollis, *maintenance foreman*; Mark Cole, *assistant*; Christopher Myers, *buyer*; Donna Freeman, *chef/supervisor*; Kathleen Costello, Norma-Jean Taylor, *cafeteria assistants*; Subscription: Carole Ando, *manager*; Connie Barczak, Donna Baxter, Bonnie Beardsley, Brigitte Blais, Marie Pato, Andrea Shorrock. **Manufacturing:** Kathleen Davis, *director*; Austin E. Starbird, *prepress manager*; Robert Marsala, *graphic arts supervisor*; Susan Kahn, *staff photographer*; Thomas Greco, *production manager/books*; Philip VanKirk, *production manager/magazines*; Diane Flanagan, *production manager/promotion*; Mary Beth Cleary, Deborah Baldwin, Rosemary Pagel, *print production associates*; Tracie Pavlik, *secretary*; Nancy Atkinson, Chansam Thammavongsa, *production assistants*; Richard Booth, Deborah Cooper, *color center supervisors*; Mark Coleman, William Godfrey, Laurene Jakab, *Designmaster system operators*; Margot Knorr, *publication applications manager*; Monica Bulson, *desktop publishing associate*; Nancy Knapp, *composition production coordinator*; Lisa Carlson, *systems operator*. **Personnel:** Carol Marotti, *manager*; Linda Ballerini, Chris Lincoln, *personnel assistants*; Denise DePaola, *secretary*.

Secret-door pivot—After reading about Carl Jordan's and Tim O'Brien's method for building a pivoting cabinet (*FWW* #88), I decided to pass along a technique that has been very successful for my company. We use standard automotive front-wheel bearings both above and below the pivoting cabinet. We take the bearing apart and weld both the race and the bearing to separate ¼-in. steel plates. Holes bored in the plates allow the units to be screwed to the top and bottom of a cabinet or to a floor or ceiling.

In a typical installation, we would screw the plate with the race to the floor and the plate with the bearing underneath the cabinet. The plates must be located at the pivot point, directly in line with each other, so that the bearing will fit into the race when the cabinet is installed.

The top mounting fixture is a little more elaborate. We screw a plate and bearing to the top of the cabinet, again centered on the pivot point. Then we weld a section of ¾-in.-dia. threaded galvanized pipe to the back side of the plate holding the race. To ensure a smooth pivot, the pipe must be centered directly above the race. Next, we screw a ¾-in. pipe flange to the ceiling, once more centered on the pivot point directly above the race plate screwed to the floor. A section of ¾-in. threaded pipe is screwed all the way into the flange, and then a pipe coupling is threaded onto the other end of the pipe.

After setting the cabinet in the lower mounting assembly, we fit the threaded-pipe-and-race unit onto the top bearing and adjust the coupling so that it connects the flange pipe to the pipe attached to the race. Sometimes it's necessary to adjust the position of the pipe flange to make the cabinet plumb and level. After the cabinet is set properly, the desired casing is installed around the unit, as needed.

With all due respect to Jordan and O'Brien, I cringe at the idea of spending $500 for hinges that will only carry 400 lbs. Our system offers plenty of strength; we've even used it to pivot a cabinet large enough to serve as a hidden door for a secret room that held a customer's "treasures." In addition, since our method prevents the cabinet from shifting side to side, there is no need for casters, except if the cabinet can't be built strong enough to resist racking. I dislike casters because they leave a telltale track on carpet every time the unit is opened and closed.

—*Richard Van Ausdal, Woodinville, Wash.*

Shelves for rare books—I have a few comments about Chris Minick's answer in *FWW* #88 regarding the use of wood, wood products and finishes for archival storage and display of photographs and rare books. The Library of Congress agrees that steel shelves with baked-on enamel are the best for archival storage; that's what I use in my back room where my slides are stored.

I also have a small collection of rare books that I wanted to display in my living room where a steel bookcase would be out of place. My solution was to build a bookcase using solid wood to minimize the chemicals released into the air (and thus into the books). I finished the piece with polyurethane and allowed it to cure for two weeks before bringing it into service.

Finally, I placed a piece of archival mat board on each shelf as a barrier between the wood and the books. Also, pieces of mat board placed between the end books and the sides of the bookcase protect the covers of those books. This mat board is widely available in many colors, sometimes with the color continuous throughout the thickness of the board. I recommend that the mat board be checked from time to time for any discoloration, which would indicate the absorption of harmful chemicals and the need to replace the mat. I should point out that I have no scientific data to support this practice, but it seems better than nothing.

—*Henry H. Hartley, Gaithersburg, Md.*

Recycle wrappers—I was very happy to receive my May/June *Fine Woodworking* in the recyclable paper wrapper. And I'd like to share with readers a few uses for the plain brown wrapper that *FWW* arrives in. Rather than throw the wrapper away, you can recycle it a few more times yourself! Reversed, it is unmarked, and you can use it as a cover on hardback books that you keep around the shop. It may also be inserted in the glue joint between turning blanks and scrapwood blocks so you can easily separate the pieces after the lathe work is done. Additionally, you could use it to catch excess glue from a clamping job. You can draw plans or patterns on it, or use it simply as scratch paper. It is excellent for wrapping up brushes for storage. I'm sure that other readers could come up with many more uses for the paper wrapping.

At least we can reuse the paper wrap; we could only throw away the plastic wrappers. Remember to reuse and not just refuse! Recycling does make a difference.

—*Bob Wheeler, Ridgecrest, Cal.*

That suspicious powder—I repair and restore furniture for a living, and I read Don Goff's letter and Walter Tschinkel's response in the March/April 1991 issue with some skepticism. Mr. Goff says he found one small hole, and yet "every few days I see fine wood powder in the drawers." This must be some voracious beetle!

Mr. Goff doesn't mention whether the chest has dust panels between the drawers, but the fact that the dust is in several drawers would lead me to believe the problem may well be worn drawer runners and drawer sides. These parts, when worn, will often produce a fine powder of ground-up wood, which can be mistaken for damage from wood worms or beetles.

Before Mr. Goff calls in an exterminator, I suggest he move the drawers from front to back and side to side, and inspect them for wear.

—*Robert S. Judd, Canton, Mass.*

More on lead inlay—I agree entirely with Lance Patterson's reply to the query regarding lead in *FWW* #86, p. 22. However, here's a slightly easier method, which is employed by many restorers in England. Instead of cutting lead sheet, they use lead solder, which is easily obtainable in several diameters and gives a very good match. Solid solder, not flux core, is best. Follow Patterson's instructions for inlaying. It would be worth checking to see if modern lead-free solders give a better match, but I have not tried this yet.

—*Arthur Kingdon, Chippenham, Wiltshire, England*

Maintaining all forests—I have been following the discussion of how wood consumption affects the environment. The letters that have been published involve both tropical rain forests and large trees in residential areas. I hope that a few comments about harvesting timber in northern California will be of interest to readers.

Last summer, the harvesting issue was a focal point of much discussion on California forest-management practices on both private and public forests because of Prop. 130, or Forests Forever, on the November ballot. Corporate timber interests and many others supported an even-aged management system for conifers. This system regarded indigenous hardwoods as weed trees suitable only for pulp. The hardwoods would have been cut, along with the old-growth softwood species, to make way for even-aged stands of more softwoods to be harvested as soon as they were profitable. Environmentalists supported outright preservation of some of the few remaining old-growth forests, as well as forestry reforms, including a ban on clear cutting and provisions limiting harvests to the yield sustainable over time.

As a woodworker, I recognized that my livelihood depends on harvesting trees. But as I listened to the discussion, I realized that my livelihood also depends on maintaining systems that allow or sustain the growth of trees until they reach an age when quality wood develops. The original old-growth forest that was here when the white man came is either gone or disappearing

quickly. If a viable supply of wood for woodworkers and consumers is to be maintained, then the regenerative ability of our forests must be restored and sustained. The remaining old-growth ecosystems are the only models we have that we can be sure are truly sustainable.

It is ironic that the increased concern for the fate of the tropical rain forests and the efforts to reduce consumption of tropical hardwoods will increase the demand for and the value of our own temperate rain forests. Although I support the concern for tropical forests, I am also concerned about our own. It is in the long-term economic self-interest of woodworkers that all timber harvesting be done with respect for the interrelationships that sustain forest growth. *—John Rogers, Redway, Cal.*

Dial calipers and a better buffer—I found two articles in *FWW* #87 most interesting because of my experiences in the subjects. The first was Robert Vaughan's article on using dial indicators and calipers. I have a machine shop as well as a wood shop, and have long been using these and many other precision tools, such as matched parallel blocks and a micrometer, in my cabinet work.

I'd like to comment on selecting the tools. Over the years, I have ruined at least four high-grade dial calipers, most of which had shrouds designed to protect finely machined components in the caliper. I simply cannot put the caliper in a box after every measurement, and despite the shrouded rack, fine sawdust gets into the rack and gearing. This causes the teeth to skip and finally ruins the device. Cleaning is difficult, and professional reconditioning costs almost as much as a new unit.

Several years ago, I purchased a digital electronic caliper. It has an easy-to-read display in either U.S. measurements or metrics, and a floating zero for gauging supposedly identical parts. Most importantly, it has exhibited none of the dust sensitivity of the rack type. The digital electronic calipers have come down in price and are available for little more then the old rack type. I bought mine from Harbor Freight Tools, 3491 Mission Oaks Blvd., Camarillo, Cal. 93011-6010; it retails for $64.99. I recommend this unit over the rack type for any shop.

My second point concerns the article by Scott Lawrence on p. 70 entitled "Auto-Body Tips for Fine Finishes." I have been using nearly the same equipment, and I can vouch for the time savings and superior results, when a little care and skill are employed.

However, there is one point with which I take issue: the use of a lamb's-wool buff for the polishing. I used to polish with a lamb's-wool buff, but found that its surface became matted and left rings of different textures in an otherwise fine finish. Then a skilled auto finisher told me about Meguiar's Hi-Tech Finesse Polishing Pad, 8 in. dia., part no. W-1000 (Meguiar's, 17991 Mitchell S., Irvine, Cal. 92714). The results are just spectacular compared to the lamb's-wool buff. All the professional auto finishers I know use this pad.

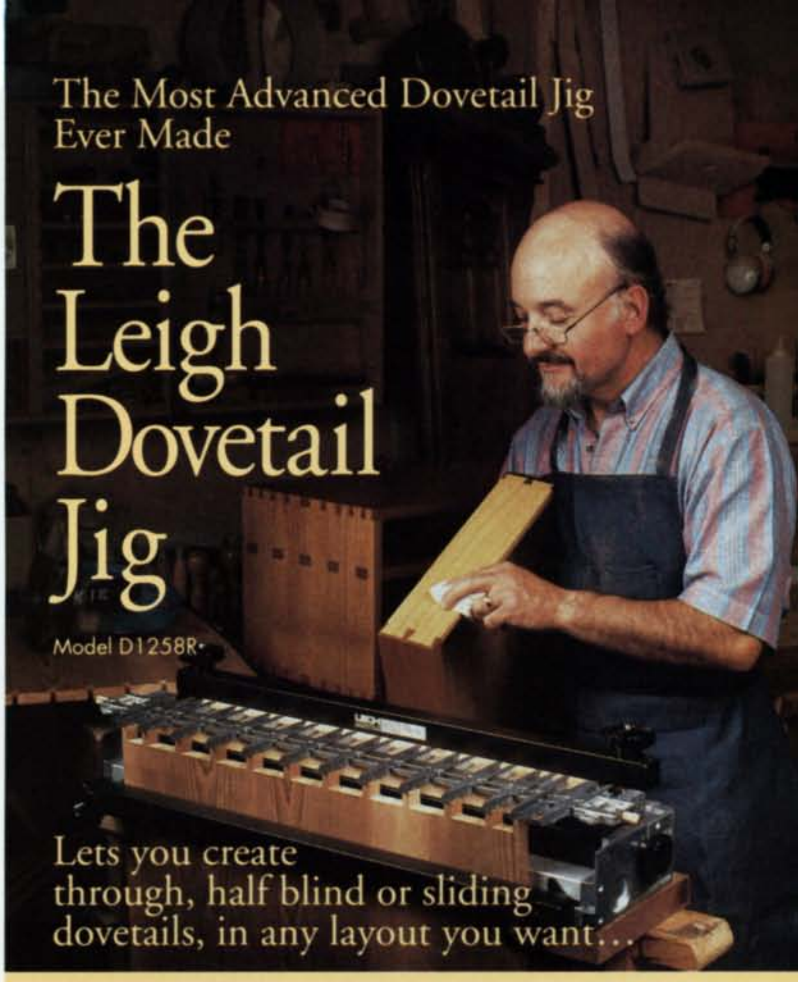
Incidentally, Meguiar's also has a line of Hi-Tech Finesse Sanding Papers with grits from S-1005 to S-2005. I use the latter. The papers should be soaked in water with a bit of detergent for at least four hours prior to use, or they leave irreparable scratches. Soaked as noted, these papers are the best I have ever used. Also, using Meguiar's No. 1 Glaze on the company's buffing pad will eliminate any scratches in a few passes.

—W.E. Diefenderfer, Glastonbury, Conn.

Update on air-line connectors—I have just finished reading *FWW* #85. Okay, so I am a bit behind! On p. 26, there is a question regarding the interchangeability of quick-change com-

READER SERVICE NO. 38

READER SERVICE NO. 204



▲ Coffee table made with Leigh MMTA, using 1¼" finish walnut and maple.

pressed-air couplings. In general, I would agree with the answer given—that there are sometimes enough differences among brands that they aren't interchangeable—but would add that there are a number of quasi-standards in existence. The standard that I use, perhaps the most popular, is called Industrial Interchange. Other styles are known by their proprietary names, such as Lincoln and Aro. Major manufacturers, such as those listed in the article, produce fittings that are interchangeable with all major lines.

Also, there are two general types of female connectors: the more popular one, which can "let go" sometimes when dragged across the shop floor, and the safer type, which requires two hands to open. It would seem best to standardize fittings in one's shop on the basis of the largest-size hose used and to use the same type of connectors for all air lines, no matter what hose size (within reason, of course).

Regarding the "Plate Joiner Primer" on p. 91 of the same issue, this tool (system) was invented and produced in Europe, and all the measurements involved are in the metric system. Why did the author omit such an important fact? It's especially important because the three sizes of biscuits and the all-important sawblade are metric. Hey, we live in a metric world now!

—Roger S. Apted, Milton, Wisc.

Safety is an attitude—I'd like to talk about something that's becoming a pet peeve of mine. It's not directed at *Fine Woodworking* specifically—it pervades the woodworking media—but I think *FWW* is the best forum. I'm upset by the phrase: "Sawblade guard removed for clarity." I see this caption and trailer on almost every photograph and video showing a tablesaw in use. As an experienced woodworker and woodworking teacher, it annoys me that in most cases, the operation being shown would be impossible with the usual splitter-mounted guard in place!

I get the feeling that this caveat is mandated by the legal department, but it's a disservice to the readers. I'm as concerned about safety as anybody, but this is just a legal platitude. What would help is to explain that the guard can't be used in this case and here's what's being done to make the operation as safe as possible. Maybe it would be a good idea to offer several options, alternatives or thoughts on jigs or other setups.

As I tell my students, "When you get right down to it, safety is not just guards; it is not just face masks; it is not just push sticks. *Safety is an attitude*—a conscious awareness of what you're doing and how to do it the best way possible. No guard is going to protect you from an inattentive, sloppy approach to using dangerous machinery."

I know that this is a pretty controversial subject, but it's worth discussion. I would like to know what other readers think.

—Dennis Preston, Brookfield, Conn.

Avoiding a narrow miss—In response to David Arnold's narrow miss in *FWW* #87, p. 6, I've seen this type of kickback occur before. It's generally the result of two factors: the lack of off-feed support for the work and lateral pressure on the push stick.

As Arnold fed the stock through the saw, the unsupported end became heavier and heavier. This required him to put increasingly greater pressure down on the board. As the stock cleared the fence-mounted hold-down, he had to add lateral pressure to the push stick. The hold-down then became a hazard because it blocked the path of his hand. To get around the hold-down, he pivoted his hand toward the blade, and the pressure he applied shifted toward the fence. These factors caused the stock to roll

READER SERVICE NO. 81

over, and that was when the kickback occurred.

Use hold-downs only where they do not interfere with comfortable and straightforward use of your saw, such as when you're working with wider stock. Not using an off-feed support forces you to take a wide variety of risks as you try to hold whatever piece of stock you're trying to cut. In Arnold's case, this resulted in a kickback. But there was also the risk of his hand or the push stick slipping and his hand moving straight toward the blade, propelled by a great deal of pressure. To counter this potential problem, use a 4-in.-tall fence. Grip the push stick with your thumb and first two fingers, and allow your smaller two fingers to slide down the top of the fence. If you slip, the push stick is lost, but that's its purpose. And your hand is holding onto the fence.

Arnold is to be commended. He made the effort to use several safety measures, and they did benefit him. We must be constantly aware of the force that a saw motor can generate and just what that force can do. *–Scott Nelson, Arlington, Tex.*

Bandsaw tires improve performance–This is a suggestion regarding alignment and use of bandsaws. *FWW* #75 had a great article advising readers that bandsaws are capable of making straight cuts and resawing lumber *if* the saw is properly aligned. A key part of alignment is to make the wheels coplanar. After following the instructions in the article and aligning my 14-in. Delta, I found things had gone from bad (crooked cuts) to worse. The worse was that the tire on the upper wheel immediately worked its way up over the rim and off the wheel, which made the tool inoperable.

My frustration has finally been resolved. I am told the tire may have been defective originally. In any case, replacing each tire with a new, tight one resolved the problem. I found that by removing the wheel and mounting it in a vise, the tire could be fairly easily stretched onto the rim. Perhaps this will be valuable to others. *–Harvey W. Gleeksman, Cranbury, N.J.*

Paying projects–I'd like to add some thoughts to Brian Keller's letter on paying projects (*FWW* #86). The part-professional level he describes is the same kind many of us work on. I've been making ships in bottles and knives on that level for some years, and I agree very much with Mr. Keller. One point that I think can't be emphasized enough is to get the plans accepted *before* you even touch the tools. Or, preferably, have the customer do at least one sketch before you make the plans. My experience is that many customers have a picture in their heads of what they want, and they expect you to magically read their minds and transform that into solid work. If the finished product doesn't look like their vision, they are disappointed. So make sure you and the customer agree on what the product is to look like.

It is also advisable to get paid in full when you deliver the product. Be wary of delivering the product, but getting paid later. I've done projects where I spent half as much time reminding, calling and writing the customer about getting paid as I spent working on the job in the first place. In some cases, I still have to put the job on the "Just Forget It" account. When you're working on a small budget, you can't do this and survive. *–Lasse Carenvall, Stenungsund, Sweden*

Scientific guidelines for prices–I couldn't help noticing "Pricing not an exact science" in the "Letters" column of *FWW* #87. As a small-shop owner, I also agree that there is no exact science associated with pricing, but there are definitely scientific guidelines.

For example, I use a simple, computerized estimating pro-

gram that I wrote using Lotus 1-2-3 software. After refining the program to meet my needs, I noticed something interesting: my estimated hours multiplied by my hourly wage added to the cost of materials plus a percentage of profit on labor and material often closely approximated two and one-half to three times my materials cost. Those are my approximate factors; I'll bet other shops have something similar. Of course, my estimated hours to complete a job and my labor rate are going to be different than those at another shop, due to such things as skill, machinery, work habits and customer affluence. Frequently, these ingredients cannot be exactly measured, but we're talking about estimates, approximates and guidelines. Anyway, once I noticed the 3-to-1 relationship between my calculated bid and my material costs, I altered my computer program to estimate the bid price using both approaches as a double-check; now, I refine the bid that I think will give me the competitive edge. Then, with the bid out of the way and the contract in hand, I can do what I really enjoy—make custom cabinets and remodel a room.

I did one other thing to get an indication of how competitive my prices are. I sketched a kitchen with proposed cabinets and took this sketch to a large national fabricator who had a sophisticated, computerized pricing program. I got the company to develop a price for the cabinets, and then I compared the fabricator's price with my price for the same design. This gave me a good guideline as to where my cabinet estimating stood. I seldom build kitchen cabinets, but this comparison gave me a feel about how my estimating system was working and where I was in the cabinetmaking neighborhood. You can't come up with an exact price out front, but there are many ways to estimate. Once you get a track record and an insight into your winning estimates, pricing becomes less and less a major mystery.

One last point. I don't think that most small-shop owners realize how effective an inexpensive computer can be in their business. For some reason, we erroneously associate computers only with corporations and not with a little shop that manufacturers specialized, one-of-a-kind products. If you don't let the darn thing own you, it can be a really helpful partner.

—Ed Young, Santa Ana, Cal.

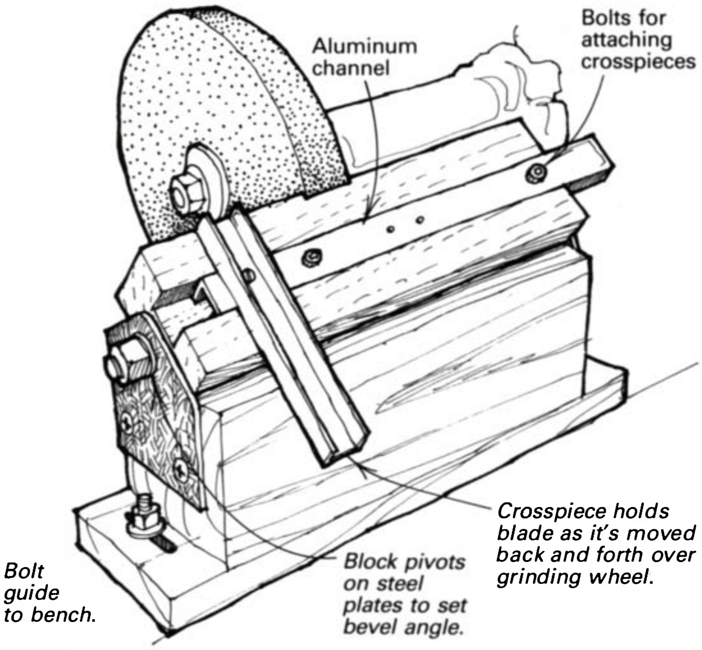
Free business counseling—I'd like to add to the hints for a successful business given in *FWW* #88, p. 6. Any person wanting to go into woodworking or any other business can receive free counseling from a SCORE (Service Corps of Retired Executives) counselor. SCORE has 12,000 volunteers across the United States ready to help anyone who is interested in starting a business or who is having problems staying in business, woodworking or otherwise. To contact a SCORE counselor, write to your closest Small Business Administration office or the Small Business Administration, Washington, D.C. All counseling is free of charge.

—Harold DeNoon, Arcadia, Cal.

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

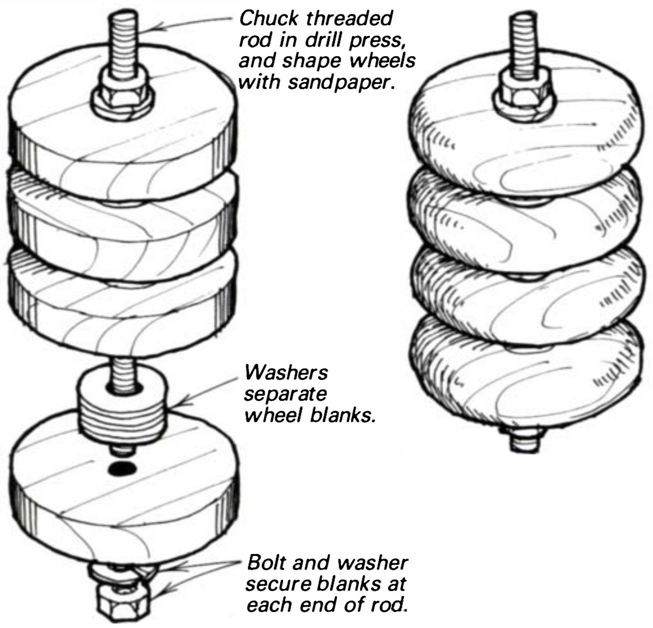
—John Lively, publisher

Adjustable blade-grinding fixture



This grinding fixture is very flexible because its pivoting hardwood block lets you adjust the angle between the blade and grinding wheel, and it can handle a wide range of blade widths. The pivoting hardwood block is attached to a wood base fitted with steel end plates, as shown above. To make it, cut a slot in the top of the pivoting block to accept a length of aluminum channel. Fit this channel with various screw holes or attachments, such as the crosspiece shown, to hold each blade correctly as it's moved back and forth across the face of the grinding wheel. Wax the channel regularly to keep it running smoothly. To provide maximum support for the blade during grinding, cut out a section of the pivoting block just in front of the grinding wheel so you can move the assembly as close to the wheel as possible. *—David Shackleton, White Rock, B.C., Canada*

Sanding toy wheels

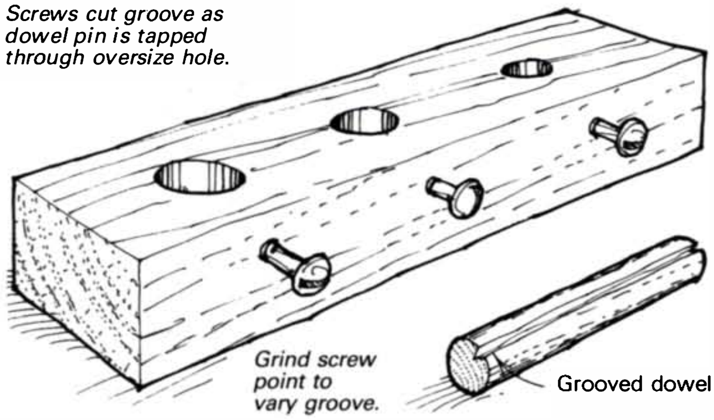


My toy vehicles are so popular with my grandchildren that I have a constant demand for wheels. I speed production by using the gang-sanding setup shown in the sketch to true the wheels and round them over in a single operation.

After roughing out the wheel blanks with a hole saw or fly-cutter, mount the blanks on a threaded rod with four or five washers between each blank, and chuck the rod in your drill press. Use sandpaper on a block of wood to true up the diameters of the wheels. Round over each wheel's edge with hand-held sandpaper, but wear a thick leather glove to absorb the heat. *—William J. Sallans, Houston, Tex.*

Quick tip: "Plasti-Clear," a spray sold by marine-supply stores for cleaning plastic windshields and instrument covers, is excellent for reducing static and dust buildup on plastic face shields in the shop. *—Susan S. Ellison, Oxford, Md.*

Grooving dowels

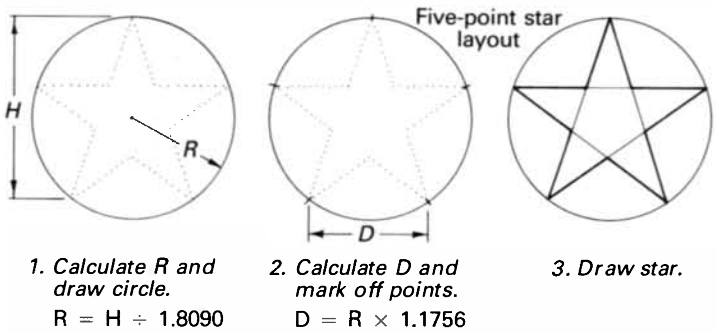


Grooved dowel pins disperse glue and hydraulic pressure in a joint better than straight pins. It's easy to groove your own dowels if you make this simple fixture. Drill a hole through a maple or oak block; the hole should be about 1/32 in. larger than the dowel being used. Then drive one or more steel screws in from the sides of the block, so that the point of each protrudes slightly into the hole. The ends of the screws may be shaped on a grinder, if you desire. To groove the dowel, tap it through the hole with a mallet. *—R. Richardson, New Iberia, La.*

EDITOR'S NOTE: A similar method was submitted by Donald Pelton of Colorado Springs, Colo.

Quick tip: 3M's Spray Mount adhesive, available from art-supply stores, is great for attaching sandpaper to sanding blocks and sanding discs and for tacking peel-off paper patterns right to the wood. *—Robert M. Vaughn, Roanoke, Va.*

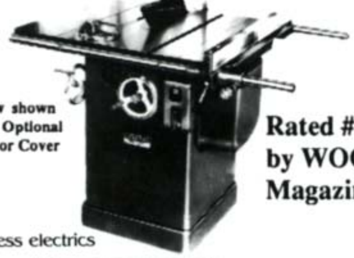
Laying out a five-point star



I recently needed to lay out a symmetrical five-point star. Since using a protractor can be time-consuming, I developed a quick and easy method that allows me to lay out any size star with only a compass and a calculator. To avoid strange fractions in your calculations, you should work in centimeters instead of inches.

To lay out a star of height (H), divide H by 1.8090 to find the radius (R) of the layout circle. Set your compass to R, and draw a circle. Multiply the radius distance by 1.1756 to determine the distance (D) between the points of the star. Reset your compass to D.

Rated #1



Rated # 1 by WOOD® Magazine

* Less electrics

GENERAL Tools

Built to last a lifetime

* 10" Table Saw standard fence 350-1	$1245
* with 50" Beisemeyer fence 350-T50	$1385
* with 50" Paralock or Excalibur 350P50/E5	$1465
* 15" Bandsaw enclosed stand 490-1	$845
* Variable Speed Lathe 160-2	$1100
Variable Speed Lathe 1hp 260-1	$2175
* 8" Jointer enclosed stand 480-1	$1450
* 15" Drill Press 6 Speed 34-01	$530
* 3/4 "' Spindle Shaper 2800-B	$1395
* 1 1/4" Spindle Shaper SS032	Call
* 14" Radial Arm Saw V154	Call
* Dowel Machine 3/8"-11/4" DM-032	$695

To Order or get Information:

SISCO SUPPLY Inc.
102 Kimball Ave
So. Burlington, Vt. 05403

802-863-9036

READER SERVICE NO. 30

SANDPAPER

IF IT IS ABRASIVE WE'VE GOT IT!

BELTS
GRITS ASSORTED UNLESS OTHERWISE SPECIFIED

1x30	$ .73ea	3x24	$ .84ea
1x42	.73ea	3x27	.87ea
1x44	.73ea	4x21 3/4	.96ea
2 1/2x16	.77ea	4x24	.99ea
3x18	.78ea	4x36	1.20ea
3x21	.81 ea	6x48	3.14ea
3x23 3/4	.84ea	2 1/4x80	2.79ea

WE MAKE ABRASIVE BELTS ANY SIZE, ANY GRIT.

SHEETS: (9x11)

FINISHING PAPER

	50/pk	100/pk
80-A	$9.00	$17.00
100 thru 280A	8.00	15.00

CABINET PAPER

	50/pk	100/pk
40-D	$17.00	$32.00
50-D	16.00	28.00
60-D	15.00	26.00
80-D	14.00	24.00
100 thru 150C	13.00	22.00

NO LOAD PAPER

	50/pk	100/pk
180-A thru 400-A	$11.00	$19.00

JUMBO CLEANING STICK $8.80

WET/DRY PAPER

	50/pk	100/pk
220 thru 600A	$14.00	$24.00

OTHER ITEMS

*WIDE BELTS
*ROLLS
*FLAP WHEELS
*PUMP SLEEVES
*PSA DISCS
*ROUTER BITS
*WOOD GLUE
*VELCRO DISCS

Econ-Abrasives
P. O. Box F865021
Plano, TX 75086

*MINIMUM ORDER $25.00
*MasterCard, VISA, or Check
*SATISFACTION GUARANTEED!!!
*CALL FOR FREE 1991 CATALOG

TX & NV Add Sales Taxes
Continental U. S. Shipping Charges add $5.50

NATIONAL (800)367-4101

READER SERVICE NO. 37

For that "SPECIAL" project

TABLE BASES W/ CARVED FEET (TABLE SLIDES AVAILABLE)

BILLIARD TABLE LEGS

In stock
No minimum

Free Brochure

COUNTRY KITCHEN LEGS

Adams Wood Products, Inc.
974 Forest Dr., Dept. Q-9
Morristown, TN 37814 • Phone (615) 587-2942

READER SERVICE NO. 1

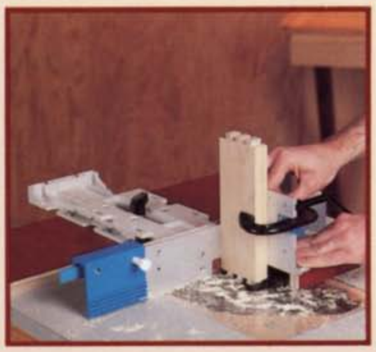
HOW WOULD YOU DO WORK LIKE THIS WITHOUT Incra Jig®

U.S. PATENT #4,793,604

and the INCRA Precision Woodworking System

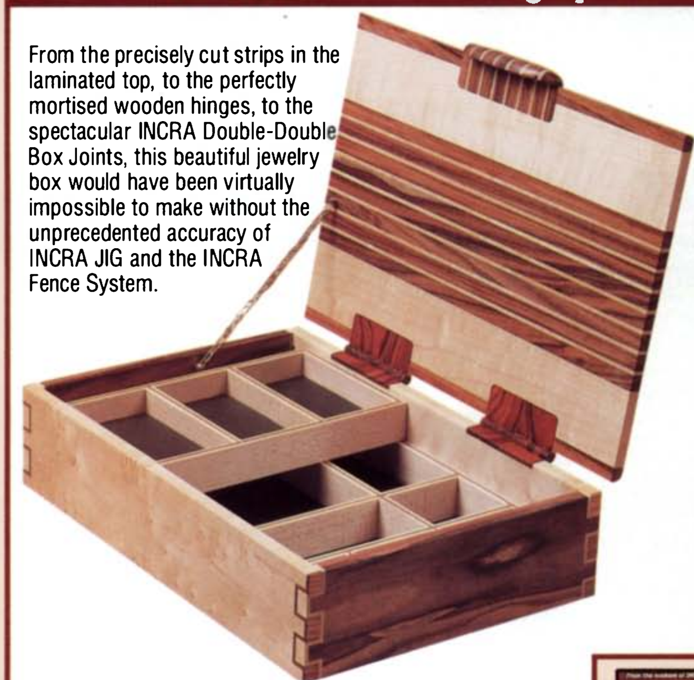
The INCRA SYSTEM includes:

- INCRA JIG
- Aluminum INCRA FENCE SYSTEM with the patented INCRA STOP
- INCRA Right Angle Fixture
- The Official INCRA JIG Handbook & Templates
- INCRA GAUGE
- NEW! The Complete INCRA JIG VIDEO

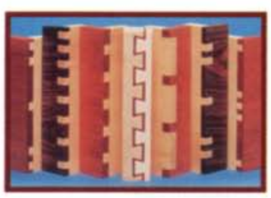


INCRA Precision Woodworking System

From the precisely cut strips in the laminated top, to the perfectly mortised wooden hinges, to the spectacular INCRA Double-Double Box Joints, this beautiful jewelry box would have been virtually impossible to make without the unprecedented accuracy of INCRA JIG and the INCRA Fence System.



This wide selection of beautiful joinery can be easily accomplished with INCRA JIG and the official INCRA JIG Handbook & Templates.



For a FREE brochure and your nearest dealer, write to:
Taylor Design Group, Inc.
P.O. 810262 Dallas, TX 75381

From the simplicity of half blind and through dovetails, to intricate joinery like the new INCRA Double-Double Through Dovetail, INCRA JIG makes it all possible.

The Complete INCRA JIG VIDEO
This 1 hour video has step-by-step instructions, by the inventor, for making box joints as well as half blind, sliding, and through dovetails, plus much more. Includes full video instructions and FREE templates and plans for making the INCRA Double-Double Box Joint.

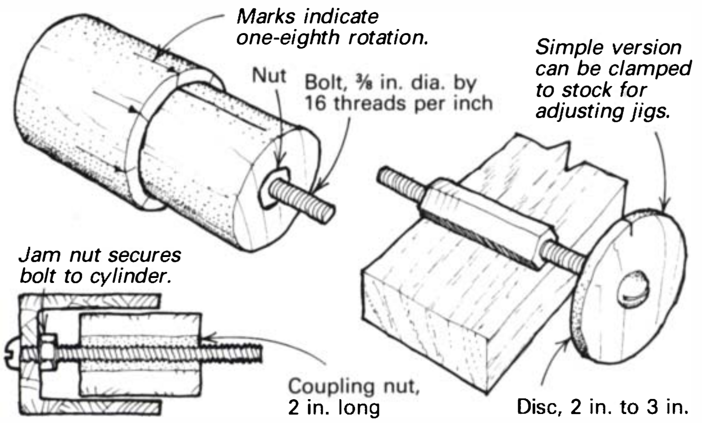
NEW

Now, start at the top of the circle and move from point to point, marking five equidistant points on the circumference of the circle. To complete the star, connect every other point with a straight line.

For example, if you want a star that's 10cm tall, first determine the radius of the circle using the formula H divided by 1.8090. If the height is 10, then the radius equals 5.5279.

Now, set your compass to 5.5279, and draw a circle before calculating the distance (D) between points. You can determine the distance by multiplying the radius (R) by 1.1756. In this case, D will be 6.4986. Set the compass to 6.4986 and mark out the points of the star. *—Daniel V. Bass, Anaheim, Cal.*

Shopmade woodworker's micrometer



You can assemble a micrometer, accurate to within 1/256 in., with a 60-cent nut and bolt from your local hardware store. Don't believe me? If you disassemble a machinist's micrometer, you will find a 2-in.-long, 40-teeth-per-inch (t.p.i.) bolt running in a 1/2-in. matching nut.

I make my woodworker's micrometer by running an ordinary 3/8-in., 16-t.p.i. bolt in a matching 2-in.-long coupling nut. The extra threads of the long nut increase the accuracy of the unit.

Since the bolt has 16 t.p.i., its head moves 1/16 in. with each revolution. Using a dial indicator to test the movement, I have consistently obtained accuracies of better than 0.0002 in 2 in. of bolt. By mounting a disc on the head of the bolt and drawing a centerline to divide the disc into halves, you can easily obtain 1/32-in. increments with the same repeatable accuracy. Divide the disc into quarters and eighths to get 1/64-in. and 1/256-in. movements. You can make a fancy micrometer, like the model shown on the left side of the sketch, or just clamp the nut, shown on the right side of the sketch, in place and rotate the head of the bolt in quarter or half revolutions with almost equal accuracy. *—R. Entwistle, Winter Park, Fla.*

Quick tip: Try applying wiping stain with a spray gun. It goes on faster and more uniformly, and then wipes off with fewer rags. *—Robert M. Vaughn, Roanoke, Va.*

Securing machines with adhesive

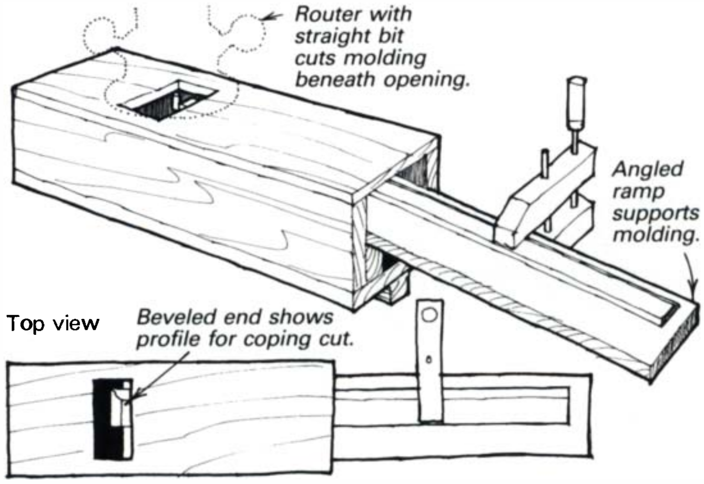
The usual solution for securing benches and machines is to bolt them to the workshop floor. An alternative to this is to literally glue the equipment to the floor with a high-quality panel-and-construction adhesive. After you have positioned your machines, level them with small wooden shims. Then use a caulking gun to run a bead around the base of the equipment, and smooth the bead quickly with your finger. When the adhe-

READER SERVICE NO. 51

sive cures, it becomes very durable and hard. The benches won't rock when you are working, and the machines won't creep. If you decide to relocate a machine in the future, you can simply remove the adhesive with a chisel.

–Richard H. Dorn, Oelwein, Ia.

Coping molding with a router



A coped joint fits and looks better than a mitered joint. So when I replaced all the base molding in my home, I decided to cope the joints at the inside corners of the rooms. Traditionally, joints are coped by first cutting a 45° miter on the end of one piece of molding and then using a coping saw to cut along the curved line created where the miter cut intersects the molding's surface. This trims the end to the exact reverse section of the molding so that it will butt into the other piece of molding already installed tightly in the corner. Being fundamentally inept with hand tools, my attempts at sawing the joint fell far short of my expectations. Finally, I came up with the following router-based fixture, which makes this job more tolerable.

The fixture is a rectangular box with one open end, into which a wood ramp is inserted at a 20° angle. A rectangular hole is cut into the top of the box above the end of the ramp. A 2x4 attached to the bottom of the box enables the whole fixture to be clamped into a Work-Mate portable workbench.

To use the fixture, cut the end of the molding at 45° so that the profile on the end shows the area to be coped away. Alternatively, you can scribe the molding with the shape to be cut and score any straight sections with a utility knife. In either case, insert the molding into the box and clamp it onto the ramp. Chuck a 3/16-in. straight bit in a router and insert the bit through the hole in the top of the fixture. Turn on the router and follow the scribed line to cut off the end of the molding. The angle of the ramp creates a slight back cut at the shaped edge, which makes the pieces fit together better. Before unclamping the workpiece, check the fit by inserting a short piece of molding through the top. Any necessary fine adjustments can be made with a file.

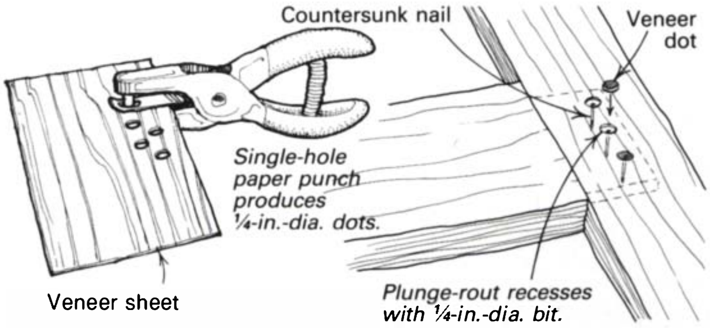
Once the molding is unclamped, the coped joint should fit quite well. After the first couple of tries, I became quite proficient with this system. The cuts were smooth, and the fit was better than anything I had previously achieved with a coping saw.

–Scott Ashworth, Mars, Pa.

Quick tip: I mounted electric outlets on all my stationary power tools and wired them so they are always hot. Now I not only

have outlets on the walls, but throughout the shop for plugging in portable electric tools. *—Kenneth Kasal, Chelsea, Iowa*

Concealing nail holes

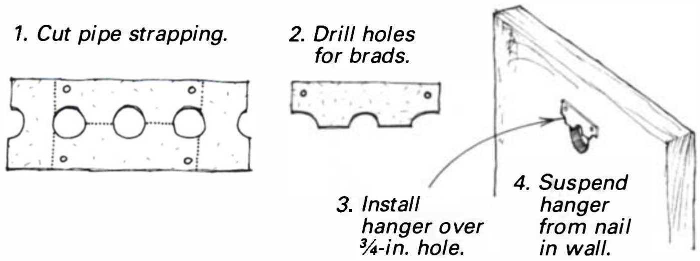


I discovered a technique for covering nail holes while rebuilding a crib for my newborn son. The side rails of the crib were fastened with mortise-and-tenon joints pinned with nails. Even though the nails were countersunk and filled, I didn't like the look.

After making several unsuccessful attempts at inlaying veneer over the nails, I remembered that a standard, hand-held paper punch, available from any office-supply store, makes a ¼-in.-dia. hole. The tool was perfect for punching out little dots from a sheet of walnut veneer. I chucked a ¼-in.-dia. straight bit in my plunge router, set the depth for slightly less than the veneer's thickness, and cut a clean recess over the countersunk nail. Be sure the nail is countersunk well below the depth of the hole to avoid damage or injury. The punched veneer dot snapped perfectly into the recess. If you repeat the procedure on each side of the mortise, the joint will look as if it has been pinned through with a walnut dowel. *—David W. Kemink, AFOSI Detachment 4201*

Quick tip: If you wax nails before using them, drill a small hole in the bottom of your hammer handle and fill it with molten wax. This way, the lubricant will always be handy.
—Bradley D. Hankins, Arlington, Tex.

Low-cost picture-frame hanger



To make a quick, low-cost picture-frame hanger, use tin snips to cut a piece of metal pipe strapping, available from hardware stores, to the shape shown in the sketch. Drill a couple of small holes in the hanger so you can fasten it with brads over a ¾-in. recess in the back of a picture frame.
—Bill Webster, Chillicothe, Ill.

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

Bending cherry for Shaker boxes

I am having poor success with my first attempt at bending 1/8-in.-thick cherry for the sides of oval Shaker boxes; the wood breaks long before it conforms to the shape of my 7½-in.-long elliptical mold. I leave the wood in a steamer for 30 minutes, and it seems adequately pliable. Could the cherry have become brittle from being stored in a dry, hot attic for the last 15 years? Can you recommend a better way to make cherry more bendable? ***—Gaylen Garner, Dubuque, Iowa***

Drew Langsner replies: I don't believe that the age or the storage conditions of your cherry lumber was a factor that led to the broken bent sides. Most likely, your bending failures were due to the type and quality of the wood that was used. To begin with, cherry is, at best, rated only fair in its bendability. Even among professional Shaker box makers, cherry is considered a difficult wood to bend. Better choices would include ash, beech, birch, red and white oak (high-grade material only) and Western cedar.

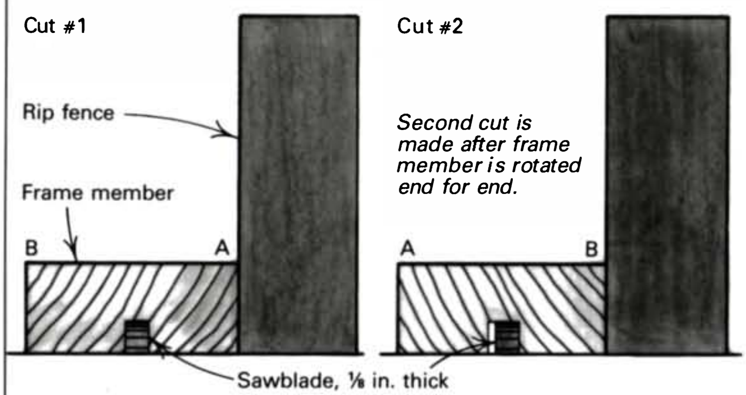
For best bending success, the wood needs to be perfectly straight grained, with practically no fiber runout along the edges and with no defects. This is why bending stock is often split (or "rived" using a froe) from a board or billet rather than sawn, as the splitting process follows the grain of the wood. Figured wood is also not a good candidate for bending stock.

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

Centering frame dadoes for thin plywood

I find working with imported 1/4-in. plywood frustrating. Because the plywood is considerably less than its stated thickness, I can't use a regular 1/4-in. dado blade in the tablesaw to cut a groove in a panel frame and expect a snug fit. What is a good method for making such a narrow groove? And is there an easy way to exactly center these grooves in cabinet stiles and rails? ***—John Oram, Denver, Colo.***

Sandor Nagyszalanczy replies: One trick I've often used for cutting a centered dado in a frame member for 1/4-in. imported plywood, which is typically just slightly thicker than 3/16 in., is as follows. First, I mount a standard 1/8-in. kerf sawblade in my tablesaw and drop in a close-fitting throat plate (to minimize tearout). Next, I set my frame stile or rail on top of the saw on edge, lay a scrap of the thin plywood next to it, and measure from the surface of the plywood to the top edge of the member. I divide that distance in half, and then use this measurement to set the distance between the rip fence and sawblade. After setting sawblade height the same as the depth of the desired groove, I make two passes on each member, as shown in the drawing below.



After running one edge against the fence, I rotate the workpiece end for end and take another cut, this time with the other edge riding along the fence. It's a good idea to make the first groove on a spare frame piece; if you made your initial measurement and set the fence accurately, the groove should be just right. If the groove is too narrow, tap the fence just a hair closer to the blade and take two more passes. Don't move the fence any more than a hair though; each increment of movement is doubled because you're recutting each edge of the groove.

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

Evening up the color of cherry

I recently built a cherry bedroom set and ended up with some objectionable stripes of white sapwood on some areas of the pieces. I didn't use any stain during finishing. When the cherry darkens over time, will the sapwood areas also darken or will the contrast only become more pronounced?

—Steve Barrett, Kalispell, Mont.

Jon Arno replies: Regrettably, the prospects are dim that time will help mellow the sharp contrast between cherry heartwood and sapwood. The color of the heartwood in most of the darker species of cabinetwoods tends to fade with time and exposure to light, but cherry is a notable exception. If the contrast changes at all over the first few years, and it most likely will, it will become substantially ***more*** pronounced. The reason the heartwood is a different color than the sapwood is because the heartwood has been impregnated by chemicals, such as nutrients and decay inhibitors, which the living tree produces and transports along the rays for storage in the dead, interior cells of the wood. (This is true in virtually all woods.) Some of these chemical compounds are fairly complex and tend to polymerize into pigments with differing sensitivities to light, depending upon the species. While in some woods the pigments will fade when exposed to light, in others, such as cherry, light actually darkens the pigments. Since cherry's almost stark-white sapwood lacks pigment, it will simply tend to yellow a little over time, taking on the appearance of dirty ivory. The heartwood, on the other hand, will undergo the patina-building process for which cherry is well known, and shift from a pinkish-tan color to a richer and darker amber orange.

I wish I could offer a totally reliable remedy, but I don't think there is one, short of lightening the wood's natural color with very strong bleach and then staining the entire piece. Perhaps a little touch-up stain, artfully applied to just the sapwood streaks, might help make the contrast less noticeable, but it won't solve the problem entirely. Further, given cherry's perpetually changing patina, even if the match is perfect when the stain is applied, it won't stay that way.

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

Traditional cock-beading methods

I am planning to build a Newport style block-front chest. I've always assumed that the cock beading was a separate piece of wood, applied to the dividers, but this doesn't seem to hold true for Newport style block-front furniture. What are the traditional as well as more modern methods of application?

—John Messinger, Kenmore, N.Y.

Lance Patterson replies: While it is generally true that cock beading wasn't traditionally applied as separate pieces on horizontal dividers, there are many examples where the vertical cock beading on case ends is applied into a rabbet. However, in my opinion, it is best to not apply any of the beading on a quality piece of furniture.

There are two main approaches to making the cock beading on the blocked dividers and the case ends. The first approach, which most beginners think of and try first, is to shape all the beading on the parts prior to any glue-up. You need to grind shaper knives or a router bit to match the beading profile, and you need to use a rub collar or pilot bearing (above the cutter) that follows a template. Then, the drawer fronts and drawers must be made and adjusted to fit the case and dividers. Unfortu-

SLICKPLANE

WITH CARBIDE CUTTERS!

This finely made plane works as good as its name for softening edges on all kinds of woodworking projects, virtually eliminating time consuming sanding. The body is 6" long and made of select rock maple sanded smooth and finished with a clear lacquer. Contours are ergonomically designed to reduce fatigue and to be comfortable in the hand. A brass sole attached to the body provides support to glide the plane over the wood. The two replaceable carbide-tipped cutters can be independently adjusted for complete depth of cut control. The *SLICKPLANE* is available from quality mail-order and retail dealers. Call **1-206-734-3482** for the dealer nearest you. **Dealer inquiries are welcome.**

WOODSTOCK INTERNATIONAL INC

WOODWORKING TOOLS AND ACCESSORIES

91W-101 P.O. BOX 2027• BELLINGHAM, WA 98227• USA

READER SERVICE NO. 83

TURN YOUR ROUTER INTO AN INDEXABLE HORIZONTAL MILLING STATION

WOODCHUCK™

Indexing Router Table

Add precision, elegance and beauty to your next project! Using the Woodchuck indexing router table system you can build eye-catching pedestals, table legs, bed posts and frame work. Easily make indexed tapers, flutes, and accent cuts or add mortises, dovetails slots, dados, rabbits and traditional joinery. Make a lasting impression.

30 min. video ...... $19.95 .... $3.00 S/H
Product Info $2.00

Models Available:

IRT-33 H ... $289.00 .....33" X 8" home version
IRT-33 P .... $395.00 ......33" X 8" shop version
IRT-80 P .... $595.00 ......80" X 8" shop version

Or send $89.00 for indexing table kit you can build yourself. Kit includes - factory built indexing head and indexing plates, blue prints and "how to" video tape.

Phantom Engineering, Inc.
16890 Church St. Bldg. 13
Morgan Hill, CA 95037
(408) 779-1616

SATISFACTION GUARANTEED
VISA & MASTERCARD ACCEPTED

READER SERVICE NO. 85

AmMax TOOL CO.

Precision tools for skillful woodworkers

FREE
* Complete catatlog sent upon order.
* Plastic caliper ($4.00 value) for any order.

TUNGSTEN CARBIDE TIPPED TOOLS

CALL TOLL FREE

1-800-782-6629 (NATIONWIDE)
(619)535-8940 (CALIFORNIA)

CUTTER	TOOL #	CUT DIA.	CUT L.	SNK D.	PRICE
Straight	ST206	1/4	3/4	1/4	5.50
	ST208	5/16	3/4	1/4	5.50
	ST210	3/8	1	1/4	5.50
	ST213	1/2	1	1/4	5.50
	ST216	5/8	1	1/4	6.25
	ST219	3/4	3/4	1/4	8.95
	ST406	1/4	3/4	1/2	5.50
	ST408	5/16	1	1/2	5.50
	ST410	3/8	1	1/2	5.50
	ST413	1/2	1	1/2	5.50
	ST413L	1/2	1-3/16	1/2	6.95
	ST413E	1/2	2"	1/2	13.95
	ST416	5/8	1-3/16	1/2	7.50
	ST419	3/4	1-3/16	1/2	8.95
	ST422	7/8	1-3/16	1/2	10.50
	ST425	1	1-3/16	1/2	10.95
Flush Trim	FT210P	3/8	1/2	1/4	6.00
	FT210	3/8	1	1/4	6.50
	FT213	1/2	1	1/4	6.95
	FT213L	1/2	1-1/2	1/4	10.50
	FT410	3/8	1-3/16	1/2	6.50
	FT413	1/2	1-3/16	1/2	6.95
	FT413L	1/2	1-1/2	1/2	10.50
Dovetail	DV210	3/8	3/8	1/4	4.95
	DV213	1/2	1/2	1/4	4.95
	DV410	3/8	3/8	1/2	4.95
	DV413	1/2	1/2	1/2	4.95
	DV416	5/8	3/4	1/2	6.50
	DV419	3/4	1	1/2	6.95
	DV425	1	7/8	1/2	8.95
Core Box	CB206	1/4	1/4	1/4	8.00
	CB210	3/8	1/4	1/4	9.00
	CB213	1/2	5/16	1/4	11.00
	CB216	5/8	3/8	1/4	12.50
	CB219	3/4	1/2	1/4	14.00
	CB413	1/2	5/16	1/2	11.00
	CB416	5/8	3/8	1/2	12.50
	CB419	3/4	1/2	1/2	14.00
	CB422	7/8	5/8	1/2	16.95
	CB425	1	5/8	1/2	17.95
	CB432	1-1/4	3/4	1/2	25.95
	CB438	1-1/2	7/8	1/2	28.95
45° Chamfer	CH210	1	3/8	1/4	12.00
	CH213	1-3/16	1/2	1/4	12.00
	CH216	1-3/8	5/8	1/4	13.50
	CH416	1-3/8	5/8	1/2	14.00
	CH419	1-5/8	3/4	1/2	16.00
	CH422	1-7/8	7/8	1/2	19.00
	CH425	2-1/8	1	1/2	24.00
Rabbet 2 FLUTES	RB232	1-1/4	1/2	1/4	12.00
	RB432	1-1/4	1/2	1/2	12.00
	SL203-2	1-1/4	1/8	1/4	10.00
	SL205-2	1-1/4	3/16	1/4	11.00
	SL206-2	1-1/4	1/4	1/4	11.00
	SL210-2	1-1/4	3/8	1/4	12.00

	TOOL #	RADIU	CUT L.	SNK D.	PRICE
Rounding Over	CR201	1/16	3/8	1/4	10.00
	CR203	1/8	3/8	1/4	10.00
	CR205	3/16	7/16	1/4	10.00
	CR206	1/4	2/1	1/4	11.00
	CR208	5/16	9/16	1/4	12.95
	CR210	3/8	5/8	1/4	14.00
	CR213	1/2	3/4	1/4	16.00
	CR406	1/4	1/2	1/2	11.95
	CR410	3/8	5/8	1/2	14.00
	CR413	1/2	3/4	1/2	16.00
	CR416	5/8	7/8	1/2	19.00
	CR419	3/4	1	1/2	20.00
	CR425	1/2	1-1/4	1/2	32.50
	CR432	1-1/4	1-3/4	1/2	42.95
Roman Ogee	RO204	5/32	1/2	1/4	15.00
	RO206	1/4	3/4	1/4	16.00
	RO404	5/32	1/2	1/2	15.00
	RO406	1/4	3/4	1/2	16.00
Cove	CV203	1/8	3/8	1/4	11.00
	CV205	3/16	7/16	1/4	11.00
	CV206	1/4	1/2	1/4	11.00
	CV208	5/16	1/2	1/4	12.00
	CV210	3/8	1/2	1/4	12.00
	CV213	1/2	5/8	1/4	13.00
	CV406	1/4	1/2	1/2	12.00
	CV410	3/8	1/2	1/2	12.50
	CV413	1/2	1/2	1/2	13.50
	CV419	3/4	7/8	1/2	27.00
Classical	CS203	1/8	5/8	1/4	18.00
	CS206	1/4	7/8	1/4	19.00
	CS403	1/8	5/8	1/2	18.00
	CS406	1/4	7/8	1/2	19.00
HALF ROUND	HR203	1/4 D	5/8	1/4	12.50
	HR205	3/8 D	11/16	1/4	13.50
	HR206	1/2 D	3/4	1/4	14.50
	HR208	5/8 D	1	1/4	16.00
	HR210	3/4 D	1-1/8	1/4	16.00
	HR410	3/4 D	1-1/8	1/2	17.00
	HR413	1 D	1-3/8	1/2	18.00
	HR416	1-1/4 D	1-5/8	1/2	35.00
	HR419	1-1/2 D	1-7/8	1/2	40.00

CARBIDE TIPPED HORIZONTAL PANEL RAISING $49 EACH

* Industrial Quality Grade C3 Tungsten Carbide Tipped
* 3 mm Thickness Carbide Offer Longer Life.

3/4" BORE	C931	C984	C985	C986	C987
1-1/4" BORE		C1084	C1085	C1086	C1087

REDUCING BUSHING: $2 / PAIR

NEW PRODUCTS

2-piece Stile & Rail -- $69 a set

CR01 OG02
BE03 PL04

OGEE FILLET PANEL RAISING
1/2" SHANK ONLY
OF466 2-5/8" $24.00
OF476 3-1/4" $39.00

STILE & RAIL Reversable
RS248 1/4" shank $37
RS448 1/2" shank $37

3 WINGS, 9 CUTTING EDGES
FINGER JOINTER
FJ463 1/2" shank $53

LOCK MITRE
ML470 $34
1/2" shank
FOR 5/8" TO 1-1/8" STOCK

KEY HOLE
KH210
1/4" shank
$6.50

TONGUE & GROOVE
1/4" SHANK $28
FOR 5/8" TO 3/4" STOCK
1/2" SHANK $29
FOR 5/8" TO 1" STOCK

3 WINGS SHAPER CUTTERS 3/4" BORE

V GROOVE C966 $38
V-PANELLING C967 $38
WEDGE TONGUE C903 $32
WEDGE GROOVE C904 $32
REVERSIBLE STILE & RAIL C965 $45
LOCK MITRE C998 $42
FINGER JOINT C961 $69
GLUE JOINT C911 $32

NET 30 DAYS TO GOVERNMENT AGENCIES, SCHOOLS.

SAME DAY SHIPPING *Count on us!*
Shipping is FREE for orders over $60 and is only $2 for smaller orders

SEND YOUR CHECK TO: AMMAX TOOLS CO.
P.O. BOX 520
POWAY, CA 92074

1-800-782-6629

HOURS: MON thru FRI 7 AM to 6 PM
NEW: SAT 8 AM — 2 PM

READER SERVICE NO. 49

nately, fitting and adjusting the large surfaces of the drawer fronts are a lot of work and a hassle.

The second approach is to make the cock beading after the case is glued together and the drawers are done. I think this approach produces a better result with much less hassle. It is visually important that the vertical lines of the blocking line up precisely. To accomplish this, I recommend that the drawer-front blocking (less the shell drawer front) and drawer fronts themselves be clamped together flat on your bench and then cleaned up. I use a shoulder plane, a #50 rasp and an assortment of cabinet scrapers to get the blocking clean and in line.

The dividers should be bandsawn slightly full around the blocking, as they will be shaved down until they protrude the right amount from the drawer fronts. To do this, put the case on its back, and put the drawers in place with blocks of wood underneath and veneer shims in the spaces around the drawers to hold them in position. Now, the dividers can be trimmed down by using a "slip" of wood (about 3⁄32 in. thick) under your spokeshave, chisel, cabinet scraper or plane. The wooden slip will slide along under your tool, acting as a depth stop so the divider projection will be even. I think it is easier to adjust the dividers this way than to adjust all the drawer fronts separately.

Next, with the drawers removed, the bulk of the beading can be cut with the scratch stock. I enjoy using this simple tool, which, in skilled hands, is capable of producing excellent results. This tool can be made quickly by sawing a 3⁄4-in.-thick piece of wood into an L shape. One part of the L should be rounded enough to allow cutter clearance, and the head end should be left flat and square. The cutter is made from a piece of bandsaw or hacksaw blade; as the beading profile is ground or filed, the edge should be left square, and the burr left on. (For more on this, see ***FWW on Making Period Furniture,*** p. 96.)

On the case ends, you should leave extra wood, for outside support of the scratch stock, until the bead is finished. In areas of difficult grain or anywhere it seems necessary, the beading can be rough carved initially. However, the scratch stock should be used for the final cut to give the most uniform results. For either approach I described, the beading on the case's inside corners needs to be carved by hand. A cabinet-scraper blade with a bead shape filed into an end can be used to even up most of this carved corner beading.

[Lance Patterson is the director of the furniture and cabinetmaking program at the North Bennet Street School in Boston, Mass.]

Removing a stuck drill-press chuck

I want to remove the chuck on my old Atlas drill press to fit a mortising attachment, but I don't know how to get the chuck off. Do you have any suggestions?

—Chris Campbell, Lansing, Mich.

Robert M. Vaughan replies: Removing a stuck chuck from an old drill press has always been a bugaboo, particularly when a person isn't sure just how the thing is fastened on the machine in the first place. First, let me define a few terms. A quill is the cylindrical assembly that houses the drill-press bearings, spindle and chuck; the spindle is the main shaft, and the chuck is attached to its end. The quill has a gear rack machined on its back side that engages spur gears on the quill operating pinion. This pinion is connected to the drill-press operating handles; as the handles are turned, the pinion moves the quill up and down.

Without actually seeing your drill press, it's hard to say just how your particular chuck should be removed. There are two conventional ways that chucks are attached to drill presses in the 14-in. to 16-in. size range. Both involve a tapered spindle end (called the "nose") that fits into a tapered socket machined into the chuck. On many better-quality drill presses, a tightening sleeve attached to the back of the chuck tightens over a threaded boss on the spindle, right above the nose. This sleeve will contain two or three shallow holes, about 3⁄16 in. in diameter, to fit a spanner wrench. Although the end of the chuck key will fit into one of these holes snugly, don't succumb to the temptation of using this as a wrench because you will ruin the hole. The sleeve's internal threads typically are right handed. Looking down on top of the spindle, onto the top of the chuck, turn this sleeve clockwise with the proper spanner wrench; the sleeve should screw down on the top of the chuck body (about 1⁄8-in. travel usually). Turning this sleeve against the top of the chuck should pop the chuck loose.

If this method doesn't work or if the sleeve threads are stripped (not an entirely uncommon condition), you'll have to remove the spindle assembly from the drill press. This is usually done by first relieving the spring tension on the quill operating pinion. This can be tricky; so be careful and observe how things go together. Now, pull the quill operating pinion out of the drill-press head, and you should be able to pull the entire quill assembly straight down and out. Take the spindle out of the quill assembly; usually there's a setscrew with a collar at the top. If you loosen that setscrew, the spindle should drive out. Next, open the chuck's jaws fully and look down inside; if a setscrew is holding the chuck on the end of the spindle, take the setscrew out—it's usually a left-handed thread. Insert a metal punch or thin steel rod down through the setscrew hole, and place the punch or rod against the tip of the spindle. Support the chuck and knock the spindle out with gentle blows from a mallet. If there's no setscrew securing the chuck, then you can try driving the chuck off by hammering against a wood block placed behind the chuck. But be careful: A really hard blow can bend the spindle nose, ruining the accuracy of the drill press.

If driving off the chuck doesn't seem easily possible, then as a last resort—and I've had to do this many times—drill a 1⁄4-in. hole through the back of the chuck, stopping as soon as the drill breaks through. Squirt a little WD-40 in the hole, and let the chuck stand for an hour or so. Then get a metal punch and drive off the chuck. If every attempt fails, you might just want to take the quill out of the press, bring it to a machinery-repair shop and let a professional do it. This might be a more expensive solution, but you'll avoid the risk of ruining your drill press.

[Bob Vaughan is a woodworking-machinery rehabilitation specialist in Roanoke, Va.]

Building products from leaves

Most civic municipalities spend a fortune each year to dispose of the billions of leaves that litter city parks and streets. Can leaves be made into some kind of useful building material, as can most of the other parts of a tree?

—Ed Harrison, Madison, N.J.

Bruce Hoadley replies: I am unaware of any building materials produced from the foliage of our temperate-zone conifers or hardwood species. The leaves or needles of trees lack any significant percentage of the cell types that have residual dry strength, and they would therefore be unsuitable as elements for composite products, such as particleboard or fiberboard. Further, I doubt that the yield of usable fibrous materials from leaves would be worth the expense of pulping them. I believe that the use of foliar residues for chemical derivatives and energy production has received some attention, but not for any building-material end uses.

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

Crude oil as a wood finish

Oil wells are common in my area of western Pennsylvania, and it is a common practice here for people to use crude oil as a furniture polish. I've experimented with crude oil and have found it to be an excellent treatment for my own furni-

ture, which is primarily finished with tung oil. I've been told that the oil's performance is due to its mixed hydrocarbon fractions and its natural impurities that together may act as a mild polish. Could you please comment on this practice?

—Daniel J. Nadler, M.D., Sewickley, Pa.

Chris A. Minick replies: On the surface, polishing fine furniture with crude oil seems ridiculous. But after thinking about it for a while, I've concluded that it is indeed foolhardy. Gasoline, kerosene and diesel fuel are distilled directly from crude oil, as are benzene, toluene, asphalt and all sorts of other yuck called "still bottoms." Smearing this stuff on furniture can only lead to problems. Your tung-oil-finished furniture has not been affected by this treatment because tung-oil finishes lack substantial surface build. Conventional film finishes, such as nitrocellulose lacquers and alkyd varnishes, will certainly be softened by the lower-order paraffinic hydrocarbons contained in Pennsylvania-grade crude oil. I'm sure you would think twice before polishing your fine dining-room table with gasoline. The same caution should extend to the use of crude oil as a furniture treatment.

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

Guitarmaking disaster due to the wrong glue

For some time now, I have been building a rosewood guitar from a kit. I was 90% done with it last summer when, to my chagrin, I discovered that the whole thing had popped apart; the back and soundboard had come almost completely off, and the sides had spread at the body's waist. I had used liquid hide glue to attach these parts because I thought it was traditionally used in guitarmaking. After noticing that the glue still felt tacky, I was able to add a bit more glue and get the guitar back together. But is there a chance that it will come apart again when the weather gets humid?

—Nicholas Sarro, East Islip, N.Y.

Grit Laskin replies: The largest percentage of blame for your guitar's problems can be placed on the use of liquid hide glue. No experienced guitarmaker I know would use hide glue on the joints you describe. There is a handful of luthiers who use it in one or two areas of a guitar, but they don't use it for joints under much stress. Instead, we most commonly use an aliphatic resin, or "yellow" adhesive, to glue guitars together. If you refer to Irving Sloane's book *Classical Guitar Construction,* you will find that he not only spells out the problems of using hide glue for general guitar construction, but he also concludes that the use of it in modern guitarmaking is purely a "sentimental attachment to an older approach." I agree with him.

Animal glues readily absorb moisture from the atmosphere and can fail when placed under stress (such as when the curvaceous parts of a guitar body are joined), especially when the glue joints are exposed to humid conditions; I imagine the guitar came apart during a humid summer in New York. Even if your guitar had been complete and finished, the joint separation problem would not have been entirely avoided, although it probably would have been lessened.

The spreading of the guitar's waist is probably due to springback of the thin bent-wood sides. Once these parts were unrestrained by the back and top, they started to straighten out. While this might have been due to the amount of force that was used to bend these parts in the first place, it was more likely due to the high humidity acting on the bare wood.

At this point, all that you can really do is apply finish to the

READER SERVICE NO. 205

READER SERVICE NO. 151

READER SERVICE NO. 4

READER SERVICE NO. 82

guitar, and hope for the best. I recommend coating the inside with a sealer; be sure to apply finish on the juncture of the back, top and sides. I don't recommend forcing the joints apart and trying to reglue them again, and definitely don't try to reglue the joints with yellow glue, since it won't stick properly to the hide-glue-coated surfaces. Unfortunately, when the humid weather arrives this summer, your guitar might come apart again. Here are some guidelines to follow in the future: Assemble all crucial joints on a guitar at the same humidity level and as close in time to one another as possible; and put a finish of some kind on the instrument as soon as it is ready.
[William "Grit" Laskin is a custom-guitar builder in Toronto, Ont., Canada.]

Finishing to protect woods' color

I intend to panel my new home with tongue-and-groove yellow poplar. How would you recommend finishing this wood to keep its natural greenish color from fading?

—Mike Hobgood, Tylertown, Miss.

I recently read that an application of Armor-All brand automotive protectant can preserve the natural color of exotic woods. Does this really work, and will the Armor-All also protect the color of other exotics, such as rosewood, padauk, cocobolo and osage orange?

—Dan Quackenbush, Olathe, Kan.

Michael Dresdner replies: Oxidation and light are probably the two biggest factors that cause wood to change color over time. This is especially true of some of the more brightly colored woods, including the exotics mentioned, which are often easy prey to these influences. Just about any finish will slow the surface oxidation of wood, but overcoming the effects of light is a bit tougher.

It is generally thought that the ultraviolet (UV) range of the light spectrum is responsible for the lion's share of color fading. For that reason, finish manufacturers routinely add UV "blockers" or "absorbers" to exterior paints and varnishes. However, few manufacturers add them to interior coatings because these are intended for use under artificial lights, which do not put out such a heavy UV concentration. The obvious solution would be to simply choose a finish that contains UV blockers. Sadly, this isn't that easy to do in many cases, since few companies add UV blockers to interior lacquers and varnishes (and fewer still advertise the fact).

I've also heard the suggestion several times that Armor-All, a liquid designed to protect the vinyl on automotive interiors from UV degrade, will protect wood colors from fading as well. This is not surprising since Armor-All contains UV blockers. Unfortunately, it also contains silicone. If it is applied to raw wood prior to coating, the silicone will contaminate the surface and cause fisheyes in most film-type finishes, such as lacquer or varnish. If Armor-All is applied *over* a dry, film-type finish, it will require reapplication every three to six months. On the other hand, it is not likely to create any problems under an oil finish. Incidentally, if you find yourself having to *remove* Armor-All or silicone from a surface, Armor-All makes a "Car Cleaner" that contains a silicone surfactant that helps break silicone's normally tenacious hold on a surface.
[Michael Dresdner is a contributing editor to *FWW* and a finishing consultant in Perkasie, Pa.]

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

3 Things you need for great dovetails:

1. Ten minutes
2. Your router
3. Keller Dovetail System.

You'll be amazed at how easy it is.

"In a class by itself." — *WOOD Magazine*

"Easy to use. Ruggedly constructed." — *FINE WOODWORKING*

"An absolute minimum of set-up fiddling — less than any other jig tested. The jig is simplicity itself." — *AMERICAN WOODWORKER*

Fast set-up. No test cuts. Unlimited widths. Precision joinery. Classic and variable spacing. Compound angles. Box joints. 20-year warranty. Made in USA since 1976.

To find out more, contact your Dealer or

KELLER & CO.
1327 'I' St., Dept. F71
Petaluma, CA 94952
(707) 763-9336

Keller Dovetail System
Simply the best.

READER SERVICE NO. 50

DELMHORST MODEL J-88
Pocket-size Wood Moisture Tester

LED display-type meter indicates ten ranges of wood moisture content between 6 and 20 percent. Ideal for a woodworking shop or serious craftsman.

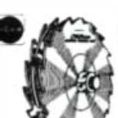
Limited 3-Year Warranty. Shipped complete with carrying case, batteries and pins.

ORDER ONE TODAY!
1-800-222-0638
NJ-201-334-2557

DELMHORST
Instrument Company
P.O. Box 68, Dept. 908
Towaco, NJ 07082

READER SERVICE NO. 24

Oldham
UNITED STATES SAW



1st Time Ever
Square and Flat Dados

No.OS8005818P
Our new and improved 8" carbide dado has a planer style sharpened outside saw rather than the normal alternate top bevel sharpened outside saw. The planer style features 2 alternate top bevel sharpened teeth and then a square sharpened raker tooth. This raker tooth gives the user a perfectly square bottom cut.
The 8" dado is also precision face sharpened with a 600 grit diamond wheel for smooth and easy cutting.

Complete in wood storage case

List 249.00
SPECIAL Introductory Offer $169.00

PHILIPPS BROS. SUPPLY, INC.
Construction and Industrial Supplies
2525 KENSINGTON AVE.
AMHERST, N.Y. 14226-4999 716/839-4800
Call Toll Free 1-800-888-7271 FAX: 716/839-4051

READER SERVICE NO. 68

SawHELPER™
Portable Tool System
MODEL U85SET
MODEL U55SET

(Available 5 or 8 ft. per side measured from blade)

COMPARE FEATURES
- Fits all miter saws, even 15" and Hitachi C8FB compound.
- The only portable system that's truly accurate and sets up in 60 seconds guaranteed.
- Steel self-squaring couplers align fences with saw to 1/100" accuracy-no other system has it!

- Flipstop™ fence gage has hairline pointer for extreme accuracy, lever action, heavy steel construction.
- Extension fences fold to extreme compactness and are made of tempered aluminum and steel. Folding legs ad just 12", support framing lumber.
- Center stand folds flat, includes quick release mounting plate for saw.

SawHELPER™, for 10 years the most accurate, compact, durable, portable system available for miter saws.

AMERICAN DESIGN & ENGINEERING INC.
St. Paul Park, MN
1-612-459-7400
1-800-441-1388

LENEAVE QUALITY—SINCE 1957

NORTHSTATE 15" PLANERS

- **Model 310: *$779***
- Powerful 3 hp motor
- Cast iron construction
- Magnetic switch
- 1 year warranty
- Dust hood
- Anti-kickback
- Stand included

- **Model 315: *$849***
- Same features as the Model 310 plus:
- Table extension
- 2 speeds

NORTHSTATE 10", 12", 14" CABINET SHOP SAWS

- **BIESEMEYER, VEGA, EXCALIBUR fences available**

- 3, 5, 7-1/2 hp motors
- Magnetic controls
- Cast iron top
- Uni-lock fence
- VERY HIGH QUALITY
- ***$1,125*** w/std fence
- ***$1,225*** with 50" rip fence

- **HTC MOBILE BASES**

NORTHSTATE CABINET SHOP SHAPER

- 3 hp/1 ph, 5 hp/3 ph
- 2 speed-reversible
- 2 spindles: 3/4", 1-1/4"
- 1/2", 1" available
- Router collets avail.
- Cast iron table
- Spring hold down & miter gauge
- Extra heavy duty
- 1 year warranty
- ***$1,095***
- FREE FREIGHT
- **Tilt spindle model avail.**

***** FREEBORN*****
Shaper cutters available

Prices Subject to Change

NORTHSTATE PLANERS

- 20", 5 hp: ***$1,350***
- 24", ***$2,795***
- 5 hp & 7-1/2 hp

NORTHSTATE BANOSAWS
- 14", 1 hp: ***$295***
- 18", 2 hp: ***$795***
- 20": ***$1,495***
- 24": ***$2,465***

PORTER CABLE
555: Plate Jointer: ***$157***
330: Sander: ***$53***
360: Sander: ***$174***
505: Sander ***$108***
9505: Commemorative 505: ***$129***
351: Sander: ***$124***
352: Sander: ***$128***
363: Sander: ***$174***
362: Sander: ***$179***
361: Sander: ***$166***
7549: VS jigsaw: ***$134***
9627: Rec. Saw: ***$127***
7519: Router: ***$224***
7538: Router: ***$224***
690: Router: ***$124***
630: Router: ***$118***
314: Saw: ***$124***
315: Saw: ***$114***
9118: Plane Kit: ***$185***
97310: Lam. Trim Kit: ***$184***
7334: Orbital Sander: ***$117***
5116: Omnijig: ***$262***

NORTHSTATE 8" CABINET SHOP JOINTER

- Heavy cast iron const.
- 2 hp, single phase
- 9" x 67" bed
- 3 knife cutter head
- Dual tilt fence
- Magnetic controls
- **SALE: *$795***
- **6" jointer: *$375***
  12" jointer: *$1,895*
- **Delta 8" jointer: *CALL!***

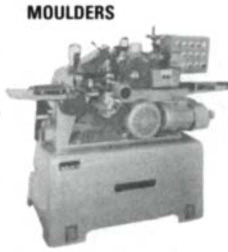
HITACHI
C15FB: Mitre Saw: ***$368***
C8FB: Comp.Mitre: ***$439***
TR-12: Pl. Router: ***$169***
F20A: Plane: ***$97***
CC14: Chop saw: ***$196***
D10D: Cordless Drill: ***$114***
CB75F: Re/band-saw: ***CALL***
M12V: 3 1/4 hp, vs router: ***$228***

DEWALT
7749: Radial Arm Saw: ***$604***
7770-10: Radial Arm Saw: ***$825***
7790: Radial Arm Saw: ***$1068***
1765: Belt/Disc Sander: ***$398***
All Dewalt Ind. radial arm saws available

- ***Freeborn Shaper Cutters***
- ***Mini-Max Machinery***
- ***Adjustable Clamps***

*****PORTER CABLE*****
complete line available

MOULDERS

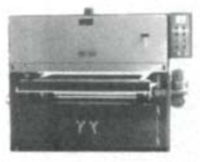


- **Four and Five Head Models**
- Variable speed
- All cast-iron construction
- 2-1/4" x 6" capacity
- Designed to make high quality moulding at the lowest possible cost

RAISED PANEL DOOR MACHINE

UNIQUE: Machine all five components with only one operator

NORTHSTATE WIDE BELT SANDER



- Best buy in the industry!
- Variable speed
- Platen head
- Dual motors
- Heavy cast iron & steel
- Plate construction
- 10, 15, & 20 hp
- 25" List: $8,650
- ***SALE: $5,895,*** 15 hp
- 37" List: $12,900
- ***SALE: $8,888,*** 20 hp
- Phase converter avail.

MINI MAX MACHINERY

NORTHSTATE DUST COLLECTORS

SALE PRICES
- **2 hp, 2 bag: $295**
- **3 hp, 4 bag: $485**

SENCO
- **SN4** ***$475***
- **SN325** ***$399***
- **SFN2** ***$386***
- **SFN1** ***$264***
- **SKS** ***$254***
- **LS2** ***$249***
- **LS5** ***$259***
- **PW** ***$345***

EMGLO 1-1/2 HP compressor ***$298***

DELTA
34-782: Unisaw & All models - Call for promo prices
46-541: Lathe: **Call for promo price**
43-375: Shaper: ***Call for special***
40-560: 16" Scroll Saw **NEW!: *$185***
40-601: Scroll Saw - ***CALL!***
31-730: Belt/Disc Sander: - ***CALL!***
37-350: 8" Jointer w/stand: - ***CALL!***
34-444: 10" Contr. Saw: ***$595***
34-445: 10" w/Unifence - ***CALL!***
28-283: 14" Bandsaw - ***CALL!***
28-245: 14" Bandsaw w/access: - ***CALL!***
17-900: 16-1/2" Drill Press: - ***CALL!***
43-355: Shaper **NEW!**
33-990: 10" Radial Arm Saw: ***$549***
36-755: Tilt arbor saw **NEW!**
32-100: Plate Jointer - **NEW! *CALL!***
22-540: 12" planer **NEW!** - **Call for promo price**
Stock feeders: 34-985, 34-994, 34-995 -Call for promo price
****Complete Delta line available.****

- **BIESEMEYER**
- **VEGA**
- **EXCALIBUR**

fences available

LENEAVE MACHINERY & SUPPLY COMPANY
*305 West Morehead St., Charlotte, NC 28202 (704) 376-7421; Toll free outside NC **800-442-2302***

*** We try not to be undersold, tell us our competitors' prices.**

RYOBI INTRODUCES THE WORKAHOLIC™ OF PRECISION TABLE SAWS.

THE NEW RYOBI BT3000 IS AN INGENIOUS NEW TABLE SAW THAT'S DRAMATICALLY DIFFERENT IN CONCEPT. IT COMBINES THE PERFORMANCE OF A STATIONARY TOOL WITH THE CONVENIENCE OF A PORTABLE TABLE SAW. USING SOPHISTICATED ENGINEERING AND DESIGN, THE BT3000 OFFERS MORE FEATURES, GREATER PRECISION AND MORE VERSATILITY THAN ANY OTHER TOOL IN ITS PRICE RANGE. THE BT3000 IS AN INCOMPARABLE PRECISION CUTTING SYSTEM FOR TRADESMEN AND SERIOUS WOODWORKERS. IN SHORT, IT'S ANOTHER BREAKTHROUGH WORKAHOLIC FROM RYOBI.

RYOBI®

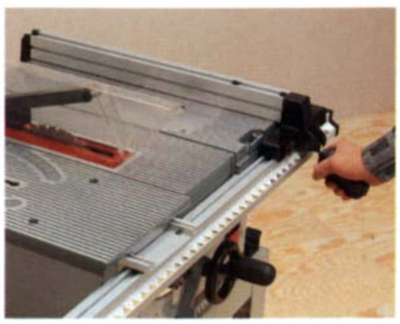
WORKAHOLICS™

NO MATTER HOW YOU CUT IT . . . YOU JUST CAN'T BEAT THE SYSTEM.

THE BT3000 IS MORE THAN JUST A TABLE SAW — IT'S AN ADVANCED CUTTING SYSTEM. AND THERE'S NOTHING LIKE IT ON THE MARKET. NOTHING.

PRECISELY WHAT YOU NEED

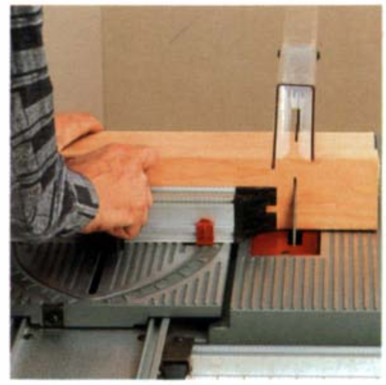
THE BT3000 OFFERS UNMATCHED PRECISION IN A TABLE SAW. FOR INSTANCE, A UNIQUE SLIDING MITER TABLE PROVIDES THE CONTROL AND STABILITY YOU NEED TO MAKE PRECISE CUTS. AN OVERSIZED MITER SCALE PERMITS PIN-POINT ACCURACY. AND AN ADJUSTABLE MITER FENCE ASSURES SMOOTH, EXACT CUTTING; CAN BE POSITIONED RIGHT NEXT TO THE BLADE. SPECIALLY DESIGNED LOCKER BRACKET MINIMIZES VIBRATION AND ENHANCES PRECISION.



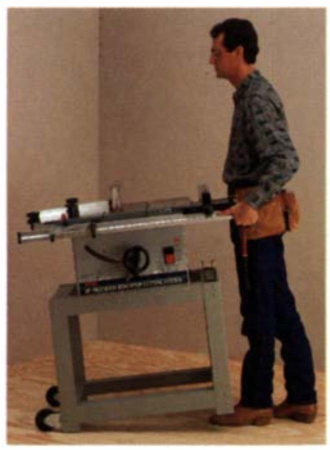
THE RIP FENCE HAS A UNIQUE LOCKING MECHANISM WHICH ASSURES PERFECT ALIGNMENT FOR PRECISION CUTTING. THE LOCK SECURES THE FRONT END OF THE FENCE INTO PLACE, AUTOMATICALLY BRINGING IT INTO ALIGNMENT, THEN CLAMPS THE BACK SECURELY ONTO THE REAR RAIL.

SPECIAL DESIGN PERMITS MOVING THE MITER AND ACCESSORY TABLES TO EITHER SIDE OF THE BLADE, PROVIDING SUPPORT WHERE NEEDED FOR CUTTING LARGE BOARDS OR PANELS. IN THIS CASE, THE MITER TABLE IS PLACED NEXT TO THE ACCESSORY TABLE, READY FOR RIPPING STOCK UP TO 30" WIDE.

POWERFUL PERFORMANCE

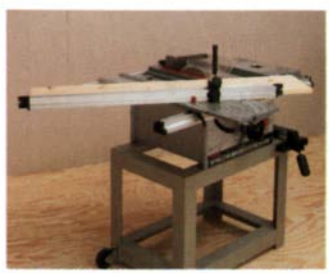


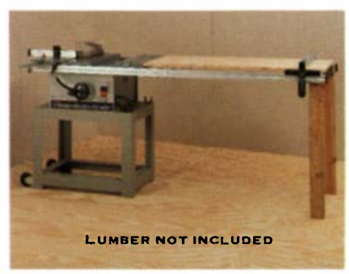
A POWERFUL 13-AMP, 2-HP MOTOR IS ENHANCED BY THE SMOOTH CUTTING CAPACITY OF A 36-TOOTH THIN-KERF CARBIDE TIPPED BLADE THAT WAS DESIGNED, TUNED AND BALANCED SPECIFICALLY FOR THE BT3000. THIS PREMIUM 10" BLADE COMES STANDARD WITH THE BT3000 AND GLIDES EASILY THROUGH NOMINAL 4X4S.



A MOVABLE BEAST

THE BT3000 WORKS LIKE A BEAST ALL DAY. DIE-CAST AND EXTRUDED ALUMINUM CONSTRUCTION MAKES THIS TOOL TOUGH. AND IT WEIGHS ONLY SEVENTY-FIVE POUNDS, SO IT'S EASY TO MOVE AROUND THE SHOP OR JOB SITE, ESPECIALLY WHEN EQUIPPED WITH THE OPTIONAL STAND AND CASTERS.





GREATER PRODUCTIVITY AND VERSATILITY

THE BT3000 HAS A COMPLETE LINE OF OPTIONAL ACCESSORIES WHICH INCLUDE A WORK STAND, DUST COLLECTION BAG, MITER CLAMPING KIT, DADO THROAT PLATE, WIDE TABLE KIT AND A LONG MITER/RIP FENCE KIT. ADAPTER KIT ACCOMMODATES MOUNTING A JIG SAW AND A ROUTER, TURNING THE SYSTEM INTO A COMPACT, SELF-CONTAINED WOODSHOP THAT GOES WHERE YOU GO.

SEE THE NEW BT3000 AT A QUALITY TOOL SUPPLIER NEAR YOU.

RYOBI®

RYOBI AMERICA CORPORATION, 1424 PEARMAN DAIRY RD., ANDERSON, SC 29625

READER SERVICE NO. 75

Building a Trestle Table

Draw wedges make self-tightening joints

by James Merritt Dunlap

A trestle table is one of the earliest examples of knockdown furniture. But like other easy-to-move knockdowns, it tends to become loose and wobbly the longer it's used and the more its wood moves due to seasonal humidity changes. So, when a client asked me to build a large, solid-black-cherry dining table that he could disassemble and take to his Alaskan cabin, I decided to improve the traditional trestle design by adding self-tightening joints. I figured these joints would be especially important in Alaska, where even permanently fixed joints loosen because of wood movement caused by extremes in humidity. The indoor relative humidity can be near 0% during our dry, subzero winter and jump to almost 100% during summer's arctic rainy season, which is similar to the monsoon season in the tropics. In these conditions, a black-cherry board that's 12 in. wide in winter predictably swells up to 12⅜ in. in summer and then shrinks back the following winter. To avoid problems created by such drastic wood movement, I built the table shown above with self-tightening, shallow-tapered, loose-wedged tenons, which the Dutch developed in the 1600s. When the long tenons securing the stretcher to the trestles become loose, slightly jarring the table causes the slick shallow-pitched wedges to fall farther into their mortises and tighten the joints.

As you can see in figure 1 on p. 40, the trestle posts are pinned to the apron assembly with wood slide bolts. The slide bolts' long center tenons extend through mortises in the posts and aprons, and are wedged to draw the pieces together. Each slide bolt also has two shorter blind tenons that extend through the post and partway into the apron. These tenons hold the apron down on the trestle post and keep the top from rocking. Although not visible in the photo above, the trestles themselves also rely on wedges to hold their two parts (post and base) together. The post, or vertical portion of the trestle, has a large tenon that goes all the way through a mortise in the trestle base, as shown in figure 1. But since the grain of the post runs vertically and that of the base runs horizontally, these parts could not be glued together. So to secure the post to the base, I angled the ends of the mortise so it was wider at the bottom and inserted a wedge on both sides of the tenon. These wedges effectively turn the tenon into a large dovetail, and they can be driven in deeper if the post tenon shrinks in dry weather.

Conditioning wood to predict its movement–The black cherry for this project came to Alaska by boat, and it absorbed moisture along the way. After receiving the shipment, I jointed, ripped and planed the parts slightly oversize (about ⅟₁₆ in. thicker and ⅛ in. wider than the dimensions in the drawings), and stickered them in the shop for six weeks. This conditioning allowed the wood's moisture content to reach equilibrium with my shop's dry winter air. Although the wood was as dry as it would get, the rainy season would cause it to swell the full ⅜ in. per foot across the grain, as I mentioned earlier. This meant I had to leave more than ⅛ in. of space on each side of the trestle posts' 10½-in.-wide bottom tenons; proportionately less space had to be left around narrower tenons. Conversely, if I had conditioned the wood and built the table

Photo above: Greg Martin; drawings: Aaron Azevedo

This black-cherry trestle table has adjustable joints for easy transport to an Alaskan wilderness cabin. If the tenoned stretcher becomes loose, wiggling the table will cause the low-pitched draw wedges to drop in their mortises and tighten the assembly.

Photo: Author

***To enlarge the trestle-base mortise** for the wedged tenon, Dunlap clamps a guide to the base at the wedge angle and cuts until the sawteeth touch the blocks at the ends of the guide. After sawing along each side of the mortise, he chisels out the waste.*

during the rainy season, I would have anticipated an equal amount of shrinkage by winter, and I would have made the joints tight. Conditioning wood for the top was especially crucial since warping can accompany wood movement. If the top boards had warped between the milling and glue-up operations, I would have remilled the boards to make them flat and true.

Gluing up the tabletop—When sorting the random-width boards, I selected the top boards based on color, figure and flatness. I then laid out the boards in the order they would be glued together, making sure the direction of their annual rings alternated to minimize distortion from warping. Next, I marked across their joints to indicate the top face of each board, and then ripped the boards parallel and jointed their edges. When jointing the edges, I alternated holding the top or bottom face of each adjacent board against the jointer's fence; this compensates for any discrepancies if the jointer fence isn't absolutely square to the bed. To make an even finer glue joint, I handplaned a single thin shaving from each machined edge to remove jointer marks.

Instead of edge-gluing all the boards at the same time, I glued up four panels of two or three boards each, and then glued the four panels together later. Because my workbench top has a slight twist, I ripped and jointed straight edges on three identical cauls and placed them on the workbench. Then I eyed across the cauls and shimmed under them until they created a flat surface for gluing up the top boards. To keep glue squeeze-out from sticking everything together, I covered the cauls with tape. When the glue was dry, I planed the panels to just slightly thicker than the top's 1¼ in. final dimension, and glued the four panels together. By assembling the top from four machine-surfaced panels, I had only three joints to hand-scrape and sand.

Making the apron assembly—To keep the large tabletop flat and to prevent it from sagging in the middle, I stiffened it with an apron assembly. The side aprons are tenoned to the end aprons, and three cross frames are tenoned to the side aprons. These are not knockdown joints; each joint is glued and has two diagonally wedged tenons. I made the tenons so they would protrude ¼ in., and then cut them flush with the face of the apron after gluing up the apron and inserting the wedges.

If you chisel the through mortises by hand, as I did, you should chop in from both sides to help keep the mortises square and to avoid splitting out the apron's surface when you come through. I filed all mortises slightly larger on the outside so the wedge could spread and lock the tenon, and I handsawed a diagonal kerf for the wedges the full length of each tenon. After grooving the end aprons and cross frames to receive the cabinetmaker's buttons for attaching the top (see figure 1), I assembled the apron dry to check that all the joints fit. When everything came together as it should, I disassembled the parts and set them aside. Before I could glue the apron together, I still needed to mortise the end aprons and two of the cross frames to receive the slide bolts that join the trestles to the apron. But first I built the trestles.

Joining the trestle post and base—To make the 11⅛-in.-deep through mortise in the trestle base, I contemplated using the traditional coach builder's method: drilling from one side with a hand brace and long bit. However, you risk bit deflection if you bore from only one side, and so I chose the speed and accuracy of a drill press, and bored in from both edges. After setting a right-angle fence and depth stop on the drill press, I drilled the haunch

Fig. 1: Exploded view of trestle table

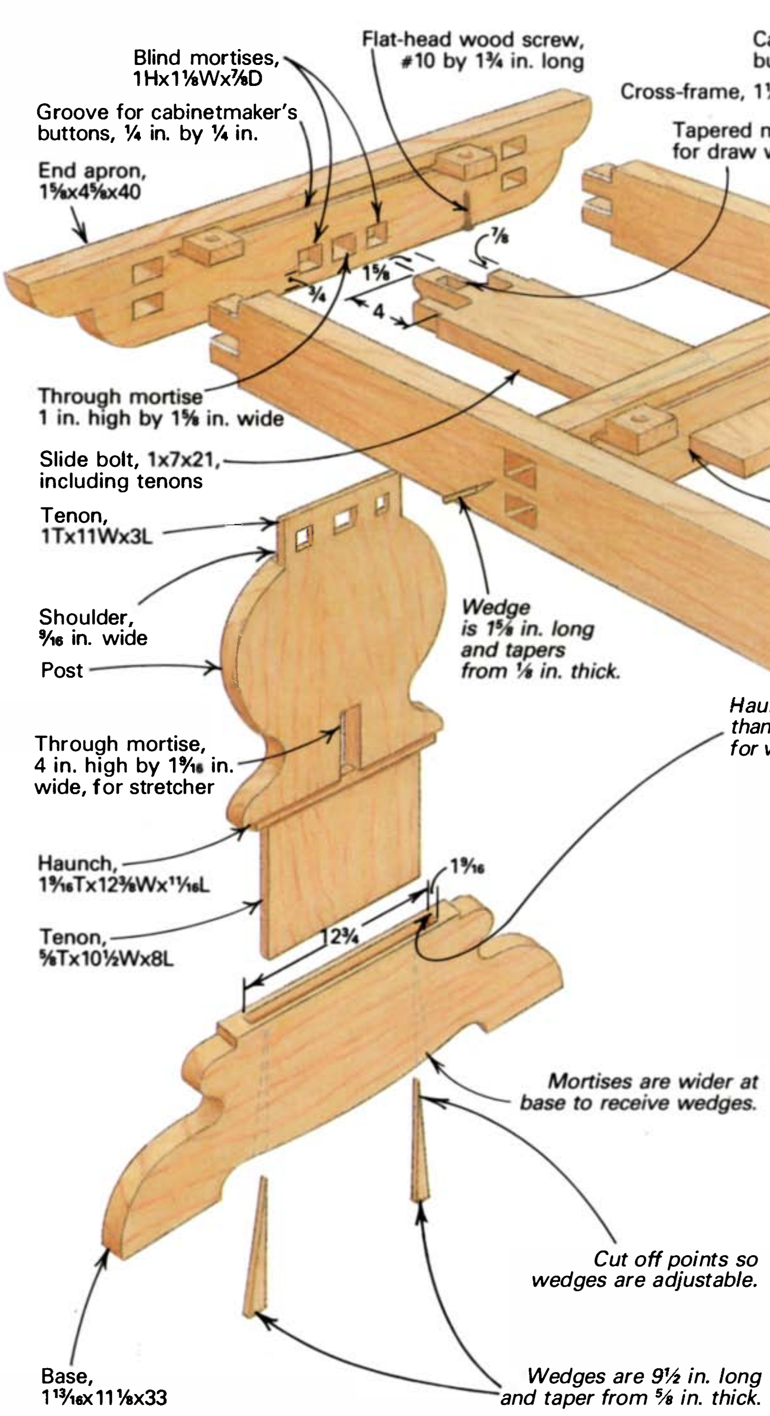
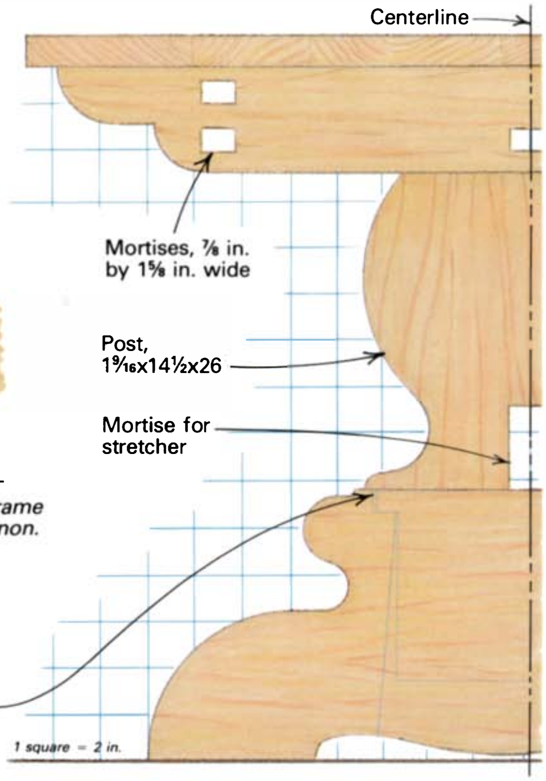


Fig. 2: End view



mortise first. I used a 1-in.-dia. bit for this shallow mortise, and overlapped each hole until most of the waste was removed. Then I squared off the ends and sides with a chisel. I drilled the ⅝-in.-wide through mortise from each side of the base piece in a similar manner, using a ½-in.-dia. brad-point bit that was long enough so the holes would intersect in the middle. Although the undersize bit allowed for ⅛ in. of deflection, the holes met perfectly.

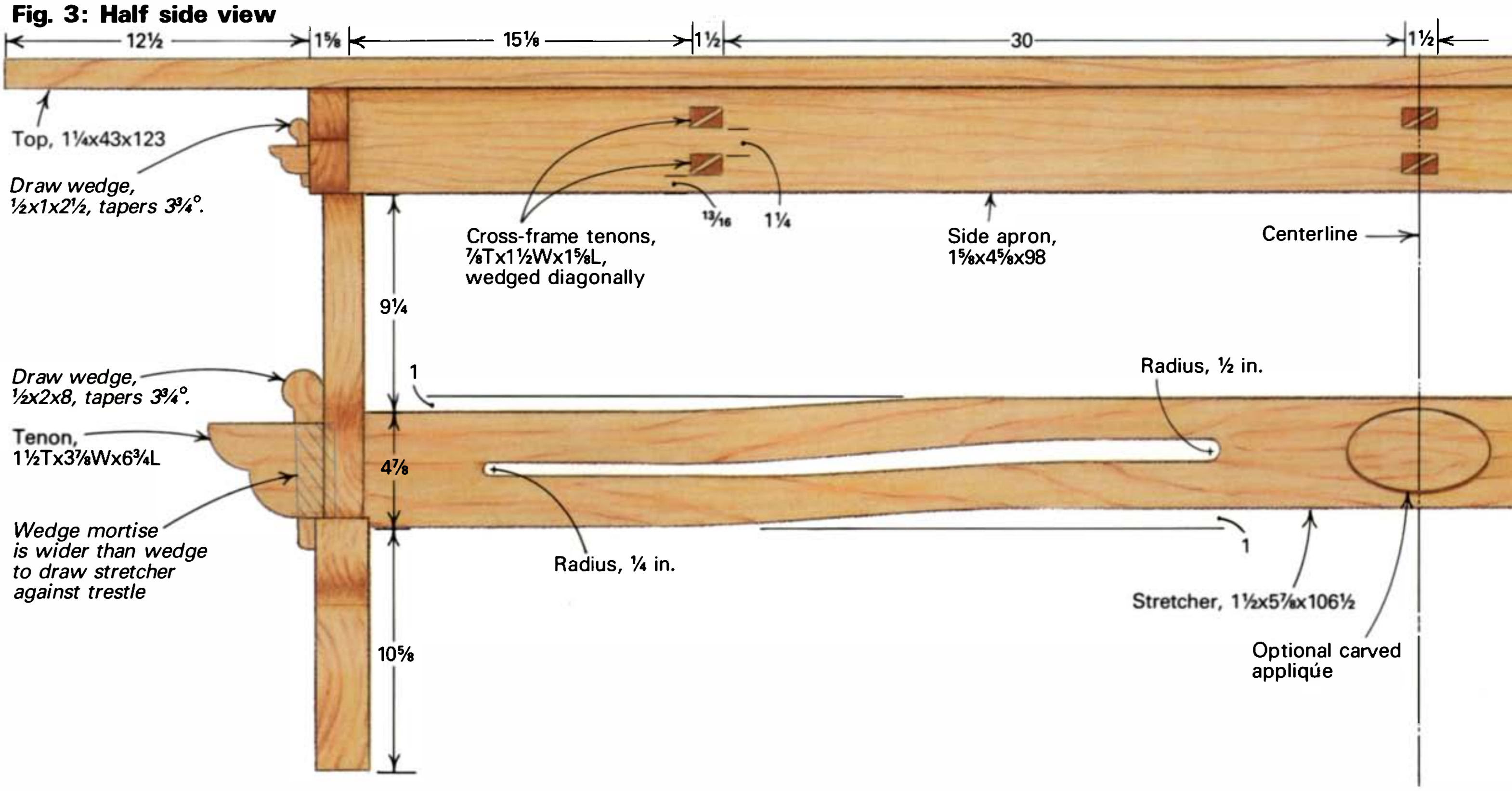
After chiseling and rasping the inside of the mortise flat, square, smooth and to size, I angled its ends to receive the wedges that are driven in on each side of the tenon to form a dovetail in the mortise and to lock the tenon securely. I used the shopmade jig, shown in the photo at right on the previous page, to guide my handsaw when cutting the 3¾° mortise angle.

The jig consists of two 3-in.-wide by 24-in.-long pieces of softwood with a 1 13/16-in.-thick hardwood block screwed between them at each end. To use the jig, I simply slipped it onto the trestle base, clamped one end even with the end of the mortise on the top and clamped the other end 28/32 in. from the end of the mortise on the bottom. I guided the side of my handsaw's blade against the mortise wall, cutting until the sawteeth reached the blocks at each end of the jig. After removing the jig, I chiseled to the bottom of the kerfs and filed the mortise smooth so the wedges would slide easily.

Since all joinery on the posts should be done before bandsawing them to shape, I squared up the stock for the posts, and ripped and crosscut each piece to 14½ in. wide by 26 in. long. I think the easiest way to cut long tenons accurately is with a dado blade on the tablesaw. To do this, I set the dado-blade height to the tenon's shoulder width, and made multiple passes over the cutter with the post laid flat on the saw table and guided by the miter gauge. I began at the end of the tenon and cut to the shoulder, and I left the tenon slightly thick so I could handplane it to size and scrape it smooth. After cutting the top and bottom tenons on both posts, I fit the bottom tenons to the mortises in the bases. Finally, I chiseled the stretcher mortises in the posts. I made these through mortises 4 in. wide to leave room for the 3⅞-in.-wide stretcher tenon to expand. When assembling the base and post, I drove the two 3¾° wedges into the joint alongside the tenon. If the joint loosens over time, it can be tightened by tapping the wedges. These wedges are each ⅝ in. wide by 9½ in. long, and they taper from ⅝ in. thick. They should be scraped smooth so they slide easily. Before final shaping and assembling the posts to the bases, I made the slide bolts and cut the mortises for them in the tops of the posts, the apron ends and the two cross frames.

Making the slide bolts—I've never seen any joint between a table apron and trestle post like my three-tenon slide-bolt connection, but it's a very effective knockdown joint. As you can see in figure 3 on the facing page, the apron end sits on the shoulder of the post's top tenon, and the slide-bolt tenons pin these two parts together. To allow for swelling, the two outer mortises in the apron are ¼ in. wider than the tenons, although the tenons fit tightly against the top and bottom of the mortises. The outer mortises in the post are the

Fig. 3: Half side view



same size as the slide-bolt tenons since grain, and therefore wood movement, run in the same direction. The center tenon fits snugly in mortises in both the post and the apron, preventing the apron from sliding side to side. The other end of the slide bolt has a ⅞-in.-thick by 7-in.-wide tenon, which fits through a mortise in the apron's cross frame. This tenon's narrow shoulder is 4 in. from the cross frame so that the bolt can be slid back to disassemble the post and apron.

I chiseled the triple mortises in the post and aprons first, and then cut and fit the tenons to them, because it's easier to accurately cut tenons to size. All three mortises go through the post tenon, but the outer mortises in the apron are only ⅞ in. deep. The mortises are ¾ in. above both the post-tenon shoulder and the bottom edge of the apron. To ensure an accurate layout, I made a ⅛-in.-thick plywood pattern of the slide-bolt tenons, based on the dimensions in figure 1 on the facing page. I then used the pattern to mark the tenons on the slide bolts and to mark the mortises on the post tenon. After cutting out the mortises on the post tenon, I held it up to the apron and marked through the mortises onto the apron. Then I chiseled out the apron mortises, enlarging the two outer blind mortises by ¼ in. side to side as mentioned earlier. Next, I traced the tenons on the slide bolt, sawed the tenon sides and chiseled from both surfaces to remove the waste.

After assembling the end aprons and post tenons with the slide bolts to check the fit, I scribed each center tenon where it emerged from the apron's outer face. Then I disassembled the pieces and laid out the tapered mortises for the draw wedges in the slide-bolt tenons. These mortises should extend ⅛ in. beyond the scribed line to ensure that the draw wedge (which I'll soon describe) will force the trestle-post tenon and apron tightly against each slide bolt's shoulder. To complete the slide bolts, I cut the large tenons on their inner ends, and chiseled their mortises in the center of the mating cross frames.

With all the joinery complete, I routed the posts, bases and stretcher to shape with templates (see figures 2 and 3 above). First, I made a half pattern and flopped it on either side of the centerline to trace the shape on a routing template. Then I clamped each workpiece to its template and routed each to shape using a straight bit and guide collar. You could just bandsaw and spokeshave the parts to shape, but routing them ensures accuracy. Mark the stretcher tenons for the wedge mortises as you did the slide-bolt tenons; these wedges will pull the trestles against the stretcher's shoulders.

Making the self-tightening draw wedges—Because the self-tightening feature of the table depends so much on loose wedges, they must be fitted carefully. I cut the 3¾°-angle stretcher wedges from ½-in.-thick stock, and used them to fine-tune the angles of the mortises. The wedges should fit well enough to drop automatically and tighten the table; so file the draw-wedged mortises until they're as slick as an Alaskan ice cube. To help get a perfect fit, I dusted the wedges with chalk (gunstock makers use soot) and slid them into their mortises. This rubbed the chalk into the grain on the high spots on the wedges and mortises; when I blew off the loose chalk, I could see where I needed to file. I repeated this procedure until the surfaces were mated and the chalk was even everywhere. If you use this chalk method, don't forget to clean off the chalk before applying finish to the pieces.

I finished the table with a mixture of tung oil, boiled linseed oil and turpentine. The first coat was a 50/50 mixture of tung and linseed oil to which I added two parts of pure gum turpentine for deep penetration. I allowed 48 hours of drying time and then applied a topcoat of one part tung oil and one part turpentine. I also carved a ram's head and glued it to the stretcher to decorate the otherwise plain table.

Six trestle benches accompany the table. I made two as long as the table is wide to be used at the table's ends, and four about 4 ft. long for use on the long sides. Like the table, the benches have draw-wedged joints, a similarly curved stretcher and trestles the same as the table's trestle posts, but without the base. When I delivered the table and benches on Memorial Day, 14 people were eager to help me assemble the pieces so they could sit around and enjoy the day's feast. □

James Dunlap is a professional woodworker in Anchorage, Alaska.

Visiting a Veneer Mill

From steaming logs to thinly sliced sheets

by John Kriegshauser

***To begin the veneer-making process,** logs that have been sawn into longitudinal halves called flitches are soaked in tanks of boiling water to soften. Then the flitches are hoisted out by a conveyor, and workmen pry off the loose bark with a spud.*

Veneer is truly one of the wonders of woodworking—sheets of paper-thin wood, wastelessly sliced from a log by a big knife. The process is easy to understand, but hard to believe. Recently, I had a chance to visit the Pleasant Hill Veneer Co. near Kansas City, Mo. In contrast to giant veneer-making plants that rotary-slice fir and other softwoods for construction plywood, Pleasant Hill is a smaller operation that primarily slices American hardwoods into "face" veneers, which are used by manufacturers to make high-quality sheet goods and cabinet products. During my tour of the mill, the entire veneer-making process was demystified as I watched workers turn raw logs into bundles of perfectly sliced veneer.

The veneer-making process begins at the log yard, where hundreds of magnificent white and red oak, walnut and cherry logs arrive by truck from Iowa, Arkansas and Kansas. Each log has been purchased from a broker, whose initials have been stamped on the butt end of the log. These brokers are independent agents who call on the region's loggers and sawmills searching for suitable veneer logs. Logs are given identifying numbers and stacked in a log yard, where a sprinkler system periodically sprays them with water to prevent them from drying and checking in the hot summer sun. Fred Kyles, the second-shift supervisor, explained that logs left out for four or more weeks are vulnerable to stain from fungal attack; so log inventory has to be turned over quickly.

Sawing and soaking—Each day, Pleasant Hill's 48-in. circular-saw mill cuts enough veneer flitches for a day's slicing. A flitch, in industry parlance, is a slab of the log trimmed to mount on the slicer. First, the sawyer rips the log down the center (the pith), creating a pair of flitches, and then he saws a parallel face down the full length of each. The barky edges remain unsquared for now, for maximum veneer yield. The flitch pairs are then fastened together, heartwood face out, with plastic bands and sent to the soaking tanks. Any bark and sawmill trimmings, as well as the log's waste, are ground into chips and fed into the boiler that supplies power, heat for the dryers and hot water for the soaking tanks.

The soaking tanks are concrete basins about 8 ft. wide, 10 ft. deep and 20 ft. long. Once loaded with flitches, the tanks are filled with scalding water. The soaking process, which lasts one or more days, depending on the species, softens the wood so it will slice cleanly. Soaking tends to even out the wood's color as well. Kyles and I looked on as a workman hoisted off the tank's lid. The water was as black as coffee, and the flitches just poked through its oily, foamy surface. Kyles cautioned me not to fall in.

To ready the flitches for the slicer, the workman fished out a bound pair with a chain hoist and placed it on a conveyor; we could barely see him through the intense steam as he cut the banding and removed the wet bark easily with a spud (see the photo above). He then rolled each flitch to the next workstation. There, one workman trimmed off the checked ends, while another abraded the wood surfaces with an angle-grinder-type rotary planer, to clear away any sand or grit that could damage the slicing knife (see the top photo on p. 44). The journey from tank to slicer takes less than 15 minutes, so the wood remains hot and wet during slicing.

The slicer—As we arrived, the slicer (shown in the bottom photo on p. 44) was being readied for another flitch. Two massive lead screws, which also bear the outfeed conveyor, withdrew the blade carriage, pulling it back on its floor-mounted tracks away from the vertical flitch table. A narrow corridor was created and the slicermen entered it, with the hot flitch dangling from an overhead chain hoist. They pressed the flitch's heartwood face against the table, as a series of small spikes or "dogs," driven by hydraulic pistons, gripped the flitch securely.

Then the machine came to life. The flitch table began moving up and down with increasing speed. The lead screws reversed and pushed the blade carriage forward until the blade almost touched the flitch; then it slowed to an advance that was barely perceptible. By now the flitch was flying up and down 50 times a minute, and the slicermen scurried to their places, opposite one another across the machine's outfeed conveyor. The first slices of veneer were

Photos: Sandor Nagyszalanczy

imperfect, falling shy of the full length of the flitch, and the slicermen hurriedly tossed them onto the floor. As the first full slices came off, the two men faced one another and worked in perfect unison to stack the sheets in the same order they came off the flitch.

At this point, Sam Clark, Pleasant Hill's production manager and millwright, pointed out some of the finer points of veneer slicing. "The flitch table," he said, "does not merely go up and down; the tracks it rides on are angled at about a 20°, creating a slightly diagonal cut to produce the smoothest veneer surface." Blue stain, a problem wherever steel meets wet, acidic wood, is controlled by limiting the wood's contact with the knife. A cam mechanism, called the offset, tilts the knife carriage *away* from the flitch at the end of each down stroke so no contact is made on the up stroke. The action of the offset is so subtle that I would have missed it had Clark not pointed it out. Another anti-stain measure is an electric heating element in the knife mounting that warms the blade, drying it between slices.

Clark also explained that large-volume buyers that manufacture plywood and other veneered products require veneer that's highly uniform in thickness. To ensure this uniformity, the blade carriage must advance precisely the same amount for each slice. This is accomplished with a pawl-and-gear mechanism that advances one notch for each slicing stroke, like a giant clock mechanism. The axle of this gear wheel is the lead screw that advances the knife carriage. The gap between the blade and pressure bar also regulates the veneer thickness. However, this gap is set to a bit less than the finished dimension of the veneer. This way, the wood, which in the context of the enormous forces of the slicer is soft and spongy, compresses as it is sliced, producing the smoothest surfaces.

When the big slicer finally stopped, the carriage was withdrawn and the remainder of the flitch, still almost 4 in. thick, was hoisted onto a dolly and taken to a large motorized saw that rides on a track above the flitch. This saw split the flitch right down its pith, and the two pieces were then remounted on a second, smaller slicer. Kyles told me that slicing a full-size flitch any further results in veneer with excessive tearout. "So we split the flitch and slice each half separately on the smaller slicer, flipping it end for end so we're always cutting from the center out toward the sapwood." Kyles showed me one of the split flitches sliced earlier on the second machine, and indeed, the quartersawn grain was clean and perfect.

Drying and trimming–Once sliced, the veneer is promptly taken to the dryer: an enormous, 40-ft.-long sheet-metal box. At the entry end, two workers load the flitch sheet by sheet onto a conveyor made of stainless-steel mesh. Just inside the dryer, a second conveyor descends from above to keep the veneer flat during its three-minute journey. The interior of the dryer consists of five enormous, rotating drums. The conveyor first goes under one drum and then over the next, as a battery of fans blows heated air across the exposed faces. When the veneer reaches the other end, workers restack the sheets, keeping them in consecutive order.

If the veneers are destined for a North American customer, they are usually crated and readied for shipment. But if they're for the European market, the flitches are first edge trimmed, and any endchecking or stain is trimmed away. (Veneer is a competitive industry; no one wants to pay to haul trimmings across the Atlantic.) The trimming is performed on a stout, iron machine called a clipper. The clipper's 16-ft. blade and the hydraulic cylinders that drive it are concealed in a housing suspended above the worktable. The worker positions a stack of veneer under a laser light that identifies the line of cut. Once the worker is satisfied with the position, the machine is switched on and the blade chops off the waste.

Sharpening a 16-ft.-long knife

"Smoothly cut, tearout-free veneer is what the customer wants," Fred Kyles, of Pleasant Hill Veneer, explained. "The art to the process is in how you soak the wood and in how you sharpen the knife." With that, Fred led me into an outbuilding just large enough to hold a giant sharpening machine and a honing bench.

The heavy, 16-ft.-long veneer-slicing knives, which are resharpened every day, are moved to and from the sharpening shed via a chain hoist and overhead track. Once there, each knife is securely bolted onto the grinding machine. The grinder, shown at right, tracks slowly along the length of the knife, bathed in a continuous shower of coolant, producing a flat, rather than hollow, grind on the knife's edge. Next, the knife is transferred to the honing bench, where it is mounted edge up. Kyles then demonstrated how the wire edge is removed: He reached into a coffee can full of kerosene and pulled out two carborundum stones, one for each hand. As Kyles walked the length of the blade, he worked the stones with a circular motion; one stone honed the knife's bevel, while the other honed its flat side. Final honing was done with hard Arkansas stones, which left a polished edge. It was terrifying to watch Kyles reach across that giant razor-sharp blade. Over the years, he confessed, he had received many serious cuts, but all had healed with only faint scars.

In spite of every precaution to keep the knife from prematurely dulling, once in a while it gets nicked and production must stop; a nicked knife causes a small but conspicuous cross-grain tear in the veneer that's almost impossible to sand out after the veneer has been glued down. Millwright Sam Clark showed us how he burnishes the crumpled steel back into place and hones out the remaining nick by hand with an Arkansas stone while the knife is still mounted in the slicer. The slicermen can usually detect nails or barbed wire embedded in the log by a telltale blue stain appearing in the veneer. But what about bullets? "A lead slug is no problem," Kyles assured me. "The knife will cut right through it. But a copper-jacketed 30-06, that's a problem. All you can do is hope to find the entry hole before you hit that bullet." –J.K.

The veneer slicer's 16-ft.-long blade must be sharpened every day of use. First, the special knife grinder shown here regrinds the edge as the machine travels along huge, precise guide rails. Then the blade is honed using two hand-held slip stones.

***To prepare the log flitches for slicing,** the rough ends are cut off with an automated chainsaw. Then any remaining bark, dirt or surface debris that might later nick the veneer-slicing knife is removed with a hand-held rotary planer.*

***Pleasant Hill Veneer Co.'s big slicing machine** effortlessly moves a 12-ft.-long oak flitch past the machine's stationary knife 50 times a minute. The sheets of veneer that peel off come down a conveyor and are stacked by the workmen in consecutive order.*

Instead of a simple guillotine-drop action, the blade makes a "sine wave" cut: First the left corner of the blade plunges through the flitch, and then as the right corner begins to drop, the left ascends. The blade rolls through the veneer with a rhythmic motion, producing a clean, perfect cut.

Now the trimmed veneer flitches are passed under a special scanner that assesses the surface area of the flitch; this information is fed to a computer that multiplies the surface area by the number of veneer sheets in the flitch to obtain the official tally in square feet. Finally, Kyles led me to the warehouse where pallets of veneer awaited the inspection of haggling veneer buyers, the majority of whom were from Europe. He removed a cardboard dustcover from a nearby pallet of white oak and called my attention to the veneer's even color and smooth surface. "That's as fine a slicing job as you'll find anywhere in the world," he said proudly.

As I was leaving, Steve Kingston, vice president of the mill, explained to me why Pleasant Hill's British parent company, Union Veneers, is currently expanding the mill's facilities. "Many species, like teak, will fade from fashion as their scarcity drives their price up. But the white oak forests of North America are expanding," he said. He went on to explain why, in his opinion, the veneer industry is environmentally sound. "We selectively harvest the few, large, mature trees in a tract of forest, allowing the newer growth a chance for some sunlight. Since each log yields a great deal of veneer, the process can go on indefinitely." □

John Kriegshauser is a furniture designer/craftsman and shop director in the College of Architecture at the Illinois Institute of Technology in Chicago, Ill. Bruce Best, an architectural designer with AGMP in Lee's Summit, Mo., assisted in writing this article.

Figured veneers

by Jim Dumas

Although many wood species are available as plainsawn or quartersawn lumber, that's just the tip of the iceberg when it comes to the vast range of grain figures available in veneers. Part of the reason for this variety is the high degree of control the veneer mill has in the way a log is sliced. Some grain figures are revealed or enhanced by being sliced in a particular way. For example, rotary-slicing bird's-eye maple creates the most round, perfect eye figure. Woodworkers aiming to add a distinguished look to their work, or elevate a project's overall appearance and value, often want unusually figured or exotic veneers. But they don't always know what to ask for; sometimes the trade names of

***Bird's-eye** (left)—The name itself describes it best. Once considered a defect, the best bird's-eye flitches are now expensive and in demand. These veneers are most often rotary cut or half-round sliced (in an arc) to produce the most uniform distribution of nice round eyes. Bird's-eye is most common in maple (shown), but bird's-eye does rarely occur in a few other species.*

***Curly** (right)—Contortions in grain direction that reflect light differently create an appearance of undulating waves known as curly grain. Many species develop this figure, but most commonly maple, shown. Stump and butt sections of trees often produce a diagonal, staircase-like curl referred to as "angel steps," and a rolling curl figure that is called "cross-fire."*

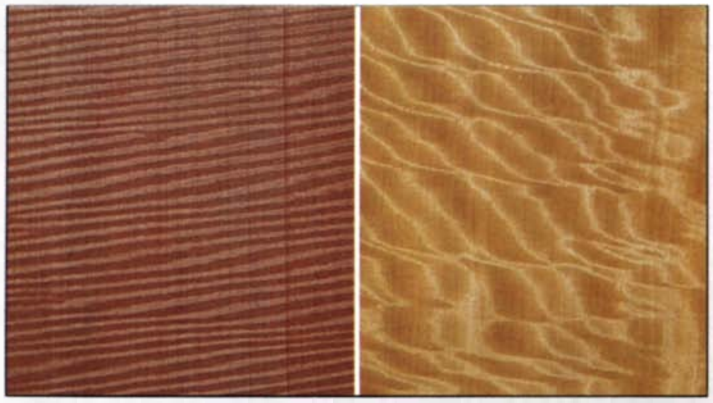
***Quilted** (left)—Although greatly resembling a larger and exaggerated version of pommele or blister figure, quilted figure has bulges that are elongated and closely crowded. Quilted grain looks veritably three-dimensional when seen at its billowy best. It's most commonly found in mahogany, moabi (shown), maple, sapele and myrtle, and occurs only rarely in other species.*

***Peanut shell** (right)—When certain woods exhibit a quilted or blistered figure, they are rotary cut to promote a random, wild grain pattern as well. This peanut-shell grain creates a visual illusion similar to quilted figure: the veneer appears bumpy and pitted, when in fact it's flat. Tamo (Japanese ash), shown, and bubinga are the two most popular examples of this figure.*

special veneers can be confusing. This is more of a problem when mail-ordering veneer because you can't see what you're getting before you buy it.

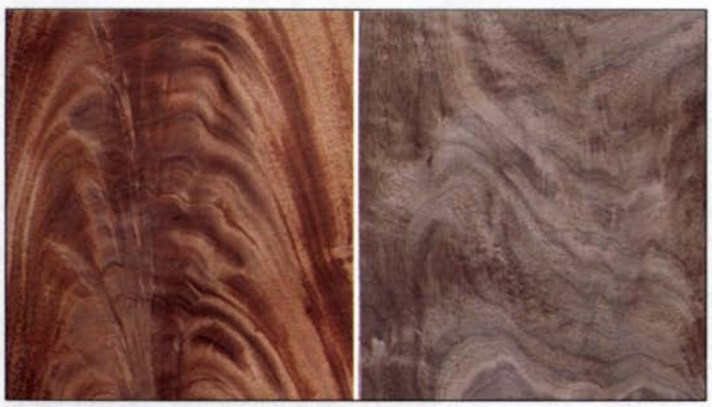
The illustrations of distinctively figured veneers shown in the photos below are intended to acquaint would-be veneer buyers with some of the more common trade names for some conventional veneer figures. However, the names I've given in the captions aren't necessarily universal for two reasons: First, simple names for a few common figure types are barely sufficient to cover all the possible examples of figure in any species of veneer. Every tree grows a little differently, and within a single flitch, you often find an entire range of figures. Second, veneer-figure nomenclature varies from country to country, and is even different among veneer sellers and users in different regions. I've seen plenty of veneer sold under the "wrong" name—wrong simply because it disagrees with my own veneer vernacular. In addition to the names listed and discussed here, there are some very unusual figure names, such as pippy (looks like measles), drapé (looks like draping vines) and plum pudding (looks like elongated dark plums). Other figures include roe, rippling and finger roll. More names come up now and then, and on a few occasions, I've even had to coin a new name for a veneer figure that defied classification. □

Jim Dumas is the owner of Certainly Wood/Hardwood Veneer and Lumber Co., a supplier of veneers to studios and contract shops, in East Aurora, N.Y. Wood samples courtesy of Certainly Wood.



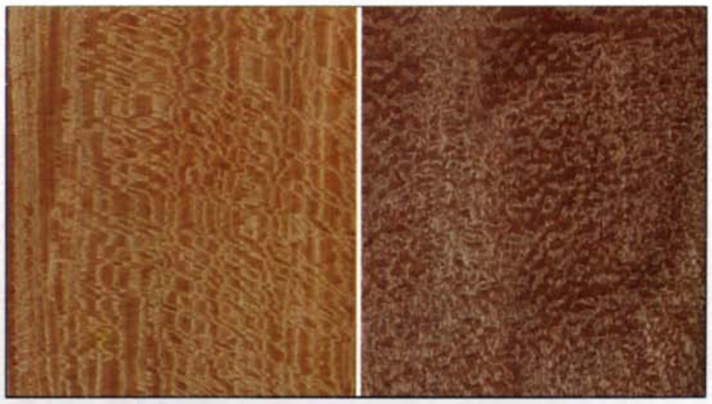
***Fiddleback** (left)—An estimable variation of curly figure, this figure's name is taken from its customary use for violin backs. Logs for fiddleback veneers are quartersawn to produce very straight grain with nearly perpendicular curls running uninterrupted from edge to edge. Maple, makore (shown), anegre and English sycamore head a list of about 12 fiddleback-prone species.*

***Mottled** (right)—Wavy grain combines with spiral, interlocked grain to produce a wrinkled, blotchy figure known as mottle. The mottled figure may be scattered randomly (broken mottle), or appear as a regular checkerboard pattern (block mottle). Members of the mahogany family, koa, sapele, bubinga and African satinwood, shown, most commonly exhibit mottled figure.*



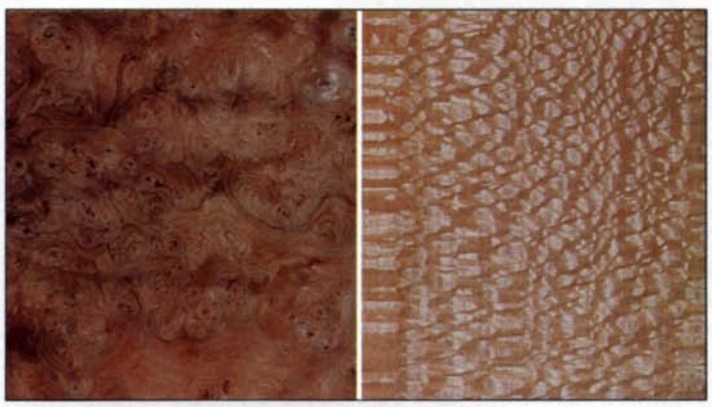
***Crotch** (left)—Cut from the juncture of a tree's main branches and trunk, crotch figures are often subcategorized as flame, plume, roostertail, feather or burning bush. All of these descriptive terms serve to convey the range of this figure's appearance. Seldom found in large sizes, mahogany (shown) and walnut species dominate the field of crotch veneers.*

***Swirl** (right)—This figure is a visually gentler version of regular crotch figure. As the name implies, the grain meanders and swirls around, often seeming to convolute and fold in upon itself. The densest portions of the swirl show up darker or shaded compared to the lighter surrounding wood. Swirl occurs in species including walnut (shown), mahogany, cherry and maple.*



***Bee's wing** (left)—Smaller, tighter and more intense than mottled figure, although structurally similar, bee's-wing figure is said to resemble that insect's appendage when magnified. (I haven't actually compared them.) East Indian satinwood, shown, is extremely well known for having this figure, and it also occurs occasionally in narra, mahogany and eucalyptus.*

***Pommele** (right)—This figure resembles a puddle surface during a light rain: a dense pattern of small rings enveloping one another. Some say this has a "suede" or "furry" look. It's usually found in extremely large trees of African species like sapele (shown), bubinga and makore. Some domestic species with a sparser, larger figure are referred to as "blistered."*



***Burls** (left)—Growths on trees produce some of the most prized veneers. Usually available in smallish, often defective sheets, burls feature swirling grain around clusters of dormant buds, rings or eyes. Varieties include "cluster burl" or "cat's paw burl." Redwood, oak, ash, madrone, elm (shown) and walnut are common burl species; exotic burls include mappa, thuya and imboya.*

***Button** (right)—When woods with large medullary rays are quartersawn, the harder, shinier rays are more fully exhibited and show up as "snowflakes" or buttons on a straight-grained background. Some veneer species, such as white oak, lacewood (shown) and American sycamore, are more attractive when sliced to reveal this button figure.*

Building an Open Hutch

Moldings detail frame-and-panel sideboard

by Ronald Layport

This curly maple open hutch, the author's first commission, was based on styles common in America between 1730 and 1840, and was designed to fulfill his clients' desire for a large sideboard. Although the construction is intricate, his one-step-at-a-time approach and the applied detail moldings help make this large project manageable.

Since this curly maple hutch was my first commissioned piece, I had mixed feelings about parting with it. Although I've been designing and building furniture for myself and family members for about six years, I was uncomfortable with the thought that I might never see this piece again. However, I'm pleased to report that the "letting go" turned out to be a joy rather than a problem. The couple who commissioned the hutch was every bit as delighted with it as I was exhausted upon its completion. I was even granted "visitation rights."

The open hutch shown here is similar to cupboards that were common in middle America between 1730 and 1840. These pieces were sometimes called hutch cupboards, open hutches, sideboards with hutch tops, and even dressers, and their designs and styles were as varied as the terms used to describe them. I used joinery common to the period, such as pinned mortise-and-tenon, frame-and-panel and dovetailed solid-board construction. I cut tenons on the tablesaw and hand-chopped mortises with a chisel, although I admit that a router is an appealing alternative for cutting the 96 mortises in this hutch. I always hand-cut dovetails because I enjoy the process, and I like seeing perfectly pointed pins running down the corner of a drawer. To create a dimensional effect, I edged the stiles, drawers, shelves and back boards with more than 200 ft. of hand-tooled bead. A wood shaper or router would make short work of forming this bead, but the techniques that I discuss for using a scratch stock provide a lot of satisfaction and an unmistakable hand-crafted quality.

Although I used hand tools to achieve a desired effect, I am not a fanatic on this issue. I could never have built this piece without my jointer, thickness planer, tablesaw and drill press. My power tools handled the bulk of the work and left me with energy for hand-working the details.

Curly maple is sometimes called tiger maple due to its cross-grain stripe. This highly figured wood is said to be found in only one out of every 10,000 maple trees. In fact, I waited a year and a half for this tree to be harvested by sawyers in northeastern Ohio. The hutch could be equally spectacular in walnut or cherry with a simple hand-rubbed carnauba wax finish.

The back of the hutch is finished so that it doesn't need to be up against a wall. Wood brackets secure the upper carcase to the lower carcase.

Designing the hutch—I've heard that a true hutch must have two doors and a drawer or two on the bottom. But since my clients gave me complete design freedom, I opted for this four-door, four-drawer hutch. Their only guideline was that they wanted "a large sideboard for the dining room, not too ornate but with some dimensional quality." I showed them two rough sketches for style and proportion, and upon receiving their approval, I began engineering the massive 85-in.-high, 62-in.-wide and 20-in.-deep piece to allow for wood movement and to avoid sagging. For instance, the hutch shelves lock into dadoes in the rear stiles for extra support.

I had to make other design considerations as well. In order for the piece to be movable, I made the top and bottom as separate units. Two slide-out cutting boards nearly double the workspace. The back is finished to the same detail as the front, as shown in the photo at left, so the hutch could also be used as a freestanding room divider. I made the bottom high enough off the floor to accommodate modern vacuum cleaners, and the doors, drawers, cutting boards and lower-carcase shelves are all removable to facilitate cleaning and moving.

Because this is such a large piece, I wanted to keep its weight down. Rather than use thick solid stock, I made the back a frame-and-panel assembly with thin, shiplap boards for the panels. The doors carry thin flat panels rather than raised panels, which would double their weight. I also thought that raised-panel doors would look too bulky on an already massive piece.

Old cupboards often appear squatty and top-heavy, in part because the serving surface of the bottom cupboard was usually set close to table height, about 30 in. This may reflect the smaller average height of people in the early 1800s, and so I raised my serving surface to 37 in. to better meet today's needs, increase storage space and achieve a more graceful vertical scale. Two doors, often wider than they were high, also contributed to the squatty look of so many old hutches. By using four doors with two panels in each, I could visually divide the front into a series of vertical sections and eliminate this stocky look. The beaded edges and applied moldings on the face frame further emphasize this vertical effect.

Building the lower carcase—Before beginning a large project like this, I like to study the wood for a couple of weeks: turning it, sorting it, viewing it from every angle. I then mark each piece of stock for its intended use and the best display of figure and color. To avoid confusion, I milled the parts for the lower carcase and assembled it before starting on the hutch top.

The lower carcase is assembled from several mortised-and-tenoned frames, and so I began by milling all the framing members to width and thickness. I planed the rails for the case sides, as well as the rails and center stiles for the door frames, 1/16 in. thinner than the side and door stiles. This was necessary because I planned to run a bead along the inner edges of the side and door stiles (see figures 1 and 2 on the following pages), and I wanted the rails to butt into the stiles below the rounded corner of the bead. I then crosscut the rails and stiles to length on my tablesaw, making sure that all pieces of the same length are precisely cut. Next, I cut the tenons on the tablesaw and chopped out the mortises by hand, as I mentioned earlier.

When dimensioning the frame stock for the case sides and center divider, note that the center divider is 5/8 in. shorter than the case sides to allow the top frame to span across it. The center divider is also 7/8 in. narrower than the case sides because it butts into the back center stile; I allowed for this 7/8 in. by making the divider's back stile narrower than the back stiles on the case sides. You should also note that the 1/4-in.-wide by 5/16-in.-deep panel grooves in the framing members are located differently in the center divider than in the side frames. The center panel is centered, while the side panels are inset 1/4 in. from the outside face of the stiles.

Before assembling the case sides, I used a scratch stock, as shown in the top photo on p. 50, to cut the 1/8-in.-wide bead along the stiles' outside faces. Some time ago, I began making my bead molding with a scratch stock after I became totally frustrated with the results from an antique molding plane. A scratch stock is simply a thin piece of steel with the desired molding profile shaped into its edge. The molding is formed by scraping with the scratch stock. My first efforts at making a scratch stock, from a bifold-door closer and then an electrical-box cover, were crude but effective. Although these tools worked, their soft metal didn't hold an edge and they were hard to control. After that, I heated, pounded, bent and filed old screwdrivers, files and even X-Acto knives to make scratch stocks. Then, one Sunday afternoon, I chanced upon a whole box (a lifetime supply) of tool steel at a flea market; for $5, I couldn't pass it up. I use a jeweler's file, chainsaw file and grinding wheel to shape the tools. The curly maple made it difficult to scratch a straight line, but I overcame this by lightly scoring a guideline along the length of the stile with the scratch stock and then cutting a shallow kerf with a dovetail saw along the guideline. The sawkerf established a straight line that the scratch stock could easily follow, even in this wildly figured wood.

I assembled the case sides and center divider first, followed by the seven horizontal frames that form the top frame, the drawer frames and the carcase floor. The top frame is simply an open frame that is dadoed at the center to fit over the stiles of the center divider. The solid wood top is screwed to this frame through elongated holes that allow the top to expand or contract with inevitable changes in humidity. Before assembling the four drawer frames, I grooved their inside edges for 1/4-in.-thick solid wood dust panels, and drilled screwdriver access holes through the top drawer frames (see figure 1 on the next page) for later fastening the top. he two bottom frames carry a 7/8-in.-thick

(continued on p. 50)

Photos except where noted: Chuck Fuhrer; drawings: Bob La Pointe

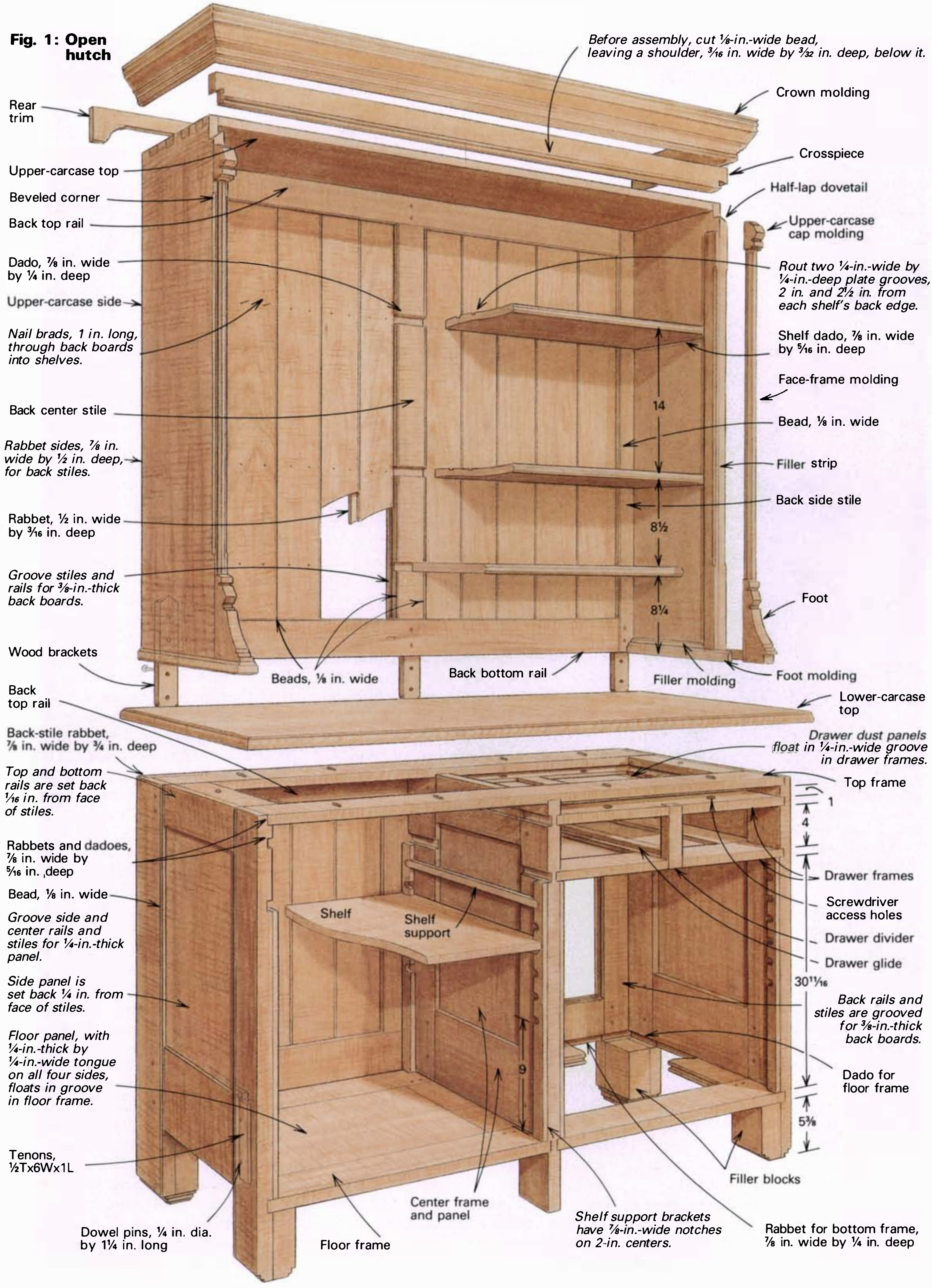


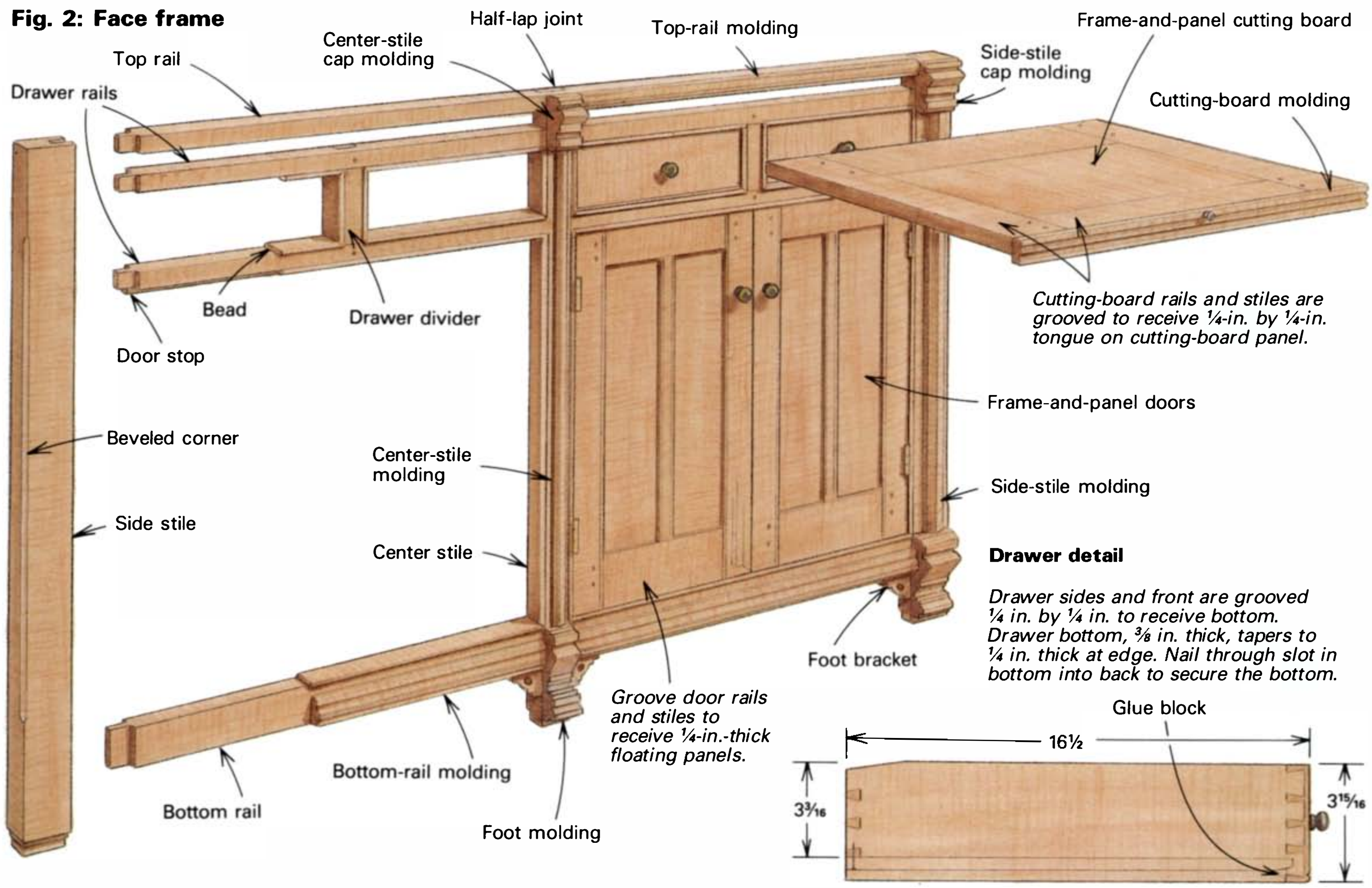
Fig. 1: Open hutch
Before assembly, cut ⅛-in.-wide bead, leaving a shoulder, 3⁄16 in. wide by 3⁄32 in. deep, below it.
Crown molding
Rear trim
Crosspiece
Upper-carcase top
Half-lap dovetail
Beveled corner
Back top rail
Upper-carcase cap molding
Dado, ⅞ in. wide by ¼ in. deep
Rout two ¼-in.-wide by ¼-in.-deep plate grooves, 2 in. and 2½ in. from each shelf's back edge.
Upper-carcase side
Nail brads, 1 in. long, through back boards into shelves.
Shelf dado, ⅞ in. wide by 5⁄16 in. deep
Face-frame molding
Back center stile
14
Bead, ⅛ in. wide
Rabbet sides, ⅞ in. wide by ½ in. deep, for back stiles.
Filler strip
Back side stile
Rabbet, ½ in. wide by 3⁄16 in. deep
8½
Groove stiles and rails for ⅜-in.-thick back boards.
Foot
8¼
Wood brackets
Beads, ⅛ in. wide
Back bottom rail
Filler molding
Foot molding
Back top rail
Lower-carcase top
Back-stile rabbet, ⅞ in. wide by ¾ in. deep
Drawer dust panels float in ¼-in.-wide groove in drawer frames.
Top and bottom rails are set back 1⁄16 in. from face of stiles.
Top frame
1
4
Rabbets and dadoes, ⅞ in. wide by 5⁄16 in. deep
Drawer frames
Bead, ⅛ in. wide
Screwdriver access holes
Groove side and center rails and stiles for ¼-in.-thick panel.
Shelf
Shelf support
Drawer divider
Drawer glide
Side panel is set back ¼ in. from face of stiles.
30 11⁄16
Back rails and stiles are grooved for ⅜-in.-thick back boards.
Floor panel, with ¼-in.-thick by ¼-in.-wide tongue on all four sides, floats in groove in floor frame.
9
Dado for floor frame
5⅜
Tenons, ½Tx6Wx1L
Filler blocks
Center frame and panel
Dowel pins, ¼ in. dia. by 1¼ in. long
Floor frame
Shelf support brackets have ⅞-in.-wide notches on 2-in. centers.
Rabbet for bottom frame, ⅞ in. wide by ¼ in. deep

Bill of Materials

Section	Amount	Description	Dimensions
Lower carcase	2	Side front stiles	1¼ × 2⅜ × 36 9/16
	2	Side rear stiles	1¼ × 3 × 36 9/16
	2	Side bottom rails	1 3/16 × 7¼ × 14 1/16*
	2	Side panels	¼ × 12 9/16 × 20 15/16
	2	Side top rails	1 3/16 × 3½ × 14 1/16*
	1	Center front stile	1¼ × 2⅜ × 35 15/16
	1	Center rear stile	1¼ × 2⅛ × 35 15/16
	1	Center bottom rail	1¼ × 7¼ × 14 1/16*
	1	Center panel	¼ × 12 9/16 × 20 15/16
	1	Center top rail	1¼ × 2⅝ × 14 1/16*
	2	Top frame stiles	⅞ × 4 × 57⅞
	2	Top frame rails	⅞ × 4 × 10 9/16*
	1	Lower-carcase top	15/16 × 19¾ × 62
	2	Back stiles	⅞ × 2½ × 36 9/16
	1	Back center stile	⅞ × 5¼ × 24 7/16*
	1	Back top rail	⅞ × 3½ × 54⅜*
	1	Back bottom rail	⅞ × 4 × 55¾*
	8	Back boards	⅜ × 6¼ × 24 5/16
	2	Back boards	⅜ × 2 × 24 5/16
	2	Back-foot filler blocks	1¾ × 2⅛ × 5⅝
	2	Front-foot filler blocks	1⅞ × 2⅜ × 5⅝
	8	Drawer-frame stiles	⅞ × 2½ × 28⅝
	8	Drawer-frame rails	⅞ × 2½ × 13 9/16*
	4	Center drawer-frame rails	⅞ × 2½ × 13 9/16*
	2	Drawer glides	⅜ × 1¼ × 15 13/16
	2	Drawer dividers	¾ × 1¼ × 5¾
	8	Drawer dust panels	¼ × 12 1/16 × 13⅞
	4	Floor-frame stiles	⅞ × 2½ × 28⅝
	4	Floor-frame rails	⅞ × 2½ × 13 13/16*
	2	Floor panels	⅞ × 12 5/16 × 24⅛
	8	Shelf support brackets	⅜ × ⅞ × 22 11/16
	4	Shelf supports	⅜ × ⅞ × 15 11/16
	2	Shelves	¾ × 16½ × 28
Face frame	8	Drawer sides	⅝ × 3 15/16 × 16¼
	4	Drawer bottoms	⅜ × 11⅝ × 16
	4	Drawer fronts	¾ × 3 15/16 × 12⅜
	4	Drawer backs	⅝ × 3 3/16 × 12⅜
Face frame (cont.)	4	Cutting-board stiles	⅞ × 3½ × 16½
	2	Cutting-board rear rails	⅞ × 4¼ × 21 5/16*
	2	Cutting-board front rails	⅞ × 2½ × 21 5/16*
	2	Cutting-board panels	⅞ × 10¼ × 19 13/16
	2	Side stiles	⅞ × 2⅞ × 36 9/16
	1	Center stile	⅞ × 1¼ × 36 9/16
	1	Top rail	⅞ × ⅞ × 56*
	1	Top drawer rail	¾ × ⅞ × 56*
	1	Bottom drawer rail	⅞ × 1 × 56*
	1	Bottom rail	⅞ × 2 1/16 × 56*
	2	Drawer dividers	⅞ × 1 × 6
	2	Door stops	⅜ × ⅝ × 27¼
	6	Door stiles	⅞ × 1⅞ × 22½
	4	Center door stiles	13/16 × 1 × 17⅞*
	2	Overlap door stiles	⅞ × 2¼ × 22½
	4	Top door rails	13/16 × 2¼ × 11¼*
	4	Bottom door rails	13/16 × 3¼ × 11¼*
	8	Door panels	¼ × 4⅝ × 17½
Upper carcase	2	Sides	¾ × 9¾ × 47¼
	2	Upper-carcase top	¾ × 8⅛ × 58½
	1	Back bottom rail	⅞ × 3½ × 55½*
	2	Back side stiles	⅞ × 2¼ × 47¼
	1	Back center stile	⅞ × 3 × 41⅞*
	2	Back boards	⅜ × 4½ × 41⅞
	2	Back boards	⅜ × 4⅞ × 41⅞
	2	Back boards	⅜ × 5½ × 41⅞
	2	Back boards	⅜ × 6⅛ × 41⅞
	2	Back boards	⅜ × 6½ × 41⅞
	1	Back top rail	⅞ × 2½ × 54⅛*
	1	Crosspiece	¾ × 2⅞ × 58½
	2	Top shelves	⅞ × 8⅜ × 57⅝
	1	Bottom shelf	⅞ × 5⅜ × 57⅝
	2	Filler strips	½ × 1 × 46½
	2	Feet	1¼ × 2¾ × 8 1/16

* Includes tenons

Fig. 2: Face frame



panel that sits flush with the frame to form the floor of the cabinet. The mortise-and-tenon joints of all the frames are through pinned with two 1/4-in.-dia. dowels.

After all the frames were glued up, I cut the rabbets and dadoes needed to assemble the frames into a cabinet. First, I rabbeted the inside back edge of the case sides to receive the back stiles, and routed rabbets for the top frame and dadoes for the bottom frames and drawer frames, as shown in figure 1. Then I dadoed the center divider for the drawer frames and bottom frames. Finally, I cut the dado in the top frame so it would fit over the center divider.

The next step is to dry-assemble the internal frames, sides and center divider. If you're like me, there's never an extra pair of hands around when you need them. I've found that pregluing the back stiles to the sides makes this assembly easier and helps square everything when clamped. Before gluing the back corner stiles to the sides, I chiseled out the mortises for the back bottom rail, ripped the grooves for the shiplap back boards and routed the dadoes for the bottom frames. Then I glued the stiles into their rabbets on the case sides, and dry assembled the carcase by aligning everything at the front and clamping the carcase together.

While the carcase is clamped up, I marked and cut the tenons on both the top and bottom rails of the back. The bottom rail has full-length tenons that are glued and pegged into the mortises in the back stiles. However, the top rail has stub tenons, 3/8 in. wide by 5/16 in. long, that slide into the groove in the back corner stiles to cap off the back boards. After ripping a groove along the inside edges of both the top and bottom rails to receive the 3/8-in.-thick shiplap back boards, I then clamped the bottom rail in place and measured for the back boards. I resawed the back boards from 1 1/2-in.-thick stock on my tablesaw, book-matched them and then ripped rabbets on them to form the shiplap joints.

After fitting the back boards, I broke down the dry assembly and began gluing up the carcase. I started with half of the lower carcase, aligning and gluing both the drawer and bottom frames between the left side and the center divider; then I added the remaining frames and the right carcase side, gluing the back bottom rail in place also. Next, I glued the top frame into the rabbets in the sides and screwed it into the tops of the center divider's stiles. I clamped across the face and back of the carcase and then checked to make sure it was square. When the glue was dry, I removed the clamps, slipped the back boards into their grooves without glue, and nailed them to the bottom drawer frame with 1-in.-long brads. Then I glued and clamped the back top rail in place. To finish up the lower carcase, I notched the drawer frames and glued vertical drawer dividers in place; added drawer glides behind these vertical dividers; and installed adjustable shelf support brackets, as shown in figure 1. To ensure uniformity of the shelf support brackets, I drilled a series of holes with a Forstner bit along a 1 7/8-in.-wide board's centerline and then ripped the board on the centerline to form two opposite brackets.

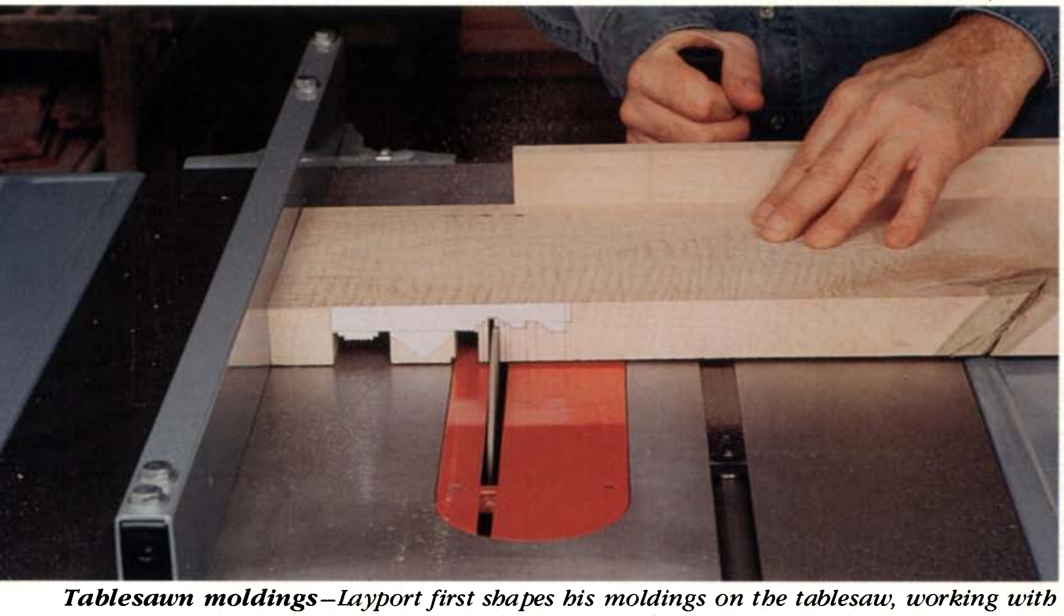
Detailing the carcase—I made a separate face frame for my hutch and then applied moldings to add a sense of dimension. The four face-frame rails are tenoned into the side stiles, and the center stile intersects the rails with half-lap joints, as shown in figure 2 on the previous page. I assembled the face frame and glued it to the carcase in one operation. Because I'm not a carver or turner, I designed the various moldings with straight lines and beveled faces to take best advantage of my skills and equipment. The highly polished, simple shapes blend well with the lines of the hutch. First I roughed out the moldings by making multiple passes on the tablesaw (see the bottom, left photo); then I refined the shapes with chisels, files and sandpaper before gluing the moldings in place.

I made the 1/8-in.-thick by 1-in.-wide bead that frames the drawer and door openings in 8-ft. lengths from scraps trimmed from other

Photo: Charley Robinson

***Cutting the bead** with a scratch stock made by filing a piece of tool steel to the desired shape imparts hand-crafted quality to the piece. A sawkerf helps establish a uniform shoulder before final shaping.*

Photo: Charley Robinson



***Tablesawn moldings**—Layport first shapes his moldings on the tablesaw, working with stock that is large enough to keep his fingers away from the blade. After refining the details with hand tools, he cuts these large blocks into the individual pieces required.*

***The finished molding,** such as the piece that helps define a foot (right), adds dimensional qualities to the face of the hutch, yet keeps carcase construction as simple as possible.*

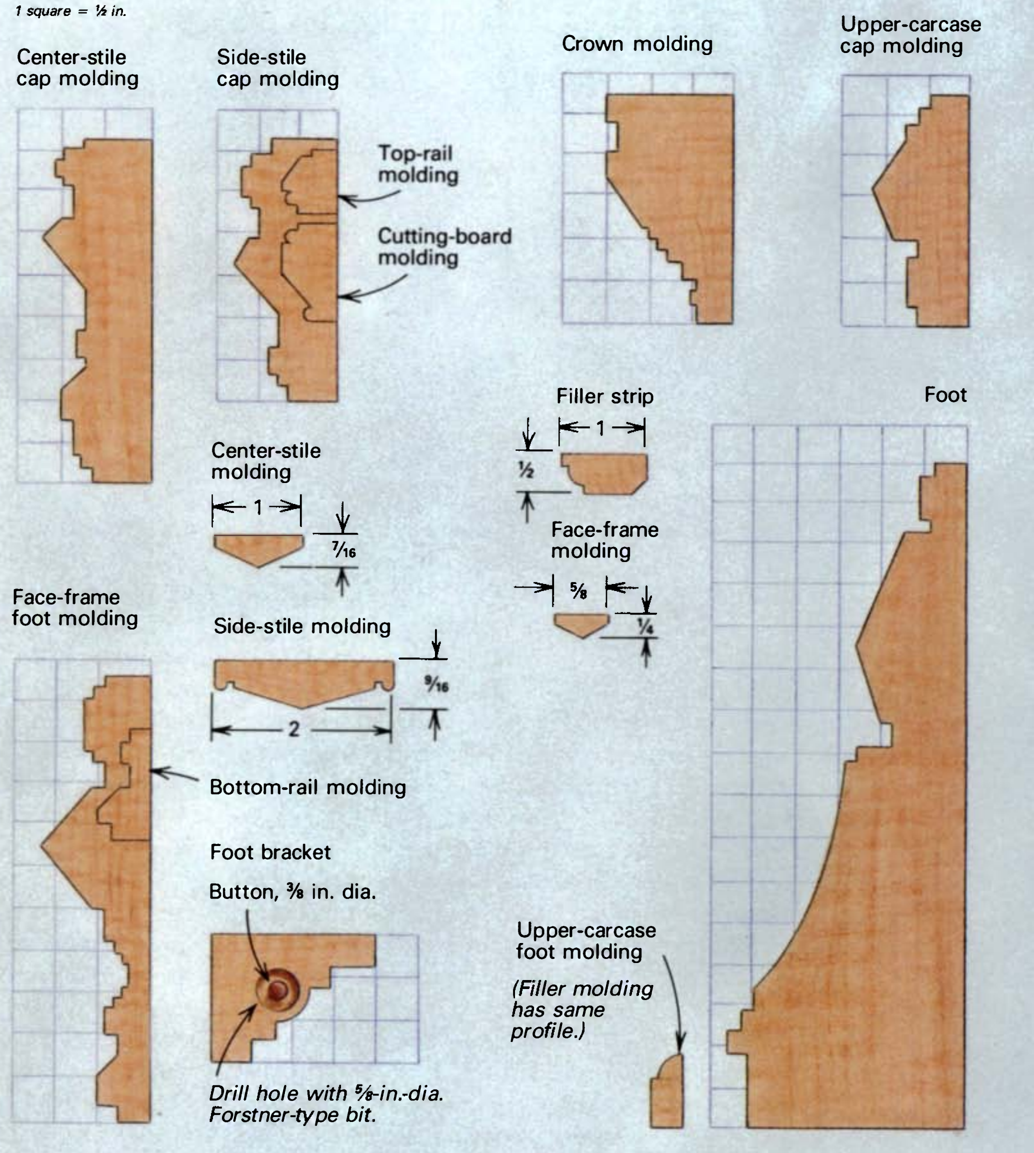
boards. To make the narrow bead with a scratch stock, I clamped the bead stock between two ¾-in.-thick boards in a bench vise for stability, and ran the scratch stock gently along the edge of the bead. I increased pressure as the bead started to form, and used a lighter touch on the last few passes, for a cleaner cut. After shaping the bead, I trimmed it to length, mitered the corners to fit the openings, and glued and clamped it to the face frame. Finally, I screwed the solid top to the top frame, working through the predrilled access holes in the top drawer frame.

Now only the drawers, doors and cutting boards were required to complete the lower carcase. Drawer construction is straightforward: through dovetails at the back and half-blind dovetails at the front. The bottoms are solid, ⅜-in.-thick panels, beveled to slide into ¼-in.-wide by ¼-in.-deep grooves in the sides and front. Each bottom is secured with a brad driven into the drawer back through a small kerf in the center back of the bottom panel. This allows the bottom to move at the back, while a small glue block holds the front in place. I made all the drawer fronts from a single ¾-in.-thick piece of curly maple to maintain the continuity of grain and color across the width of the carcase; the rest of the drawer parts are made with straight-grained maple. After all four drawers were completed, I scratched a bead along the top and bottom edges of the drawer fronts.

The mortised-and-tenoned door frames are ¾-in.-thick and carry ¼-in.-thick panels, similar to the carcase sides, but with a center stile. As with the case sides, the door rails and center stile should be 1/16 in. thinner than the outer stiles so they will fall below the beads on the stiles. I made the cutting boards the same as the floor of the carcase: a ⅞-in.-thick floating panel inside a mortised-and-tenoned frame. I put moldings on the front of the cutting boards (see figure 2 on p. 49) to serve as stops and to visually tie the cutting boards into the dimensional scheme of the cabinet front.

Fig. 3: Molding profiles

1 square = ½ in.



Building the upper carcase—Most of the tops on old hutches were built with a bottom board that rests on or just above the serving surface. Many also were divided in the center to support short shelves. However, I wanted long, uninterrupted shelves and an open bottom that would not disrupt the beauty of the serving surface. The pinned mortised-and-tenoned back frame adds rigidity to the upper carcase, and the shelves are dadoed into the back frame to prevent twisting and sagging.

After dimensioning the stock to the sizes given in the bill of materials on p. 49, I began cutting joints. First, I hand-cut the dovetails to join the top and sides. The top is narrower than the sides so the back boards could be slid into place from above. Next, I routed dadoes in the sides and back stiles to receive the shelves and rabbeted the rear edge of the sides for the back frame. After crosscutting the shelves to length, I scratched ⅛-in.-wide beads along the top and bottom of the shelves' front edges. I also routed ¼-in.-wide by ¼-in.-deep plate grooves, shown in figure 1, to accommodate various-size plates and platters.

I assembled the upper carcase by gluing and clamping the top, sides and shelves together. Next, I glued and pegged the back bottom rail to the back side stiles, and glued and clamped this assembly to the top, sides and shelves. The back center stile is tenoned into the top and bottom rails, but is not secured until the back boards are in place. After inserting the back boards and nailing them to the shelves with 1-in.-long brads, I glued and clamped the back top rail to the back stiles and pegged the center stile to the top and bottom rails. To complete the upper-carcase structure, I glued the beaded crosspiece to the top's front edge and into half-dovetail notches in the sides (shown in figure 1).

The upper-carcase molding, like the detail molding for the lower carcase, was also roughed out on the bandsaw and tablesaw, and refined with hand tools and sandpaper. I glued and clamped the trim to the front edges of the sides, and then attached the crown molding with screws through predrilled holes in the beaded crosspiece.

Because I sanded everything as I went along, just light scraping and minimal sanding were needed before finishing. I applied two coats of hot linseed oil and two coats of tung oil, rubbing each coat out with 0000 steel wool before buffing on a final coat of paste wax. When the finish was dry, I drilled holes for the three wood brackets, shown in the photo on p. 47, so I could secure the upper carcase to the lower carcase after the hutch had been delivered to my clients. □

Ron Layport designs and builds one-of-a-kind furniture in Pittsburgh, Pa.

Water-Base Finishes

Tips and techniques for choosing and using these new materials

by Chris A. Minick

If you've visited your local hardware or paint store lately, you've probably noticed some new cans on the shelves. Many longtime wood-finish manufacturers have recently introduced new lines of water-base wood-finishing products that promise to be environmentally safe and easy to clean up. Although these products are available in the form of familiar finishes, such as lacquer, varnish and polyurethane, they lack most of their traditional counterparts' harmful solvents and can be cleaned up with plain, clear water.

While water-base finishes, which are non-flammable and essentially non-toxic, hold the promise of healthier and safer application, as well as a cleaner environment, there is a price to pay. These new finishes have properties that make them *very* different from their traditional, solvent-base equivalents: Mixing and thinning them is different, applying them is different and troubleshooting their problems is different. They even *look* different straight out of the can. Even if you are an experienced finisher, all this means that you'll have to invest some time to relearn old habits before you'll get a good finish using water-base products. This article will give you an overview of the water-base finishing process, including how to prepare the wood, and some techniques I've learned for successfully applying these new materials. I'll also tell you how water-base and solvent-base finishes differ, how to avoid incompatibility and how to troubleshoot some common water-base dilemmas. But first, let's examine the legal impetus behind this latest finishing revolution.

Water-base products and the law—Why is there a sudden flurry of new water-base finishes? Many of these new products have come about largely in response to recent governmental regulations restricting the amount of solvent or "volatile organic compound" (VOC) in finishing materials, such as clear finishes, sealers, fillers, stains and paints. VOC legislation was first passed in California as a means to reduce air pollution, and several states in the East, notably New York, New Jersey and North Carolina, have adopted California-inspired VOC regulations. Many other states, as well as civic municipalities, are considering adopting similar standards. Industry experts anticipate that VOC regulations will be nationwide by the mid-1990s, at which time water-base and other VOC-compliant finishes will be the standard, rather than the exception to solvent-base finishes as they are currently.

But before you get rid of every can of solvent-base finish on your shelves, read on. Most current regulations state that those hobbyists and small-shop woodworkers who use *less than one gallon of finish per day* are exempt. However, there's a catch: VOC regulations are compelling finish manufacturers to concentrate on developing and producing mostly materials that meet VOC standards; so you can expect that many solvent-base products will be less available in the future. There are several types of wood finishes that won't be dramatically altered to comply with VOC regulations. Most oil finishes, such as 100% tung oil and boiled or raw linseed oil, will remain unchanged. Some oil-varnish mixtures, like Watco Danish oil, may be slightly reformulated to reduce VOCs, but the change should be hardly noticeable to the end user. Commercially prepared shellac will be available in not less than a 3-lb. cut, but you'll still be able to make your own shellac finish in any

With an increasing number of states and municipalities adopting regulations restricting the amount of volatile organic compounds (VOCs) allowed in paint and other coatings, many finish manufacturers have introduced new lines of non-toxic water-base stains and clear finishes.

strength you desire by mixing dry shellac flakes or buttons with alcohol. High-solids varnishes, such as McCloskey's Clean Air Formulation spar varnish, are in another class of low-VOC finishes. These are made compliant with VOC regulations by altering the resins to allow lower solvent levels, and they don't have a water base. I won't discuss these types of finishes here, but in general, they take longer to dry, may be more difficult to apply and have slightly lower protection qualities than their conventional counterparts.

Solvent base vs. water base—Most of the finishes you've used in your shop are probably solvent base, including traditional lacquers, varnishes, polyurethanes and shellac. Typically, solvent-base finishes are a mixture of resin (which forms the actual finish film), driers (to accelerate drying the resins) and solvent (which acts as a carrier for the resin and allows application). Water-base finishes come with the same general resin types, such as polyurethane and acrylic, as solvent-base finishes, but their formulations are considerably more complicated. In addition to resins and solvents, water-base finishes commonly contain surfactants, defoamers, thickeners, flow-out additives, mar reducers and other additives necessary to make the resin compatible with water. And, of course, water-base finishes contain lots of water, which is primarily what makes them low in VOCs.

Besides reducing VOCs and decreasing air pollution in the lower atmosphere, water-base finishes offer woodworkers several other important advantages. They are non-flammable, easy to clean up, practically non-toxic, and have very little odor. If you are a professional woodworker, there is an added bonus: since these finishes aren't flammable, you won't need an expensive explosion-proof spray booth; plus, you may lower your insurance rates. However, water-base materials also have a few disadvantages. Water-base products may develop poor film properties when dried in a humid environment, and they must be stored carefully to avoid freezing. Many are tricky to apply, and the first coat usually raises the grain of the wood substantially. Also, water-base materials may not be compatible with traditional (usually oil-base) stains, sealers and fillers. Finally, most water-base finishes appear milky white in the can and when they are first applied (see the photo above), which may make you apprehensive about using them. But don't worry; they dry quite clear.

Which type and brand of water-base finish should you use? Unfortunately, I don't think any one product is ideal for all wood-finishing situations. There are dozens of water-base finishes now available in hardware and paint stores and home centers, including many nationally distributed products made by major finish manufacturers, such as McCloskey, Fabulon, Star Bronze (ZipGuard), Flecto, Benjamin Moore and Carver Tripp (see the photo on the facing page). Though few cans clearly state that the product is water base, terms and phrases like "low in VOCs," "cleans up with water" or "environmentally safe" will usually tip you off to a water-base product. Before selecting a particular finish, I recommend you buy several different types and brands, make up some samples and conduct your own in-shop tests for stain resistance, hardness and adhesion, as each product has slightly different application characteristics and final-film properties. (For more on this, see "Evaluating Wood Finishes," *FWW* #82.) Regardless of the finish you select, you'll have to get used to its individual application characteristics. But despite the variations among different water-base products, many of the same basic procedures apply for using them, starting with the way the wood's surface should be prepared prior to finishing.

Surface preparation—Many problems with water-base finishes can be avoided by properly preparing the wood surface before application. As mentioned earlier, the high water content of these finishes tends to raise the wood's grain, resulting in a fuzzy surface after the first coat. To avoid this, deliberately raise the grain by wetting the wood with clean water after sanding, and then sand it smooth again before finishing. Allow the wood to dry overnight, and then knock the grain down with fine-grit sandpaper (no coarser than 180-grit). But be careful: The *type* of sandpaper you use can cause problems with water-base products. Non-loading sandpapers, like Norton's No-fil or 3M's Tri-M-ite, are coated with a wax-like substance (usually stearates), which prevents clogging and extends useful life, but can contaminate a surface and create fisheyes or brush streaks. Thoroughly cleaning a contaminated surface with a tack rag can alleviate the problem, but even the rag can cause problems. Most commercial tack cloths are saturated with a sticky, non-drying oil that can leave fisheye-causing residues behind after wiping. A better (and cheaper) alternative is to use a clean, water-dampened cloth, which works well as a water-base tack cloth. Also, *do not* use steel wool to smooth the wood or to rub out between coats of finish; small shards of steel can embed themselves and rust when a water-base finish is applied. Alternatively, use a plastic, non-woven sanding pad, such as a Scotch-Brite brand finishing pad.


Because most water-base finishes first appear milky white, applying them can be a little disconcerting. But fear not; they dry crystal clear. To avoid brush marks, hold the brush at about a 30° angle to the work and pull it across the workpiece in long, even strokes, allowing the finish to "flow" onto the wood.

Compatibility—Perhaps the biggest drawback to water-base materials is their limited compatibility with other standard finishing materials. Stains, fillers and sealers used under water-base finishes must be chosen carefully to ensure compatibility and adequate adhesion of subsequent coats. I've had water-base topcoats applied over an oil-base stain peel off in sheets (see the left photo on the following page). To avoid a catastrophe, experiment by staining and topcoating a sample before coating the workpiece. You can use a water-base stain like Smooth and Simple Wood Stain (available from Clearwater Color Co., 217 S. 5th St., Perkasie, Pa. 18944; 215-453-8663). Further, many stains, fillers and sealers are specifically designed for use with water-base finishes. Aniline wood dyes, either water or alcohol soluble, and NGR (non-grain-raising) stains, like

Photos: Sandor Nagyszalanczy

The incompatibility of many water-base finishes with other finishing materials can be a problem. *The sample shown here was topcoated with a water-base polyurethane applied over an oil-base stain; after being scored with a razor knife (for demonstration purposes), the water-base finish peeled up easily.*

Their tendency to foam during application, *especially when brushed on, is a common problem with water-base finishes. The right half of the sample shows a clear water-base finish brushed on straight from the can (note the bubbles); the same clear finish was brushed on the left half after a defoaming agent was added.*

Behlen's Solar Lux (available from Garrett Wade, 161 Ave. of the Americas, New York, N.Y. 10013; 800-221-2942, 212-807-1757), are completely compatible. In addition, a wash coat of shellac is a good sealer beneath water-base topcoats. In my trials, this wash coat didn't raise the wood grain objectionably, but rather imparted a slight yellow tint, adding a richness to the finish that I find lacking in many clear water-base materials. It's also possible to concoct a shopmade sealer by diluting a water-base material by 50% with distilled water. Only distilled water should be used, as "hard" (mineral-laden) tap water can cause sand-like specks (called gel specks) in the film, ruining the finish. However, some water-base finishes won't tolerate dilution; consult the label or manufacturer first.

Troubleshooting—Even if you've licked incompatibility dilemmas and have applied the finish properly (see the sidebar below), problems may still arise. The key to good results with a water-base product is detecting and solving problems before they ruin your project. One of the most common and annoying problems that occurs while applying water-base finishes is foaming and bubbling, especially if you use a brush (see the above photo at right). The foaming is caused by soap-like materials (surfactants and leveling agents) that keep the resin in emulsion and help the finish flow out. I've found that I can eliminate the problem most of the time by adding a "defoamer" in the form of about 1 oz. of mineral spirits to a gallon of finish. Mineral spirits seems to decrease the final finish's gloss a bit, but this is barely detectable. Chicago, Ill., woodworker John Kriegshauser discovered that he could use 1 oz. of half-and-half (cream and milk) to a gallon of finish as a defoamer. Although this may seem a little unconventional, the chemical structure of milk fat is very similar to some commercially made de-

Applying a water-base finish

Water-base finishes don't look or handle much like their traditional solvent-base counterparts; so it shouldn't come as much of a shock that they'll probably require some getting used to. Water-base finishes can be applied directly from the can via a brush, a standard compressed-air spraying system or HVLP (high-volume low-pressure) spray equipment. But application techniques, such as brushing methods and spray-equipment setups, are somewhat different for water-base than for solvent-base materials. Before delving into the techniques, a few words about safety: While water-base finishes are low in toxicity, *they are not completely non-toxic.* Hence, the same safety precautions for solvent-base finishes also apply to water base: Avoid skin contact, provide adequate ventilation and use an approved mist-and-organic-vapor-rated mask for spray application.

Water-base finishes have a narrower "application window" than most solvent-base finishes. In other words, they are less tolerant to low temperatures and high humidity. Ideal application conditions are between 60°F and 80°F and less than 80% relative humidity. If the temperature of the finishing room is too low or the humidity is too high, water-base finishes will not form an optimum film. Minimum temperatures are different for each product; so check the label. Many finishes have additives that ensure adequate film formation at high humidity levels, but it's better to avoid working on humid days if possible.

Brushing: Water-base materials are more difficult to brush on than solvent-base products for two reasons. First, they have a tendency to foam; so selecting the proper brush is crucial. The cheap, 59-cent variety won't work here, but neither will an expensive, natural-bristle brush; the bristles absorb water quickly, swell and splay, increasing the likelihood of brush marks. I've found the best choice to be a nylon-bristle brush with tapered tips; mine cost about $8. Tapered bristles have fewer tip ends, generating fewer bubbles. Avoid brushes with flagged bristles—ones that look like they have been shredded—because they encourage bubble formation, particularly when the finish is brushed on too heavily. Some finishers have had good luck with "paint pads," which are inexpensive applicators with plastic handles and short, non-flagged bristles.

Brushing technique is especially important to attain a flat, smooth finish. First, wet the brush with distilled water. This keeps the finish that has soaked into the brush from drying and ruining the bristles or from peppering the finish with flecks of dried finish. Next, dip the brush in the finish and tap off the excess. Hold the brush at about a 30° angle to the work surface and pull it across the workpiece in long, even strokes (see the photo on p. 53). The foamers. I've tried half-and-half and it worked amazingly well and didn't change the finish's final gloss.

Fisheyes—those little crater-like pockmarks in a finish—can occur with both solvent-base and water-base finishes; they're due to localized differences in the finish film's surface tension. The cause is frequently due to some kind of surface contamination, such as stearates left from sanding, traces of oil from compressed air or dirty handprints; almost any waxy or oily dirt can cause fisheyes. To combat the problem, don't make the mistake of adding "fisheye eliminator" to your mixture. Most of these additives, even some designed for use in water-base systems, contain silicone oil. Silicone is one of the banes of the finishing world because it contaminates everything it contacts—your brushes, spray equipment and the wood—and it actually *increases* the chances of fisheyes on your next finishing job. The way to eliminate fisheyes is to correct the problem at the source. Keep the workpiece as clean as possible, and wipe its surface with a clean cloth before finishing. If fisheyes persist, add a flow-out agent specifically designed for water-base materials. (I use one made by Amity; call 800-334-4259 or 608-837-8484 to find your local Amity dealer.) This additive can eliminate fisheyes by lowering the film's surface tension. If all else fails, try lightly resanding, wiping down the surface and then recoating.

As with traditional nitrocellulose lacquers, most water-base finishes dry rapidly: A thin coat will dry dust free in about 10 minutes or so, and it will be ready for recoating in about 80 minutes. This is a real plus when you need to complete a project in a hurry. But this rapid drying can be detrimental in some instances, such as when brushing finish on a large tabletop in a low-humidity environment. In this case, the finish brushed on one area dries before the adjacent area is covered, causing lap marks. To avoid this problem and maintain a "wet edge" when brushing, try adding a small amount of propylene glycol. (I use Hydrocote Glaze Extender from Hood Products, PO Box 160, Tennet, N.J. 07763; 800-229-4937.) This retards the evaporation of the water in the finish slightly, prolonging the finish's "open time." About 1 oz. per gallon works in most situations, although a little more won't hurt.

Witness lines, faint lines that sometimes show up in a multiple-coat finish when it's sanded or rubbed out, may indicate poor adhesion between coats. Since the problem is caused by too little "coalescent solvent" in the mixture, the remedy is to add more of it. In most cases, small amounts (1 oz. per gallon) of standard lacquer thinner will serve this function because it increases the "bite" of each new coat to the previous one and allows the individual layers to meld together into a solid film.

If your final finish comes out looking good, but scratches or stains too easily, you can make the film more durable by adding a "cross-linker additive" to the finish before application. Carver Tripp makes one called Safe & Simple Super Strength Hardener (available in hardware and paint stores). It's designed for use with the company's own water-base products, but I've found it also works with many other water-base finishes.

One final consideration for water-base finishes: Since these products were created to be easier on the environment, you must dispose of old or unused finish properly. Many people think that because the finishes contain water, they can be dumped down the kitchen drain. *Don't do it!* Besides being illegal in many areas, it's also unwise. "Hard" water will turn the discarded liquid into a mass of sticky glop that's capable of thoroughly plugging your drain. A better alternative is to pour or brush heavy coats of the unwanted material onto some cardboard scraps and let it dry. Once the finish is dry, it is harmless and can be disposed of with your regular trash. □

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

---

finish should "flow" out of the brush and onto the surface with very few bubbles. This technique (traditionally used for applying shellac) works well on both horizontal and vertical surfaces; but thinner coats should be applied to vertical surfaces to avoid sags and runs. Also, avoid the temptation to brush out any bubbles that form; most will break before the film dries.

Spraying: If you spray water-base materials, first make sure your compressor's air filter and water trap are clean; any stray oil will contaminate the finish. Next, your spray gun setup may need changing. For best results with a conventional siphon-feed gun, install a tip with a slightly smaller orifice (and matching needle) than one you would use for nitrocellulose lacquer. Finishing consultant Michael Dresdner recommends using a fluid tip with an orifice between 0.040 in. and 0.055 in. in combination with a low-volume air cap (5 cu. ft./min. at 30 psi). Fluid apertures of HVLP spray guns should be similarly reduced for water-base finishes; a 0.9mm (0.036 in.) tip works well.

Spraying horizontal surfaces is fairly straightforward, but vertical surfaces can present problems. Too light of a coat can produce orange peel; too heavy a coat may run or sag. I like to mist on several light coats in close succession, applying just enough material to completely wet the surface each time. This method requires some practice, and you'll have to adapt it for the material you're using. Every brand of water-base finish I've tried has its own characteristic fluidity. Some are thin enough to be sprayed directly from the can, while others require thinning before use. How much to thin depends a lot on your spraying technique. If you do need to thin the water-base finish to achieve a good spray pattern, be sure to use only distilled water or a special water-base reducer.

Once you're done spraying, clean your gun and cup immediately with warm, soapy water followed by a clean-water rinse. Any dried finish left in the gun can usually be removed with lacquer thinner. To avoid rusting problems, most water-base finish manufacturers recommend using a gun that has stainless-steel fluid passages. However, my gun has regular steel fluid passages; so after cleaning, I run some denatured ethyl alcohol (available at hardware stores) through the gun to remove the last traces of water.

Rubbing out: After the topcoats dry, you can rub out a water-base finish using automotive rubbing compounds or conventional techniques and materials (see "Rubbing Out a Finish," *FWW* #72). I've had good luck using either water or mineral oil as a lubricant along with pumice and followed by rottenstone compounds. One caution: don't let the rapid drying time of the water-base finishes fool you. Ultimate film properties won't fully develop for four to five *weeks* and the longer you wait, the less likely you are to experience water or oil damage during the rubbing process. (If you don't rub it out, the film is hard enough after about three days to put your project into service.) Waxing the finish right away somewhat delays the development of the film's hardness. Waiting about two weeks before waxing is usually sufficient, but the longer you can wait, the better. *—C.M.*

Inlaying Turquoise and Silver

Adding life and luster to ancient ironwood

by John S. Manuel

Larry Favorite stumbled onto the beginnings of his career as an artist and craftsman while exploring the Sonora Desert in Arizona. He found a piece of ironwood, one of the heaviest and hardest woods in the world, and brought it home. Nothing much happened with the wood until Favorite found himself out of work. Then, one day while walking in his backyard, wondering how he would make a living, he rediscovered his desert find. He had seen some crude ironwood vases and other items in a local craft shop, and decided he could make objects that were at least as good as those being sold downtown.

"The first piece I made was a letter opener," said Favorite, who now operates a woodworking studio in Greensboro, N.C. "I followed that with some small pieces of jewelry. I started buying silver cutouts from the Indians and gluing them onto the wood. One day a man asked me why I didn't do inlays."

Even though Favorite knew nothing about inlays, the man commissioned him to make a belt buckle with his name inlaid into it. Favorite figured out how to do it, but the job took a month. He's learned a lot about inlay in the 15 years since then, and he's won dozens of awards for his inlaid boxes, vases and sculptures, like those shown at left and on the bottom of the facing page.

Favorite works only in ironwood, which has a wavy grain pattern that varies in color from a maple-like pale cream to a dark mahogany-like brown. Favorite enhances its beauty by inlaying turquoise into checks and cracks; then he accents the wood with sawn silver in the shape of Indian dancers, trees, animals and even landscapes.

Collecting the wood—Favorite makes an annual wood expedition into the Sonora Desert, the only place in the world where his preferred type of ironwood grows. Favorite gets his wood from private property, but collects only dead wood, some of which has been lying on the desert floor for more than 1,000 years. Often the wood must be dug out of the sand, and Favorite

Favorite's award-winning boxes, right, and vases, left, are made of ironwood and inlaid with silver and turquoise. The lustrous finish comes from sanding with successively finer grits of paper and then buffing with polishing compound before applying paste wax.

***The turquoise is pushed firmly into a crack** with tweezers. After gluing the stone and then sanding it flush with the wood, Favorite repeats this procedure until all gaps are filled. Hairline cracks are then filled with cyanoacrylate adhesive and fine sawdust.*

***Favorite cuts out the inlay** with a jeweler's fretsaw and a fine-tooth blade. A photocopied pattern of the inlay is glued to the silver sheet to guide the cut, and a jeweler's bird-mouth pin supports the thin metal as he makes the intricate cuts.*

has often irritated a few rattlesnakes and even a Gila monster.

Ironwood weighs 80 lbs. to 90 lbs. per cubic foot; so the pieces must be cut into lengths of no more than a few feet before they can be carried or dragged. Favorite chainsaws the lengths, but because of the hardness of the wood itself and the sand in its pores, he ruins four to five cutting chains per trip. Before cutting, Favorite decides how the pieces will be used and what grain patterns should be preserved. A sinewy branch may be best suited for sculpture, a stump for a vase, a straight section of trunk for boxes.

Preparing stock—Because he likes to preserve the wood's natural growths and weather-worn shapes, Favorite does little cutting or shaping for vases and sculptures. After minimal shaping, these pieces are sanded and polished, as described on the following pages, before they are inlaid.

To make a box, however, Favorite bandsaws sections from the logs with a ¾-in.-wide, 10 teeth-per-in. (t.p.i.) blade. From each section, he cuts a slice about ¾ in. thick from the top and bottom, to make the lid and base of the box. Both base and lid are then ground flat with 40-grit paper on a 6-in. by 48-in. belt sander. Ironwood dust is highly toxic; so a good dust mask and adequate ventilation are essential here. Once ground flat, the pieces are set aside.

The next step is to cut out what will become the inside or hollow of the box. Switching to a ¼-in.-wide blade, Favorite bandsaws through one side of the body of the box and cuts out the center. A curved cut is easiest to make. He applies gap-filling cyanoacrylate to the sawkerf and clamps the entry kerf closed.

Once the glue has dried, Favorite smooths out the inside of the box with a 3-in. pneumatic drum sander. He starts with 40- or 60-grit paper, followed by 80-, 120-, 220-, 320-, 400- and 600-grit. Because the wood is tough, coarse sandpaper is important. Each level of sanding should just smooth out the marks of the previous level. "Once sandpaper loses its cutting ability," he says, "it tends to burn or scorch the wood. Then when I've tried to finish the wood, I would get a rippling or orange-peel effect."

Next, the outside of the box or the vase form is sanded with 40-grit paper. Then, the vases and box components are sanded through 220-grit in preparation for the turquoise and silver inlays.

Inlaying turquoise—Many crafters consider cracked wood defective, but these flaws can be an advantage when inlaying. Turquoise fitted into these cracks and checks adds color to each piece and draws attention to the often beautiful patterns created as a tree dies.

Favorite buys blocks of reconstituted turquoise from Colbaugh Processing, Inc., So-Hi Estates, Box 209, Kingman, Ariz. 86401; 602-565-4650. He throws these blocks in a salvaged garbage disposal that he runs on his benchtop, plugging the inlet and outlet holes to contain the turquoise. The disposal produces everything from fine chips to marble-size pieces, making it pretty easy to find the size and shape piece to match the dimensions of the cracks and checks.

Before the turquoise can be inserted into the wood, splintered edges and other weak areas along the cracks must be smoothed with a flex-shaft or hand-held rotary grinder. Fine, carbide-tip dental burrs are best for this work. Donning a jeweler's loupe to magnify the cracks in the wood and the crushed stone, he uses a pair

Photos of finished work: Susan Kahn; all others: Charley Robinson of tweezers to select pieces of turquoise to fill the cracks. Each piece is pushed down until it is snug against the sides of the opening, as shown in the top, left photo on the previous page. At this stage, the turquoise may project slightly above the surface of the wood, but don't worry about it. Everything will be sanded flush later.

Once the fissure is filled with turquoise, "Hot Stuff" Super T cyanoacrylate glue, available from hobby shops and mail-order woodworking suppliers, is applied over the top and sides of the turquoise. After the glue cures for about a minute, the surface can be sanded with 120-grit paper, either by hand or mounted in a drum sander. Dust created by the sanding fills the hairline cracks between the turquoise. Check for gaps and, if necessary, repeat the procedures with finer pieces of turquoise until all cracks are completely full.

With some pieces, you may want to stop now, and just finish the object. Favorite generally prefers to decorate his pieces a little more by adding a silver inlay.

***Favorite outlines the area to be inlaid** with a fine burr, and then hogs out the waste in the middle with a larger bit. It requires a steady hand to maintain a depth of cut that will leave the silver just slightly below the surface of the wood.*

***The silver inlay is glued into the routed recess** with a couple of drops of cyanoacrylate adhesive and then gently tapped into place. Do not overheat the silver when sanding or buffing the piece or it will expand and pop out.*

Inlaying silver—As with turquoise, the silver offsets the dark color of desert ironwood beautifully. Favorite also uses the silver inlays to highlight or offset a particular pattern of wood grain. For example, he may inlay a windswept silver tree amid swirling wood grains. "I will make up a silver design based on how the wood speaks to me," he says, although he is partial to desert scenes and Indian designs, in keeping with the area from which he harvests the wood.

Once Favorite has selected a design, he draws it, photocopies it and then cuts out the paper image, so it can be tacked onto an 18-gauge silver sheet with rubber cement or spray adhesive sold by art stores. The silver is then set on a standard jeweler's bird-mouth bench pin and cut out with a jeweler's fretsaw and either a 4/0 or 5/0 blade, as seen in the top photo at right on the previous page. (Polishing compounds, buffing wheels, silver and other jewelry equipment used by Favorite are available from Rio Grande Albuquerque, 6901 Washington N.E., Albuquerque, N.M. 87109; 800-545-6566.)

After cutting out the image, Favorite lays it on the wood and traces around the edge with a 0.5mm drafting pencil. He then removes the silver and carves out the inlay area with a Dremel Moto-Flex Tool and three different cutters. First, Favorite cuts just inside the pencil line with a #171L Midwest carbide burr, also available from Rio Grande Albuquerque. Holding the burr at an angle, he undercuts the line enough to fit the silver inlay just below the wood's surface. The undercut edge also forms a slight lip that helps hold the inlay in place. After the outline has been roughed out, Favorite goes around the recess with a small #169 burr, enlarging the border. Then, the middle of the recess is cleared out with a Dremel #650 ⅛-in.-dia. straight cutter (see the top photo). The small burrs used to outline the recesses—a #170 or #169—are also handy for cutting out minute features, such as the toe of a bear. Regardless of the shaping operation, sharp burrs and cutters are a must. Favorite constantly changes cutters; it usually takes less than a half hour of work to ruin a burr.

After putting a few drops of cyanoacrylate glue on the wood, Favorite taps the silver image in place with a small metal hammer, as shown in the bottom photo. He then sands the wood down to the level of the silver, starting with 220-grit and followed by 320-grit paper on a pneumatic sander with an 8-in. drum.

Finish-sanding and buffing—Once the wood is flush with the turquoise and silver inlays, Favorite repeatedly sands all surfaces with 400-, 600- and 800-grit paper using a small electric-powered finishing sander. "These sandings must be done very slowly and carefully; so I just barely contact the surface of the inlay," Favorite says. "If the silver gets hot, it will expand and pop up."

Vases and sculptures are now ready for final buffing with White Diamond Buffing Compound applied on an 8-in. buffing wheel turning at 3,450 RPM. Finally the piece is polished with paste wax to create a pleasant sheen and protect the wood surface.

Boxes are assembled before final buffing. This procedure is pretty simple. The bottom is attached to the body of the box with cyanoacrylate glue. Tops are usually secured with insert hinges fit into recesses cut in both the top and side of the box with a slot cutter chucked in a table-mounted router. The insert hinges (available from Woodworker's Supply of New Mexico, 5604 Alameda Place N.E., Albuquerque, N.M. 87113; 800-645-9292) have barbs that stick in the wood, but as added protection, Favorite puts a drop of cyanoacrylate into each slot before putting in the hinge. □

John Manuel is a freelance writer living in Durham, N.C. Larry Favorite can be contacted at Route 2, Box 198, Stokesdale, N.C. 27357.

Stacking dado blades aren't all alike. Shown above are, from left to right: a high-speed steel set; a typical carbide-tip set; a carbide set sharpened with a beveled, or shear, face and a slight top bevel; and a carbide set with a reverse hook angle on its teeth.

A Close Look at Dado Blades

How blade design affects quality of cut

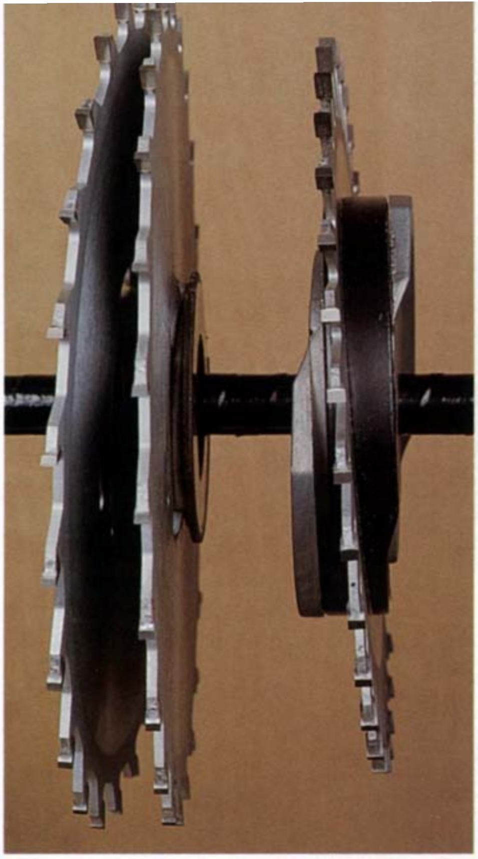
by Jim Puterbaugh

A dado is a groove or trench cut across the wood's grain. When a board is inserted into the trench, it forms a strong and simple joint, which has many applications and is commonly used for connecting shelves to bookcases or cabinet sides. Although a router can be used to cut dadoes, more than one pass may be required to reach full depth and to fine-tune the width of the groove. Because of these shortcomings, most small shops still cut these grooves with a dado head mounted on a tablesaw or radial-arm saw. A dado head is a special blade, or set of blades, that typically can be adjusted to cut a groove of any width from ¼ in. to 13⁄16 in. in a single pass.

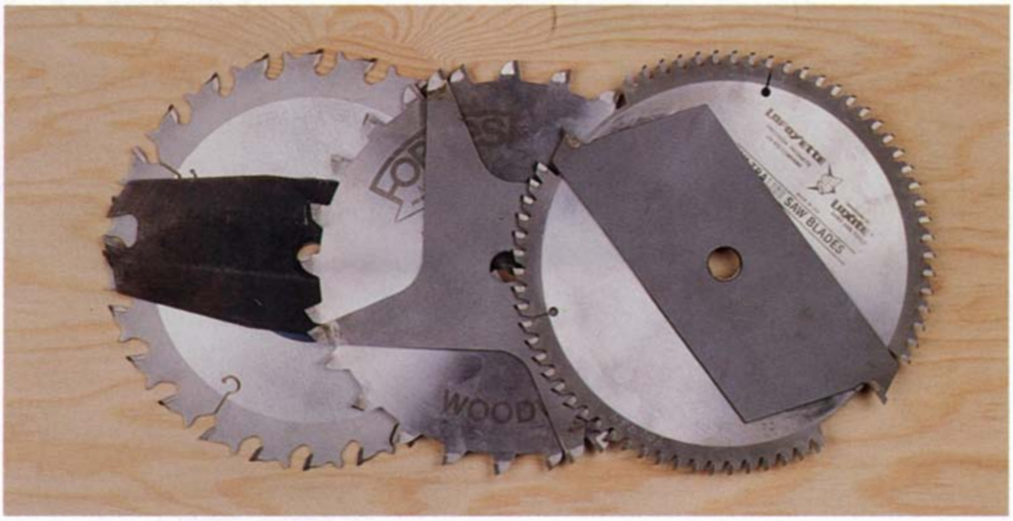
The requirements for a well-cut dado are straightforward: you want a channel with a precise width; square shoulders; a clean, flat bottom; and no tearout along the edges. But achieving all this is not so easy. After using a few different dado heads, I observed several problems, particularly an uneven or rounded bottom and sufficient tearout along the edges of the cut to ruin an exposed joint. The reviews of dado heads that I read seemed incomplete because they included just four or five sets cutting only one type of wood. What follows is the knowledge I gleaned from trying out more than 30 dado heads on both a radial-arm saw and a tablesaw and on five kinds of material: pine, Eastern maple, melamine-coated particleboard, birch-veneered plywood and thin-oak-veneered plywood. After using each of the blades, I decided to examine the principles involved in getting a good cut and how design variables affect performance, so that a prospective consumer could evaluate a dado set before buying it. The chart on pp. 62-63 lists the dado blades I tried; specific manufacturers are only mentioned in the article if a product offers a unique feature. The chart groups blades into four categories based on how well the sets performed right out of the box. I'll explain how I arrived at the distinctions among the categories in the sections describing the blade types; first let's look at dado blades in general.

The two basic types of dado blades—There are two types of dado blades on the market: the adjustable or "wobble" dado (see the left photo on the following page) and the stacking dado (shown in the photo above). Most adjustable dado heads have a single blade mounted between beveled hubs. By rotating the blade in relation to the hubs, you can tilt it at various angles on the saw's arbor. Because the blade is tilted, it cuts a wide channel and appears to wobble as it spins. A new twist in the adjustable dado market is the two-blade, or V-wobble, dado. This is actually two blades joined with a hub that allows the blades to be splayed in a V and then tightened onto the arbor after being spread enough to cut the desired channel width.

Stacking dadoes consist of two outer cutters, both ⅛ in. wide, and a set of four or five "chippers," which are mounted between the outer cutters and hog out the center of the dado. The outer cutters and some combination of chippers are "stacked" on the saw's arbor to give the desired width of cut. The outside cutters resemble conventional sawblades and have between 18 and 60 teeth. Chippers usually have only two teeth, although some have four or six teeth (see the bottom, right photo on the next page). Most stacking sets include 1⁄16-in.- and ⅛-in.-wide chippers (some sets also have one that's ¼ in. wide), which allow you to adjust width of cut in 1⁄16-in. increments, from ¼ in. to 13⁄16 in.; finer adjustments can be made with paper or metal shims mounted on the arbor between chippers and blades. The Hogger, made by LRH Enterprises, Inc., is the exception. It has two ⅛-in.-wide outside cutters and only two



***Tearout is common on cross-grain work.** From left to right are solid pine, melamine-coated particleboard and oak-veneered plywood. The author found little or no tearout with any of the blades on Eastern maple and less on birch plywood than on the oak.*



***The two types of adjustable dadoes** (above): The double blade, or V-wobble, at left, and a single-blade wobble at right.*

***Stacking sets with unique tooth designs** (right). Freud's Safety Dado, left, has a finger in front of each tooth to limit chip size and the potential for kickback. The Forrest blade, center, has four-tooth chippers and a reverse hook on its teeth to reduce tearout. Lafayette, right, addresses the problem of tearout with 60 teeth on its outer cutters.*

chippers, both ¼ in. wide. By adding metal shims, it can be set to cut from ¼ in. to 1 in. wide—³⁄₁₆ in. wider than most blades.

Generally, you get what you pay for with dado heads. Wobble dadoes range from $30 to $117, high-speed steel (HSS) stacking dadoes from $40 to $80, and carbide stacking sets from $145 to $350. But before you lay down your hard-earned cash, you should know that your saw can defeat even the best dado set. If the arbor is out of round or has horizontal or vertical runout, no dado set will work properly. (See *FWW* #87, p. 58, for an article on checking arbor runout with a dial indicator.) On some saws, the arbor threads are worn or are a smaller diameter than the main shaft. This lets the outer cutter of a stacking set settle lower than those on the inside and produces a channel with an uneven bottom.

The problem of tearout—Tearout along the edges of the dado is probably the most frustrating factor associated with cutting dadoes, and avoiding tearout is one reason that you may want a $300 dado set instead of a $50 set. I didn't find any problem with tearout on hard maple using any of the blades, wobblers or stackers, but there was significant tearout from the cheaper sets on the pine, melamine and veneered plywood with most of the sets, as you can see in the top, right photo. Interestingly, I found that tearout was virtually eliminated with the radial-arm saw, even using the least-expensive dado sets; figure 1 on the facing page shows why. The teeth of a blade mounted on a radial-arm saw enter the wood from the top, thereby cleanly severing surface fibers. But when a blade is mounted on a tablesaw, the teeth enter from the endgrain and exit from the critical surface, forcing the fibers to tear away from the board. In spite of the increased tendency for tearout, dado blades are often used on a tablesaw because the length of a crosscut on most radial-arm saws is limited to 15 in. or less, while length of cut on the tablesaw is unlimited. Subsequent discussion of tearout refers to using dado blades on a tablesaw.

Safety—Dado blades are wood- and finger-grabbers. Their mass and speed combine for quick action when things go wrong. One of the disadvantages of using a dado head on a radial-arm saw is that the blade has a tendency to "pull" into the wood, causing the saw to suddenly leap forward, which could be disastrous if the operator's hand was in the blade's path. Once aware of the danger, the operator can pull the saw forward slowly, while resisting the blade's tendency to climb onto the workpiece. When dado blades are used on tablesaws, the danger is kickback. During my evaluation, I injured a finger when a board kicked back, and so I can authoritatively advise you to always use hold-downs or featherboards to keep your work on the table and against the fence; always use stop blocks when making blind dadoes; and always keep your hands as far as possible from a moving dado set.

Freud has come up with a design that the company says reduces the hazards of dado blades. Freud's Safety Dado (in the bottom, right photo) has an anti-kickback feature: the body of the blade is made with a finger in front of each tooth, restricting blade bite to ¹⁄₃₂ in. and reducing kickback force on a tablesaw, as well as the tendency to pull into the board on a radial-arm saw.

Results of the trials—As I mentioned, the chart is divided into four groups: wobble, or adjustable, dadoes; stacking sets with alternate top bevels (ATBs); stacking sets with designated inside and outside cutters; and stacking sets designed to reduce tearout. Generally, you can expect better results (a flatter bottom and less tearout) on plywoods and laminates as you move from one group to the next and I'll try to explain why as I describe the distinguishing features of the various groups.

Adjustable dadoes—The major advantage of adjustable dadoes is their relatively low price. In addition, their "one-piece" design makes them convenient to store and use, and some of the single-blade models can be set for a narrow, 3⁄16-in.-wide cut (stacking dadoes start at 1⁄4 in. wide). However, in trying to be everything in one, they sacrifice quality of cut. For example, the bottom of the cut can be flat at only one setting, and this is determined by how the blade is sharpened, as shown in figure 2 at right. If a set is sharpened to cut flat at 1⁄4 in., all other settings will yield a concave cut, which is unacceptable for exposed joints. If sharpened to cut flat at 3⁄4 in., the blade will produce a convex bottom at all narrower settings, which is still less than satisfactory in an exposed joint. The other major problem with adjustable dadoes is severe tearout; no matter how many teeth the blade has, there is only one tooth cutting each wall of the groove. In my trials, the wobble dadoes cut the solid maple without much tearout, but mounted on a tablesaw, they didn't make clean cuts on any plywood or softwood. Another less obvious problem with wobble sets, which can be a nuisance at times, is that adjusting the width of cut changes both the depth of cut and the distance from the fence of both edges of the dado.

The newer, two-blade dado heads partially solve some of the problems associated with single-blade wobble dadoes. Despite the difference in list price, the two V-wobble models on the market appear to be identical. These sets have more teeth, cut a somewhat flatter bottom and leave less tearout than most single-blade wobble sets. Also, width adjustments don't affect depth of cut, although they still change the cut's distance from the fence. Even though tearout was reduced on some woods, it was still a major problem on softwood and plywood, mainly because of the outside tooth limitation inherent in a wobble design. Another problem peculiar to two-blade models is difficulty of sharpening; the blades can't be removed from the hub, which necessitates constant adjustment of the sharpening jig, and each tooth of each blade must be individually sharpened to a different bevel.

Stacking dado sets—Stacking dadoes are the sets of choice for consistently clean work. When manufactured correctly and sharpened with care, a stacking dado will cut a flat bottom at all widths. In addition, tearout can be less of a problem with stacking sets because the multiple teeth on the outer blades score the wood fibers along both edges of the cut. The outside cutters, however, must be sharpened to a knife-like projection that cuts slightly deeper to score the wood fibers and prevent severe blowout at the end of a cut. The pattern left by the deeper-cutting outer blades is called the "scribe," and it varies from set to set (see figure 2). If you will use exposed through dadoes often, the design of the scribe is critical to the appearance of the finished joints.

On steel stacking sets (group 2 in the chart), the outer blades are identical. Both are ground with ATBs: five teeth beveled in one direction, and one raker and five teeth beveled in the other direction, as shown in the photo on p. 59. This means that either blade can be mounted at the extreme inside or outside of the set, but this interchangeability reduces both blades' ability to cleanly score the edges of the cut. In my trials, these blades produced tearout

Fig. 1: Dadoing on radial-arm saw versus tablesaw

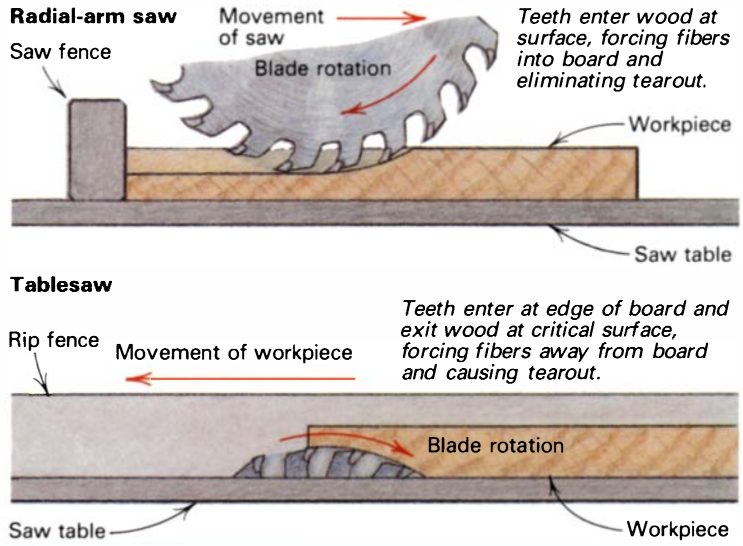
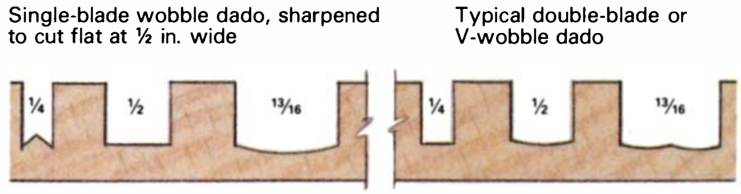


Fig. 2: Dado-bottom profiles

Adjustable dado heads will cut different bottom profiles at different settings.



Profile of stacking sets depends on how outer cutters are sharpened.

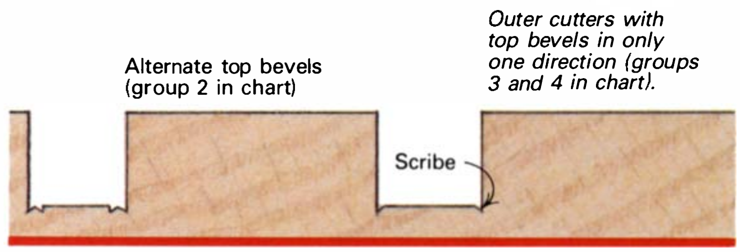
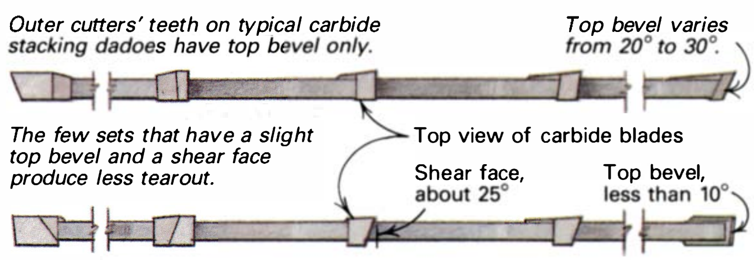
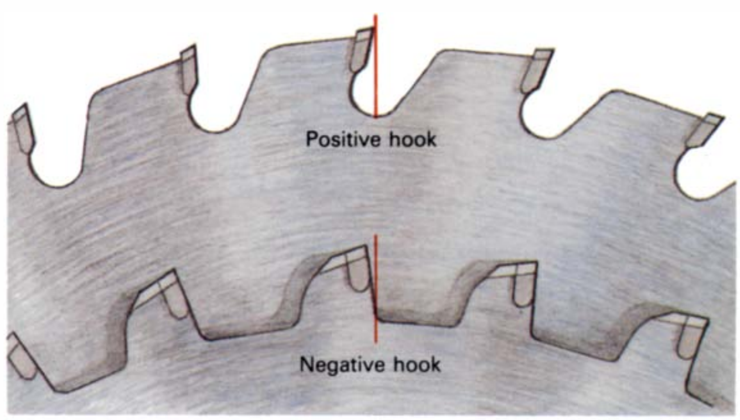


Fig. 3: Tooth geometry of outer cutters



Most sets have a positive hook on their teeth; tearout is reduced with a 0° hook and eliminated with a negative hook.



Photos: Jim Boesel; drawings: Vince Babak equivalent to the V-wobblers: they adequately cut solid woods, but generally tore out melamine and plywoods. Sears and Vermont American each offer "thin-rim" steel sets with more than 100 small teeth on the outer blades, which produced a smooth cut and left less tearout than the other steel stackers.

In my trials, the steel stackers often left a rough-bottom dado, though fairly flat. The quality of the bottom depends mostly on the accuracy in sizing the arbor hole and the accuracy in grinding all the chippers to cut the same circumference. I found that the arbor holes on the cheaper stacking sets were often inconsistent; in two of the sets I tried, the holes were so undersized that I couldn't get them on my saw. In other cases, I found both loose-fitting and tight-fitting arbor holes within a single set.

The carbide stacking sets (included in group 2 in the chart) are the next step up in price. Because of the durability of the carbide-tip teeth, these sets will stay sharp longer, but they don't give a significantly better cut than a standard 8-in. stacking steel set. The least-expensive carbide sets often have stamped-out arbors, which can present the same problems with fitting on the arbor and cutting a clean bottom as I mentioned with the steel stackers.

The high-quality carbide stacking dado sets in group 3 in the chart have an inside and outside cutter (each outer blade has teeth beveled in only one direction with an occasional raker), a well-machined arbor hole, good quality and quantity of carbide, and prices starting around $170. These sets cut both hard and soft solid woods cleanly, but most still had a problem with tearout on plywoods and melamine. The bottom of the channels they cut were flat and most had a small scribe, acceptable for exposed joinery. The most striking exception was F.S. Tool Corp.'s 40-tooth blade, which left a very wide and deep scribe.

Tooth designs that reduce tearout—Group 4 in the chart consists of five carbide stacking sets that have been designed specifically to reduce or eliminate tearout. The Luxite 60-Tooth set (see the bottom, right photo on p. 60), made by Lafayette Precision Products Inc., was the only fine-tooth carbide set that showed any marked reduction in tearout in melamine and veneered plywood as a result of a larger number of teeth. In my trials, I found that sets with 18 to 40 teeth had about the same degree of tearout.

Two other sets in group 4, Lafayette's Luxite Ultraline Shear and General Saw Corp.'s 25° Shear Face, are sharpened differently than the rest. Each tooth on the outer cutters is ground with a beveled "shear" face, as well as a slight top bevel (shown in figure 3 on the previous page). This makes the teeth cut more like a knife and

Dado Blades

Manufacturer	Model	List Price	Blade Dia. (in.)	Teeth (no.)	Steel (S) or Carbide (C)	Comments
Group 1: Wobble dado heads. Similar cutting qualities: severe tearout on softwood, melamine and plywood; okay on hardwood.						
Continental Manufacturing & Supply Ltd.–(503) 630-6555	Acu-Edge 11-300D	$49.99	6½	8	C	Single-blade wobble set; formerly Acu-Edge adjustable dado
The Credo Co.–(800) 547-9151, (503) 982-0100	Adjustable Wobble Dado	$47.24	7	12	C	Also makes similar 8-tooth blade for $34.70
Delta International Machinery Corp.–(800) 438-2486, (901) 363-2843	34-959 Adjustable Microset	$45.05	6½	12	C	Ground to give flat bottom at ¼ in. wide; ¾-in. dado is concave
Sears/Craftsman–(800) 366-3000, (312) 875-2500	GT-3262 Adjustable Wobble Dado	$49.99	7	32	C	Also makes similar sets with 16 and 24 teeth
Vermont American Tool Co.–(704) 735-7464	Dial-A-Groove 26752 Adjustable Dado	$40.00	6½	12	C	Also makes similar 24-tooth steel blade for $30
DML Inc.–(800) 233-7297, (502) 587-5562	Challenger AD8000 (V-Wobble)	$117.60	8	48	C	2 blades/24 teeth each; similar to Sears Excalibur; less tearout than with single-blade wobblers
Sears/Craftsman	Excalibur GT-32708 (V-Wobble)	$76.47	8	48	C	2 blades/24 teeth each; similar to DML Challenger; less tearout than with single-blade wobblers
Group 2: Stacking dado sets with alternate top bevels (ATBs) on outside cutters. Tearout is equivalent to V-wobblers.						
DML Inc.	D800 Steel Stacking Dado	$44.10	8	48	S	Standard steel stacker design: 5 teeth beveled one way; 1 raker and 5 teeth beveled the other way
Vermont American Tool Co.	26742 8-in. Dado Set	$56.00	8	48	S	Standard steel stacker
Delta International Machinery Corp.	34-334 6-in., Flat-Ground Stacking Dado	$53.30	6	36	S	Same design as 8-in. steel stackers, but fewer teeth because of smaller diameters; also has 6-in. hollow-ground steel dado for $66.65
Oldham/United States Saw–(800) 828-9000, (716) 778-8588	800-5220 8-in. Stacking Dado	$42.92	8	20	S	Standard steel stacker
Sears/Craftsman	GT-32177 Smooth-Cut 8-in. Stacking Dado	$54.99	8	112	S	Much less tearout than with standard steel sets; also has similar 7-in. steel dado for $46.99
Vermont American Tool Co.	26747 Thin-Rim Dado Set	$56.00	7	112	S	Similar to Sears Smooth-Cut
Oldham/United States Saw	800-5818 Carbide Regular Stacking Dado	$168.56	8	18	C	All carbide sets with ATBs performed similarly
Sears/Craftsman	GT-3264 Carbide Stacking Dado	$89.99	8	22	C	Similar to DML Super-King
DML Inc.	DC-800 Super-King	$144.01	8	22	C	Very similar to Sears Carbide Stacking Set

provides better chip clearance than blades with top bevels only. Both sets cut somewhat easier and cleaner than the sets without a shear face, but I still had minor tearout on melamine; when used on oak plywood, the tearout was significant (see the samples in the top, right photo on p. 60).

Another design option for reducing tearout is to decrease or reverse the hook on the blades' teeth (see figure 3). As the hook angle is decreased, more force may be required to hold the wood down and feed it through a tablesaw, but I didn't find this to be a serious problem. On the plus side, decreasing the hook angle reduces the tendency for the blade to grab and pull into the work on a radial-arm saw. F.S. Tool Corp. makes a set with a 0° hook that cuts about the same as the two sets with a shear face—a little better on melamine and plywood than the high-quality sets with a positive hook, but still with significant tearout on the plywood. Forrest Manufacturing Co. makes the only dado set with a negative hook on all its teeth, including chippers (see the bottom, right photo on p. 60). This effectively makes the teeth cut "up" into the wood, even when used on a tablesaw. It was the only set that cut the oak-veneered plywood without tearout (see the top, right photo on p. 60) and it also gave a perfectly flat bottom with a discreet little scribe.

Conclusions—So, can you get a good dado with an inexpensive dado set? If you have a radial-arm saw with a true arbor and its limited crosscut capacity doesn't prevent you from using it with softwoods, plywoods or melamines, you can get by with a good wobble head or steel stacking set. If you have an ATB steel stacking set with accurately sized arbor holes, your saw sharpener can regrind the outer blades and chippers to correct its shortcomings. First, bevel and reset the teeth on the outer blades so they will be specifically inside and outside cutters and so they will leave a small scribe; second, sharpen all the chippers evenly so they will cut a flat bottom. You can lessen tearout on a tablesaw by making a tight-fitting wood table insert to create an anvil effect and break off the wood fibers close to the cut. Plus, you can make a very shallow preliminary "scoring" cut first, followed by a final cut to full depth.

But clean work in one pass on a tablesaw comes with a higher price tag. If you work mainly with solid woods and can live with some tearout when using melamine and veneered plywoods, a good-quality stacking set from group 3 in the chart will do fine. But to minimize or eliminate tearout, even on fragile laminates, you'll have to look to the sets in group 4. □

James Puterbaugh is a physician and woodworker in Portland, Oreg.

Manufacturer	Model	List Price	Blade Dia. (in.)	Teeth (no.)	Steel (S) or Carbide (C)	Comments
Group 3: Carbide stacking sets with designated inside and outside cutters, accurate arbor holes and positive hook. Less tearout than with groups 1 and 2.						
Amana Tool Corp.–(800) 445-0077, (516) 752-1300	Carbide Stacking Dado 8x5/8x13/16	$173.00	8	24	C	Maximum carbide and deep gullets should give long life; good buy
Delta International Machinery Corp.	Carbide Stacking Dado 35-550	$246.55	6	18	C	6 in. dia. only allows 1-in.-deep cut on most tablesaws, but should be adequate for most joinery; nice box
DML Inc.	ID-800 Industrial Carbide Stacking Dado	$233.10	8	24	C	Beautifully made set; nice box
DML Inc.	C-9000 Custom Dado Set	$245.00	8	36	C	Similar to DML ID-800; more teeth on outer blades didn't reduce tearout
Everlast Saw and Carbide Tools, Inc.–(800) 828-7297, (516) 491-1900	Carbide Dado Set 8x5/8x13/16	$196.98	8	18	C	A little light on carbide, which might account for lower price
Freud Inc.–(919) 434-3171	High-Performance Safety Dado	$218.90	8	24	C	Chip-reduction safety feature; 6-in. blade set available
F.S. Tool Corp.–(800) 387-9723, (602) 759-5222	54DL08 Positive Hook	$289.00	8	40	C	Particularly wide and deep scribe; positive 6° hook
F.S. Tool Corp.	53DL08	$199.80	8	24	C	Performed similarly to 54DL08 40-tooth blade
LRH Enterprises, Inc.–(800) 423-2544, (818) 782-0226	Hogger Mini-Scribe	$169.95	8	12	C	Only two ¼-in.-wide chippers; cut from ¼ in. to 1 in. wide; fewer pieces, cheaper to sharpen
Systi Matic Co.–(800) 426-0000, (206) 823-8200	ADS22-Fine	$208.60	8	22	C	Well-crafted set
Systi Matic Co.	ADS42-Superfine	$365.80	8	42		6 teeth on each chipper; did not cut appreciably better than Systi Matic ADS22
Group 4: Carbide stacking sets designed to reduce tearout.						
Lafayette Precision Products Inc.–(800) 729-9050, (718) 383-4545	93-08133 Luxite 60 Tooth	$285.00	8	60	C	Less tearout than with other sets with large number of teeth
Lafayette Precision Products Inc.	92-08133 Luxite Ultraline Shear	$225.00	8	12	C	Shear angle on face of teeth on outer cutters; less tearout than with most sets that have top bevel only
General Saw Corp.–(800) 772-3691, (201) 867-5330	DS-803 25° Shear Face	$210.00	8	18	C	Shear angle similar to Lafayette Precision Luxite Ultraline; less tearout
F.S. Tool Corp.	54DL08-0° Hook	$289.00	8	40	C	Less tearout than with positive-hook blades
Forrest Manufacturing Co., Inc.–(800) 733-7111, (201) 473-5236	Dado King Multitooth, Lasercut Dado Set	$299.00	8	24	C	Negative hook on cutter and chipper teeth; 4 teeth on each chipper; no tearout on all five woods tested

The author designed this full-length standing mirror as a limited production piece, as evidenced by the four variations shown here. The adjustable hardware holding each mirror together is almost invisible, but makes it possible to disassemble the piece for shipping.

Knockdown, Stand-Up Mirror

A contemporary version of a cheval glass

by Bill Bivona

Photo this page: Roger Birn

Two years ago, during a lull in our stairbuilding business, I designed and built a stand-up mirror to bring in a little money and to let my partners and employees get back to one of the things they most enjoy—building furniture. When we started the business, furnituremaking was a goal we all shared. But economics led us into architectural millwork and stairbuilding, and we have been pretty successful. At times we have built custom furniture, but this was our first attempt at a well-designed production piece. A coat rack was my inspiration; I visualized the mirror in a dressing room with garments hanging from it. My basic aim was to make a stable, freestanding, full-length mirror. I didn't want the smooth line of the piece marred by adjustment knobs, and so I used a nearly invisible keyhole hanger instead. This hardware also makes it easy to disassemble the mirror when you move it. In fact, everything fits into one box for shipping.

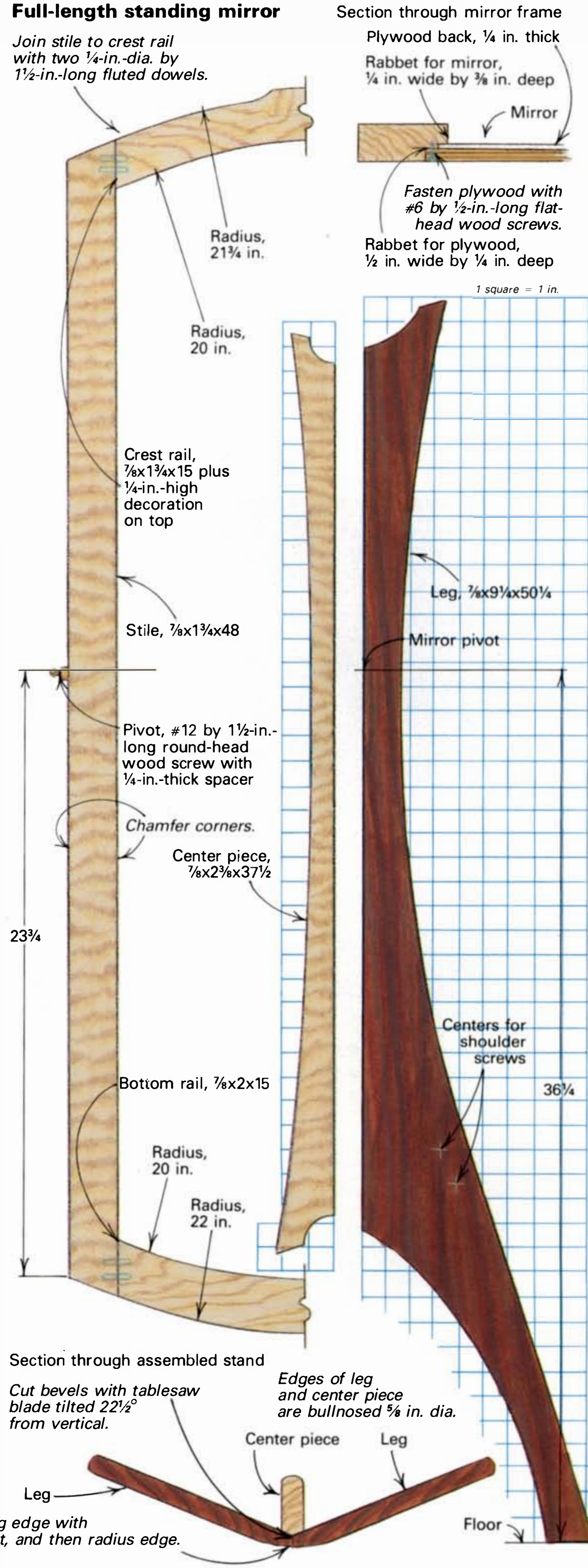
In discussing the mirror, I'll describe my manufacturing methods, but keep in mind that all of my techniques can be adapted to a small shop. The stands on each side of the mirror, shown on the facing page, are assembled from three separate pieces; the long edges of the pieces are beveled and glued together. The mirror frame is doweled at the corners and rabbeted to accept the mirror. Another type of keyhole fastener, similar to the kind used to hold bed rails to headboards and footboards, secures each stand to the stretcher. I'll discuss the fasteners in detail later.

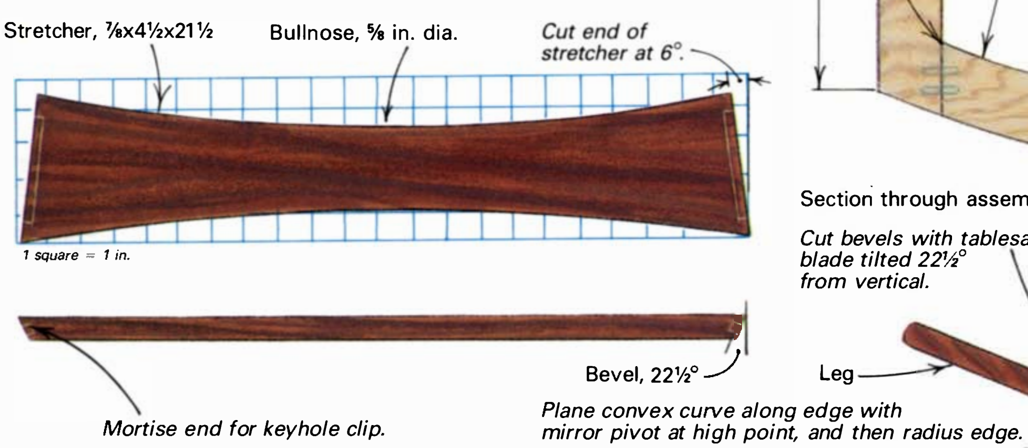
To speed production and ensure accuracy, I made jigs that enable us to bullnose and profile the curved parts of the stand in one pass on our spindle shaper. I also made a clamping jig for gluing up each three-piece stand. Although you may not be concerned with speeding up production, I urge you to build jigs to minimize the headaches involved in producing the identical parts and symmetrical assemblies. Jigs like mine can be used to shape parts with a table-mounted router, and I think you'll find the time invested in jig-making well spent, even if you're only building a single mirror.

Start by selecting wood—I have made some mirror frames from a single species and have even lacquered some black, but the design really lends itself to contrasting woods with a clear finish, like the walnut and curly maple mirror in the foreground of the photo on the facing page. Be careful to select straight stock, especially for the mirror frame, because a warped or twisted frame can force the glass to distort the image. If anything, err toward a convex mirror to make the viewer look thinner as opposed to fatter.

You should be able to arrange the patterns, which you can make from the drawing, to get the four legs, the bottom rails, the stretcher and the mirror's crest from a ⅞x9½x144 planed and jointed board. Lay the straight edge of each leg, two per side, on the board's jointed edges. Don't be too concerned with short grain in

Full-length standing mirror





Photos except where noted: Gary Weisenburger; drawing: Aaron Azevedo

***Shaping the curved edges**—The author sandwiches a stretcher between two templates to shape its curved edges in one pass. Either template can follow the shaper's guide bearing. Note the knockdown hardware screwed into the stretcher's mortise.*

***Safety measures**—Bivona inserts a dowel handle into a hole in the narrow end of the leg's template jig to keep his fingers clear of the shaper cutter. His right thumb is hooked over the jig's edge to keep that hand from slipping. (Guard removed for photo.)*

Safety tips for using shaper jigs

1. Don't shape wild-grained or knotty wood.
2. Always feed the stock against the rotation of the cutter. Don't climb-cut or feed in the same direction as the cutter rotates or you risk having the cutter grab the work and pull it, and possibly your hand, into the path of the cutter.
3. Allow plenty of extra length on each end of the jig. The template should contact the guide bearing before any cutting begins and support the workpiece after the cut is completed.
4. Make the jig as large as possible, even if the workpiece is small. The larger the jig's mass and table contact area, the less liable it is to kick back.
5. Put handles on the jig, like the one in the bottom photo above, to keep your hands away from the cutter.
6. Keep hands and body out of the line of possible kickback.
7. Cover the cutter with a guard.

the curved bottom section of the legs; it only supports the weight of the mirror. You can cut the mirror frame's narrow stiles and the two center pieces for each stand from a ⅞x5x120 board—perhaps of a species that contrasts with the legs. I bandsawed the curved parts to within ¼ in. of the layout line, and then trimmed and bullnosed them later on a spindle shaper.

The stretcher must be machined carefully because it joins the stands at a compound angle (shown in the drawing on the previous page). Before crosscutting this angle, rip and joint both edges of the stretcher parallel. Since I made several mirrors at once, I cut the compound angles with a shopmade crosscut box. My box is similar to the one made by Kelly Mehler on pp. 72-75 of this issue, but modified to hold the stretcher at opposite 6° angles for each of the end cuts. For a single mirror, I would make one compound cut with the miter gauge set at 6° and then reset the opposite 6° angle to cut the other end; the tablesaw blade should be tilted 22½°.

Before shaping the stretcher's edges to the curves shown in the drawing, I clamped the stretcher in a router jig to mortise the ends for the double keyhole clip, which is shown in the top photo at left. This clip, which is available from Modular Systems Inc., PO Box 399, Fruitport, Mich. 49415; (616) 865-3167, locks onto two shouldered screws on each back leg.

My router jig is basically a plywood platform with a hole cut in the center. I inserted the stretcher through the hole from beneath the platform so its compound-angled end is flush with the platform's top surface. Guide blocks, made from ¾-in.-thick scrapwood, are screwed to the platform's surface to create a rectangular opening just wide enough for my plunge router's guide bushing to slide in. Then I set up the router with a ½-in.-dia. mortising bit and guide bushing and routed the ¼-in.-deep mortise. Situate the guide blocks so the mortise will be 3½ in. long, centered end to end, and ⅛ in. from the stretcher's inside edge (the edge that faces the back of the mirror). Of course, to use the jig, you must anchor the platform securely and provide a way to hold the stretcher firmly while you rout the mortise. I solved the first problem by screwing and gluing a 6-in.-wide by 18-in.-long plywood cleat perpendicular to the bottom of the platform and reinforcing it with plywood gussets. When the cleat is placed in the bench vise, the platform is held level, solid and secure. Then, to support the workpiece, I screwed a 4-in.-wide by 18-in.-long plywood ramp to a large plywood gusset cut with a 22½° angle. This assembly is screwed to the bottom of the platform so that the workpiece can be clamped to the ramp with its beveled endgrain extending through the hole and aligning flush with the platform's top. After routing the mortises, I bandsawed the curves on the stretcher's long edges.

Trimming and shaping a curved edge in one pass—I have developed a method for trimming and bullnosing curved parts in a single pass on a spindle shaper. If you don't own a shaper, you can use a table-mounted router and a 1¼-in.-radius bullnose bit with a guide bearing (no. 160-2015 from Eagle America, PO Box 1099, Chardon, Ohio 44024; 800-872-2511). The templates I use for this operation are a little unusual. Instead of clamping the workpiece against a single template, I sandwich it between two identical ¾-in.-thick plywood templates, like the stretcher jig shown in the top photo. This way, I can flip the loaded jig over and guide either template against the bullnose cutter's guide bearing. This gives me the flexibility of feeding from whichever direction produces the smoothest cut.

As you can see in the top photo on this page, the stretcher templates are longer than the workpiece and have a filler piece on each end that fits into the keyhole-clip mortise. The loaded jig as-

***Gluing up the stands**—Jigs fitted with cam clamps are used to glue up mirror stands (left). On the left, a pair of legs registers against stops at each end and cam clamps press them together; on the right, clamps, held in place with dowels, press the center piece down.*

***Attaching the stretcher to the legs**—After hooking the stretcher's keyhole clip on the heads of shoulder screws in the back leg (right), Bivona will push the stretcher down to lock it against the leg. An awl poked through the shaping jig marks for the screws.*

sembly is fastened together at each end with countersunk ¼-20 by 2-in.-long joint-connector bolts and T-nuts (available from The Woodworkers' Store, 21801 Industrial Blvd., Rogers, Minn. 55374-9514; 612-428-2199) that pass through the filler. The templates for the three pieces that make up each stand are the same length as their respective workpieces because the ends of these parts require shaping. However, I made these templates 2 in. wider along their straight sides, where two joint-connector bolts and T-nuts secure the templates to the workpiece. The bolts pass through a 2-in.-wide filler strip against which I butt the edge of the roughed-out leg.

The leg templates also have two small holes, which I used to locate the shouldered screws that lock the stretcher to the back legs (see the drawing). After trimming the back legs, but before removing each from the jig, I poked an awl through the holes to mark the legs; don't forget to make a left and right back leg. Finally, I beveled the straight edge of the legs at opposing 22½° angles to form pairs, and then I beveled both corners of each center piece's straight edge at 22½°, so it will fit in the V formed by the legs. Although I beveled these parts on the shaper by power-feeding the pieces past a custom-made cutter and against the fence, you could also do it on a jointer with an angled fence.

Assembling the stands—To make gluing the three-piece stands a simple, almost non-thinking task, I made the clamping jigs shown in the left photo above. Each cradle-like jig holds two legs at the proper angle so their beveled edges mate perfectly. Plywood cams mounted on the jig clamp the two legs together after glue is applied to the mating edges. Then the center piece of the stand is glued between the V in the legs and secured with another set of cam clamps pinned between two long pieces of hardwood. This assembly is held in place above the center piece with dowels in the ends of the jig. To let glue squeeze-out escape, I cut a ¼-in.-deep trough in the bottom of the jig, which I kept waxed.

Let the stands dry for eight hours before routing or handplaning a slight convex curve lengthwise along the sharp, straight edge where the legs are joined. The high point of the curve is about 14 in. from the top of the stand, where the keyhole plate will be attached. This curve softens the look of the piece and ensures that the mirror will pivot freely past the stands. After planing the curve, rout or chisel the mortises for the keyhole plates on which the mirror hangs. These single keyhole plates, which are similar to the one used on the ends of the stretcher, are available from Liberty Hardware Manufacturing Co., 928 Alton Place, High Point, N.C. 27263; (800) 542-3789. Locate each mortise so the keyhole-plate pivot point is 14 in. from the top of the stand, and rout or chisel a relief under the plate's keyhole for the mounting screw heads. I have a large jig that I used to rout the curve and mortise for the clips on the legs, but if you are only building one frame, it would be easier to do these jobs with hand tools.

Next, I radiused the long, convex inside edge of the legs on a stroke sander. To avoid sanding too much of the keyhole-plate mortise, I filled it with a spare plate and sanded down to it. You could work the same way with a belt sander or by hand-sanding with a block. Then, after the stands and stretcher are finished with clear lacquer, the base is ready to assemble. Drive a shoulder screw in the two awl holes in each back leg, screw a keyhole clip in the stretcher mortises, and then insert the shoulder screws in the clip and push the stretcher down until it locks into place, as shown in the photo at right, above.

Making the mirror frame—I shaped the mirror frame's 1¾-in.-wide crest rail and 2-in.-wide bottom rail with template jigs and a straight bit on my shaper, but they could also be done with a handplane and spokeshave. The stiles are doweled to the rails, as shown in the drawing on p. 65. After gluing the frame together, I cut and shaped the ends of the stiles to match the rail's curves. I then routed two stepped rabbets in the back of the frame for the mirror and for the ¼-in.-thick plywood back. To do this, I used a rabbeting bit with interchangeable bearings; the rabbet for the ⅛-in.-thick mirror is ¼ in. wide by ⅜ in. deep, and the plywood rabbet is ½ in. wide by ¼ in. deep. Set the mirror in small dots of clear silicone every foot or so, and fasten the plywood back with #6 by ½-in.-long flat-head wood screws, but be careful to stay close to the edge of the plywood. The pivots for the frame are #12 by 1½-in.-long round-head wood screws with ¼-in.-thick by ¾-in.-dia. spacer washers. I made the spacers from brass, but you could use wood. If you use the Liberty Hardware plate, drive each screw until its head is about ⅛ in. above the washer.

Hang the mirror in its frame by inserting the screw heads in the plates and pushing the mirror frame down. There should be enough friction between the stand, bushing and mirror so the mirror can be set at an angle. If there isn't, remove the mirror, tighten each screw about a quarter turn and try the fit again. Once it's adjusted, the mirror can thereafter be knocked down and set up without tools. □

Bill Bivona is part owner of Hardwood Design Inc. in Slocum, R.I.

Reproducing an Antique Plow Plane

Substituting Corian and brass for ivory and gold

by Dwight H. Barker

Fig. 1: Plow plane

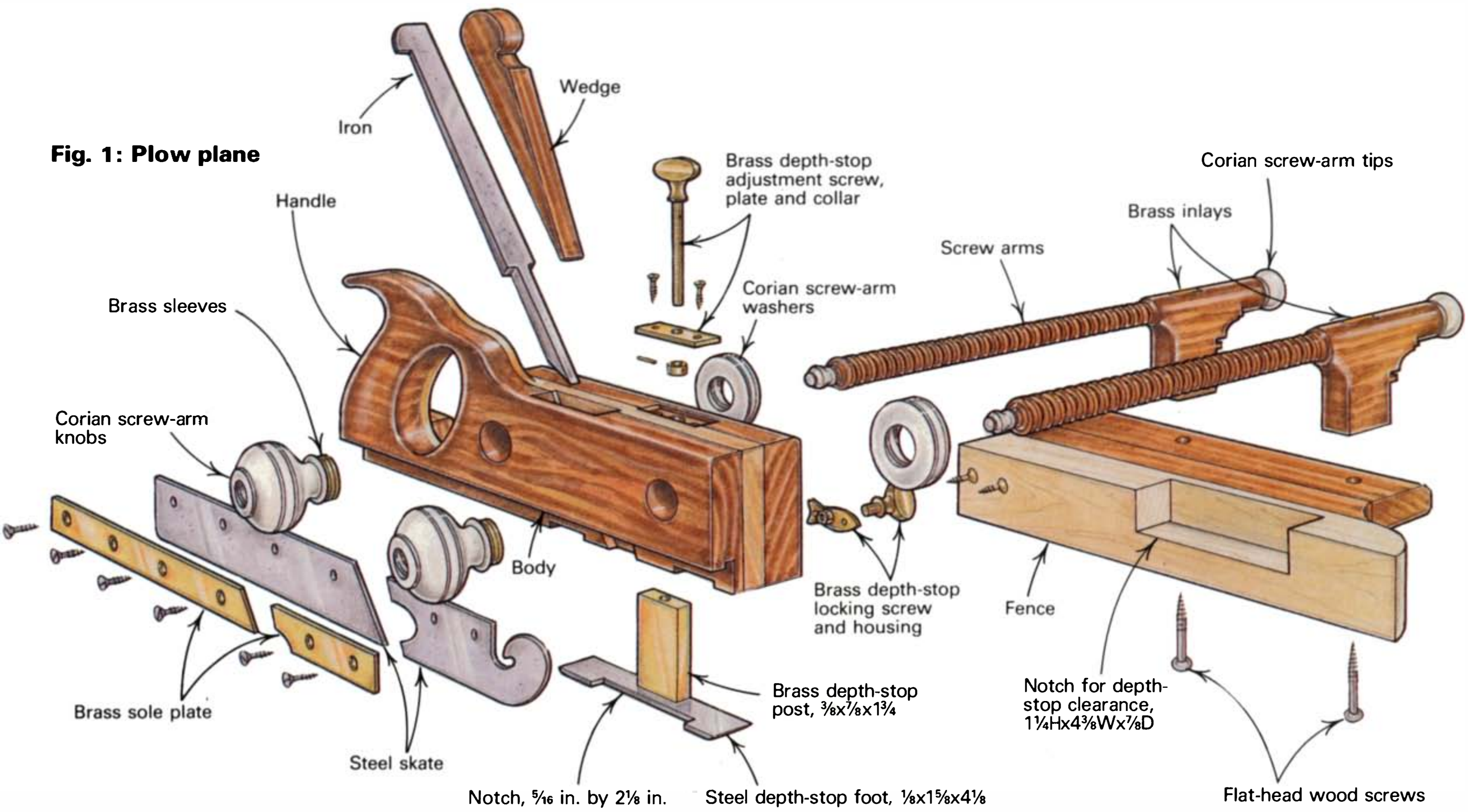
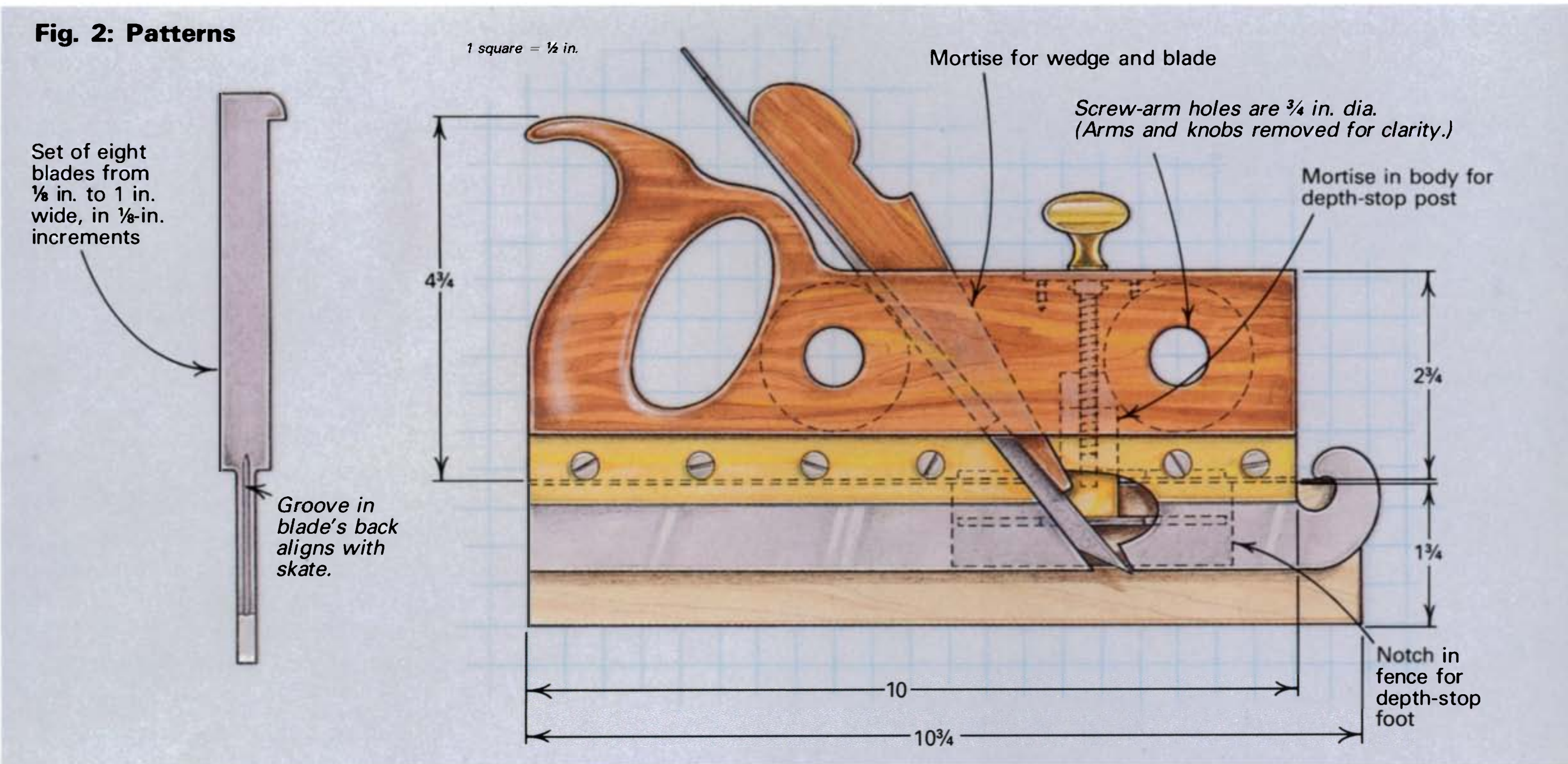


Fig. 2: Patterns



A plow plane was one of the most complex and expensive tools in a 19th-century joiner's toolbox. This tool, used for planing grooves with the wood's grain, became a necessity with the advent of frame-and-panel construction, which required grooves for holding floating panels. In his book, *The American Cabinetmaker's Plow Plane,* John Moody suggests that some type of plow plane existed as early as 1300 B.C. because frame-and-panel cabinets dating from that period were found in Tutankhamen's tomb. However, he states that they definitely were used in the mid-1500s for cutting grooves for various purposes, including panel doors, drawer bottoms, cabinet backs, tongue-and-groove wainscoting and a number of other miscellaneous jobs.

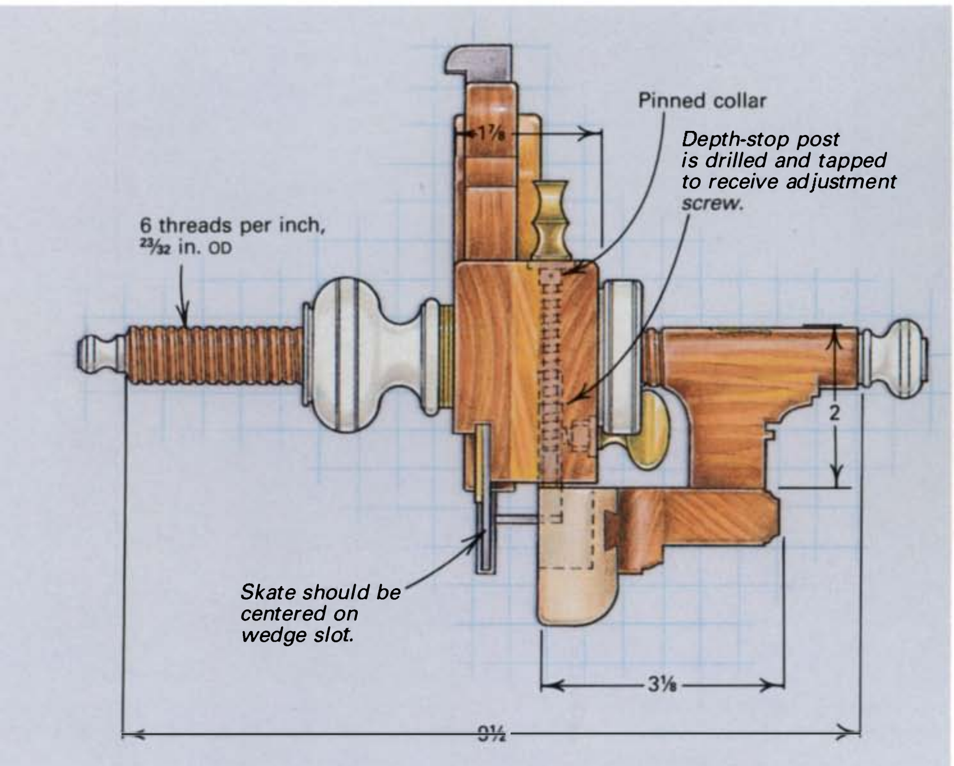
Most plow planes had a stop to control the groove's depth and a set of eight blades, graduated in ⅛-in.-wide increments. The distance that the groove would be cut from the board's edge was set with an adjustable fence. The arms that held the fence to the body were locked in place with one of three different methods: wedges, thumbscrews or threaded knobs on screw arms. The screw-arm designs arose in an effort to keep the movable fence parallel to the body of the plane, and several British and U.S. toolmakers developed systems for handling this problem. Generally speaking, only the most complicated and expensive screw-arm models had handles.

As a collector and user of antique tools, I've always been fascinated with the "fancy" plow planes that were often given to master cabinetmakers and joiners instead of the more customary retirement watch. These planes were made of various woods, such as rosewood, ebony, boxwood, maple, beech, mahogany and some of the fruit woods, and detailed with brass, silver, gold and ivory. Although some were undoubtedly used by their proud owners, others were so ornately embellished that they were most likely meant for display. For example, in 1854, the Greenfield Tool Co., Greenfield, Mass., advertised 58 varieties of plow planes, including one from solid ivory with silver fittings listed at $75; another company, L&CH DeForest, offered an ivory plow with solid, 22-carat gold nuts and washers and gold tips on the arms for $1,000—the price of an average house at the time. Unfortunately, these museum-quality antique plow planes sell today for $8,000 and up—definitely out of my price range. So I decided to design and build my own reproduction with all the features that I liked (see the photo below and the drawings at left and below).

I patterned my fancy plane after a more modest one in my collection, stamped D. Colton, Philadelphia, but I borrowed the scroll shape at the front of the skate, or sole, from the 1850 British plane maker, William Kimberley. I love for people to ask me about the turned ivory knobs and tips on the arms because they aren't ivory, but are Corian, the countertop material made by Du Pont. Corian is easy to machine with woodworking tools, and it looks and feels enough like ivory to be an acceptable substitute. My total cost for the materials was about $125, including a $25 set of antique irons and the cost of having the brass nameplate engraved. Part of the pleasure of making the plane was using some of my other antique tools. Even though the finished plane weighs 6 lbs., it works well.

Building the body and fence—I wanted to use rosewood for the plane's body, but settled for a beautiful piece of ¾-in.-thick Bolivian morado, which is often used as a rosewood substitute and was available locally. Since the plane's body was to be 1⅞ in. thick, I had to glue up three pieces to achieve the desired thickness. Rather than try to hide the laminations, I accentuated them by sandwiching a ⅜-in.-thick piece of Pennsylvania cherry between two pieces of morado. This arrangement worked out quite well because the 1⅛-in.-thick handle is flush with the plane's right side and extends right to the joint between the cherry and morado on the left side.

Most of the planes built in the 1840s had one-piece bodies, and so the tapered throat for the iron and wedge was shaped using a ¼-in. auger bit, chisels, pitch boards and tapered files called plane maker's floats. Because of my laminated construction, I was able to avoid this extreme excavation work by cutting out the throat, which is centered on the handle, before gluing the body together. First, I bandsawed the body blanks, including the basic handle shapes, on the cherry and on one piece of morado, and then I laid out the throat pattern on the inner faces of the two handle pieces. I used a Disston backsaw from my antique collection to cut several kerfs up to the pattern lines, and then removed the waste with a



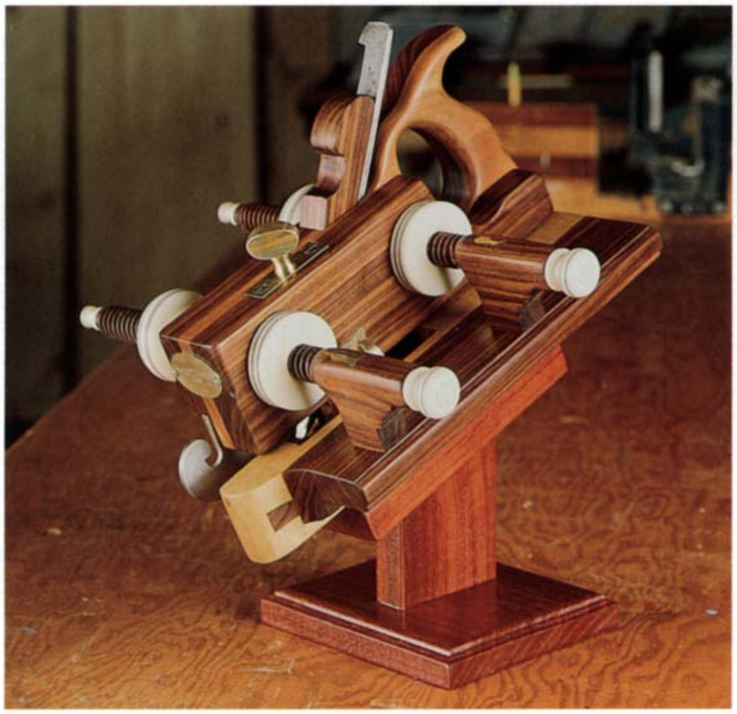
Wooden plow planes, with their adjustable fences and interchangeable blades for cutting various grooves, were the forerunners of metal combination planes, such as the Stanley #45. Fancy plow planes were made from exotic woods and detailed with precious materials. The author used Du Pont Corian in place of ivory on his reproduction plane shown here.

Photos: Jim Boesel; drawings: David Dann chisel, as shown in the top photo below. When I glued all three layers together, the wedge throat was a fait accompli.

After gluing up the body, I filed, scraped and sanded its outer edges. Next, I cut out the handle opening with a scroll saw and filed its contours. I cut the rabbet and groove for the skate and brass plate in the bottom of the body on my 8-in. tablesaw. Then I drilled a hole through the body from top to bottom for the depth-stop adjustment screw. I mortised out clearance for the depth-stop post in the base of the body and for the depth-stop foot in the fence by first drilling a series of holes with a brad-point bit to set the depth and then by chiseling out the waste.

The fence on old plow planes was often made from a single piece of wood, but I glued up three pieces, as you can see in the bottom photo. I milled the sliding dovetail that joins the morado portion of the fence to the maple wear piece with a table-mounted router, and then bandsawed the radius at the front of the fence to show off the dovetail. The contours on the fences of antique plow planes were formed with molding planes, and studying them is a fairly reliable way of identifying a particular maker. I came up with my own simple design using a couple of different router bits. Finally, I drilled two ¾-in.-dia. holes through the plane body for the arms.

***Carving out the tapered wedge slot** was easy because the body is laminated. After using a backsaw to cut kerfs to depth on the mating pieces of morado and cherry, Barker chisels out the waste.*



***The finished plane sits on a bubinga display stand.** Here you can see the three-piece fence construction and the clearance notch for the depth stop in the maple portion of the fence.*

The screw arms—The screw arms were the biggest challenge I faced in making the plane. After bandsawing out the morado blanks, I purchased a thread box and tap, and attempted to thread a scrap of morado. I was not successful. The instructions specifically said not to use very hard or tropical woods, such as maple or rosewood. This intrigued me because plane makers in the 19th century used thread boxes on maple, rosewood and boxwood. If there is a trick to positioning the cutter in the thread box, I never figured it out. Instead, I turned to a friend who is a clock maker, with years of experience as a machinist, to chase, or hand-cut, the screw-arm threads. He turned my screw arms to a diameter of 0.735, 0.015 shy of ¾ in., and machined 6 threads per inch on his lathe. I suggested brushing on boiled linseed oil as a lubricant, which worked well. To avoid chipping out the wood, he made very light cuts, in 0.005-in. increments, and cut one side of the threads at a time. I was most relieved and grateful when this task was completed.

Details and fittings—Since I had already enlisted the aid of a machinist, I had him turn the Corian parts. After drilling out the knobs and washers to the inside diameter of the threads (about 0.630 in. or just over ⅝ in.) on the screw arms, he formed the internal threads with a tool mounted on a boring bar on the lathe. The decorative Corian tips were turned with small tenons and epoxied into holes bored in the ends of the arms. I enhanced the ivory look by "antiquing" the Corian parts. First, I wiped them down with Minwax mahogany stain, and then filled the grooves with burnt umber artist's acrylic paint; finally, I lightly sanded and waxed each part.

The brass bar stock was given to me by a friend who owns a metals distribution company in Philadelphia. The two-part steel skate was made by my clock-maker friend, as were the brass sole plate, the thumbscrews and the brass sleeves at the base of the Corian screw-arm knobs, a detail often used by Philadelphia and Lancaster plane makers. Christian symbols have historically been incorporated in woodworking tools (don't forget, Jesus was a carpenter), and so I inlaid decorative brass fish symbols in the screw arms and pressed a nut into another to receive the depth-stop thumbscrew.

In place of the maker's mark stamped into the endgrain on the front of the body of old planes, I cut an oval nameplate from 0.030-in. sheet brass with a German jeweler's saw from my collection, and had it hand-engraved on Jeweler's Row in Philadelphia. I finished the wood parts with tung oil and boiled linseed oil, because I like the smell, and followed it with a coat of Antiquax, an English wax polish. The plane now resides in one of my display cases, but I don't hesitate to pull it out and demonstrate it from time to time. □

Dwight Barker is a mechanical designer in Ambler, Pa. He has also written for Fine Tool Journal, *PO Box 4001, Pittsford, Vt. 05763.*

Further reading

The American Cabinetmaker's Plow Plane, Its Design and Improvement 1700-1900 by John A. Moody. The Tool Box, 8219 Old Petersburg Road, Evansville, Ind. 47711; 1981.

Woodworking Planes by Alvin Sellens. Alvin Sellens, 134 Clark St., Augusta, Kan. 67010; 1978.

Wooden Planes in 19th Century America, Volume II by Kenneth D. Roberts. Ken Roberts Publishing Co., Fitzwilliam, N.H. 03447; 1978.

A Disc Sander on a Bandsaw

Getting double duty from a common shop tool

by Roger Ronald

With a few hours' work and about $20 worth of hardware, I added a disc sander to my Rockwell/Delta 14-in. bandsaw (see the top photo). When I bought the saw secondhand, the door for the sheet-metal box that covers the drive pulley and belt on the back of the saw was missing. The shaft protruded 2 in. beyond the pulley, a condition that gave me the idea for mounting a sanding disc there. Because sawing is done only from the machine's front, there is no interference between sawing and sanding functions. For safety reasons, it's best to keep all the moving parts, except the face of the disc, under cover—either the original belt cover or a shopmade box of wood or metal.

Mounting the sanding disc—To attach the ½-in.-thick disc to the shaft (see the bottom photo), I simply bolted a 3½-in.-dia. solid-steel pulley to the disc through three holes, evenly spaced around the pulley to ensure good balance. I chose a solid-steel pulley because it's easier to drill than cast iron and stronger than one made of sheet metal. If your bandsaw's lower shaft doesn't extend beyond the pulley, you could replace the pulley with one made from solid steel and drill the mounting holes directly in it; just make sure the bolts don't interfere with the belt groove.

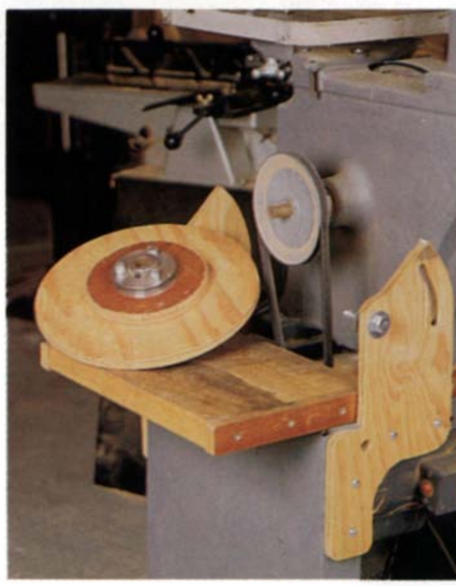
I cut out the large sanding disc to have a diameter of 12½ in.; the smaller plywood disc in the photo acts as a spacer to keep the sanding disc clear of the sheet-metal box. The heads of the ⅜-in.-dia. mounting bolts are counterbored into the sanding disc's surface. I trued up the sanding disc and trimmed it to exactly 12 in. (to fit commercial adhesive-backed sandpaper discs) with a router after mounting the assembly on the shaft. I did this by clamping a router with a straight bit to a sturdy table and positioning the router so that the cutting edge of the bit contacted the edge of the disc. Then I rotated the disc by hand, moving the router in bit by bit until I had cut a perfect 12-in.-dia. circle. I sealed the plywood disc with a two-part epoxy coating to prevent splinters from pulling away from its surface when sandpaper is peeled off.

The tilting table—By adding a tilting table to a disc sander, straight-edge sanding is improved, large pieces are more manageable and sanding at precise angles becomes possible. Most of the table dimensions are arbitrary or will depend on the bandsaw. After bolting two uprights to the saw's base, I experimented with the placement of the table's pivot point until the table edge would stay close to the disc even when tilted. This point was 1 in. from the plane of the disc and ⅝ in. below the work surface. I used ½-in.-dia. bolts for the pivots, with flat washers between the wooden parts. The lock-adjustment handle is a 1¼-in.-dia. dowel with a threaded connector imbedded in its end. The connector draws a carriage bolt's square shaft tightly into the table-edge extension (see the bottom photo). □

Roger Ronald works out of a garage shop in Sachse, Tex.

Photos: Jim Boesel

This 14-in. bandsaw has a sanding disc mounted on its lower drive shaft. The table's front edge is beveled so that it can be tilted and locked at any angle up to 45° (above).



The author bolted a standard pulley to a plywood sanding disc, and mounted the disc on the bandsaw's drive shaft. The smaller plywood disc between the pulley and the large sanding disc is just a spacer. A bent nail in the end of the table-edge extension (far right in photo at right) points to an angle gauge written on a strip of paper that's taped to the upright's edge.

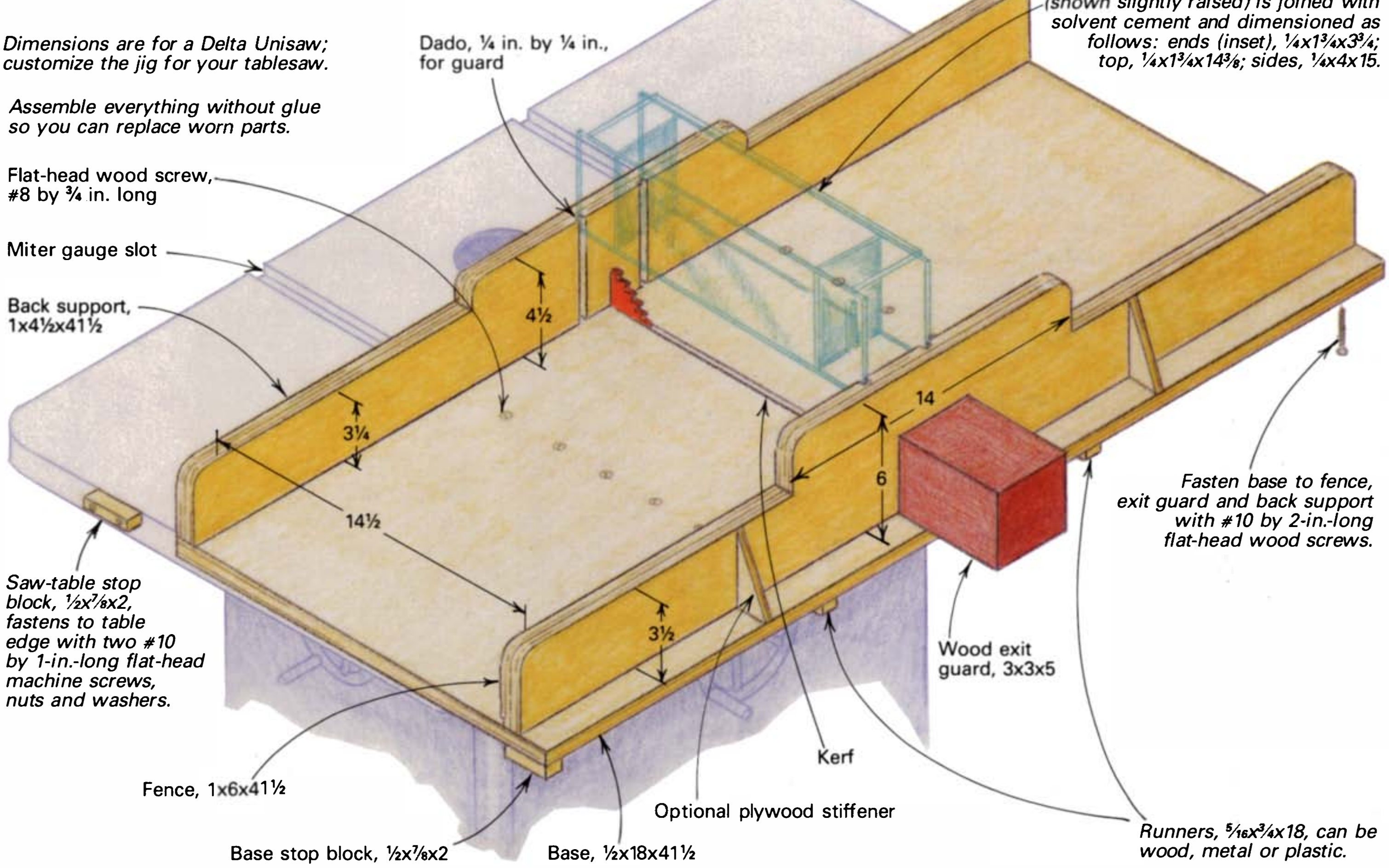
Mehler uses his shopmade crosscut box to square the end of a heavy maple board on the tablesaw. He also made the Lexan guard, which rides on the workpiece.

A Tablesaw Crosscut Box

Safe and precise cutting with a shopmade jig

by Kelly Mehler

Plywood tablesaw crosscut box



Crosscutting boards on the tablesaw with a miter gauge isn't easy. Even with a long auxiliary fence, the board drags on the table and skews off at an angle, which causes an inaccurate cut. This is one reason why I don't crosscut with a gauge anymore; instead I use a shopmade crosscut box that carries the workpiece past the sawblade for consistently accurate cuts—even on wide doors. And by clamping auxiliary fences to the box, I can quickly and safely cut perfect open mortises, tenons and finger joints.

The plywood base of my crosscut box, shown in the drawing, is screwed to two hardwood runners that slide in the miter-gauge slots milled into the saw table. Since the base is cut in half the first time the box is used, a fence and a back support are screwed to the base to hold the halves together. To make the box an accurate cutoff tool, I took special care to square the fence to the kerf. When crosscutting with the box, I align the cutoff mark on the workpiece with the kerf in the box, hold the piece against the fence and push the box past the sawblade until the piece is cut. For safety, I made a clear Lexan guard, which fits between the support and the fence; I also added a wood exit guard, which covers the blade where it comes through the fence, and a stop on the saw table, to keep the box from going so far that the blade cuts through the exit guard. Besides the midsize box shown in the photo on the facing page, which has a 14½-in.-wide capacity, I also have a box for 12-in. workpieces and a box for 30-in. panels; and I made a similar box for my router table.

I use the mid-size box the most, and so I'll tell you how to make it, as well as its Lexan guard. Although it's sized for my Delta Unisaw, you can easily adapt it to your machine. Your box's accuracy will depend on three factors: Your sawblade must be parallel to the miter-gauge slots (see "Tuning Up Your Tablesaw," *FWW* #78); the box's fence must be perpendicular to the blade's line of cut; and you must build the box with stable material.

Cutting the parts—The main parts for the crosscut box are from high-quality, 9-ply, ½-in.-thick birch plywood. I made the 1-in.-thick fence and back support by laminating two pieces of plywood. The base should extend 1 in. wider than your saw table to attach the stop and to clamp workpieces on the end. The fence and support should be the same length as the base. After laminating the fence and back support, I jointed their bottom edges square, and rabbeted the fence's inside bottom edge ⅛ in., so sawdust wouldn't prevent the workpiece from laying tightly against it. I also cut ¼-in.-wide by ¼-in.-deep dadoes across the inner face of the fence and support to receive the ends of my Lexan blade guards: a standard guard (see the drawing) and an auxiliary guard for cutting tenons and other joints (see the center photo on the next page). Then I bandsawed the fence and support to the dimensions in the drawing (proportion yours to your saw table). The fence is higher in the center to hold a workpiece vertically (to cut finger joints, mortises and tenons) and lower on the ends, to clamp narrow pieces to the box.

Rip the runners to fit snugly side to side in the miter-gauge slots, but leave them thinner than the depth of the slots to allow for dust. (Most saws have ¾-in.-wide by ⅜-in.-deep slots.) After screwing the base to the runners, as described below, you can scrape them until they slide easily. I used osage orange runners on this crosscut box, but any vertical-grained hardwood (to minimize shrinkage), aluminum or plastic would work as well.

Attaching the base to the runners—Before you begin assembling your box, let me caution you: don't use glue. Instead, fasten

Photos: Gary Weisenburger; drawing: Aaron Azevedo

all parts together with countersunk flat-head wood screws (as shown in the drawing). To fasten the base to the runners, put them in the miter-gauge slots and place the base on top of them with its front edge aligned with the front edge of the saw table and its left edge extending 1 in. beyond the saw table. Mark the base over the runners' centerline and extend these lines across the base with a straightedge. Drill pilot holes and countersink for #8 by ¾-in.-long wood screws every 4 in., alternating the screws 1/16 in. on either side of the line, to prevent drilling and screwing into the same grain line and splitting the wood runner. Don't put screws under the fence or support, or you'll have to remove these components before you can replace the runners.

The runners should fit tightly in the table's miter-gauge slots, and so you'll probably have to pry the base from the table. Now, cut off the runner's excess length and scrape their edges until they slide easily in the slots. Scrape the high spots only, as indicated by dark marks left on the runners after sliding the box back and forth. If the slots are clean and don't leave a distinctive mark, coat them with a graphite marking crayon or pencil lead. When the runners slide easily in the slots, without sideways play, rub them with paraffin to seal and lubricate them.

Attaching the fence and back support—The base is fastened to the back support with screws spaced 3 in. apart. Be careful not to drive any into the dadoes for the Lexan guard or where the tablesaw blade will cut through the base. The back support doesn't need to be square to the blade, but for your box to be accurate, the fence must be absolutely straight, flat and square to the sawblade.

I used a square to check that the face of my fence was perpendicular to the base. Joint the edge if it's not, and recut the rabbet if necessary. Then fasten the base to one end of the fence with one screw from underneath, and clamp the opposite end to the base so it's aligned with the front edge. Make sure the inside face of the fence is flat. When I made this box, the plywood fence was warped, and so I temporarily clamped a stiff straightedge to the outside of the fence until I completed alignment. Next, to square the fence to the blade, raise the blade until it just barely cuts through the base. Then, slide the fixture in the slots and cut through the base, but stop before you saw into the fence. Now, turn off the saw, pull its plug and raise the blade to its maximum height. Squaring the fence is easy, but it takes some patience. Slack off on the clamp that binds the fence and base, and use a square to align the fence 90° to the sawkerf in the base. Check for square-

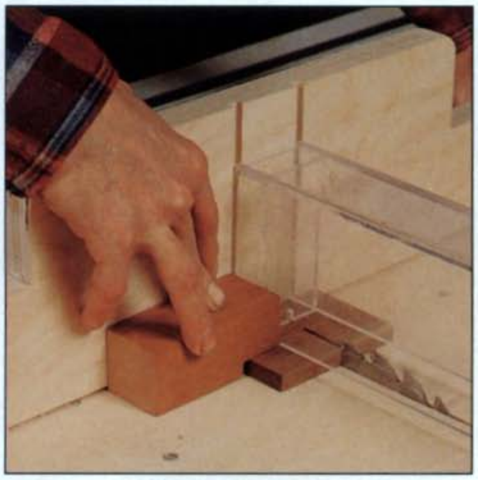
More than a crosscut jig

If you have been using a miter gauge to cut wide, heavy pieces, you'll appreciate how easily a crosscut box handles large pieces. And accuracy is so great that I even use the box to cut small pieces. I keep large pieces flat against the base by clamping a hold-down block to the fence above the workpiece. You can hold light, narrow pieces with your hand, as you would on a miter gauge. But I hold small pieces down with an L-shaped block, as shown in the left photo below.

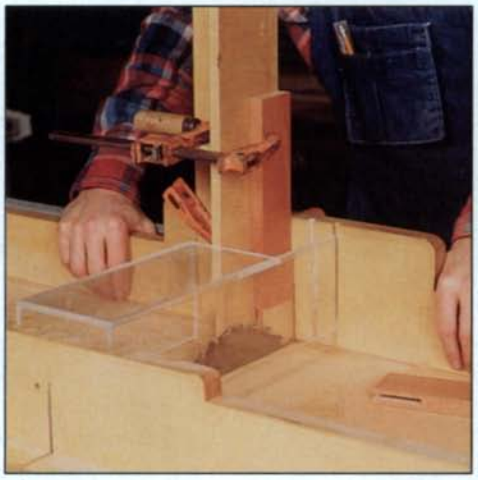
It's easy to accurately align the cutoff mark on the workpiece with the box's sawkerf. If you need to cut many pieces to the same length, clamp a stop block to the right side of the fence, so it is the required distance from the kerf. Then, crosscut one end of each piece by holding it against the fence on the left of the kerf and cut it to length by sliding it to the right against the stop. If the end of the piece extends beyond the end of the box, clamp a long L-shaped stop to the fence. Be sure you cut the correct end by stacking workpieces so that you pick them up and put them in the box without flipping or rotating them.

Joinery on the crosscut box: I use my crosscut box to cut open mortises and tenons by clamping a vertical support to the fence so that it is square to the base, as shown in the center photo below. I made an auxiliary Lexan guard (see the center photo below) for this type of joinery. You can secure three corners of the guard in the dadoes in the back support and fence, but make the guard's top and one side shorter to accommodate the auxiliary vertical support.

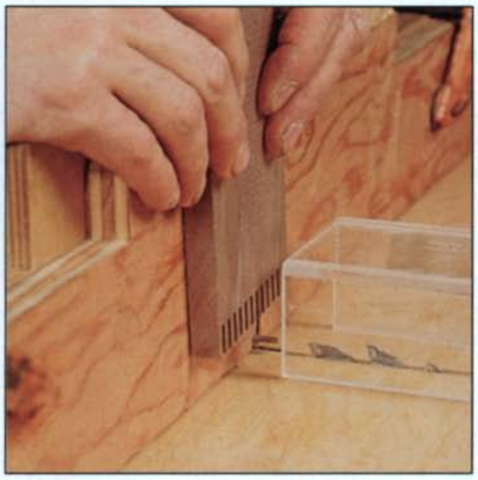
The box is also great for cutting finger joints using the auxiliary jig shown below in the photo at right. This jig is shaped like the box's fence and it has an index pin (a headless #6 screw) ⅛ in. from the box's ⅛-in.-wide kerf, to cut equal-width fingers and spaces. For the finger-joint jig, I made a Lexan guard that is the same width as the one I use for crosscutting, but it is shorter to accommodate the jig and workpiece. Instead of fitting the jig in the slots, I clamp its ¾x4x3¾ plywood end, which is screwed flush to the end of the three-sided Lexan guard, to the support. *—K.M.*



***To cut a small workpiece,** Mehler puts the guard on top of it, holds the workpiece down with an L-shaped block, and pushes the crosscut box with his other hand.*



***The crosscut box becomes a tenoning jig** when a vertical support is clamped to its fence. Open mortises, like the one above, can also be cut with this setup.*



***Mehler clamps his finger-joint jig** to the box's fence with the jig's index pin ⅛ in. away from the ⅛-in.-wide blade to produce equal-width spaces and fingers.*

ness on both sides of the blade; when you're satisfied, retighten the clamp. Remove the box from the tablesaw, and secure the base to the fence with one screw through an extra-large hole in the base near the clamp. Now remove the clamp.

Before drilling for the rest of the screws, replace the box on the saw and cut through a wide scrap piece. Test the cut with a square; if you need to adjust the fence further, loosen the screw in the enlarged hole, tap the fence into alignment, retighten the screw, and again cut and check the test piece. Continue this process until you're satisfied, and then drill for and drive the rest of the screws at 3-in. intervals.

If you repeatedly cut heavy pieces, you can help maintain the squareness of the fence with plywood stiffeners (shown in the drawing). They not only help strengthen the fence, but also make replacing the fence easier because you need only align a new one on the stiffeners and guard. Keep the stiffeners about 8 in. from the ends of the fence so you can still clamp a stop to the fence when repetitively cutting stock to the same length.

Making blade guards—A blade guard is a necessity. The clear Lexan guard I made shields my fingers from the blade and helps protect me from offcuts and sawdust that may fly off the blade. I don't find the guard restrictive as some woodworkers might claim. Since the ends of the guard's extra-long sides slide in dadoes in the fence and back support, the guard can be lifted to accommodate up to a 3½-in.-thick workpiece. You could make the guard with clear acrylic plastic, such as Plexiglas, but the polycarbonate Lexan can resist a stronger impact. I cut the parts on the tablesaw and then glued the guard together with Weldon 3 solvent cement, although Weldon 35 is recommended for polycarbonate (both are available from IPS, PO Box 379, Gardena, Cal. 90248; 213-321-6515). I clamped the assembly with the top centered between the sides and with the ends inset about 1 in. Then, following the directions on the cement, I ran a thin stream of it into the joints, as shown in the top photo at right. Put only enough in the joint to fill it; too much and it will run down the sides. To run a stream of solvent into the end joints, stand the assembly up vertically. The ends strengthen the guard, even though the blade will cut through them.

Since the sawblade comes through the fence when it's raised to maximum height, I made an exit guard for crosscutting a thick workpiece. The guard in the drawing fits my 10-in. tablesaw, but you can adjust the dimensions if your saw is larger. The guard should be 2 in. to 3 in. wide, at least ¼ in. above the blade at its maximum height, and extend at least 1 in. in front of the blade when the blade is centered on the face of the front fence. Fasten the guard to the box by driving two screws through the fence and into the guard. I countersunk them into the bottom of the Lexan guard dadoes. Finally, screw the base to the bottom of the guard, and finish all the wood with Watco oil. Then I fastened stop blocks to the box and saw table to keep from sawing through the exit guard. I screwed a ½x⅞x2 stop block to the base where it overhangs the saw table (near its left, front corner), and I screwed another one to the edge of the table. The block on the base should be about 1⁄16 in. from the table edge (so it won't bind), and the block on the table should stop the box when the center of the fully raised blade reaches the face of the fence. I fastened the block to my table by countersinking two #10 by 1-in.-long flat-head machine screws, washers and nuts into 3⁄16-in.-dia. holes through both. Before you do this, make sure there aren't any obstructions under the table where you intend to drill the holes. Then slightly round over the corners of the block screwed to the table, so you don't take flesh off if you bump it.

With the Lexan guard parts clamped together, *Mehler squeezes one-minute cement into the joints. The ends of the guard's sides slide into dadoes in the box's fence and back support.*

To demonstrate the capacity of his wide cutoff box, *Mehler trims the end of a 30-in. paneled door. A wedge between the door and support presses the workpiece against the fence.*

Making other crosscut boxes—To cut wider panels, such as the 30-in. door in the bottom photo above, I made another crosscut box with a base as wide as my saw table from front to back. Since more than half of its width extends over the back of the saw at the end of a cut, it should be supported on an outfeed table. If you make a box much wider than this, I think you will also need a support in front of your saw. I recently attached an outfeed table to my saw and now wonder how I lived without it for so long. Instead of an outfeed table, you could use outfeed rollers (which are best when attached to the saw), a separate table, saw horses or even an adjustable ironing board.

Finally, since crosscut boxes help make such accurate cuts, I also made a 14-in.-wide by 26-in.-long box, which is more convenient for narrow workpieces. This box doesn't overhang the left side of the table, and so I stop the box's travel short with a dowel in the outfeed table. With a little imagination, I'm sure you'll come up with variations, such as a mitering box, a crosscut box with an adjustable angle or a beveling box. □

Kelly Mehler operates Treefinery Woodshop and Gallery in Berea, Ky.

Production Basics for a Small Shop

A reversal of fortune with a revision of procedures

by Jim Tolpin

One of the luckiest days in my woodworking career was the day I realized I was going broke. I can now joke about "back then" since my situation is much better today, 20 years later. But in my first 10 years as a cabinetmaker, working out of a one-car garage, I barely provided for myself, let alone the family of four I now support. I could often be found constructing highly refined pieces of casework that required hours of hand-joinery and tedious detailing. I bathed in each client's approval of my work at the time of delivery, but little did I know that much of their joy was in obtaining such work for such a price. Fortunately, I learned that it wasn't the woodworking itself that forestalled my financial success, but rather the way in which I was working the wood.

I decided to unplug myself from the shop to figure out what I was doing wrong. It didn't take long before I had three answers. First, I didn't have the faintest idea of how to build consistent production cabinets; second, my methods and tools were primitive and counterproductive; third, I was a poor businessman. To continue woodworking as a livelihood, I'd have to learn how to build pieces of high-quality cabinetry as efficiently as possible. So to fix my career and resolve my earlier woes, I chose to revise the shop first and then the process, before looking at the business affairs (which is another story). In this article, I'll examine some specific processes in my revised system, along with their applications to my woodworking. To explain the system's benefits, I'll show how I group operations, and then I'll take you through the ordering and layout processes for solid-stock components of a typical cabinet project. Finally, I'll describe my methods for joining face frames (see the sidebar on p. 78). But first, let me give a few examples of how I reorganized my shop.

Work flow and block production—To better use the space in my 22-ft. by 24-ft. garage shop, I replaced some machines and upgraded others. My major purchases were a more powerful tablesaw, an 8-in. jointer and a lighter planer. I also installed a dust collector and an air compressor, and I revamped fence systems for the tablesaw and radial-arm saw and added shop-built extension tables to both. Then I concentrated on the floor plan. Proper placement of major stationary tools and work surfaces reduces operator fatigue, allows smoother material flow through the shop and increases production. For example, I clustered tools into symbiotic groups (like the jointer/tablesaw/router-table arrangement in the bottom photo on the facing page) to enable quicker operation changes. To maximize open floor space, I built knockdown work surfaces, shown in the top photo on the facing page, and a support grid for my portable thickness planer. When not in use, the thickness planer is suspended from the ceiling joists, and the platform stands hang on the wall. With the physical plant in shape, I turned my attention to the production process.

I realized that to make the shop really work for me, the tasks involved in building a set of cabinets had to be sequenced carefully. Again, the flow of materials through the shop is critical. Products of one operation must not prevent access to the machinery and space requirements of the next; components must be grouped so that a particular tool setup is created only once; and functions must be organized so all materials reach the same production phase at the same time. I first analyzed the material flow and grouped processes to see how they could be sequenced, from layout and cut lists, to the fabrication stage, to the installation of the product on-site. Over the past 10 years, through much thought, many trials and errors, and with advice from tool and hardware manufacturers, I've developed what I call a block production method (shown in the flowchart on the facing page) to make the most of my time and modest floor space.

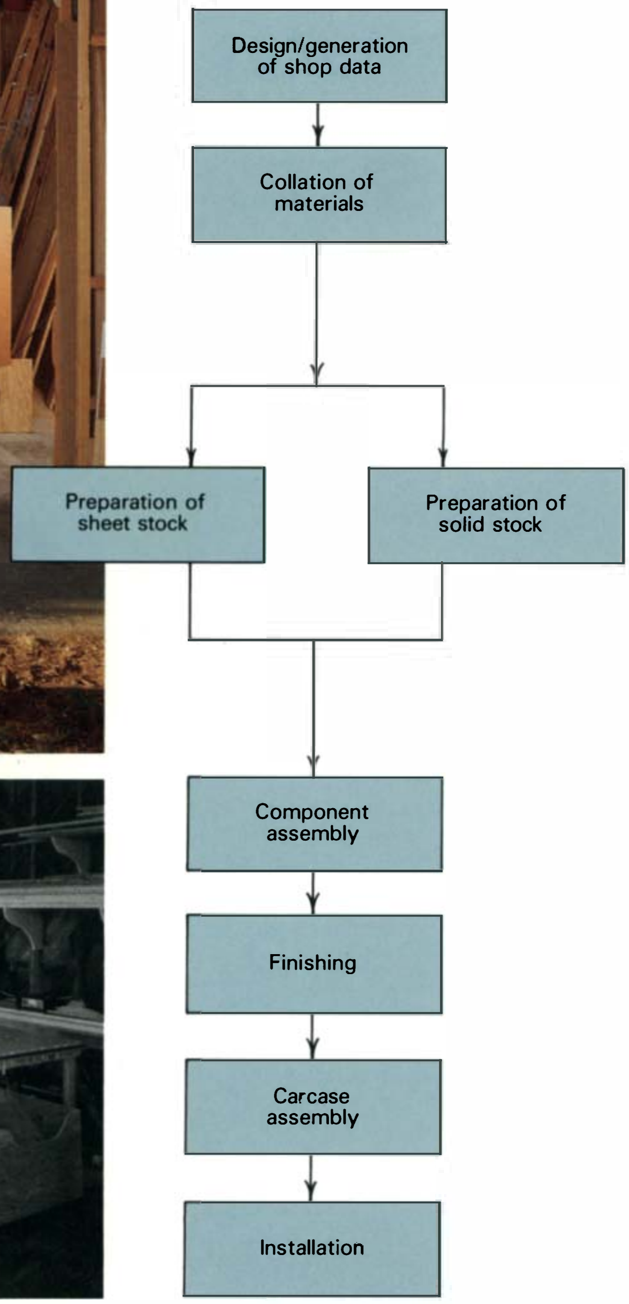
The premise of block production is that all the tasks involved in the manufacture of cabinets can be grouped into exclusive "blocks." The materials intended to undergo a certain block operation are carefully ordered so that all steps occur at the proper time. I keep a large copy of the flowchart hanging on the wall of my shop to remind me where to turn at the end of each production block. In addition to the vast time savings that have resulted from implementing this method, there have been other benefits as well. First, it's possible to accurately generate data on the amount of labor required in any given process (valuable information when estimating the costs of proposed projects); second, breathing spaces are built into the work pace so that between blocks, you can catch up and clean up (for most independent cabinetmakers, this really makes a difference in work quality); third, it's possible to do more than one project at a time without confusion, and a small job automatically nets a higher profit margin as it rides through the tool setups of a larger one.

From cut lists to ordering—Once I had created a well-oiled procedure for cabinetmaking, I was ready to plan out some work. When figuring materials for a cabinet project, I've found that one of the most necessary shop drawings is an elevation of each module to be built. I do this on a 5-in. by 8-in. index card, which provides space for a drawing and a list of pieces with their dimensions. I keep all these elevation cards handy in a file-card box, and from them, I develop two master cut lists: one for solid stock and one for sheet goods. The amount and sizes of materials that need to be ordered are compiled from these cut lists.

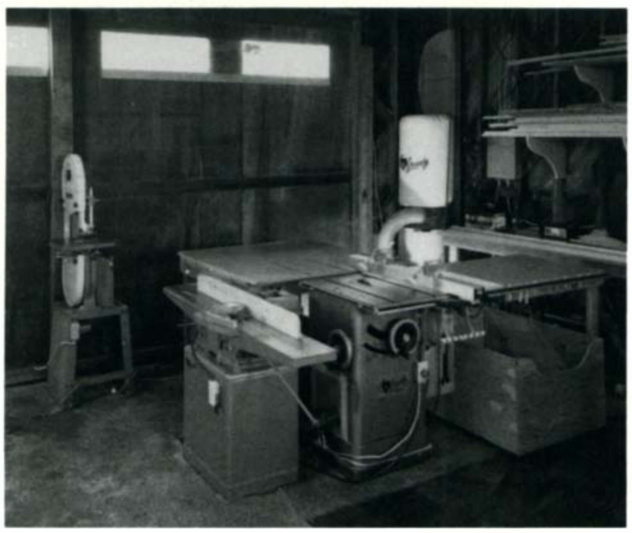
In my early cabinetmaking days, preparing and assembling solid stock were more than two production blocks; they were almost my entire operation. The involved procedures of milling, dimensioning and joining solid stock filled my shop with fragrant aromas, but

Photos: Patrick Cudahy

Generalized flowchart of production



Tolpin streamlined his shop methods and business practices to rescue his cabinetmaking enterprise from financial limbo. He reorganized his shop, above, by upgrading machines and then building fixtures, like the mobile tool cabinet and knockdown plywood lifts. To save floor space, his lightweight surface planer is mounted on a support grid and suspended overhead when not in use.



To further maximize shop space and improve work flow, Tolpin grouped stationary tools into workstations, like the jointer/tablesaw/router-table combination (right).

they did little to fill my pockets. Now I make much of the casework from sheet stock, but solid stock remains the material of choice for select components, like doors, drawer faces and face frames. The processes I use in solid-stock preparation can also be applied to simple wood-furniture projects. First, when figuring how many board feet of solid stock you'll need, add about 15% to account for defects and waste. Then, when you order the wood, ask your supplier(s) to plane it to ⅛ in. thicker than the finished dimension you need and to leave the edges unjointed, which is referred to in the trade as S2S (surfaced two sides). Final-planing the material yourself is the only way to ensure that it will be smooth and uniform. I surface 1-in.-thick stock down to 13⁄16 in., which lets me shape more definition into the molded edges of doors and drawer faces than would be possible with ¾-in. stock. Another advantage is that edgebanding for ¾-in.-thick sheet goods can be ripped from the stock in one operation. After you've ordered materials, you can start planning how you'll lay out and cut the components.

Laying out solid stock—I anticipate the layout stage for solid stock with some trepidation; so I quickly set aside as much material as possible—before my brain overheats. I begin by sorting through the pile, and separating the widest pieces of stock. After spreading these out, I refer to my solid-stock cut list. Since the pieces in this list are in widths, it's simple to assign the widest components to the widest stock, which soon commits a significant amount of board footage. The layout task then becomes more manageable. While taking care to avoid defects in the wood, I chalk the layout lines directly on the stock, and allow at least 1 in. of waste at the board ends. Since many of the wider components are drawer faces, I lay out adjoining drawers end to end on the same board to ensure a continuous flow of grain patterns from one cabinet to the next. Boards to be glued up into panels should also be cut from the wide stock.

Door-rail and stile stock is selected from the straightest wood left in the pile. If there are paired doors, I try to lay out adjoining stiles side by side, and then rip the stock into two pieces. This allows the grain to match perfectly from door to door, and any wood movement will be similar. Whenever possible, I group components of similar length on the stock so I can rough-crosscut the boards into lengths that are easy to handle. When all the parts are laid out, I'm ready to rip them to width and crosscut them to length in preparation for the component-assembly block.

In creating my block production method, I discovered some differences between the avocation and the occupation of custom woodworking. Today, the revised system I use to process materials enables me to pursue my favorite work as a legitimate business. I hope these methods will be useful to others too, because even though our endeavors as independent cabinetmakers won't be found on the charts that list growth industries, there's no doubt in my mind that we're doing important work. □

Jim Tolpin owns a custom cabinetmaking shop in Ferndale, Cal. He is the author of Working at Woodworking, *the new book from which this article was adapted. The book is available from The Taunton Press, 63 S. Main St., PO Box 5506, Newtown, Conn. 06470-5506.*

Joining cabinet face frames

If a project calls for face frames, I've found that I don't need to join the parts with dowels, mortises and tenons, or even biscuits because my cabinet's plywood carcases keep the face units in place. To improve efficiency and maintain frame quality, I adapted the standard industry techniques of screwing face-frame components together through angled holes in their back sides for use in my one-man production shop. The resulting joints are strong, stay flush and don't require clamps while the glue dries. To drill the angled pockets, I use a Ritter bit (available from Woodworker's Supply of New Mexico, 5604 Alameda Place N.E., Albuquerque, N.M. 87113; 800-645-9292), which is a long countersink bit designed to drill at a low angle. The joint is glued and fastened with square-drive face-frame screws (also carried by Woodworker's Supply of New Mexico), which have pan heads that won't split out endgrain.

The angled pockets for the face-frame assembly screws *are drilled with a special shallow-angle countersink bit and with the frame member held 22½° from vertical on a shopmade jig.*

In addition to the bit, you'll need a jig to hold the pieces in position for drilling. You can either buy the jig or make your own; the left photo below shows my shopmade jig in place on the drill press. The support for the stock to be drilled is 22½° from vertical, and has lines drawn on its surface 90° to the base of the jig. These lines indicate proper alignment of the stock.

To prepare for countersinking, chuck the bit into the drill press, and set the speed at 1,000 RPM. Place the jig on the drill-press table in its approximate position, and lightly clamp it down. Run a series of test holes in scrap the same thickness as the frame until the exit hole is centered in the end of the stock and the countersink is deep enough to bury a screw head. When you're satisfied, set the stop for the quill travel, and tighten the jig's clamps.

Now, arrange the precut face-frame parts into the configuration shown on the elevation drawing for that cabinet. Mark the back surface of each end that butts one another, and drill the holes where indicated. Pieces 1¼ in. to 2¼ in. wide receive two holes, while narrower stock receives only one. Wider stock can receive a hole every ¾ in. to ⅞ in. While drilling, hold the stock tightly to the sloping jig and perpendicular to the drill-press table, using the reference lines on the jig. After drilling all the holes required to join the frame, turn the components over face down. It's tricky to lay out from the perspective of inside the cabinet, but you will soon get used to it. Once the parts are properly oriented, mark the position of the interior joints. Measure carefully, unless the components themselves can be used as spacers.

When joining the face-frame parts, *Tolpin double-clamps one of the solid-stock workpieces securely to his bench to counter its strong tendency to slide out of flush as the screws are driven home.*

You should fasten the innermost joints of the frame first. Secure the pieces to receive the screws along the edge of your work surface, using two C-clamps at the joint, as shown in the photo on the right. Firmly butt the component to be fastened against the clamped piece at its marks, and drill pilot holes for the screws. Back off the free piece, clear out the chips and apply glue to its end. Then reposition the piece, and drive the screws home. Release the clamps, lift up the joined components and remove any excess glue with a damp rag. When the whole frame is together, check diagonal measurements to ensure that it's square (if needed, clamp a temporary brace across it), and set the assembly aside to dry.

Be sure to let the structure sit overnight to reach full glue strength. Then, to clean up the frames, block-plane the surfaces and edges of the joints, and sand the wood to 220-grit. The assembled units are ready for the next production block, where I apply the finish and install hinge plates. The completed face frames are then mounted to the cabinet carcases in another stage, before final installation. *—J.T.*

A Woodturner's Chess Set

Checkmate in cherry and ebony

by Michael D. Mode

There are many styles of chessmen, but few are as elegant and well adapted to being lathe-turned as this 18th-century French-style set, made by Mode from cherry and ebony.

As a turner, I thought it would be quick work to make a set of traditional "Staunton" chessmen; the classic style with carved horse-head knights, bishops with diagonally slotted miters, and crowned kings with crosses on top. But, I must confess, I underestimated the amount of carving involved, and spent as much time working on the four knights as I did on the other 28 pieces.

Several years later, I was commissioned to make a set of chessmen based on an 18th-century French style. One look and I knew this design was aimed to please the turner: almost all the work could be done on the lathe. In the following pages, I'll show you how I turned the set shown here, discuss the tools I used and my method for mounting the turning blanks on the lathe. For the most part, making the set requires basic lathe skills, but this doesn't mean it's easy to turn; there are some technically difficult areas, such as between the thin discs that characterize the set. A few pieces also feature non-turned details, such as the crowns of the kings and queens, but these are relatively simple to make, as I'll explain later.

Preparing the blanks—When I made this set for my client, I started by scaling up a photo of a set in a book to create full-size drawings; the tallest piece, the king, is 5⅛ in. I then transferred the profile from each drawing to the edge of a piece of stiff cardboard and labeled the diameters of key features, such as the base, the discs, etc. This gave me a set of pattern cards, shown in the drawing on the next page. To make your patterns, photocopy or trace the drawing to full size, and glue each copy to a separate card.

After choosing two contrasting woods for the dark and light

Photo: Dave Haas

The chess pieces are finished with several coats of tung oil and weighted with solder melted into the screw-chuck hole in the bottom, which is then covered with felt.

Photo this page except where noted: Susan Kahn

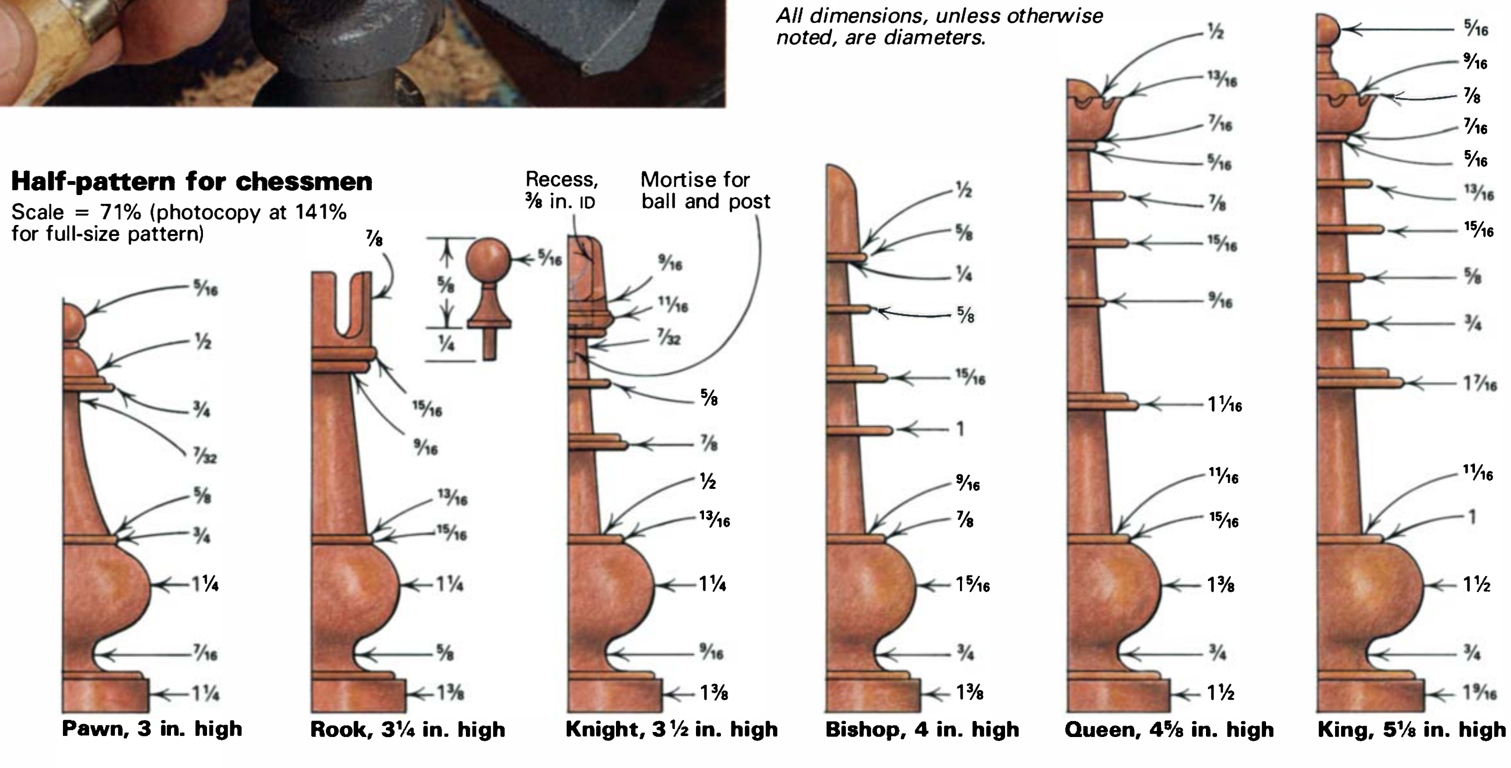
To lay out each chess piece, the author holds a cardboard pattern up to the turning blank, above, and uses a pencil to transfer key features. The blank is held in a screw chuck on the lathe.

Mode's shopmade skewed parting tool (below) *cleanly cuts the column of each piece without damaging the delicate discs.*

chessmen, you're ready to cut out the 32 rough blanks needed for the set. Black gaboon ebony and boxwood are traditional woods for high-quality chess sets; I used ebony for the dark pieces, but chose cherry for the light pieces and was pleased with the overall look. To save on precious (and expensive) wood and to allow for slight errors in centering, begin with turning squares that are 1/16 in. to 1/8 in. larger than the finished diameter of each piece. Four different-size squares are sufficient for the set: 1 5/16 in. for the pawns; 1 7/16 in. for the knights, rooks and bishops; 1 9/16 in. for the queens; and 1 5/8 in. for the kings. For further economy, I crosscut each blank to exact length, corresponding to its finished height.

Lathe tools—While you can use any number of different tools to turn the chessmen, I recommend the following: a 1/2-in. spindle gouge with the corners ground in the "fingernail" pattern, for turning the cylinder and roughing the shape; a standard 1/4-in. parting tool, for laying out the minimum and maximum diameters and removing most of the wood between the discs; a 3/8-in. and a 1/4-in. spindle gouge, each ground in the fingernail pattern and finely honed, for finishing cuts; a finely honed 1/2-in. skew chisel, for a smooth finishing cut; a small scraper with a square-ground edge, about 1/4 in. wide, for boring out the tops of the rooks; and finally, a long-point 1/4-in. parting tool with the tip ground to an angle like a skew chisel. I made this special tool by regrinding a regular small parting tool to have a sharp, sloping edge (see the bottom photo); it functions like a narrow skew to smooth the column in between the discs as described below.

Mounting and turning—I turned all the pieces on a screw chuck, which allowed me to turn the top of each without worrying about the lathe's tailstock getting in the way. To protect lathe tools from being damaged by accidental contact with the body of the chuck when cutting close to the base, I fit a 5/16-in.-thick hardwood spacer ring over the screw before mounting the blank. By making a set of four different spacers, corresponding to the four final base diameters in the set, and mounting them accordingly, you can use each spacer to help make all same-size bases identical. This is especially useful on the 16 pawns.



Photos except where noted: Sandor Nagyszalanczy; drawing: Vince Babak

Begin turning the set with the pawns: Making the 16 identical pieces is a good warm-up. Rather than being super critical about the first few pawns, I made several extras and then discarded the worst or most dissimilar ones.

After placing a blank on the chuck and turning it down to a cylinder using the ½-in. spindle gouge, I held the cardboard pattern to the spinning work and transferred the diameter lines (see the top photo on the facing page). Then, with the ¼-in. parting tool, I reduced the marked areas to a size just slightly larger than the finished diameter, checking them by carefully sliding my Vernier caliper over the spinning blank. Next, I cut the shapes with the ⅜-in. gouge and ½-in. skew, starting with the ball on the top and proceeding to the base, section by section. Always make your cuts "downhill," which in this case means cutting from the larger diameter toward the smaller one. Use the ¼-in. gouge to form the deep cove between the flat bottom section and the bulbous base.

Now make the rooks. After roughing out their shape, I made the finish cuts on the outside and then bored out the inside of the top with the small scraper, leaving the wall about 5/32 in. thick. A bit of hand detail work finishes the top so it resembles a castle turret. First, drill four ⅛-in. holes to form the bottom of the slots. To position these holes, mark their center height by drawing a line with the piece spinning (the location is shown on the pattern). Then mark them on this line 90° apart by using your lathe's indexing system (if it has one), by working with dividers or by simply eyeballing them. After drilling, use a fine-tooth saw to cut out the slots, working to the edges of the holes; a dovetail or razor saw works nicely. By keeping the cuts as straight as possible, you can cut the two opposite sides simultaneously. Leave the resulting slots slightly narrow, and clean them up with a fine flat file, adjusting the width of the sections between them. Finally, carefully sand the edges.

The knights are next, and each receives a hollow top much like the rooks. However, half of the top is cut away and shaped into a cleft that receives a ball and post, set dead center inside the opening. The ball and post, shown next to the rook pattern in the drawing, is turned as a single unit from a small blank; a ⅛-in.-dia. by ¼-in.-long tenon turned on the bottom is later glued into a hole atop the knight. After cutting out the cleft with a coping saw, I cleaned up the profile with a round file. Now, drill the hole for the ball and post with a ⅛-in. twist bit in the lathe tailstock. If you will spray-finish the set, prefinish the ball and post now, before gluing it in.

The knight is your first encounter with the thin discs that add visual character to the chess set. First, turn each disc to nearly final diameter, removing as much wood as possible between discs with the parting tool. Taper the center column from bottom to top, as shown, but leave it slightly oversize for now. Make a clean cut across the endgrain of each disc right down to the column. However, leave each disc a bit thick and then return to make a finishing cut with a freshly honed skew chisel. The finished discs should be about 1/16 in. thick—no thinner. Double discs are a little thinner than twice the thickness of a single disc. Finally, the column is turned smooth and should have a continuous taper that's visually uninterrupted by the discs. The junction of each disc and column should be clean and crisp. As I said earlier, the column must be turned downhill from bottom to top, but it may be hard for you to make clean cuts next to the bulbous base and above each disc. This is where the special skewed parting tool comes in handy: It is narrow enough to work in the small space between the discs and it makes a cut smooth enough to require little sanding. Used carefully, the long point of this tool can be brought in right next to the base or a disc to cut downhill with a shearing action (shown in the bottom photo on the facing page). Because of the narrowness of the tool's skewed cutting edge, it's difficult to cut a long taper without undesirable undulations, and so I use the regular ½-in. skew wherever possible to continue the column cut to the next disc. I suggest a trial run until you get the feel of the job and become comfortable using this tool.

By the time you get done with the knights, you should have the knack of turning the discs and columns that adorn the other pieces. Each bishop has one disc more than the knights, but these pieces involve no extra handwork. I used the ⅜-in. "fingernail" gouge to round the edges of the discs, as well as the base and much of the top. In addition to having even more discs, the king and queen have crowns, each with eight round notches that can be laid out in much the same fashion as the tops of the rooks described earlier. A round file, about ⅛ in. or slightly wider, cuts these notches nicely. I finished all the turning and sanding on each piece first and then laid out the eight points and filed the space between them, leaving each notch slightly shallow until all were started. This way, if the sections between the notches ended up being unequal, I could correct them while working to the final depth. Be careful not to nick the ball on top of the king's crown with the file.

Finishing and adding weight—When all the pieces were done, I finished them with multiple applications of tung oil, applied with the pieces turning on the lathe. One advantage of using a screw chuck is that a piece can be turned first and then remounted on the lathe for finishing and still be centered dead on. This rechucking ability helps immensely if you choose a finish that must be applied in many coats, such as lacquer, which requires sanding between coats.

Chessmen need to be heavy to keep them from being accidentally bumped out of position during a match; even a dense wood like ebony is not heavy enough, and so I weighted each piece with melted solder. Fortunately, the mounting holes left on the bottoms of the pieces from the screw chuck provide an excellent place for adding the solder. Depending on the size of the screw on your chuck, you may need to enlarge the hole after turning to hold enough solder to add sufficient weight: A ¼-in. or bigger hole won't need enlarging, but it should be at least an inch deep. To do the filling, first bore a hole in a thick scrap wooden block, to act as a stand to hold the chess pieces upside down. Now use an electric soldering iron to melt the solder into the hole, drop by drop. Work quickly so the solder flows as continuously as possible and fuses into a solid mass. Regular rosin-core solder, used for electronic projects (available at Radio Shack stores; check your local phone book) works well, but the rosin flux is messy; non-flux solder is better, but may be hard to find. Stop just short of filling the hole to the top because solder hardens into a tiny dome; if it protrudes you'll have to cut it off (an old chisel does the trick). The pieces will become quite warm from the heat, but I've never experienced any problems from it.

All that remains is to add a felt cushion to the bottom of each piece, which hides the filled hole and makes the pieces feel nicer when they're slid across a wooden chessboard. You can cut or punch your own pads out of regular felt material (available in fabric, hobby-supply or craft stores) or use adhesive-back felt pads, which are easy to apply, but hard to fix if they aren't set in the right place the first time. To apply regular felt, cut squares slightly larger than the diameter of each piece. Brush glue (yellow or white) onto the bottom of each piece and set it down firmly on a felt square. When dry, carefully trim off the excess with sharp scissors. Choose colors that complement the wood varieties you've chosen, for a handsome final touch. □

Michael Mode is a professional lathe artist living in Middlebury, Vt.

Making a Chisel Cabinet

A simple case for an elemental tool

by Carl Dorsch

The slanting sides of this chisel cabinet emphasize the subtle concave curve of the door. Although Dorsch used magnetic strips to secure his chisels, the cabinet could easily be customized for other types of collectibles.

Wood chisels are some of my favorite tools. I have a rather extensive collection that includes two sets of bevel-edge chisels: one set of five for general work and one set of seven for fine paring. Rounding out this collection are a couple of firmer chisels and three mortise chisels that I made. I had built a large, double-door cabinet for my handplane collection, and there was enough space on the doors to hang the chisels. But I knew I would despise the rattling when opening and closing the cabinet doors; besides, I wanted to store the chisels in their own case to reflect my appreciation for them.

The small, single-door wall cabinet shown here is perfect for the chisels. Although a bit extravagant, the cabinet fulfills my storage needs and was fun and easy to make. Cabinet construction is straightforward. The two sides are doweled into the bottom and top, as shown in figure 1 on the facing page, and angle toward the front at 15°; the cross-grain quartersawn oak sides further emphasize the concave door. The chisel handles rest on narrow shelves and magnetic strips hold them in place. You could substitute deeper shelves and other fasteners to display your favorite collectibles. Tablesawn cove moldings trim the top and bottom.

Building the cabinet—My chisel cabinet was inspired by James Krenov. After seeing a curved-panel cabinet he had made, I knew just what to do with a warped panel left over from another project. I had glued up the book-matched, ⅜-in.-thick oak panel, but never used it because it bowed about ½ in. across its width. While nature did a good job creating the curved panel that became the door on my chisel cabinet, a more controlled approach would be to cooper the door by gluing up beveled staves (see *FWW* #56, pp. 36-39) and then shaping the panel with a round-bottom plane. This way, the door can be made to predetermined specifications to suit your requirements. For this project, though, I would still make the door first and then build the cabinet carcase to fit.

Since the door was already done, I began by cutting identical pieces of ¾x4¾x17 oak for the top and bottom so that my cabinet would be ¼ in. wider than the overlaid door. This leaves ⅛ in. showing on either side of the door. The ends of the top and bottom are mitered at 15°, as shown in figure 1. Crosscut two ⅝-in.-thick cabinet sides to 35 in. long and then rip them to 4½ in. wide with the blade tilted to 15° to match the angle of the top and bottom. With the blade still at 15°, rip ¼-in.-wide by ¼-in.-deep rabbets on the back inside edges of the sides to accept the cabinet

(continued on p. 84)

Fig. 1: Chisel cabinet

Detail: Section view of cabinet bottom

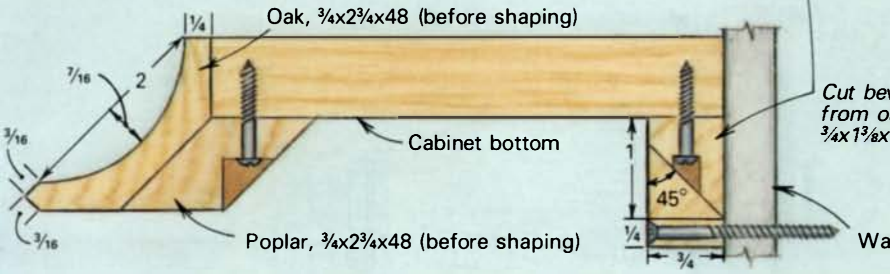
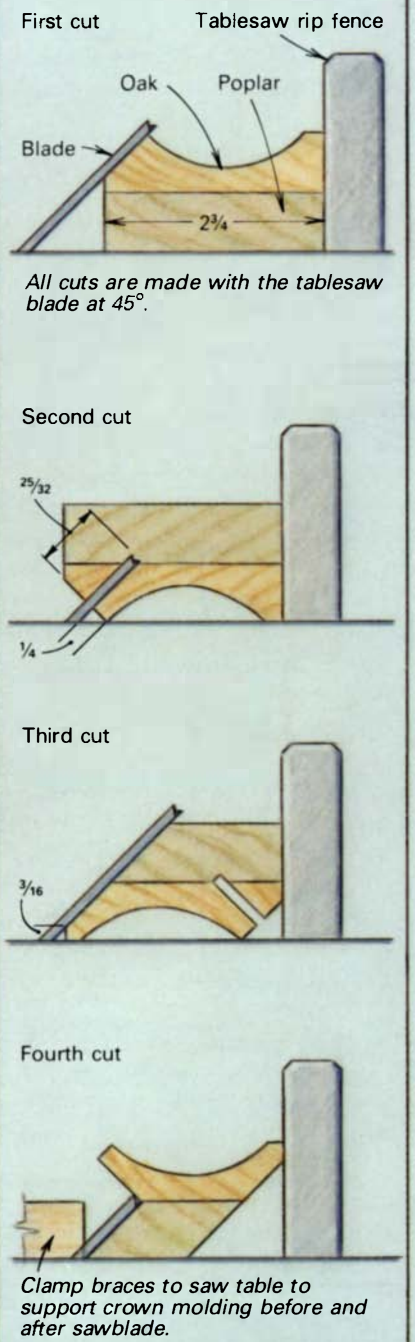
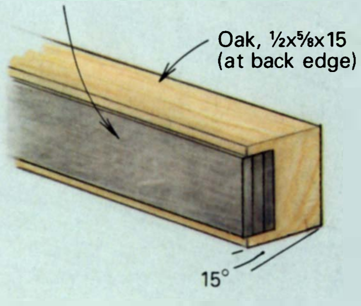


Fig. 2: Making the cove molding



Detail: Magnetic tool holders

Three layers of flexible magnetic strips, 1⁄16 in. thick by ½ in. wide, are glued into ½-in.-wide by 5⁄32-in.-deep dado.



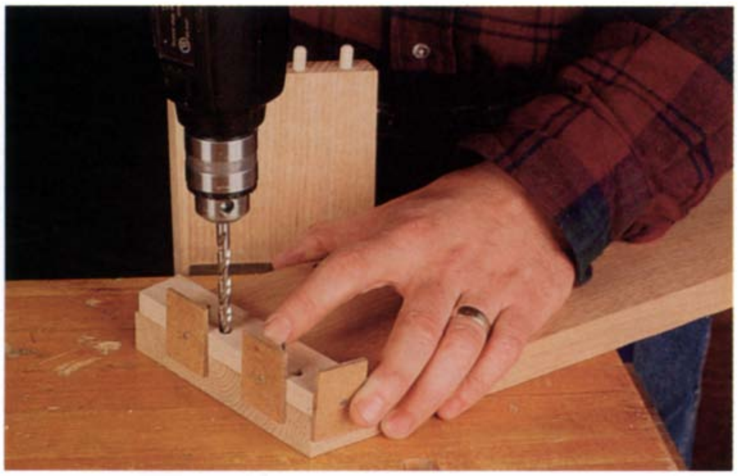
back. With the blade at 90°, cut matching rabbets in the top and bottom pieces. The cove molding will hide the ends of these rabbets.

If you want shelves in your display cabinet as I did, you should crosscut their ends 15° to match the angle of the sides. Then dado the cabinet sides to receive the shelves. I used a marking knife to trace the outline of each shelf end onto the sides and then I pared the dadoes with a chisel. You could also rout the dadoes using a straightedge clamped across the sides as a guide.

To locate and drill the holes for the dowels that join the sides to the top and bottom, I made the maple doweling jig shown in the photo below. When using the jig, keep the cleats that are nailed to the edges of the guide block on the outside and rear surfaces of each piece, as shown below. Securing the jig to the workpiece with 4d finishing nails keeps it from shifting during drilling and the nail holes are hidden when the carcase is assembled. Drill the dowel holes 9⁄16 in. deep to prevent the 1-in.-long dowels from bottoming. The 1⁄2-in.-thick doweling jig also makes a good depth stop when inserting the dowels into their holes. (For more on this, see *FWW* #70, pp. 69-73.)

Before glue-up, I dry-assembled the carcase to ensure everything fit and the carcase was square. When you are satisfied with the fit, disassemble the carcase, put glue in the dowel holes in the cabinet sides and insert the dowels. Then put glue in the holes in the top and bottom pieces, and assemble and clamp them to the sides. Measure across the diagonals and clamp as needed to square up the carcase; don't overtighten the clamps or you will bow the sides. When the glue has dried, measure and cut the back to fit into its rabbets. I used 1⁄8-in.-thick hardboard, veneered on the inside face with goncalo alves, for its striking appearance, and on the other side with mahogany, to balance construction and prevent bowing. I test-fit the shelves and back, but didn't permanently install them. I'll do this after I apply the finish later in the construction process.

Making and installing the cove moldings—Rather than rout the edges of the top and bottom, I made and attached cove molding from a separate piece of straight-grained quartersawn oak. This eliminated shaping endgrain and also conserved wood by reducing the thickness needed for the top and bottom. Although the molding can be made from 1½-in.-thick stock, I didn't have any this size and so I laminated ¾-in.-thick poplar to the back of ¾-in.-thick oak. It is easier and safer to make all the molding from two 4-ft.-long pieces of stock and then crosscut and miter the individual short pieces to length.



This jig guides the bit for drilling dowel holes, and serves as a depth gauge when setting the dowels. Be sure to position the cleats against the outside and back edges of the workpiece.

I coved the molding by clamping a fence diagonally across the tablesaw and running the molding stock over the blade at an angle, taking very small cuts and raising the blade slightly after each cut, as discussed in *FWW* #87, p. 51. I then beveled and rabbeted the back edge of the molding following the sequence of tablesaw cuts shown in figure 2 on the previous page. When making the fourth cut, be sure to clamp braces to the tablesaw, as shown, to support the molding. If your cabinet sides are angled 15°, then the moldings should be mitered at 37½°. If not, you can figure the angle for each miter by measuring the included angle between the front and side and dividing this angle by two. Subtract the result from 90° to get the correct miter-gauge angle, and cut the miters on the tablesaw.

Glue and screw the front pieces of molding to the top and bottom of the cabinet and then fit each side piece individually. If the miters do not fit as cut on the tablesaw, pare the side molding miters with a sharp chisel to match the front moldings. After the front corner miters fit, trim the back ends to length by crosscutting at 15°. Attach the side moldings with a dab of glue and a screw at the front and with a screw that fits into a slotted, countersunk hole at the back, to allow for seasonal wood movement.

Hanging the door—Fitting the door to the cabinet is the most critical part of construction because there is little room for error. Install the moving half of the knife hinges in notches cut in the door, and then test-fit the door to the cabinet. Because my door was slightly bowed along its length, I had to spokeshave the cabinet sides' edges to accommodate the bow, as well as slightly trim their 15° bevel to the door's curve. When the door fits, use it to mark the top and bottom for the locations of the pin half of the hinges. Pare the hinge mortises with a chisel, but stop short of the mark for the hinge end. Test-fit the door again, this time by holding the pin half of the hinge on the door while sliding the hinge into its mortise. Do this for both the top and bottom. Center the door on the cabinet by adjusting the length of the hinge mortises. The door is held closed by two round magnets that are epoxied into holes drilled into the edge of the unhinged cabinet side. Strikes for the magnets are epoxied into shallow mortises drilled into the inside face of the door with a Forstner bit.

Now, remove the door and the hardware before finishing the cabinet. I applied a light coat of Minwax Golden Oak and rubbed on a mixture of tung oil and polyurethane. I added extra polyurethane to the mixture that was applied to the shelves and bottom for more protection where the handles of the chisels will rest. When the finish is completely dry, slide the shelves into their dadoes from the rear, fasten the back panel into its rabbet with 10 #6 by ¾-in.-long screws and reinstall the door.

The magnetic strips that hold the chisels are screwed to the cabinet back from the rear. Although magnetic tool holders are commercially available, I think they look too bulky and their magnetism is so great that they make tool removal awkward. So I made my own holders, as shown in the detail in figure 1 on the previous page. For each holder, I used cyanoacrylate to glue three flexible magnetic strips together and then into a dado in a ½x5⁄8x15 piece of oak. Flexible magnetic strips are available from most craft-supply stores and many mail-order tool companies. The three strips provide just enough magnetic attraction to keep the chisels in position, yet allow them to be removed easily.

I hung the cabinet on beveled cleats at the bottom and two small L-brackets at the top, as shown in figure 1. Cove molding around the top and bottom hides these attachment fixtures when the cabinet is hung on the wall. □

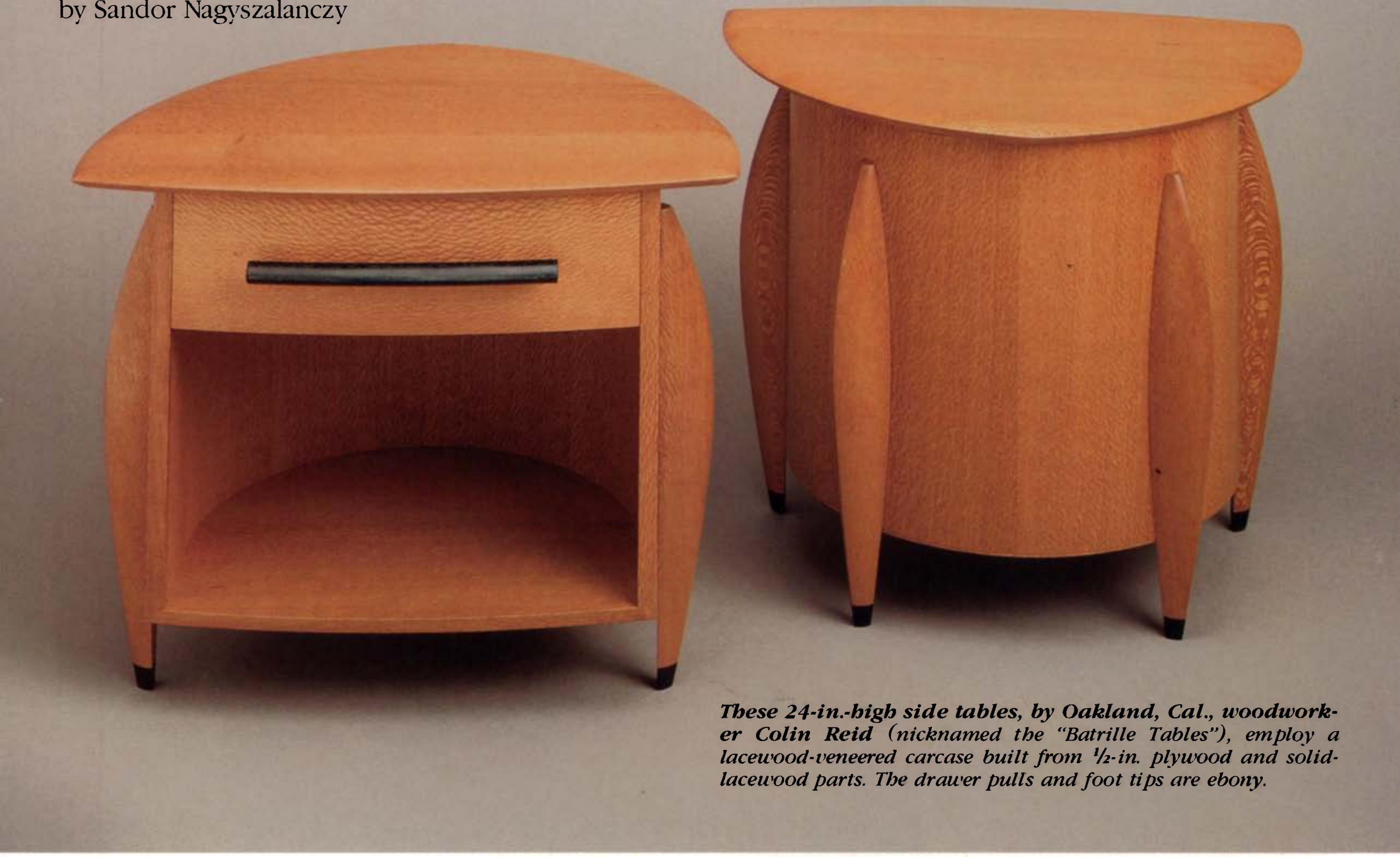
Carl Dorsch is an amateur woodworker in Pittsburgh, Pa.

Photos: Charley Robinson; drawings: Lee Hov

California Design '91

Recent furniture from the Baulines Crafts Guild

by Sandor Nagyszalanczy



These 24-in.-high side tables, by Oakland, Cal., woodworker Colin Reid (nicknamed the "Batrille Tables"), employ a lacewood-veneered carcase built from ½-in. plywood and solid-lacewood parts. The drawer pulls and foot tips are ebony.

California holds the reputation for setting many of the trends and fashions that eventually sweep across the country: from surfing to sushi bars. In keeping with this tradition, California's Baulines Crafts Guild (BCG) recently held its latest trend-exploring exhibition of arts and crafts, which included the furniture shown in this article.

California Design '91: Furniture and the Decorative Arts took place last January and February at San Francisco's Contract Design Center. The exhibit, which featured the work of 73 Californians, included more than 60 pieces of woodworking: furniture, cabinetry, lamps, clocks and wooden accessories. Also included were functional and sculptural pieces crafted in other media, including ceramics, glass, metalwork and textiles.

In a competition open to both BCG members and other California artisans, entrants submitted photos of their work to a jury of design professionals, including a former museum curator, a professor of environmental design and a West Coast design-magazine editor. The committee selected pieces for their technical quality, innovation in design and creative use of materials. The focus for the furniture in the show was on one-of-a-kind work, as well as prototype furniture. Much of the work displayed the makers' willingness to experiment with new forms and media, and several pieces in the show were made from non-wood materials in unusual applications, such as a ceramic chair made by San Franciscan Leo Peck, and a chair assembled from electric-guitar parts by Trent Hickman of Santee, Cal. In addition, some makers adopted a playful approach in naming their work. For example, when Colin Reid completed the tables shown in the photo above, he was struck by the similarity between the sweep of the tables' tops and the hat worn by Sally Field when she played Sister Batrille in the 1960s' television show *The Flying Nun;* hence the name, "Batrille Tables."

As Californians are known for their eclectic tastes, it's not surprising that the BCG show included work created in a wide range of styles and design approaches. Robert Erickson's "Alexis" lounge, shown in the bottom photo on p. 87, is his variation of a traditional Morris chair, influenced by Art Deco style and commercial reclining lounge chairs. The lounge's unique upholstery, done in split cowhide by Thomas Bridwell, reveals Erickson's affinity for 1950s' auto interiors, as evidenced by the corrugated "tuck and roll" on the side panels. Rather than relying directly on established styles and motifs, maker Charles Cobb started with the materials and designed his piece to fulfill visual goals. To create the side table in the top, left photo on p. 86, Cobb started with a drawer front from stunningly figured acacia wood, grown in northern California, and designed the rest of the piece around it. Working from another perspective, furnituremaker Aspy Khambatta prefers not to use

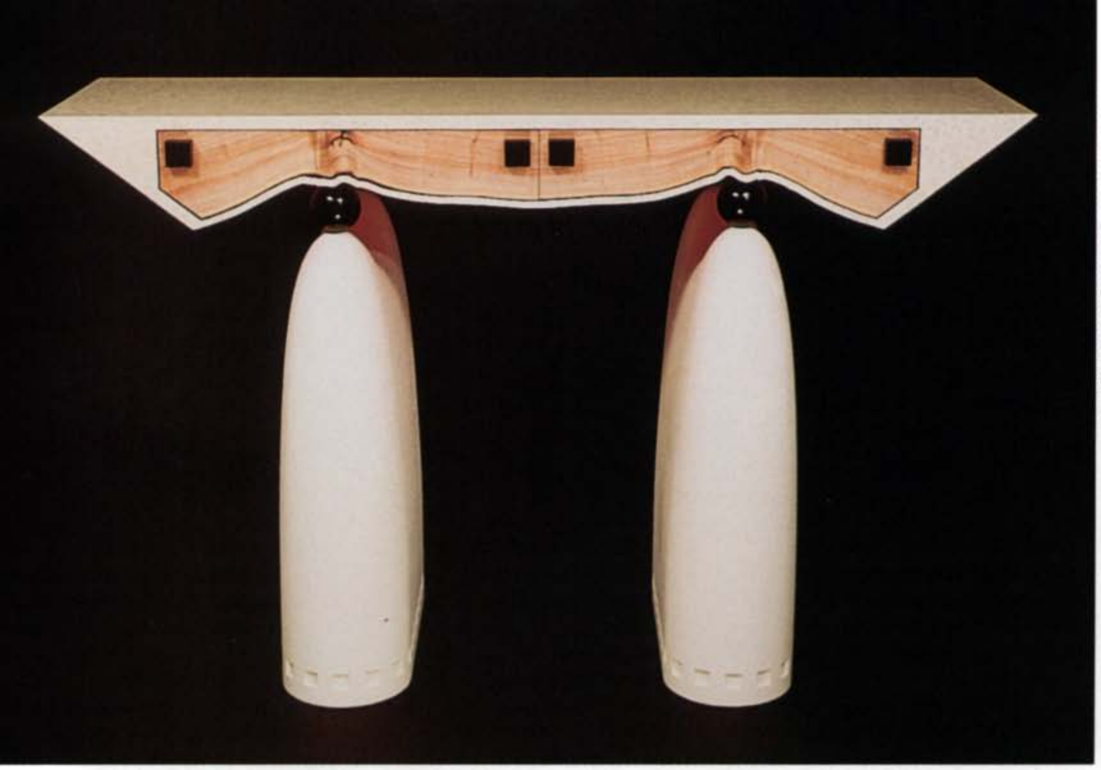


Photo left: Ron Bath; photo right: Joe Schopplein

Carolyn Grew-Sheridan's "Spike" table, *above, is 3 ft. tall and made primarily of bird's-eye maple and wenge. The Oakland, Cal., designer/crafter set a brass ball atop the table to act as a convex mirror, offering viewers an interesting fish-eye-lens-type reflection of the room around them.*

Santa Rosa, Cal., furnituremaker Charles Cobb's side table, *above, has an acacia drawer front and a 60-in. by 20-in. top covered with Italian pseudo bird's-eye maple veneer that rests on four balls atop painted particleboard pillars. Cobb's intention was to "create the illusion that if you gave the top a shove, it would roll off."*

Photo left: Debra Casserly; photo right: Roger Heitzman

The base of Mason Rapaport's 60-in. by 30-in. glass-top coffee table, *above, was built from four layers of 1/16-in. Baltic birch plywood, vacuum-pressed over an armature of U-shaped plywood ribs and veneered with quilted African mahogany.*

For his table, El Cerrito, Cal., furnituremaker Aspy Khambatta *turned four 28-in.-long, square maple blanks as a unit, and then separated them to form the base (left). Wenge strips connect the base quarters, while a thin layer of fretsawn wenge atop each base adds visual detail beneath the glass top.*

highly figured woods in his work so that the form becomes the point of visual focus. His table, shown in the bottom, left photo above, employs clean lines, relatively plain woods and strong geometric forms to achieve this goal.

Since its inception in 1972, the BCG, based in the San Francisco Bay area, has encouraged both its members and other California artists to push the limits of their aesthetic designs, methods of construction and uses of materials. In addition to annual exhibitions, like California Design '91, the guild has pursued this goal by establishing an apprenticeship program. The BCG offers aspiring young woodworkers, like Mason Rapaport, whose glass-top coffee table is shown in the bottom, right photo above, sponsorship and the opportunity to work and study with a veteran woodworker, in this case longtime guild member Roger Heitzman.

To ensure the best presentation for the work in California Design '91, the sixth of the BCG's annual design exhibits, the guild spent $15,000 collected through entry fees, donations and fund raising. The guild hired local exhibit designer Theodore Cohen to lay out the show. Cohen broke up the 6,000-sq.-foot showroom floor with white, 4-in.-high plywood risers, each fitted with a back for displaying weavings and other hung objects. To further enhance the work, the BCG employed a theatrical lighting company, which installed quartz-halogen lights. All of this created a very professional presentation of the pieces on display. □

Sandor Nagyszalanczy is associate editor of FWW. *The BCG is a non-profit organization dedicated to the teaching and advancement of crafts, and features yearly exhibits, quarterly meetings, a seminar series and an apprenticeship program. For more information on the BCG, call (415) 331-8520.*

Photo left: Jess Shirley; photo right: Christopher Irion

This "Iris Love Seat" was built by Paul Reiber, *a member of James Krenov's first graduating class at the College of the Redwoods in Ft. Bragg, Cal. Reiber is still building and carving furniture in his shop in nearby Mendocino. The cherry loveseat, above, features a floral relief carving across the back splats and traditional springs that support the 34-in.-wide cushion, covered in off-white muslin.*

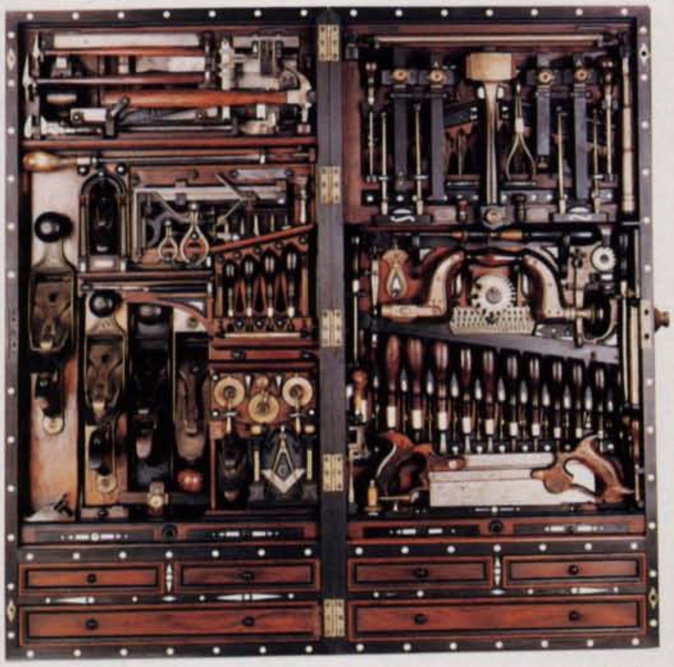
Robert Erickson's Art Deco-influenced "Alexis" lounge chair, *below, is very practical: "You can sleep in it, read in it or whatever," says the Nevada City, Cal., craftsman. The mechanism for adjusting the back is made from cocobolo and custom brass parts. The cherry lounge and ottoman are upholstered in leather.*

Philo, Cal., veteran craftsman Tom McFadden's dining table, *above, has a curvaceous laminated ash base and a 72-in. by 48-in. top featuring veneer McFadden sawed himself from an orchard-grown, grafted walnut tree. The lighter-colored half is English walnut, while the darker half is black-walnut rootstock.*

Photo: Richard Sargent

READER SERVICE NO. 160

From Back Cover to Poster



TOOL CHEST LEGACY

If the workmanship in a tool chest is any indication of the maker's talent, then the craftsmanship of master carpenter and stonemason H.O. Studley must have been awe-inspiring. In an oak clamshell box adorned with rosewood, ebony, pearl and ivory, Studley kept both tools he made and a collection of the finest hand tools made prior to 1900, including a complete set of woodworking tools as well as machinist and stonemasonry tools. To pack the 300-plus tools into a case only 19½ in. wide, 39 in. long and 9¾ in. deep, Studley devised a jigsaw-puzzle arrangement of flip-up trays, fold-out layers and hidden compartments. Maine native Pete Hardwick now owns the chest, which has been in his family since it was bequeathed to his grandfather by Studley. Hardwick acquired the chest from his brother by trading a 1934 Ford sedan for it. A good trade? It would seem so: Just one tool—the Stanley #1 plane housed in the ebony archway in the upper-left part of the chest—was appraised at $700. Hardwick, a nonwoodworker, plans to sell the chest.

Now available from *Fine Woodworking* magazine

The response to *Fine Woodworking's* July/August back cover was overwhelming. So many of you called or wrote asking for a poster reproduction of the exquisite tool chest by H.O. Studley, that we decided to go ahead and print one up.

We rephotographed the chest and enlarged the photo to fill the 18″ x 26″ poster shown above. Seen at this size, Studley's ingenuity and workmanship is even more apparent.

The poster is printed in full color on the same book-quality stock as the *Fine Woodworking* covers. And we'll mail it to you carefully rolled to keep it suitable for framing.

It makes a great gift for you or a friend.
To order, use the coupon below or call 1-800-888-8286.

☐ **Please send me** ____ copies of The Tool Chest poster at $9.95 each, plus $2.50 postage and handling (#180).

Name ____________________

Address ____________________

City ____________ State ____ Zip ________

☐ Payment enclosed ☐ MasterCard ☐ VISA ☐ Am. Ex.

Charge card # ____________________

Exp. Date ________ Signature ____________________

TAUNTON MAGAZINES
...by fellow enthusiasts

The Taunton Press
63 South Main Street
Box 355PWAM
Newtown, CT 06470

CLASSIFIED

The CLASSIFIED rate is $5.75 per word, minimum ad 15 words. All payments must accompany orders; all are noncommissionable. The WOOD & TOOL EXCHANGE and SITUATIONS WANTED are for private use by individuals only; the rate is $8.00 per line. Minimum 3 lines, max. 6 lines, limit 2 insertions per year. DISPLAY CLASSIFIED rates on request. Send to: *Fine Woodworking*, Advertising Dept., Box 5506, Newtown, CT 06470-5506. Deadline for the *September/October* issue is June 25. FAX (203) 426-3434, or phone (800) 283-7252.

Business Opportunities

SHOP FOR SALE—4000 sq. ft., plus office and storage. Cooperstown, N.Y. area. 3PH air and vacuum. Growing area. $55,000. (607) 965-8162 evenings.

TAGUA-IVORY. 10 assorted, $10. Distributors wanted. HILTARY AGRICULTURAL, Box L, Scottsdale, AZ 85252. Visa/MC. For orders: 800-872-5263. Dealer inquiries: 602-994-5752.

AUSTRALIAN FRANCHISE REQUIRED for items suitable for distribution through a chain of 150 hardware stores. Jeays Hardware, Hancock Street, Sandgate, Brisbane, Queensland, Australia 4017.

PLANS WANTED. Will pay cash for rights. Groups wood project plans (birdhouses, lawn ornaments, etc.) Must own rights. Send samples, prices. Trendlines, Dept FWPL, Box 6447, Chelsea, MA 02150.

INVENTIONS/NEW PRODUCTS/ideas wanted. Call TLCI for free information. 800-468-7200, 24/hrs per day. USA & Canada.

CHAIR-FACTORY 2340 sq./ft. leased, excellent location with tourist trade $160,000. Jackson Hole Furniture: (307) 733-7503.

SEEKING SHOP/S TO PRODUCE 150 units of complex, museum-quality project. Cabinetry, small-scale carpentry, moving parts, intricate carving. Enormous project. Betalhpa Editions, PO Box 20042, Rochester, NY 14602. FAX/phone: (716) 442-0570.

ESTABLISHED CABINET MAKERS BUSINESS, all equipment, inventory, financial statements. $150,000. Toronto area. Gay Lacoursiere. (416) 472-2200.

QUALITY LONG ISLAND CITY, NY woodworking shop renting bench space. All machinery and spray booth available. Contact Bill at: (718) 784-9035.

DESIGNER/BUILDER of green wood/hardwood furnishings seeks creative business-minded partner. 221 Columbia St., Brooklyn, NY 11231. Geli (718) 260-9122.

Situations Wanted

CABINET MAKER seeking quality work in Southwest. Fully proficient, extensive experience in architectural millwork and custom shops, high-end cabinetry. Professional, dependable. Robert: (203) 866-2202.

CO-OPERATIVE BENCH SPACE NEEDED: Midwest/East Coast. C. Long, Rte. 2, Box 169, Waynesville, NC 28786. (704) 926-2280.

Help Wanted

PARTNER WITH TOP SKILLS, with or without capital, to join established premium custom shop. Fully experienced. Write: XFABRICA, Inc., 64 Grand Ave. S., Cambridge, Ont., Canada N1S 2L8.

EXPERIENCED CABINETMAKER/FINISHER/PROJECT LEADERS— for planning fabricating and installing high-end furniture and architectural millwork. Positions from $15,000 to $30,000 for self-motivated individuals with independence to contribute to growing business. Excellent benefits. Send resume: Woodfellows, 8512 Fairway Pl., Milleton, WI 53562.

Instruction

ONE YEAR apprenticeship program in woodworking. Intensive training encompassing design, production, and marketing of fine furniture and cabinetry. Tuition. Maxwell & Kelly Furniture Co., Philadelphia, PA. (215) 988-9065.

MUSICAL STRING INSTRUMENT REPAIR. In one year you learn to repair and build guitar- or violin-family instruments. Call Red Wing Technical Coll. (800) 657-4849. EOE.

LEARN WOODEN BOAT BUILDING AND DESIGN. Two full-time residential programs that offer intensive training in a creative but disciplined environment. VA approved. Accredited member, NATTS. Financial aid available. Equal opportunity enrollment. The Landing School, Box 1490F, Kennebunkport, ME 04046. (207) 985-7976.

LEARN TO TURN WOOD. Precision lathe work for fun and fine products taught by JAMES L. COX WOODWORKING SCHOOL. Free brochure. RD 2, Box 126 Beaver Dam Rd., Honey Brook, PA 19344. (215) 273-3840.

INDIVIDUAL INSTRUCTION learning furniture making from log to finished product with classical hand joinery emphasized. Instructor: graduate of John Makepeace School, Dorset, Eng. Contact Geoffrey Noden. (609) 890-8152.

APPRENTICE WITH MASTER CRAFTSMEN. Unique in-shop experience. Woodworking and other crafts. Year round program. Baulines Craftsman's Guild-FW, Schoonmaker Point, Sausalito, CA 94965. (415) 331-8520.

CHICAGO-AREA APPRENTICESHIP. Prestigous high-end woodworking studio. Work and study for 1 year. Design and build own projects under master crafstman. No tuition, no salary. Some experience in power tools required. For brochure write: David Orth, 1107 Chicago Ave., Oak Park, IL 60302.

THE HYMILLER SCHOOL of Fine Finishing Repair and Hand Joinery. One and two-week intensive in-shop training will give you all the necessary knowledge to start your own business. Send $5 for complete information package. 3rd generation master craftsman. 912 Lakeshire Dr., Fairfield Glade, TN 38555. (615) 484-9309.

WOODTURNERS

Since 1976, I've been teaching beginners to turn, and experienced turners to hone their skills. I also stock Myford *Mystro* lathes, Sorby tools, & other turning essentials. Call or write for free brochure:
RUSS ZIMMERMAN
RFD 3, Box 242 Putney, Vermont 05346
802-387-4337

FINE CABINETMAKING

Courses with master craftsman in long established professional and teaching workshop in beautiful historic area.
For Prospectus call U.K. 0803 862861
Christopher Faulkner
Ashridge Workshops, Dartington, Totnes, Devon TQ9 6EW, England.

Glues/Adhesives

HIDE GLUE-ALL GRADES, including glass chipping, 5# and up. Bjorn Industries, Inc., Box 1280, Matthews, NC 28106. (704) 364-1186.

Building? Restoring? Repairing?
use **CHEM-TECH T-88** the epoxy professionals use! Strength and reliability proven in boats and aircraft over 15 years. Introductory offer 1/2 pt. of T-88 $9.95. Technical staff on call to answer your questions. Call or write.
CHEM TECH
4669-F Lander Rd
Chagrin Falls
OH 44022
(216) 248-0770

Finishes

SPRAY-ON-SUEDE. Free brochure (sample enclosed). Donjer Products, Ilene Court—Bldg. 8F, Belle Mead, NJ 08502. (800) 336-6537.

POLYESTER WOOD FINISH. A complete line of professional products for producing the ultimate piano/high tech finish. Clears, custom colors. Information kit $3. Donald M. Steinert Co., Dept. FW, 800 Messinger Rd., Grants Pass, OR 97527. (503) 846-6835.

VELVIT OIL—One coat penetrating, transparent oil. "Hand rubbed finish" in 10 colors. Stains, fills, seals, finishes, protects, beautifies in one application. No lap marks. No need to varnish. Easy to apply. Economical. Velvit Products Co., FWW, PO Box 1741, Appleton, WI 54913. (414) 722-8355.

Accessories

FREEBORN SHAPER CUTTERS 25% to 35% OFF. Free catalog. Call Frank at Top Shelf. (717) 289-4686.

FINALLY!! FRAMERS MOULDING. Lengths, custom cuts, finished or unfinished. Wholesale prices, framing tools, hardware. Complete catalog $1. FrameWealth, Dept F, RD #2 Box 261-7, Otego, NY 13820.

VACUUM BAG PRESSES

Use the atmosphere as a press. Evenly distributed pressure creates perfectly veneered panels and bent laminations. Compact & affordable. Call or write:
(707) 964-7557
MERCURY VACUUM PRESSES
BOX 2232 • FORT BRAGG, CA 95437

Miscellaneous

BRANDING IRONS. Names, signatures, logos, any size, design. Norcraft Custom Brands, Box 277F, So. Easton, MA 02375. Telephone (508) 238-2163 anytime.

LEGAL IVORY

Vi tually identical to animal ivory. Tagua is the nut from a tropical palm tree. Ideal for jewelry, knobs, small turnings, inlay, or scrimshaw.
Box of 10 Regular size (up to 1½" diameter) OR BOX OF 5 Jumbo $10 plus $3.00 S&H
(Dealer inquiries invited)
WOODWORKERS SUPPLY
5402 S 40th St./Phoenix, AZ 85040
1-800-423-2450

$7.50 + 1.50 S&H
SECRETS OF SUCCESSFUL MITERING . . .
Build your own table saw miter jigs!
Easy and Complete Plans and Instructions
PLUS **Illustrated table saw tune-up guide!**
A. Petersen Woodco
P.O. Box 1441
Fremont, NE 68025
(402) 721-4285
Send $7.50 + 1.50 S&H
Check or Money Order

THE FINE GOLD LEAF PEOPLE ™
Genuine, Imitation and Variegated Sheets & Rolls
Brushes, Supplies & Technical Books
IN USA: *Three Cross Street*
Suffern, NY 10901-4601
1-800-283-5323
FAX: 914-368-1535
IN CANADA: *508 Douglas Avenue*
Toronto, Ontario, M5M 1H5
416-787-7331
"WORK WITH THE BEST IN THE BUSINESS"

SLIPCASES FOR YOUR BACK ISSUES. Bound in dark blue and embossed in gold, these durable cases will protect your back issues of *Fine Woodworking* and help you keep order on your bookshelf (or in your shop). Each case holds at least 6 issues of the magazine--more of our earlier, thinner issues. The cost is $7.95 each, $21.95 for 3, $39.95 for 6. Please add $1.00 for p and h, outside the U.S., add $2.50 each (U.S. currency only, please). PA residents add 6% sales tax. JESSE JONES INDUSTRIES, Dept. FWW, 499 E. Erie Ave., Philadelphia, PA 19134. Charge orders: Min. $15.00 call toll free (800) 825-6690. 7 days, 24 hours.

THE BEALL TOOL CO.
The Beall Wood Threader
The ultimate wood threading device. Attaches to router & makes perfect threads in 5 right hand sizes and 3 left.
Write or call: Dept. FW, 541 Swans Rd., NE, Newark, OH 43055, 614-345-5045, 1-800-331-4718.

Musical Supplies

LUTHIERS' SUPPLIES: Imported tonewood, tools, varnishes, books, plans, parts, accessories, strings, cases, for violins, violas, cellos, basses and guitars. Assemble-yourself violin and guitar kits. Catalog, $.50, includes 10% discount certificate. International Violin Company, Ltd., Dept. WX, 4026 W. Belvedere Ave., Baltimore, MD 21215.

HAMMERED DULCIMER PLANS! By noted builder Charlie Alm. Best book on subject. $19.95. WOODWORKS, Box 428, Dept. FW, Brookston, IN 47923. (317) 563-3504, (800) 526-4791.

GUITAR, BANJO MANDOLIN and violin kits. Repair tools, replacement parts, tone woods and finishing supplies. Free 96-page catalog. Guitar Shop Supply, Box 900F, Athens, OH 45701. 800-848-2273.

Plans & Kits

BRAZILIAN END TABLES AND COFFEE TABLE. Rich and impressive design. Detailed plans, $9. KUROKAI DESIGNS, PO Box FW8344, Silver Spring, MD 20910.

MARQUETRY KITS! Scenic wood inlays! Brochure $1. KITS, 16204 92nd Ave. Ct. E., Puyallup, WA 98373.

EXCITING WOODEN TOY PLANS. Plans for eye-catching toys with super realistic wheels described in free brochure. Toy-PrO, Dept. FW, PO Box 773810, Steamboat Springs, CO 80477.

MAKE WOODEN TOYS, whirligigs, door harps, doll houses, clocks, music boxes, weather instruments, crafts, furniture with our plans, parts, kits, supplies — Catalog $1. (614) 484-4363 — Cherry Tree Toys, Belmont, OH 43718-0369.

FULL-SIZE PROFESSIONAL PLANS - Catalog $3. Over 200 professionally-designed plans for building fine furniture. Furniture Designs, Inc., CK-71, 1827 Elmdale Ave., Glenview, IL 60025.

ADVANCED WOODWORKERS furniture plans, wall units, desks. $1. Cornerstone Designs 6346-65 Lantana Rd. Suite 10-CF, Lake Worth, FL 33463.

BUILD AN AFFORDABLE MAPLE TOP work bench a craftsman would be proud to own. For plans send $9 to Dane Woodworking, Inc., PO Box 667, No. Scituate, RI 02857.

ATTENTION WOODWORKERS. Need a portable shop table? Ours holds tablesaw and mitre saw. For plans send $3. to: Covert Marketing, PO Box 12176 Dept. 102, Santa Rosa, CA 95406-2176.

JEEP CJ-5 "WOODY" PLANS: Beautiful oak and mahogany hardtop as seen in April 1991 *FOUR WHEELER* magazine. Detailed instructions $29.95. Sundance Studios, Box 1865, Arboles, CO 81121.

BUILD AN 18-in. MINIATURE DOG SLED. Full size plans $7.50/ppd. Precut kits also available. WOOD'N STUFF, PO Box 58267, Fairbanks, AK 99711.

100 WOODWORKING PATTERNS every other month only 10¢ each. Free trial membership. Pay only $9.99 for sets you keep. FC&A Woodworking Pattern Club., Dept. 9FW-7CL, 103 Clover Green, Peachtree City, GA 30269.

PORTABLE TABLESAW, ROUTER TABLE. Super accurate fence. Build your own plans. $14.95 or free details. Burgeson Wood Products & Custom Cabinets, 35660 Jayhawker Rd., Agua Dulce, CA 91350. (805) 251-4585.

ADIRONDACK, COUNTRY, AND ORIGINAL outdoor furniture plans. Chairs, loveseat, picnic table, benches, swings, etc., New designs, attractive and easy to build. Catalog $2. (credited.) PLANCRAFT, Box E1779, Hernando, FL 32642.

Publications

BUILD, RESTORE, REPAIR, refinish! Carvings, moldings, brass, hardwoods, veneers, upholstery, caning, lamps. $1 for unique wholesale catalog. Van Dyke's, Dept. 71, Woonsocket, SD 57385.

DISCOUNT BOOKS. Catalog offering a complete selection of books for woodworkers and woodcarvers. Woodworkers Bookstore and Gallery, 464 Pratt St. Ext., Meriden, CT 06450. (203) 634-4454.

1991 LEATHERCRAFT CATALOG. 100 pages. Largest selection available of genuine leathers, tools, kits, books, supplies. Fine tooling, utility garment leathers, suedes, exotics. Belt, wallet, moccasin kits, & more! Send $2 P/H to: TANDY LEATHER COMPANY, Dept. FW791C, PO Box 2934, Ft. Worth, TX 76113.

THE TOOL CHEST CRAFTSMAN LIBRARY CATALOG
... for both the professional and amateur
1000's OF BOOKS COVERING
• Woodworking - All Aspects
• Home Remodeling & Maintenance
• Tools & Their Uses • Contracting
• Projects For Home & Recreation
To order your catalog send $2.00 (refundable with first order) To: **THE TOOL CHEST Dept.T** 45 Emerson Plaza East Emerson, NJ 07630

HARD-TO-FIND MINIATURE TOOLS
Over 1,000 specialty items for working small and when precise detail counts. Send $1.00 for 4 issues of our 48 page catalog. *Micro-Mark* 340-904 Snyder Ave. Berkeley Heights, N.J. 07922

WORLD WOODS IN COLOR


OVER 275 COMMERCIAL WOODS IN FULL COLOR PLATES.
Use this magnificent book to identify wood, discover recommended uses, determine mechanical specifics, check color, or distinguish between botanical, commercial, and colloquial names. This is an unique book and the only full color wood reference guide on the market. 320pp. Hardbound. Rush $52.95 today or call toll free USA & Canada 1-800-345-4447.
Linden Publishing Inc.
3845 N. Blackstone • Fresno, CA 93726.
Immediate refund if not fully satisfied.

Send for your FREE *Fine Woodworking* catalog.
Find out about the very best woodworking books and videos available. Our catalog contains comprehensive titles on tools, furniture making, design, turning, carving and much more.
TO GET YOUR FREE CATALOG, CALL 1-800-888-8286 OR WRITE:
The Taunton Press
63 South Main Street, P.O. Box 5506
Newtown, CT 06470-5506

Hand Tools

JAPANESE TOOLS SINCE 1888. Free catalog. Tashiro's, 1024 S. Bailey St., Ste. B, Seattle, WA 98108. (206) 762-8242.

TOOLS—ANTIQUE & USED—STANLEY. Quality selection of scarce handtools for collectors and woodworkers — planes, scrapers, spokeshaves, saws, chisels, levels, rules, unusual items, etc. Complete, working tools. Satisfaction guaranteed. Prompt, postpaid service. VISA/MC. Current illustrated list—$2.50 Subscription $10/yr., 5 lists. Bob Kaune, Dept. C791, 511 W. 11th., Port Angeles, WA 98362. (206) 452-2292.

Japanese Pull Saws
We have the largest selection of Japanese Pull Saws in the United States. Send $1.00 for a 2 year subscription to our 80 page catalog of fine woodworking tools.
THE JAPAN WOODWORKER
1731 Clement Ave., Suite 100 • Alameda, CA 94501
Phone (415) 521-1810

Power Tools

RESTORED MACHINERY - Finest woodworking machines ever made. Oliver, Yates, Northfield. Bandsaws, table saws, wood lathes, etc. Puget Sound Machinery. (206) 857-5088.

WOODTURNING LATHES: bowl, spindle, large swing, long bed, slow speed. DeRose & Co., PO Box 150, Mechanicsville, VA 23111. (804) 746-1705.

FELDER BF441 NEW 12-in. saw, 16-in. jointer/planer, 1¼-in. shaper, boring attachments, all -3 cast iron. $15,500. (503) 292-8193. -0

FREE DISCOUNT WOODWORKING tools and supplies catalog. Best prices for over 3000 brand-name products. Trendlines, Dept. FW1, Box 6447, Chelsea, MA 02150. 1-800-366-6966.

DELTA AMERICAN MADE. New and used specials. New 5HP, 3HP Unisaw, $1400. Send for complete listing and prices. New 1PH, 3HP special motor replaces Delta 83651, $288. PPD. Plaza Machinery, Box 14, Bethel, VT 05032. (802) 234-9673.

LAMELLO MACHINES
NEW TOP TEN MODEL
SPECIAL INTRODUCTORY PRICE
Largest selection of Lamello accessories, parts. **Select Machinery, Inc.** / Hank Koelmel, 64-30 Ellwell Crescent, Rego Park, NY 11374. (718) 897-3937, 8:00 AM-4:30 PM
CALL OR WRITE FOR FREE BROCHURE

WIDEBELT SANDERS

For the small shop, kits or ready to run, 24" capacity, quick change belts, conveyor feed, rugged, accurate + affordable. Free information.
MILLER WOODWORKING MACHINERY, INC.
1110 E. QUILCENE RD.
QUILCENE, WA 98376
(206) 765-3806

Safety Equipment

FILTER BAGS FOR DUST COLLECTION SYSTEMS. Fabric $12/yd. ppd. Free system plans. Barter Enterprises, Box 102B, Prospect Harbor, ME 04669.

Software

CABINETMAKERS!
PROFESSIONAL COMPUTER PROGRAMS
DESIGN AND CUT LISTS..............$295
PANEL OPTIMIZATION..................$195
IBM OR APPLE MACINTOSH
SEQUOIA SOFTWARE CO.,
P.O. BOX 1556, LAYTONVILLE, CA 95454
(707) 984-8472 Visa/MasterCard/Discover

Wood

ATTENTION WOODWORKERS maple and redwood burl. Figured, quilted, bird's-eye, lace. Any size or thickness available. Quality. Albany, OR. (503) 926-1123.

MESQUITE LUMBER. SASE for prices. Include $2 for sample. H. Nordmeyer, PO Box 68, Knippa, TX 78870.

WEST AUSTRALIAN TIMBERS. Banksia nuts, grasstree (blackboy), rasperry jam, sheoak, mallee roots, mulga and desert hardwoods. Mount Shadforth Timbers, RMB 872B Denmark, 6333 West Australia. Telephone/facsimile (098) 409031.

KILN-DRIED HARDWOOD AND PINE LUMBER, paneling, flooring. Ceramic tile inserts. Free catalog. CATSKILL MOUNTAIN LUMBER, Box 450, Swan Lake, NY 12783. (800) 828-9663.

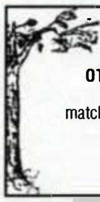
BRAZILIAN ROSEWOOD SHORTS, $4.50 per board foot, 25 foot minimum (average length 3—4ft. H & B Hardwoods. (502) 454-5828, (502) 425-1326.

TEAK—BURMESE SHORTS 1½-ft. to 4-ft. lengths. 4/4, 6/4, & 8/4 thicknesses. Plantation grown. Unbelievable low price of $3.25 per bd. ft. plus shipping. Call Dixon Woodworking. (619) 728-3868, FAX (619) 540-6164.

NATIVE TEXAS HARDWOODS. Mesquite, figured fiddleback oaks, pecan, many others. Burls, turning, carving blocks. Texas Kiln Products. (800) 825-9158.

REDWOOD LACE BURL, OTHER WESTERN SPECIES, squares, slabs, whole. Western lumber, figured lumber, rare woods, sample kits. SASE list. Eureka Hardwood Supply, 3346 D St., Eureka, CA 95501. (707) 445-3371.

UNICORN
UNIVERSAL WOODS ltd
OVER 90 SPECIES IN OUR LARGE INVENTORY OF QUALITY MATERIAL
EXOTICS–DOMESTICS–MILLWORK
VENEER–MAIL ORDER–FREE CATALOG
4190 Steeles Ave. West, Woodbridge Ontario Canada L4L 3S8
CALL US AT (416) 851 2308


GROFF & HEARNE LUMBER
WALNUT--CHERRY AND OTHER FINE CABINET WOODS.
Boards to 40" wide, matching flitches, slab cuts, kiln dried.
Groff & Hearne Lumber
858 Scotland Road,
Quarryville, PA 17566
717-284-0001

FINE VENEER
Highest Quality
Low Prices
Full Length Veneers
Large Selection
Exotic Lumbers
Custom Plywoods
Retail or Wholesale
Area Code 716
655-0206
Call or Write for *FREE* Catalog
certainly wood
11753 Big Tree Rd., E. Aurora, N.Y. 14052
Fax. No. (716) 655-3446
Our wood certainly makes a difference.

HARDWOODS
EXOTIC & DOMESTIC
OVER 75 SPECIES
LUMBER • PLYWOOD • VENEERS
TURNING SQUARES & BLANKS
COLLECTORS SAMPLE KIT
30 EXOTIC & DOMESTIC WOODS
½" x 3" x 6" SANDED FINISH
$29.00 PLUS $5.00 S&H
Ideal for: Collectors • Schools • Craftsmen • Cabinet & Furniture Makers • Architects • Designers
1-800-423-2450
WOODWORKERS *Supply*
5402 S. 40th St. • Phoenix, AZ 85040
(602) 437-4415

TRUE QUARTERSAWN LUMBER. Oak, cherry, pine, cut from prime logs. Air-dried. Newman, Box 46, New Braintree, MA 01531. (508) 867-3318.

ATTENTION WOODWORKERS maple and redwood burl. Figured, quilted, bird's-eye, lace Any size or thickness available. Quality. Albany, OR. (503) 926-1123.

RARE CUBAN MAHOGANY (*Swietenia Mahogani*) 4/4 to 12/4, ebony, cocobolo Brazilian rosewood, bocote, and more. The true source of high quality at the right price. SASE, Tropical Exotic Hardwoods, PO Box 1806, Carlsbad, Ca 92008. (619) 434-3030

RAREST CALIFORNIA BURLS direct from logger. Huge selection beautifully figured redwood, maple, manzanita, and madrone. Also guitar-quality squares or slabs. (707) 442-1319.

HOMESTEAD HARDWOODS, 2111 Messick Rd., N. Bloomfield, OH 44450. (216) 889-3770. Kiln-dried ash, basswood, butternut, cherry, chestnut, curly maple, oak, poplar, sassafras, walnut.

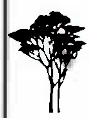
LARGE CALIFORNIA WALNUT SLABS, dry, perfect for desks, tables. Contact: California Walnut Furniture Designs, 12681 Wolf Rd., Grass Valley, Ca 95949. (916) 268-0203.

EXOTIC HAWAIIAN HARDWOODS- bundles of kiln dried Koa, Mango woods. Slabs, turning squares. Also custom wood products, furniture. Call or write for price list. Maui Trading Company. (808) 878-2705. RR2, Box 263, Kula, HI 96790.

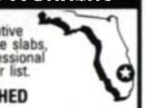
TURNING BLOCKS, BURLS, AND CROTCHES—exotic and domestic hardwoods—write or call for price list. Wood-ply Lumber, 100 Bennington Ave., Dept. F, Freeport, NY 11520. (516) 378-2612.

MESQUITE LUMBER. Kiln-dried and bowl blanks. MESQUITES UNLIMITED, Rte. 4, Box 322, Wichita Falls, TX 76301. (817) 544-2262

FOREST COUNTY WOOD PRODUCTS
FINE CABINET WOODS & SUPPLIES
• 1/4 Sawn W. Oak • Molding
• Bird's Eye & Curly Maple • Flooring
• Paneling
LITTLE HICKORY ROAD
TIONESTA, PA 16353
(814) 755-3317

GILMER WOOD CO.
503-274-1271

Rare & Exotic Woods
• in logs, planks & squares
• over 50 species in stock
• also cutlery, turning & musical instrument woods
2211 NW St. Helens Rd., Portland, OR 97210

UNUSUAL VENEER
FOR ARTISTS AND CRAFTSMEN
Tired of boring, uniform, industrial veneers? ARE YOU READY for unusual, exciting cuts?
CALL or WRITE for our FREE brochure!
B&B RARE WOODS
10946 W. Texas Ave.
Lakewood, CO 80232 call: 303-986-2585

ATTENTION
FLORIDA WOODWORKERS
We have Florida's largest selection of exotic and native hard and soft woods, table slabs, veneers, etc. for the professional and novice. Send $1.00 for list.

HENEGAN'S WOOD SHED
7760 Southern Blvd.(FW), West Palm Beach, Fl 33411
Call (407) 793-1557

WESTERN PENNSYLVANIA WOODWORKERS
50 Domestic & Imported Woods · Veneers
Finishes · Mouldings · Hardware · Plans · Books
Carving Stock · Magazines · Quality Tools
Call or Visit Our Store
WOODCRAFTERS SUPPLY
7703 Perry Hwy (Rt. 19) Pittsburgh, PA 15237 (412) 367-4330
2921 Buffalo Rd. Erie, PA 16510 (814)899-5466

ROSEWOOD $6/BD FT. 4/4, 8-in. and greater widths, individually cut. Pit sawn in the Honduran mountains. Air-dried, rough sawn. Prices subject to change. Tropical Hardwoods, (619) 788-1948.

SELECT & BETTER 20/BD. FT. BULK PACKS: cherry $2/bd. ft.; red elm $1.47/bd. ft.; walnut $3.04/bd. ft.; 4 by 4 walnut carving stock. Additional species. Visa/MasterCard. Free catalog. Badger Hardwoods, Rt. 1, Box 262, Walworth, WI 53184. (800) 252-2373.

GABON EBONY, SNAKEWOOD AND PINK IVORY lumber, logs and billets. Quality guaranteed. Wholesale prices. Over 60other species in stock. Free catalog. (213) 542-3576. Exotic Hardwoods, 4100-B Spencer St., Torrance, CA 90503.

OVER 60 SPECIES OF HARDWOODS. Prepaid sample box $49. Huge inventory of turning and carving stock. Many specials. Free list. CUT AND DRIED QUALITY HARDWOOD. 143 Cedros, Solana Beach, CA 92075. (619) 481-0442.

PINK IVORY: Logs, log sections and dimensioned stock. Direct from logger, importer, specializing in precious African hardwoods. Quality always guaranteed. M. S. Tisdale, 25000 S.W. 207th Ave., Homestead, FL 33031. FAX (305) 246-0404, phone (305) 248-0593.

CHERRY TURNING STOCK. 8/4 to 16/4 to 48-in. lengths. Poplar precut, sanded drawer parts. SASE for prices and details. Randall Grace, 3110 Summers Rd., Franklin, TN 37064. (615) 791-1832.

TIGER MAPLE, FIGURED CHERRY & OAK. Heavy stock a specialty. Eastwoods Co., RD #1, Hornell, NY 14843.

WOOD & TOOL EXCHANGE

Limited to use by individuals only

For Sale

LARGE PRIVATE STOCK, (FAS, most clear) black walnut, cherry, red and white oak. Good dimensions. Fair prices. Bring truck? Dr. James Shrewsbury, 505 S. Jefferson, Princeton, KY 42445. (502) 365-6119.

FOR SALE: *FINE WOODWORKING*, issues 24—82. Excellent condition, best offer. FOB. Don: (417) 752-3473.

FINE WOODWORKING 1—88, *WOODSMITH* 1—74, *WOOD* 1—42. $650. All or none at all. (409) 825-6407.

1887 FOOT-POWERED mortising machine. Excellent original condition. $375. For more information call: (319) 895-8067.

AMERICAN SAWMILL: Triumph planer model #4483, 22-in. with side head attachments. Chipblower, 1765 RPM, w/19-in. intake, 18-in. exhaust with Lincoln 30HP motor, Square-D controls. Tom Reynolds: (404) 554-2275.

MULTI-ROUTER, used once. All accessories. Powermatic 3HP shaper. Used once. Reasonably priced. Business hours. (212) 582-6871.

FINE WOODWORKING, issues 1—87. Good condition, includes Index 1—50. $240 includesshipping in the USA. (612) 274-3189.

POWERMATIC #66, 10-in. tablesaw. New $1450. 6-in. Makita hand power plane, #1805B. $275. (205) 246-3511. PO Box 991, Jackson, AL 36545.

COMPLETE SET of *FINE WOODWORKING* issues 1—66, and *FINE HOMEBUILDING* issues 1—24. Best offer, either set or both, no individual issues. M. L. Polley, 23316 Vashon Hwy. S.W., Vashon Island, WA 98070.

AMERICAN SAWMILL: Triumph planer model #4483, 22-in. with side head attachments. Chipblower, 1765 RPM, w/19-in. intake, 18-in. exhaust with Lincoln 30HP motor, Square-D controls. Tom Reynolds: (404) 554-2275.

FINE WOODWORKING issues 1—89, complete with index. Excellent condition. Best offer. (416) 648-4287.

MULTI-ROUTER, used once. All accessories. Powermatic 3HP shaper. Used once. Reasonably priced. Business hours. (212) 582-6871.

Wanted To Buy

FINE WOODWORKING, all back issues wanted. Philip Castleton, RR #2, Stouffville, Ont., Canada L4A 7X3. (416) 640-8883.

WANTED: BACK ISSUES OF *FINE WOODWORKING*. Issues 1—49 needed to complete set. Please call David at (313) 642-3979.

WANTED!! *FINE WOODWORKING*, issues 1—86, complete if possible. Please call: (305) 652-5964, evenings.

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

ARIZONA: **Exhibition**–International Lathe-Turned Objects Challenge IV, Sept. 8–Nov. 3. Arizona State University Art Museum. Contact Wood Turning Center, PO Box 25706, Philadelphia, PA 19144. (215) 844-2188.

ARKANSAS: **Workshop**–New Methods in the Cleaning and Painting of Wooden Artifacts, July 11–16. Parker Restoration, PO Box 93, Gentry, 72734. (501) 736-8510.

CALIFORNIA: **Juried shows**–Contemporary Crafts Market, Oct. 12–13, San Diego Convention Center, 111 W. Harbor Dr., San Diego; Nov. 1–3, Santa Monica Civic Auditorium, Main St. at Pico Blvd., Santa Monica; Mar. 20–22, 1992, Fort Mason Center, Herbst & Festival Pavilions, Marina Blvd. at Buchanan St., San Francisco. Jury deadline for all three: June 25. For info, contact Roy Helms & Associates, 777 Kapiolani Blvd., Suite 2820, Honolulu, HI 96813. (808) 422-7362.
Workshops–Furnituremaking with hand tools using traditional joinery, weekends. Call for schedule: Debey Zito, (415) 648-6861.
Show–Furniture and other items from Pacific Northwest woods, thru June 30. Sponsored by Humboldt Woodworking Society and Ambiance Gallery. Contact Ambiance Gallery, 226 F St., Old Town, Eureka, 95501. (707) 445-8950.
Exhibit–Mixed media show including woodturning by Ruth Hardin and wood furniture by Yuko Shimuzu. Banaker Gallery, 1373 Locust St., Walnut Creek, 94596. (415) 930-0700.
Juried show–San Diego Woodworkers Design in Wood Show, thru July 7. In conjunction with the Del Mar Fair. For info, contact R.C. McNamara, 3893 Mt. Blackburn Ave., San Diego, 92111. (619) 277-1949.
Show–Turned Wood '91, thru July 7. Los Angeles. Featuring 24 turners. Opening reception, June 1. del Mano Gallery, 11981 San Vicente Blvd., Los Angeles, 90049. (213) 475-8508.
Juried exhibit and fair–3rd annual College of the Redwoods' WoodFair, July 12–14. College of the Redwoods, 7351 Tompkins Hill Rd., Eureka, 95501-9302. (707) 445-6966.
Workshops–Various workshops including Japanese woodworking, joinery and sharpening. Contact Hida Tool Co., 1333 San Pablo, Berkeley, 94702. (415) 524-3700.
Solicitation–New artists wanted for the Los Angeles Craft & Folk Art Museum Research Library. Used by collectors, curators, architects, designers. No fee. Contact the Craft & Folk Art Museum Library, c/o the May Co., 6067 Wilshire Blvd., Los Angeles, 90036. (213) 934-7239.
Workshop–Special English and French Wood Finishing Techniques with Bruce Luckhurst, July 22–26. College of the Redwoods (Mendocino Coast), 1211 Del Mar Dr., Fort Bragg, 95437. (707) 961-1001.
Classes–Saturday morning tool clinic, July 27; Building a 10-ft. Nova Scotia skiff, Aug. 3–10; Saturday morning tool clinic, Oct. 5. San Francisco. Contact the National Maritime Museum Association, Bldg. 275, Crissy Field, San Francisco, 94129. (415) 929-0202.
Conference–Summer Woodworking Conference, Aug. 1–4. Biloa University, La Mirada. Including demonstrations and lectures on routers, finishing, woodturning, scroll saw techniques, woodcarving, more. For info, contact The Summer Woodworking Conference, 1516 S. Pontius Ave., Los Angeles, 90025. (213) 477-8521.
Workshop–Lumber Drying, Aug. 5–9. UC Forest Products Laboratory, 1301 S. 46th St., Richmond, 94804. (415) 231-9487.
Fair–ACC Craft Fair, Aug. 7–8 (trade), Aug. 9–11 (public). Herbst Pavilion, San Francisco. For info, contact American Craft Enterprises, PO Box 10, 256 Main St., New Paltz, NY 12561. (800) 836-3470, (914) 255-0039.
Juried exhibit–Artistry in Wood '91, Aug. 10–Sept. 15. Sponsored by the Sonoma County Woodworkers Association. Also, demonstrations on various woodworking topics, every Saturday and Sunday from 1 P.M. to 4 P.M. Sonoma County Museum, 425 7th St., Santa Rosa, 95401. (707) 579-1500.
Shows–9th annual Long Beach Harvest Festival, Aug. 31–Sept. 2, Long Beach Convention Center; Fresno Harvest Festival, Sept. 13–15, Fresno Convention Center; 8th annual Riverside Harvest Festival, Sept. 20–22, Riverside Convention Center; 2nd annual Ventura Harvest Festival, Sept. 27–29, Ventura County Fairgrounds. For info on all, contact Harvest Festival, 111 Liberty St., Petaluma, 94952.
Show–Woodworking Machinery & Furniture Supply Fair, Sept. 28–Oct. 1. Anaheim Convention Center, Anaheim. For info, contact Arthur Schwartz, 1516 S. Pontius Ave., Los Angeles, 90025. (800) 826-8257, (213) 477-8521.
Seminar–10th International Wood Machining Seminar, Oct. 21–23. Berkeley. Contact Continuing Education in Engineering, UC Berkeley, 2223 Fulton St., Berkeley, 94720. (415) 642-4151.

COLORADO: **Classes**–Woodworking and related classes, year-round. Red Rocks Community College, 13300 W. 6th Ave., Lakewood, 80401. (303) 988-6160.
Workshops–Summer woodworking and furniture design workshops. Teachers include Alan Peters, Thomas Moser, Peter Korn, Harv Mastilir, Kathleen Loe, Michael Emmons, Sam Maloof, Simon Watts, Gail Fredall Smith, Jim Barefoot, Robert DeFuccio, Nora Hall, Monroe Robinson, Bob Flexner, Stephen Proctor. Anderson Ranch Arts Center, PO Box 5598, Snowmass Village, 81615. (303) 923-3181.
Workshops–Woodworking classes and workshops sponsored by Colorado Woodcarving Guild, July 20–Aug. 2. Also, Colorado Open Woodcarving competition championships, July 27–28. For info on both, contact Colorado Woodcarving Guild, 2613 Alteza Lane, Colorado Springs, 80917. (719) 574-8323.

CONNECTICUT: **Exhibit**–56th annual Society of Connecticut Craftsmen exhibit, July 13–Sept. 29. Presentation of certificate to Dennis Elliott, SCC's master crafter/educator for 1991, July 21. Stamford Museum and Nature Center, 39 Scofield Rd., Stamford. For info, contact SCC, PO Box 615, Hartford, 06142. (203) 423-4350.
Exhibition–56th annual exhibition of Society of Connecticut Craftsmen, July 13–Sept. 29. Including woodwork. Stamford Museum & Nature Center, Stamford.
Juried exhibition–34th annual Guilford Handcrafts Expo, July 18–20. Guilford. Also, classes for adults and children. Contact Guilford Handcrafts, PO Box 589, 411 Church St., Guilford, 06437. (203) 453-5947.
Workshops–Cedar and Canvas Canoe Making with Horace Strong, July 22–26; Building a Norwegian Pram with David Foster, Aug. 12–17; Adirondack Guideboat Building with Steve Kaulback, Aug. 19–24. Contact Brookfield Craft Center, PO Box 122, Route 25, Brookfield, 06804. (203) 775-4526.
Juried show–15th annual SoNo Arts Celebration, Aug. 3–4. On the streets of South Norwalk. For info, contact The SoNo Arts Celebration, Exhibiting Arts Committee, PO Box 2222, South Norwalk, 06852. (203) 849-9366.

DISTRICT OF COLUMBIA: **Seminars**–Coatings for Furniture Conservation III, July 29–Aug. 1. For info, contact Training Secretary, CAL/MSC, Smithsonian Institution, 20560. (301) 238-3700.
Exhibition–Awards in the Visual Arts 10, thru Sept. 2. Hirshhorn Museum and Sculpture Garden, Smithsonian Institution. For info, call (202) 357-2700.
Fair–Washington Gift Show, Aug. 25–28. Washington Convention Center. For info, contact George Little Management, 2 Park Ave., Suite 1100, New York, NY 10016. (212) 686-6070.

FLORIDA: **Juried festival**–20th annual Riverside Art Festival, Sept. 28–29. In Riverside Park. Deadline: July 15. For info, contact Riverside Art Festival Committee, Riverside Avondale Preservation, 904 King St., Jacksonville, 32205. (904) 389-2449.

GEORGIA: **Workshops**–Japanese woodworking by Toshihiro Sahara. One Saturday each month, year-round. Contact Sahara Japanese Architectural Woodworks, 1716 Defoor Place N.W., Atlanta, 30018. (404) 355-1976.
Show–International Turned Objects Show, June 29–Nov. 10. Morgan Cultural Center, Madison. For info, contact International Sculpture Center, 1050 Potomac St. N.W., Washington, DC 20007. (202) 965-6066.
Conference–Custom Woodworking Business Conference and Exposition, Nov. 22–24. Georgia World Congress Center, Atlanta. For info, contact John Berry, Trade Show Div., Vance Publishing Corp., 400 Knightsbridge Pkwy., Lincolnshire, IL 60069. (708) 634-2600.
Competition–Design Emphasis '92 furniture design competition, call for entries. Sponsored by and held in conjunction with the International Woodworking Machinery & Furniture Supply Fair '92, Aug. 21–24, 1992, Georgia World Congress Center, Atlanta. For info on the competition, contact Shirley Byron, IWF, 8931 Shady Grove Court, Gaithersburg, MD 20877. (301) 948-5730.

IDAHO: **Juried festival**–23rd annual Art on the Green, Aug. 2–4. North Idaho College, Coeur d'Alene. For entry deadline and info, contact Citizen's Council for the Arts, PO Box 901, Coeur d'Alene, 83814. (208) 667-9346.

ILLINOIS: **Classes**–Swiss method chip carving, July 1–5, July 22–26, Aug. 19–23 (advanced). For info, contact Alpine School of Woodcarving, 225 Vine Ave., Park Ridge, 60068. (708) 692-2822.
Show–National Hardware Show, Aug. 11–14. McCormick Place Complex, 23rd St. and Lakeshore Dr., Chicago, 60616. For info, contact Pat Dolson, Association Expositions & Services, (203) 964-0000.
Juried show–Evanston/Glenbrook Hospitals' 7th annual American Craft Exposition & Sale, Sept. 6–8. Reception, Sept. 5. Henry Crown Sports Pavilion, Lincoln St., Evanston. For info, contact Shelly Robinson, Winger & Associates, 320 N. Michigan Ave., Suite 1901, Chicago, 60601. (312) 263-4313.
Seminar–Computers for Woodworking, Sept. 13–15. Chicago. Contact Architectural Woodwork Institute, 2310 S. Walter Reed Dr., Arlington, VA 22206. (703) 671-9100.
Workshop–End use applications of adhesives and sealants, Sept. 23–25. The Forum Hotel, Chicago. Contact The Adhesive and Sealant Council, 1627 K St. N.W., Suite 1000, Washington, DC 20006. (202) 452-1500.

INDIANA: **Show**–Market Square Traditional Wholesale Show, July 27–29. Coliseum & Exposition Center, Fort Wayne. For info, contact Market Square Wholesale Shows, PO Box 220, Newville, PA 17241. (717) 776-6989.
Meeting–International Wood Collectors Society annual meeting, Aug. 4–9. Terre Haute. Contact Dave Gahimer, Box 118, Rose-Hulman, 5500 Wabash Ave., Terre Haute, 47803. (317) 569-5704.
Festival–50th Chautauqua of the Arts festival, Sept. 28–29. On the streets of Madison. For info, contact Dixie McDonough: (812) 265-5080.

IOWA: **Classes**–Beginning and Intermediate Chip Carving with Tim Montzka, June 22–23; Intermediate Acanthus Carving with Emphasis on Design with Phillip Odden, June 24–28; Bentwood Box and Basket Making with Johann Hopstad, July 20–24; Making a Knife with Handle and Sheath with Havard Bergland, July 20–24 & July 29–Aug. 2; Figure Carving in Relief with Oddvin Parr, July 20–24; Stave Construction of Small Vessels with Johann Hopstad, July 29–Aug. 2; Acanthus Carving and Other Motifs for Decorative Use with Oddvin Parr, July 29–Aug. 2; Beginning and Intermediate Figure Carving with Harley Refsal, Aug. 5–9 & Sept. 20–22; Flat Plane Figure Carving with Harold Enlow, Aug. 17–19 & Aug. 21–23. Vesterheim, Norwegian-American Museum, 502 W. Water St., Decorah, 52101. (319) 382-9681.
Juried exhibition–10th annual exhibition of woodcarving in the Norwegian Tradition, July 26–28. Entry dates: July 1–14. Vesterheim, Norwegian-American Museum, 502 W. Water St., Decorah, 52101. (319) 382-9681.

KENTUCKY: **Workshops**–Woodturning and joinery instruction. One day to one week. Contact Jim Hall, Adventure in Woods, 415 Center St., Berea, 40403. (606) 986-8083.

MAINE: **Workshops**–Various week-long boatbuilding and woodworking workshops, thru Oct. 12. Including Marine Carving, Fundamentals of Boatbuilding, Basic Woodworking, Oar & Paddle Making, Boatbuilding Tools & Techniques, Joinerwork. Contact WoodenBoat School, PO Box 78, Brooklin, 04616. (207) 359-4651.
Classes–House Design and Building, July 8–26, Aug. 5–23; Post and Beam Building, Sept. 15–20. Shelter Institute, 38 Centre St., Bath, 04530. (207) 442-7938.
Classes–Summer workshops, July 29–Aug. 14. Including Pattern & Plane Making, Build Your Own and Row it Home, Creative Carving, Building a Sea Chest, Junior Woodworking. The Rockport Apprenticeshop, Elm St., PO Box 539, Rockport, 04856. (207) 236-6071.
Workshop–Design as Exploration with Milton Glase, Aug. 25–31. Haystack Mountain School of Crafts, PO Box 87, Deer Isle, 04627. (207) 348-2306.
Classes–Woodworking classes for adults and children in daytime, evenings and on weekends. Portland School of Art, 97 Spring St., Portland, 04101. (207) 775-3052.

MARYLAND: **Juried festival**–Columbia Festival of the Arts, June 28–30. Kittamaqundi Lakefront, Columbia. For info, contact Columbia Festival Artisans '91, Columbia Art Center, 6100 Foreland Garth, Columbia, 21045. (301) 730-0075.
Juried show–28th annual Havre de Grace Art Show, Aug. 17–18. Tydings Memorial Park. Sponsored by the Soroptimist International of Havre de Grace. For info, contact PO Box 174, Havre de Grace, 21078. (301) 879-4404.
Exhibition–Emerging Masters, thru Sept. 14. Furniture by students from the Rhode Island School of Design and Southeastern Massachusetts University. Meredith Gallery, 805 N. Charles St., Baltimore, 21201. (301) 837-3575.

MASSACHUSETTS: **Workshops**–Summer woodworking workshops, June 30–July 20, July 22–Aug. 11, June 30–Aug. 11, Aug. 15–18. Horizons, 374 Old Montague Rd., North Amherst, 01002. (413) 549-4841.
Show–Regional Wood Furniture: A Varied Approach, thru June 23. Fitchburg Art Museum, 185 Elm St., Fitchburg, 01420. (508) 345-4207.
Workshops–Timber Frame Restoration, July 15–19; House Building, July 29–Aug. 16, Aug. 26–Sept. 13; Timber Framing, July 22–26; Cabinetmaking, June 24–28, Oct. 7–11; Finish Carpentry, July 8–12, Sept. 30–Oct. 4. The Heartwood School, Johnson Rd., Washington, 01235. (413) 623-6677.
Classes–Woodworking classes, throughout most of the year. Boston Center for Adult Education, 5 Commonwealth Ave., Boston, 02116. (617) 267-4430.
Show–Boston Craft Market, June 21–23. For info, contact WRS, 3000 Chestnut Ave., Suite 300, Mill Centre, Baltimore, MD 21211. (301) 889-2933.
Fair–ACC Craft Fair West Springfield, June 18–20 (trade), June 21–23 (public). Eastern States Exposition, West Springfield. Contact American Craft Enterprises, PO Box 10, 256 Main St., New Paltz, 12561. (800) 836-3470.
Exhibitions–Interior Showcase: A Collaboration of Design and Crafts, thru July 13; interior designers Albert Columbro and Fred Fiandaca create two unique living spaces that feature American crafts and designs. Also, The Legacy of Sam Maloof: Woodworking as a Way of Life, thru Aug. 30;

highlighting work by seven second-generation furniture artists and vessels by 15 woodturners. The Society of Arts and Crafts, 101 Arch St., Boston, 02110. (617) 345-0033.

MICHIGAN: **Class**–Building the Norwegian Pram with Oars, July 17–24. 500 E. Broadway Highway, Charlotte, 48813. For info, call (517) 543-5325.

MINNESOTA: **Juried show**–9th annual Upper Midwest Woodcarvers' Exhibition, July 22–26. Blue Earth. For info, contact Harley Schmitgen, 311 E. 14th St., Blue Earth, 56013. (507) 526-2777.
Workshop–8th annual Villa Maria Woodcarving Workshop, Aug. 11–17. Frontenac. Classes include relief carving, birds, small animals, chip carving, marquetry, more. Villa Maria Workshop, PO Box 37051, Minneapolis, 55431.
Class–Woodcarving class with Chris Effrem, Aug. 19–23. Wood Carving School, 3056 Excelsior Blvd., Minneapolis, 55416. (612) 927-7491.

NEW HAMPSHIRE: **Juried show**–The Shaker Tradition in Furniture and Wood, thru Sept. 2. Canterbury Shaker Village in association with the Guild of New Hampshire Woodworkers. For info, contact John Skewes, Guild of New Hampshire Woodworkers, 132 Drinkwater Rd., Kensington, 03833. (603) 778-7360; or call Scott Swank, Canterbury Shaker Village at (603) 783-9511.
Classes–Classes in fine arts and studio arts. Manchester Institute of Arts and Sciences, 114 Concord St., Manchester, 03104.
Classes–Various woodworking classes, year-round. Including antique repairs, carving canes & walking sticks, small boxes, kitchen utensils, lathe turning, hand carving, more. Contact The Hand & I, PO Box 264, Route 25, Moultonboro, 03254. (603) 476-5121.
Workshops–Advanced Violin Repair: Neckgraft, June 24–28, July 1–5; Violin Building and Varnishing, July 8–Aug. 16. University of New Hampshire, Continuing Education, Brook House, 24 Rosemary Lane, Durham. 03824-3528.
Fair–58th annual League of New Hampshire Craftsmen Fair, Aug. 3–11. Mt. Sunapee State Park, Newbury. For info, contact League of New Hampshire Craftsmen Foundation, 205 N. Main St., Concord, 03301. (603) 224-1471.

NEW JERSEY: **Workshops**–Hand Carved Signs with Raymond Halacy, June 28–30; Classic European Wood Carving with Nora Hall, July 5–9; Cabinet Making with David Van Hoff, July 12–17; Making a Shoji Screen with Toshio Odate, July 20–21; Marquetry with Andrew Millican, Aug. 2–5; Making a Dovetailed Box with David Finck, Aug. 9–13; Cedar/Canvas Canoe Building with Horace Strong, Aug. 16–20; Making an Accoustic Guitar with Dick Boak, Aug. 23–30. Peters Valley Craft Center, Layton, 07851. (201) 948-5200.
Juried fair–21st annual Peters Valley Craft Fair, July 27–28. Contact Peters Valley Craft Center, Layton, 07851. (201) 948-5200.

NEW MEXICO: **Classes**–Woodworking classes. Northern New Mexico Community College, El Rito, 87520. (505) 581-4501.

NEW YORK: **Workshops**–Tablesaw Techniques, June 22; Gilding, June 22; Stenciling with Bronze Powders, June 29. Crafts Students League, 610 Lexington Ave. at 53rd St., New York City, 10022. (212) 735-9731.
Juried show–Chautauqua Crafts Festival '91, July 5–7, Aug. 9–11. Bestor Plaza, Chautauqua Institution, Chautauqua. For info, contact Chautauqua Crafts Festival, PO Box 89, Mayville, 14757.
Workshops–Japanese Hand Tools with Robert Meadow. July 13–14, Aug. 3–4. Learn use, sharpening techniques, joinery, furnituremaking. All levels. The Luthierie, 2449 W. Saugerties Rd., Saugerties, 12477. (914) 246-5207.
Juried show–17th annual Fall Festival Arts & Crafts Show, Oct. 12–13. Deadline: July 20. For info, contact Fall Festival Art Committee, PO Box 808, Ellicottville, 14731. (716) 938-6794.
Classes–Various beginning and advanced woodworking classes, including woodturning, wood finishing, router techniques, marquetry, tool sharpening, furniture repair and more. Constantine, 2050 Eastchester Rd., Bronx, 10461. (212) 792-1600.
Exhibition–Explorations II: The New Furniture, thru Aug. 4. American Craft Museum, 40 W. 53rd St., New York City, 10019. (212) 956-3535.
Workshops–Building a Herreshoff Pram with Bill Smithers, July 6–13. The Antique Boat Museum, 750 Mary St., Clayton, 13624. (315) 686-4104.
Juried festival–15th annual American Crafts Festival, June 29–30, July 6–7. Lincoln Center, NYC. For info, contact American Concern for Artistry & Craftsmanship, PO Box 650, Montclair, NJ 07042. (201) 746-0091.
Exhibit–Recent work by Tommy Simpson, Mitch Ryerson, Polly Cassel, Jay Stanger and Peter Dean, thru July 26. Leo Kaplan Modern Gallery, 969 Madison Ave., New York City, 10021. (212) 535-2407.
Show–14th annual New York Renaissance Festival, July 27–Sept. 15. Sterling Forest, Tuxedo. Weekends only. For info, contact Creative Faires Ltd., PO Box 1688, Westhampton Beach, 11978. (516) 288-2004.
Fair–New York International Gift Fair, Aug. 11–15. Jacob Javits Convention Center, New York City. Includes Accent on Design and American & International Crafts. For info, contact George Little Management, 2 Park Ave., Suite 1100, New York, 10016. (212) 686-6070.
Workshops–Boat Restoration with Mike Mahoney and Bill Smithers, Aug. 12–16; Building a Flat-Bottom Lapstrake Skiff with Bill Smithers, Aug. 24–26; Making St. Lawrence Skiff Oars with Bill Smithers, Sept. 14–15; Boat Restoration and Refinishing Techniques with Philip Gillesse, Sept. 21–22. The Antique Boat Museum, 750 Mary St., Clayton, 13624. (315) 686-4104.
Meetings–New York Woodturners Association, first Tuesday of each month. Woodturning techniques and exhibits also. The Craft Student League, YWCA, 610 Lexington Ave., New York City.

NORTH CAROLINA: **Workshops**–Many woodworking and woodcarving workshops, year-round. Including Woodcarving, Woodturning, Windsor Chair Making, Bowl Turning, more. Contact John Campbell Folk School, Route 1, Box 14A, Brasstown, 28902. (800) 562-2440, (704) 837-2775.
Juried shows–Blue Ridge Hearthside Crafts Shows, June 21–23, July 12–14, Aug. 16–18, Oct. 11–13. Also, woodcarving workshop by Tom Wolfe, Sept. 7–8. All at Blue Ridge Hearthside Craft Center, Highway 105, near entrance to Seven Devils. For info, contact the craft center at Route 1, Box 738, Banner Elk, 28604. (704) 963-5252.
Workshop–Woodcarving, June 29–30. Folk Art Center of the Southern Highland Handicraft Guild, Milepost 382, Blue Ridge Parkway, PO Box 9545, Asheville, 28815.
Workshops–Advanced Ladderback Chairmaking, June 24–29; 17th-Century Joinery, July 8–13; Making Your Shaving Horse, July 22–26; Green Woodworking with Kids, July 30–Aug. 1; Ladderback Chairmaking, Aug. 5–10; Windsor Chairmaking, Aug. 19–24; Country Living, Sept. 2–6. Country Workshops, 90 Mill Creek Rd., Marshall, 28753. (704) 656-2280.
Fair–High Country Mountain Fair, July 9–14. High Country Fairgrounds. For info, contact Fantasma Productions, 2000 S. Dixie Highway, West Palm Beach, FL 33401-7714. (407) 832-6397.
Fair–44th annual Southern Highland Handicraft Guild Fair, July 18–21. Asheville Civic Center, Asheville. For info, contact the guild at PO Box 9545, Asheville, 28815. (704) 298-7928.
Exhibits–Haywood Community College new members exhibit, thru Aug. 4; Celebrate Folk Art, Sept. 7; annual members' exhibit, Aug. 9–Dec. 1. All at Folk Art Center, Blue Ridge Pkwy., Asheville. Sponsored by Southern Highland Handicraft Guild. For info, contact the guild at PO Box 9545, Asheville, 28815. (704) 298-7928.
Classes–Methods for Furniture with Lauren McDermott, July 1–2; Carving with Paul Sasso, July 15–26; Crazies Plus Wood Squared with Jim Fawcett and Trent Whitington, July 29–Aug. 14; Personal Directions in Wood with Leo Doyle, Aug. 19–30; Furniture: Quick & Fun with Douglas Prickett, Sept. 2–6. Penland School, Penland, 28765-0037. (704) 765-2359.
Juried show–Heritage Arts & Crafts Show, July 3–7. At Thashers' Reunion. Contact High Country Crafters, 46 Haywood St., Asheville, 28801. (704) 254-2787.
Workshops–Wood Carving with Tom Wolfe, Sept. 7–8; Marquetry with Claude Edwards, Sept. 21–22. Blue Ridge Hearthside Craft Center, Highway 105, near entrance to Seven Devils. For info, contact the craft center, Route 1, Box 738, Banner Elk, 28604. (704) 963-5252.
Meetings–North Carolina Woodturners, second Saturday of every month. Also, woodturning workshops for all levels. For info, contact Eric Hughes, Route 3, PO Box 300, Conover, 28613. (704) 464-5611.

OHIO: **Workshops**–Woodturning/Carved Bowls with Al Stirt, July 8–12; Building Kitchen Cabinets with a Router with David Hout, July 8–12; Making an Appalachian Dulcimore with Nick Engler, July 8–12; Woodturning/Hollow Form Vessels with David Ellsworth, July 15–19; Sack-Back Windsor with Boyd Hutchison and Kevin Malong, July 15–19; Turning for Windsor Chair Makers with Boyd Hutchison, July 20–21; Continuous-Arm Windsor with Michael Dunbar, July 22–26; General Woodturning Techniques with Alan Lacer, July 22–26; Shaker Box Making with John Wilson, July 29–Aug. 2; Hand Tool Joinery with Ernie Conover, July 29–Aug. 2; General Woodturning Techniques with Palmer Sharpless, July 29–Aug. 2. Conover Workshops, 18125 Madison Rd., Parkman, 44080. (216) 548-3491.

OKLAHOMA: **Show**–15th annual Eastern Oklahoma Woodcarvers Association show, July 12–14. Kensington Galleria Shopping Mall, 71st St. and S. Lewis, Tulsa. Judging in more than 25 categories. For information, contact Tom Hamilton, 701 W. Kiowa, Cleveland, 74020. (918) 358-2685.

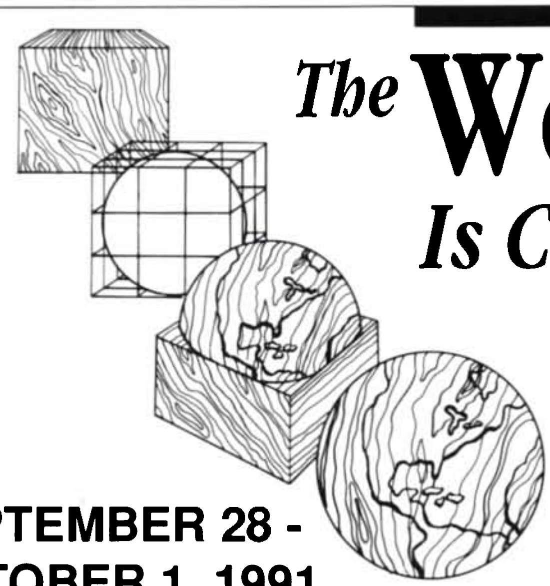
OREGON: **Competition**–Table Lamp + Chair 1991 furniture design competition, thru June 22. Sponsored by the American Institute of Architects, Institute of Business Designers and Oregon School of Arts and Crafts. Contact Lynne Leigh Paul, PO Box 69352, Portland, 97201. (503) 246-7314.
Workshops–Traditional Japanese Woodworking with Makoto Imai, June 24–28; English and French Wood Finishing Techniques with Bruce Luckhurst, July 15–19. Oregon School of Arts and Crafts, 8245 S.W. Barnes Rd., Portland, 97225. (503) 297-5544.
Exhibition–Wooden Boats on Exhibit, July 27–28. River Forum, 4380 S.W. Macadam Ave., Portland. For info, call Dave Swan at (503) 640-5671.
Show–Furniture show, Aug. 10–31. Including work of Dennis Elliott. Maveety Gallery, PO Box 148, Gleneden Beach, 97388. (503) 764-2318.
Show–Cat theme multimedia show, Aug. 10–Sept. 15. Including woodturning. Made in Jefferson Gallery, 3259 Jefferson Scio Dr., Jefferson, 97352. (503) 327-2543.
Meetings–Guild of Oregon Woodworkers, third Friday of every month. For location, contact the Guild at PO Box 1866, Portland, 97207. (503) 293-5711.

PENNSYLVANIA: **Workshop**–Chemical & Natural Dye Coloring, Color Bleaching and Difficult Stain Removal with Prew Savoy, June 22–23. Olde Mill Cabinet Shoppe, 1660 Camp Betty Washington Rd., York, 17402. (717) 755-8884.
Classes–Woodcarving/Clay Sculpture with Joe Dampf, July 1–5; Power Carving for Beginners with Werner Tollefsbol, July 1–5; Swiss Style Chip Carving with Wayne Barton, July 8–12; Power Carving/Advanced with Nancy Jones, July 8–12; Woodcarving in the Round with Bob Butler, July 15–19, July 22–26; Bird Carving/Advanced with Wayne Edmondson, July 15–19; Clay/Wood with Joe Dampf, July 29–Aug. 9; Bird Carving/Beginners with Carl Sinkula, Aug. 26–30. Also, woodcarving show and all-wood festival, July 13–14. For info on all, contact Cook Forest Sawmill Center for the Arts, PO Box 180, Cooksburg, 16217. (814) 677-3707.
Juried festival–25th annual Sidewalk Sale/Central Pennsylvania Festival of the Arts, July 11–14. On the Penn State campus, State College. For info, contact CPFA, PO Box 1023, State College, 16804. (814) 237-3682.
Workshop–Traditional Shaker Oval Box Making with John Wilson, July 12–13. Troy. Sponsored by The Wood Store and Oak Hill Veneer. For info, contact Richard Garrison at (717) 297-1270.
Fair–44th State Craft Fair, July 25–28. Franklin & Marshall College, Lancaster. Contact Pennsylvania Designer-Craftsmen, PO Box 718, Richboro, 18954. (215) 860-0731.
Classes–Windsor Chairmaking, all levels, weekly and weekends. Contact Jim Rendi, Philadelphia Windsor Chair Shop, PO Box 67, Earlville, 19519. (215) 689-4717.
Juried exhibition–The Dining Experience/A Craft Expression, Aug. 10–Sept. 22. Luckenbach Mill Gallery, 459 Old York Rd., Bethlehem, 18018. (215) 691-0603.
Exhibition–International Lathe-Turned Objects Challenge IV, thru Aug. 11. Port of History Museum, Philadelphia. For info, contact Wood Turning Center, PO Box 25706, Philadelphia, 19144. (215) 844-2188.
Juried show–Long's Park Arts & Crafts Festival, Aug. 31–Sept. 2. Lancaster. Contact Long's Park Arts & Crafts Festival, PO Box 5153, Lancaster, 17601.
Fair–Pocono State Craft Festival, Aug. 24–25. Sun Mountain Resort. For information, contact Pennsylvania Designer-Craftsmen, PO Box 718, Richboro, 18954. (215) 860-0731.
Show and competition–8th annual William Rush Woodcarving and Wildlife Art Show & Sale, Nov. 2–3. Penn State Delaware County campus, Lima. For deadline and info, contact Bob Young, 736 Oak Way, Havertown, 19083. (215) 446-8945.
Workshops–Woodturning workshops for all ages and skill levels. Including applications of tool design, principles of sharpening, finishing, more. Call for dates. David Ellsworth School of Woodturning, Fox Creek, 1378 Cobbler Rd., Quarkertown, 18951. (215) 536-5298.

TENNESSEE: **Exhibit**–Exhibition of faculty mixed media, thru Aug. 9. Arrowmont School of Arts and Crafts, PO Box 567, Gatlinburg, 37738. (615) 436-5860.
Workshops–Woodturning: A Multiple Axis Approach with Stoney Lamar, July 8–12; Woodturning with Philip Moulthrop, July 29–Aug. 2; Woodturning Hollow Vessels with David Ellsworth, Aug. 5–9. Arrowmont School, PO Box 567, Gatlinburg, 37738. (615) 436-5860.
Juried exhibition–From All Directions, Oct. 17–Dec. 14. Entry deadline: July 6. Arrowmont School of Arts and Crafts, PO Box 567, Gatlinburg, 37738. (615) 436-5860.
Show–Smoky Mountain Sculptures in Wood show, Oct. 5–6. Chilhowee Park, Kerr Building, Golden Gloves Arena. Woodcarving competition with 17 categories. Contact Jack or Carole Williams, 2608 Reagan Rd., Knoxville, 37931.
Juried show–5th annual Master Woodworkers show, Oct. 25–27; Candy Factory, Knoxville. Furniture and accessories. For deadline and info, contact Michael Perrin, Route 2, Box 195-A, Blaine, 37709. (615) 933-8436.

TEXAS: **Show**–7th annual East Texas Woodcarving show, Sept. 13–14. Longview Mall, Longview. For info, contact W.A Chronister, PO Box 244, Gladewater, 75647. (903) 845-4334.
Show–7th annual Woodcarving show and sale, Oct. 18–19. Ridgmar Mall, Ft. Worth. Sponsored by Ft. Worth Woodcarvers. For information and an application, contact Dan Mingea, 1805 Thomas Place, Ft. Worth, 76107. (817) 731-9565.

VERMONT: **Workshops**–One- and two-week workshops in woodworking: July 21–27; cabinetry: July 14–20; furnituremaking: June 23–29. For information, contact Yestermorrow, PO Box 344, Warren, 05674. (802) 496-5545.
Seminar–Build Your Own Musical Instrument with Robert Meadow, Aug. 5–18. Putney. For info, contact Andy Robinson, Catalpa House and Studios, PO Box 856,



The World *Is Coming to* Anaheim

NEW IN '91! SPECIAL MACHINERY ORIENTATION PROGRAMS

SEPTEMBER 28 - OCTOBER 1, 1991

Anaheim Convention Center
Anaheim, California

Exhibit Hours:
Saturday through Tuesday -10 am - 6 pm

- ***SEE TECHNOLOGY*** *in action*
- ***COMPARE*** *the latest products and services*
- ***LEARN*** *vital information at the industry's most comprehensive conference program*

Open to the trade only. No one under 16 admitted.
Sponsored by the Association of Woodworking and Furniture Suppliers.

Over 700 exhibitors from the U.S. and 20 foreign countries.

Miles of aisles showcasing working machinery and supplies for the woodworking, furniture manufacturing, cabinet, bedding, upholstery and related industries.

Special Woodworking Fair Night at Disneyland.

Pre-Register and Save

Send $5.00 and the pre-registration form below by September 10th and your badge will be mailed to you. ON-SITE REGISTRATION (REGISTRATION RECEIVED AFTER SEPTEMBER 10th) is $15.00. ***Act now and save $10.00.***
Make check payable in U.S. dollars to Woodworking Fair.

Woodworking, Machinery & Furniture Supply Fair

Woodworking, Machinery & Furniture Supply Fair
1516 S. Pontius Ave.
Los Angeles, CA 90025

Please send information on
- ❑ Conference Program
- ❑ Hotel
- ❑ Air Travel

Note: This form is for pre-registration only. Return completed form and $5.00 by Sept. 10th. After Sept. 10, 1991 you will have to register on-site and pay $15.00.

Please photocopy this for each additional registrant.

Primary Services (Check One)
- A ❑ Manufacturer, Wood
- B ❑ Manufacturer, Upholstered Products
- C ❑ Manufacturer, Cabinets
- D ❑ Manufacturer, Other
- E ❑ Dealer/Distributor
- F ❑ Other: (please specify)

Primary Products (Check One that best describes your company's products):
- 1 ❑ Furniture, Wood
- 2 ❑ Furniture, Metal & Other
- 3 ❑ Partitions and Fixtures
- 4 ❑ Bedding
- 5 ❑ Cabinets
- 6 ❑ Manufactured Homes
- 7 ❑ Millwork
- 8 ❑ Architectural Woodwork, including Molding
- 9 ❑ Hardwood Dimension and Flooring
- 10 ❑ Plywood - Veneer
- 11 ❑ Industrial Wood Products
- 12 ❑ Upholstered Products
- 13 ❑ Wood Products such as Doors, Windows, Sashes, Toys, Boats, Pallets, Caskets and Musical Instruments
- 14 ❑ Equipment and Tools
- 15 ❑ Raw Materials
- 16 ❑ Finishing Products
- 17 ❑ Textiles, Fabrics
- 18 ❑ Publication, Consulting, Teaching or Other Service: (please specify)
- 19 ❑ Other: (please specify)

Your Job Description (Check One)
- G ❑ President/Owner
- H ❑ Senior Executive/V.P.
- I ❑ General Manager
- J ❑ Purchasing
- K ❑ Plant Manager/Supt.
- L ❑ Plant/Industrial Engineer
- M ❑ Foreman/Production Exec.
- N ❑ Maintenance/Service
- O ❑ Designer
- P ❑ Sales
- Q ❑ Consultant/Educator
- R ❑ Other: (please specify)

Source: FW

Your Name - First, Last	
Your Title	
Name of Company	
Street Address	
City, State, Zip	
Country	
Area Code/Phone	FAX:

READER SERVICE NO. 84

Putney. (802) 387-5865.
Exhibit–18th annual woodcarver's exhibit, Aug. 17. Peoples Academy Gymnasium, Morrisville. For info, contact C.A. Brown, RFD 1, Box 268, Waterville, 05492. (802) 644-5039.
Show–1st Burlington Woodworking Show, Sept. 20–22. Burlington Memorial Auditorium, 250 Main St., Burlington. For info, contact Woodworking Association of North America, PO Box 706, Plymouth, NH 03264. (800) 521-7623, (603) 536-3768.

VIRGINIA: **Exhibition opportunity**–Place settings of three or four pieces that are functional or metaphorical. Deadline: June 30. Hand Workshop, 1812 W. Main St., Richmond, 23220. (804) 353-0094.
Juried show–Wood Show, Aug. 3–Sept. 2. Featuring furniture, sculpture and art made primarily of wood. Also, lecture by Wallace Gusler on regional variations of furniture in Virginia, Aug. 3, 8 P.M. Middle Street Gallery, Middle St., PO Box 341, Washington, 22747. (703) 675-3440.
Juried festival–Sugarloaf's 11th annual Virginia Crafts Festival, Sept. 13–15. Prince William County Fairgrounds. For info, contact Deann Verdier, Sugarloaf Mountain Works, 20251 Century Blvd., Germantown, MD 20874. (301) 540-0900.

WASHINGTON: **Symposium**–Use of the Lathe: Ideas for the Classroom, June 21–23. Overlake School, Redmond. Instructors include Allen Androkites, Kip Christensen, Leo Doyle, Bonnie Klien, Albert LeCoff, Christopher Weiland. For info and application, contact Wood Turning Center, PO Box 25706, Philadelphia, PA 19144. (215) 844-2188.
Show–Beneath the Ice: The Art of the Fish Decoy, June 24–Aug. 19. Tacoma Art Museum, Tacoma. For info, contact Museum of American Folk Art, 61 W. 62nd St., New York, NY 10023-7015. (212) 977-7170.
Exhibit–Women who Work Wood, thru June 30. Northwest Gallery, 317 N.W. Gilman Blvd., Issaquah, 98027. (206) 391-4221.
Conference–18th annual Museum Small Craft Association Conference, Oct. 4–6. Papers invited on small craft of explorers and natives at first contact in North America, due by July 4. For information, contact MSCA Conference, Center for Wooden Boats, 1010 Valley St., Seattle, 98109. (206) 382-2628.
Conference–Perspectives from the Rim, July 11–14. University of Washington, Seattle. National surface design conference. For info, contact Diana Nielsen, UW Extension GH-22, University of Washington, Seattle, 98195. (206) 543-0888.
Workshops–Galvanized Hardware Fabrication, July 13; Caulking, Aug. 10; Art of Marine Survey, Aug. 12–16; Block Making, Aug. 24. Contact Northwest School of Wooden Boatbuilding, 251 Otto St., Port Townsend, 98368. (206) 385-4948.
Exhibition–From the Woods, thru Aug. 18. Whatcom Museum, 121 Prospect St., Bellingham, 98225. (206) 676-6981.
Meetings–Northwest Woodworkers Guild, last Wednesday of each month. Contact Kirk Kelsey, 744 N. 78th, Seattle, 98103. (206) 789-2142.
Juried show–11th annual Woodcarving Show, Nov. 9–10. Western Washington Fairgrounds Expo Hall, 9th and Meridian, Puyallup. For deadline and info, contact Northwest Carvers Association, 115 Del Monte Ave., Fircrest, 98466. (206) 564-3278.

WEST VIRGINIA: **Workshops**–One- and two-week woodworking workshops, July 7–Aug. 9. Including guitar construction, treenware, log-house construction, guitar repair, mountain dulcimer construction and chip carving. Augusta Heritage Center, Box CN, Davis & Elkins College, Elkins, 26241-3996. (304) 636-1903.
Workshops–Ladderback Chairmaking with Thomas Lynch, Aug. 5–9; Wood Finishing and Refinishing with Marie Hoepfl, Aug. 9–11; Basic Cabinetry with Jim Probst, Aug. 19–23. Crafts Center, Cedar Lakes Conference Center, Ripley, 25271. (304) 372-7005.

WISCONSIN: **Exhibition**–Wood sculptures by three artists, July 31–Sept. 1. West Bend Gallery of Fine Arts, 300 S. 6th Ave., West Bend, 53095. (414) 334-9638.

CANADA: **Juried show**–8th annual Wood Show, Aug. 9–11. Durham Community Centre, Grey County. For info, contact The Wood Show, PO Box 920, Durham, Ont., N0G 1R0. (519) 369-6902.
Classes–Various woodworking classes including bird carving, wood sculpture, willow chairmaking and more. For information and schedule, contact the Haliburton School of Fine Arts, PO Box 339, Haliburton, Ont., K0M 1S0. (705) 457-1680.
Exhibit–Beneath the Ice: The Art of the Fish Decoy, Sept. 9–Nov. 4. Kamloops Arts Gallery, B.C. For info, call Susan Flamm at (212) 977-7170.
Show–1st Ottawa/Hull Woodworking Show, Sept. 13–15. Palais des Congres, 200 Dubortage, Hull, Que. For info, contact Woodworking Association of North America, PO Box 706, Plymouth, NH 03264. (800) 521-7623, (603) 536-3876.
Meetings–Canadian Woodturners Association meetings, throughout the year. Second Tuesday of each month. Contact Bob Stone, PO Box 8812, Ottawa, Ont., K1G 3J1. (613) 824-2378.
Meetings–Blue Mountain Woodworking Club meetings, throughout the year. Third Wednesday of each month. Contact Glenn Carruthers, PO Box 795, Stayner, Ont., L0M 1S0. (705) 444-1752.

AUSTRALIA: **Shows**–Australian Timber & Working with Wood shows, July 26–28, R.A.S. Showgrounds, Sydney; Oct. 3–6, Royal Exhibition Building, Melbourne. For info, contact Patrick O'Reilly, Riddell Exhibition Promotions Pty. Ltd., 10 Mallett St., Camperdown, NSW 2050. (02) 565 1099.

ENGLAND: **Classes**–Oxford International Summer School, Aug. 4–10. Classes in art, craft and design. For brochure, contact Oxford Summer School, c/o Richard Speed, Gable End, Hatford, Nr Faringdon, Oxfordshire, SN7 8JF. (0865) 718298.
Classes–Woodworking classes. Smith's Gallery, 56 Earlham St., WC2. Contact Laetitia Powell, Parnham, Beaminster, Dorset, DT8 3NA. (0308) 862204.
Exhibition–10th Exhibition of Early Musical Instruments, Nov. 8–10. Royal Horticultural New Hall, Westminster, London. For info, contact Exhibition Organizer, The Early Music Shop, 38 Manningham Lane, Bradford BD1 3EA. 0274 393753.

GERMANY: **Fairs**–Furniture and Interiors fair, Sept. 25–Oct. 1. Trade Fair for Building Systems, Building Materials and Building Renovation, Oct. 31–Nov. 6. Contact Koch Trade Fairs, 157-161 E. 86th St., New York, NY 10028. (212) 369-3800.

ITALY: **Competition**–The Year 2000: 3rd Office Design Competition. Exhibit of designs, Sept. 19–23. Milan. Deadlines begin July 31. For info, contact Cosmit, Corso Magenta, 96, 1-20123 Milan. (02) 48008716.

PUERTO RICO: **Exposition**–2nd World Expo for Woodworking Machinery and Furniture Supply, June 21–23. Roberto Clemente Coliseum, San Juan. For info, contact Exposiciones Las Americas, PO Box 11228, Caparra Heights Sta., 00922. (809) 751-6900.

Protect Your Back Issues

SLIPCASES FOR YOUR BACK ISSUES. Bound in blue and embossed in gold, each case holds at least 7 issues of *Fine Woodworking* (a year's worth), and costs $7.95 ($21.95 for 3, $39.95 for 6). Add $1.00 per case for postage and handling. Outside the United States, add $2.50 each (U.S. funds only). PA residents add 6% sales tax. Send your order and payment to the address below, or call toll-free, 1-800-825-6690, and use your credit card (minimum $15). Jesse Jones Ind., Dept. FWW, 499 E. Erie Ave., Philadelphia, PA 19134. (No P.O. boxes, please).

Fine WoodWorking

Attention Retailers

If you would like to carry *Fine Woodworking* in your store, just write or call 1-800-283-7252, and find out how easy it is to set up an account directly with us—no hassles, no risk, attractive terms.

The Taunton Press, 63 S. Main St., Box 5506, Newtown, CT 06470-5506

HORIZONTAL/VERTICAL SANDING MACHINE

NEW!

MODEL NO: BOY-80

MOTOR: 1½ HP
N.W.: 227 LBS
G.W.: 243 LBS
CUFT: 10.3'

$599

VERTICAL OSCILLATING UNIVERSAL EDGE SANDER
US. PATENT NO. 493987

NEW!

MODEL NO. MS-600

MOTOR: ¾ HP
N.W. 126 LBS
G.W. 141 LBS
CUFT 7.8'

$499

NEW!

MODEL NO: MS-360

MOTOR: ½ HP
N.W. 99 LBS
G.W. 108 LBS
CUFT: 4.5'

$329

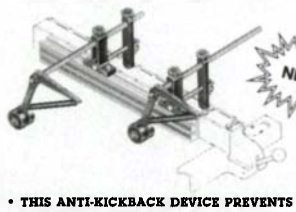
SCROLL SAW

MODEL: MS-22

MOTOR: 1/8 HP
N.W.: 65 LBS
G.W.: 68 LBS
CUFT: 3.6'

$189

ANTI-KICKBACK HOLD-DOWN DEVICE ON TABLE SAW MODEL: MS-FK1



NEW!

- THIS ANTI-KICKBACK DEVICE PREVENTS THE STOCK FROM KICKING BACK.
- SPRING-LOADED WHEELS HOLD THE STOCK TIGHTLY AND AGAINST THE RIP FENCE.
- CLAMPING HEIGHT AUTOMATICALLY SELF-ADJUST ACCORDING TO STOCK UP TO MAX. THICKNESS 4"
- EASY TO BE MOUNTED ON ANY FENCES AVAILABLE
- MAX. GRIPPING THICKNESS: 4"
- MAX. EXTENSION OF WHEEL: 12"
- WHEEL DIAMETER: 2" dia.

$49.99

For a complete catalog or more information write
OR CALL TOLL FREE
1-800-544-1361

SUNHILL-MACHINERY

SUNHILL
1000 ANDOVER PARK EAST
SEATTLE, WASHINGTON 98188
(206) 575-4131 • FAX (206) 575-3617

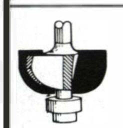
READER SERVICE NO. 88

MLCS Ltd.

CARBIDE TIPPED ROUTER BITS

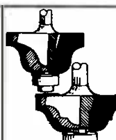
PROFESSIONAL PRODUCTION QUALITY SPECIAL OFFER – 50% to 75% BELOW COST!

• 1/4" Diameter Shanks x 1-1/4" Long • Two Flute Thick High Quality Tungsten Carbide Tips • 1/2" Ball Bearing Pilot • One Piece Construction (Not assemblies) • Professional Size • Piloted Bits are Supplied Complete with 1/2" Ball Bearings



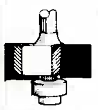
COVE
#340 1/8" $12.00
#341 1/4" $13.00
#342 3/8" $14.00
#343 1/2" $15.00

ROUND OVER
#350 1/8" $11.00
#351 3/16" $11.00
#230 1/4" $12.00
#353 5/16" $14.00
#354 3/8" $15.50
#355 1/2" $17.00



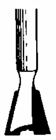
ROMAN OGEE
#231 5/32" $17.00
#232 1/4" $18.00

CLASSICAL
#490 1-1/4" $22.50
#491 1-1/2" $25.00



SLOT CUTTER
#366 1/8" $14.00
#368 1/4" $14.00

RABBETING
#370 3/8" $14.00

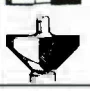


DOVETAIL
#403 3/8" 9° $ 7.50
#405 1/2" 14° $ 8.50
#409 3/4" 14° $10.50
(For Leigh Jigs)
#402 3/8" 8° $12.00
#404 1/2" 8° $12.00

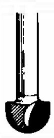
STRAIGHT

#470 1/4" $ 7.00
#471 5/16" $ 7.00
#472 3/8" $ 7.00
#473 7/16" $ 7.00
#474 1/2" $ 7.00
#476 9/16" $ 7.00
#478 5/8" $ 8.00
#479 3/4" $10.00

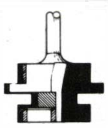
BULL NOSE
#460 1/4" $14.00
#461 3/8" $15.00
#462 1/2" $16.00
#464 3/4" $21.00



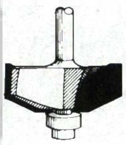
45° CHAMFER
#375 1-1/2" $15.00



CORE BOX (ROUND NOSE)
#415 1/4" $10.00
#416 3/8" $11.00
#417 1/2" $14.00
#418 3/4" $15.00



TONGUE & GROOVE
#545 Straight $29.00
#546 Wedge $29.00
(not shown)

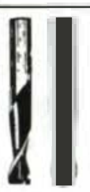


RAISED PANEL
#385 25° $25.00
#387 Cove $25.00
(not shown)
#390 Ogee $28.00
(not shown)

BEADING
#450 1/8" $11.00
#451 3/16" $11.00
#233 1/4" $13.00
#453 5/16" $14.00
#454 3/8" $15.50
#455 1/2" $17.00

FLUSH TRIM
#500 3/8" $ 7.00
#502 1/2" $ 7.50

EDGE BEADING
#530 3/16" $15.00
#531 5/16" $15.50



SOLID CARBIDE
Flat Bottom
#601 1/8" $ 9.00
#602 3/16" $12.00
#603 1/4" $12.00
Round Bottom
#608 1/8" $10.00
#609 3/16" $13.00
#610 1/4" $14.00

When ordering any 3 or more, deduct $1.00 each.
All prices postage paid. PA residents add 6% for state sales tax.

FREE CATALOG

To order by MasterCard or Visa — Toll Free 7 Day 24 Hour Order Service Call **1-800-533-9298** or send check to

MLCS Ltd., P.O. Box 4053 FK, Rydal, PA 19046

READER SERVICE NO. 93

Hob-Knobing...

...with the best furniture hardware there is. The kind demanding craftsmen have been ordering from us for years. Be it knobs or pulls, rely on our new 70-page catalog to help you with the toughest project. To get your copy of this valuable reference, use circle #401 and send $4.00 to:

PAXTON HARDWARE LTD.

7818 Bradshaw Road, Dept. FW19, Upper Falls, MD 21156
Quick Shipment *Free Mini-Catalog*

READER SERVICE NO. 11

12 SHOWS THIS FALL!

★The Woodworking Shows★
machinery
tools • supplies

- Baltimore/Wash.
- Chicago
- Columbus
- Denver
- Detroit
- No. California
- Philadelphia
- Portland
- Richmond
- Seattle
- So. California
- Twin Cities

Call for free brochure
Monday - Friday 8 am - 5 pm Pacific Time
1-800/826-8257 or 213/477-8521

READER SERVICE NO. 62

Photo: Robin Novatsky

David Esterly compares his carving with a full-scale photo of the Grinling Gibbons original, which was destroyed by a 1986 fire in London. Gibbons made his carvings slightly larger than life size so details would be observable even when viewed from afar.

New life for Grinling Gibbons' carvings

David Esterly was busy at his workbench in upstate New York, carving grapes in the manner of his guiding spirit, 17th-century woodcarver Grinling Gibbons, when he heard a radio report that a fire at the Hampton Court Palace in London had reduced some of Gibbons' finest baroque work to lumps of featureless charcoal.

In dismay, he put aside his tools on that Easter Monday in 1986 and wrote down his reaction to the disaster. The resulting article, part elegy for the lost carvings and part tribute to the man who had single-handedly transformed English woodcarving, was later published in the British journal *Spectator*.

With Gibbons, Esterly wrote, oak had given way to limewood, and earthbound solidity to feats of impossible lightness. Soaring compositions of fruit and foliage, tangles of leaves and flowers, garlands of nuts and berries had been artfully choreographed into dancing wood sculpture that seemed to mirror nature more than refine it.

Another British expert on Gibbons' work, Frederick Oughton, earlier described Gibbons' startling work as "sculptural freehand with disparate motifs introduced willy-nilly as scallops, seashells, fruit and flowers, and other objects were apparently pushed together almost untidily, but in the end forming a dazzling composition." (*Grinling Gibbons and the English Woodcarving Tradition* by Frederick Oughton. Stobart Davies, Ltd., Priory House, Priory Street, Hertford SG14 1RN, England; 1979.)

Because of the fire, Esterly concluded gloomily that some of the best examples of Gibbons' technique were destroyed, and he wondered where the expertise was today to replace them. Ironically, that expertise would come from Esterly himself. The *Spectator* article got him an invitation to Hampton Court and his skill got him the restoration job of a lifetime. As Esterly puts it, "I'm the only person crazy enough to make a living out of original limewood foliage work. It's so time-consuming that most professional carvers avoid it like the plague."

The job took four years, with Esterly at the center of a specialist team of restorers replacing and recarving the scorched swags and pendants that had adorned the King's bedchamber and adjoining rooms since the time of Charles II. With infinite delicacy, forget-me-nots, rosebuds, crocuses and oak leaves were chiseled out of native lime grown on the Hampton Court grounds and fit into the salvaged floral compositions, which, but for a carelessly placed candle, might have remained undisturbed for another 300 years.

For all the damage, though, the fire has brought unexpected benefits. For one thing, it has prompted a full-scale review of all the carving at Hampton Court and given the restorers the opportunity to reverse years of general neglect.

Secondly, it has provided young, enthusiastic professionals with unprecedented, hands-on access to some of the jewels of English carving. Who but Gibbons has been able to reproduce in wood the precise bloom of a ripening peach, the very texture and mass of a bursting apricot, or the exact weight and trajectory of an ear of corn on its stem? His complete mastery of technique and flawless sense of proportion and design have much to teach. The restorers are eager to learn.

"It's exceedingly stimulating," says Esterly. "Gibbons has been my guardian spirit for years, and it's interesting to be forced to suppress all my own creativity in order to copy him slavishly to the last detail. I'm stealing everything I can!"

While he may be stealing Gibbons' ideas, Esterly has also taken on the toughest part of the restoration. Other carvers repaired pieces that were partially damaged, but he re-created the lost sections, such as the left-hand foliage pendant above the west door of the King's Drawing Room. All that remained of the 7-ft. piece were a couple of 1½-in.-wide crocus heads.

Fortunately, the restorers had access to life-size photographs of all Gibbons' carvings. Esterly is the first to admit his debt to the unnamed civil servant who in 1939, seeing war clouds gather, prudently took it upon himself to record the work for future generations. These photographs, "my life's blood," says Esterly, are pinned to his bench, enabling him to check the size and configuration of the newly carved elements, as shown in the photo above. "We've adopted a very conservative philosophy of restoration," says Esterly. "Nothing which is not either documented by photograph or clearly indicated by a surviving feature is replaced. Whereas restorers in the past speculated on some of the missing elements and snapped in a few flowers here and there, we take the view that if it's missing when we took the carving down, then it will stay missing when we put it back up again. For the first time, we are trying to preserve the historical integrity of the carvings."

The restoration work has also revealed some tricks of Gibbons' trade. The salvaged pieces of foliage seem much too large. "The first impression is that the flora is vastly over modeled. But that's because we're looking at it at close quarters. Remember that it was designed to be seen from 20 ft. below and back. If it had been carved to life, all the detail would have disappeared in a dense and unreadable thicket of vegetation. That's Gibbons' genius," Esterly said.

Tall and elegantly mustached, David Esterly is a softly spoken Californian in his mid-40s whose passion for Grinling Gibbons takes him by surprise even today.

"I was walking down Piccadilly in 1973 with the woman who was later to become my wife when she grabbed me by the arm and steered me into St. James church to see the carvings." What followed dictated the course of his life.

"It was a conversion experience," he says.

"I had seen his carvings in a vague sort of way already [Esterly was then a post-graduate student at Cambridge and surrounded by some of Gibbons' best work], but I found myself looking at them in St. James as if for the first time. The scales fell from my eyes."

He initially mistook his interest for an academic one and planned to write a book. But as time went on, he realized he could not convey how the style had evolved without understanding the techniques firsthand. "So I bought a few chisels and some wood, and had a go. Then I lost all interest in writing."

There followed lean years in a cottage in Sussex, "living off nothing but spaghetti" while he perfected his newly discovered skill. Self-taught to a high degree of proficiency, he is engagingly dismissive of his talent. "I'm not a fine artist. I'm not a sculptor. I'm a humble carver."

Despite his reverence for the master in his own work, Esterly is not content merely to copy. "I've discarded Gibbons' conventionalisms. I don't do cherubs or lace or medallions or acanthus leaves because they don't mean that much to me. What I do is adapt his style to suit the 20th century. But, look, he invented the style; I'm only a pygmy perched on a giant's shoulders."

As for the joys of a carver's life, Esterly calls it "an honorable profession where cheating shows and virtue has its own reward." It is also one that "has given many an anonymous carver a little power over the grave."

—Trevor Barnes, Surrey, England

Photo: James Kozyra

Carl Tese of New York City, made this table from maple, bird's-eye maple veneer, lacewood veneer and feathers.

Photo: Dean Powell

Peter Thibeault of Boston, Mass., made his piece, "A Toy Tower for a Tall Tot," from antique-toy parts, dominoes, blocks, game boards, maple and medium-density fiberboard. It stands 96 in. high.

Art-furniture awards

The American Society of Furniture Artists (ASOFA) has announced the winners of its first national juried competition of contemporary art furniture. The judges, Franklin Parrasch, director of the Franklin Parrasch Gallery in New York City, Rick Snyderman, director of Snyderman Gallery in Philadelphia, Pa., and Adam St. John, founder and president of ASOFA, reviewed nearly 400 designs before selecting the work of 25 artists. These artists are featured in Furniture of the '90s, an exhibition that ran last April and May at the Council for the Visual and Performing Arts Gallery, University of Texas, in Houston. Peter Thibeault, Peter Pierobon and Carl Tese were each winners of $1,000 "Awards of Excellence" (see the photos at left of examples of Tese's and Thibeault's work). The exhibition will be opening at the Parrasch Gallery (584 Broadway, New York City) in August.

St. John founded the ASOFA two years ago when he realized that the art-furniture field was experiencing phenomenal growth. The ASOFA was created to establish and preserve high professional standards in the art-furniture field, to promote the artists and their furniture, and to sponsor art-furniture competitions and exhibitions. There are three levels of membership in ASOFA—professional, affiliate and student—and each membership includes a subscription to a quarterly newsletter. While membership has grown steadily over the last two years, St. John said he has made some changes that will improve the organization's financial position and should eventually help increase membership. In addition to the ASOFA trade organization, St. John has established the ASOFA Institute—a charitable and educational organization. Under current Internal Revenue Service guidelines, donors may now make tax deductible contributions to the ASOFA Institute.

The ASOFA is currently looking for gallery space in Houston so it can display art furniture from around the country on a permanent basis. For additional information on the organization, and for a catalog on the exhibition at the Parrasch Gallery in August, contact ASOFA, PO Box 270188, Houston, Tex. 77277-8855. *—Charley Robinson*

Snakewood: the aristocrat of canes

My interest in snakewood, *Piratinera guianensis,* began as a result of reading *Know Your Woods* by Albert Constantine, Jr. (Charles Scribner & Sons, 866 Third Ave., New York, N.Y. 10022; 1959). The passage, "A cane made of snakewood is considered the aristocrat of canes," stayed with me for more than 20 years. When I read Irving Sloane's article, "The Trade in Exotic Hardwoods" (*FWW* #38), listing Theodor Nagel and Co. (PO Box 28 02 66, D-2000 Hamburg 26, Billstrasse 118, Germany) as an importer of snakewood, I decided to order a turning blank so I could make a personal walking stick. However, Theodor Nagel and Co. is a large dealer, and the company's usual customers are wood retailers. Because I wasn't ready to meet Nagel's minimum purchase requirements, my search for snakewood continued. Then, about five years ago, I heard of David Persram (Furniture and Wood-Craft from Guyana Woods, 24 Belvoir Court, Bel Air, Georgetown, Guyana, South America), who would ship wood for approval before billing. I ordered a 1¼-in.-sq. by 36-in.-long blank of his best stock.

I thought this was truly going to the source because snakewood is primarily found in Guyana, French Guiana and Suriname, where the wood has traditionally been used to make native archery bows. Snakewood trees grow to about 78 ft. high and up to 3 ft. in diameter.

The trees are harvested at medium to high mountain elevations by native Indians, who then chop off the pale cream-colored sapwood. Because of snakewood's heavy weight (75 lbs. to 85 lbs. per cubic foot), logs are usually cut into 3-ft. to 4-ft. sections to facilitate hauling them off the mountains. A 12-in.-dia. tree will yield approximately 3 in. of heartwood and it is rare to find a heartwood section larger than 10 in. dia.

The most prized and rare snakewood is highly figured with black markings on a reddish-brown background. The figure can vary between logs and even in different parts of the same log. It is difficult to get finely figured, defect-free wood large enough and straight enough for cane blanks, like the one

Photo: Jerry Blanchard

The rich figure and color of snakewood is evident even in a blank (above); so Blanchard added little ornamentation—gold bands and a blackwood knob—to his 12-sided cane.

in the photo above. Unfigured wood is popular for stringed instrument bows.

Several weeks had passed since I placed my order, and I had forgotten about it when a slim package covered with foreign stamps arrived. Opening that package was a magical moment. The blank was wondrous: very heavy, hard and a rich red-brown color with beautiful black markings the entire length on all sides. A nice letter followed asking for payment if I was pleased with the wood.

I set to work and found this very durable and rot-resistant wood cuts well with sharp tools and is not abrasive. Thin strips are strong and flexible, yet the wood cleaves or splits fairly easily. I had no trouble handplaning 12 facets the length of the body of the cane. The rays on the quartered grain had a slight tendency to tear or lift, but it scraped glassy smooth. I turned the ends of the cane on a metal-cutting lathe fitted with a polished tool bit with lots of top rake, to precision-fit the wrought solid-gold bands. It turned perfectly—like lignum vitae, but without the waxiness. I've used epoxy and cyanoacrylate glues on snakewood, and both adhered well.

I finished the cane with a high-gloss tung oil, but because snakewood is very dense, I began by soaking the blank in oil in a vacuum chamber (see *FWW* #31, pp. 22-24) to draw the oil more deeply into the pores. Over a period of weeks, I applied additional thin coats, sanding in between with 600-grit silicon-carbide paper to yield a glossy finish. I have other beautiful cane blanks aging in my shop, but no matter how nicely they turn out, my first snakewood cane will always be special. *—Jerry Blanchard, Carmel, Cal.*

EDITOR'S NOTE: North American sources of snakewood include: Art Eisenbrand Exotic Hardwoods, 4100 Spencer St., Torrance, Cal. 90503; Gilmer Wood Co., 2211 N.W. St. Helens Road, Portland, Oreg. 97210; and A & M Wood Specialty, Inc., PO Box 3204, Cambridge, Ont., Canada N3H 4S6.

A joinery challenge

Fantastic! Fabulous! Although these words are overused, they are the only ones that come to mind to describe the Pinto Collection of treen in the Birmingham (England) Museum.

The examples in the Pinto Collection are of fine quality and encompass almost every conceivable small wooden object. One of the more unusual displays is a set of seven nesting bickers, which are large, wide-mouth drinking cups made in the early 1800s that range in size from 5½ in. dia. to 2¼ in. dia. (shown below). The bickers are of stave construction bound with split willow and joined with a series of "feathers" cut into the edge of each stave. The staves alternate between sycamore and Scottish mahogany, which is alder that has turned a rich reddish brown from soaking in peat bogs. The feather joints between the staves are so accurately cut that no glue was necessary to make the bickers watertight.

In the traditional coopering manner, the bases are fitted into an internal groove close to the bottom. The two larger bickers have more interesting "quartered" bases and false bottoms. This chamber contains a dried pea or small piece of wood that rattles so that when the contents were drunk, the rattle could be sounded for a refill.

I can understand how one bicker could be made by slicing the stave edges with a knife or chisel, but so many were made that there must be a fairly easy method for cutting the feathers. I've tried various approaches and met with only limited success; so I'm turning to *FWW* readers for suggestions on how the makers accurately laid out and controlled the cuts to make the bickers watertight.

—David Springett, Warwickshire, England

EDITOR'S NOTE: Send ideas on how these bickers were made to Charley Robinson, *FWW*, 63 S. Main St., PO Box 5506, Newtown, Conn. 06470-5506.

Photo: Permission of Birmingham City Museum and Art Gallery, England

The feathered joints of these Scottish bickers, or wide-mouth drinking cups, are so accurately cut that they are watertight even without glue. It's a mystery how the early-19th-century makers were able to repeatedly achieve this accuracy.

Product reviews

Fein Sander, *Fein Power Tools, Inc., 3019 W. Carson St., Pittsburgh, Pa. 15204.*

As the pronunciation of its name implies, this is indeed a fine sander, although its functions are rather limited. While the Fein Sander, shown in the photo at left on the top of p. 106, could be used for flat-area sanding in a pinch, this powerful triangular-head machine has been designed to get into tight inside corners, and it does that very well.

The sander runs at high speed (20,000 oscillations per minute), while vibrating within a very tight pattern (moving through only 2°), which enables the points of its triangular head to sand into the inside corner of a 90° joint without banging up the adjacent sides. The abrasive sheets (it takes only its own precut abrasives) are stiff, enabling it to sand quickly and aggressively, and sometimes too aggressively; tip it too far or leave it in one spot too long and it will quickly cut a groove that was not in the original design.

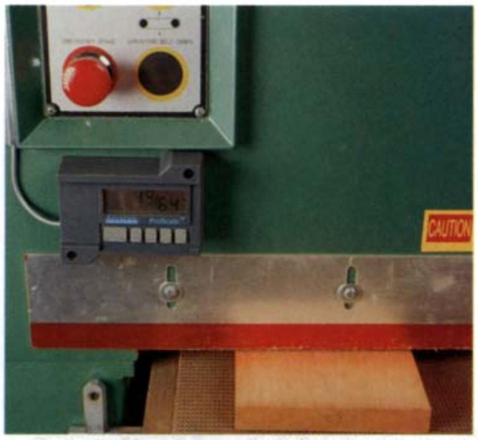
The Fein Sander is offered with one of two triangular sanding pads. One pad is hard rubber and takes pressure-sensitive-adhesive (PSA)-backed abrasive sheets; the other pad uses a hook-and-loop fastener system to secure the abrasive. Both have drawbacks. The PSA sheets stick tenaciously to the rubber pad, making it difficult to change papers. The hook-and-loop pad makes changing the abrasive much quicker and easier, and allows a grit to be removed and then reapplied without being damaged. After some heavy use, however, the corners of the hook-and-loop pad started to fray, and the abrasive no longer held well at the corners, necessitating replacement of the pad itself. The cost of the two types of pads is the same: $7.40 for a pack of two, and $13.50 for a box of 50

INDEX TO ADVERTISERS

Photo: Charley Robinson

The triangular head of the Fein Sander makes the tool ideal for getting into tight corners and other hard-to-reach places.

Photo: Sandor Nagyszalanczy



The ProScale 100 is an accurate digital measuring system that is adaptable to a machine with a moving table.

abrasive sheets for all grits except 36, which is $27 per pack of 50. The Fein Sander is available in two models: electric (model MSx 636; suggested retail $330) or pneumatic (model MOx 6-21; suggested retail $795), and comes in a metal carrying case with the necessary wrenches for changing pads.

ProScale 100, *Accurate Technology, Inc., 11533 N.E. 118th St., Suite 220, Kirkland, Wash. 98034.*

When I first saw the ProScale 100, it struck me as one of those devices that is very handy, though not indispensable. Several months of use has not really altered that assessment.

The ProScale 100, shown in the above photo at right, provides an accurate digital readout for a moving table tool, such as a planer, drum sander or wide-belt sander, with a maximum range of table movement of 10 in. I mounted it to a 24-in.-wide belt sander—the accuracy of which is as important as its ability to abrade. Mounting the ProScale 100 was as straightforward as its directions implied, and the long cord provided between the "read" mechanism and the readout box enabled me to place the read head out of the way, yet keep the display box conveniently close to the adjustment controls. This allows the operator of the machine to easily read the display while raising or lowering the table. The table's movement is displayed in one of several modes: thousandths of an inch (decimal), hundredths of a millimeter or fractions of an inch to one sixty-fourth. You can also set it to read in either sixteenths or thirty-seconds, in which case the display shows up to three dashes (called bars) to indicate the number of sixty-fourths over the fractional reading.

In addition, the device sports a zero setting, which enables you to reset the readout at any table position; plus and minus buttons to alter a display without moving the table; and a memory that saves your last setting when the device is shut off. I found the floating zero particularly handy for my wide belt sander because it allowed me to "set" the sanding belt with a hit-or-miss cut at zero, and then read the amount I wanted to remove rather than the thickness of the board.

The ProScale 100 is amazingly durable considering its accuracy. In spite of constant inundation with wood dust, it held its accuracy even when the reader was repeatedly run up and down over several inches. (Ironically, its accuracy was measured against one of its modern electronic brethren: a set of digital calipers that read to 5/10,000 in.) In fact, I found only two things about the unit that I feel need correcting. One is the scale bar itself. Initially, it occasionally stuck when the table was moved downward. I corrected this problem by adding a small weight to the top of the bar. The other problem is the battery power. I had to replace the batteries several times due to workers failing to shut off the unit before the weekend. While changing the batteries is a complicated and overly involved process, this irritation could be minimized by adding an automatic shut-off that would turn the device off after several minutes of non-use. Since the memory feature would save any settings anyway, this would protect the battery life without losing any ground.

Considering the initial cost of my wide belt sander, I am disappointed that one of these clever devices was not included as part of that original equipment. The ProScale 100 has a retail price of $279. The manufacturer produces other models with capacities up to 8 ft. that can be used on tablesaws, chop saws or a variety of other equipment. Contact Accurate Technologies for product and ordering information.

—Michael Dresdner, Perkasie, Pa.

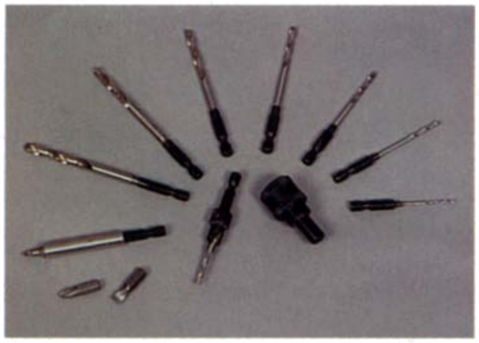
Insty-Bits, *Insty-Bits, 3336 Idaho Ave. S., Minneapolis, Minn. 55426.*

Working in the shop, I used to keep two electric drills in service—one to bore holes and one to drive screws—because using a chuck key to change bits took too long. With the Insty-Bits chuck in one power drill, I can rapidly change from a drill/counterbore combination bit (shown in the photo below) to a screwdriver bit, eliminating the need for a second electric drill. I was sold on the system when installing cabinets from a ladder. I found I could hold the workpiece in place with my left hand, and put my drill in its holster and push on the lock ring with my right hand to easily change from drill to driver bit. Try that with other drill chucks. A groove on the shank locks the bit in place so you can tug on stubborn drill bits that resist extraction from a hole. Frankly, I think Insty-Bits are the best thing to happen to drilling and screw driving since electric motors.

The manufacturer makes it easy for you to try Insty-Bits by offering a $27.95 kit that includes seven hex-shank twist drills, graduated from 1/16 in. dia. to 1/4 in. dia. in 1/32 in. increments, and a 3/8-in.-dia. shank chuck to fit your driver/drill. The company also makes chucks with a 1/4-in.-dia. shank to fit smaller drills, a 1/4-in. hex shank for screw guns, and a threaded chuck, which you can screw onto a 3/8-in.-dia. threaded shaft. The Insty-Bits system also includes other hex-shank tools: twist drills up to 1/4 in. dia. (in 1/64 in. increments); adapters for standard twist drills; spade bits up to 1 in. dia.; adjustable drill/counterbore combination bits for screws up to a #12; a metal-cutting countersink bit; hex, square, Torx brand, Phillips head and slotted screwdriver bits; magnetic nut setters; adapters for straight shank tools; and arbors for wheel-type tools.

—Gary Weisenburger

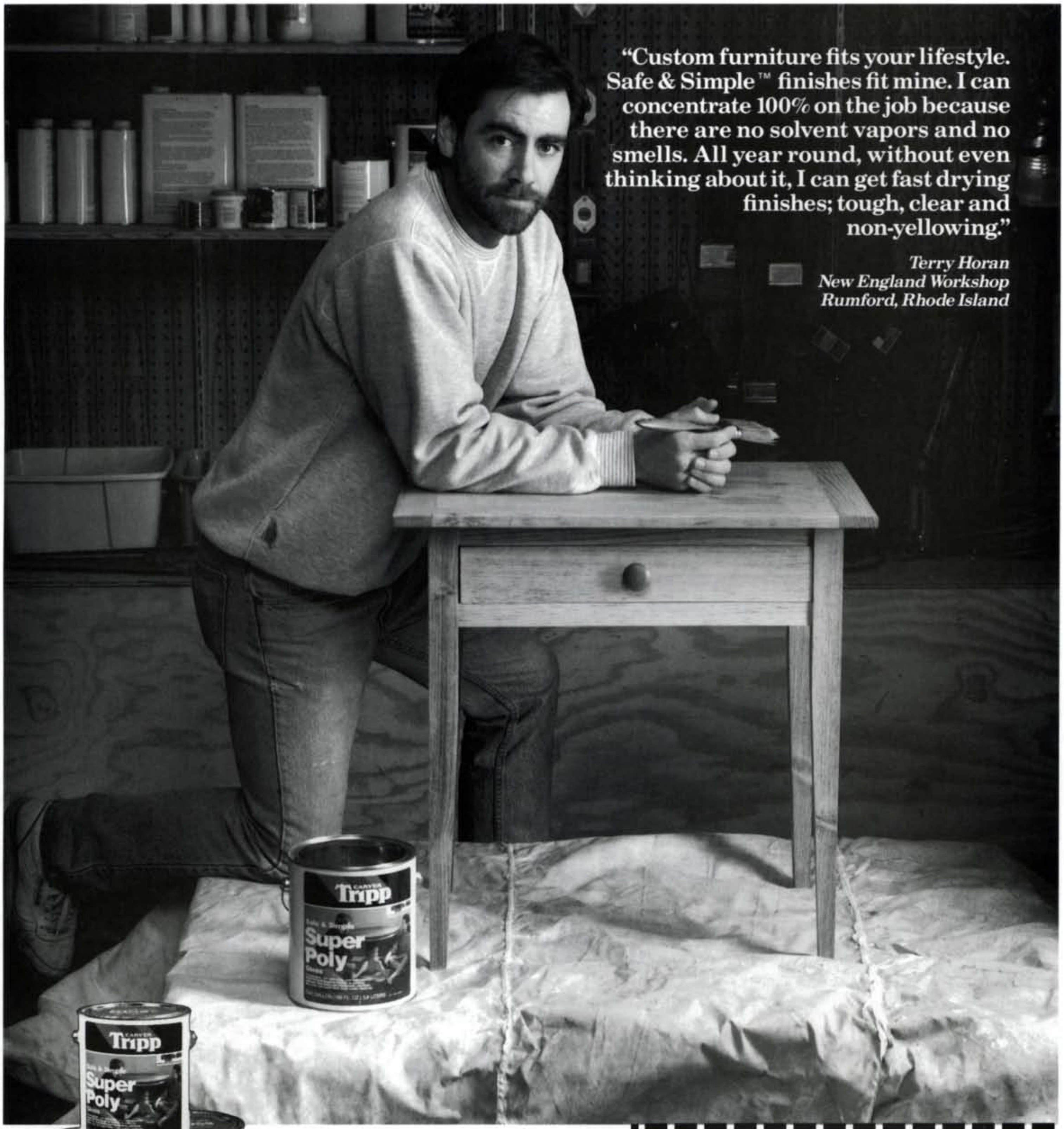
Photo: Gary Weisenburger



Insty-Bits make it easy for you to change bits without fumbling for a chuck key. Pushing the lock ring lets you slip a bit in and out of the chuck, while a groove on the shank locks the bit in place when the ring is released.

Notes and Comment

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



CARVER Tripp

Proud Sponsor of
"This Old House" &
"The New Yankee Workshop"

Safe & Simple™ Environmentally Responsible Finishes

- **No toxic vapors, nonflammable, odorless.**
- **Dries in 30 minutes to a hard, crystal clear finish that never yellows.**
- **Easy water clean up.**

Parks Corporation, Somerset, MA 02726, 1-800-225-8543

$5 per gallon **Introductory Rebate Offer Carver Tripp Super Poly** **$5 per gallon**

Complete this coupon and mail, together with cash register receipt (with Carver Tripp Super Poly circled) and the UPC code from the back label, to Parks Corporation, Consumer Rebates, P.O. Box 5, Somerset, MA 02726. Please allow 6 to 8 weeks for payment.

Name ______________________

Address ______________________

City ____________ **State** ______ **Zip** ______

Offer expires 12/31/91.
Limited to one rebate per individual or household. FW791

READER SERVICE NO. 80

A New Twist

The natural beauty of the almost endless variety of figure, grain and texture found in wood springs alive in the twisting ribbon-like forms of sculptor Robert E. Longhurst of Chestertown, N.Y. Longhurst says his sculptures are often inspired by natural organic forms. After sketching hundreds of designs to develop his ideas, he makes models of clay, ribbon or foil-wrapped wire to refine his vision before working in wood. Each sculpture is laminated together with pieces of kiln-dried stock and then carved. He says that his tools and methods aren't special, and that his shop could just as easily belong to someone who restores antiques or who just likes to putter. The important thing is the magic—the form and the idea he has captured. The sculptures shown here are all part of his completed Loop series: the 30-in.-high Loop XLVI (below, left) is zebrawood. Loop LIII (below, right) is 12 in. high and carved from African rosewood. The 30-in.-high delicately twisting Loop LIV (right) is amaranth.

©1990

©1987

©1990

Photos: Courtesy of R.E. Longhurst