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February 1994, No. 104
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Fine WoodWorking®

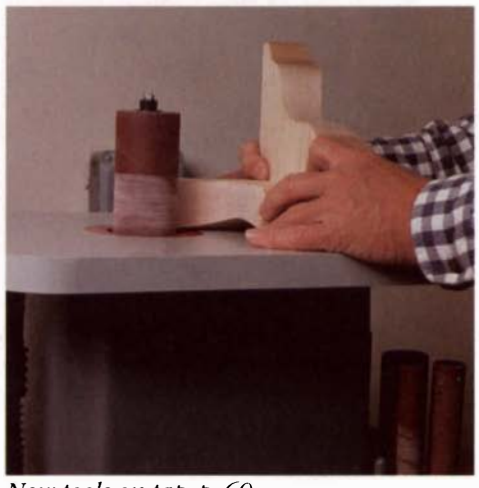
January/February 1994 No. 104

DEPARTMENTS

ARTICLES

Shopmade tablesaw guards, p. 56

A dozen ways to build a box, p. 75



New tools on tap, p. 60

On the Cover: *Garrett Hack has accomplished the delicate balancing act of making a strong but light carcase. For more on Hack's technique, see p. 62. Photo: Sloan Howard*

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Editor's Notebook

Entry deadline near—There is still time to send in entries for the new *Fine Woodworking Home Furniture* book. If you missed the call for entries in *FWW* #103, we are looking for examples of finely crafted household furniture to showcase in a new book. We are not looking for art furniture. But we do want pieces that show top-quality craftsmanship and are of a practical design that most people would want in their own homes. Each piece of furniture will be displayed in the book with photos and some information about its materials and construction.

We're excited about this new project and want to make sure as many people as possible enter. But all entries must be received by Jan. 31, 1994. Entry forms were in *FWW* #103, p. 19, but additional forms, with all the rules, can be obtained by calling (800) 283-7252, Ext. 554.

A final note about entries. Some of the early entries have not been complete. We can't judge incomplete entries, so make sure you follow all the instructions that come with the entry form.

Now hear this—The recent introduction of quiet sawblades (see "What's New and Hot" on p. 60) has once more raised the issue of noise in the woodshop.

We know from our visits to shops around the country that ear protection devices, ranging from simple ear plugs and ear muffs to elaborate machine sound baffling, are much more in evidence. I know one woodworker who even keeps a decibel meter handy to measure sound levels in his shop.

We want to hear more about readers' solutions to noise problems. Have you figured out an ingenious way to quiet your power tools while still maintaining performance and safety? What about shop vacuums and dust-collection units? Drop us a line with your ideas, and we'll try to include the best ones in an upcoming article.

Going for the guild—Woodworkers tend to be a solitary lot, frequently plying their craft alone, reveling in unique and creative solutions for shop problems. But others hunger for a chance to swap those great ideas with their colleagues.

That's where guilds play an important role, bringing woodworkers together in an atmosphere of collegiality to share what they know. I recently had the opportunity to attend just such a meeting hosted by the Nutmeg Woodturners Association, a guild serving turners in Connecticut.

They descended on the home and shop of Dennis Elliott. Featured in *FWW* #84, Elliott is known for his turned wall sculptures made from bigleaf maple burl slabs. The turners were immediately drawn to his custom-built Jim Thompson lathe. Filled with sand, the lathe weighs about 3,000 lbs.

The massively sturdy setup was evident as Elliott invited the visiting turners to try their hands on a faceplate-mounted burl slab nearly 3 ft. across. But because few turners have such a behemoth lathe in their shops, he also had set up a General lathe for much smaller spindle and bowl work. In no time, turners of all abilities and interests were swapping tips and techniques. Pro or beginner, they were all encouraged to try and to learn new skills.

Fine Woodworking serves as a communications network of sorts for woodworkers, but local guilds can be indispensable for hands-on information. No guild in your area? Think about starting one.

Follow up—Bradley S. Rubin's intriguing crib design (*FWW* #100) using drawer slide hardware for the drop sides, has inspired readers to try building similar cribs. The drawer slides he used (#C1029-16) were made by Belwith International, 3100 Broadway, Granville, Mich. 49418; (800) 235-9484. *–William Sampson, executive editor*

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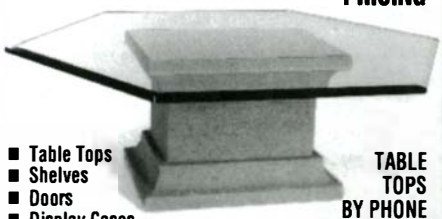

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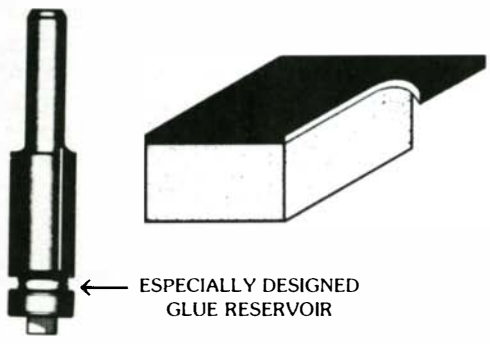

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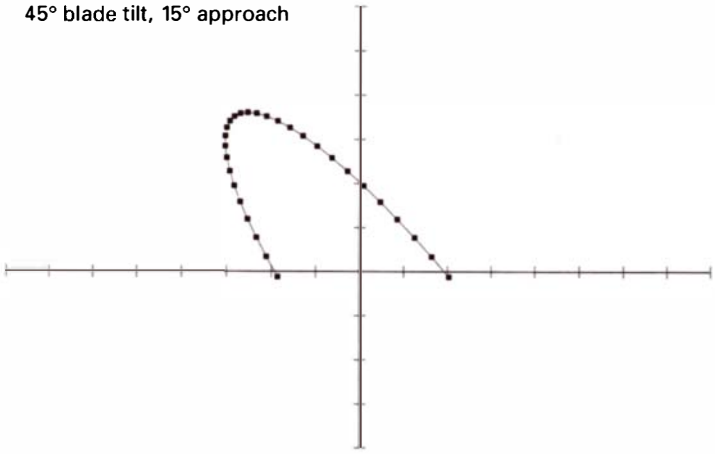
Coves from a spreadsheet—Thanks for the article on making coves on a tablesaw (*Fine Woodworking* #102, p. 82). I have now tried it for the first time, and I am really excited about the possibilities. The asymmetrical cuts are particularly interesting. I do not have a computer-aided design (CAD) program available, but it is straightforward trigonometry to calculate the position on the cove for a given point on the blade.



Using a spreadsheet/charting program (Excel), you can easily calculate a series of points around the blade, and then chart the results. See the example above. By adjusting the margins on the chart, I was able to get the horizontal and vertical axes close to the same scale. *—Frank Gregg, Dallas, Texas*

Safety first—I was appalled with shop practices shown in the article "Jointer Savvy" (*FWW* #102). The photograph on p. 48 shows Mr. (Bernie) Maas with a shirt sleeve rolled partially up his forearm, dangling toward the infeed table. Shirt sleeves should always be rolled above the elbow. Hearing protection should also be worn at all times when operating the Rockwell-Delta 8-in. jointer shown. The photo on p. 51 shows Mr. Maas' left hand placed at the edge of the board with less than ½ in. of clearance to the jointer knives. This is an extremely dangerous practice that could easily result in severe injury. For an article that includes a paragraph "Safety comes first," these photographs were poorly chosen.

—Michael Persichetty, Sunnyvale, Calif.

Avoid sprung joints—In *FWW* #102, p. 52, "Using a jointer: the advanced class," Mr. (Peter) Tischler makes a serious error. He advocates making a sprung joint to aid in clamping.

To explain the result of this type of clamping, suppose you are clamping 10 narrow pieces of wood to make a tabletop. By gluing up these pieces each with 1/64 in. of spring, you end up with a tabletop with 10/64 in. more stock along the edges than in the middle. As soon as a little expansion occurs, due to a little humidity, the tabletop edges will take on a wavy edge or bulge upward or downward.

Don't do this. You will be sorry. I was. I did it early in my woodworking hobby career. In fact, the table is still around to see. Further, I didn't even have to wait for high humidity to see the bulge. *—W.G. Sheard, Horseheads, N.Y.*

Leave jointer knife sharpening to pros—Rebeveling and resharpening (jointer) knives with a honing action (*FWW* #102) is for the birds. Reading about this in past issues, I tried and retried with no good results. Cutting action actually worsened.

I sharpen most of my cutting tools and tried sharpening my jointer knives. My early 4-incher went quite well. When I updated to a 6-in., I gave up sharpening. The firm that I use does a good job and grinds flat to 35°. I joint all kinds of figured wood with 99% smooth cuts. *—Ralph Z. Neff, North Canton, Ohio.*

Safer bevels on the jointer—I must point out what I see as a safety problem with the article "Jointer Savvy—Knowing your machine makes for safe and skillful joinery." After reading the title of the article, I had to laugh at the photo shown on p. 51, "Smooth chamfers and bevels." The position of the fence seriously jeopardizes the safety of the operator. When the fence is angled away from the knives, the board can easily slip down off the fence, possibly causing the operator's hands to come in contact with the knives. Try it; it slips really easily. The proper position is to have the fence angled toward the knives. This allows the board to be held in snug against the fence and the bed of the jointer. The possibility of injury is greatly reduced.

—James D. Redway, Middlebury, Conn.

Valuable business advice—William A. Sieck's article, "A visit from OSHA" (*FWW* #102, pp. 120, 122), is a must read for any woodworker considering a move to the business world. As an employer, I believe Mr. Sieck will also agree that there are many more agencies that require compliance.

For the past 40 years, I have owned woodworking businesses that have employed as few as two and as many as 100. During this 40-year period, I have seen a frightening growth of regulatory agencies. Unfortunately, government bureaucracies want to grow; in this case, growth and power are found by creating new regulations, amending the old ones and setting up non-conformance penalties.

Thanks to Mr. Sieck's article, new and old entrepreneurs have no excuse for not being prepared for an OSHA visit.

—John Long, Oroville, Calif.

Another side to squaring stock—In three recent articles—"Setting Up Shop" (*FWW* #100), "Jointer Savvy" and "Flat, Straight and Square" (*FWW* #102)—you present only the method of working that requires jointing one face of a board prior to thickness-planing the other. This method is necessary with the old-fashioned planer with steel-feed rollers. That's because the steel rollers require so much pressure to feed the board they press the cup flat while planing. The recent design planers with rubber-feed rollers require far less pressure to feed the board and will not press the cup out of a board. Repeated light passes, rotating between passes, will produce a flat board.

The 10- and 12-in. portable planers are very satisfactory and have become quite popular, yet Peter Korn recommends starting shop with a $1,500, 8-in. jointer while the average woodworker is agonizing over spending $400 or $500 for a 12-in. portable planer. An average 6-in. jointer at around $400 can be tuned to put a straight edge on a board, and a 12-in. portable planer, at around $450, can be tuned to plane a cupped, rough-sawn 11-in. or 12-in. board flat without ripping and jointing.

The large durable machinery is, no doubt, economical for the professional production shop. However, the bulk of your readers are part-time, home-shop woodworkers. Give us a break, and present methods of work that are appropriate for our budgets and needs. *—Eugene C. Hise, Oak Ridge, Tenn.*

Use a better respirator—I enjoyed Peter Korn's article "Flat, Straight and Square" (*FWW* #102). But the photographs accompanying the article feature a man wearing a respirator that is inadequate protection for wood dust. Woodworkers should use a dust respirator that is approved by the National Institute of Occupational Safety and Health (NIOSH) for machining wood. Other processes like staining and finishing may require further protection. The one-strap model depicted is obviously unsafe. Woodworkers can contact the Art Hazards Information Center for more information (212) 227-6220.

—Angela Babin, M.S., director, Art Hazards Information Center, New York, N.Y.

Streaks in tulip—I just finished the fine article by John Sillick in *FWW* #102. I have one correction to suggest. The purple and black streaks he mentions are not due to improper log storage or drying practices. These are most visible when the log is first sawn. With exposure to light, these marks will become somewhat lighter. These marks are due to mineral uptake by the tree in certain locations. *—Lee W. Dodd, Niles, Mich.*

Tulip or poplar, that's the question—John Sillick (*FWW* #102) made the comment that tulip, *Liriodendron tulipifera*, is routinely sold as poplar and generally is mistaken as a member of the poplar family when it is actually a member of the magnolia family. Having recently purchased a collection of samples of veneers from a regional hardwood supplier, I was curious as to how they identified tulip and poplar hardwoods.

Their veneer wood book classified poplar under *Liriodendron tulipifera* with no additional classification for tulip. Either it is actually tulip being called poplar, as John Sillick's article states, or poplar misclassified. At any rate, if it were not for your timely articles, weekend woodworkers like myself would never know the difference. This might be the reason why I just renewed my subscription for another two years. Please continue to inform and instruct us. *—Alfred W. Yakel, Edmond, Okla.*

Give it the heat—In *FWW* #102, I noticed a question asking about the disassembly of epoxy or plastic resin glue joints. Here's another two cents worth.

As a guitar repairman/builder I have to occasionally disassemble epoxy joints. My best tool is a common electric flat iron set on "linen," the hottest setting. Just heat up the wood and the joint, slip a thin, sharp tool in and work the joint open. I do this commonly on fingerboard-to-neck joints, and it works every time. Just be careful, and let the heat do the work. Work with the grain so you don't pull slivers, and try not to scorch the wood. Also, don't use Mom's or the wife's iron They hate it when you get epoxy and wood resin on their iron and then on their clothes. Buy one of your very own at the next garage sale down the street. *—Ron Lira, Oklahoma City, Okla.*

Vinegar does the trick—In the September/October issue of *Fine Woodworking*, Chris Minick in his "Q&A" answer on p. 32, does not mention aliphatic glues, but writes in such sweeping terms that one is led to believe there is no way to disassemble a Titebond joint. Before reading this issue, I had tried unsuccessfully to break such a joint apart with water and then steam. I then called Paul Annetts of Stowe Restoration, Stowe, Vt., who said, "vinegar."

I set the improperly glued chair back, with its 8x½-in. mortise-and-tenon joint in one of my wife's sinks and just poured vinegar over it, replenishing when the mood struck me. Since it was canning time, she ejected me from her kitchen, and I took the offending assembly to my shop. There, I mounted it in a vise, with the joint in a horizontal plane. I poured vinegar into a glue injector and carefully squirted it into the joint. I had a hunch that I had failed to wet the joint regularly enough and set a schedule of inspection every 20 minutes. Sure enough, the vinegar was absorbed very rapidly. After about 1½ hours, I gave the top rail a tap with the hammer, and, voilà, it came apart.

—Robert D. Wood, Chippewa Bay, N.Y.

Telling it like it is o n tools—I enjoyed the review of router tables by Mr. (Mark) Duginske (*FWW* #102) for many reasons, but

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94-105

mainly because this was the first practical review out of *FWW* for many years. Why? First, size. Limiting the scope of the article to four cast tables lets me assimilate the features of each without losing track. Many times when you review 10, 12 or 15 similar tools, they all start to blend together. Second, Mr. Duginske is not afraid to tell it like it is. In previous reviews, I got the feeling that the reviewer was pandering to the large corporations or that *FWW* was looking out for their advertising department—all the tools were good, all of them worth buying, and the conclusions were masterpieces of not hurting anybody's feelings. This time, though, we got the straight facts, and a conclusion that stated the reviewer's preference clearly. Bravo, Mr. Duginske.

–Hollis Fitch, Tarpley, Texas.

Sources for Shaker plans—The article "Shaker-Style Clock" (*FWW* #101, p. 63) by Phil Lowe contains an interesting statement. Lowe states, "I found a lot of pictures of clocks, but no dimensioned drawings." How could Lowe not have come across the following good, better, best references that contain measured drawings of Shaker wall clocks: *Shop Drawings of Shaker Furniture and Woodenware Vol. II*, by Ijner Handberg (The Berkshire Traveller Press, 1975, pp. 2-3); *How to Build Shaker Furniture*, by Thomas Moser (Sterling Publishing Co., 1985, pp. 196-97); and *The book of Shaker Furniture*, by John Kassay, (University of Massachusetts Press, 1980, pp. 131-33).

–John Kassay, San Bruno, Calif.

Tips for using compressed air—The article "Random-Orbit Sanders" (*FWW* #101) by Sandor Nagyszalanczy was educational as well as practical. I would like to add some technical information concerning the compressed air. Any moisture in the air that is taken in by the compressor goes directly into the system. This moisture will condensate and come out of the supply line with the compressed air. In the case of the air sander, it will run out of the tool onto the project and is very harmful to the air motor of the sander. If an oil-based finish is being sprayed on, water leaves fisheyes and other surface defects. The compressor should be operated in a cool, dry environment. Ideally, the supply line should run up from the unit, across a ceiling and back down a wall to a water separator. This gives the compressed air a chance to cool down and the moisture to devaporize into droplets. The separator is much more effective at this point, rather than mounted near the compressor. Also, an oil separator should be added when spraying because an air-compressor cylinder introduces small amounts of oil into the air system.

–Chris Steadman, Cincinnati, Ohio.

Out of the mouths of babes—About a month ago, I was making some simple shelves to organize the shoes in my wife's closet. The shelves were made of common ¾-in. plywood, which I had put together with shallow dadoes, drywall screws and Elmer's glue. I put the screws in with an electric screw gun. Not fine woodwork, rather do-it-now woodwork.

My 5-year-old daughter, Kathleen, was "helping" me by holding the drywall screws. She was impressed, if not a little frightened, by how fast the drill drove the screws into the plywood. I was hitting the trigger of the drill a little hard, and most of the screw heads were driven below the surface of the plywood.

Kathleen continued to talk and ask questions as I put in more screws, not really paying a lot attention to the conversation. She suddenly got my attention when she observed, "Did you know that if you drilled a hole on top of those screws and put a wood-

en plug in on top, you can sand it off, and it will look smooth like there aren't any screws there at all?"

Stunned, I stopped work and looked up at her. After a moment, I said, "That was a very good idea, and where did you find out about such a good idea?" With a delighted laugh at getting my undivided attention, she said in a very confident voice, "*New Yankee Workshop*."

I was astounded. Unnoticed by me, she not only has watched *New Yankee Workshop*, but she has understood a lot of it. This is a 5-year-old girl with a massive collection of Barbie dolls; she has older sisters and is very involved with girl stuff. I am still a little awed by this incident. I am a successful engineer; I probably got interested in science from watching *Industry on Parade* on television when I was less than 10 years old.

I believe my daughter's understanding is a real compliment to the quality of Norm Abram's presentation and to the value of the program beyond woodworking. I believe Norm does very fine woodworking in more ways than one. I could say a few words about elitists, but it doesn't really matter.

–John M. Casstevens, Rockwall, Texas

Baby powder fights rust—Robert Vaughan answered a question in *FWW* #102 regarding the best means of controlling rust on unprotected surfaces. He failed to mention the use of talcum powder for the protection of working surfaces.

My experience has shown ordinary baby powder to be a simple, effective method. When I received my new tablesaw several years ago, I was instructed to apply baby powder to the table's surface, lightly rubbing it in with a soft cloth during application. This is to ensure all pores are covered with powder. This process is repeated after each use for the first two weeks, and slowly progressing to applications once every several months. Now I only apply once every six months.

To my surprise, this method has proven to be extremely effective. There is absolutely no rust, the table surface is very slick, there is no buildup, and my workshop always smells nice. The powder is cheap and easily dusted or vacuumed from the machine just prior to use. *–David Szabo, Branchburg, N.J.*

Watch out for acid-caused rust—In a question about curing and preventing rusty machines (*FWW* #102), reference was made to the use of muriatic acid (hydrochloric acid) in cleaning rusty cast iron. Muriatic acid is a solution of hydrogen chloride gas in water; the more gas, the stronger the acid.

A bottle of muriatic acid stored in a shop or basement for cleaning swimming pools and other uses will give off the gas, and this will react with the moisture of condensation on any available surface. On iron surfaces, rust results. It is an insidiously slow reaction, but it will happen sooner or later. You cannot keep the cap on tight enough.

–Roy A. Norman, Brunswick, Ga.

Salvaging trees for lumber—Regarding the letter by Ted Zogrotzki (*FWW* #102) concerning "Hardwood in your neighborhood," his suggestion is a wonderful source of raw wood that's available in everyone's area. But speaking from my son's business standpoint: Be certain that if you make arrangements to collect downed trees, you are at the place when you state that you'll be there. There have been too many times when the collector didn't show, and my son had to return to the job site to collect the trees (which costs money in time and labor).

Henceforth, he will save the tree if the collector is on the job

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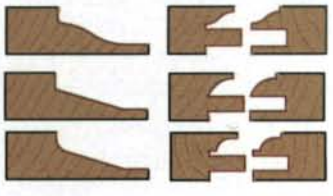

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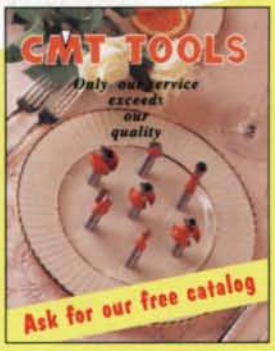

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site, or he may drop it off if he's in the neighborhood. But he does not leave the trees on site. The customer pays to have the tree removed. *–Orv Dunlap, Phoenix, Ariz.*

Ammonia surprises—In *FWW* #102 "Methods of Work," there is a suggestion that ammonia can be used to darken brass. Use of this method could lead to some unpleasant surprises.

Brass with internal stress is subject to severe cracking in the presence of ammonia. Internal stress is the result of cold work: bending, pressing or spinning, mostly of sheet metal, which is not followed by annealing. Bar stock and castings could also have some locked-in stress and be subject to ammonia cracking.

I'd suggest that the process be tried with one sample piece first to see what will happen as well as to determine the time required for the desired effect. Also, don't contact the piece with the liquid ammonia solution. The effects will be different. *–Rodney T. Swain, Darien, Conn.*

A point of pride—In a recent letter to the editor, mention was made of three great woodworkers/teachers of yesteryear: Marlow, Gottshall and Joyce. And there was a request for an article about the writer's idol, Andy Marlow.

I, too, would like to see an article devoted to one of these master woodworkers. My experience with woodworking was transformed by a present of Gotshall's *Reproducing Antique Furniture*. At the time, I considered it a gag gift: The projects were so far beyond my limited talents. But I located another of Gotshall's books, *How to Make Colonial Furniture*, and it was much more my speed. After a few projects and some wasted pine, I decided to take a step up and waste a little mahogany. So little by little, with Gotshall's help, I worked my way through some of the magnificent pieces in *Reproducing Antique Furniture*.

I was reminded of this experience recently by a furnace repairman who came to the house to fix a temperamental wall heater. At one point, while waiting for the pilot to warm up, he studied my desk in the corner of the room. It is the 'partners' desk from Gotshall's collection. Of this desk, I am unashamedly proud. In the event of a house fire, I would return to rescue the family after assuring myself that this desk was safely out of harm's way. It is highly ornamented, with ball-and-claw feet on cabriole legs, carved acanthus leaves on the knees and drawer fronts, and quarter-turned columns on the corners. I had spent nine months (curiously, the gestation period in humans) building this glorious piece.

The repairman said at length, "Nice desk." Swelling with pride, I replied, "Yes, I made it." He studied it more closely as I waited for the appropriate words of lofty praise. After a minute digesting its many features, he smiled and said, "You must be handy with a router." Oh, well. So, how much do I know about fixing wall heaters? *–James Hurley, Nevada City, Calif.*

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–James P. Chiavelli, associate publisher

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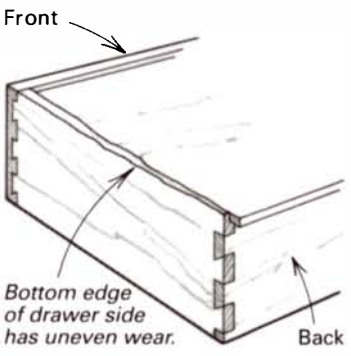
Making drawer repairs

We have an Empire-style secretary (scrutoire) believed made about 1837 in Thomaston, Maine. The lower edges of the drawer sides are badly worn, and the drawer guides are correspondingly grooved so that some of the drawers are actually sliding on their bottoms. Drawer sides and backs are about 5/16 in. thick, made of softwood and joined with half-blind dovetails at the front and through-dovetails at the back. Drawer guides are also softwood. What is the proper repair, if any, for this antique? ***—O.H. Wright, Bartow, Fla.***

Jeff Jewitt replies: In my view, repairs are definitely in order, first, to prevent further damage to the drawers and, second, to put the piece back into proper service. Repairs to antique furniture should pursue the least intrusive approach that will fix the problem. Because most of the damage is to unfinished, secondary wood, repairs are rather straightforward and can be accomplished by anyone with competent hand-tool skills. If the front edge of the rail is worn also, you may want to have an experienced furniture conservator make the repair because it involves replacement of a primary wood face.

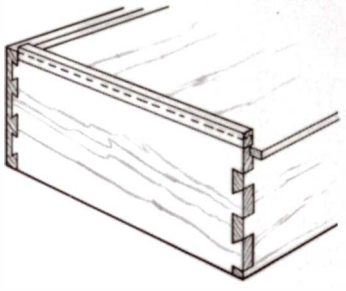
This is the procedure I recommend, dealing first with the drawer sides. When you look at the drawer from the side, you will probably notice that the wear is uneven and is most severe toward the back (see the drawing at left). You should plane this level so that a new piece can be spliced on. This is easier to do if you remove the bottom, which may be nailed or screwed to the back. Be sure to save the fasteners, and return them to their original locations. With the fasteners removed, the bottom should gently slide out. Once the sides are planed level, splice on new pieces of wood, made deliberately oversized (see the drawing at right). To be consistent with the original construction, use hot hide glue. The pre-mixed hide glue is an acceptable substitute.

Worn drawer side



Repaired drawer side

After planing drawer's bottom edge, splice on slightly oversized new wood. Plane the patch to just above the dotted line.



The sides are probably Eastern white pine, and I would urge you to use the same. Try to get wood that has tight grain because it will wear better. Once this is done, mark a line for the original drawer height, and plane to just slightly above this line. Hopefully, the wear does not go past the groove for the drawer bottom, but if it does, cut a groove in the new wood to accept the drawer bottom. Do likewise for the rest of the drawers.

Now look at the drawer runner. The design of the case assembly will determine the ease of the repair. The runners are infinitely easier to repair if you can remove them. If the piece has solid sides and was constructed to allow for seasonal expansion of the sides, the runners should "float" and be held in place with a minimum of fasteners. Most American construction has the runners tenoned in the front to a groove let into the rail. There is usually a nail driven through the back panel or possibly at the end of the runner driven into the side. Remove the nail, and gently pry the runner from side to side. Normally, the runner comes out easily, but watch for nails holding the tenon. If you're lucky, the design of the runner may allow you simply to turn the runner upside down and thus expose fresh wood. If not, let in small pieces of similar wood to fill in the grooves, again using hide glue. If your secretary has frame-and-panel sides, the runners are sometimes glued to the upright frames and should be repaired in place.

If the front rail is worn also, chisel out the worn area, and replace it with a piece of wood, matching the grain and species as best you can. This poses a problem because the wear is usually close to the sides. Use an offset dovetail saw for this task. The new wood piece should be inpainted to match the surrounding surface as closely as possible, using dyes and shellac. If you lack these skills, have a professional do the job. Do not sand or alter the surface surrounding the new piece. Better to have a slightly visible repair than an altered original surface in the quest of the "perfect repair." If the groove is slight, or it doesn't bother you, leave it alone.

Repairs that are honestly done, with careful attention to the historical integrity of the piece, rarely detract from its value. If you do the repairs yourself, please, take your time, use hand tools and take heart in the fact that the original maker would undoubtedly be proud to have his piece functioning properly once again.

[Jeff Jewitt specializes in the conservation and restoration of antique furniture in North Royalton, Ohio]

Getting clean inside corners

I do limited production of wooden objects, which quite often require 90° inside corners. The problem is sanding these corners in a minimum amount of time and without ending up with rounded edges. ***—Jerry King, Toronto, Ont. Canada***

Sandor Nagyszalanczy replies: I always try to sand individual pieces before glue-up—I apply glue judiciously, then pop out any beads of squeeze-out with a sharp chisel. For inside corners that can't be sanded, I recommend a sharp scraper; you can work it right into the corner (start there, pull away to smooth). For a small project, sometimes a sharp chisel can be used as a scraper.

[Sandor Nagyszalanczy is a contributing editor to *FWW* and a woodworker in Santa Cruz, Calif.]

Working with wrinkled and brittle veneers

I have 14 pieces of Carpathian elm burl veneers. The pieces are several years old, and they are dry, brittle and wavy. How can I make them flexible so that I can glue them to a flat surface? What type of glue should I use?

I also have some walnut veneer that has mildew spots on it. Can the spots be removed? ***—George B. Taylor, Tucson, Ariz.***

John Kriegshauser replies: I have tried various recipes for flattening curly veneer, but none have delivered the magic that they promised. Wetting the veneer with water seems to be the key, and the addition of some glycerin to the water may help a little. The problem arises because the wrinkled state is the natural state for burly veneer, and it will only stay flat when it is securely bonded to a flat panel.

If you are gluing down the individual leaves without seaming them together, the task may be easy because the moisture in the glue can relax the curl in the veneer. You may have to mist or sponge additional water on the top face of the veneer depending on how stiff the wrinkles are, but remember, the glue dries by absorption, so the glue will not stick if the veneer is saturated.

If you want to seam the leaves together, you will have to press the leaves flat before seaming them. To do this, wet each leaf, and place it between three or four layers of newspaper. Stack two or three of these veneer/newspaper sandwiches on top of one another, and clamp them between two flat panels. After an hour, unclamp the stack, and replace the wet newspaper with dry. Repeat at even longer time intervals until the veneer is dry.

But do not let the veneer's flat appearance fool you. The wrinkles will reassert themselves if the panels are left out for as little as an hour, particularly in your dry climate. My solution is to keep them under pressure. I cut a rectangle out of medium-density

fiberboard (MDF) the size I want, lay it on the veneer and, using the edge of the MDF as a guide, gently saw the edges on each leaf. I then organize the taping process, so it requires the minimum amount of time, and slip the assembly directly into the press.

Success can be achieved with almost any glue, but the application of the glue is also important. Too little glue and the veneer will show blisters where it is not bonded to the substrate. Too much glue and it will flow beneath the veneer creating puddles and wavy ripples in the surface. Yellow glue will work, but the interval between "too much" and "too little" is small and hard to judge. Last year, I was forced to apply veneer with some year-old yellow glue that had grown thick and sludgy. It worked beautifully, and I fully recommend it. Titebond II (from Franklin International, 2020 Bruck St., Columbus, Ohio 43207; 800-877-4583) is, I think, similar to a veneer adhesive that is used commercially, but I have not yet tried it. Two-part plastic resin adhesives are excellent, but messy and difficult to mix up.

Try using household laundry bleach on your mildewed walnut. If a residue remains, lightly sand the surface to see if you can cut through it. If the stains are clear through the veneer, your only option is to wipe out all the color with a two-part bleach (sodium hydroxide, commonly known as lye, and hydrogen peroxide), and then add color with a walnut stain or dye. Remember that veneer, while more durable than most vegetables, is still a biological product subject to decay. At some point, it is just gone.

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

Working with burls

On my farm, I have a black cherry tree that has an unusual burl. It developed around the base of the tree at ground level and looks like it could provide some interesting material.

I'd like to know what I should do with this burl, how it should be harvested, handled, dried and maybe some suggestions for possible uses. I have excavation equipment available if that would be the preferred harvest method.

—George J. Newberger, Ravenna, Ohio

Bruce Hoadley replies: I have never seen a burl like the one you've described. I can only imagine it has most unusual wood tissue within it. My advice is probably what you would have done anyway: Cut the stem off about 6 in. to 10 in. above the burl swell; dig around the base so the main roots can be cut away as they are encountered until the burl mass is free (this phase will be much more trouble than you ever thought); blast it with a garden hose to clean off as much dirt as possible; then just stand back and look at it for a while.

One thing I know about burls is to first discard most of the rules we use for normal wood and to prepare for the totally unexpected. One burl may dry flawlessly while the next may pull itself apart in several places upon drying. It may turn out to be sound and solid throughout, or it may be pocketed by rot, included bark, stones or soil. I wouldn't hope to get it dried out in one big hunk, but you might want to try. I'd probably be too curious to resist cutting into it and finding out what it was all about inside. I'd then cut it into smaller chunks, slabs or turning blanks, depending on what my aspirations for it were.

Some surface defects will almost certainly show up during the drying process, so I'd be shopping the catalogs for a good supply of stick shellac to fill the cracks later. In the past, I had some success using PEG-1000 soak treatments to stabilize the wood prior to drying; you may find some experimentation worthwhile.

With burled wood, I think rough shaping the blank while it's green is a good idea. First, you have the advantage of finding out up front whether there are hidden defects that would necessitate scrapping the piece. Second, the wood machines much more easily while green. And third, you will probably pay closer attention to a half-finished project during drying than to a rough chunk or slab. There are no exact guidelines for the drying process—you have to play it by ear. Prop up the chunks or sticker the slabs to ensure good air circulation around the pieces. If the pieces fail to lose weight or show signs of molding, the drying process needs to be speeded up; if surface checking or rapid cracking is evident, slow the drying down.

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

Hardware sources

I'm looking for a source for reproduction Arts-and-Crafts-style hardware. Can you help me out?

—Larry Oby, Colorado Springs, Colo.

Kevin Rodel replies: Here are a couple of sources for Arts-and-Crafts-style hardware: Buffalo Studios (1925 E. Deere Ave., Santa Anna, Calif. 92705; 714-250-7333. Catalog, $6) and Crown City Hardware Co. (1047 N. Allen Ave., Pasadena, Calif. 91104; 818-794-1188. Catalog, $6.50).

[Kevin Rodel and his wife, Susan Mack, build furniture in the Arts-and-Crafts style in Pownal, Maine]

Dealing with pine pitch

In building Southwest furniture, I work with a lot of 5/4 and 8/4 pine. Frequently, after completing a nice piece of furniture, I find sap seeping through a small crack, knot or pore in the wood. It is very frustrating to try to stop the seepage so that the piece can be finished. I've tried glue and, at times, literally dug a hole in the wood and filled in with a new piece. Sometimes this works, sometimes not. Is there any product or method that can kill the sap or stop it from flowing?

—Robert O. McCartan, Tucson, Ariz.

Jon Arno replies: The high resin content in pine can cause serious, and sometimes latent, problems with many finishes. Even when the woodworker has exerted every effort in preparing the wood, months or even years later resin may ooze out of the wood and cause the finish to soften or bubble up. Although resin seepage most commonly occurs on the end grain or around knots, it can happen anywhere. The reason for this is pine contains resin canals, which are minute cavities between the wood cells where the tree stores resin. Pitch pockets occur when the tree grows around a wound, entrapping a substantial quantity of resin.

Little can be done about pitch pockets other than avoid them when cutting out the furniture parts. If you're stuck with a pitch pocket, you can try scraping the resin out and filling the resulting hole with wood filler. Resin seepage on flat surfaces or along the end grain can be controlled to some extent by selecting a finish that is not softened by pine turpines. Turpentine-based varnishes or ones that use paint thinner (mineral spirits) for thinning or cleanup are not usually resin resistant. Some of the modern polyurethane varnishes using mineral spirits as a vehicle will resist resin, but only those which polymerize as they cure. By and large, though, it is safer to select a finish formulated with some other vehicle.

Lacquer-based finishes do tend to hold back resin, but shellac is perhaps the best. Because shellac is alcohol based and dries to leave a thick, rigid film on the surface, it provides a relatively strong resin barrier. Unfortunately, shellac is not particularly durable in other respects and tends to cloud when exposed to humidity. The technique I use is to give the project a generous undercoat of shellac and switch to a more durable varnish for the topcoats. This approach works reasonably well, but I still experience an occasional problem with resin bubbles around knots.

Your problem is probably compounded by the extremely arid climate of southern Arizona. Most pine lumber is kiln dried to approximately 12% to 15% moisture content. Although this would be dry enough for most regions of the country, it's not low enough for your climate. As the wood loses moisture to achieve equilibri-

um, it is doubtless sweating a little resin. In the future, buy your lumber several months in advance, and store it in a stickered pile. This should allow the resin time enough to come to the surface and harden into crystallized beads, which can then be scraped off before the wood is put to use.

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

Chemically staining wood

I'm interested in chemically staining wood. I'd like to get more information on the treatments mentioned by Chris Minick (FWW #98, p. 34): oak exposed to ammonia, cherry treated with lye, birch treated with baking soda and butternut treated with baking soda. Are there any more woods that will react and change color or appearance with common chemicals?

—Richard B. Mabie, Seattle, Wash.

Chris Minick replies: A certain nostalgia surrounds the use of chemical stains for changing the color of wood. After all, these were the colorants used by Thomas Chippendale and George Hepplewhite and many other great masters of woodworking history. But a treatise on chemically altering the color of wood is well beyond the scope of this column. Besides, I'm firmly opposed to chemically staining wood for three reasons: First, most chemicals useful in changing the color of wood are highly toxic and most often extremely caustic. These chemicals present a severe health risk to the finisher and should only be used by individuals with formal chemical training. Second, chemical stains depend on the trace contaminants present in wood to achieve the desired color change. Because the level of trace materials varies from tree to tree, even within the same species, the results of the stain job are often unpredictable. Finally, and perhaps worst of all, many chemicals capable of staining wood are strong oxidizing agents. If not properly neutralized, these chemicals will damage subsequent coats of finish applied over the stained wood.

Modern dye stains are a safer, more predictable alternative to chemical stains. I'm sure Chippendale and Hepplewhite would not have used dangerous chemical stains if modern dye stains had been available back then.

If, in spite of these admonitions, you would still like to explore chemical staining, I'd recommend George Frank's *Adventures in Wood Finishing*, The Taunton Press, 1981.

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

Table-mounting routers

I am planning to purchase a dedicated, variable-speed, heavy-duty router for the router table that I'm building. What type of router is better suited for router tables, plunge router or standard router, and why? *—Ted Zogrotzki, Penn Valley, Pa.*

Pat Warner replies: The best choice by far for a router table is the fixed base Porter Cable 7518 because the motor is easily extracted from the base for bit changes. And this tool has more vertical motor travel (more than 3½ in.) than any router whether plunge or fixed base. The 7518 (and 7519) has the biggest and most durable casting of any router, and it's drilled and tapped for the largest screws of any router (5/16-18). When this casting is fastened to the underside of a router tabletop, it acts as a heavy mending plate and aids in flattening and strengthening the top. This heavy-duty, soft-start, multi-speed tool can run for extended periods (hours) on the toughest of materials (e.g. plastic, hardwood and aluminum).

I would not use a plunge router in a router table. A plunge router is primarily a multi-depth tool, and the router table is typically a

single-depth machine. Therefore, the rapid, multi-depth advantage of the plunge router is lost. Also, plunge routers don't easily separate from their bases, so the routers are usually mounted to a large piece of plastic and hung through a big hole in the router table to make bit changing easier. For precision joinery, a router tabletop must be very flat. If the top has a big hole in it, the integrity and equilibrium of the slab is lost. Moreover, the interruptions of the mounting plate guarantee a bumpy ride for the stock as it passes over the tabletop. Also, plunge routers use 4mm screws to mount the subbase. Although adequate for this purpose, these screws are rather lightweight for suspending a heavy router. [Pat Warner is a woodworker in Escondido, Calif.]

Restoring obsolete equipment

I purchased a 1940s Walker-Turner, fixed-arm, 26-in. scrollsaw. I want to take it apart and restore or update it with newer components because it is a tool I use on a regular basis. I've had no luck in finding parts, owner's manual or any information on this particular machine.

—William Belisle, Southampton, Mass.

Robert Vaughan replies: The Walker-Turner scrollsaw you have can be restored into a fine machine. This machine is similar in size and quality to the Delta model that sells for around $1,200.

There are no commercial sources for original parts specifically made for that scrollsaw. Finding parts illustrations or operation manuals is a matter of finding someone who might have a stash of old Walker-Turner manuals.

Restoring an obsolete machine is a do-it-yourself proposition. The market for parts isn't perceived strong enough to justify anyone's investment in inventory, technically competent employees and research and development.

A job shop that does machinery rebuilding will be your best bet to correct really serious problems. Power transmission distributors can help with simple stuff such as pulleys and belts. Looking over currently made machines may offer opportunities to buy existing parts and have them modified to fit your obsolete machine. [Robert Vaughan is a contributing editor to *FWW* and a woodworking machinery rehabilitation specialist in Roanoke, Va.]

Editor's note: The following sources have proven helpful in the past in supplying old machinery parts and manuals (if you have a favorite source, please send information to Charley Robinson, *Fine Woodworking*, P.O. Box 5506, Newtown, Conn. 06470-5506):

Boshco, 42 Manning Road, Billerica, Mass. 01821; (508) 667-1911

Classified Exchange, P.O. Box 34908, Memphis, Tenn. 38134; (901) 372-8166

Ed Mueller Co., 101 East Benson St., Cincinnati, Ohio 45215; (800) 642-5656

Lumberman's Exchange, P.O. Box 1759, Columbia, Tenn. 38402; (800) 821-9199

Peeco, Division of Woodworkers Equipment and Machine Co., P.O. Box 148, Olin, N.C. 28660; (800) 726-3613

SLI Parts and Service Corp., 1600 South Division, Grand Rapids, Mich. 49507; (800) 274-1266

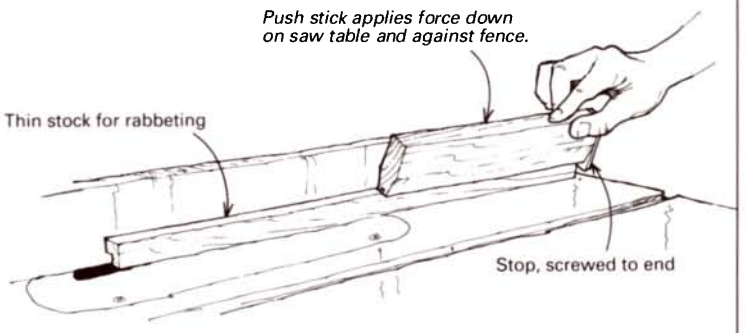
Wolfe Machinery, 6107 Merle Hay Road, Johnston, Ia. 50131; (800) 345-6659

Woodworking Machinery Distributors Association, Adams Building, Suite 109, 251 W. DeKalb Pike, King of Prussia, Penn. 19406; (215) 265-6658

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

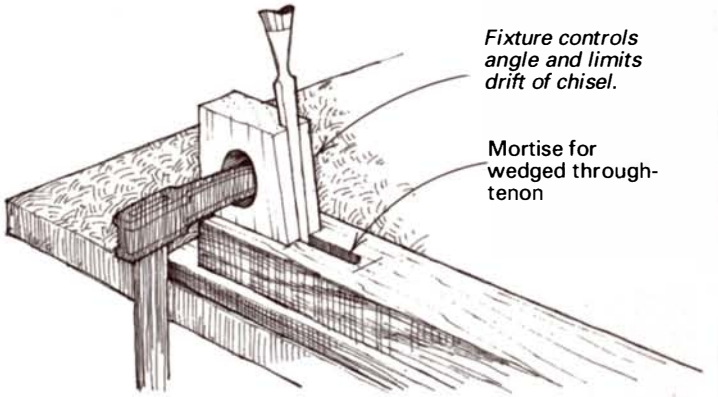
edited and drawn by Jim Richey

Follow up: push stick for rabbeting thin pieces



In the August, 1993 "Methods of Work" (*FWW* #101, p. 18), we showed Abijah Reed's custom push stick for advancing long, thin pieces, such as picture frame parts, through the saw. We incorrectly illustrated the device being used for ripping a thin piece. The intended use for the push stick, as Mr. Reed and others have pointed out, is strictly for slotting or rabbeting, as shown in the drawing above. The blade should not protrude above the workpiece. *—Alec Waters, assistant editor*

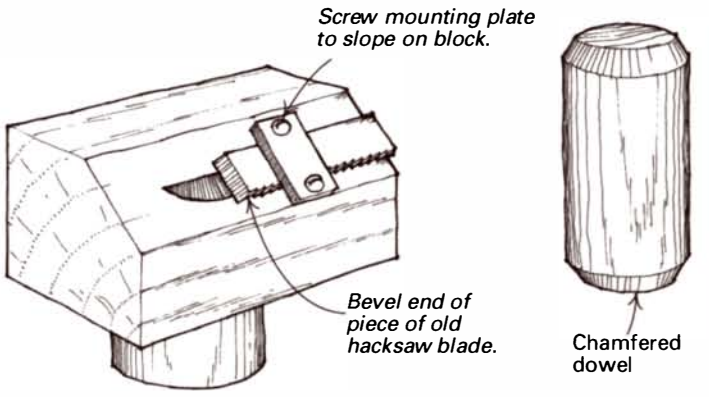
Chopping mortises for wedged tenons



A design for sofas and chairs our shop recently built specified that the arms be attached to the front legs by wedged through-tenons. I solved the problem of cutting a mortise with consistently tapered ends for the wedges by first wasting most of the mortise with a plunge router. Then I chopped out the ends of the mortise with a sharp chisel guided by this fixture (above) that controlled the chisel angle and its lateral drift.

—Joseph M. Wilson, Pictou, N.S., Canada

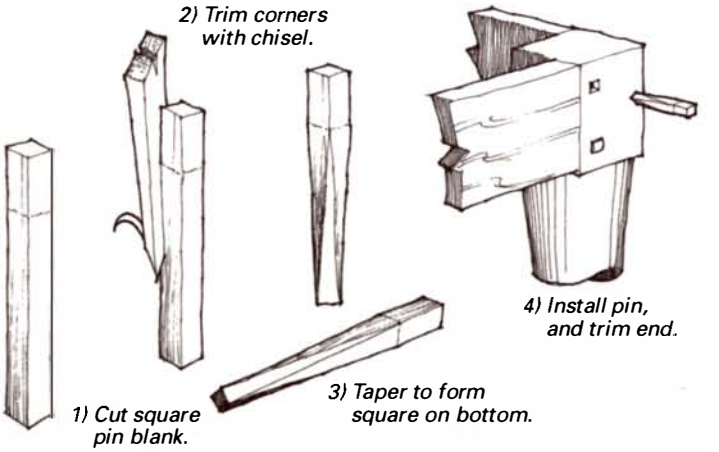
End-chamfering fixture for dowels



To cut a chamfer on the end of a wooden pin or dowel, I made this fixture using an old hacksaw blade. To make the cutter, drill a half-blind hole into a wooden block. Then bevel the top of the block 45° to reveal a slight opening at the bottom of the hole that you've drilled. Break off a short length of a hacksaw blade, and bevel an end on a grinder and sharpening stones. Fix the blade on the block's slope with a mounting plate, as shown in the drawing below left. The depth of cut is determined by the amount the blade overlaps the opening.

To use the cutter, simply insert a dowel into the hole and turn. If you want a really smooth cut, make a first cut with a cardboard spacer in the bottom of the hole. Then remove the spacer, and make the final cut. *—Osamu Otake, Nagano, Japan*

Square-headed tenon pins



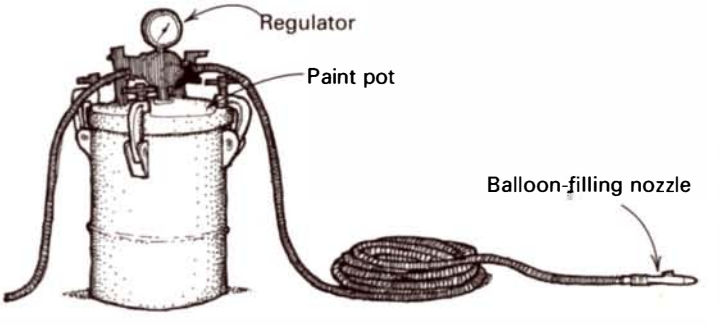
A mortise-and-tenon frame isn't complete unless the tenons are pinned. Square-headed pins strengthen the joint and add visual interest, and they also feel right. Here's how I do it:

With the rails clamped tightly in the frame, I drill the pin holes through the mortise cheeks and the tenon, all equal depth with a ¼-in. bit. If you want to emphasize the square corners of the pin, square up each pin hole at the top with a ¼-in chisel. To cut the pin blanks, I use the drill bit as a gauge and set the saw fence exactly ¼ in. from the blade. I raise the blade just over ¼ in., and rip several lengths of ¼-in.-sq. pin stock from some hardwood such as oak. I cut the pin blanks to length by adding ½ in. to the depth of the pin hole, and draw a pencil line on the pin blanks to show the hole depth.

Now I taper the pin by shaving each corner with a sharp chisel. I start at the depth mark and pare progressively deeper as I push to the bottom of the pin, taking two or three slices per corner. When the taper is right, the bottom of the pin will have a square cross section that's smaller than the top of the pin blank. Next I put a dab of glue in the hole and pound each pin into place, taking care to align the corners of the pin with the square hole. The pin should have just the right amount of resistance as it bottoms out. When I trim, I leave about 1/16 in. of the pin proud, which makes a nicely rounded head when sanded.

—Larry Joseph, Alva, Okla.

Production glue pot



In our speaker-making plant, we use lots of polyvinyl-based glue. It all starts in a Binks Paint Pot, goes through a regular ⅜-in. air hose and exits through at a helium balloon-filling nozzle (available at welding supply stores). To prevent rust in the

A few feet or so from a 1940 Delta Bench Drill Press stands another "sure-to-be" Delta heirloom. The new Delta Sanding Center™ Belt/Disc Sander.

George Reid, master craftsman and furniture historian, admits he's never seen anything quite like it. A machine capable of precision edge-sanding a 24" diameter circle.(48" with accessory extension.) With a 6"x 48" belt and 12" disc, accompanied by a power take-off shaft that handles dozens of accessories. Like pneumatic drums, flap wheels, buffing wheels and a flexible shaft, just to name a few. And a hefty cast iron base that incorporates single port dust collection.

In his 51 years of working with wood, Mr. Reid has created scores of perfect historical reproductions and original heirlooms, both full size and miniature, using his old Delta machines. And at age 78, George isn't about to back away from a new idea like the Delta Sanding Center. He points out, "This time Delta's put everything into one machine."

For more information on the Sanding Center or the name of your nearest Delta dealer, call toll free: Delta International Machinery Corp., Pittsburgh, PA, 800-438-2486. In Canada, 519-836-2840.

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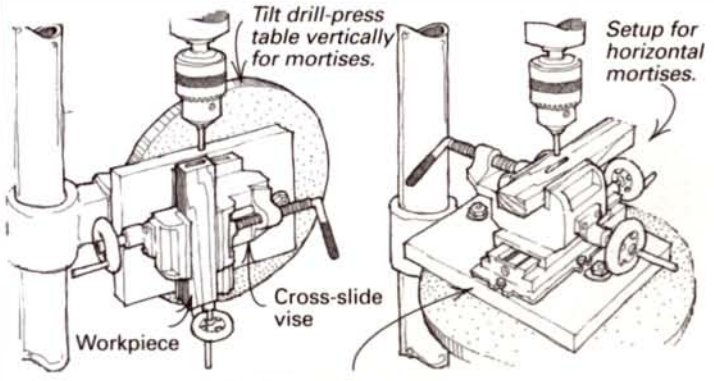
paint pot, we sprayed some cold galvanizing compound on the inside of the top and always use a paint-pot liner.

–Chuck Waugh, Boring, Ore.

Drill-press mortising

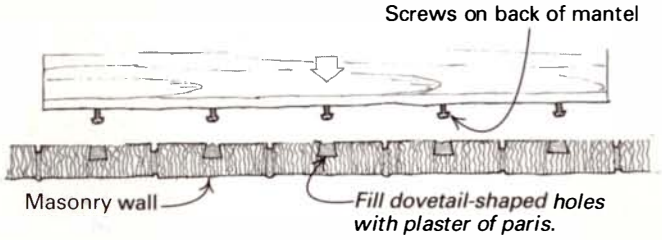


Inspired by Ken Picou's loose-tenon joinery and Ross Day's shop-built mortiser (*FWW* #98, p. 46), I turned my drill press into a mortiser by adapting a cross-slide vise.

I lag-bolted the vise securely to a heavy piece of oak, which, in turn, I bolted to the drill-press table. My drill press, a popular import model, has a round table that can pivot. This feature allows me to position the cross-slide vise for either horizontal or vertical mortises.

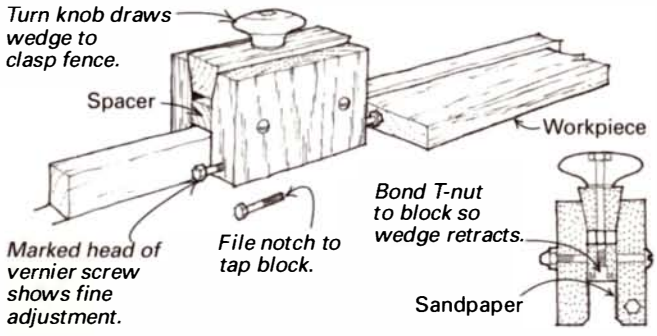
I set the drill press at its highest speed (3,200 rpm) to cut the mortise quickly and cleanly. *–John F. Clemens, St. Louis, Mo.*

Plaster of paris fastening system



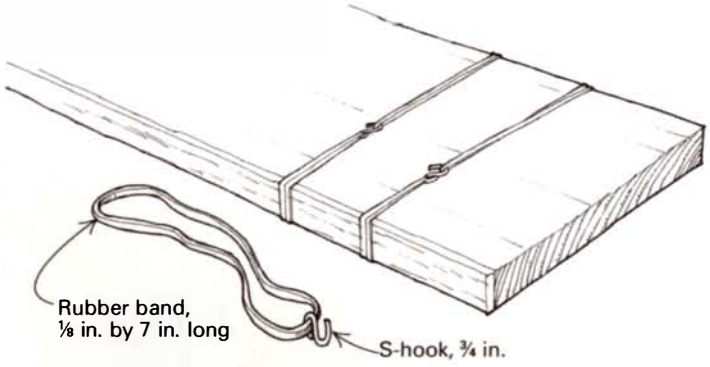
This technique for mounting fireplace mantels to brick walls adapts to many other applications where strong but hidden fastening is needed. Screw several large sheet-metal screws into the underside of the finished piece to be attached. For each screw, drill a mating hole into the brick or stone. Enlarge the bottom of the holes (to form a dovetail shape) by redrilling several times at an angle. Fill the hole with wet plaster of paris, and quickly place the screws into it. The soft plaster will harden in just a few minutes. *–Gene Carson, Blackburg, Va.*

Wedge-tightened stop block



This easy-to-set radial-arm-saw stop block incorporates two useful features: a wedge-tightening mechanism and a vernier screw for fine adjustment. I use the fine adjustment to correct trial cuts. The stop's chamfered inside edges allow for sawdust clearance, and the sandpaper provides grip on either the left or right fence. *–Francis Chan, Nassau Bay, Texas*

Rubber-band clamps

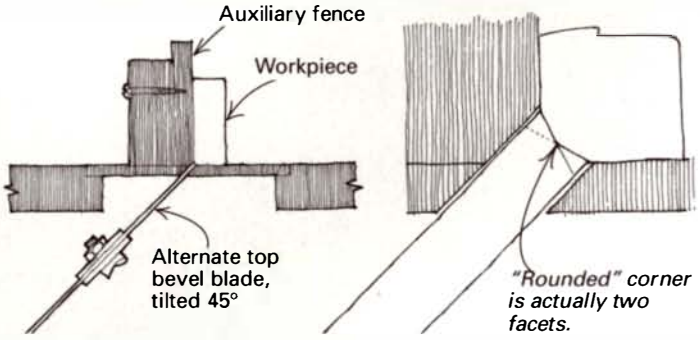


A woodworking friend of mine once grumbled that he wished he were in Heaven because "In Heaven they have enough clamps." This common lament came back to me recently as I attempted to glue edging strips to plywood shelves with too few clamps. So I decided to try to make some clamps using rubber bands and hooks.

A trip to the stationery store revealed that rubber bands come in many different sizes and styles. I bought a box of the largest they had, which were about ⅛ in. wide and 7 in. long. A trip to the hardware store yielded a supply of ¾-in., open S-hooks. I attached a hook to each rubber band by bending the hook closed using a pair of pliers. The other end of the hook stays open to clasp the other end of the same rubber band.

–John B. Moon, Mount Vernon, Wash.

Rounding over the edges of small boards



Because I couldn't find an appropriate router bit for putting a tiny radius on the edges of small boards, I came up with this method using a tablesaw, which cuts a corner that's less than ⅛ in. on a wooden workpiece. First install a standard alternate top bevel (ATB) sawblade in your tablesaw. ATB blades are fitted with beveled teeth and have no square raker teeth. Set the blade angle to 45°, and use a machinable wooden fence and table insert. Adjust the fence so that the blade's centerline will travel exactly into the square edge of your workpiece. Some eyeballing and trial and error may be required to position the fence. Adjust the radius up to about ⅛ in. by cranking the blade into the edge.

What you are actually getting are two facets along the corner. On this small a scale, the edge looks and feels virtually round, especially if you sand lightly.

–Per Madsen, San Francisco, Calif.

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

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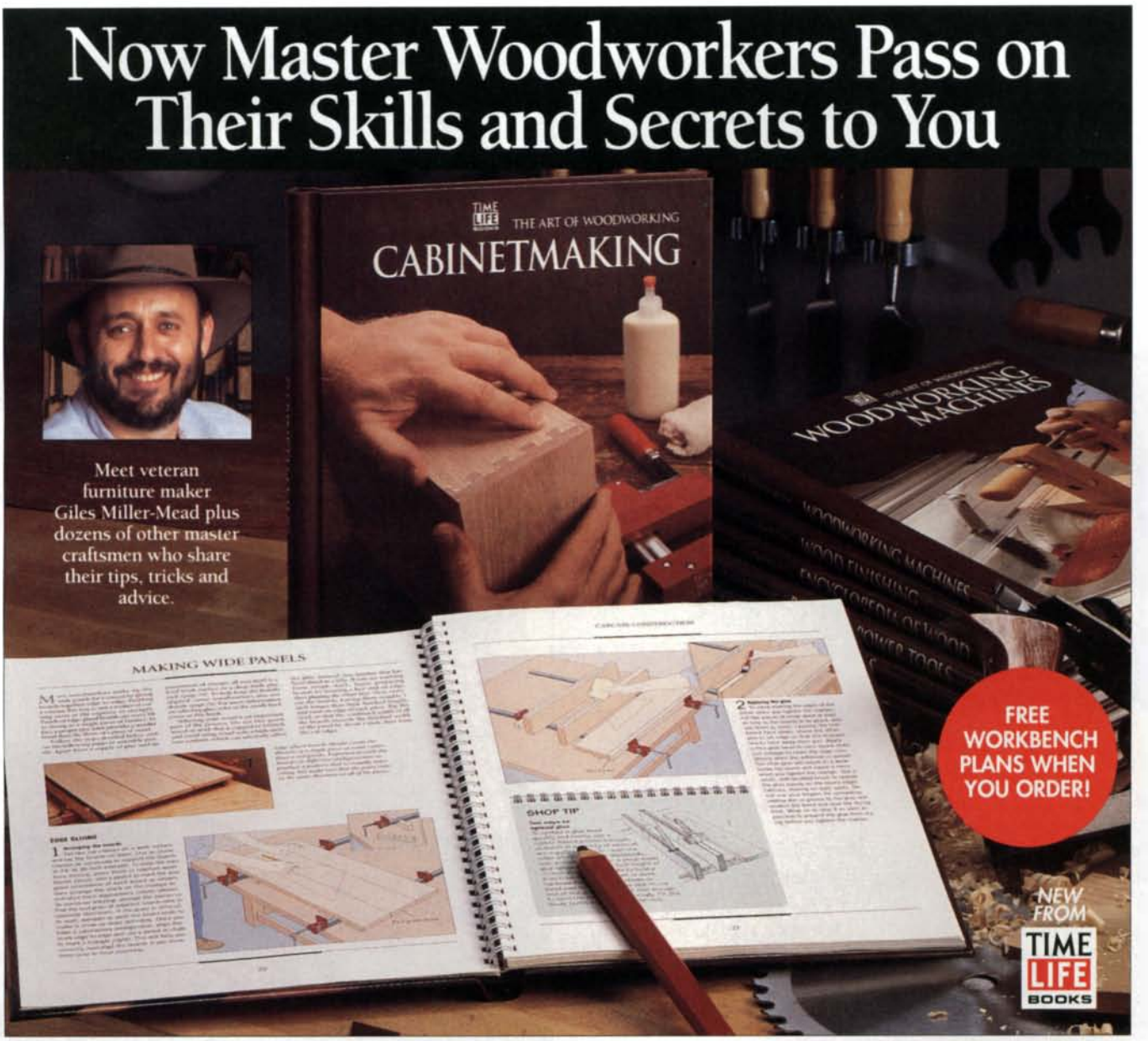

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JORGENSEN CLAMPS

STYLE 35 ALUMINUM BAR CLAMPS

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

ADJUSTABLE HANDSCREW KITS

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

ADJUSTABLE HANDSCREWS

Item#	Jaw Length	Opening Capacity	List	Sale	Box of 6
#5/0	4"	2"	13.80	8.35	48.59
#4/0	5"	2-1/2"	14.80	8.95	51.99
#3/0	6"	3"	15.90	9.59	55.75
#2/0	7"	3-1/2"	17.10	10.35	58.95
#0	8"	4-1/2"	19.00	11.75	68.00
#1	10"	6"	21.76	12.50	68.00
#2	12"	8-1/2"	24.95	14.50	78.00
#3	14"	10"	31.61	18.00	99.00
#4	16"	12"	42.30	23.95	139.00

STYLE 37 2-1/2"Throat 1/4"x3/4" Bar

Item#	Bar Length	List	Sale	Box of 6
3706	6"	9.86	6.05	32.50
3712	12"	10.92	6.50	35.10
3718	18"	12.05	6.99	37.75
3724	24"	13.16	7.99	42.50
3730	30"	14.70	8.85	47.75
3736	36"	16.05	9.99	53.95

STYLE 36 - STYLE 37 CLAMP W/E-Z HOLD

Item#	Bar Length	List	Sale	Box of 6
3606	6"	18.95	11.75	65.95
3612	12"	20.09	12.49	69.95
3618	18"	21.95	13.65	76.95
3624	24"	27.08	15.45	85.95
3630	30"	29.42	16.85	95.95
3636	36"	35.09	18.25	103.95

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

Item	Bar Length	List	Sale	Lots of6
4512	12"	30.07	19.39	109.99
4518	18"	31.73	20.45	116.99
4524	24"	33.55	21.75	123.99

PONY CLAMP FIXTURES

Model	Description	List	Sale	Lots of 12
50	3/4" Black Pipe Clamps	13.61	7.75	83.99
52	1/2" Black Pipe Clamps	11.37	6.40	68.50
53	Double 3/4" Pipe Clamps	38.50	24.45	274.00

STEEL "I" BAR CLAMPS

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

PRAZI BEAM CUTTER

PR-7000	12" beam cutter for worm drive saws	149	124

SKIL

4540	Jig Saw v/spd adjust. straight line	126	85
4560-02	Var. spd Jig Saw auto-scroll w/cse.	144	95
4580-02	Var. spd & vari-orbit Jig Saw w/cs.	162	105
7102	"Sandcat" 2-1/2" x 16" Belt Sander	74	57
7313	3" x 18" Belt Sander	84	65
7621	3" x 21" var. speed Bett Sander	238	149
7575	1/4 sheet Palm Sander	74	54
7576	above Sander with bag	80	58
1605-02	Biscuit Joiner with case	221	129
2735-04	12 volt cordless Drill with charger, case, and 2 batteries	249	132
2736-04	2735-04 w/keyless chuck	269	135
7484	5" Random Orbit Sander	153	104
5250	2-1/4 HP Circular Saw	81	65
5350	2-1/3 HP Circular Saw	100	75
5750	7-1/4" Circular Saw drop foot	254	159
3810	10" Mitre Saw 15 amp	359	205
3810K	3810 w/60 tooth carbide blade	Sale	229
5825	6-1/2" Worm Drive Saw	257	158
5660	NEW 8-1/4" 60° Circular Saw	230	144
5510	5-1/2" Circular Saw	165	110
77	7-1/4" Worm Drive Saw	257	144
77:04	7-1/4" Worm Drive Saw Kit complete with case 24 tooth carbide blade & adjustable rip fence	292	189
5860	NEW 8-1/4" 60° Worm Saw	282	169
5790	10-1/4" Circ. Saw 15 amp	472	289
5657	NEW 7-1/4" Circ Saw - pivot foot	205	118
5525	NEW 6-1/2" Circ Saw - big capacity	173	98
3400	10" Table Saw - Bench Top	270	179
3330	16" Scroll Saw - Bench Top	205	135
3370	4" Belt/6" Disc Sander - Bench Top	205	135
3380	8" Drill Press - Bench Top	205	138

HITACHI TOOLS

Model	Description	List	Sale
C7SB	7-1/4" Circular Saw	216	115
C7BD	7-1/4" Circular Saw with brake	235	124
K10001	Hitachi Steel case for above saws		14.99
M12V	3 HP variable speed Router	477	225
TR12	Plunge Router 3 HP	355	174
F1000A	12" Planer/6" Jointer	2774	1549
P12R	12-9/32" Planer	1425	719
P12RA	12-9/32" Planer/6-1/8" Jointer	1880	910
C10FA	10" Deluxe Mitre Saw	553	299
C12FA	12" Mitre Saw	600	315
C8FB	8-1/2" Slide Compound Saw	1026	599
FREUD LU91M008	8-1/2" carb. blade 48 tooth	68	43
C15FB	15" Mitre Saw	773	635
FREUD LU85M015	15" carb. blade 108 tooth	145	105
F20A	3-1/4" Planer 3.4 amp	179	95
G12SA	4-1/2" Grinder 6.9 amp	147	75
DS10DVAK	12 volt cdls Drill Kit w/2 batt	383	189

Hitachi Air Tools

NR83A	Framing Nailer 2" - 3-1/2" Full Head	680	379
NR83AA	Framing Nailer 2" - 3-1/2" Clip Head	740	409
NT65A	16 ga. Brad Nailer 1" - 2-1/2"	590	318
NT45A	18 ga. Brad Nailer 13/16" - 1-3/4"	484	269
NV45AB	Coil Roofing Nailer 7/8" - 1-3/4"	740	379
NV83A	Coil Nailer 2" - 3-1/4"	740	409
NV50A1	Coil Nailer 1-1/4" - 2"	534	305
N5008AA	7/16" Stapler - 16 ga. 1" - 2" lgth	578	309
N3824A1	1" Stapler 16 ga. 1/2" - 1-1/2"	626	335

QUAL-CRAFT JACKS

2200	Pump Jack	79	58
2201	Pump Jack Brace	30	20
2203	Pump Jack guard rail holder	31	21
2204	Work Bench & rail holder combo	53	39

Buy any 6 (can be assorted) deduct additional 10%

2601	Wall Jack	167	108

Lots of 4 deduct additional 10%

WEDGE SMART LEVEL

SM-PR2	2 FT Level with sensor and case	120	88
SM-PR4	4 FT Level with sensor and case	150	105
SM-PR6	78" Level with sensor and case	180	139
SL209	NEW 9" Torpedo Level w/sensor	69	45
SL224	NEW 2 FT Level with sensor	79	55
SL248	NEW 4 FT Level with sensor	95	65

AEG POWER TOOLS

VSRE500K	V/spd 5" Random Sndr w/cse	279	149
VSRE600K	V/spd 6" Random Sndr w/cse	284	155
HBSE75S	3" x 21" variable speed Belt Sander	299	168
ABSE15S1	1/2" cdls 12 volt Drill complete w/cse	389	174
FSPE100	Barrell Grip v/spd Jig Saw	265	145
BSPE100K	Top Hdle v/spd Jig Saw w/cse	275	148
EZ560	3/8" cordless 7.2 volt Drill 2 speed	205	139
OFS50	1HP Plunge Router	299	135
TXE150	New 6" var/spd Rand Orb Sander	220	139
SKS300	NEW 10" Compound Mitre Saw	999	499

DREMEL TOOLS

3950	Moto Tool Kit with bits & case	129	79
3952	Super Moto Tool Kit with accessories	145	95
1671	16" Scroll Saw- 2 speed "Bestbuy"	278	169
1695	NEW 16" var. speed Scroll Saw	398	219
290	Electric Engraver with point	24	16
8508	Cordless Moto Tool Kit with case	104	59
1731	5" Disc\1" x 30" Belt Sander	178	114

FEIN

Msx636	Oscillating Triangle Sander	Sale	185

PONY

LPN672	Air Palm Nailer with glove	Sale	94.99

BOSTITCH AIR NAILERS

Model	Description	List	Sale
N80S-1	Stick Nailer	Super Sale	348
N12B-1	Coil Roofing Nailer	845	395
N60FN-2	Finishing Nailer 1-1/4" - 2-1/2"	625	335
T50S4-1	Decking & Sheathing Stapler	595	345
MIIIFS	Flooring Stapler 15 ga	895	525
N100S	Stick Nailer 2" - 4"	895	555
T31	Brad Nailer 5/8" - 1"	270	145
CWC1001	HP Pancake Compressor	445	289

SENCO AIR NAILERS

SFN1	Finishing Nailer 1" - 2"	377	269
SFN2	Finish. Nailer 1-1/2" - 2-1/2"	571	375
SN325	Nailer 1-7/8" - 3-1/4"	665	425
SLP20	NEW Pinner w/case 5/8" - 1-5/8"	399	269
SKS	Stapler 5/8" - 1-1/2" - 1/4" crown	351	245
M2	Stapler 1/16" wide - 1-3/8" - 2" length	490	345
SN70	NEW HD Framing Nailer 2" - 3-1/2"	625	475

Not available in all states

PASLODE IMPULSE GUNS

IM250	Trimpulse Finish Nailer Kit complete drives 3/4" - 2-1/2" brads	849	595
IM325	Impulse Framing Nailer Kit complete drives 2" - 3-1/4" nails	849	595
IM-200-S16	Impulse Siding Stapler	849	629
402500	Extra battery	Sale	38.95
402502	No-Mar Work contact element	Sale	19.25

Paslode Nailers not available in MN, WI, IA

REMINGTON POWER FASTENING TOOLS

75707	476 Power Hammer with case	35	28
77550	480 Power Driver with case	169	104
78480	482 Multi Driver with case	369	235

PORTA NAILER

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

SIOUX TOOLS

8030	New 3/8" variable speed Drill	238	139
8000	3/8" var/spd close quarter Drill	201	123
690	5" Air Random Orbit Sander	139	132
690V	690 with vacuum pick up	250	155
690VV	690 w/NEW venturi dust collection	281	175
658	5" Air Random Sander - dual action	261	155

LAMELLO BISCUIT JOINTERS

TOP 10	"Simply the Best"	699	538
STANDARD 10	"Professionals Choice"	499	399

RECORD WOODWORKING VISES

Model	Jaw Width\Opening	List	Sale
53E	10-1/2"\15" Quick release	189	109
52D	7"\8" Quick release w/dog	137	85
52-1/2D	9"\13" Quick release w/dog	175	105

WAGNER PRODUCTS

120	Power Sprayer	70	57
CP	Cordless Painter	100	79
230HD	Power Painter/Sprayer	100	84
959	Power Roller	140	105
255	Airless Kit	180	130
375E	Airless System	195	155
404	Airless Painter & Roller	320	249
505	High performance Airless Painter	440	369
550	Professional Airless Painting System	769	685
HVLP	Fine coat finishing HVLP System	195	155
CS2000	Professional fine finish HVLP System	339	269

BLACK & DECKER

Model	Description	List	Sale
1166	3/8" Drill 0-2500 rpm 4 amp	105	65
4011	1/4 sheet Palm Sander	86	59
2600	3/8" Drill rev. 0-1200 rpm 4.5 amp	149	89
1180	3/8" Drill rev. 0-1200 rpm 5 amp	197	108
1321	1/2" Spade handle Drill 450rpm 7amp	307	174
1349-09	1/2" Timberwolf Drill 2 speed	513	285
2037	Drywall Gun 0-4000 5.0 amp	184	98
2038	Drywall Gun 0-2500 rpm 5 amp	184	99
2054	Tek Gun 0-2500 5.0 amp	282	152
2050	Tek Gun 0-900 5.0 amp	283	158
2660	Drywall Gun 0-4000 4.5 amp	149	78
2665K	3/8" cordless 12V Cyclone Drill	294	158
2750	4-1/2" Grinder 10,000rpm 6 amp	156	83
3157	Orbital var. speed Jig Saw 4.5 amp	231	145
1703-1	10" Mitre Saw w/73-770 blade&bag	329	185
79-032	Workmate 200	121	79
79-033	Workmate 300	140	89
79-034	Workmate 400	177	109
1180	3/8" Drill rev. 0-1200 rpm 5 amp	192	108
2694	7-1/4" Super Sawcat Circ Saw w/cse.	275	152
2695	8-1/4" "Super Sawcat" Circ Saw w/cse.	308	158

Piranha Carbide Tooth Saw Blade

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

ELU by Black & Decker

3338	2-1/4 HP Plunge Router var. speed	448	249	4024	3"x21" variable speed Belt Sander	338	179
3304	1 HP variable speed Plunge Router	307	164	4029	4"x24" Belt Sander	519	239
3375	3-1/8" Universal Planer 7.2 amp	329	155	4015	1/2 sheet Sander 3.0 amp	220	129
3380	Biscuit Jointer with case	569	248	3339	NEW 3 HP var. speed Plunge Router	500	265

READER SERVICE NO. 77

KIT SPECIALS

SAW KITS

Model	Description	Special Sale
1581VSK	Bosch Top handle Jig Saw with case & 30 Bosch blades	175
1582VSK	Bosch CLIC barrel grip Jig Saw with case & 30 Bosch blades	175
TS254K	Ryobi 10" Mitre Saw with accessory kit and Black & Decker 73-770 60 tooth blade	259

SANDER KITS

7334K	Porter Cable 5" Random Orbit Sander w/case & 1 roll 100X & 1 roll 150X discs	159
7335K	Porter Cable 5" v/spd Rndm Orb Sander w/case & 1 roll 100X & 1 roll 150X discs	169
7336K	Porter Cable 6" v/spd Rndm Orb Sander w/case & 1 roll 100X & 1 roll 150X discs	175

CORDLESS DRILL KITS

9852K	Porter Cable 9852 Drill Kit Includes: extra Porter Cable battery	185
9853K	Porter Cable 9853 keyless Drill Kit Includes: extra Porter Cable battery	185
9855K	Porter Cable 1/2" cordless Drill Kit. Includes: extra Porter Cable battery	219

BISCUIT JOINER KITS

555K	Porter Cable Plate Biscuit Joiner with case, tilt fence, & 1000 assorted biscuits	195
JS100K	Freud Plate Biscuit Joiner with case & 1000 assorted biscuits **($30.00 Rebate)**	188
JM100KK	Ryobi Plate Biscuit Joiner with case and 1000 assorted biscuits	242
1605-02K	Skil Plate Biscuit Joiner with case and 1000 assorted biscuits	155

DEWALT

Model	Description	List	Sale
DW944K-2	3/8" 9.6V cordless drill kit w/2 batteries	277	144
DW945K-2	3/8" 12V cordless drill kit w/2 batteries	298	169
DW364	7-1/4" Circ. Saw with brake, 13 amp	275	145
DW306K	8.0 amp Recip Saw with case var. speed	282	155
DW610	1-1/2 HP 2 handle Router	270	148
DW411	1/4 sheet Palm Sander, 1.7 amp	97	58
DW705	12" Compound Mitre Saw	658	358
DW704	12" Mitre Saw	560	298
DW100	3/8" Drill, 4 amp, 0-2500 rpm, rev	116	68
DW250	4.5A Drywall Gun, 0-4000 rpm, rev	162	88
DW947K	3/8" 13.2 volt cordless Drill Kit	380	205
DW318K	Top Handle Jig Saw with case	258	144
DW254	4.5A Drywall Gun, 0-2500 rpm, rev	162	88
DW402	4-1/2" Grinder 6 amp	158	94
DW682K	New Biscuit Joiner with case	428	225
DW614	NEW 1-1/4 HP Plunge Router	250	144
DW615	NEW 1-1/4 HP Electronic Plunge Router	290	158
DW624	NEW 3 HP Plunge Router	440	245

SUPER SPECIAL

DW625 NEW 3 HP v/spd Plunge Router **Sale** 269

DW675K	NEW 3-1/8" Planer with case	280	159
DW430	NEW 3" x 21" Belt Sander	290	165
DW431	NEW 3" x 21" variable speed Belt Sander	320	182

RYOBI

Model	Description	List	Sale
JP-155	6-1/8" Jointer/Planer	648	305
TS-254	10" Mitre Saw	420	198
TS-254K	above Saw with access. kit & B&D 73-770 carbide blade	510	259
AP10	10" Surface Planer 13 amp	794	379
RE600	3 HP Plunge Router var speed	465	215
BE321	3" x 21" var. speed Belt Sander	290	135
SC160	NEW 16" Bench Scroll Saw	282	135
TFD172VRK	9.6 volt cordless Drill Kit w/2 batteries	292	154
TFD222VRK	12 volt cordless Drill Kit w/2 batteries	325	172
JM100K	Biscuit Jointer with case	453	209
RS115	4-1/2" v/spd Random Orbit Sander	136	78
BT3000	NEW 10" Table Saw with stand	1204	545
W660C	BEST BUY 7-1/4" Circ Saw 13A	184	88
TSS220	8-1/2" Slide Comp. Saw	966	445
TS260	10" Compound Mitre Saw	486	239
BE424	4" x 24" var. spd Belt Sander	376	179
TR30U	3/4 HP Trimmer	170	85
DS1000	NEW Detail Sander	90	44
S550	1/6 sheet Palm Sander	82	54
RS112	Palm grip Random Orb Sander	90	55
AP12	NEW 12" Bench Planer	884	399
JS45	NEW Top Hdle Jig Saw v/spd	98	69
TDS4000K	NEW 12V Drywall Gun kit 2 spd	368	215
RA202	NEW 8-1/4" Bench Radial Arm Saw	695	389
BS900	NEW 9" Bench Band Saw	298	174
IDV28	NEW 28 Gal. Industrial Dry Vac	198	119
OSS450	NEW Oscillating Spindle Sander	298	174

WERNER LADDERS

Introducing a full range of Werner brand ladders at discounted prices! Werner ladders - A name you can stand on.

WOODEN STEP - TYPE IA- 300# RATING

Model	Size	Weight(lbs)	Sale
W394	4'	21#	53.95
W395	5'	26#	55.95
W396	6'	32#	66.95

ALUMINUM STEP - TYPE 1A- 300# RATING

404	4'	16#	65.95
405	5'	20#	77.95
406	6'	24#	92.95

FIBERGLASS STEP - TYPE 1- 250# RATING

6004	4'	13#	53.95
6005	5'	16#	64.95
6006	6'	18#	67.95

FIBERGLASS STEP - TYPE 1- 250# RATING

6004-S w/pail shelf	4'	15#	59.95
6005-S w/pail shelf	5'	18#	69.95
6006-S w/pail shelf	6'	20#	73.95

FIBERGLASS STEP - TYPE 1A- 300# RATING

6204	4'	14#	65.00
6205	5'	18#	75.00
6206	6'	20#	82.00

ALUMINUM FLAT STEP TYPE 2- 225# RATED EXTEN.

Model	Size	Working Length	Weight(lbs)	Sale
D1216-2	16'	13'	22#	117.95
D1220-2	20'	17'	27#	135.95
D1224-2	24'	21'	33#	159.95
D1228-2	28'	25'	42#	185.95
D1232-2	32'	29'	53#	209.95
D1236-2	36'	32'	62#	239.95
D1240-2	40'	35'	73#	298.95

ALUMINUM FLAT STEP TYPE 1- 250# RATED EXTEN.

Model	Size	Working Length	Weight(lbs)	Sale
D1316-2	16'	13'	26#	127.95
D1320-2	20'	17'	32#	152.95
D1324-2	24'	21'	39#	169.95
D1328-2	28'	25'	50#	199.95
D1332-2	32'	29'	62#	235.00
D1336-2	36'	32'	77#	299.95
D1340-2	40'	35'	85#	329.95

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

D1516-2	16'	13'	31#	159.95
D1520-2	20'	17'	37#	169.95
D1524-2	24'	21'	45#	199.95
D1528-2	28'	25'	56#	219.95
D1532-2	32'	29'	66#	259.95
D1536-2	36'	32'(250# rating)	79#	309.95
D1540-2	40'	35'(250# rating)	89#	349.95

ALUMINUM FLAT STEP TYPE 1A+ 300# RATING

D520-2	20'	17'	42#	209.95
D524-2	24'	21'	49#	239.95
D528-2	28'	25'	66#	279.95
D532-2	32'	29'	74#	319.95
D536-2	36'	32'	89#	369.95
D540-2	40'	35'	99#	419.95

FIBERGLASS FLAT STEP TYPE 1A- 300# RATING

D6116-2	16'	13'	34#	179.95
D6120-2	20'	17'	40#	199.95
D6124-2	24'	21'	53#	239.95
D6128-2	28'	25'	60#	269.95
D6132-2	32'	29'	74#	309.95

FIBERGLASS FLAT STEP TYPE 1A- 300# XTRA HEAVY

D7116-2	16'	13'	37#	209.95
D7120-2	20'	17'	43#	245.95
D7124-2	24'	21'	58#	279.95
D7128-2	28'	25'	66#	309.95
D7132-2	32'	29'	79#	369.95

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

PANASONIC

Model	Description	List	Sale
EY6205BC	Variable speed 12 volt Drill with 15 minute charger & case	353	179
EY6205EQK	Same as EY6205BC but comes with NEW **Ironman** battery	368	189
EY6200BC	2 speed 12 volt Drill D-handle with 15 minute charger & case	336	178
EY6282EQK	Var. spd 9.6 volt Drill with 15 min. charger, case, and NEW **Ironman** battery	315	168
EY62821DKW	9.6 volt Drill Kit w/2 batteries	275	158

Ironman Battery = Battery has 40% more life and 20% more torque!

SUPER SPECIAL

EY6181CRKW NEW 9.6V PREDATOR Compact Drill Kit with 2 batteries - 10% more power than EY62821DKW **Sale** 158

EY6100CRKW	**NEW 12V PREDATOR** drill kit with 2 batteries, 1 hr charger, & case	358	189
EY6100EQK	**NEW 12V PREDATOR** drill kit w/NEW **Ironman** battery, 15 min. charger, & case	358	199
EY6900BC	NEW 12 volt Hammer Drill variable speed with 15 minute charger	396	205
EY6207BC	NEW 12 volt 1/2" Drill w/keyless chuck variable speed with 15 minute charger, battery & case	420	222

Most Tools In This Ad Shipped Federal Express for $9.00!

SEE NEXT PAGE FOR MORE SPECIALS!

PORTER CABLE

ROUTERS

Model	Description	List	Sale
630	1 HP Router 6.8 amp	230	129
690	1-1/2 HP Router 10 amp	255	138
9690	690 Router w/steel case	305	149
691	1-1/2 HP Router D handle	280	149
695	1-1/2 HP Router/Shaper	390	218
696	Heavy Duty Shaper Table	225	129
100	7/8 HP Router	185	104
5060	"Stair Ease" Stair Templet	225	139
5061	"Stair Ease" Hard Wood Templet	235	145
5008	Dovetail Template kit	130	85
5009	Mortise & Tenon Jig	75	48
693	1-1/2 HP Plunge Router	315	172
6931	Plunge Router Base	125	77
5116	16" Omni-Jig	465	254
7310	5.6 amp Laminate Trimmer	160	92
7312	5.6 amp Offset Base Lam Trimmer	225	125
7319	5.6 amp Tilt Base Lam Trimmer	180	109
97310	Laminate Trimmer Kit complete	355	195
7518	3-1/4 HP 5 speed Router	495	268
7519	3-1/4 HP 2 handle Router	430	234
7536	2-1/2 HP 2 handle Router	355	198
7537	2-1/2 HP "D" handle Router	375	205
7538	3-1/4 HP Plunge Router	430	234
7539	3-1/4 HP var. spd Plunge Router	495	264

DRYWALL GUNS

7399	Drywall cutout unit 5.6 amp	140	89
43218	3/16" bit for 7399 unit	Sale	6.50
6645	New 0-2500 Drywall Gun 5.2 amp	195	114
6640	0-4000 Drywall Gun 5.2 amp	190	114
2640	0-4000 Drywall Gun 4 amp	140	89

SANDERS

Model	Description	List	Sale
351	3"x21" Belt Sander without bag	270	148
352	3"x21" Belt Sander with bag	280	154
360	3"x24" Belt Sander with bag	350	194
361	3"x24" Belt Sander without bag	330	184
362	4"x24" Belt Sander with bag	365	198
363	4"x24" Belt Sander without bag	345	189
503	3"x24" Belt Sander w/bag Worm Drive	645	344
504	3"x24" Belt Sander Worm Drive	625	334
330	1/4 sheet Palm Sander $10 rebate	105	60
7400	NEW 7" Vertical Grinder 12 amp	250	149
7401	NEW 7" Polisher 8 amp	260	159
7403	NEW 6" Power Paint Remover 8 amp	280	175
74D2	NEW 7" Vertical Disc Sander 8 amp	250	149
505	1/2 sheet Orbital Pad Sander	225	118

RANDOM ORBIT SANDERS

7334	5" Pad 6000 rpm	221	119
7335	5" Pad var. speed 2500-6000 rpm	241	129
7336	6" Pad var. speed 2500-6000 rpm	246	137
73333	Dust Collection Kit	Sale	24.50

SAWS

315-1	7-1/4" Top handle 13 amp Circ. Saw	220	118
9315-1	315-1 comp. w/case & carbide blade	250	139
617	7-1/4" Pushhandle Circ. Saw 13 amp	220	124
9617	617 comp. w/case & carbide blade	250	142
368-1	8-1/4" Top handle Circ. Saw 13 amp	270	149
314	4-1/2" Trim Saw 4.5 amp	250	139
9314	above Saw with case	275	154
345	6" Saw Boss 9 amp	190	104
9345	345 comp. with case & carbide blade	220	119

BISCUIT JOINER

Model	Description	List	Sale
555	Plate Biscuit Joiner with case	320	168

SUPER SPECIAL

556 555Joiner w/5556 tilt fence & 100 bisc **Sale** 175

5554	1000 Assorted Biscuits	Sale	29
5553	1000 #20 Biscuits	Sale	29
5552	1000 #10 Biscuits	Sale	29
5551	1000 #0 Biscuits	Sale	29

PLANERS

320	Abrasive Plane 3 amp	235	119
9118	Porta Plane w/carbide cutter & case	380	209
9652	Versa-Plane w/carbide cutter & case	550	304
9367	367 Planer with case	250	144

DRILLS

7556	1/2" Right Angle 330/700rpm Drill w/cse	375	224
666	0-1200 rpm 3/8" var. speed Drill 4 amp	230	125
9614	1/2" D handle Hammer Drill w/case	355	205
7557	3/8" variable speed angle Drill	340	185
97751	1/2" var. speed Hammer Drill w/case	265	155
2620	3/8" HD var. speed Drill 0-1000 rpm	180	99
6611	New 3/8" Drill 0-1000 rpm 5.5 amp	210	118
6614	New 1/2" Drill 0-750 rpm 5.5 amp	220	124
6615	New 6614 with keyless chuck	220	124

JIG SAWS

7549	Top handle Jig Saw	260	145
7649	Barrel-grip Jig Saw	260	149

RECIPRO SAWS

Model	Description	List	Sale
9627	Recipro Saw 2 speed 8 amp	255	139
9629	Recipro Saw variable speed 8 amp	265	148
9637	Full var/spd Recipro Saw 8 amp	265	148
9647	TIGER CUB Recipro Saw	205	117

NEW TOOLS

9852	12 volt 3/8" Drill w/cse 0-400/0-1000 rpm	280	149
9853	9852 with keyless chuck	210	154
9855	12V 1/2" Drill w/cse 0-350/0-1000 rpm	335	184
8500	12 volt battery for above Drills	69	45
9841	9.6 volt cordless Drill Kit with 15 minute charger, battery, & case	309	169
9840	9.6 volt cordless Drill Kit with 1 hour charger, 2 batteries, & case	289	164
8400	9.6 volt battery for above Drills	65	39
332	Palmgrip Random Orb Sander	116	64
333	above Sander with dust bag	131	68
334	333 sander with PSA pad	131	74
352VS	3" x 21" Belt Sander w/bag var. speed	295	165
7116	24" Omni-Jig	530	294
1700	Heat gun 750° - 1000°	110	69
550	Pocket cutter with case	330	185
7700	10" "Lazerloc" Miter saw	634	339
1400	14" abrasive cut-off machine	372	215
310	Production Laminate Trimmer	250	145
312	Production Offset Laminate Trimmer	295	168
410	Underscribe Trimmer	266	154
347	7-1/4" "Framers" Circ. Saw	225	129
9347	347 Saw with case	255	145
447	7-1/4" "Framers" Circ. Saw w/brake	245	139

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MAKITA

CORDLESS

Model	Description	List	Sale
6070DW	3/8" var. speed rev. Drill 7.2 volt	128	74
6071DWK	3/8" variable speedrev. Drill with removable battery 7.2 volt	216	110
5090DW	3-3/8" Paneling Saw 9.6 volt	270	145
6010DWK	3/8" Drill Kit 7.2 volt	182	99
6010SDW	3/8" Drill 7.2 volt - 3 Hr charge	99	59
4390DW	9.6 volt Recipro. Saw Kit	258	148
ML900	Incandescent Flashlight 9.6 volt	Sale	37
5600DW	6-1/4" Circular Saw 10.8 volt	494	265
6010DL	3/8" Drill with flashlight 7.2 volt	230	118
6891DW	Drywall Gun 0-1400 9.6 volt	270	144
4300DW	Jig Saw Kit comp 9.6 volt	261	145
6710DW	Cordless Screwdvr Kit 7.2 volt	212	115
T220DW	New cordless Stapler Kit 9.6 volt	370	188
DA391DW	3/8" angle Drill Kit 9.6 volt	312	158
6012HDWE	2 speed Drill Kit with 2 batteries	255	129
6092DW	Variable speed Drill kit - no clutch	257	138
6093DW	Variable speed Drill Kit complete	283	139
6093DWE	6093DW Drill Kit with 2 batteries	296	145
6095DW	6093DW Kit with keyless chuck	291	135

SUPER SPECIAL
6095DWE 6095DW Drill Kit w/2 batteries **Sale 139**

6201DWE	NEW 9.6V Drill Kit with 2 batteries	310	155
6211DWE	12V "Mac Pak" Drill Kit w/2 batteries	342	168
6011DW	NEW 12 volt Drill Kit	314	155
632007-4	9.6 volt Battery	48	30
632002-4	7.2 volt Battery	40	28

ROUTERS

3606	2 Handle Router 1 HP	180	105
3620	1-1/4 HP Plunge Router w/case	220	129
3601B	1-3/8 HP Router	288	158
3612BR	3 HP Plunge Router round base	383	169
3612BRA	3612BR Router with brake	524	175

SANDERS

BO4510	1/4 sheet Pad Sander	106	54
BO4530	6" Round Sander	117	59
BO4550	1/4 sheet Pad Sander w/bag	98	49
9035	1/3 sheet Finish Sander	129	69
9045B	1/2 sheet Finish Sander	266	139
9045N	1/2 sheet Sander with bag	288	148
9900B	3"x21" Belt Sander w/bag 7.8amp	297	165
9901	3"x21" Belt Sander w/bag 6.7amp	278	155
9924DB	3"x24" Belt Sander with bag	329	159
9401	4"x24" Belt Sander with bag	378	205
GV5000	5" Disc Sander	173	69
9207SPC	7" Sander-Polisher 1500-2800 rpm	443	245
BO5000	NEW 5" Random Orbit Sander	120	65

GRINDERS

9514B	4" Grinder 4.6 amp	111	65
N9501B	4" Grinder 4.0 amp with case	168	89

SAWS

Model	Description	List	Sale
5007NBA	7-1/4" Circ. Saw w/electric brake	263	124
4200N	4-3/8" Circular Saw	252	134
JR3000V	Var. speed Recip. Saw w/case	252	135
9820-2	Blade Sharpener	394	189
JV2000	Var. speed Orbital Jig Saw	302	165
5005BA	5-1/2" Circular Saw	250	138
4301BV	Orb var. speed Jig Saw 3.5 amp	292	162
5402A	16" Circular Saw 12 amp	743	395
LS1440	14" Mitre Saw	969	429
2414	14" Cut-off Saw AC/DC	403	218
4320	Var. spd economy Jig Saw 2.9 amp	141	84
5008NBA	8-1/4" Saw w/electric brake	316	188
5201NA	10-1/4" Circular Saw 12 amp	688	359
LS1030	10" Mitre Saw	428	188
LS1020	10" Mitre Saw 12 amp	630	339
2708W	8-1/4" Table Saw w/carb blade	585	275
2711	10" Table Saw with brake	1067	509
4302C	Variable speed Orbital Jig Saw	351	185
5077B	7-1/4" Hypoid Saw	281	138
5007NB	7-1/4" Circular Saw 13 amp	232	116
5007S	5007NB with square cutting guide	283	144
LS1011	10" slide Compound Saw	946	498
5820	7-1/4" Circ. Saw w/brake 7.5 amp	210	119
5012B	11-3/4" electric Chain Saw 11.5A	255	145

PLANERS

2012	12" portable Bench Planer 12amp	959	495
N1900B	3-1/4" Planer with case	232	129
1911B	4-3/8" Planer 7.5 amp	309	139
1100	3-1/4" Planer with case 6.8 amp	478	259
1805B	6-1/8" Planer w/case 10.5 amp	768	409
2030N	12" Planer/6" Jointer	2861	1999
2040	15-5/8" Planer	2167	1599
410	Dust Collection Unit	596	315

DRYWALL GUNS

6800DBV	0-2500 rpm 3.5 amp	180	89
6801DBV	0-4000 rpm 3.5 amp	180	89
6805BV	0-2500 rpm 4.8 amp	214	109
6820V	0-4000 rpm 5.2 amp	171	92
6802BV	0-2500 rpm Screwdriver 4.8 amp	223	115

DRILLS

6402	3/8" Drill 0-1200 rpm 5.2 amp	199	105
6404	3/8" Drill 0-2100 rpm 2.8 amp	112	58
6510LVR	3/8" Drill 0-1200 rpm 3.5 amp	168	88
6302	1/2" Drill 0-550 rpm 5.2 amp	228	114
6013BR	1/2" Drill 550 rpm 6 amp	280	138
6301LR	1/2" D-handle 550 rpm 5.2 amp	281	145
DA3000R	3/8" angle Drill 0-1400 rpm	314	148
6300LR	1/2" right angle 550 rpm 5.2 amp	401	205
DA6300	1/2" angle Drill 2 speed 7.5 amp	472	239
HP1030W	3/8" v/spd Hammer Drill w/cse	210	119
HP2010N	3/4" v/spd Hammer Drill w/cse	335	172

FREUD

INDUSTRIAL SAW BLADES

5/8" bore - All Blades are Carbide Tipped

Model	Description	Teeth	List	Sale
LU72M010	General Purpose 10"	40	69	36
LU81M010	General Purpose 10"	40	78	42
LU82M010	Cut-off 10"	60	93	49
LU84M011	Combo 10"	50	78	42
LU85M010	Super Cut-off 10"	80	115	59
LM72M010	Ripping 10"	24	69	38
LU73M010	Cut off 10"	60	84	45
LU87M010	Thin Kerf 10"	24	72	39
LU88M010	Thin Kerf 10"	60	88	45
LU85M015	Mitre Saw blade 15"	108	175	99
LU91M010	Compound Mitre Blade	60	88	54
LU98M010	Ultimate 10"	80	128	68
LU89M010	Non-Ferrous metal 10"	72	104	58
SC-001	Blade Stabilizers (pair) for 5/8" arbor		Sale	12.99

STACKED DADO SETS

SD306	6" Dado - Carbide	215	112
SD308	8" Dado - Carbide	230	119

"TK" BLADE SERIES

TK203	7-1/4" Framing - 24 tooth	31	18
TK206	10" Framing - 24 tooth	39	24
TK303	7-1/4" Finishing - 40 tooth	38	22
TK306	10" Finishing - 40 tooth	47	25
TK903	7-1/4" Combo - 30 tooth	33	19
TK904	8-1/4" Combo - 35 tooth	36	23
TK906	10" Combo - 50 tooth	53	29
TK204	8-1/4" Flat - 24 tooth	31	19

MISCELLANEOUS

FB107	7 piece Forstner bit set w/cse 1/4" - 1"	92	54
FB100	16 piece Forstner bit set w/cs 1/4"-2-1/8"	338	184
94-100	5 piece Router bit door system w/cse	320	159

CHISEL SETS

Model	Description	List	Sale
WC104	4 piece Chisel set with case 1/4" - 1"	65	39
WC106	6 piece Chisel set with case 1/4" - 1"	87	58
WC110	10 piece Chisel set w/cs 1/4" - 1-1/2"	143	82

POWER TOOLS

BRAND NEW
TR215 NEW 10" slide compound Mitre Saw 688 **359**

EB100	Edge Banding Machine	409	209
CE82	3-1/4" Planer with carbide blades	245	135
EDS13213V	Cordless Drill Kit	415	205
EDS12012V	Cordless Drill Kit	379	189

The folowing tools have a $30.00 rebate thru 1/15/94
Price shown is before rebate.

JS100	Biscuit Jointer with case	334	162
FT2000E	3-1/4 HP Plunge Router var. speed	410	205

New Products from *freud*

New Quiet Blades

F410	10" - 40 carbide teeth	95	49
F810	10" - 80 carbide teeth	135	74

New Super Dados

SD506	6" carbide w/case & shims	292	148
SD508	8" carbide w/case & shims	344	168

BOSCH

ROUTERS

Model	Description	List	Sale
1608	5.6 amp Laminate Trimmer	154	88
1608LX	same as above w/trimmer guide	175	110
1608T	5.6 amp tilt base Trimmer	175	99
1609	5.6 amp offset Base Trimmer	220	119
1609K	Laminate Installers Kit w/1609	315	175
1608U	Underscribe Laminate Trimmer	208	124
1609KX	Same as 1609K&Underscribe base	369	198
1600	2-1/4 HP Router D handle	411	255
1601A	1 HP Router 25,000 rpm	175	105
1602A	1-1/2 HP Router 25,000 rpm	229	149
1603	1-1/2 HP D handle Router	252	155
1604A	1-3/4 HP 2 handle Router	249	134
1604AK	same as above w/case & access.	299	169
1606A	1-3/4 HP D handle Router	273	168
90300	3-1/4 HP Router-Heavy Duty	556	355
1613	NEW 1-3/4 HP Plunge Router	290	184

SUPER SPECIAL
1613EVS 2 HP v/spd Plunge Router **Sale 184**

1614	NEW 1 HP Plunge Router	225	128
1614EVS	NEW 1-1/4 HP v/spd Plunge Router	260	149
1615	NEW 3 HP Plunge Router	395	228
1615EVS	NEW 3 HP var. spd Plunge Router	460	244

SAWS

1581VS	Top handle Jig Saw	275	145
1582VSC	CLIC Barrell Jig Saw	275	145
1581DVS	Dustless Top handle Jig Saw	295	168
1582DVS	Dustless CLIC Barrell grip Jig Saw	295	168
BC	Bosch metal case for above Jig Saws	34	32
BBA	30 of Bosch's best Jig Saw blades		27.99
1632VSRK	Recip Saw 8.4 amp Orb var spd	225	148
1655	NEW 7-1/4" Circ. Saw	285	114

SUPER SPECIAL
1581VS or 1582VSC with Bosch steel case and 30 Bosch Blades **Sale 175**

PLANERS

Model	Description	List	Sale
3272	3-1/4" Planer 4.2 amp	155	88
3272K	3272 Planer with case	169	99
3258	3-1/4" Planer w/blade guard 5.7amp	247	138
3258K	3258 Planer with case	273	154

SANDERS

1272	3"x 24" Belt Sander	325	199
1272D	3"x24" Belt Sander with bag	340	185
1273	4"x 24" Belt Sander	339	205
1273D	4"x 24" Belt Sander with bag	359	188
1273DVS	Var. speed 4"x24" Belt Sander	380	204
3270D	3"x21" Belt Sander w/bag 5 amp	270	145
3283DVS	5" Random Orbit Sander	169	98
3283DVSK	above sander w/discs and case	199	118
1370DEVS	6" Random Orbit Sander	391	219
1289D	1/4 sheet Sander with bag	98	59

DRILLS

1195VSR	3/8" var. speed Hammer Drill	211	125
1194VSR	1/2" var. speed Hammer Drill	259	145
1194VSRK	Same as above with case	287	169
11212VSR	"Bulldog" 3/4" SDS Rotary Drill	370	198
11304	"The Brute" Breaker Hammer	2055	1179
11305	Demolition Hammer 10 amp	1099	629
3050VSRK	9.6 volt cdls Drill Kit w/2 batteries	256	138
3051VSRK	3050VSRK with keyless chuck	266	145
1021VSR	3/8" Drill 4.8 amp 0-1100 rpm	189	105
1022VSR	3/8" Drill 4.8 amp 0-1100 rpm	195	109
1023VSR	1/2" Drill 4.8 amp	205	114
1942	Heat Gun 600° - 900°	115	78
11310EVS	Demolition Hammer	819	469
11220EVS	1-1/2" Spline Hammer Drill	819	459
11210VSR	3/4" Rotary Drill var speed	335	185
1420VSR	Drywall Gun 4.8 amp 0-4000 rpm	160	88

GRINDERS

1347AK	4-1/2" Grinder with case & access.	175	104
1348AE	5" Grinder 8.5 amp	209	118

MILWAUKEE

RECIP SAWS

Model	Description	List	Sale
6527	Super Sawzall variable speed 8 amp with case & Quick Loc Cord	309	164
6528	6527 with Wired Cord	305	164
6511	2 speed Sawzall with case	244	135
6507	"The Original" Sawzall with case	259	138
6508	Var. speed w/case-Wired Cord	255	138

CORDLESS

0399-1	12V cordless variable speed Drill with battery, charger, & case	309	165

SUPER SPECIAL
0407-1 Same as 0399-1 but with keyless chuck and 2 batteries **Sale 168**

0395-1	9.6 volt cordless Drill with case	284	158
0219-1	9.6 volt cordless Drill with case	309	175
6539-1	Screwdriver 190 rpm	127	75
6540-1	6539-1 with bits & case	162	95
6546-1	Screwdriver 200 & 400 rpm	138	79

SAWS

6215	16" Chain Saw	321	179
6365	7-1/4" Circular Saw	214	122
6367	above Saw - double insulated	209	128
6366	6365 Saw with fence & blade	224	127
6368	6365 Saw w/fence, blade & case	244	139
6377	7-1/4" Worm Drive Saw	324	179
6378	8-1/4" Worm Drive Saw 15 amp	334	185
6256	Variable speed Jig Saw 3.8 amp	259	144
6405	8-1/4" Circular Saw 13 amp	254	149
6460	10-1/4" Circular Saw 15 amp	459	265
6232	4-3/4" Band Saw w/cse v/spd	480	279
6175	14" Chop Saw 15 amp	499	279
6369	NEW 7-1/4" Circular Saw w/brake	259	148
8490	NEW 10" Mitre Saw	444	248

HAMMER DRILLS

5399	1/2" D-handle Hammer Drill Kit	325	188
5397-1	3/8" var. speed Hammer Drill Kit	250	138
5371-1	1/2" var. speed Hammer Drill Kit	375	184
5377-1	5371-1 w/keyless chuck	375	185
5348	1-1/2" Rotary with case 500 rpm	905	520
5353	Eagle 1-1/2" Rotary Hammer w/cse.	935	495
5365-1	HAWK 1" SDS Rotary Hammer with case and bits	600	324

ROUTERS

5660	Router 1-1/2 HP 10 amp	345	184
5680	Router 2 HP 12 amp	355	198

DRYWALL GUNS

Model	Description	List	Sale
6754-1	0-4000 4.5 amp	192	108
6749-1	0-2500 5.2 amp	214	124
6750-1	0-4000 5 amp	168	94
6747-1	0-2500 rpm 5 amp	186	103
6767-1	Screw Shooter Kit	229	135

DRILLS

0224-1	3/8" Drill 5.2 A magnum 0-1200 rpm	215	114
0225-1	Above drill with keyless chuck	203	119
0234-1	1/2" Drill 5.2 A magnum 0-850rpm	229	119
0235-1	above Drill with keyless chuck	229	128
0244-1	1/2" Drill 5.2 A magnum 0-600rpm	229	123
0222-1	3/8" Drill 3.5 amp 0-1000 rpm	189	107
0228-1	3/8" Drill 3.5 amp 0-1000 rpm	186	104
0230-1	3/8" Drill 3.5 amp 0-1700 rpm	209	112
0375-1	3/8" close quarter Drill	229	127
0379-1	1/2" close quarter Drill	260	145
3102-1	Plumbers rt angle Drill Kit 500rpm	375	209
3002-1	Electricians rt angle Drill Kit 600rpm	375	209
1676-1	HD Hole Hawg with case	479	258
3107-1	1/2" v/sp rt angle Drill Kit 0-500 rpm	385	204
3300-1	1/2" v/spd rt angle Kit 0-850rpm	339	182
3202-1	D handle rt angle w/cse 350 rpm	375	205

BELT SANDERS

5925	3" x 24" with bag 10 amp	440	239
5936	4" x 24" with bag 10 amp	440	235

SANDERS

6125	5" Rand Orbit Sander 10,000 rpm	200	117
6126	6" Rand Orbit Sander 10,000 rpm	205	115
6127	5" Random Orbital Sndr dustless	260	145
6008	1/3 sheet Orbital Sander	209	116
6010	1/2 sheet Orbital Sander	214	124
6016	1/4 sheet Palm Grip Sander	95	52
6017	6016 Sander with dust bag	97	54

GRINDERS/POLISHERS

5455	7"/9" Polisher 1750rpm	245	135
6145	4-1/2" Grinder 10,000 rpm	165	99
6142	4-1/2" Grinder 10,000rpm w/cs & acces	204	124
6098	7" Sander/Grinder 8000 rpm	325	185

MISCELLANEOUS

8975	Heat Gun 570° & 1000°	96	59
8977	Vartemp Heat Gun 212° - 1000°	128	77
8980	8975 Heat Gun w/case, air reduction, hook, deflector, & spreader nozzles	145	92
9068	1/2" Impact Wrench with case	438	269

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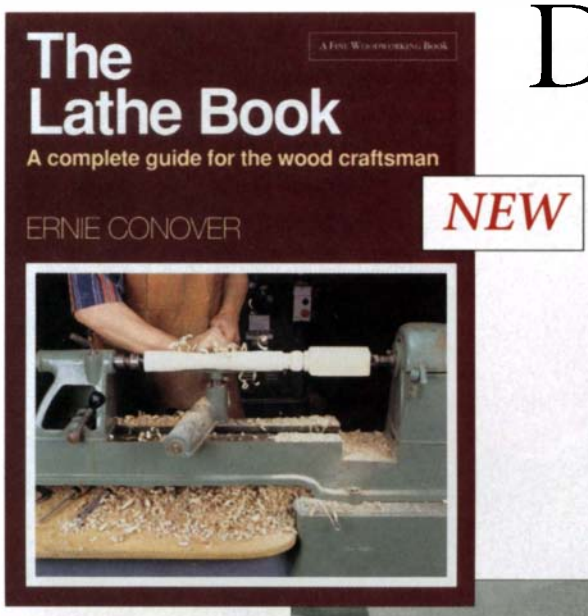

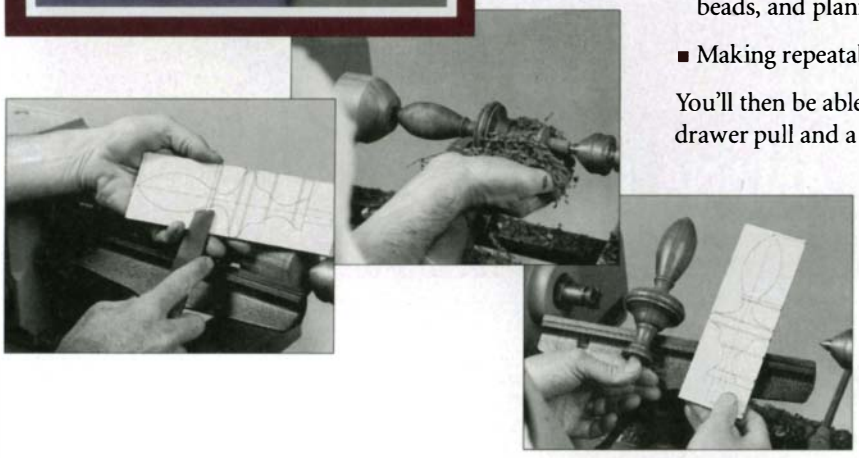

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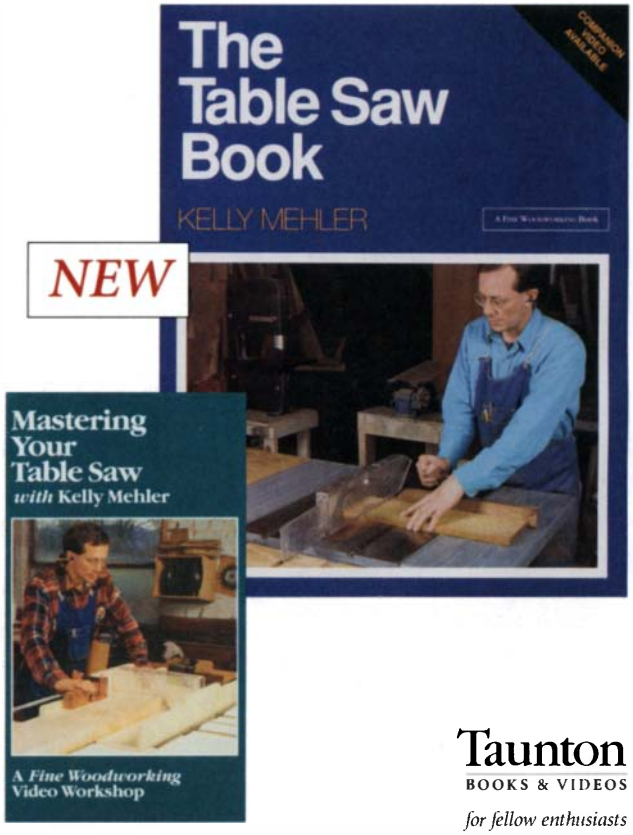

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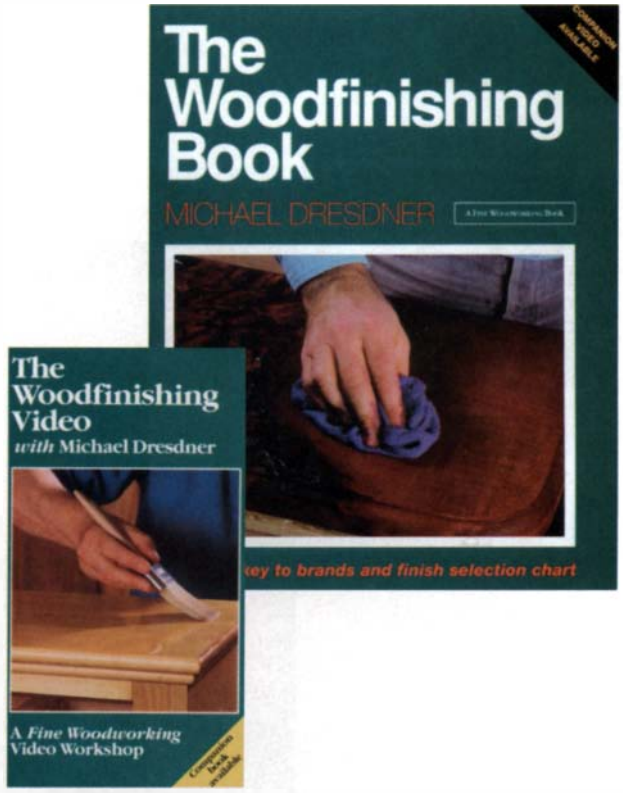

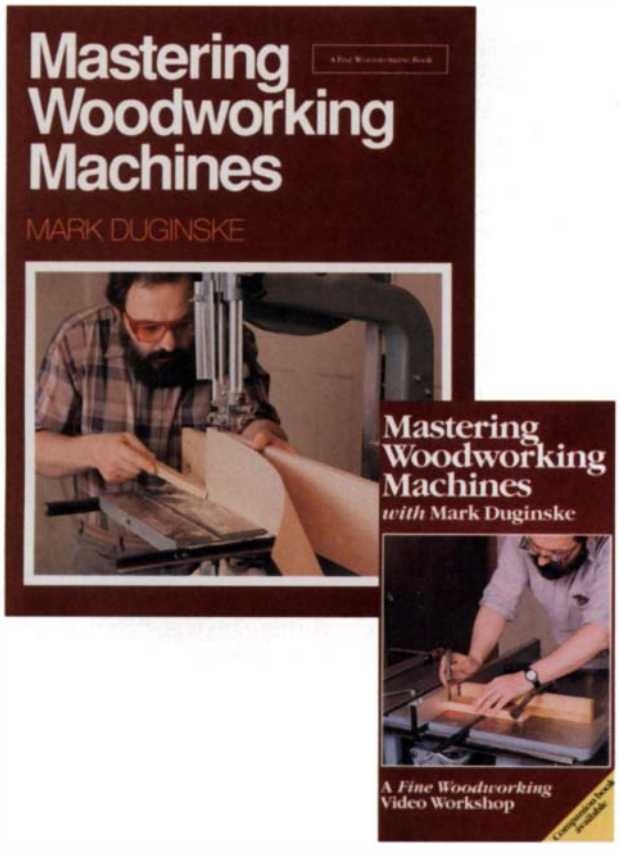

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Captain's Desk Is Compact and Efficient

Component construction puts it all together

by Cameron Russell

A captain's desk is highly functional, *providing a variety of storage in a compact piece. Also called a davenport, after the sea captain who commissioned a similar piece in the late 18th century, this desk presents a variety of joinery challenges, from mortises and tenons to half-blind mitered dovetails.*

Originally designed for cramped ship's quarters, captain's desks pack a lot into a small space. In addition to the writing surface and drawer storage, this desk has a compartment for large items behind a hinged door and a lockable compartment beneath the inlaid leather writing surface.

I decided to build my desk in a series of individual components: the desk box and writing surface, the frame-and-panel drawer case, the door and drawers, columns, base frame and the feet. The components can be made in any order, finished and then assembled into the completed desk.

The desk is also one of my favorite pieces because its components require a variety of joinery techniques and furnituremaking skills: dovetail joints for drawers and the desk box, mortises and tenons for the frame members, lathe turning between centers and with a faceplate, hinge setting, insetting leather (see the box on p. 47) and installing a lock and escutcheon.

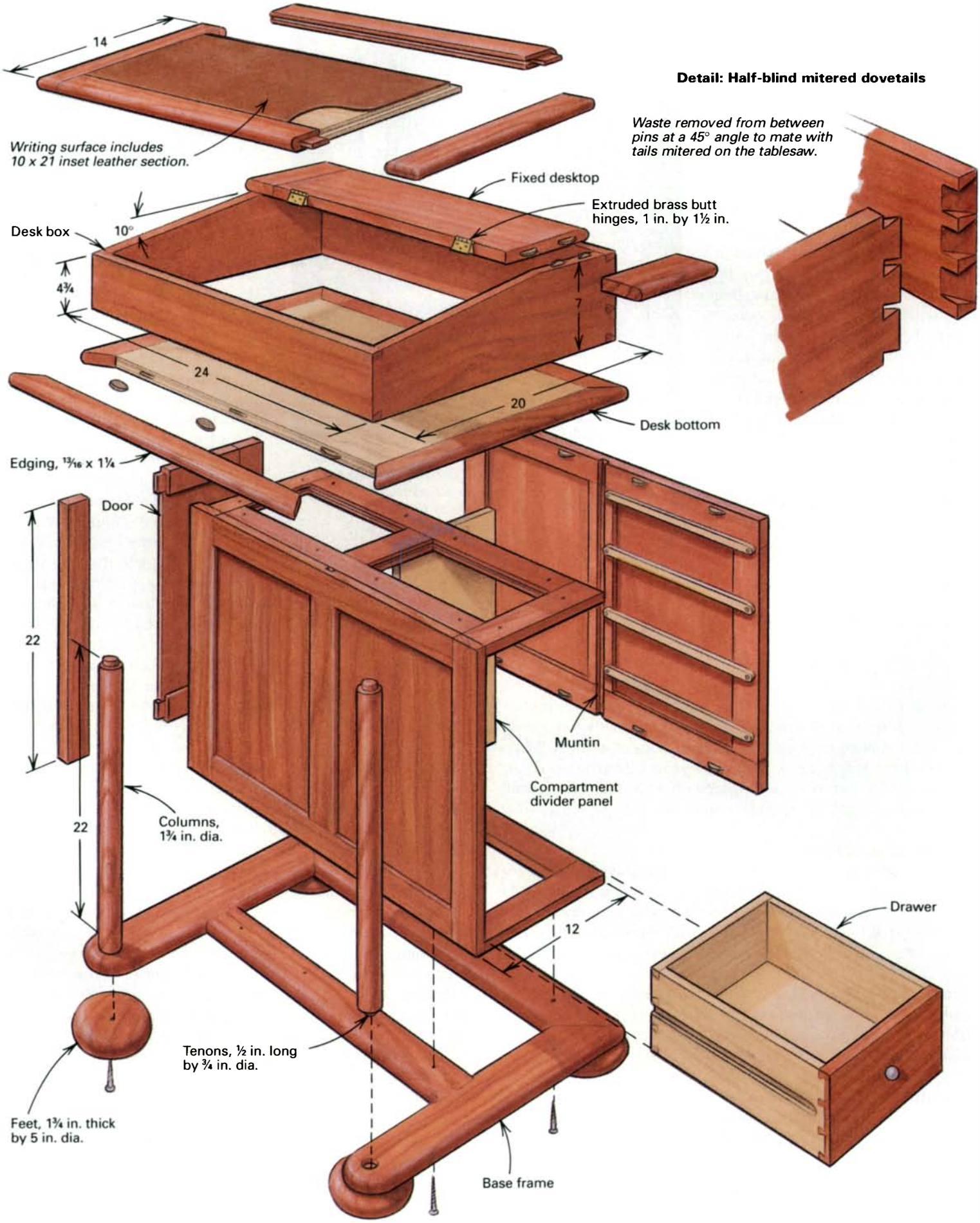
The desk box

The lockable desk box is joined with half-blind mitered dovetails and has a hinged lid that rests on angled sides to form a comfortable writing surface. To get the slant of the right and left sides identical, I joined them with double-faced tape. I then marked out the

Photos: Trevor Mills, courtesy of Cameron Russell

A captain's desk

This project provides plenty of storage in a small space and also provides opportunity for lots of joinery practice.



Detail: Half-blind mitered dovetails

Waste removed from between pins at a 45° angle to mate with tails mitered on the tablesaw.

Drawings: Bob La Pointe

10° slope on the sides, bandsawed and planed them smooth.

I used half-blind mitered dovetails to join the desk box because this joint is strong, provides the exposed joinery that goes with the vague nautical theme and lets the grain pattern wrap around the box. To cut this joint, I mark and saw the tails first with the ends of the sides still square as in a normal dovetail joint. I then use the tails as templates to mark out the pins on the ends of the front and back pieces.

After the tails have served as templates, I miter the sides on a tablesaw crosscut tray. I cut the pins in the front and back of the box by sawing to a 45° angle from the line that will become the inside corner out to the outside corner. The waste between pins is chiseled and pared carefully to mate with the mitered tail ends (see the detail on p. 45).

The desk bottom is a plywood panel framed by 13/16-in.-thick edge strips mitered at the corners. The edge strips are shaped from both faces with a 3/8-in.-radius roundover bit mounted in a router table.

The fixed desktop is made breadboard-style with end caps biscuit joined to the top. Because the top is only 7 in. wide and mahogany is a relatively stable wood, this cross-grain construction hasn't been a problem. The front edge of the fixed top is beveled 5° to match a corresponding bevel on the upper edge of the writing surface. Combined, these bevels allow the slanted writing surface to rest flat on the 10° tapered sides of the desk box with no gap at the hinge joint.

The desk-box top and bottom are secured to the box with biscuits and screws, as shown in the drawing on p. 45. Before gluing the box, I applied masking tape to the insides of corners. When the inevitable glue beads oozed out, they formed on the taped surface, not the wood. I stripped the tape off while the glue was still tacky and managed to avoid any further cleanup.

***Vertical storage**—Originally used to store sea charts, the large compartment behind the hinged door is great for wall maps, posters or other items that won't fit in the drawers on the opposite side of the desk.*

The writing surface

The writing surface is composed of a leather-covered panel secured in a mortised-and-tenoned stile and rail frame. A 1/4-in.-wide groove runs around the inside edge of the frame to house the rabbeted edge of a 1/2-in.-thick plywood panel. Because leather thickness varies, have the leather on hand, so you can position the panel groove to keep the leather flush with the surrounding frame. I veneered the bottom face of the plywood panel with Honduras mahogany to match the rest of the desk. After the writing surface frame and panel has received its final finish coat, the leather is inlaid into the recessed panel (see the box on the facing page).

Installing the hardware

The writing surface is hinged to the fixed desktop with brass butt hinges that are let equally into each piece. A chest lock mortised inside the box secures the writing surface to the box. I roughed out the lock mortise with a small straight bit in a laminate-trimming router and then cleaned up the edges with a chisel.

Mass production techniques for the drawer case parts

The main box that forms the body of the desk houses drawers in one side and a door-covered storage compartment in the other. The front and back of the box are identical frame-and-panel assemblies, each consisting of two stiles stretching the entire vertical height, two rails, a muntin (a single center divider) and two panels. The door is also a frame-and-panel assembly built of the same dimensioned stock as the front and back panels. The top and bottom of the drawer case are web frame assemblies identical to one another except for one detail. The door-covered compartment has a plywood floor let into grooves in the frame.

All of the frame pieces are 3/4 in. thick by 1 3/4 in. wide, so I milled all this stock and cut the joinery at one time. I used 1/4-in. by 1/4-in. grooves for all the panels and 1-in.-deep mortises for all the joints. When the milling operations were complete, I dry-assembled the frames to test the joinery. While the frames were assembled, I marked each joint, so I could round over the edges without cutting into the joint area. I then milled each piece separately on the router table, being careful to stop shy of my marks. I assembled the frames (including the panels, which can be solid wood or veneered plywood or composition board) and used a chisel and a fine file to extend the roundovers into a crisp corner. This detail took surprisingly little time and added another hand-crafted touch to the desk.

I attached the drawer guides before the drawer case was assembled because there was more room to work. I made up blocks to locate the guides while I screwed them in place.

All the rails, stiles and muntins of the top and bottom web frames have grooves cut around the inside edges. The grooves house a rabbeted 1/2-in.-thick plywood floor panel for the storage compartment and mate with 1/4-in.-long stub tenons on the ends of the rails and muntins that hold the frames together. With the web frames assembled, I routed grooves along the muntins and across each rail to house the compartment divider.

I cut biscuit joints to attach the top and bottom web frames to the front and back panels and then dry-assembled the pieces. When everything fit properly, I disassembled, sanded and finished all the components. The only drawback to applying a finish at this stage is that glue surfaces must be protected by masking. This small effort is a good trade-off for the ease of working on flat surfaces vs. applying finish inside a small box. And, as an added bonus, the quality of finish will be much better.

Making the drawers

The drawers are traditionally joined with through-dovetails at the back and half-blind dovetails at the front. The 1/4-in.-thick plywood bottoms slide under the back and into grooves in the side and front. I made up pads of upholstery fabric covering 1/2-in.-thick foam and 1/8-in.-thick plywood to cover the drawer bottoms and

the writing compartment floor as well. This feature not only looks rich but also allows small items to be picked up more easily.

Turning columns and feet and adding a base frame

I turned two cylindrical columns to connect the desk box and the base frame, as shown in the drawing on p. 45. The shoulder-to-shoulder length of the columns is the same as the height of the drawer case.

The base frame is a large U-shaped structure mitered in each corner with an additional cross member under the front side of the drawer case. I used biscuits to join all of the frame pieces, but before assembly, I bandsawed and sanded the open ends of the frame to their half-round shape.

The four round feet are blocks that I bandsawed to rough shape and then turned and sanded on a lathe. I used a plywood template to check my turning progress. Again, I countersunk screws through the bottom of the feet and fastened them to the base frame. When the desk was entirely assembled, I then covered the screw heads with felt pads on the feet bottoms.

Finished with a special mix

The finish used on this desk was an oil mixture made of equal parts tung oil, boiled linseed oil and gloss urethane. I find this mixture penetrates like any oil finish but builds up quickly because of the urethane. I allowed the first coat to penetrate the wood for 20 minutes, reapplying in any areas that soaked in and became dry. After 20 minutes, I wiped off all of the excess oil and disposed of the rag in a fireproof container. The following day, I rubbed in the oil-urethane mixture using 400-grit silicon carbide wet-or-dry sandpaper. Again, I wiped off the excess oil and let it dry overnight. The 400-grit application was repeated for another two or three days followed by a few days of 600-grit applications. Finally, when the oiling was completed and the entire desk assembled, the whole piece was waxed with a mahogany-colored paste wax. This final step really highlighted all of the half-round moldings from the top right down to the feet. □

Cameron Russell is a furnituremaking and design instructor at Camosun College in Victoria, B.C., Canada.

Inlaying leather

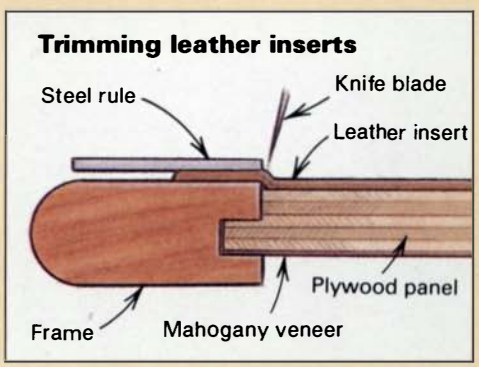
Leather is a great material for a writing surface. Its texture provides the right combination of support and cushioning to give handwriting a pleasurable feel. And because this desk is so small, the required leather should be available from most craft supply stores or from Berman Leathercraft, Inc. (25 Melcher St., Boston, Mass. 02210; 617-426-0870).

Selecting and preparing leather: For a writing surface, top-grain leather (the most expensive kind) is not necessary. The most critical factor is choosing a color to complement the wood tones.

Trim the leather with a sharp knife, leaving about ½ in. extra material on each side. Moisten the face side of the leather by lightly spraying it with water from the kind of squeeze bottle used to mist house plants. Flip the leather over onto a clean piece of unprinted paper, and it's ready for gluing.

Preparing the leather paste: To glue up the leather, I use a special paste made from laundry starch, alum, powdered chalk, wintergreen and water. White or yellow glues don't allow enough time to position the leather, and they also can make the leather hard or stain it by seeping through the leather's pores. I have also tried plastic resin glues, and I have had the same problems with them.

Laundry starch (4 tablespoons), the kind used to starch table linens, is the main ingredient of my special leather paste. If you can't find starch in a large supermarket, try a commercial laundry that caters to restaurants. Powdered alum (½ teaspoon), which I've found in the spice rack of the supermarket, is a salt that helps the paste grip the leather. Powdered white chalk (1 tablespoon), such as used in a carpenter's chalk line, is added as a thickener. Finally, oil of wintergreen (three or four drops), available from most pharmacies, helps discourage the growth of fungal bacteria. Although the wintergreen is not a vital ingredient, it makes the shop smell like a candy store, and it helps prevent breakdown of the leather, especially in moist environments.



Mix the ingredients listed above in a wide-mouth glass jar. Slowly add boiling water until the mixture is about the consistency of paint. Pour the water as slowly as possible and stir vigorously to avoid lumps. Once the ingredients are mixed to a creamy consistency, stop adding water, and heat the jar in a pan of water over a low heat. Continue stirring. Before long, the starch should react, and the mixture will suddenly turn into a paste. Place a lid on the jar, and the paste will remain usable for several hours.

Gluing on the leather: Spread the paste evenly on the underside of the moistened leather, working from the middle out to the edges to ensure an even stretch to the pliable moist leather. Once fully pasted, fold the pasted side over on itself to prevent drying out while you work on the wood surface. Brush a layer of paste on the wood at about the same rate as if you were painting it. Unfold the leather on the wood backing, and press it in place using your fingertips and working from the center out to the edges. The slow-setting paste allows the leather to slide and shift as required. Once the leather has been worked out to the sides of the recess, use your thumbnail to crease a line in the leather where the frame meets the backing board.

The next step is probably the most critical in getting a neat job. Hold a straightedge on the waste side of the leather directly above the crease line. Draw a sharp knife along the straightedge angled in about 5° or 10°, as shown in the drawing at left. If done correctly, the leather edge should neatly tuck up to the frame. Once trimmed and tucked, wipe any excess paste from the frame and leather with a damp cloth. Allow the panel to sit overnight to give the paste a chance to dry before applying the dressing.

Dressing the leather: I rub in a special home-brewed dressing to give the leather a rich sheen. To blend my dressing, I mix two parts anhydrous lanolin (an ingredient found in many skin-care and cosmetic products and usually available at well-stocked pharmacies) and three parts Neat's foot oil, a traditional leather preserving oil. I rub the dressing vigorously into the leather with my fingertips. The friction from my hands melts the lanolin and works it deep into the pores of the leather. When the leather is saturated, I wipe off the excess and buff the surface with a soft flannel cloth. The dressing can be applied every year or whenever the leather appears to lose its luster. Avoid too much dressing, though, or a greasy film may begin to build. *—C.R.*

Reproducing Your Project

A dedicated crosscut box and flush-trimming sander make it easy

by Ken Picou

You've just built a piece of furniture that you really like, and you know that you'll want to build it again. It might be a personal project, or if you're a professional woodworker, maybe it's a design that you'd like to produce regularly or as commissions arise. Many projects—especially chairs—can be quite confusing because of all the components and all the angles that need to be accurately cut. Once you've done the thinking and gone through the whole trial-and-error process, so everything's set up and working well, why not record all the necessary information, so you can reproduce your design simply and accurately anytime you wish with very little set-up time?

Faced with the economic reality of woodworking as a profession, I came up with a simple system for duplicating furniture parts without spending a great deal of time setting up or having to remember just what it was I did last time. My system is based on the use of two easily made items: a sliding crosscut box dedicated to the design in question and a set of templates, which I use in conjunction with a bearing-guided, flush-trimming drum sander for shaping any curved parts. With these two tools, I'm able to produce my side chair (see the photo at right) in about 12 hours, from dimensioned lumber to finished chair. The technique can be used for any piece of furniture and works fine regardless of how many angles or curves are in a piece. Here's how I do it.

A dedicated crosscut box

The dedicated crosscut box starts as a basic shopmade crosscut box with runners to fit in the saw table's miter-gauge slots (for more on building this kind of jig, see Kelly Mehler's article in *Fine Woodworking* #89, pp. 72-75). I then add a removable pivoting fence for cutting angled parts. All stops and angles for a project are marked on the table along with the name of the part and the width of stock (see the bottom photo on p. 50). If I need to cut an extra-long piece, I just screw a story pole to the table (or to the pivoting fence) and clamp my stock to the story pole. I use a small, wooden handscrew as a stop whenever I'm doing more than a few like items. I set the stop so it's about ¼ in. above the table, which allows sawdust to escape rather than getting stuck between my stock and stop, throwing off my measurement.

Templates and template-sanding

After I've cut all my blanks using the dedicated crosscut box, I use my templates as patterns (see the photo on the facing page) and mark the blanks for rough cutting on the bandsaw. I use phenolic-resin board for my templates because the material will stand up indefinitely. If your templates won't be seeing a lot of use, cabinet-grade plywood will work fine.

I bandsaw out the parts and screw the templates to their respective parts, keeping the screw holes in waste material or where there will be a mortise (see the top left photo on p. 50). Then I template-sand the parts to shape with a bearing-guided, flush-trimming drum sander I designed for this purpose, as shown in the top right photo on p. 50. (EDITOR'S NOTE: For more on Ken Picou's flush-trimming sander, see *FWW* #101, p. 36.) You could also use a

***Building a dozen dining chairs** could be a very daunting project (photo left). But, because of his system for creating multiples of a design, the author manages with something approaching calm. Here he traces a template's outline (which also serves as a pattern) onto a thicknessed blank before heading to the bandsaw to rough cut the part.*

***The author's chairs** (photo right), in mesquite (left) and in bird's-eye maple (right), are comfortable, handsome and relatively straightforward to make with his production techniques.*

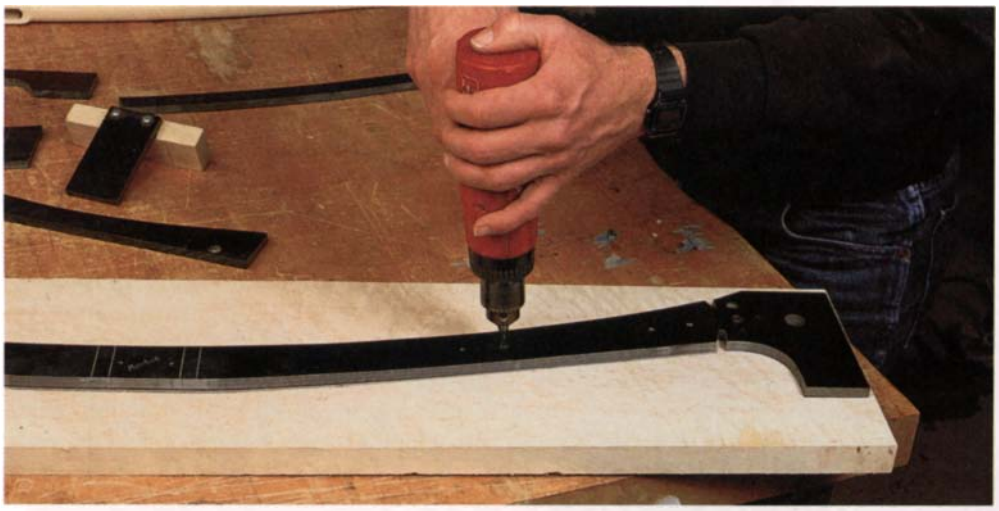
Photos: Vincent Laurence

bearing-guided, flush-trimming router bit, but in highly figured stock—such as bird's-eye maple—tearout is almost inevitable.

It pays to take your time and get the template *exactly* the way you want the part to be. Often, you can use the original part (from a prototype) to make the template by attaching the rough-cut template stock to the original part with double-faced tape and template-sanding the template.

I usually run my sander with a 50-grit sleeve at 1,700-1,800 rpm. I've found this to be a good combination to remove stock quickly without burning the wood. I use a ¾-in. plywood subtable on my drill press when I'm template-sanding because it allows me to adjust the height of my sander's phenolic-resin bearing. I drill a recess hole for the bearing, making it ¼ in. oversize to prevent any binding. Being able to adjust the bearing vertically so that its top is just flush with the top of the template ensures that the drum is removing stock evenly over the entire width of my blank. Also, the recess in the subtable allows me to run the bearing all the way below the subtable's surface. This allows me to use the drum freehand in case I need to do any touch-up work. The sanding drum can also be used as a vertical thickness sander when used with a one-point vertical fence. I find this useful when thicknessing chair backrests. □

Ken Picou is a designer and woodworker in Austin, Texas.



***Screws connecting template and stock** are all positioned so they fall in mortises, in waste stock or beyond where a piece will be crosscut to final length (photo above). The section of the template that extends past the notches indicating the end of the chair leg (far right) provides a reference surface to position the leg squarely in a router jig for mortising.*

***With template attached to its underside,** a front chair rail is easily sanded to shape using the author's invention, the Robo-Sander (photo right), which is a bearing-guided sanding drum. Using the drum instead of a bearing-guided router bit prevents tearout, especially in heavily figured woods such as this bird's-eye maple.*

***The dedicated crosscut box** lets the author make virtually identical copies of his design next week, next year or in 10 years. All angles, stock widths, part names and cutoff points are marked on the box, making production a simple matter of running through the cut list.*

***A variety of different types of medium-density fiberboard** (MDF) are available from nine companies that manufacture the material (above). Although it has been used in industry for 28 years, MDF is just now becoming more available to consumers and small shops. The difference in density (right) is obvious when comparing MDF, left side, to common particleboard, right side.*

A Woodworker's Guide to Medium-Density Fiberboard

Get the most from its glass-flat surfaces and razor-sharp edges

by Jim Hayden

Medium-density fiberboard, or MDF as it is more commonly known, is the newest of the furniture-quality wood composites. Because of its dense, uniform composition and flatness, it has surpassed plywood and particleboard as the sheet good of choice for fine work and more routine uses.

Pre-finished faces are flat as the slate on a pool table, which along with its dimensional stability makes it an excellent substrate for veneer. The edges machine well, with no chipout, and MDF accepts a full range of joinery and fasteners.

But if you have never seen a 4x8 or 5x8 sheet of MDF or have never even heard of MDF, you have plenty of company. MDF has been an industrial product for its entire 28-year history, with most shipments earmarked for furniture factories and cabinet producers. Only recently has it become more available to retail consumers and small shops. Once you have some MDF in your shop, you may find, as I have, that it is also good stuff to make some of your jigs, fixtures and templates.

Whether you use it for jigs or the substrate for fine veneered furniture, there are some special tricks and tips for using MDF. I'll share what I've learned from my own experience and from research done for the National Particleboard Association (NPA), which includes eight of the nine MDF companies, as well as from the reactions of woodworkers who regularly use MDF in the cabinet shop of the Arthur M. Sack-

Photos except where noted: William Sampson

Museum quality MDF— *These display cases at the Freer Gallery of the Smithsonian Institution show off some of MDF's versatility. The case above shows the crisp edge-holding ability of MDF in a painted piece. The case on the right makes use of walnut veneered MDF with solid-wood moldings.*

ler and Freer Galleries in the Smithsonian Institution (see the photos at left).

Machining MDF

Because it's homogeneous (see the inset photo on p. 51), MDF machines better than plywood or particleboard, and even some natural woods. There are no layers or chips, brittle edges, knots or grain. I routed all 15 types of MDF made in the United States, courtesy of the nine MDF companies (see the photo on p. 51). The boards share a sameness in meeting industry standards: They match in density and superb flatness. They differ because the trees harvested near the plants differ. The wood chips, shavings and sawdust (or residuals) from the local sawmills and plywood mills are the raw material of MDF. Also, the companies use proprietary formulas, thus adding a few minor, and in some cases, a few major differences, such as formaldehyde content.

I've used two brands of MDF regularly during the last five years. I'm impressed with the consistently smooth surface of the sheets. MDF starts out as a low-density, 15-in.-thick slab 18 ft. long. A ¾-in. board is compressed at 800 lbs. pressure, then 50,000 lbs. pressure to almost final thickness. Sanders, in a series of grits, take over and finish off with 120- or 150-grit, sanding and burnishing to precisely ¾ in.

Sometimes I measure new sheets. I find their thickness to be scrupulously maintained. However, extreme heat and humidity changes, such as daily changes encountered with outdoor storage, will cause a permanent thickness increase. But the thicker boards, ¾ in. and 1 in., will take some abuse in storage (i.e., stored on edge) and not warp.

Sawing—A 50-tooth combination blade is suggested for rough-cutting large sections of MDF on the tablesaw. But I make so many things out of cutoff pieces that I go right to my finish-cut blade. That used to be a 60-tooth triple-chip. I loved that blade; with a pair of hold-downs and my pride and joy, shopmade, European-style adjustable splitter, a piece of MDF would slide down the fence and exit the blade with a new edge so smooth that I had to stroke it. Then I bought the other blade manufacturers recommended for MDF, a 60-tooth thin-kerf alternate top bevel (mine is a Freud TFLU88). It seemed to cut even cleaner than the triple-chip, and material moved more easily through the blade because of its semi-thin kerf (nominally .090-in.). Its teeth angles fit the NPA's specs for a blade to saw cleanly top and

Photos this page: Jim Hayden

bottom surfaces of overlaid panels. They are a 15° hook, 15° top bevel and a 10° alternate face bevel.

I use 6-in. blade stiffeners for a slightly finer cut, and I made a zero-clearance insert to keep the dust down where it belongs. I'll talk more about MDF dust problems and solutions later.

My friends in the cabinet shop have good results using the tablesaw to kerf MDF sheets, so they can be bent into curved forms, as shown in the photo at right.

Edge-shaping and routing—When I saw or rout an edge, rabbet or dado for joining, I get sharp edges with MDF. The edge surface looks and feels smooth. When rubbed counter to the cut direction, it feels slightly fuzzy or scratchy, depending on the brand of MDF, but the piece is ready for glue-up and assembly. My contoured router cuts (cove, roundover and Roman ogee) are clean and smooth, with crisp edge profiles, as shown in the photo at right. The edge surface is a little rougher than on straight cuts, but that disappears with normal light sanding for finishing. When routing or shaping, feed MDF about 25% slower than wood for maximum edge smoothness.

MDF does have its limits. Sharp protruding contoured edges aren't a good choice. And being 10% urea-formaldehyde or other glue, MDF does wear down cutters faster than wood.

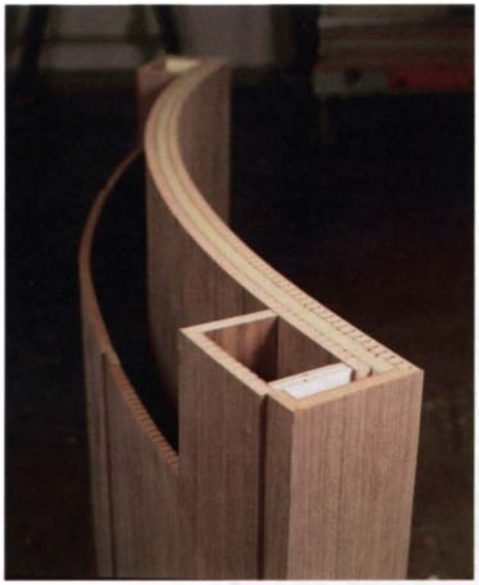
MDF sawdust is fine resin-coated particles of wood dust, light enough to become airborne and settle on everything in sight. Building a router table/tablesaw extension with vacuum attachments has virtually eliminated floating dust and cut down on my set-up time (see the photo at left on the following page). I use a high-quality dust mask, the Dustfoe 66, which I purchased from Highland Hardware (1045 N. Highland Ave. N.E., Atlanta, Ga. 30306; 800-241-6748) and have installed vacuum setups on all my machine tools.

I wanted the same low-dust environment for freehand routing, so I built an acrylic and MDF safety guard/vacuum hookup that bolts into T-nuts epoxied on the underside of my router base plate. It is almost 100% effective with MDF dust.

Successful sanding—Other advice to the contrary, don't sand an MDF panel before attaching an overlay. Scuff-sanding can cause a weaker glue bond. I just make sure my work table and the panel faces are nice and clean, then proceed.

Flat and contoured edges should be sanded before finishing to remove the nap. A belt sander is a good choice for flat edges, as is an abrasive wheel for contoured edges. Use a sequence of 100- to 150-grit, or 120- to 180-grit. It's a light sanding, not a dust raiser. Some shops prefer hand-sanding.

Sanding also is the process that can raise the most of MDF's extra-fine dust. At our cabinet shop in the Smithsonian, the helmet-type powered air-purifying respirator is used (see the photo at right on p. 54).



Kerfs for a curve— *Woodworkers at the Sackler Gallery cabinet shop in the Smithsonian Institution kerf-bend veneered MDF to make a curved museum bench.*

Crisp profiles—*Medium-density fiberboard excels in maintaining sharp edge profiles. Shown here are, from left, examples of cove, roundover and Roman ogee, all created with a router.*

Using screws in MDF

Screw size	Pilot hole	Minimum edge*
#6	3/32 in.	1/2 in.
#8	7/64 in.	5/8 in.
#10	1/8 in.	1 in.

**Minimum sheet thickness for driving screws into an edge without splitting.*

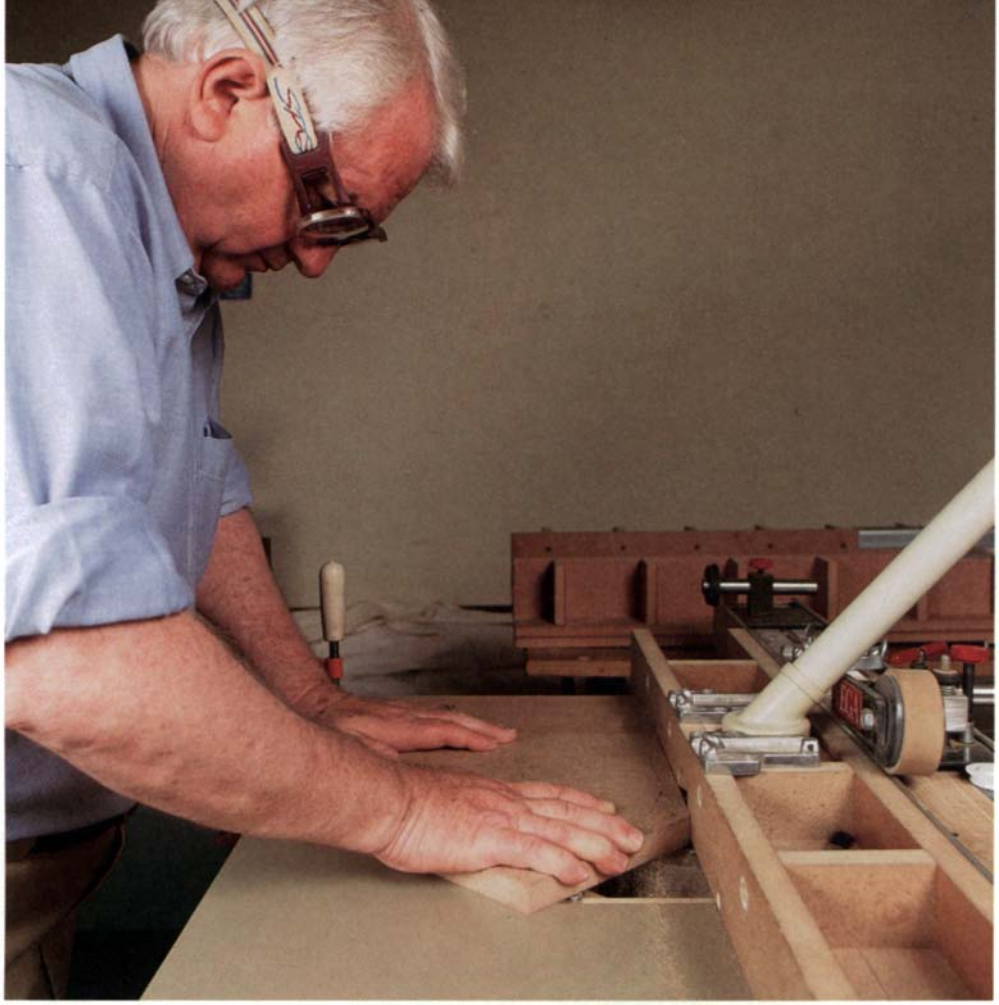
Joinery and glue choices

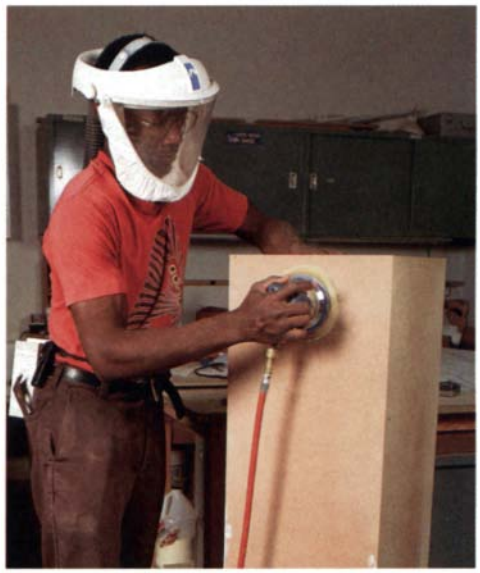
MDF machines and glues well, giving it literally a sharp edge over plywood and particleboard in joint-making. "We do a lot of case work with Medex MDF, using miter joints," explains a cabinetmaker at the Smithsonian. "I have to be careful handling the Medex edges. They are so sharp I've cut my fingers several times."

The furniture and cabinet industries use dowels extensively in MDF case work. Drawers are often made with 7/16-in. dovetailed or rabbeted MDF sides. Independent furniture and cabinetmakers seem to be sold on biscuit joinery for MDF. If you use dowels, spiral and grooved dowels are recommended over plain dowels by eight of the nine MDF companies.

The joints that work well with MDF (as shown in the photo on p. 55) include: loose-tenons (spline-tenons), dovetails, sliding dovetails and finger joints. Spline or biscuit miters, lock miters, miter and rabbet joints, simple miters, rabbets, dadoes, and butt joints with biscuits or dowels also work well.

Adhesives—A high solids or gap-filling glue is ideal for MDF. I use modified (yellow) polyvinyl acetate (PVA) or Titebond II





***Dealing with dust**—A worker in the Sackler Gallery cabinet shop (above) at the Smithsonian Institution avoids the fine dust produced by MDF by wearing a Racal powered respirator while finish-sanding a display cabinet.*

***Shop-built attachments handle MDF's dust** on the author's router table (left). Built as an extension of his tablesaw table, the router table houses a shop vacuum and sound baffling, which makes for quiet, dust-free operation.*

when assembly time permits. Otherwise, it's white PVA, the same as I'd use for wood. Contact cement, epoxy and urea resin work well when needed. A factory method is to use a hot-pressed rigid resin to bond an MDF core and hardwood veneer. Under low pressure at 250° for less than three minutes, the thermosetting glue doubles the panel's stiffness. I would rate urea resin and epoxy as the best thermosetting glue candidates, but it's best to make your own tests on scrap for any setup before the final glue-up.

Hardware and fasteners

A straight-shanked screw with deep, wide, sharp threads is best for MDF. I use Robertson square drive, particleboard and sheet-metal screws. (On the West Coast, a savvy MDF user recommends Twinfast particleboard screws.) The fine-threaded sheet metal or self-tapping screw is also good. And drywall screws make handy temporary holders for MDF projects.

Do not use tapered wood screws. Screw threads cut MDF fibers and resins. While regular wood springs back, MDF distorts. The distortion and tapered screw shape combine to make for poor fastening.

There's a limit to the screw size an edge will take without splitting (see the chart on p. 53). Use longer (not larger) screws in the edge for increased strength. More screws add strength, up to 4 in. apart.

Drill pilot holes in the edge, so the board won't split, and drill them to the depth the screw will be inserted, plus about ¼ in. It's also a good idea to drill pilot holes in the face plane. See the chart on p. 53 for common screw sizes and correct pilot holes.

Screws in the face should be at least 1 in. away from corners, and edge screws should be 3 in. from corners. A slow drill speed or dull bit will burnish the pilot hole wall and cause crumbling. Run a sharp bit at high speed (3,000 rpm for industrial applications). You'll get a clean, accurate hole with top pull strength.

There's a "turns" trick to make sure you don't over-torque and strip the panel threads. A three-quarter turn past flush on the face is maximum torque. A three-eighths turn past flush on the edge is the limit there. Even with a properly sized and countersunk pilot hole, the screw will break away beyond these points.

My friends in the cabinet shop sometimes use pneumatically driven ring-shank coated nails or coated staples on glued joints to save clamping time. If you do that, be careful not to drive edge staples with their legs parallel to the surface, or you may get splitting.

Hinges—After trying all sorts of hinges, I found the best hinges for MDF attach face to face. When hinges are installed, MDF may "pyramid," or develop a bump around hinge screws. To prevent the pyramid and to ensure the hinge is flush, drill a partial countersink along with the pilot holes.

Laminating, veneering and finishing

Good bonding strength, dimensional stability, flatness and other qualities previously mentioned make MDF an ideal substrate for numerous materials, including high-pressure laminates and veneers. Crossbanding is unnecessary with even the thinnest veneers.

Either veneers or paint can be used to finish edges. A painted edge may work well with laminated, veneered or, of course, painted face planes. It involves a typical edge-finishing process. Careful sanding is followed by one or two coats of sealer. Burnish smooth each coat of sealer before applying the final topcoat.

Quick-drying sanding sealers, auto-body primers and even white PVA glues diluted 20% can be used as edge sealers.

Sealing in formaldehyde may be a factor in finish selection. The level of formaldehyde in untreated MDF may remain above ambient levels for several years.

High-pressure laminates offer almost total sealing, matching factory applied thin

and thick vinyls. After that comes alkyd oil primer and oil enamel paint combined, two coats of polyurethane, and latex-ammonia combined with two coats of latex wall paint. (The latex-ammonia types will raise the grain.) Ironically, the effective alkyd oil finishes contain formaldehyde, but it normally off-gases in two weeks.

Finishes that are less effective sealers include: oil base or lacquer sealer plus a top coat of varnish or lacquer; two coats of lacquer or oil primer; lacquer sanding sealer plus one or two coats clear lacquer; quick-drying lacquer sanding sealers; and shellac or varnish applied without a sealer.

Despite their other merits, finishes that will not effectively seal in formaldehyde in MDF include: two coats of regular latex paint, penetrating oil sealer, stains, waxes or linseed oil.

There are treated low-formaldehyde MDFs, such as Plum Creek, and formaldehyde-free brands, such as Medite II and Medex (exterior grade), to consider. I asked the Sackler and Freer cabinet shop supervisor, Cornell Evans, for his impressions of Medex. "Medex has no formaldehyde and is fire-rated. It is lighter and harder than (regular) MDF," he said. "It glues better and takes paint better. We use it for case work. It has sharp edges, is water repellent and is much less dusty (than other MDFs). There is no fine sawdust when cutting. We use ⅝-in. Medex in place of ¾-in. MDF."

Finding and buying MDF

Standard MDF costs about 60% less than seven-ply birch plywood and about 40% more than particleboard. And formaldehyde-free, water-resistant Medex-type MDF is about triple the cost of particleboard, but it is still 15% less than top-quality birch plywood.

Locating and buying medium-density fiberboard is sometimes difficult because so much of it goes directly to industry. In the summer of 1990, several MDF companies began test-marketing their products around the country.

California is a big test market. The Medite Corporation based in Medford, Ore., is placing ¾-in. Medite in 20 Home Depot stores there. (Try Home Depot elsewhere for other brands.) J.E. Higgins, a chain of small lumberyards, has MDF in their yards in Los Angeles, San Francisco and Sacramento.

Some chains have MDF in selected stores across the country. The stores include: Handy Dandy, Channel and Lowes. Sequoia Supply in Columbia, Md., distributes Plum Creek MDF to lumberyards in parts of Maryland, Virginia and Pennsylvania.

If you know of mills that cater to woodworkers, call them. If you must special order, local independent dealers are your best bet. A chain that has particleboard but no MDF may be able to order some for you from its particleboard source, but you will pay top dollar.

Small commercial shops can buy from one of the 2,000 industrial wood products distributors in the United States. Would the industrial distributor welcome me if I showed up as an individual to buy one or two sheets? Probably not. But my 275-member Washington Woodworkers Guild has an agreement with one to sell to all our members, large orders or small. (Guilds have buying power. We have price discounts from several stores, wholesalers and manufacturers.) Don't overlook the fact that some sellers are willing to deliver sheet material.

If all else fails, write one or more of the MDF companies listed at right, and tell them everything you went through and how badly you want their product. If you have equally interested friends or belong to a guild with a genuine interest in MDF among its members, mention that also. No one is promising you instant results, but many letters from many woodworkers do a market make. □

Jim Hayden is an amateur woodworker and a professional photographer at the Arthur M. Sackler Gallery and Freer Gallery in the Smithsonian Institution, Washington, D.C.

Sources of supply

The following companies manufacture medium-density fiberboard. Contact them for the name of a distributor near you.

Georgia-Pacific Corp., Holly Hill, 133 Peachtree St., N.E., PO Box 105605, Atlanta, GA 30348

International Paper, Masonite Division, Spring Hope Plant Highway 64 and County Road 1306, PO Box 369, Spring Hope, NC 27882; Marion Plant Highway 301, PO Box 8, Sellers, SC 29592

Louisiana-Pacific Corp., Eufaula Mill, Route 3, Box 22, Clayton, AL 36016; Oroville Mill, PO Box 158, Samoa, CA 95564

Medite Corp., PO Box 4040, Medford, OR 97501; PO Drawer 1427, Las Vegas, NM 87701

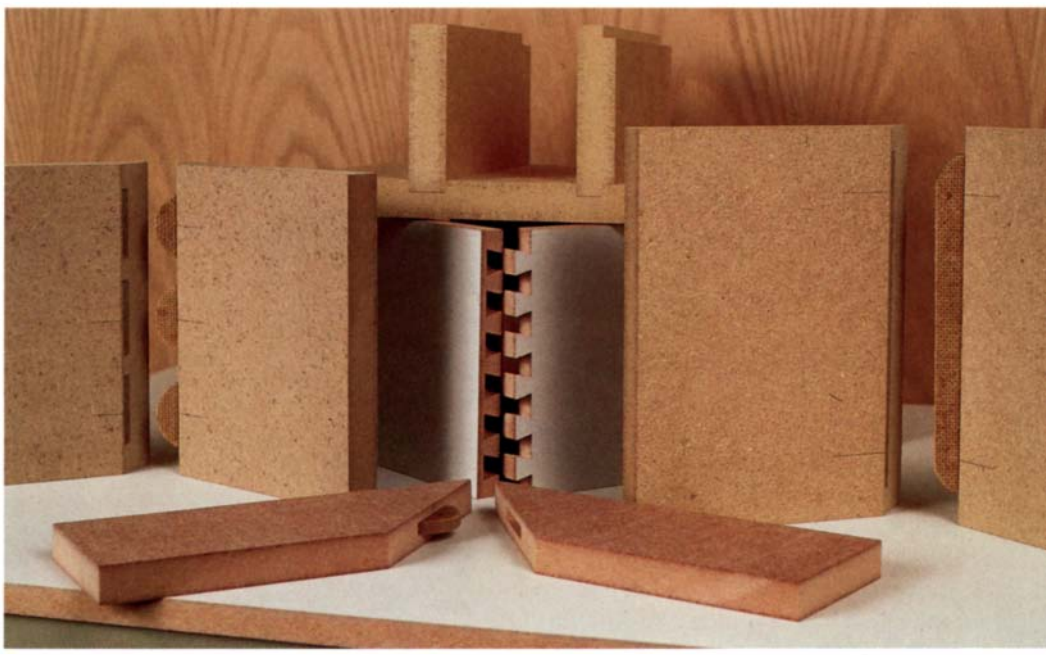
Norbord Industries, Inc., PO Box 26, Deposit, NY 13754

Plum Creek Manufacturing, L.P., PO Box 160, Columbia Falls, MT 59912

Sierrapine Ltd., product sales by Timber Products Sales Co., PO Box 269, Springfield, OR 97477

Weyerhaeuser Co., PO Box 290, Moncure, NC 27559

Willamette Industries, Inc., Bennettsville, PO Box 636, Bennettsville, SC 29512; Malvern, PO Drawer 190, Malvern, AR 72104

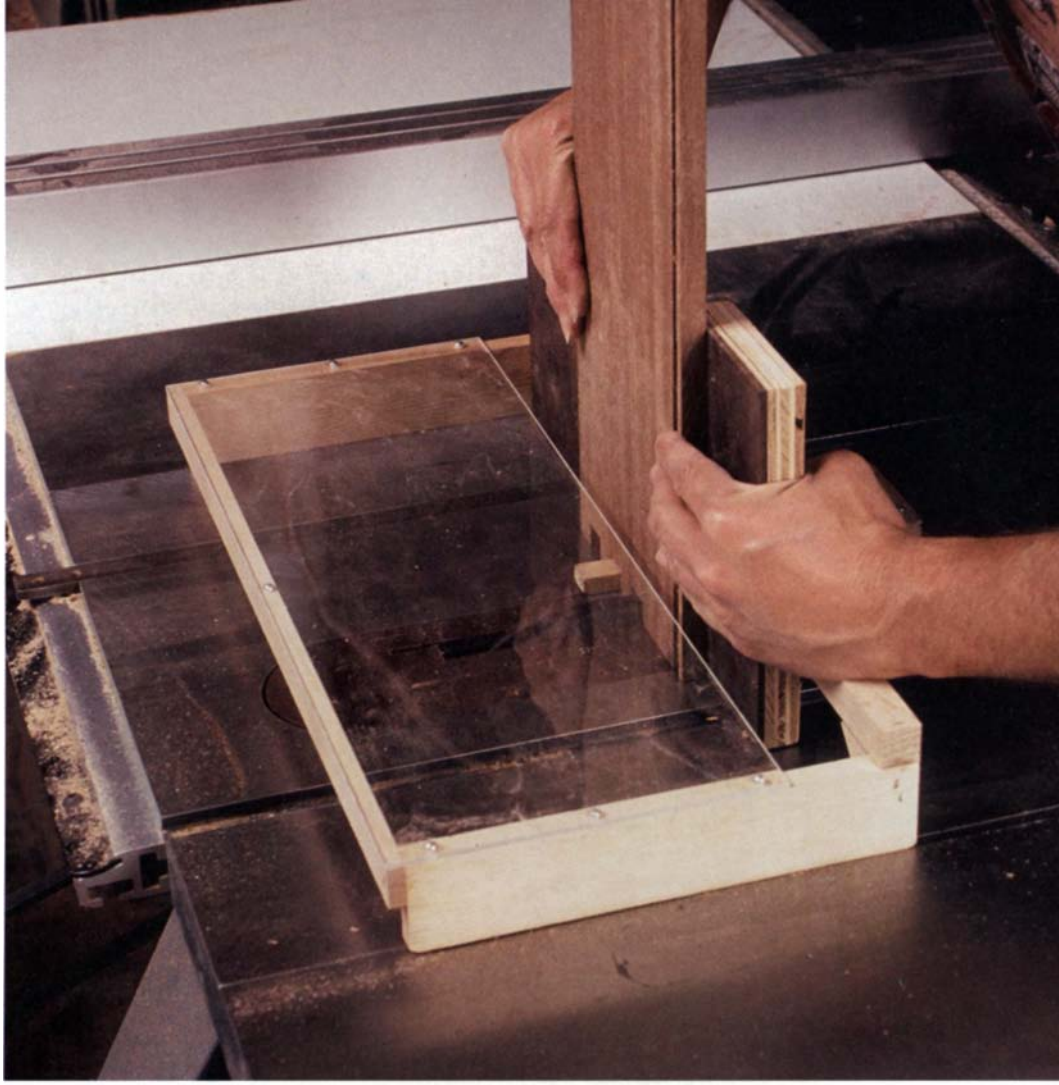


***A wide variety of joinery** is possible with MDF. Examples shown here surrounding a routed dovetail joint are, clockwise from left, biscuits, dado, rabbet and dado, spline miter and biscuited miter. The background is a sheet of factory-veneered MDF.*

Shopmade Tablesaw Guards

Building safety into your jigs

by Sandor Nagyszalanczy

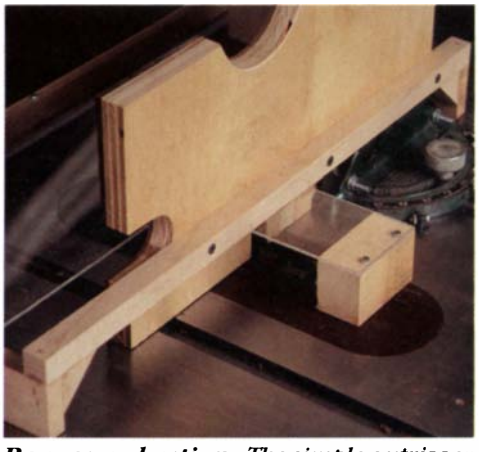


Safety without sacrifice—*A Plexiglas shield keeps hands safely away from the blade without compromising visibility on the author's box-joint jig.*

"Blade guard removed for photo clarity." How many times have you been watching a home-improvement show or woodworking video and seen those words appear across the bottom of the television screen? Well, I want to know: ***what*** blade guard? In almost all the cases I've seen, a stock tablesaw guard wouldn't have worked in the applications shown.

What's a woodworker to do? Must we continually expose ourselves to unreasonable risks when we perform operations that require removal of the tablesaw's standard blade guard—jobs like sawing tenons, cutting box joints and cove cutting? I suppose we can hope our luck holds out, or we can wait for some kind of sensational all-purpose saw guard to hit the market. But I advocate another alternative: to design safer tablesaw jigs and setups by adding guards and safety devices that prevent accidental contact with the sawblade. I think any woodworker bright enough to design innovative jigs for complicated woodworking tasks could make those same jigs a lot safer without investing too much extra time or material. After all, how much is a finger worth?

In this article, I'll show you some of my solutions for making common tablesaw jigs and setups much safer. One thing I aim for in modifying my jigs is to reduce the degree to which safety relies on judgment. It's a given that, as you work, especially at repetitive tasks, there will be times when your attention flags or is diverted. A safe jig protects you during these lapses. The very best safety feature is one that eliminates the possibility of contacting the blade with anything but the stock. I try to get as close as possible to this ideal in all my jigs.



Rear guard action—*The simple outrigger behind the box-joint jig lets you complete the cut without exposing the blade.*

In many cases, I've retrofitted existing jigs with guards to show that you don't have to build all new devices to add safety to your woodworking. Because jigs are, by definition, custom-made, the safety measures you take will also have to be individualized. So I haven't tried to cover all the bases here, only to share a few specific solutions and underscore the general idea that safety and guarding features ought to be built into every jig you make.

Clear guards for sliding jigs

Carriages that slide in the tablesaw's miter slots almost always require that the stock guard be removed. Whether you want to use a sliding crosscutting box or a jig for cutting tenons, dovetails or box joints, you can easily retrofit clear blade guards that allow you to see what's going on but keep you from getting cut.

Box-joint-jig guard—I made the guard for my box-joint jig shown in the top photo in about a half-hour from a few scraps of wood and a Plexiglas cutoff purchased from a local plastics store. (Glass shops

Photos: Sandor Nagyszalanczy

and hardware stores often carry clear plastic sheet goods.) The guard is a low box with wood sides and a Plexiglas top that mounts directly over the box-joint jig and provides protection ahead of and after the cut. As an added bonus, I've noticed that it deflects chips and makes dust-collection more efficient.

I made the guard's frame 21 in. wide by 10 in. long, which is wide enough to handle 10-in. drawer sides. I drilled holes in the ⅛-in.-thick Plexiglas sheet so that it could be screwed to the top of the frame (leave the protective paper on the Plexiglas during cutting and drilling to protect it from scratches). When attaching the plastic, I left it about an inch shy of the face of the jig, creating a slot for the workpiece. The 2-in.-high sides provide plenty of clearance between the plastic and the blade. I chamfered and waxed the lower edges of the sides to keep them gliding smoothly. Then I attached the guard to the back side of the box-joint jig with screws through the rear frame member.

To provide blade protection behind the jig, I added a second guard made from a block of wood and a 3-in. by 4-in. piece of Plexiglas, screwed to the underside of the rear frame member (see the bottom photo on the facing page). Even if you don't want to make the entire guard frame, adding a rear guard is an excellent idea. It protects you after the jig has been pushed through the cut when you're reaching over the saw table and are probably the most vulnerable to blade contact.

This type of exit guard is a good addition to any sliding jig. And you can make using it even safer by clamping a stop block to the rip fence or right to the table that will limit the forward travel of the jig—allowing a complete cut through the workpiece but stopping the blade short of the exit guard's rear block.

Tenoning-jig guard—Protecting my hands from the blade involved the addition of three components to my sliding tenoning jig: a clear plastic shield ahead of the cut, an exit block to cover the blade behind the cut and a hand rest to prevent my left hand, which holds the workpiece against the jig, from sliding down into harm's way, as shown in the photo at right. The clear shield is nothing more than a 10-in.-long, 2½-in.-wide piece of ⅛-in.-thick Plexiglas screwed to the edge of a wood strip. This strip mounts to the face of the tenoning jig via slotted holes I made using a straight bit in the plunge router. The slotted holes allow me to shift the shield in or out depending on the width of the workpiece. I glued and screwed a 2½x2x1½ wood exit block to the back of the jig. I used a brass screw just in case it's accidentally hit by one of the two sawblades used during tenoning. A larger block would provide more protection, but as long as you use the jig in conjunction with a stop block, this size is fine. The final component, the hand rest, is a 4x2x1½ block glued to the edge of the tenoning jig's fence. You could position this block higher, if you find it more comfortable.

Crosscut-box guard—A shopmade sliding crosscut box that rides in the tablesaw's miter slots is great for trimming and crosscutting long boards or moldings. And adding a guard is the perfect way to make this sliding jig safer to use. The guard that I made for my crosscut box, as shown in the top photo on p. 58, is basically an inverted U-shaped channel that rests on top of the stock over the line of cut, preventing hands from reaching into the blade. This design is very similar to the clear plastic guard that Kelly Mehler built in his article in *FWW* #89, except that mine was made as a retrofit and has wood sides—I don't miss being able to look through the sides of the guard.

I started building the guard by cutting two 2¼-in.-wide, ⅜-in.-thick wood sides and a 3½-in.-wide, ⅛-in.-thick Plexiglas top, all slightly shorter than the front-to-back dimension inside my crosscut box. I then nailed sides and top together with #16 brass escutcheon pins through holes drilled in the plastic. Because the guard was retrofitted to my crosscut box, I couldn't cut grooves for the ends of the guard to slide in, as in Mehler's design. But for a smaller (12-in. capacity) box like mine, two narrow guide strips tacked on the inside of the box's front support are adequate to keep the guard in place and let it ride up and down. Chamfering and

Untouchable tenoning jig—*An adjustable Plexiglas blade guard and a hand rest combine to keep your exposure to the blade near zero on this tenoning jig. The block that's clamped to the rip fence provides a positive stop and prevents the blade from cutting through the exit block at the back of the jig.*

***Crosscuts safe and simple**—A three-sided box over the line of the cut reduces the chance of accidental blade contact on the author's crosscut jig. The box, with ⅜-in. wood sides and a ⅛-in. Plexiglas top, is held in place at one end by two cleats and rides up and down between them. An exit block guards the blade at the end of the cut.*

rounding the ends and edges of the wood sides makes the guard slide up and down easily. To shield the blade where it exits the crosscut box, I added a rear guard that is a variation on the one for the box-joint jig described previously. In this case, I simply glued and screwed on a wood block to sheathe the blade.

***Sliding miter-carriage guard**—*Many woodworkers like to cut miters on the ends of moldings, picture frames and other trim using a carriage with twin 45° fences, which slides in the tablesaw's miter-gauge slots. When you use this type of jig, you hold the workpiece against the fence during the cut, and your fingers often come close to the blade. And as you finish the cut, the blade exits between the fences, not far from where your thumbs are wrapped over the top of the fences. It's an operation that begs for a guard.

To add protection to my sliding miter jig shown in the bottom photo on the facing page, I cut a triangular block from some scrap 2x4 I had around the shop and glued and screwed it to the jig's baseplate just behind the intersection of the fences. This block acts as an exit guard and a mounting surface for a clear blade guard. The back end of this blade guard, a 5-in. by 12-in. piece of ⅛-in. Plexiglas, is screwed to the top of the block, and the front end is screwed to a wood strip nailed to the miter jig's front cross support. To complete the safety treatment, I clamp a stop block to the saw table to prevent the blade from cutting through the exit block.

Two resawing guards

Probably one of the most dangerous operations to perform on an unguarded tablesaw is resawing, for two reasons: First, the blade is usually raised to or near its full height. If there's a slipup, you are exposed to more harm than with any other tablesaw operation. Second, there is maximum surface area contact between the wood and the blade. If the wood distorts and binds between the fence and blade (or the kerf closes up and pinches the blade), the workpiece is kicked back with the full force of the saw. These are two excellent reasons to invest a few minutes and a couple of pieces of wood to protect yourself against disaster.

I've come up with a pair of guarding devices for resawing. Both are simple, but effective. These jigs serve two purposes: They keep the board upright during the cut, and they keep your hands from coming anywhere near the blade.

The first is a clamp-on guard, as shown in the photo at right. It consists of a 12-in.-long block of 4x4 lumber with a 2x2 stick screwed to one side. At 3½ in., the 4x4 is thicker than the depth of cut of most 10-in. tablesaws (if your sawblade rises higher, use a thicker block). The block is positioned over the throat plate, just far enough to the left of the blade to allow the stock to feed past. Because the resawn stock will have to be planed anyway, you can set the guard for a fractionally loose fit to account for the distortion caused when the workpiece is cut. The 2x2 stick should be made long enough to center the 4x4 with respect to the blade arbor.

To use the clamp-on resaw guard, set the rip fence, lower the blade into the table and put a piece of stock in place above the blade. Then position the block so it's over the throat plate and snugged up to the workpiece. Secure the end of the stick to the saw table with a C-clamp.

If you do a lot of resawing, you might want to make the second style of guard, which incorporates a dedicated throat plate. On this device, the wood block is attached directly to a replacement throat plate. In addition to providing protection like the clamp-on guard, this version enables you to raise the sawblade through the blank plate for a close fit that supports narrow workpieces right next to the blade. And it prevents the leading edge of the work from hanging up.

Make the replacement throat plate from plywood, particleboard or Masonite that's the same thickness as the original plate. The easiest way I've found to shape the new plate is to use the factory throat plate as a template. I cut out a slightly oversized blank on the bandsaw, attach the factory plate to it with Scotch brand 924 Adhesive Transfer Tape (available in ½ in. and ¾ in. widths from University Products, 517 Main St., Holyoke, Mass. 01041; 800-628-1912) and then trim the new one to size using a piloted, flush-trimming router bit. Once the new plate fits snugly in your saw, screw on the block from below. I keep a couple

***Resawing reconsidered**—A chunk of 4x4 screwed to a stick is all that it takes to keep the stock vertical and the blade safely hidden while resawing. If you resaw often, you can screw the guard block directly to a dedicated throat plate.*

of these dedicated throat plates handy—one for resawing 4/4 stock and one for 8/4. You can cut slots instead of holes for the screws through the replacement blank to permit adjustment for resawing boards of various thicknesses.

When working with either style of resaw guard, use a push stick to feed the end of the stock through the gap between block and fence—even if the blade is buried in the wood. If resawing must be done in two passes, set the blade height to slightly less than half the width of the board. The board is easily snapped apart after the second pass, and the small unsawn strip down the center of each resawn half can then be planed off. Incidentally, you can also use a similar guard—with a block that's not as high—when ripping narrow strips to width.

***Wide featherboards are excellent for coving**—They exert downward pressure over the cutting area while keeping hands from coming near the blade.*

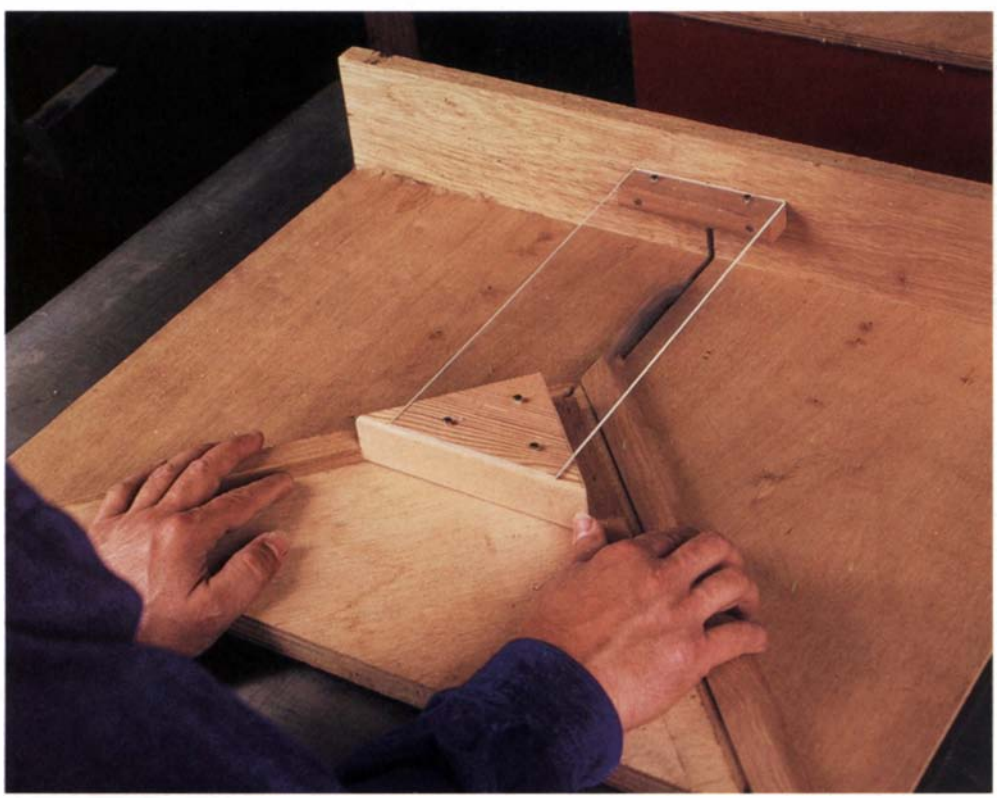
Hold-down cove-cutting guard

Passing your hands directly over the blade is dangerous, even if the blade is buried in a thick workpiece—the stock might be kicked back, suddenly exposing the blade. In tablesaw cove cutting, you have to keep constant downward pressure on the workpiece to get good results, so this danger is always present.

My cove-cutting guard, as shown in the photo above, is attached directly to a clamp-on fence, which guides the workpiece across the blade. The guard employs a featherboard-style hold-down over the blade. The hold-down prevents fingers from getting near the blade while keeping the stock flat on the table. And because the hold-down is firmly positioned, it does a better job of flattening the stock than your hands can. The only thing better than a guard like this is a power feeder, which will keep the stock flat on the table and your hands safely away from the blade while feeding the piece for you.

I made the cove-cutting fence from straight-grained stock; I used a 1¾-in.-wide, 1½-in.-thick piece of Douglas fir. A block of wood 1¾x3x4 is screwed to the top of this fence. Its position along the fence varies depending on the angle of the fence, which is determined by the desired cove profile (for more on cove cutting, see "Coves Cut on the Tablesaw," *FWW* #102, p. 82). I cut the featherboard from a 4½-in.-long, 3-in.-wide, 2-in.-thick block and cut the feathers on the bandsaw, making each one about 3/32 in. thick. Then I attached the featherboard to the fence block with a ⅜-in.-dia. carriage bolt.

To use the device, clamp the fence to the saw table to the right of the sawblade with the guard centered over the blade. With the sawblade lowered into the table, place the workpiece under the featherboard. Pivot the featherboard until it exerts enough pressure on the piece to press it flat, but not so much that the workpiece is difficult to feed. Depending on the thickness of the work, you may have to relocate the hole for the carriage bolt in the fence block. Finally, clamp a secondary fence to the saw table to keep the work from wandering away from the main fence during cove cutting. As you make each pass over the blade (the blade should only cut about 1/16 in. deep each pass), use the next workpiece or a piece of scrapwood the same width as the workpiece to push the end of the work under the featherboard. □



***Miter shield**—A triangular piece of 2x stock serves as an exit block as well as a mounting surface for the Plexiglas blade guard on this sliding miter-carriage jig.*

Sandor Nagyszalanczy is a contributing editor to Fine Woodworking *and a writer, musician and furniture designer/craftsman in Santa Cruz, Calif.*

What's New and Hot

The latest offerings from tool manufacturers

by Charley Robinson and Alec Waters

Ryobi oscillating spindle sander—Gracefully curved features add a sensuous feel to a piece of furniture, but sanding those curves can be a pain. Ryobi's new sander can change all that. The machine sands quickly and smoothly without bogging down even under the heaviest loads, and the oscillating action eliminates sanding scratches. This lightweight unit easily stores under the workbench, and at less than $200, there'll be a lot of oscillating spindle sanders in home shops.

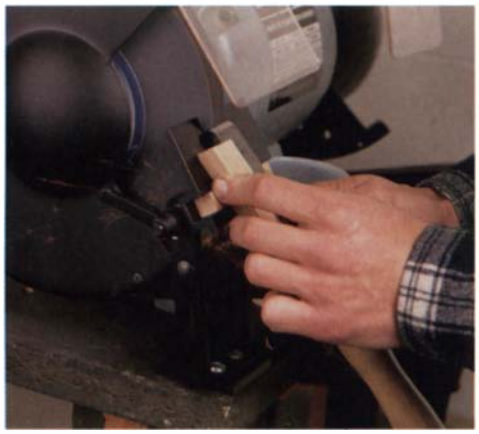
As we head into the new year, it's good to see manufacturers making concerted efforts to target the "serious woodworker," the guy who's more than a weekend hobbyist but is not a full-time professional. Sound like someone you know?

That's good news for us because now we're seeing some beefier tools than previously had been available and without the associated high cost and overkill of professional equipment. Generally, these tools include upgraded bearings and more powerful motors, so they'll do more work with greater accuracy and last longer than consumer-grade merchandise. And some of the machines that heretofore have been available only in commercial grade are being made more accessible to the average woodworker. Ryobi's oscillating spindle sander shown above is a prime example.

Some other products in this new barrage that caught our eye and that you might appreciate are featured in the photos on these two pages. In addition, there were a couple of items that weren't available at press time, but should be on the market by now and are worth a look. One is a new quiet blade ($95-$135) from Freud that runs at much lower decibels than regular 10-in. tablesaw blades and the other is Panasonic's new cordless, 12v drill/driver (about $225). This is one of the best balanced and most comfortable drills we've held. With a 15-minute recharge time and power to spare, it's sure to be a favorite. There are a lot more tools of interest that we don't have room to show here, but we'll be featuring them in this and future editions of "Tool Forum" (see p. 112). □

Charley Robinson is an associate editor and Alec Waters is an assistant editor at Fine Woodworking.

Photo this page: Vincent Laurence



***Veritas grinder tool rest**—Veritas makes an aftermarket grinder tool rest that has provisions for sharpening jigs. The anodized aluminum rest has a generous slot for sliding jigs to grind jointer knives, plane irons or turning tools. The tool post bolts to a bench directly in front of any grinder with up to a 1-in.-wide wheel. Widely adjustable, the rest positions easily and locks positively. The rest, which lists for around $35, is sturdy, and it allows you to quickly line your tool steel squarely to a stone.*

Photo: Robert Vaughan

***Everlast SMT 1210 blade**—According to contributing editor Robert Vaughan, this Everlast circular sawblade is the quietest he's used, as registered on a decibel meter. When installed on his radial-arm saw, the 12-in., 100-tooth, alternate top bevel blade ($100-$190 for a 10 in., about $200 for a 12 in.) crosscut birch plywood and medium-density fiberboard (MDF) effortlessly and without tearout.*

***Weather-Tite glue and Stand-Up pads**—The next time you're gluing up a panel, you might try two new products. The first is Elmer's (Borden) water-resistant glue (about $6 for a 16-oz. bottle). This adhesive sets fast, won't run on vertical surfaces and can be used in certain exterior applications. It also can be painted or stained. The second item is Brink & Cotton's (Warren Tool Group) clamp pads, which fit over most pipe clamp jaws to protect your work. The pads (less than $10 per pair) have flat feet that hold the clamp upright.*

***Hitachi drill, Irwin bits, Noxon punch**—Hitachi's cordless drill (list price, $250) features electronic feedback for constant torque from the 9.6v motor. Irwin introduced the TurboMax drill bits (list price, $22). Because of a new tip design, these bits stay sharp longer and drill holes faster than most other twist drills. Noxon Inc. introduced a unique line of spring-loaded, hand-powered punches, nail sets, drivers, stamps and chisels (all less than $10). Pulling back on the spring-loaded handle and letting go delivers a blow to the working end of the tool. Small brads and finishing nails can be set with no hammer marks.*

Sources of supply

Borden Inc., 180 East Broad St., Columbus, OH 43215; (614) 225-7572

Everlast Saw and Carbide Tools Inc., 9 Otis St., West Babylon, NY 11704; (516) 491-1900

Freud, PO Box 7187, 218 Feld Ave., High Point, NC 27264; (800) 334-4107

Hitachi Power Tools U.S.A. Ltd, Steve Reynolds Blvd., Norcross, GA 30093; (800) 598-6657

The Irwin Co., 92 Grant St., Wilmington, OH 45177; (800) 866-5742

Noxon Inc., North 2921 University, Spokane, WA 99206; (800) 356-6966

Panasonic, 1 Panasonic Way, Secaucus, NJ 07094; (201) 392-6655

Ryobi America Corp., 5201 Pearman Dairy Road, Suite 1, Anderson, SC 29625; (800) 525-2579

Veritas Tools Inc., 12 East River St., Ogdensburg, NY 13669; (800) 667-2986

Warren Tool Group, PO Box 286, Garrettsville, OH 44231; (800) 543-3224

Photos except where noted: Alec Waters

Building a Strong, Light Carcase

Thin, deep front rails give a refined look with plenty of strength

by Garrett Hack

Some people think that the larger a piece is, the more difficult it is to build. That's true to a certain extent, but designing and building smaller, more delicate pieces that still will stand up to the rigors of normal household life—kids and dogs included—is a challenge of its own. Perhaps the most difficult situation is the table or desk with drawers.

Three pieces of wood joined to form a U-shape have virtually no structural integrity. Exert a little pressure on one side, and the corner joint will fail. In contrast, if you join four pieces of wood to form a box, you've got a fairly sturdy structure. Put a top (or bottom) on the box, and you have a structure that will take some abuse. But if you cut a bunch of holes in the front of the piece (drawer openings), you've eliminated much of its strength.

Furnituremakers have come up with various ways of strengthening desks and tables whose fronts are mostly drawers, such as beefing up the frame internally and using heavy-duty front rails. Neither of these is ideal. An internal frame (basically, a shallow box around the internal perimeter of the carcase, sometimes with a crossbar) reduces useable drawer space, and thick, bulky front rails may fit the bill structurally, but they aren't the most aesthetic solution. My solution addresses both of these shortcomings.

Unless you use it to stand on while changing a light bulb, most of

the stress on a piece of furniture like this is from racking, not downward compression. What's needed then are not massive front rails, but deep rails—rails that tie the front of the piece to the three solid sides of the carcase and provide maximum resistance to racking. Together with the table's leg-and-apron construction, these thin, deep rails ensure a piece of furniture that is tough but still looks quite refined, as shown in the photo on the facing page.

Carcase joinery

After I've prepared all my stock and turned the legs for this side table, I begin cutting the joinery. I used a pair of haunched tenons for each leg-to-apron joint (see the drawing on p. 64). Adding a haunch to a tenon increases the glue area of the joint, making it stronger. Even more importantly, though, the haunches increase the mechanical resistance of the joint to twisting.

I lay out my mortises first, clamping all the legs together side by side so that the mortises are all positioned identically. I make all of the mortises with a shop-built slot mortiser, but if you don't have a mortiser, a plunge router and mortising jig (or mortise chisel and mallet) will also work fine. Next I square the ends and then chop the haunch mortises with a sharp paring chisel. To keep the haunch mortises consistent, one to another, I make a small pattern from scrap, and use the pattern as a depth and angle check.

After I've cut all the leg mortises and the corresponding apron tenons, I cut, plane and scrape the front rails. It's important that the faces of the rails that accept the stiles be finish-planed now so that you don't alter the fit by removing stock after cutting the joinery. I also cut the bead into the lower front rail and aprons now, using a scratch stock. I clamp the three front rails together edge to edge to align them, as I did the legs, and I mark out the tenons at each end and the dovetailed slots for the stiles.

I rout the dovetailed slots first, and then work out the pin width and depth on one end of each of the stiles, leaving them long so I can rout a few trial pins. Then, once I have a good pin, I cut the stiles to length and rout the remaining pins. Next I mortise the front legs for the rails, mortise the rails themselves for the drawer runner and kicker tenons and then cut the front rail tenons (see the drawing on p. 64 for joinery details).

Because I wanted maximum joint strength, I mitered the apron tenons at each rear leg. Mitering the tenons allows me to make them longer than would be possible if their ends were square, increasing the glue surface and strengthening the joint. I mark the cutoff line on the tenon by sticking a sharply tapered pencil in through the opposite mortise.

While the leg-to-apron joints are still together, I also score the legs where the tops of the aprons intersect them and carry these marks around each leg with a sharp knife. I crosscut the legs just shy of this mark. Then I plane the legs level with the rest of the carcase after glue-up so that legs and aprons are all precisely even.

I drill the pocket holes in the aprons, using an angled fixture on my drill press to hold the apron in place. I use a Forstner bit first to provide a flat seat for the screw head and then follow with a slightly oversized twist bit to allow for seasonal movement of the wood. I generally prefer buttons for attaching tabletops, but for this small a table, either the buttons would have to be so thin that they would have broken, or they would have to be so thick that they would have interfered with the drawers.

Simple lines, remarkable woods and structural integrity combine with impeccable craftsmanship to make the author's Shaker-inspired hall table a jewel in wood. All drawer faces are from one pear board; the carcase is carefully grain- and figure-matched bird's-eye maple, and the pulls and pegs are rosewood.

***Rosewood pegs strengthen the joint,** and they add a distinctive touch to the author's table. The adjustable wrench keeps the pegs properly oriented, parallel to the case's top and sides.*

Assembly

After I finish planing and scraping all parts not already smoothed, I begin the assembly: first both rear legs and apron and then the two front legs and two bottom drawer rails. After the glue has set on these first two subassemblies, I join them with the side aprons.

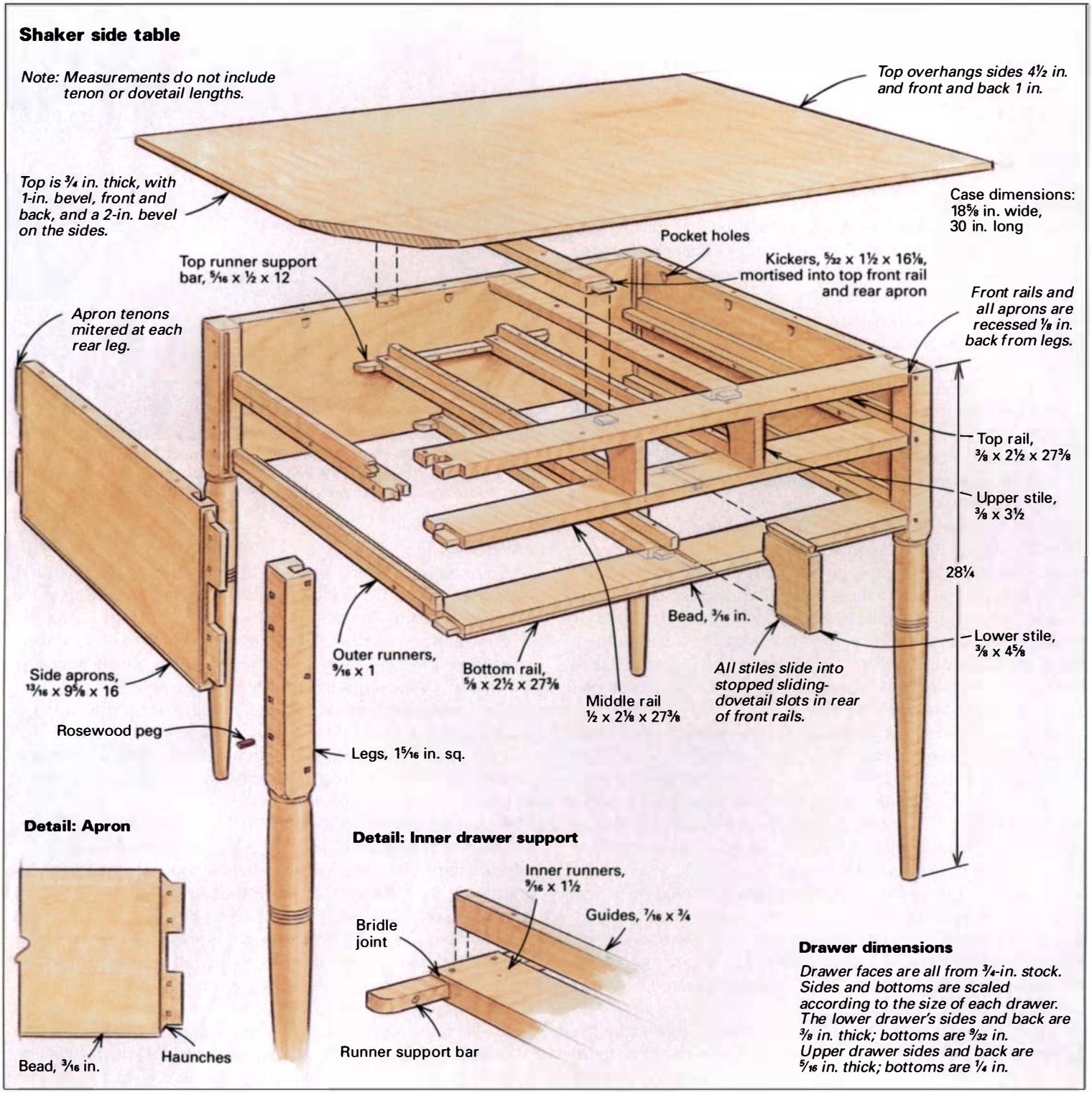
The top drawer rail finishes the case assembly (see the drawing). This rail was sometimes left out by the Shakers in similar pieces, but it's an important element when trying to maximize strength while retaining a delicate-looking carcase. Not only does it add strength to the carcase but also it completes the drawer face frame visually and drops the top drawers slightly so that they're more accessible beneath the overhang.

I cut the dovetailed ends of the rail first, lay it in position, scribe around it and chop the mortise to receive it. Then I drill and countersink a few holes in the rail to secure the top and glue and screw (insurance) the rail into place. I level the top of the case with a jointer plane, working slowly around the piece to take care not to tear out any fibers as I pass over the legs. I finish the carcase assembly by tapping the stiles home into the stopped sliding dovetail slots in the front rails, dabbing just a bit of glue into the slots.

I pin all the joints with small, square rosewood pegs because they add mechanical strength to the joints and because I like the contrast with the maple. I mark out peg locations with an awl, rub a small square of masking tape over the hole-to-be (it prevents tearout when drilling) and drill my holes. To make it easier to fit the pegs into their holes, I square the top third of each hole roughly with a paring chisel, pare the bottom two-thirds of each peg fairly round and taper the end of each peg with a little pencil sharpener. I drive the pegs home with a 12-oz. hammer (rosewood is very dense and not likely to be damaged by the metal). When hammering, I hold onto the pegs with a small adjustable wrench to keep the pegs parallel to top and sides (see the photo above). I tap the pegs home and then pare them almost flush with a chisel, finishing up with a block plane and a scraper.

The next step is to install the web frame: drawer runners, guides and kickers. If you want the drawers to glide smoothly, you must plane all wear surfaces glassy smooth (wax applied later will further reduce friction). The guides should be parallel to the carcase sides and the runners flush with the top of the drawer rails. I cut the guides so they're just shy of the stile faces and the rear of the

Photo facing page: John Sheldon



carcase; that way, I only have to worry about the fit of the runners.

The runners for the top bay of drawers serve as kickers for the bottom drawers, preventing them from dropping down when they're partially open (see the drawing for details). I thickness the runner stock so that it's ⅛ in. thinner than the front rails, which allows the drawer to drop slightly but not scrape the kicker on opening. I thickness the top drawer kickers similarly.

I glue and screw the outside runners and guides into place. For the interior runners, I tenon the front end to slip into the mortises in the face-frame rails, and then I use a bridle joint at the rear to attach the runners to the support bars, as shown in the drawing above. The beauty of using this bridle joint is that it allows adjustment of the runners horizontally and vertically before screwing the bar in, and it lets me install the runners and guides after the case is assembled, making that job considerably simpler.

I center the guides on the runners, apply glue and screw through the runners into the guides from below. Winding sticks help me get everything on the same plane, and a few sticks cut to *exactly* the widths of the drawer openings keep the guides parallel. The last parts to go in are the top drawer kickers, which I tenon into the top drawer rail at the front and set into a mortise at the top of the apron in the back. In addition to keeping the drawers from dropping when they're opened, the kickers also add to the overall integrity of the carcase.

I like to have the top and case completed and assembled before starting on drawers in case there's any tension between the carcase and top. I don't want any surprises (drawers binding, for example) after I've fitted the drawers (see the box on the facing page

Photos except where noted: Vincent Laurence; drawing: Bob La Pointe

for how I build and fit drawers). I milled the boards for the top nearly to final thickness, matched and glued them and then finish-planed and scraped top and bottom.

I beveled the underside of the top all around, rough-cutting the bevel on the tablesaw and then finishing up with a sharp plane held askew. I drew a pencil line all around the edge as a guide for the bevel. This thin beveled edge is pleasant visually, lightening the top in appearance, but without diminishing the mass and the strength of the top in the middle. Before securing the top, I apply a coat of finish to both the top and bottom.

The finish is built up of thin coats of spar varnish, linseed oil and turpentine. I rub each coat in well, let it dry until it just starts to tack up and then vigorously rub off any excess. To bring out the contrasting grain of the bird's eyes, I add a small amount of Minwax Golden Oak oil stain to the varnish mixture. After three or four coats of this finish, inside and out, I polish the whole piece with steel wool and a mixture of beeswax, linseed oil and turpentine. I give the drawer runners, guides and bearing surfaces of the drawer sides the same treatment. □

Garrett Hack is a furniture designer, maker and one-horse farmer in Thetford Center, Vt.

Building and fitting drawers

The trick to getting drawers to fit sweetly is to cut the faces to fit the openings *exactly* (see the top photo). If you can't fit a drawer in its opening, you can always plane the sides to fit—but you can't add any wood back if you start with a sloppy fit.

I cut and pare the dovetail pins on the drawer face first. Then I finish-plane the inside and outside of the drawer faces so that they are at final thickness before I mark and cut the tails at the front of the drawer sides. I also drill the holes for the tenon on the pull now.

To keep the drawers both strong and light, I varied the drawer side thickness, so the smaller upper drawers have thinner sides than those below. As with the drawer faces, I finish-plane the insides and outsides of the drawer sides before marking out the tails, except for the first few inches of the *outside* face around the joint. I leave this area unplaned at this stage because I'll be cleaning up the joint with my plane after glue-up anyway.

Once I've cut and test-fitted the drawer-face dovetails, I cut the sides to length and rout sliding dovetail slots from the bottom of the sides about ¾ in. in from the end. Because the thickness of the drawer back won't affect the fit of the sliding dovetail joint, I finish-plane the backs after I have fit the joint. I used the tablesaw to plow drawer bottom grooves into the faces and sides. I also set aside a piece of scrap with the groove in it to use later for sizing the beveled drawer bottoms.

Beginning with the face dovetails, I assemble each drawer, squaring each corner as I tap it home and clamping the joint if necessary to keep it square. Often I won't even use clamps, though, because a properly fitting set of dovetails doesn't require clamping. After I've joined the drawer face and sides, I slide the back into its dovetailed slot in the side. When the back is two-thirds home, I put a small amount of glue in the slot and on the pin and finish tapping it home. Then I check (and adjust, if necessary) again for square by measuring the diagonals and comparing. I set the drawer on my tablesaw's flat-ground top while the glue is setting up. This way, twist won't be built into the drawer from sitting on a less than flat surface.

***Drawer face blanks that are snug but do not bind** are key to sweetly fitting drawers. Hack leaves the drawers snug at this point, so there will be a minimum amount of play when he planes the sides.*

***Planing drawer sides to fit** is a painstaking process. Hack takes a few passes with a plane and checks the drawer in its opening. The chamois between the drawer side and the board supporting it protects the inside face of the drawer side.*

I proportioned the thickness of the drawer bottom to the drawer sides by eye and by feel: thinner bottoms for the smaller upper drawers and thicker bottoms for the larger drawers below. I beveled the underside of the drawer bottoms, so I could keep the bottom thicker in the middle (and therefore stronger). And I could position the bottom a little deeper in the drawer and still have enough lip to support the bottom securely. Also, a beveled bottom has a certain elegance. I glue up the bottoms from thicknessed stock, rip and crosscut each bottom to size, finish-plane the top surface and then rough out the bevels on the tablesaw. Then I plane each bevel until it fits in the grooved piece of scrap I saved for testing this fit, finish-plane the underside of the bottom and slide it home into the drawer frame, securing it with two screws at one-third points across the bottom into the drawer back.

The first step in fitting drawers is to plane the area I left unplaned around the half-blind dovetails joining the drawer faces to the sides. Then I just plane both sides equally, constantly testing the drawer in the opening until there is a total of about 1/16-in. play from side to side, as shown in the bottom photo. (For larger drawers, I'd leave a bit more clearance.)

Next I level the bottom of the sides and face with a jointer plane, working with the grain all the way around. I also ease all the edges, so they're more pleasing visually and tactilely and to help the drawers glide more smoothly. Once the bottom is level, I flip the drawer over and level the top, stopping often to check the drawer's fit. For drawers of this size, 1/16-in. play at the top is plenty for seasonal movement. —*G.H.*

Picture-Framing Techniques

Use router table setups to shape profiles and joinery

by Leon Segal

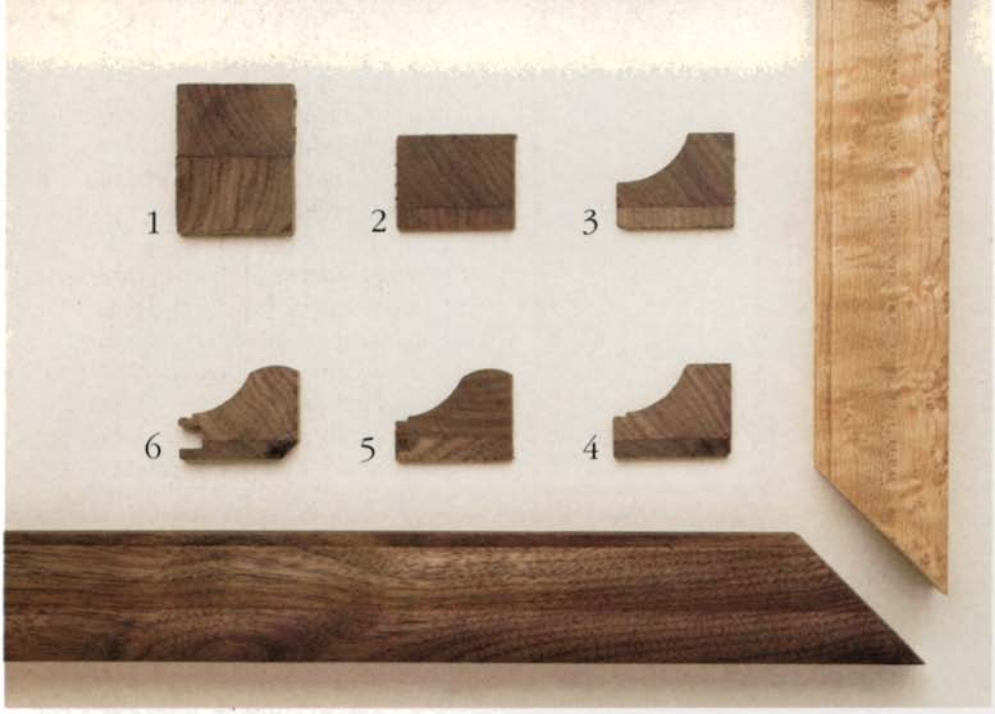
I started making frames for my family's paintings and photographs because I was unimpressed by the cheap pressed-wood frames I'd seen in department stores. Once I decided to make my picture frames from exotic and domestic hardwoods, I quickly found that no matter what type of frame I built—whether a simple solid frame or a built-up frame like the one in the photo on this page—I could use my shopmade router table to perform 90% of the work and achieve high quality. The router does a fine job shaping the outside of a frame (see the top right photo on the facing page) and rabbeting for a picture and glass. With special fences and jigs, the router also neatly plows grooves for miter splines and for a slide-in back.

Design and materials

I often vary a frame's design to suit a picture. Although most of the differences are in the frame profile and decorative treatment, I've also tried variations in the construction of the frames. For example, if I need to frame a large portrait that necessitates a wide frame, I combine several profiles in the frame, such as coves, flutes and ogees (see the inset photo above). Using individual sections can give depth to a frame, and it allows me to save precious species of wood for the visible parts. I use less valuable woods for the unseen fill areas.

Before I make a frame, I usually sketch a profile and note any critical dimensions. I can still refine details and proportions later, but the sketch helps me to choose the woods to use and to figure approximately how much of each kind I will need. Depending on the hardwood that I select, I can give a frame a light look or a more formal appearance (see the top left photo on the facing page), and I can even pick woods that will complement the colors in the picture to be framed. If I'm gluing up a frame, I often prepare contrasting woods, being sure to plane surfaces that will be mated. To minimize bow in the stock, I first rough-

***Surrounded by a variety of woods—** For this picture frame, Segal glued router-shaped segments of bocote, madrone and tiger maple over poplar and pine.*



***The two hardwood frame pieces** are identical in profile, and each will accept a simple, applied back. But the bird's-eye maple piece (right) looks lively while the dark walnut piece (bottom) appears more formal. The six cross sections show the shaping sequence Segal used (clockwise from top left): After glue-up (1), he ripped down the stock (2). Then using his router table, he cut the cove, rabbet, roundover, groove and chamfer (3 through 6).*

Photo: Alec Waters

***Relying on his shopmade router table** for shaping work, Segal advances an assembled frame by the bit, taking multiple passes. He uses a custom-made fence with an appropriately sized cutout for the bit.*

crosscut the long pieces in two. Then I joint the sections square.

Decorative inlays are my favorite border for frames. I make my own inlay bandings ⅛ in. to ¼ in. thick, which allows enough depth for router-shaping (see the photo on p. 68). I save cutoffs and frame scraps to make refrigerator magnets or key chains.

Shaping and assembling

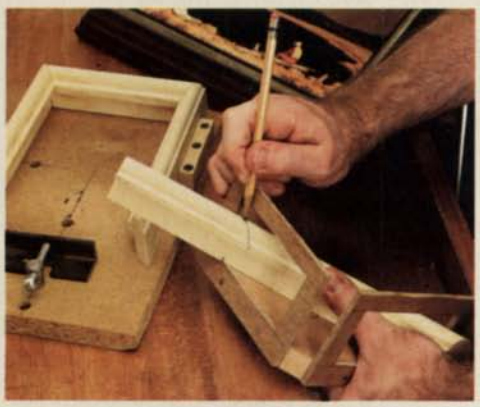
Although I frequently build up thicknesses to make a frame, gluelines are seldom a problem. They can be virtually invisible if located below the rabbet that will hold the picture. On the outside of a frame, you can rout a bevel or cove to disguise the line (see the drawing on p. 68), which also helps remove frame bulk.

To rout a shape, a ¾-in.-radius cove for example, I take several passes on the router table, plus a light (under 1/64 in.) finishing pass. This reduces tearout, especially on highly figured stock. Straight-grained stock will usually rout cleanly, but even so, I always move the work slowly. I form the rest of the profile with a sequence of router shaping (see the top left photo). To make the operations safe and fast, I use several router-table fences with hold-downs dedicated to special tasks. Each one is different in height or has a cutout sized for a particular bit.

To form a recess for the picture, mat and glass, I use a straight bit and plow a ¼-in.-deep rabbet in the inside of the frame. The rabbet's width depends on the size of the picture. I allow 1/32 in. clearance, so everything slides in easily. The back-holding slot can be cut in the frame itself or in a rail at-

Frames from recycled moldings

by Ted Myers



***Marking and clamping miters**—Ted Myers made two fixtures to help him make frames from salvaged moldings.*

As a certified Yankee, it grieves me to see architectural remnants wasted. Scraps of molding from doors and windows or narrow boards often wind up in a wood stove or at a landfill. Because of a few nails, a lack of breadth, old paint or a knot here or there, these castoffs are sadly condemned to oblivion. I can't bear to see that happen, so I've been backlogging old moldings to make picture frames.

It's fairly easy to strip off layers of paint and to fill nail holes and cracks. Old moldings can be left with their original patina, or once sanded, they can be waxed, painted, stained or varnished. Leftover barn wood, colored by Mother Nature, also makes a handsome frame. If I don't like a piece's profile, I reshape it using handplanes or my router.

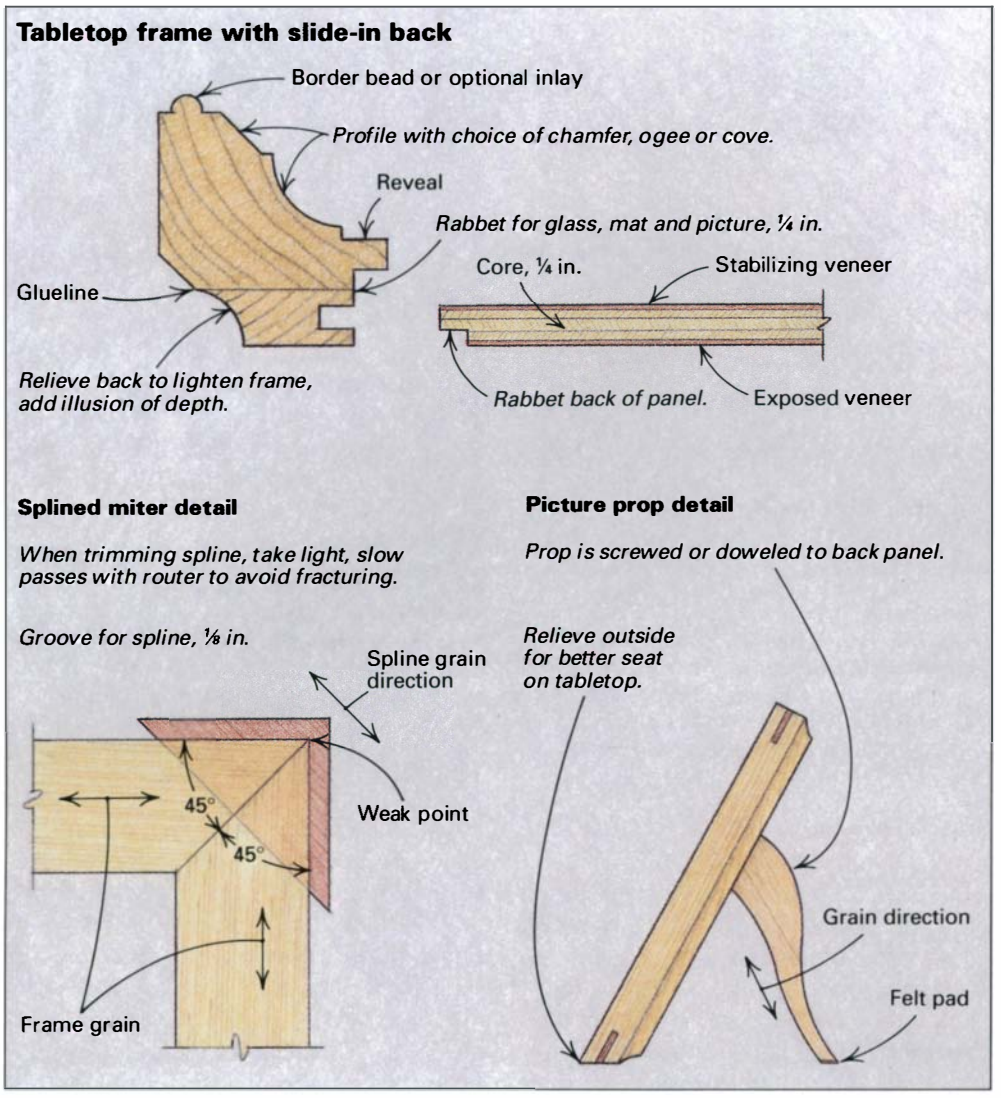
To help construct frames, I made two devices: a miter-marking gauge and a clamping fixture (see the photo at left). The gauge lets me accurately transfer a cutoff line that I've marked on the inside of the rabbet for the picture. To make the gauge, I first cut the right-triangle base from a scrap of 1x4 pine. Then I made the sides from lauan, sawing out the molding windows using a Dremel tool.

The clamping fixture has two fixed stops and two adjustable angle brackets that pivot. Cutouts in the bottom legs of the bracket accept dogs with ¼-20 by 2-in. machine screws that clamp the frame on the particleboard base.

With framed pictures now filling up my family's wall spaces (my stock of moldings greatly reduced), I justifiably took two buckets of 2-in.-long scraps toward the kindling pile. But then I thought: "Why not glue them to that plywood scrap that blew off that fellow's pickup truck—spray it all white—enter it as a piece of sculpture at the next East Grandy Arts-N-Crafts Show?...Now where is that glue bottle?" □

Ted Myers is an English teacher, machinist and woodworker in Cambridge, Minn.

Photos except where noted: Sloan Howard



With a groove-cutting jig and a slot-cutter *in his router table, Segal plows grooves in this inlaid frame for the miter splines. The jig cradles the frame corner securely at a 45° angle to the fence and keeps his hands out of harm's way.*

tached to the back (see the drawing at left). I leave a ⅛-in.-thick lip on the back for strength. If I use a back rail, I glue it to the frame after I've routed the other profiles.

Mitering and pre-finishing parts—You can build frames from single moldings (see the story on p. 67), or you can build up a frame from sections and then tilt the frame slightly. This requires the miters to be cut at compound angles. However, I prefer to make non-tilted frames, so I can leave the work flat and cut the miters at 45°. The perception of depth is achieved by the profiles I routed.

Before I cut any miters, I apply a thinned coat of varnish to the pieces. The pre-finish keeps glue stains off the mitered corners, and the thinner prevents the sawblade and router bits from gumming up. I cut the frame miters on my radial-arm saw using a fixture (see the box on the facing page). The wider the frame, the more important the accuracy of the miter. I first miter the long sides of a frame. If I cut a long piece short or if too much tearout occurs, I can almost always cut the shorter section from this longer piece.

Cutting and inserting splines—I usually reinforce my miters by inserting visible corner splines. With the frame glued together, I rout the spline grooves using a slot-cutting bit and the jig shown in the photo below. I cut the splines from contrasting wood, leaving them oversized, so I can trim them flush after the glue is dry.

I orient the grain of the splines at 45°, which means the outside corner is the weakest point, the spot where routing tearout is likely to occur (see the splined miter detail above). Therefore, I make sure the spline and its groove have adequate glue near the point, and I take extra care when trimming the corner. By shaping the underside of the frame, you can reveal more of the spline as a decorative touch (see the photo on the facing page).

Making and fitting the back—How you treat the back of the frame depends on whether you want the picture to hang on a wall or stand on a table. For a wall-hung frame, you can install a cardboard or plywood back with turn-buttons to hold the picture in place. For a standing frame, I like to put on a sliding back, so there won't be any exposed hardware.

To make a decorative back panel, I veneer both sides of a plywood core (see the drawing above). For the core, I use ⅛-in. (3-ply) poplar plywood or ¼-in. lauan. After I glue on the veneers, I cut the back

Drawings: Vince Babak

panel about ½ in. wider than the opening width in the back of the frame. Next I cut the panel 1 in. longer than the opening, so it extends past the frame contents. Then I rout a rabbet on the sides and top of the back so that it slides into the groove in the back (or back rail) of the frame.

Installing the picture—To slide in the picture, glass, mat and back, there must be an entry slot. After the frame is assembled, I rout an access slot in the frame's bottom where it will be inconspicuous. To set the width of the cut, I clamp on a pair of stop blocks to the router-table fence: one block to start the cut (see the photo at right), one to end it. With a ½-in. spiral bit positioned adjacent to the router table's fence, I move the frame left and right between the stops and make the slot in multiple passes. Then I use a chisel and sandpaper to trim and smooth the routed area.

If you lift a standing frame from a table, you don't want the sliding back to fall out. So I insert cardboard spacers to form a friction fit between the picture and the back. If I'm not using a mat, I just insert more cardboard. After I have fit the picture, I mark and cut the back to final length.

Other back details—When a frame is destined for a table or desk, I give it a simple prop to support the frame upright (see the picture prop detail on the facing page). I make the prop from scrapwood, sometimes laminating together a few pieces. By installing the prop to the back with a single fastener, I make the prop swivel, so the picture can stand either vertically or horizontally. You may have to vary the length of the leg, the angle of the frame or the attachment location to get the frame to sit the way you want. And you may want to relieve some more of the frame bottom, so it sits more comfortably on the tabletop. □

Leon Segal is a business manager and woodworker in Randolph, N.J.

Access slot—*After routing a picture-entry slot by sliding this frame between two stop blocks on his router table, Segal checks the fit of the glass. The frame back was coved to show more of the spline.*

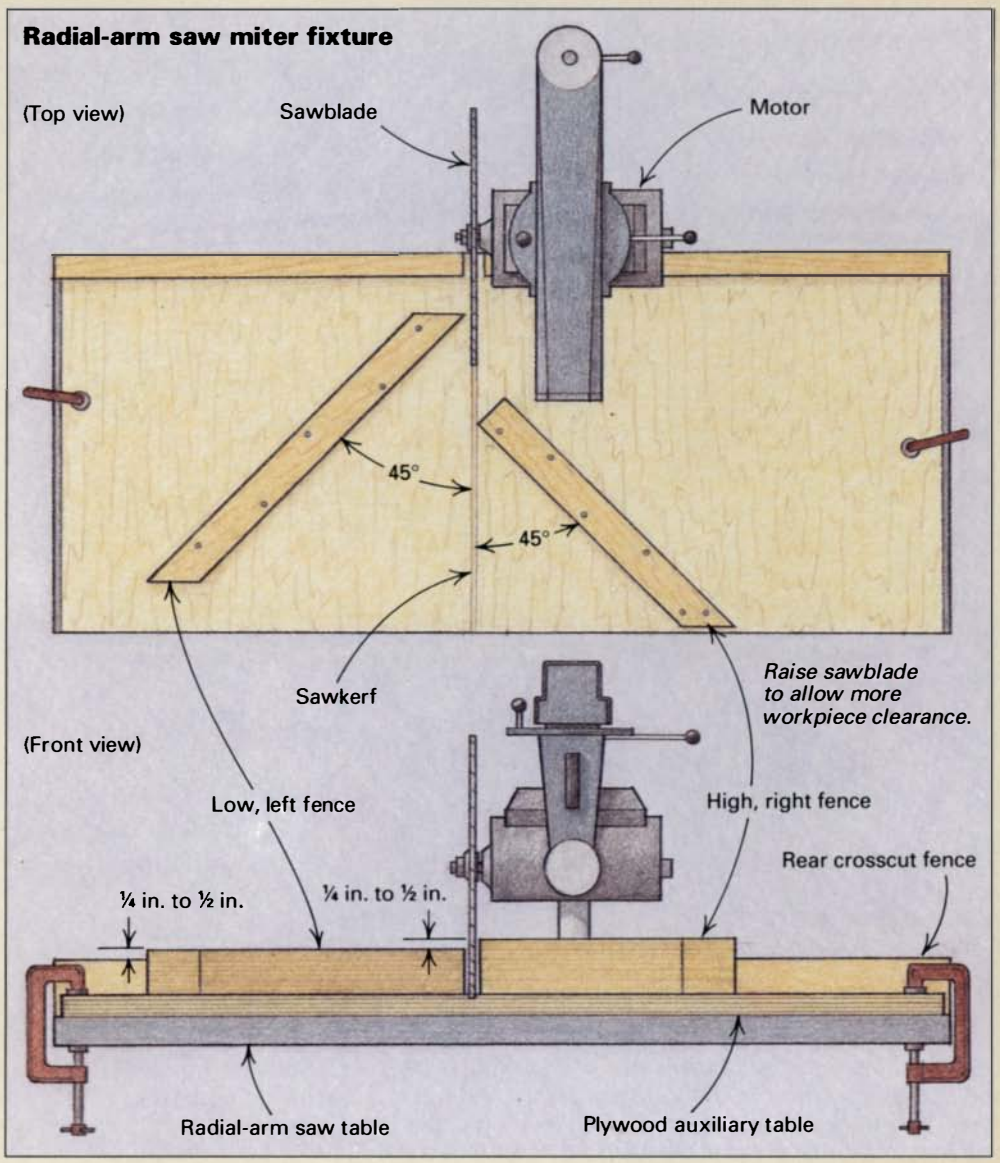
A mitering fixture

The radial-arm saw has been my mainstay for cutting miters for years. When I'm mitering, I leave the saw set at 90° and skew the work using a fixture (see the drawing at right). This saves me from resetting the saw each time I make a cut.

The mitering fixture sits on the saw's table and butts against the rear crosscutting fence. The fixture has two fences screwed to a plywood auxiliary table, similar to the one shown in *FWW* #93, p. 14. But unlike that setup, my device enables exact miters at any point in a piece of stock—an important feature if you want to cut a miter near the center of a long section.

I can align long work against either miter fence without the piece interfering with the normal fence. This also allows the waste to fall safely in back of the crosscutting fence. The different heights of the fences let me miter either left- or right-handed. I just shim the work with a block of appropriate thickness so that the workpiece clears the opposite fence.

When you're screwing down the lower fence, countersink the heads, so they won't interfere with the work when you're aligning a piece against the right fence. And when you're shimming work with plywood or other stock, raise the blade, so it just cuts through the workpiece. If the work tends to slip when supported against the exposed height of the fence, stick some 220-grit sandpaper to the registration surface using double-faced tape. —*L.S.*



Photos these two pages: Alec Waters

Disappearing Doors Provide Easy Cabinet Access

Selecting and installing pocket-door hardware

by William Lego

***Disappearing pocket doors** hinge open like a conventional door and then push into the cabinet. The mechanism can be adjusted, so the door fully retracts and the knob tucks in behind the face frame as it does on the entertainment center shown here.*

***Aligning a pocket door with a conventional lipped door** below it requires a narrower stile on the pocket-door compartment (inset photo). Also, the pocket door is set 3/8 in. proud of the face frame, so it's on the same plane as the lipped doors.*

Photos this page: Charley Robinson

There is no substitute for retractable pocket doors in applications like a television cabinet or a fancy liquor cabinet where open doors would only get in the user's way. Pocket doors, sometimes called flipper doors or retractables, open in a side-hinged fashion, like conventional doors, to be perpendicular with the face of the cabinet. But unlike their conventional cousins, they are pushed back into the depth of the cabinet, parallel to the cabinet's sides. Some pocket-door mechanisms can be used to retract a door to the overhead position in a compartment. Unlike tambours, pocket doors are solid, one-piece units that blend perfectly with other conventionally hinged doors in a cabinet.

The various hardware systems available that make pocket doors possible have similar functional features but differ in their means of accomplishing the action. They are similar in that they all have a set of 90° opening hinges, and they all have sliding retraction mechanisms that work to ensure the top and bottom of the door retract smoothly together. When closed, the doors typically fit fully inset with business-card clearance between cabinet facings and doors. Of the various mechanisms available, the ones that work the smoothest and hold their adjustments most precisely tend to be more expensive.

***Adjusting the door's position** up and down, in and out or side to side requires just a few twists of a screwdriver. The author particularly likes the rack-and-pinion system's ability to precisely set and hold a door in alignment.*

Pocket-door hardware

The doors attach to the mechanism by either a conventional hinge that screws to the back of the door or with a 35mm or 40mm European-style cup hinge. Cup hinges gain their name from the cup-shaped portion of the hinge that fits into a hole bored into the back of the door. The mechanisms with cup hinges offer the most positive door-to-hinge attachment. Further, cup hinges typically offer a three-axis adjustment that conventional hinges lack. Doors can be adjusted up and down, left and right and in and out in their openings until they are perfectly aligned. However, cup hinges require a drill press and a special bit to bore the hinge holes into the back of the door.

Pocket-door hardware also varies in the follower that links the top and bottom hinge-slide mechanisms together. The follower keeps the hinges parallel, so the door doesn't sag and jam as it's pushed and pulled in and out of the cabinet. Followers are either passive, a solid link between the hinges, or active with some sort of mechanical tracking device linking the hinges.

Passive followers have either steel or wooden struts linking top and bottom hinges, as shown in the photos on p. 72. The steel struts are supplied with the mechanisms, the wooden ones typically are not. If the system requires a wooden follower, it may have to be relieved or dadoed to fit around the mechanism. The passive-follower systems are the least expensive and are less accurate and harder to install and adjust than the active mechanism.

Active followers use one of several configurations: cable, pantagraph (scissors) or rack and pinion, as shown in the photos on p. 73. The cable mechanism works similarly to the mechanisms used on drafting boards. The pantagraph-type of mechanism advances like a piece of wall-mounted medical equipment. And the rack-and-pinion system uses an ingenious toothed strip and mating cogged wheel to ensure parallel tracking.

Over the years, I've had a chance to use all these systems. The cable system is more challenging to install, and unless perfectly installed, the cable allows some wobble. The pantagraph mechanism works well, but it is nearly as pricey as the medical equipment to which it is compared. Of all the systems, the rack-and-pinion system gets my vote. It is fairly easy to install and to remove for finishing the cabinet interior, once the cabinet is complete and the doors are fitted. Though more costly than the cable system, the rack-and-pinion system is a good value because the mechanism allows precise adjustment (see the photo above) and will hold to tight tolerances once set.

Pocket-door hardware is widely available from mail-order sources specializing in woodworker's supplies. For a local source, I recommend trying non-chain hardware stores. A non-chain hardware store is more likely to be willing to special order items they don't carry. You can also contact the manufacturers listed in the sources of supply box on p. 74 for their nearest retail outlet.

Installation considerations

In tail-wagging-the-dog fashion, I plan my cabinet construction around the hardware that I will be using. First there are the overall cabinet dimensions to consider. The width that can be covered with a pair of retractable doors is limited by the size of the available mechanisms and the depth of the cabinet. Generally, the mechanisms are designed for a maximum cabinet depth of 24 in. Some mechanisms, however, can work in deeper cabinets. The pricey pantagraph types, which start at about $300 per door, come in sizes that can handle up to a 34-in. (people width) door. The cabinet-sized units come in lengths of 12 in. to 24 in. in 2-in. increments. Door retraction is generally 3¼ in. to 5 in. less than slide length. For a 22-in. slide, this would mean a 17-in.- to 18¾-in.-re-

Photo this page: Vincent Laurence

traction capacity per door. A two-door set, with a pair of 22-in. glides, would span 34 in. to 37½ in. and still have the doors fully retractable. The non-retractable distance of the slide mechanisms will vary with manufacturer and style. You may be faced with spending a few more dollars on a mechanism with a greater retraction-capacity to slide-length ratio or building your entire cabinet 2 in. deeper. You also need to decide in the planning stages if you want the doors to fully retract. For doors with projecting knobs, for instance, you may want to let the door protrude a few inches, so the knob won't bang the face of the cabinet.

Note that hardware retraction systems are often rated for the weight of the door that they are designed to carry. Too light a system will be sloppy; too heavy a system may be stiff. Buy appropriately, but err on the heavier side.

As a final note to the planning phase, I point out the ambivalent meaning of the little word *set* when applied to hardware packages. *Set* can mean the collection of hardware necessary for a door, or it can mean enough for a pair of doors. Be certain when ordering to frequently mention the number of doors you wish to outfit with retractor mechanisms. Examine the contents of your set when it arrives to be sure it matches your needs. If you put the set on a shelf until you are ready for it, you may find yourself a set short when you get ready to install the hardware.

Pockets for your pocket doors?

If you like the appearance of a retractable door sliding invisibly into its own little compartment, an additional panel may be installed inboard of the door. This panel may function merely to conceal the retraction mechanism or it may serve to support shelves. Because such a panel takes up precious space and makes immediate adjustment of the mechanism impossible. I personally prefer to omit these panels unless they serve a functional, shelf-supporting purpose. If you opt to use a concealment panel, make sure you can easily remove it to adjust the mechanism if needed.

Planning for full retraction

Because the hinges on the mechanisms are usually self-closing, a knob or pull of some type is needed to swing the door open. But because the doors retract with only ¼ in. clearance from the cabinet side, pocket doors are usually installed so that they protrude about 3 in. from the front of a cabinet to accommodate the knobs. Otherwise, a projecting knob would interfere with the face frame or cabinet side on European-style cabinets (or 32mm construction, as it's called).

To fully retract on 32mm cabinets, the door must be canted inward so that the knob clears the front of the cabinet. When fully opened, the face of the knob rests against the inside face of the cabinet side. In this case, a concealment panel would be impractical and extra room would have to be left for any type of pull-out shelf or drawer. A flush-mounted ring pull would solve the canting problem, but it would take more time to install and the ring pull would limit your design choices in hardware.

The doors also can be set to fully retract on conventionally face-framed cabinets. A wooden glide-mounting strip is necessary behind each glide, as shown in the top photo on p. 74. The mounting strip brings the glide flush with the inboard edge of the face frame. If the face frame is wide enough, the knob will tuck neatly in behind the frame. This may provide just enough room for a television platform to swivel, as shown in the photo on p. 70. But be aware that this installation requires care on the retraction cycle to avoid banging the knobs into the facings.

Whether you choose full or to-the-knob retraction, a stop is required. A small rubber bumper screwed to the cabinet floor does the job.

***Passive followers** are solid struts that keep the hinge-slide mechanism aligned so that the door doesn't sag and jam when it's opened or closed. A wooden follower is used in this mechanism (above).*

***Steel struts** are also commonly used with passive followers to connect the top and bottom hinges (right). Passive followers are the most economical pocket-door hardware.*

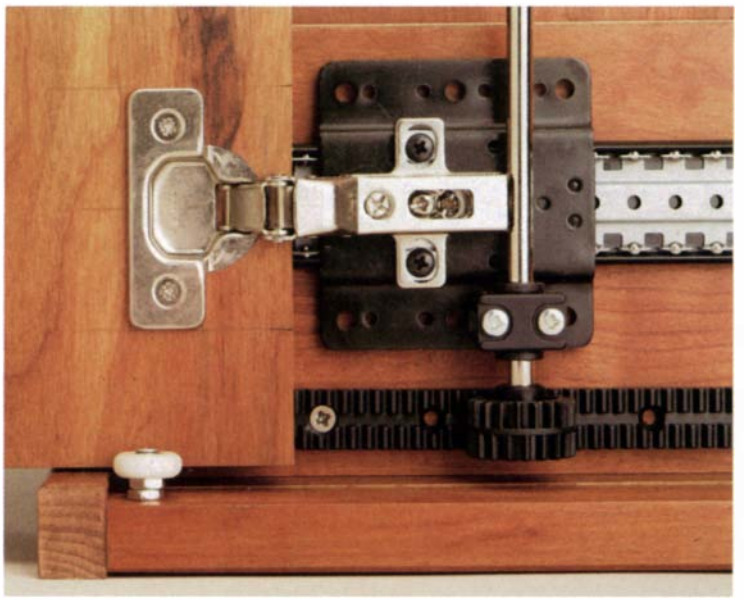
Photos except where noted: Robert Marsala

Active followers *come in a variety of forms, including the cable system shown here (above right).*

A pantagraph*-type active follower is expensive and is designed for architectural (people-sized) doors (above left).*

A rack and pinion *is the active-follower system preferred by the author because it is easily installed and adjusted for extremely accurate door alignment (left).*

***Glide-mounting strips** position the hardware flush with the inner edge of the frame so that pocket doors can be used on cabinets with conventional face frames.*



***Pocket-door alignment** is less critical if the face frame overlaps the cabinet ceiling and floor by ¼ in. The overlap creates clearance at the top and bottom of the door when it's pushed into the cabinet.*

Sources of supply

The following companies manufacture pocket-door hardware:

Accuride, 12311 Shoemaker Ave., Santa Fe Springs, CA 90670; (310) 903-0200

Julius Blum Inc., Blum Industrial Park, Highway 16-Lowesville, Stanley, NC 28164; (704) 827-1345

Häfele America, Co., 3901 Cheyenne Drive, PO Box 4000, Archdale, NC 27263-4000; (800) 334-1873

Knape & Vogt Manufacturing Co., 2700 Oak Industrial Drive, Grand Rapids, MI 49505; (616) 459-3311

Other planning considerations

Once the depth of cabinet is decided, there are a few tricks that can make the installation much easier. Before boring hinge holes in the doors for cup hinges, I recommend assembling the hardware as it will be installed to see the action and to anticipate any additional restrictions. If the design permits, I plan the case work so that the facing overlaps the cabinet ceiling and floor as well as the sides, as shown in the bottom photo. Having the cabinet floor and ceiling offset ¼ in. from the facing provides some clearance so that the retracted doors don't have to be hyper-parallel with the ceiling and floor.

When planning doors, be sure to allow for the cup hinges. On frame-and-panel doors, a 35mm- or 40mm-dia. hole is a big bite out of the door stile. Also, doors large enough to cover a big television may require wider stiles and rails than usual. I design these doors first and then keep all other rails and stiles consistent. I make the stiles 2½ in. to 3 in. wide to leave plenty of material after the hinge holes are bored.

When planning for the overall dimensions of the door, allow 1/16 in. clearance top to bottom and a total of ⅛ in. clearance side to side (divided into the two side gaps and a center gap). Doors can be further trimmed, if necessary, in the final fitting.

If you are using a lipped-door style for all conventionally hinged doors and drawers in the assembly, choose an edging pattern that does not taper the front door edge excessively. Be mindful that the cup-hinge holes come close to the front surfaces and edge of the door. You can get a matching look with the pocket doors by shaping only the outside edge to match the outside appearance of the lipped doors. Do not, however, cut any rabbets on the insides of the doors. Mount the pocket door glides to allow the surface of the pocket doors to project ⅜ in. beyond the cabinet fronts, thus matching the appearance of the lipped doors. Also, if you want the pocket doors to align with conventional doors above and/or below the retractables, the width of the face frame around the pocket doors must be reduced, as shown in the inset photo on p. 70. If you are using fully inset doors throughout your job, no such adjustment need be made.

The retraction-mechanism kits are pretty complete, yet I always find I need a few little rubber bump-buttons or a few adhesive-backed felt dots that did not come with the kit. After installation, look for possible trouble points. Check for rubbing or scraping between the door and mechanism as the door is fully opened and closed. Apply felt discretely if and where needed. Generally speaking, the pricier the retraction mechanism, the less likely you'll need to fine-tune the operation with after-market items.

To hold tight tolerances, the overall cabinet case work should be thick enough and strong enough to retain its shape under a load. With unfaced, European-style cabinets, a stiffener screwed to the underside of the cabinet ceiling may be needed if there is to be a loaded compartment above the pocket-door compartment.

As with anything, you get what you pay for. With retractable-door hardware, I recommend spending a bit more up front to avoid the grief less-expensive and less-accurate systems might bring. Installing pocket doors isn't advanced calculus, but instructions and procedures must be followed rigorously. Pocket doors involve the interrelated workings of several plastic packets full of small parts, all of which contribute to the success of the whole. Plan carefully, read all instructions and don't be surprised to have a few Murphy sightings in your shop if it is your first pocket-door installation. After all, only the sawdust knows when you demonstrate to your friends and say, "nothin' to it!" □

Bill Lego is a woodworker in Rockford, Ill.

***Twenty years of furnituremaking experience** separate the author's nailed, butt-joined carpenter's toolbox from his pegged, finger-joined walnut jewelry box. Drawer fronts are joined to drawer sides with pinned, half-blind, half dovetails.*

A Dozen Ways to Build a Box

Let function, economy and style guide your choice of joinery

by Gary Rogowski

The first box I ever built I put together with enough nails to build a small house. "Can't be too strong," was my motto. That toolbox is still together, too. But in building furniture for the last 20 years, I have learned a few more ways of putting boxes together, from plain and simple to elaborate and complex—all without those nails (see the photos above).

Box construction is a basic building block of furnituremaking. Whether you want to build a desk or a kitchen cabinet, an entertainment center or a jewelry box, knowing how to build a box that is both functional and stylistically appropriate is crucial. The more joinery options you're familiar (and comfortable) with, the greater your furnituremaking vocabulary and the greater the chances that you will consider your furniture projects successful.

There are three essential considerations when deciding on the joinery for a box: function, economy and style. Ask yourself what the box is for. A box's function will usually help determine appropriate types of joinery for the project based on how much work is involved (economy) and on the look you're trying to achieve (style). A carpenter's toolbox or a birdhouse doesn't really require anything more sophisticated than butt joints. Kitchen cabinets, because you generally need quite a few of them, are well-suited to simple joinery techniques, but they also must be strong. There's

Photos: Vincent Laurence

no point in dovetailing these cabinets; it would take forever and not serve any but a decorative purpose. A splined or biscuit-joined miter, however, is a very good compromise.

Other boxes, whether they house your fine silver or your prized handplane collection, may justify the time and effort required to dovetail a carcase precisely. The attention you pay to detail and the emphasis placed on the joinery as a design feature, are in keeping with the valued contents of those boxes.

There are many ways to put together a box. I discuss a dozen in this article, but there are at least another dozen besides. The methods I've presented here, though, collectively form a good initial "vocabulary" of woodworking joinery. I've also provided some basic guidelines on choosing and cutting joinery, both for solid wood and for plywood and other sheet goods. No magazine article can cover such a vast topic in depth, however, so I've also listed a few books on joinery that treat the subject in much greater depth (see the further reading box on p. 79).

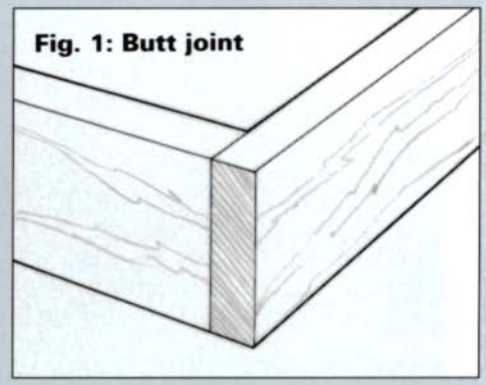
Knowing your alternatives just gets you started. Choosing the right joint for the job and acquiring the requisite skills is still up to you. Fortunately, as with most aspects of woodworking, there will be no one right answer (see the photo on p. 79), and every foray into unfamiliar territory will add to your repertoire.

Butt joints

Butt joints are the simplest and quickest way of putting a box together. Boards are simply cut to length at 90° both to the board's edge and to its face (a square cut) and then glued at the ends and fastened with nails or screws (see figure 1).

The problem with butt joints in solid stock is that you're joining long grain to end grain. That is an inherently weak connection because glue doesn't bind well to the open-ended wood fibers of the end grain. A box that's joined with butt joints won't last forever, especially if it's subject to a lot of abuse, but for applications such as garden frames or birdhouses, it's fine. Often, too, these kinds of utilitarian projects are made of plywood, which provides a better glue surface than solid stock for this joint.

FIGURE 1: ***The butt joint*** *is the simplest of woodworking joints, but in solid stock, it is also the weakest because of the long-grain to end-grain glue surface.*



Rabbet joints

The advantage of a simple rabbet joint over a butt joint is that the glue surface area is larger. It's still a long-grain to end-grain joint, but the greater surface area helps somewhat. Another advantage of the rabbet joint is that by cutting the rabbet at the end of one board to precisely the thickness of the mating board, your boards are automatically flush (see figure 2 below). Window frames are often made this way.

Rabbets can be planed by hand, cut on the tablesaw or routed. If the box is small and will not be put under a lot of stress, the glue joint should hold up fine by itself without mechanical fasteners. For larger pieces, however, and where greater strength will obviously be necessary, it's a good idea to nail or screw the joint, or pin it with dowels. Even with plywood, which is often joined with rabbet joints to make cabinets, the addition of fasteners is probably a good idea, providing a measure of insurance.

A double rabbet joint has a still greater glue surface area and, when cut on the tablesaw or routed on a router table, is easily set up. By setting bit or blade height and depth precisely the same, the boards will mate perfectly (see figure 3 below).

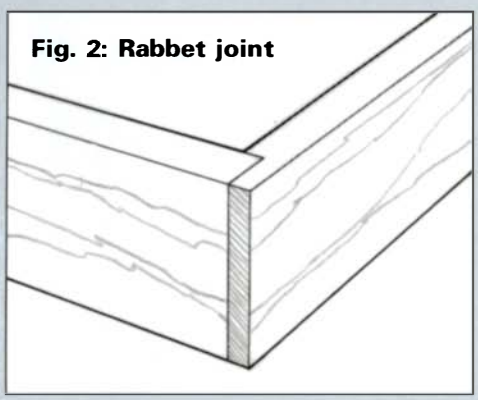
Another variation on the rabbet joint is the dado rabbet. This joint's greatest asset, besides its being relatively easy to create, is that it possesses some mechanical strength by virtue of its captured dado (see figure 4 below). This joint is best used with plywood, however, because in solid stock, the end of the board extending past the dado is susceptible to breaking, especially when you're fitting the joint. The grain is just so short there that a little too much pressure can cause the end to pop right off. Still, if fitted carefully, using a thin dado and keeping it as far from the corner as possible, the joint can be assembled without a great deal of trepidation.

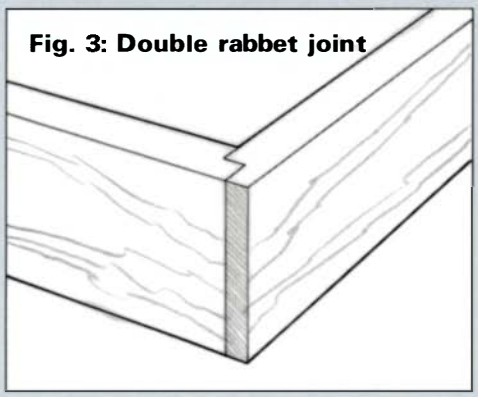
If you want the ends of the dadoed boards to be flush with the sides of the mating boards, it's crucial that you lay out the joint accurately. That's because the placement of the dado locates the rabbeted box side. If the dado is not set in far enough from the corner, the rabbeted side will remain proud of the corner; if the dado is set in too far, you have some short end grain to remove after glue-up.

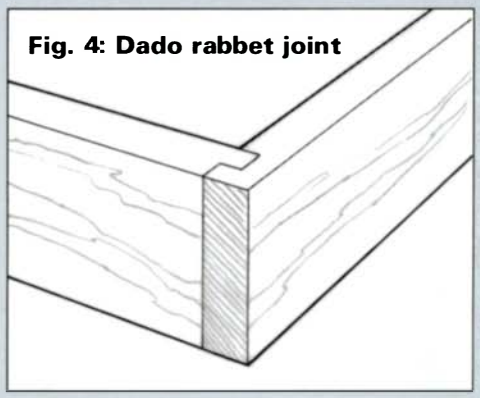
FIGURE 2: ***A rabbet joint*** *has a greater glue surface area than a butt joint and, therefore, is stronger. Additionally, with an accurately cut rabbet, the mating board will automatically set flush to the end of the rabbeted board.*

FIGURE 3: ***The double rabbet joint*** *has an even greater glue surface area than a rabbet joint and is easy to set up on the tablesaw or router table.*

FIGURE 4: ***The dado rabbet joint*** *possesses mechanical strength in one direction because of the captured dado.*







Drawings: Maria Meleschnig

Miter joints

Both butt and rabbet joints show end grain from one side of the corner. To avoid this or to carry a decorative edge around a box, mitered corners can be used (see figure 5 below). Depending on their size, miters can be cut on a miter saw, a sliding compound-miter saw or on a tablesaw.

On the tablesaw, I set the blade at 45° (for a four-sided box) and cut the miters with the box sides lying flat in a standard sliding crosscut jig. To ensure that the resulting joint is really 90°, I cut mating ends of a joint on opposing faces of the blade. This way, if the blade is a half of a degree over or under 45°, it's made up for with the cut on the second board.

Because miter cuts land somewhere between end grain and long grain, strengthening them makes sense. There are many ways of doing this, but two of the strongest and most attractive ways are the use of splines and of keys (see figures 6 and 7 below).

For a splined miter, a groove needs to be cut before gluing up the joint. To do this, I flip the box sides over in the crosscut jig so that the miter is facing down. The blade is still set at 45°, which is 90° to the miter. I locate the groove as far toward the inside corner of the miter as I safely can (thus allowing for a wider spline) and clamp a stop block in place so that both pieces will be grooved in the same spot. Then I just pass the box sides over the blade (see the photo at left below).

I cut splines either from plywood or solid stock. I use plywood splines for smaller or plywood boxes only because the plywood will not move with changes in humidity. When using solid splines, I always orient the grain in the same direction as the grain of the box sides. This way, the spline moves with the box. It's also a stronger construction. Even though a spline is fragile before it's installed (because it's a length of perpendicularly oriented, short-grained wood), once it's in the carcase, the spline's grain bridges the miter. I always test-fit the splines before gluing, checking especially to see that they aren't too deep for the grooves.

Another way of strengthening a miter joint is to glue in splines or keys across the joint after the miter has been glued together (see figure 7 below). The grooves for these joints can be cut on the tablesaw with a router or by hand.

For smaller boxes, I use a simple jig that clamps to my tablesaw's crosscut jig and that holds the box sides up at 45° to the table (see the photo at right below). I set blade height at about two-thirds the thickness of the joint, so I only have to clean up the keys on the outside of the box. Then, ei-

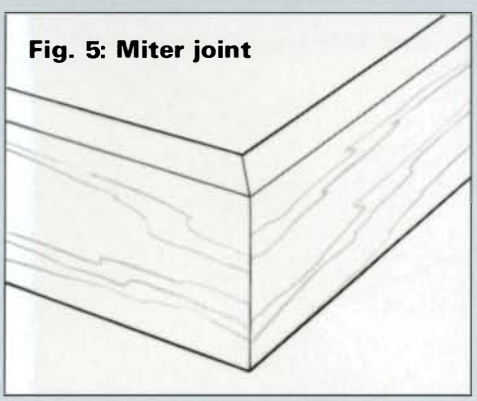
The author's jig for cutting grooves for keys *clamps right into his crosscut box. For boxes that fit safely into this jig, three keys provide plenty of strength.*

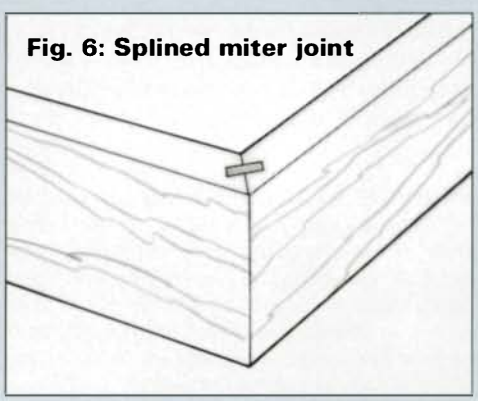
Cutting the groove for a spline *in a miter joint is simple using a clamped stop block in a sliding crosscut jig. The stop block ensures that the groove for the spline is positioned in the same place in both boards being glued together.*

FIGURE 5: ***Mitered joints*** *look more "finished" generally than corners with exposed end grain, but miters are also trickier to cut precisely, which is critical if the joint is to close up nicely.*

FIGURE 6: ***A splined miter joint*** *is considerably stronger than a simple miter joint. Whether plywood or solid wood is used for the spline, long grain bridges the miter and a long-grain to long-grain glue surface area results.*

FIGURE 7: ***Keyed miter joints,*** *like splined miters, are stronger than simple miter joints because of the long-grain to long-grain glue surface. The keyed miter joint is glued up as a simple miter joint, and then grooves for the keys are either cut or routed. The keys are cut oversized and then trimmed flush after they've been installed and the glue has set up.*





***Keyed miters**—Two sides of an alder toy box (above) show how attractive a keyed miter joint can be. **To rout key grooves in big mitered carcases** (left), it's safer with a simple jig.*

ther holding the box firmly in the jig or clamping it in, I pass the entire setup over the blade. Because I only use this setup for relatively narrow boxes (drawers and such), I cut three key grooves, which make positioning of the jig straightforward: one groove equidistant from either edge of the board and one in the center.

Larger boxes require more support for a safe cut, and even though larger jigs can be made for the tablesaw, it's safer and much more accurate to keep the workpiece still and move the tool—in this case, a router—over the workpiece.

I made the fixture in the photo at left above so that I could rout grooves in a chest of drawers with mitered corners. The jig is centered on the corner of the carcase, at 45° to it, and is supported by angled blocks underneath it. The whole fixture is clamped together and to the carcase. The slots in the face of the jig are sized to fit my plunge router that's outfitted with a template guide. Using a straight bit, I rout grooves across the corners.

I plane the keys, so they're just proud of the corner of the box and then glue them into place, long grain across the corner. Once the glue has set, I cut the key nearly flush with the carcase and plane and sand the keys perfectly flush. By using a contrasting wood, this joint can be made attractive as well as strong (see the photo at right above).

Solid-wood corners for sheet goods

When building a carcase of plywood or some other sheet stock, it's possible to use a solid-wood corner and a tongue-and-groove joint. Grooves are generally cut into the solid corners with a tablesaw or router, and then the corresponding tongues are cut into the plywood or particleboard sides. It's also possible to tenon the sheet stock into the solid corners at full thickness. The joint is glued over the full length of the corner piece, which is oriented with its grain running along its length (see figure 8 below).

This type of joint is not suitable for solid stock, however, because the corner must be oriented lengthwise if it's to have any strength. What you'd end up with if you glued in solid panels for the full length of the corner would be a cross-grain construction resulting in either a failed joint or a cracked solid panel.

By using an oversized corner block, you can add a decorative element to the box, shaping a bead, bevel or roundover into the corner. Also, you can choose to leave the corner block proud of the carcase sides or sand it flush to them.

If you prefer to keep the corner block inconspicuous (flush with the carcase sides), it's better to cut the grooves into the plywood sides and cut tongues in the corner piece to keep the joint strong. That way, the corner block is not weakened by the opposing grooves coming too closely to one another.

Biscuits could also be used to join the corner to the carcase sides. This not only would help align the joint but also would provide a long-grain to long-grain gluing situation.

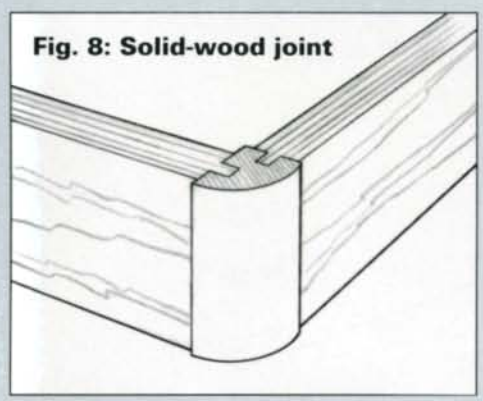


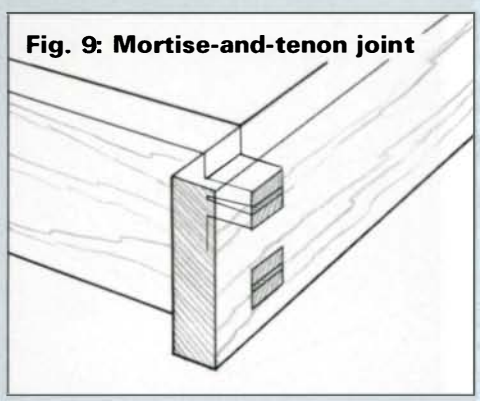
FIGURE 8: ***Solid-wood joints** can be used with panels of plywood or some other sheet stock to create strong, attractive boxes of almost any size. The corner block can be oversized and rounded over (as it is here) or shaped in some other way. Or it can be the same thickness as the carcase sides so that it's less noticeable.*

Mortise and tenon

Mortise-and-tenon joints can be used for carcase construction when the carcase sides are not flush at the corners. An example of this would be a chest of drawers in which the sides are tenoned into mortises in the top.

Mortises can be cut in a variety of ways. Chopping them by hand worked well for a

FIGURE 9: ***Mortise-and-tenon joints** can be used to join carcases whenever the sides aren't going to meet flush at a corner. The joint can be hidden or exposed, wedged or not. The joint here, with its hidden wedged-tenon, is a good joint in a situation where strength is needed but the joinery isn't the emphasis.*



few centuries until someone tried drilling them out first. With a fence on a drill-press table, accurate mortises can be drilled out quickly using a brad-point bit. The corners can then be squared or the tenons pared round to match the mortise.

Plunge routers, however, do a better job with this joint. With an accurate template, you can rout all the mortises at exactly the right spots to a precisely uniform depth.

An improvement on the mortise and tenon is the addition of a wedge (or wedges) in the tenon. The wedge creates pressure on the walls of the mortise, giving the joint some mechanical strength in addition to the strength of its long-grain glue surface (see figure 9 on the facing page).

If a wedged-tenon is also a through-tenon, as they often are, the wedges add visual interest to the piece as well. It's important, though, that you don't position a wedged-tenon too closely to the end of a board because the short grain on the outboard side of the mortise could easily break.

Further reading

Tage Frid Teaches Woodworking: Two Volumes in One, Unabridged (Joinery and *Shaping, Veneering, Finishing* combined), The Taunton Press, 1993.

Fine Woodworking on Joinery, The Taunton Press, 1985.

Fine Woodworking on Boxes, Carcases, and Drawers, The Taunton Press, 1985.

Finger joints and dovetails

Finger joints and dovetails, because of their large long-grain to long-grain glue surface areas, are the strongest joints in a woodworker's carcase-building repertoire. They are also nice-looking. In terms of appearance, both are best cut in solid stock, though they'd work equally well in plywood.

A tablesaw or router jig is the most efficient means of accurately cutting and spacing finger joints (see figure 10). I use a dado set on my tablesaw with a shop-built jig (for information on a similar setup, see *FWW* #89, p. 74). A router table also works.

In addition to having a large glue surface area, dovetails also possess a great degree of mechanical strength in one direction. Through- and half-blind (lapped) dovetails are the most commonly used types of dovetails for building carcases.

Through-dovetails can be cut in a variety of ways. Laying them out by hand and using a dovetail saw and chisel is the time-honored approach, but the dovetail-fixture makers are quick to tell you of the ease and speed with which you can achieve perfect results using their products. It's a matter of preference, really, and of how many you'll be cutting. Furnituremakers who cut dovetails daily can cut dovetails for an entire drawer in less time than it takes to read the manual for one of the fixtures. But once you're over the learning curve, it doesn't really take that long to set up one of the fixtures, especially if you have dozens of drawers to dovetail. In either case, make sure the dovetails are well-spaced, ending with half pins at the corners for greatest strength (see figure 11 below).

Half-blind dovetails are good when you want to hide the joinery from one side, but you still want the strength of dovetails (see figure 12). Drawer fronts are the most obvious example. Done by hand, they require one more marking gauge setup and a bit more chisel work. Regularly spaced half-blind dovetails can also be router cut (for more information, see *FWW* #99, p. 58). □

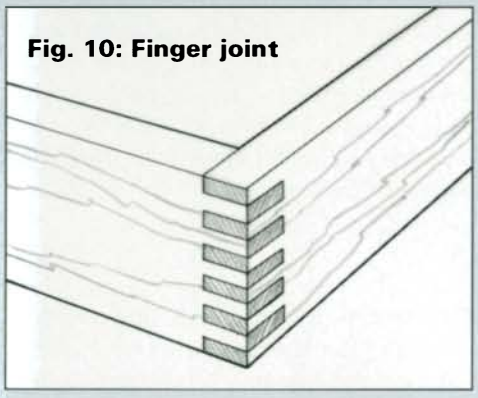
Gary Rogowski teaches woodworking at the Oregon School of Arts and Crafts.

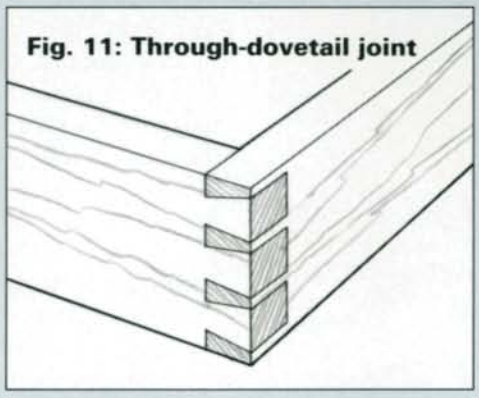
Choosing an appropriate joint *for a box is as much a matter of personal taste as it is an engineering decision. Boxes in the author's shop include a drawer featuring through- and half-blind dovetails, a simple rabbeted plywood box and three finger-jointed boxes.*

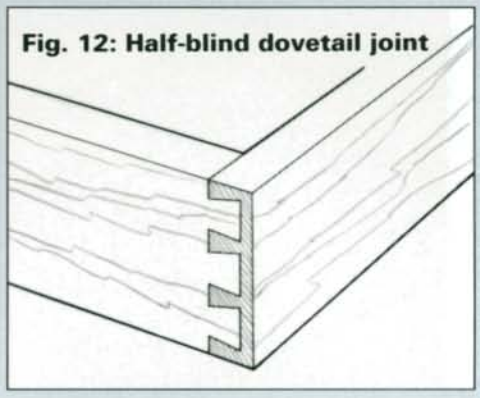
FIGURE 10: ***Finger joints*** *are a strong and attractive way to join a box. The large glue surface area provides a great deal of strength, and the play of light on alternating edge and end grain makes them enticing to look at as well.*

FIGURE 11: ***Dovetails*** *are the strongest carcase joint and through-dovetails are the simplest dovetails to cut, whether by hand or with a fixture and router. The joint's mechanical strength, large glue surface area and its reputation as being the hallmark of a craftsman make it a perennial favorite even in situations where its strength may not be necessary.*

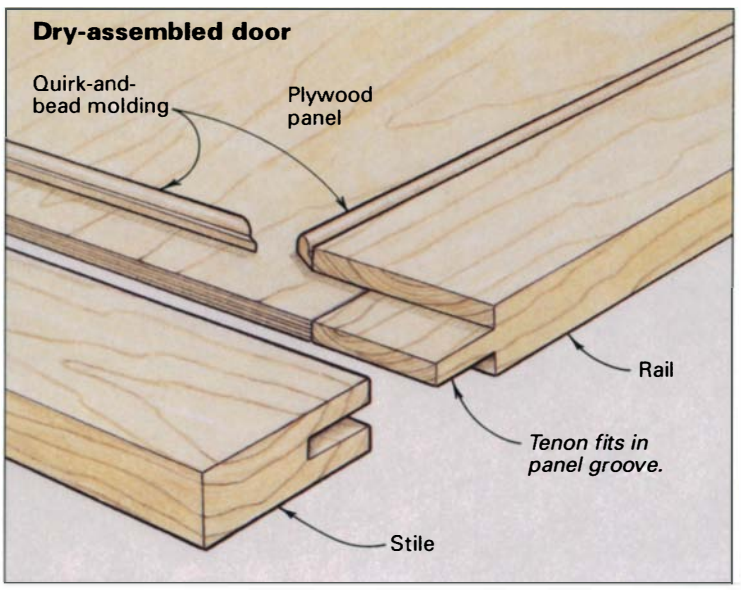
FIGURE 12: ***Half-blind, or lapped, dovetails*** *are a good solution when you need a strong joint but don't want the joinery to steal the show. They're also the classic drawer front-to-side joint, and in contrasting woods, they are very attractive.*







***Quirk-and-bead molding and an antiqued stain and lacquer finish** give Mario Rodriguez's pine, plywood-paneled door an air of simple period elegance.*



Quick But Sturdy Cabinet Door

Molding rims plywood panel to create traditional look

by Mario Rodriguez

When I had to make a batch of pantry cabinets in a hurry and at a low cost, I developed the design for this frame-and-panel door. I wanted the door to have a traditional flavor and reasonable strength but obtained with the least possible labor and materials. I decided to use a plywood panel and dress it up with a simple quirk-and-bead molding, as shown in the photo at left. I planned the simplest joinery I could, and then I decided to apply the molding instead of milling it onto the frame pieces. The molding is easily made with a stock router bit, and the quirk, or recess, behind the bead produces a dramatic shadow that gives the flat-paneled door its visual weight. The design is well-suited for small- or medium-sized doors on kitchen cabinets, vanities and built-in storage units and will look as good painted as with a clear finish.

Grooving non-stop

I chose ¼-in. plywood (good on both sides) for the panel to keep the door light and stock preparation to a minimum. Frame-and-panel construction accommodates the expansion and contraction of a solid panel by allowing it to float in the frame. Here, with no wood movement to worry about, I was able to glue the panel on all four sides, making it a structural element of the door. I greatly simplified the joinery by housing both the panel and the rail tenons in the same ¾-in.-deep groove (see the drawing below). At ¾ in., the tenons are somewhat short, but the plywood panel glued all the way around at full depth in the groove adds considerably to the door's strength.

This technique not only removes the need for making separate mortises for the tenons but also means that you don't have to stop the grooves on the stiles as you normally would with frame-and-panel doors. Instead, you just run the grooves the full length of all the frame members.

I usually plane my frame stock ¾ in. thick and rip the pieces 2 in. wide. Then I groove the inside edge of each piece on the tablesaw. Because ¼-in. plywood is usually somewhat less than ¼ in. thick, I don't bother with dado blades. I just cut the groove in two passes with a regular blade raised to ¾ in. However you cut the groove, it will be helpful to mill extra stock with the frame members for use as test pieces as you seek the setting that will give the panel a snug fit.

Rails get tenons

Next I cut the cheeks of the tenons. Because the tenon length is the same as the groove depth, I leave the tablesaw's blade at the same height I used to cut the groove. I mount the rails onto a sim-

Drawing: Heather Lambert

***Tenoning jig from scrap**—A stick of pine nailed to a square of medium-density fiberboard makes a jig to produce reliable tenons.*

ple, shopmade jig for safety and support (see the photo above).

I cut the tenon shoulders on the tablesaw using the miter gauge. I use the fence as an end stop, which is permissible here (though it isn't in normal crosscutting). That's because I'm not cutting all the way through the piece, so there's no danger of kickback or jamming. You could also use a stop block clamped to an extended fence on your miter gauge.

Size up the panel

I use ¼-in. cabinet-grade plywood for the panels in most doors like these. For larger or heavier-duty doors, it would be advisable to split the panel with a medial rail or use ½-in. plywood and rabbet around the back to produce a ¼-in. tongue.

When I cut out the panels, I take particular care to ensure that they come out square. Then, when I glue up the frame members around them, I can rely on the panel to make the door square and the glue-up trouble-free.

Attending to assembly

When I assemble the doors, I apply glue generously in the grooves and on the tenons. Then I lightly clamp the rails and stiles around the panels. Next I double-check for squareness and clean up the glue squeeze-out. After removing the clamps, I clean up the frame and fair the joints with a sharp block plane.

Quirky molding

The quirk-and-bead molding can be produced from excess frame stock with a beading cutter in a router. I bead all four corners of the stock on a router table or simply a router upside down with a fence clamped to the base, as shown in the top right photo. To free the pieces of molding, I cut a kerf down the middle of each edge (see the center photo at right) and then rip through the full thickness of the stock.

I cut the miters for the molding on the tablesaw with the miter gauge, but the miters can be cut nearly as fast with a dovetail saw and a block plane for fitting. First I dry-assemble the molding. Then I glue it in with yellow glue and hold it in place with masking tape, as shown in the photo at right. I close minor misalignments at the miters by pulling the molding away from the frame slightly. The tiny gap created behind the molding won't be noticed—it will read as part of the shadow that gives this simple molding its distinction. □

Mario Rodriguez is a furnituremaker and teacher in Warwick, N.Y., and a contributing editor to Fine Woodworking.

***Beads on every corner**—Rodriguez machines all four edges of an extra piece of frame stock to generate molding for a door. For short lengths, use an inverted router; for longer ones, use a router table.*

***Kerf between the beads to cut their back edge,** and then rip the two pieces from the board.*

***Masking tape supplies all the clamping pressure** you need to glue up the molding. The shadow line created by the quirk behind the bead gives a bit of leeway in correcting small mitering errors.*

Photos: Jonathan Binzen

Aligning the front on a chest of drawers—*The author has developed a technique for beltsanding his cabinet fronts and drawers at the same time. When he combines them with front-mounted stops, the cabinet faces are flat and smooth and drawers always align with the face frame, regardless of season.*

VIDEO TAKES
SEE PAGE 84

Drawer Fronts That Fit Flush

Beltsanding and drawer stops leave a front that's always aligned

by Christian H. Becksvoort

Maintaining drawer-front alignment to the face frame can be a seasonal problem on furniture built with slab (or wide board) construction and typical rear-mounted drawer stops. The depth of the case can vary considerably from summer to winter depending upon the width, species and cut of the wood (see *FWW* #94, pp. 38-41). The length of wood does not change noticeably with changes in moisture content, however, so flush-mounted drawers with stops at the back tend to protrude in the winter and are recessed in the summer.

I've borrowed a technique of front-mounted drawer stops from an antique piece and have used it quite successfully for the last several years. Front-stopped drawers always maintain the same position in relation to the front of the cabinet, and they don't need to be individually adjusted for each drawer. This technique uses a stop glued to the divider under the drawer instead of placing the stop at the back of the drawer.

The stops also help me sand the drawer fronts and cabinet front at the same time, ensuring a flat, smooth plane and perfect drawer alignment. I install the drawers in the carcase against the stops and wedge them in place. I then beltsand the entire front of the case, including drawer fronts, drawer dividers and the front edges of the cabinet sides, as shown in the bottom photo on p. 84. The drawers support the belt sander, so I don't have to worry about balancing it on the thin dividers and gouging the case sides when I sand to the edge of the case. While sanding the drawer fronts, I'm also able to sand out all the minor misalignment that occurs when sliding the dovetailed dividers into place in the case sides.

There is no other technique that will leave the case and drawers as flat and as perfectly aligned. The whole system works because I house my drawer bottoms in grooves that are 5/16 in. from the bottom edge of the drawers. This leaves plenty of clearance for the ¼-in.-thick drawer stops glued to the drawer divider below the drawer. The stops are out of sight and don't interfere with the drawer's contents as top-mounted stops might.

Fitting the stops

First I fit the drawers, leaving about 1/32-in. to 3/64-in. gap on either side, and a gap above the drawer appropriate to the size, species and moisture content of the drawer front. I also make the drawers short enough (about ½-in. shy of the full cabinet depth) to accommodate more than the full range of movement expected in the cabinet side.

Then I mark the location of the stops, referencing from the back of the case. If this were a perfect world, I could simply mark from the front of the case, allowing for the thickness of the drawer front and the leather bumper. But perfectly aligning the snug, sliding dovetail joints that connect the dividers to the carcase is not an easy task. Sometimes the glue grabs before the divider is fully seated; other times that last tap knocks the divider 1/16 in. past where you want it, and no amount of pounding will reverse it. Referencing the stops from the back of the case lets me sand out misalignments when I'm sanding the drawer fronts to align with the case.

To make sure that all the stops are aligned, first I find the divider that is inset the farthest. I measure from the front of this divider, deducting the thickness of the drawer front plus a leather bumper. This mark is where the front of the stop needs to be to leave the drawer front flush with the divider's face. I then make a gauge for marking the rest of the dividers by measuring from the back of the cabinet to the mark. I cut a 4-in.- to 6-in.-wide scrap board to that length to serve as a guide for laying out all the stops. The gauge is slipped into the opening, making sure it is pushed tightly against the cabinet back and side, so all the drawers will be equidistant from the back of the cabinet. The stop position is marked by scribing a line along the front edge of the measuring gauge, as shown in the top photo. I find that a knife-scribed line is more accurate than a pencil line when marking the stops. To make the scribed line more visible, you can darken it by running a pencil sharpened to a chisel point along the line.

***Scribed lines accurately position stops**—The author uses a 4-in.- to 6-in.-wide board, cut to the appropriate length, as a gauge to scribe alignment marks for the drawer stops. Measuring from the cabinet back eliminates any variations that may have occurred when gluing in the dovetailed drawer dividers.*

***The drawer stops are glued**, positioned on the dividers and held in place with spring clamps. The stops must be thin enough to clear the drawer bottoms and short enough to allow drawer side clearance at the ends. Leather bumpers are temporarily glued to the stops to position the drawers for sanding.*

I cut the stops from waste stock, 3/8 in. to ½ in. wide and ¼ in. thick. For drawers 14 in. and narrower, I usually use a single strip across the divider. The strips are centered in the drawer opening, and they leave plenty of room on each side for the ½-in.-thick drawer sides. Wider drawers get two stops about 2 in. to 3 in. long. After sanding, the stops are glued to the scribed lines and held in place with spring clamps (see the bottom photo above). The stops must be located about 1 in. from the carcase sides so they don't in-

Photos: Charley Robinson

terfere with the drawer sides. Then the leather bumpers are temporarily glued to the fronts of the stops, using a minute amount of glue. After the front has been sanded, the leather is removed for finishing (otherwise it becomes hard) and reapplied when the case is complete. I prefer the quality feel and sound of leather bumpers on a custom piece because they make a better impression than the rubber, plastic or cork bumpers so frequently found on store-bought furniture.

Sanding the case and drawers

The first time I used this method of stopping drawers, it dawned on me that this was the perfect solution to sanding the entire cabinet face. No more balancing a belt sander on a ¾-in.-wide divider, hoping not to gouge the cabinet side or intersecting dividers. This was a real bonus. It takes a little preparation, but the results are well worth the effort.

***Wedging the drawers in place** holds them for beltsanding. The drawers should be wedged on each side to center them in the opening and wedged at the top to hold them firmly against the drawer dividers and stops. The entire front of the cabinet can then be sanded to one flat, smooth plane.*

***Sanding the cabinet front,** with the drawers held in place by front-mounted stops and wedges, ensures that the entire face of the cabinet will be flat and smooth. The drawers support the sander and prevent gouging the face frame. This technique eliminates the need to set each drawer individually.*

First, after drilling holes for hardware or knobs in the drawer fronts, I slide all the drawers back into the case. Next I make shims, using 1/16-in. by ½-in. pine strips, tapering the ends into wedges with a quick knife cut. I shim the drawer sides to center the drawer from side to side in the opening, as shown in the top photo on this page. Then, using thicker pine strips, I shim the top of the drawer front to hold the drawer against the divider below it. The shims should be good and tight to keep the drawer from vibrating during the sanding process.

With all the drawers securely in place, I lay the cabinet on its back on two padded sawhorses of convenient height. Using a belt sander and an 80-grit belt, I work my way across the face of the cabinet, from one end to the other, as shown in the bottom photo on this page. Before sanding with a 120-grit belt, I check the cabinet face for high and low spots by laying a 5-ft.-long straightedge on the face of the cabinet and sighting along the straightedge's bottom edge. I repeat the process in four or five places across the cabinet face, marking the high spots with a pencil line. I then connect these marks, making a topographical map, of sorts, on the cabinet face to show me where more material needs to be removed. After sanding with 120-grit and 150-grit belts, I switch to a vibrating-pad sander or random-orbit sander and 180-grit, 220-grit and 320-grit discs.

Finishing details

At this point, the front of the cabinet is a single, flat, smooth plane. I remove the drawers for a final hand-sanding with a bolt through the knob hole. The first drawer is always difficult to remove, especially if the shimming was done correctly and you forgot to drill the knob holes before wedging in the drawers. However, once the first one is out, I have room to reach in and push out the rest from behind. I hand-sand each drawer face with 400-grit paper and ease and smooth all the edges. The same goes for the cabinet face: Remove all traces of cross-grain scratches and break all edges. Then vacuum out the inside of the case, remove the leather bumpers and the case is ready for the finish of your choice. □

Christian H. Becksvoort builds custom furniture in New Gloucester, Maine, and is a contributing editor to Fine Woodworking.

Leveling a cabinet front: Video shows you how

VIDEO TAKES

A magazine article can be a great help in learning new tricks and techniques. But sometimes, it's easier to learn and understand a process when you can watch someone doing it. In a 13-minute companion video (VHS) to this article, Christian Becksvoort takes you through the steps he uses to align drawer fronts and face frames simply and easily with a belt sander. There is no other process that will leave a cabinet front in such a smooth, flat plane. To order, call (203) 426-8171, or send $7 to The Taunton Press Order Department, DrawerVid 011035, P.O. Box 5506, Newtown, Conn. 06470.

--Charley Robinson, associate editor

Choosing a Finish

Appearance is just one consideration

by Chris A. Minick

Ask ten woodworkers what they like best about woodworking. I'll bet a truck-load of walnut that finishing isn't at the top of the list. Most woodworkers hate finishing—and with good reason. Finishing requires you to work with stinky chemicals rather than shaping wood. Because finishing is the last step in a long process, a mistake could ruin the whole project. Or the error could mean spending hours stripping off the finish with more smelly chemicals. Furthermore, there are so many types and brands of finish to choose from (see the photo below). It's no wonder why many woodworkers get accustomed to applying only one kind of finish to every project. While that approach may be efficient, it could lead to a visual sameness to your work. More importantly, your old standby finish may not be the most suitable treatment for your project's intended use.

I consider three things when choosing a finish: the application equipment I have, the appearance I want and the protection I need for a project (such as film hardness and moisture resistance). To sort out the most common finishing-product options, it helps to know about their properties. I use the comparison chart on pp. 86-87 to weigh the strengths and weaknesses of each finish.

Penetration and application

The most important factor affecting how a finish performs is whether it penetrates the surface. Based on where the finish resides, woodworking finishes can be divided into three general classes: "in the wood," "in and on the wood" and "on the wood."

In-the-wood finishes—Penetrating finishes like tung, linseed and Danish oils are easy to use. Just wipe them on, and wipe off the excess. Because easy repairability is their biggest advantage, I often use oil finishes on projects that take abuse. A periodic reapplication of oil hides any scratches. The lack of a surface film allows oil finishes to be re-coated anytime without fear of adhesion loss.

Oil finishes darken wood but leave it natural-looking. That

Picking finishes and applicators—*Along with the most common wood finishes, author Chris Minick displays the applicators he prefers for each. From left: paste wax, linseed oil, Danish oil and mineral oil—all applied with a rag; semi-gloss interior paint—applied with a polyester brush; shellacs—applied with an ox-hair brush; polyurethane varnish—applied with a foam applicator; water-based acrylic—applied with a nylon/polyester brush; and nitrocellulose lacquer—applied with a spray gun.*

Photos except where noted: Alec Waters

chocolate-brown color of the walnut box on the left in the photo below was achieved with three coats of linseed oil. I like the appearance of an oil finish on dark woods, but I find the yellow color of tung oil objectionable on light-colored woods like birch. In addition, tung oil tends to obscure subtle figure.

Not all so-called oil finishes are purely oil. Danish oils, for example, which add a rich, satin luster to certain hardwoods (see the photo on the facing page), are usually dilute varnish solutions to which oils have been added for increased penetration.

In-and-on-the-wood finishes—Oil-based varnishes and lacquers have the unique ability both to penetrate the wood and to form a protective coating on the surface. This class of finish produces that wonderful illusion of depth associated with fine furniture. Some woodworkers steer away from polyurethane varnishes, fearing they will give projects a plastic-coated look, but I've found an easy way to avoid the plastic look. Because I don't have a good touch at spraying on an oil-based varnish, I usually brush on three or four coats of thinned varnish to a piece. Then I burnish the final coat (after it has dried) with a soft cloth to kill the plastic look. The key to getting a nice finish with oil-based varnish is to apply thin coats and then rub out the last. The walnut box on the right in the photo below has a brushed-on varnish finish.

Nitrocellulose lacquer is an in-and-on-the-wood finish that exhibits marvelous depth, high luster and is quick-drying. These attributes make it the preferred finish of professional furnituremakers. Brush-on formulations of nitrocellulose lacquer are available, but I've found them difficult to apply. Spraying is the most practical way to apply nitrocellulose lacquers. Unfortunately, I don't have a spray booth or the other explosion-proof equipment needed to safely apply highly flammable finishes. As a consequence, I only use solvent-based lacquers on small projects.

On-the-wood finishes—As the name implies, on-the-wood finishes lay on the surface and do little to accentuate the grain or color of wood. The shellac finish on the center walnut box (see the photo below left) has the typical satiny look of this class of finish. Wax is an obvious on-the-wood finish, too. And aside from its easy repairability, one of the best things about wax is its nontoxic nature (see the story on p. 88).

It may surprise you to learn that the new water-based finishes also lay on the surface of the wood. The chemical composition of a typical water-based finish prevents the resin from penetrating the wood. This accounts for the no-depth look that these finishes impart to bare wood. However, I've found water-based finishes look great when applied over sealed surfaces (see the photo at right on p. 89) rather than directly to the wood. A fair amount of practice is needed to acquaint oneself with the idiosyncrasies of applying water-based finishes. But because water-based finishes are nonflammable, have little odor and are easy to clean up, I find the benefits are worth the application effort.

Surface preparation—Of course the final finish you achieve is only as good as the surface you prepared. In some instances, sanding to 600-grit is all you need. In other cases, you may want a scraped surface. If you do sand, it's best to work your way up through the grades of grit, as described in *FWW* #99, p. 40. I often use my random-orbit sander to smooth a surface (see the photo on the facing page) because I can sand cross-grain without scratches or swirls. Smoothing between coats and after the topcoat will further improve the look and feel of your finish.

Appearance: color and luster

Clear finishes are far from colorless. While the color of a finish is not usually my primary consideration when selecting a finish, color can have a profound effect on the final appearance of the project. The samples shown in the photos above the chart are all cherry with three coats of finish. Paints were not included in the chart because of their wide variety.

Solvent-based acrylic lacquers (commonly found in auto supply stores) are clear and make good coatings for light-colored wood or as a clear coat over whitewashed, stained or painted pieces. Wa-

Same wood, different lusters—*These three boxes were made from a single piece of walnut (a strip is shown at bottom), but finished differently: The left box was coated with linseed oil to give a dull look; the center box was wiped with shellac and waxed to a satin sheen; the right box (with the reveal on the lid) was brushed with polyurethane varnish and burnished to a low gloss. The finishes also bring out variations in color and grain contrast.*

Comparison of translucent finishes

Finish type	Tung, linseed oils	Danish oil
Finish description		
Surface penetration	In	In
Stain resistance	Poor	Poor
Moisture resistance	Poor	Poor
Relative color ◆	Dark amber	Amber
Relative luster	Dull	Satin
Best applicator ✖	Wipe on	Wipe on
Repairability	Excellent	Excellent
Dry time (hours)	18-24	6-12

Notes: ◆ 3 coats of finish were used to achieve these colors on cherry.

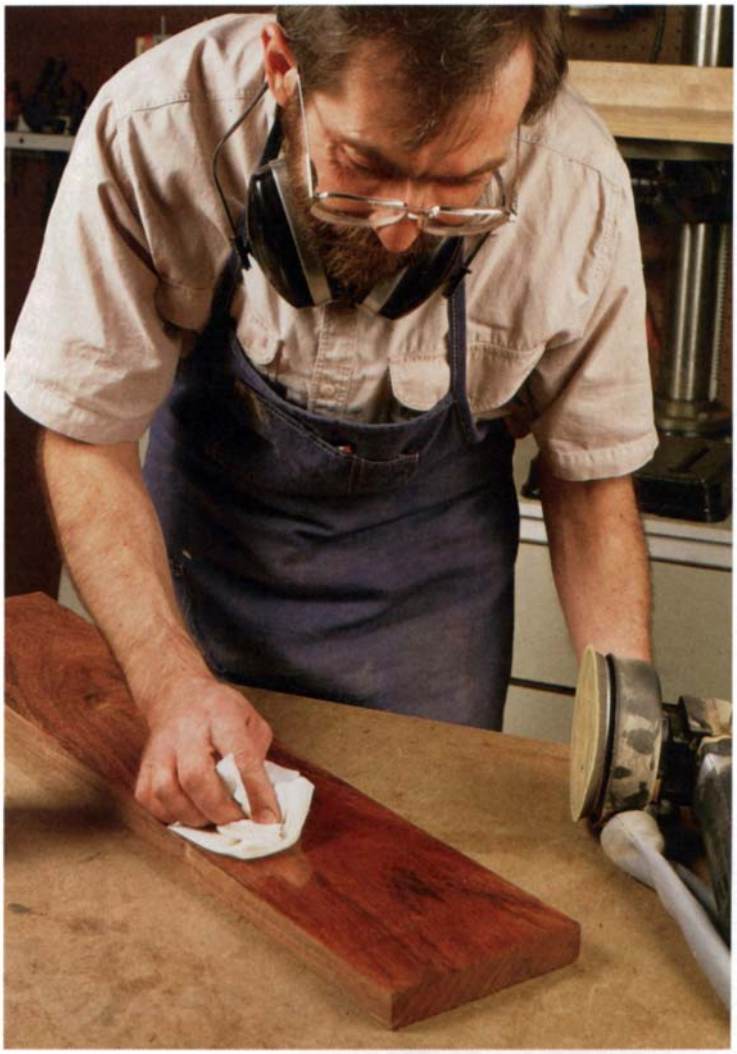
Chart photos: Sloan Howard

ter-based acrylic finishes are just as colorless as their solvent-based kin, but they look hazy over dark stains. Oil finishes are on the other end of the color spectrum. These deep-colored finishes drastically alter the hues of wood. But because oils don't form a surface film, the dark yellow tint is only noticeable on light-colored wood. Standard alkyd varnishes, polyurethane varnishes and nitrocellulose lacquers impart an amber glow, often called "warmth," as displayed by the lacquered Queen-Anne highboy in the top photo on p. 88. By contrast, the bluish tint of a water-based polyurethane coating gives stained wood a cold cast, an effect that is even more pronounced on walnut. I prefer warmer finishes, so I rarely use water-based polyurethane in my shop.

Aside from color, there's another quality of finishes that affects appearance—luster. A finish's formulation, thickness and method of application cause a surface to be either dull, satin or glossy. It's usually the style of a furniture piece that dictates which looks best. For instance, we're accustomed to seeing a hand-rubbed finish on an 18th-century, French period piece. Yet we prefer a more rustic look on a Shaker-style bench. A hard and glossy polyurethane varnish looks out of place on either piece.

Layering different finishes on the same piece—Finishes can also be layered for special effects. The spruce guitar soundboard in the photo at right on p. 89 has a double-layer finish along the top. First I brushed on fresh, super-blond shellac to enhance the grain and chatoyance of the stock and to add an amber color to the finish. Next I applied the vertical bands of water-based finish, so I could compare each against the look of acrylic and nitrocellulose lacquers. When undercoated with shellac, the color and depth of the water-based finishes closely matched the lacquers.

My favorite finish for black walnut is a three-layer finish. I apply linseed oil to deepen the brown color; two coats of shellac seal in the oil and enhance the wood's highlights. Finally I apply a topcoat of water-based lacquer to add depth. Layered finishes can produce unusual effects, so always test a layered finish on scrapwood before committing it to your project. Keep in mind, too, that



Good surface preparation and Danish oil do wonders *for this piece of macacauba (a relative of rosewood). The rich colors of the dense tropical wood also come alive when the surface is sanded to 600-grit and waxed, as the back part of the board shows.*

Oil-based (alkyd) varnish ✢	Polyurethane (uralkyd) varnish ✢	Nitrocellulose lacquer ✢	Acrylic lacquer ✢	Shellac (orange)	Bees, carnauba waxes	Water-based acrylic ✢	Water-based polyurethane ✢
In & on	In & on	In & on	In & on	On*	On	On	On
Good	Excellent	Very good	Very good	Very good	Poor	Fair	Fair
Very good	Excellent	Good	Very good	Good	Poor	Fair	Fair
Amber	Amber	Light amber	Clear	Amber	Clear	Clear	Bluish
High gloss	High gloss	High gloss	High gloss	High gloss	Satin	Medium gloss	High gloss
Brush	Brush	Spray	Spray	Brush	Wipe on, buff	Spray/ brush	Spray/ brush
Poor	Poor	Good	Fair	Very good	Excellent	Poor	Poor
2-6	2-6	¼-½	½	½	¼	2	2

* Shellac can be considered "in and on" for dilute solutions.

✢ Most manufacturers add flatting agents to create a "satin" option.

✖ Many finishes can be applied (less effectively) by other methods.

Photo: Herb Lotz

Highboy gets a high-end finish. *Andrew Davis of Santa Fe, N.M., hand-rubbed layers of lacquer to finish this mahogany Queen Anne highboy. Aniline dye and japan colors were used to add tint.*

not all finish combinations are compatible. Generally, I've had good luck layering water-based finishes over solvent-based ones if I seal in between them with shellac.

Protection

Durability is an important consideration when I'm choosing a finish. Along with film hardness and adhesion, a finish often has to resist abrasion, distortion, heat and solvents. Generally, the higher the molecular weight of a finish, the more protection it offers. Oil finishes, although easy to repair, offer little protection from water or food stains. The varnish component of Danish oil increases the protection level of the finish only marginally. Likewise, paste wax performs rather poorly at resisting stains or moisture. By contrast, the superior protection of polyurethane varnish makes it my first choice for kitchen tabletops and other pieces that must stand hard use. Oil-based varnish, shellac and both acrylic and nitrocellulose lacquers protect wood against stains and water, but not quite as well as polyurethane. Water-based finishes are slightly less protective than a nitrocellulose lacquer.

So while certain finishes provide excellent stain and water protection without repairability, others repair easily but don't provide much protection (see the chart). Do you settle for protection or repairability? You may not have to make that choice. Combining different finishes on the same project provides a way to take advantage of the strong points of each.

Applying separate finishes on the same piece—I often use different finishes on the same project. Vertical and horizontal surfaces in a piece will wear differently, so you may want to finish them differently. And because of the effects of dust and gravity, you may want to apply the finishes differently as well. The top of my dining room table is finished with a polyurethane varnish, which is practically bulletproof—protecting against food stains, water and abrasion. Because the table's legs are subject to chair bangs and kicking feet (three teenagers live in my house), I oiled the legs with linseed. By occasionally re-coating them, I hide the scratches. The stool in the photo at left on the facing page was al-

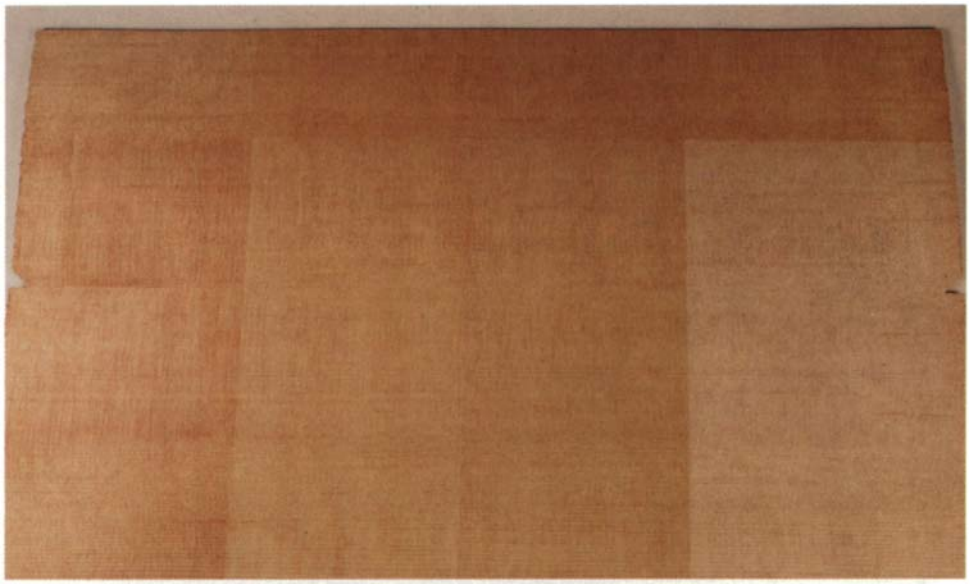
Nontoxic finishes

Safe to apply—*To add a nontoxic finish to his maple cheese board, the author rubs on mineral oil (above), also known as paraffin oil, which is prescribed as a laxative.*

While browsing through my hardware store, I picked up a can of interior oil-based varnish. Plainly printed on the label was "nontoxic when dry." This statement surprised me because I knew the finish must contain metallic driers to function properly. Although lead compounds are no longer used as driers in varnish, manganese, zirconium and cobalt are used, and their low-level toxicity effects have not been fully explored. So why risk putting heavy metals on your salad bowl or breadboard?

Current research about food-preparation surfaces indicates that wooden cutting boards are better than synthetic ones (see *FWW* #101, p. 104). And the study suggests that if you finish the wood, you may actually impede some of the wood's beneficial effects (the tannins may deter bacteria). However, if you decide to finish the wood, there are several superior nontoxic finishes.

Mineral and linseed oil: My first choice for finishing wooden kitchen items is mineral oil, which is a petroleum-derived hydrocarbon. Sold as a laxative in my pharmacy, the bottle of mineral oil I use recommends "one to three tablespoons at bedtime." I feel pretty safe using this finish on a cheese board (see the photo at left). A few coats of mineral oil help protect against food stains and dishwater, and an occasional re-coating keeps the board looking new. Another laxative, raw linseed oil (not the boiled kind which may contain metal driers), imparts a yellow color to wood and also makes a fine nontoxic finish.



A layered finish adds depth. *This spruce soundboard stock (above) shows what effect an under layer of super-blond shellac (the top horizontal band) has. From the left, the vertical finish strips are nitrocellulose lacquer, acrylic lacquer, water-based acrylic and water-based polyurethane.*

Separate treatments—*Minick chose five finishes for this stool (left). The seat was coated with water-based acrylic; the legs were shellacked, painted and waxed; and the rungs were Danish oiled. Similarly, a guitar's body and neck may be finished differently.*

so treated with a combination of finishes. With a multi-finish approach, I like to finish the components separately. Before finishing, I mask off the surfaces that will be glued. Once the finish is dry, I assemble and glue up the components.

One last test of a finish comes when I stand back to admire a project. The finish should enhance the wood. If all I see is the finish, then I chose the wrong one. A close friend summed it up best, "You never see a perfect finish, you only see the bad ones." □

Chris Minick is a finishing chemist and a woodworker in Stillwater, Minn. He is a regular contributor to Fine Woodworking.

Further reading

To learn more about:

Brushing on a finish, see *FWW* #98, p. 54 and *FWW* #95, p. 46.

Finish durability, see *FWW* #82, p. 62.

Finishing hazards, see *FWW* #92, p. 80 and *FWW* #80, p. 58.

Spraying a finish, see *FWW* #82, p. 56.

Water-based finishes, see *FWW* #89, p. 52 and *The Woodfinishing Book*, by Michael Dresdner, The Taunton Press, 1992.

Tung and walnut oils: Pure tung and pure walnut oil dry without metallic driers. As long as their container says "pure," both walnut and tung oil are considered nontoxic. Products labeled tung-oil finish or tung-oil varnish may contain resins or metallic driers. One source for drier-free oils is Wood Finishing Enterprises (1729 N. 68th St., Wauwatosa, Wis. 53213; 414-774-1724).

Waxes and shellac: Carnauba wax (made from Brazilian palm trees) or paste furniture waxes that contain beeswax (secreted by honey bees) give a nice shine to a smooth piece of hardwood. Both waxes are approved by the Food and Drug Administration (FDA) as nontoxic food additives. I apply paste furniture wax to cutting boards fairly often because its protection against water is low.

Shellac, a nontoxic resin made from insect secretions, is also recognized by the FDA as a food additive. Used as a candy glaze (hence the name confectioners' glaze) and as a timed-release coating on oral medications, shellac makes an excellent choice for baby cribs and other pieces requiring a film-forming finish. Shellac has a short shelf life once dissolved in alcohol. So it's best to prepare your own solutions from fresh, dry shellac flakes. I've found the pre-mixed variety is often too old to dry properly.

Watch paints and water-based finishes: Most children's toys look best when painted. Don't use common house paint—oil-based or latex! These paints often contain pigments, biocides and fungicides that may be harmful if ingested. Instead, use one of the specially developed nontoxic paints, which are available at most arts and crafts stores. Look for the seal of The Arts and Crafts Materials Institute or the words "conforms to ASTM D-4236" on the label. Either designation indicates the product meets government and industry standards for a nontoxic paint.

Similarly, don't assume water-based finishes are nontoxic just because they contain water. A clear, water-based finish can contain up to 15 separate additives, some of which are harmful if ingested. Also, be careful if you apply a clear finish over stain. It's best to read the can and call the manufacturer if you're unsure.

Material Safety Data Sheets: No discussion of finish toxicity is complete without mentioning Material Safety Data Sheets (MSDS). These sheets include information for the safe handling and disposal of a product, and they list most of the hazardous ingredients it contains. But except for special cases (carcinogenic and certain highly toxic materials), hazardous ingredients at concentrations of less than 1% of the formulation do not have to be listed on the MSDS. Just because a material doesn't appear on the MSDS does not mean it isn't in the finish. Metallic driers, for instance, typically fall below the 1% rule and do not have to be listed. If you have concerns about a particular finish, call the manufacturer. You'll be provided with the product's MSDS and other safety information. *—C.M.*

Drop-Leaf Breakfast Table

Cabriole legs and knuckle joints make it compact and versatile

by Robert Treanor

As an apartment dweller, I am constantly fighting a losing battle for space. In one small, narrow hallway in my apartment, the phone and its paraphernalia has to share space with one of the precious closets. Little room is left for a table on which to write messages or to place small items. It seemed to me that a drop-leaf table, narrow when closed, would fit the space and provide terms for a truce in my little battle. And as a peace dividend, I could always open up the table and use it elsewhere for special occasions.

The small table I made, as shown in the photo at right, is a good example of a late Queen Anne breakfast table. The 18th-century form combines grace and versatility, and making it demands the same attributes in the craftsman. The half-blind dovetailed aprons, rule-jointed leaves and the knuckle joints on the swing legs all require precise work. And shaping the compound curves of the cabriole legs needs a steady hand and eye. The skills are not difficult to master, and the effort will be rewarded with a useful and elegant table. The original on which my table is based was made of walnut, but I built mine of cherry. Maple or mahogany would also be appropriate. I used pine for the small amount of secondary wood.

Modesty and majesty—This small Queen Anne breakfast table contains a broad range of joinery. Pinned tenons, knuckle joints and half-blind dovetails connect the aprons and legs, and rule joints run between the leaves and fixed top.

Taking stock

Begin the table by milling the required material. Leave the leg billets slightly oversized, and set them aside for a few days so any movement can later be planed out. The pieces that will form the side aprons should be left a few inches over finished length at this point. The extra length will allow you to recut the knuckle joint for the hinge of the swing leg if necessary. Cut the fixed top and the leaves from the same board, so color and figure will be consistent.

Knuckle joint is linchpin

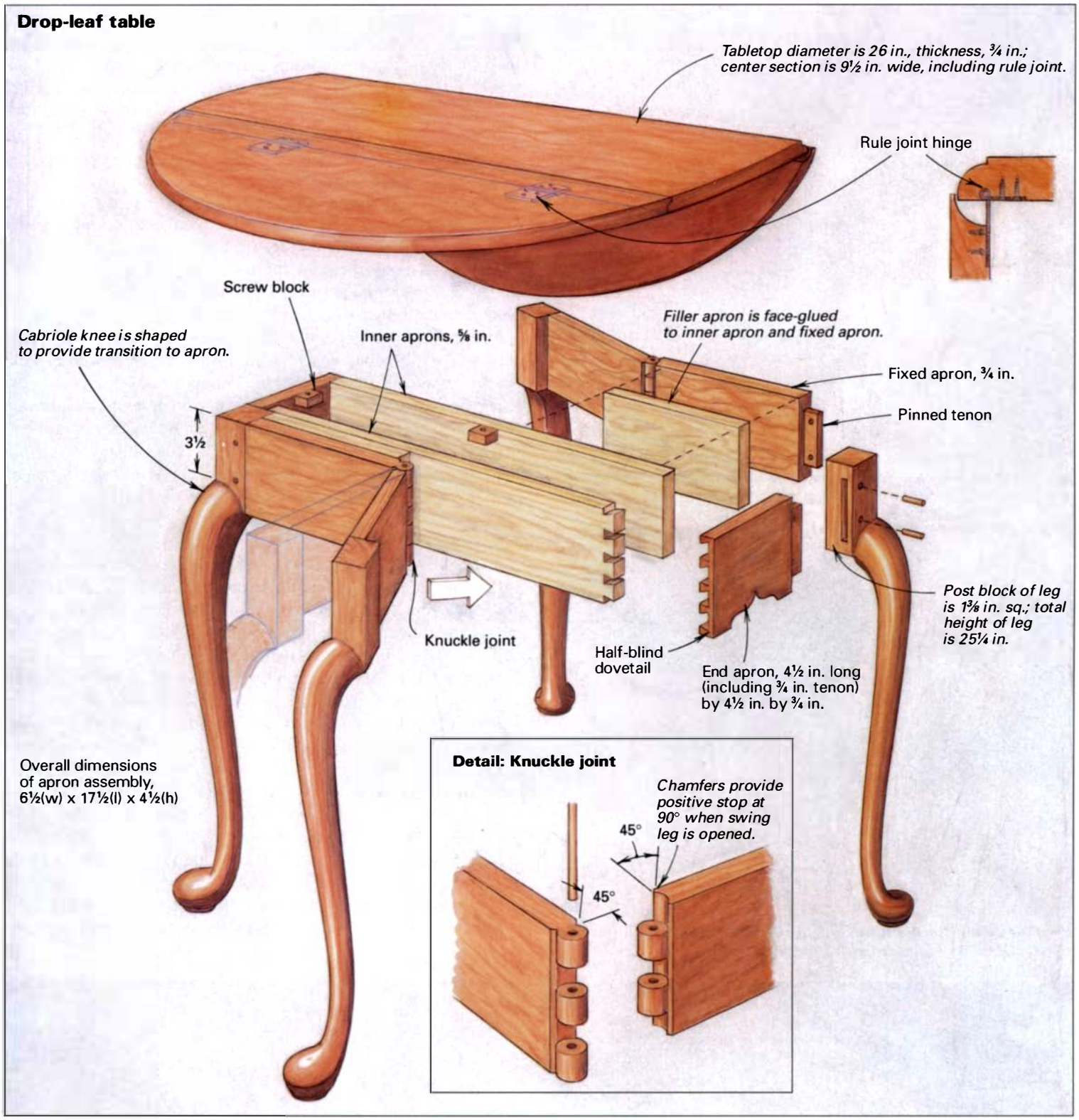
The knuckle joints are at the heart of the table, and I start with them. The joint and the aprons it connects must be accurately aligned to ensure the fly leg stands vertically both in its home position, where it must meet the end apron squarely, and in its open position, where it must support the leaf at just the height of the fixed top.

A knuckle joint is basically a finger joint with its fingers rounded over and the bottoms of its sockets coved. To provide a positive stop for the swing leg at 90°, the joint has mating 45° chamfers on both aprons, as shown in the drawing detail. The knuckles can be cut on the tablesaw with a finger-joint jig and then finished with hand tools. With only two joints to cut, though, I opted to make the entire joint with hand tools.

Cutting and fitting the joint is not difficult, but accurate layout is essential to success. Begin the layout by marking in from the end of each piece by the thickness of the material. Then carry a line around the apron at that point. Draw diagonal lines in the square you've created on the top and bottom edges of the stock, and draw a circle, as shown in the top photo on p. 92.

The short section of the diagonals between the circle and the original layout line is the chamfer line. To make chamfering easier and more accurate, you'll need a relief cut. Draw a line parallel to the first layout line, and score along it with the corner of a sharp chisel guided by a square. Then chisel a shallow V-groove on the side of the line nearest the end of the board. The groove provides a channel for your saw to ride in as you start the relief cut. Make the relief cut with a tenon saw or dovetail saw, stopping just as the kerf touches the circle laid out on the edge of the board. Now make a guide block beveled at 45°, and ride a rabbet plane on the

Photos: Jonathan Binzen



bevel to cut the chamfers, as shown in the center photo on p. 92.

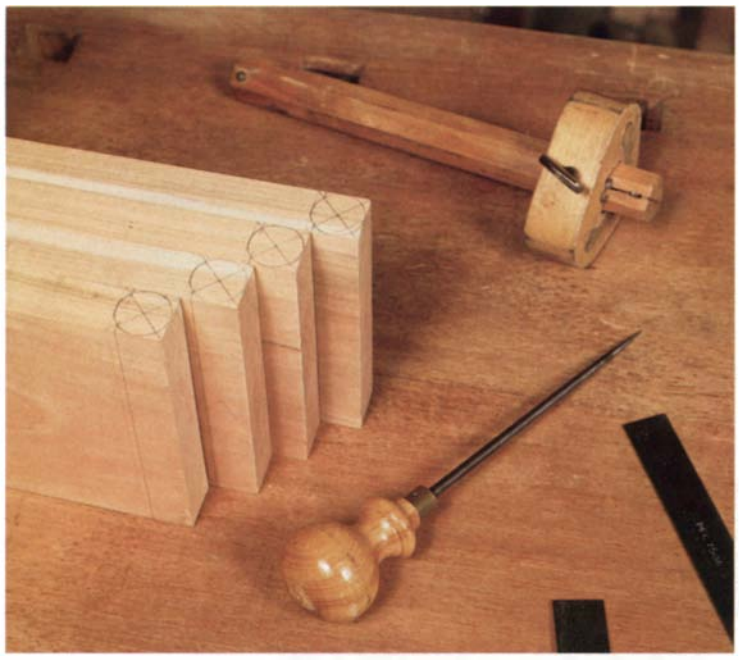
Shape the barrels of the hinge with chisels and a block plane. Refer to the circles on each edge of the board as you proceed. Begin the rounding by planing a series of facets from end to end. Continue cutting narrower facets until the barrel is round. You could also use a router for some of the rounding over. A piece of scrapwood can be coved to the same radius as the barrel and used as a sanding block for final smoothing.

Lay out and cut the sockets between the knuckles next. Divide the board into five equal units across its width, and extend the division lines around the barrels. Using a backsaw, cut down the waste side of the lines to the chamfer, and then chop out the waste material with a chisel, as you would when cutting dovetails, working from both sides to avoid chipout.

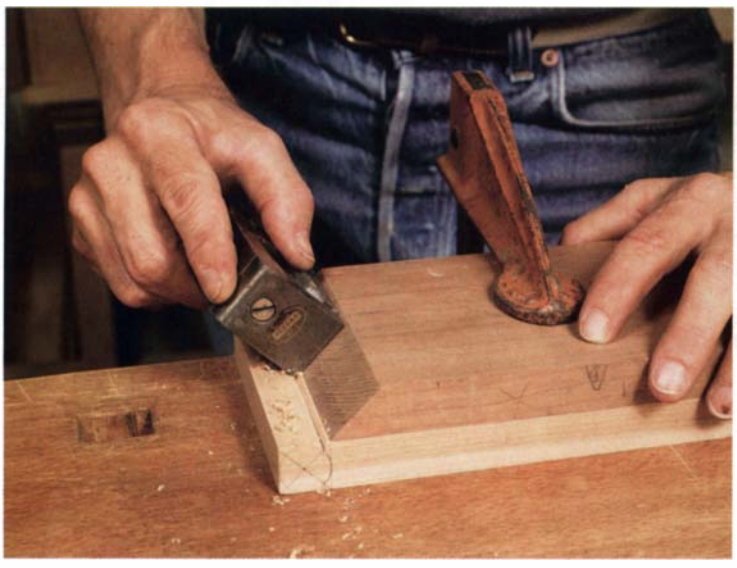
The bottoms of the sockets must be coved, so they mate with the radius of the knuckles. Use gouges that match the sweep of the cope for the end sockets and a straight chisel to shape between the knuckles, as shown in the bottom left photo on p. 92.

I used a piece of 3/16-in. drill rod for the hinge pin. A length of brazing rod or dowel rod would also work. To drill the hole, assemble the joint on a flat surface, and clamp it together end to end with a pipe clamp. Then clamp the whole assembly to a fence on the drill-press table, and drill the hole. To avoid bit wander, drill a little more than half way through the joint, and then flip the

Drawing: Lee Hov



Lay out the knuckle joints accurately, *and you're halfway to a good hinge. The diagonals determine the hinge center point.*



Run a rabbet plane along a guide block *to cut the chamfer that limits the swing of the knuckle joint hinge.*

assembly and complete the hole from the opposite edge.

Drive the hinge pin into the joint, and check the action of the hinge. It should move smoothly without binding or much squeaking. When the joint is open to 90°, the two chamfers should form a gapless line. Set the aprons on a flat surface to ensure that they sit perfectly flat both when in line and at 90°.

Joining legs and aprons

It is best to cut the leg-to-apron mortise-and-tenon joints before shaping the legs. With the legs square, the whole process is easier and more accurate. The fly legs each have one mortise and the fixed legs have two. I cut the mortises with a plunge router, holding the legs in a simple box on which I guide the router. You could also chop them by hand or with a hollow-chisel mortiser. I find it quick and efficient to cut the tenons with a dado head on the tablesaw. For these tenons, which are ¾ in. long, I stacked the dado set ¾ in. wide and made the whole cut in one pass.

The end aprons have a tenon cut on one end and a half-blind dovetail on the other. Start the dovetailing by laying out and cutting the tails on the pine inner apron. Then use the tails to lay out the pins on the end apron. Before putting the end aprons aside, cut the ogee detail on their bottom edge.

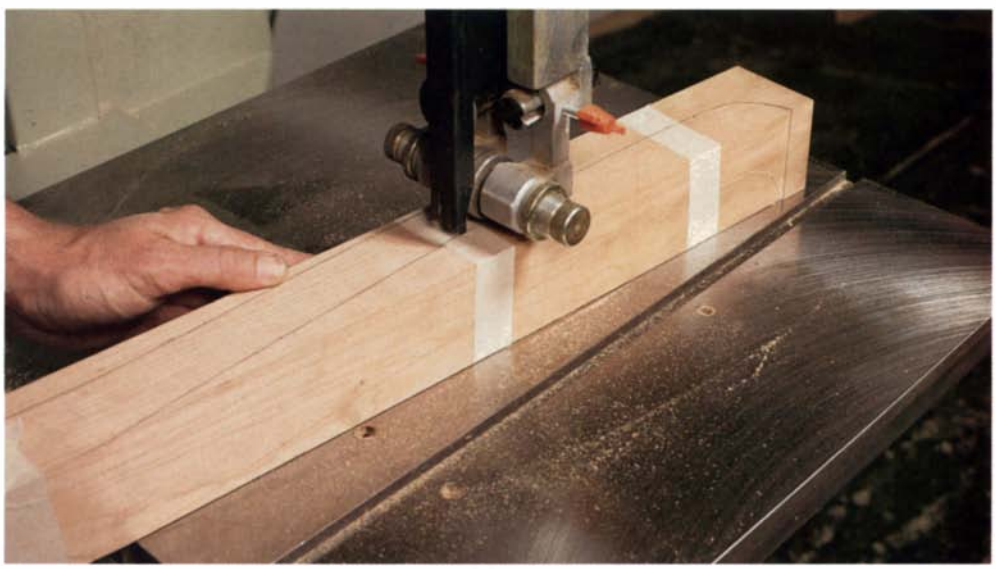
Cabriole curves emerge

Named after the French dancing term for a leap, cabriole legs do give furniture a certain vitality or spring. And they're not all that difficult to make. A small portion of the work is done on the lathe—the foot and the pad beneath it. The rest of the shaping is done with the bandsaw and hand tools.

The leg blanks have been milled square and mortised by now. Leave the horn at the top (the extra inch that reduces the risk of a split during mortising) to provide waste for chucking on the lathe. Make a full-sized template of the leg out of thin plywood or poster board, and use it to lay out the cabriole curves on the two adjacent inside surfaces of the leg. Then cut out the legs on the bandsaw. Cut the curves only; don't cut out the post block (the section above the knee) until you've turned the feet. If you were to cut away the post-block waste now, it would be difficult to center the leg blank on the lathe. When you've cut one curve, tape the cutoff back into place, and cut the second face (see the bottom right photo).

Untape the cutoff, and mount the leg between centers on the

Scoop out the center sockets *with a straight chisel. Cove the outside sockets with a gouge of appropriate radius.*



Billet rebuilt—*With the blade guide lowered to just above the stock, bandsaw along the layout lines. Tape the cabriole cutoffs back in place, and turn the billet 90° to make the second pair of cuts. After turning the foot, clean up the bandsawn curves with a spokeshave.*

lathe. Then turn the major diameter of the foot. Measure up from the bottom ¼ in., and use a parting tool to establish the pad of the foot. With the major and minor diameters defined, use a small gouge or a scraper to shape the foot's profile, as shown in the bottom left photo below. Finally, before removing the leg from the lathe, sand the foot. Then you can take the legs to the bandsaw and cut away the waste above the knee.

The remainder of the leg shaping is done at the bench with an assortment of hand tools. You can hold the leg with a bar clamp clamped in your bench vise. The first step is to fair the bandsawn curves with a spokeshave. Be particularly careful working at the top of the foot because this is end grain and will chip easily. The front arris of the leg, though it moves in and out, should be a straight line when seen from the front.

Once the spokeshave work is complete, use a cabinetmaker's rasp to cut chamfers on the corners of the leg. Leave the corners sharp in the area above the knee. Next use the rasp to round over the chamfers and blend the curves of the leg, as shown in the bottom right photo below. The cross-section of the leg should be circular at the ankle and square with rounded corners just below the knee. When you've finished the coarse shaping with the rasp, refine the curves with a file. Further smoothing can be done with a hand scraper and sandpaper.

Next shape the knee to provide a transition between the leg and apron, as shown in the drawing on p. 91. Lay out a curved line from the top of the knee to the point where the apron joins the leg. Then cut away the waste above the line with a sharp bench chisel. With the same chisel, shape the knee in a smooth curve. Once the shaping of the legs and knees is complete, saw the horns from the legs. Give all the parts a final sanding, and you are ready to glue up the table base.

Assembly and subassembly

With 10 separate pieces comprising its apron, this table presents an unusual challenge in the gluing up. The way I do it, there are three stages. First glue up the half-blind dovetail joints that link the end aprons to the inner aprons. Make sure the aprons meet at exactly 90° before setting them aside to dry. Next glue one fixed and one swing leg to each of the hinged aprons. A bar clamp with pads on the jaws will work well. To keep the hinge from pivoting, use handscrew clamps with light pressure to clamp the hinge to the bar clamp. Set all four subassemblies aside to dry overnight.

To complete the base assembly, you'll need two filler aprons made from secondary wood. They are face-glued between the fixed section of the hinged apron and the inner apron (see the drawing on p. 91). The fit has to be perfect, so dry-assemble the subassemblies, measure the gap and mill the filler apron at that point. Glue the filler apron between the inner and outer aprons, keeping all three aligned with brads or biscuit joints.

The final glue up is best done with the base upside down on a flat table. While the pieces are dry-clamped, check that the hinge will open through its range unimpeded. Then glue up the last two apron-to-leg joints. After the glue-up, pin all the mortise-and-tenon joints with ¼-in.-dia. pegs.

Rule joints

I cut the rule joints that connect the leaves and the fixed top before roughing out the circular shape of the top. I do mill the boards carefully, though, and scrape or plane off the millmarks before cutting the rule joint. I find it easiest to cut the joint on a router table. First cut the roundover on the fixed top with a ½-in. roundover bit. Guide the top against a fence, and make trial cuts on scrapwood. Leave a ⅛-in. fillet at the top of the cut. Then chuck up a ½-in. core-box bit, and cut the leaves to fit the fixed top.

When installing the rule-joint hinges, leave some leeway for the top to expand and contract with variations in humidity. Instead of aiming for a joint that will close entirely on top, offset the hinge barrels 1/64 in. to 1/32 in. toward the leaf.

Once the hinges are in, lay out the top's diameter on its underside. It can be cut out by hand or with a bandsaw or a sabersaw. Scrape and sand the edge to remove the sawmarks, and shape the edge to a slight belly with planes, files and sandpaper. Give the top a final sanding, and attach the base to it with screws driven through slotted holes in screw blocks attached to the inner aprons.

I finished the table with several coats of a tung oil/Danish oil mix. A coat of paste wax was applied after the oil finish was completely dry. Make sure the underside of the top and the inside surfaces of the aprons receive the same amount of finish as the visible surfaces. If you skimp on finish underneath, the table will take on and lose moisture unevenly and could be prone to warping. □

Robert Treanor is a cabinetmaker and teacher in San Francisco.

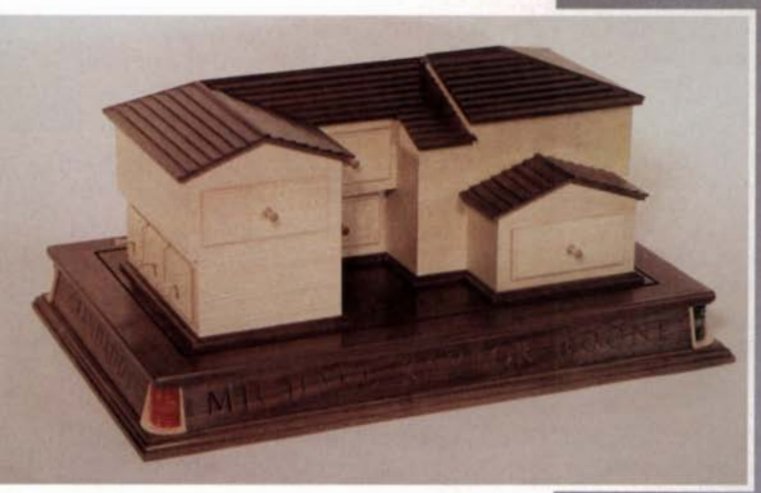
***Shaping the foot**—Only the lower part of the foot and the pad are shaped on the lathe. To provide good purchase for the live center, leave the leg full-sized above the knee until after turning.*

***Shape and blend the curves of the cabriole legs** with rasps and files. The leg should be round at the ankle and square with rounded corners just below the knee.*

Jewelry Box Gems

Detail, figure and form enhance functional designs

by Alec Waters



***Masculine memorabilia**—New Mexico artist Andrew Davis makes a keepsake box in a different architectural style each year for his cousin. The walnut and ash box (above) is patterned after a house in Newport Beach, Calif. Its dyed-maple corner blocks resemble port and starboard running lights. The classical-motif box (right) has a cherry pedestal drawer incised with the date. Above the 16-segment turned base sits a hollow tiger-ash column. The carved Corinthian capital is the lid.*

Fine wooden boxes traditionally have been the container of choice for jewelry. Elegantly simple or elaborately ornamented, a good jewelry box is as valued as its contents. Knowing this, boxmakers specialize in selecting prized materials and in carefully fitting and joining components.

The jewelry boxes on these pages offer a sampling of design possibilities. The flowing curves and figure in the chest in the center photo below are a vivid departure from the simple lines of the box in the bottom photo. Comparing the selections of woods, forms and joinery often gives clues to the material tastes and styles of a box's keeper. And contrary to a popular misconception, jewelry boxes need not be the exclusive domain of women. As seen in the photos on the facing page, boxes can make perfectly appropriate "homes" for safe-keeping the treasures of either gender.

Infinite variety also applies to a box's decorative treatments. Inlays, reveals, moldings and finish colors allow a boxmaker to evoke anything from formality to playfulness, as shown in the box embellishments in the top photo. Also, a box can exhibit a wide range of woodworking, such as cabinetmaking or turning, especially if the box is outfitted with custom hinges, latches or pulls. Ed Sheriff of Birmingham, Ala., went as far as installing lights in a jewelry case to illuminate its adornments (see *FWW* #101, p. 86). The most complete boxes include lined trays and intricate compartments to provide the best jewelry display and storage options. □

Alec Waters is an assistant editor for Fine Woodworking.

Photo: Paul Burri

***Vertical and horizontal lines** define this jewelry box (left) that Californian Paul Burri made for his wife. The geometric shapes of the Honduras mahogany upper box and the lower zebrawood case are exaggerated in the details inside. The turned and carved necklace carrier rotates and telescopes on wooden slides.*

***This serpentine-front jewelry chest** (below) made by Sandor Nagyszalanczy of Santa Cruz, Calif., stands 8 in. high. Its lacquered bird's-eye maple case is accented by rosewood trim and drawer pulls that echo the wave-front shape. The drawers fit into a pigeonhole framework made of 3/8-in. Baltic-birch plywood.*

Photo: Sandor Nagyszalanczy

Photo: Sloan Howard

***Straight components** and crisp joinery are the hallmarks of this router-shaped box (left). Patrick Warner of Escondido, Calif., capped the 9-in.-wide by 3-in.-high white-oak box with a bird's-eye maple top. In keeping with the clean look, he left the wood unfinished.*

Photos facing page: Herb Lotz

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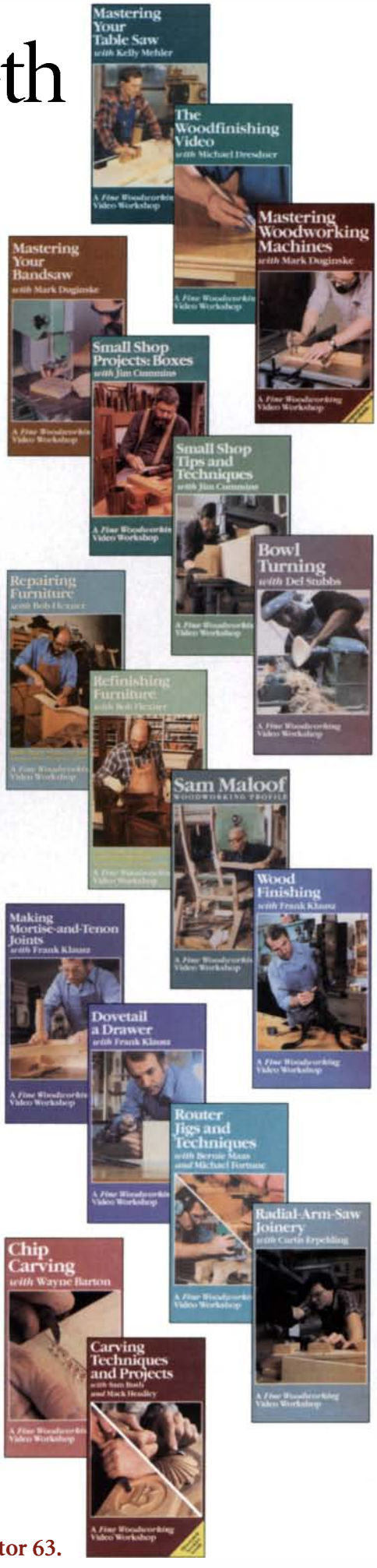

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Index to issues 98 through 103

This alphabetical index covers all the issues of *Fine Woodworking* magazine published during 1993 (*FWW* #98 through #103). Starting in 1988, *Fine Woodworking* has published annual indexes, which can be found in *FWW* #74, #86, #92 and #98. The Taunton Press also sells a cumulative index covering issues #1 through #100 (Fall 1975 through May/June 1993) for $12.95. The format of each index reference is issue number:page numbers. A hyphen between page numbers means the discussion is continuous; commas between page numbers indicate an intermittent discussion. This index, like all previous indexes to *Fine Woodworking*, was prepared by Harriet Hodges, chairmaker, of New Castle, Va.

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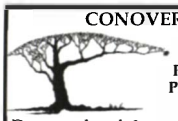

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11-950 8" bench drill press 145
36-090 10" Sidekick miter saw 214

md

SMPR2 SMARTLEVEL™ 2' Pro Rail w/Module & Case
$89

PR4 4' Pro Rail w/mod. w/cs 105
PR78 78"Pro Rail w/mod. w/cs 139

RYOBI

OSS450 Oscillating Spindle Sander
$174

RE600 3 hp VS plunge router 214
JP-155 6-1/8" jointer/planer 309
QS1000 **NEW** quickstand 54
TS254 10" mitre saw 199
TS260 10" comp. miter saw 245
TSS220 8-1/2" sldng comp. mit 445
TS380 15" miter saw 439
RA202 **New** 8-1/4" radial saw 399

AP12 12" Portable Planer
$399

BT3000 10" sliding tble saw w/sd 539
TR30U laminate trimmer 88
BE321 3x21 VS belt sander 138
DS1000 triangle detail sander 44
JM100K plate jointer 214
TFD2202VRK 12v cdls kit/2 bat. 174
TDS4000K **New** 12v drywl drvr kt 229
BS900 **New** 9" bench bandsaw 175
BMM2400 **New** 24V mulch. mowr 399

PONY AIR

LPN672 Air Palm Nailer With Glove
$94

Drives 6d-50d nails!

freud

JS100 Jointing System W/Case & 500 Assorted Biscuits
$179

JS100 plate jointer w/case 164
FT-2000E 3.25 hp vs routr 209
EB-100 edge banding system 229
UC-900 5 pc shaper cabinet set 349
94-100 5 pc router cabinet set 159
95-100 5 pc rtr set w/99PK1 199
91-100 13pc 1/2" router bit set 189
90-100 15pc 1/4" router bit set 159

F410 NEW! Quiet Blades & Super Dadoes 10"x40T
$54

TR215 **New** 6-1/2" sldg cmpd saw 399
F810 **NEW** 10"x80T quiet blade 76
SD506 **NEW** 6" super dado set 165
SD508 **NEW** 8" super dado set 194

Milwaukee

6527 Variable Speed Super Sawzall
$169

5371-1 1/2" hammer drill kit 185
5365-1 Hawk 1" SDS rtry. h. kit 325
5353 Eagle 1-1/2" rtry hmr kit 499
5660 1-1/2 hp 10 amp router 185
5680 2 hp 12 amp router 199

6490 10" Miter Saw w/C.T. Blade (Free Blade)
$265

6507 VS sawzall with case 139
6508 VS sawzall with case 139
6528 VS super sawzall 169
5397-1 3/8" hammer drill kit 139
5375-1 1/2" hammer drill kit 169

0407-1 NEW! 12 Volt VSR Cordless Kit w/Keyless Chuck & Extra Battery
$174

6127 5" random orbital sander 149
0222-1 3/8" VSR 3.5 amp drill 108
0229-1 3/8"vsr keyless w/bit set 109
0234-1 1/2"VSR 0-850 magnum 124
0244-1 1/2"VSR 0-600 magnum 124
1676-1 2 sp. hole hawg kit 259

6368 7-1/4" Saw w/C.T. Blade, Case and Fence
$138

6369 7-1/4" saw w/ct blade 149
6753-1 0-4000 VSR screwdriver 88
6750-1 5 amp VSR screwdriver 94
0375-1 3/8" close quarter drill 128

6767-1 5 Amp Heavy Duty Screw Shooter Kit
$139

3107-1 vs right angle drill kit 204
6142 4-1/2" angle grinder 124
5455 7" 1750 rpm polisher 138
5460 7" vs 0-1750 polisher 169
6256 VS top handle jig saw 139
6014 1/2 sheet finishing sander 119
8975 dual temp. heat gun 59

PORTER-CABLE

333 NEW! Quicksand™, 5" Dustless Random Orbit Sander
$69

332 **New** 5" Quicksand PSA sndr 64
334 5" dustless PSA sander 69
352VS 3x21 vs belt sander 164
7116 **New** 24" Omni jig w/video 299

7335K-2 5" VS Sander w/Case, Pad, Dust Kit, 2 Rolls Holed Paper
$179

7336K-2 6" sander kit as above 189
7334 random oribtal sander 122
7335 5" VS random sander 132
7336 6" VS random sander 138
505 1/2 sheet finish sander 124
330 speed bloc finish sander 64
97310 laminate trimmer kit 194

550 NEW! Pocket Cutter
$179

352 3x21 sander with bag 154
360 3x24 sander with bag 194
362 4x24 sander with bag 199
503 3x24 wormdriver w/bag 349
504 3x24 wormdrive sander 339

9853 - 12 V, 3/8" VSR, 2 Speed Drill Kit W/Keyless Chuck & 2 Batteries
$179

9840 9.6 drill kit w/2 bat 164
9841 9.6v drill kit 15 min. chg. 174
9855 12v, 1/2" kit w/2 batteries 199
6611 3/8" VSR 5.5 amp drill 119
6614 1/2" VSR 5.5 amp drill 124
6615 1/2" VSR 5.5 amp, kyless 124
6645 0-2500 VSR 5.5 amp drvr 114

556 Plate Jointer W/Case & Adj. Tilt Fence
$179

555 plate joiner w/case 179
5116 16" Omni jig 259
7536 2-1/2 hp router 199
7537 2-1/2 D handle router 209
7399 drywall cutout 84
7310 laminate trimmer 94
9118 porta plane kit w/ct cutter 209

9690 1-1/2 HP Router w/Case
$139

345 6" Saw Boss w/c.t. blade 104
347 **NEW** 7-1/4" 15 amp saw 139
9347 7-1/4" 15 amp saw w/cs 149
447 7-1/4" 15 amp saw w/brk 149
314 4-1/2" trim saw 138
9314 4-1/2" trim saw kit 148
9315-1 7-1/4" saw w/case, ct bl 138
7549 top handle VS jig saw 144

7539 3-1/4 HP 5 Speed Plunge Router
$265

690 1-1/2 HP router 138
691 1-1/2 hp D handle router 154
696 router-shaper table 134
695 router table w/router 224
7518 3-1/4 hp 5 speed router 269
7519 3 hp production router 234
7538 3-1/4 hp plunge router 234

7700 NEW! LaserLoc 10" Mitre Saw
$345

9637 electronic vs tiger saw kit 149
9647 tiger cub with case 118
693 1-1/2 hp plunge router 169
6931 plunge router base 78
97751 1/2" 2 spd hmr drl kt 159

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8" Handscrew
$12

1 10" handscrew 13
2 12" handscrew 15
3 14" handscrew 19
4 16" handscrew 25
7224 24" I-bar clamp 18
7236 36" I-bar clamp 19
7248 48" I-bar clamp 21
7260 60" I-bar clamp 24

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50L12 50" Commercial w/12" Left
$295

52L12 52" homeshop fence 239
40L12 40" homeshop fence 209
28L12 28" homeshop fence 199

Panasonic

EY6100CRKW NEW! 12 V, 3/8, 2 Bat. 21 Position Clutch Kit
$199

EY6181CRKW 9.6v Pred kt/2 bat 169
EY6205EQK12v 3/8" lrnmn drl kt 189
EY6207EQK12v 1/2" lrnmn drl kt 224

JET

WBS-14CS NEW 14" Wood Bandsaw
$519*

JBS-18 18" bndsw 2hp w/stand 949
WBS-20 20" wdcttng bandsaw 2199
OVS-10 oscillating spindle sndr 1849

DC-650 1 HP, Dust Collector
$214*

DC-1200 2HP, dust collector 414*
DC-1900 d. col. 3 hp/1900 cfm 609
EHVS-80 6x89 edge sander 629
JSG-6 6"belt/12" disc sander 569

JJ-6CS 6" Long Bed Jointer
$454*

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

JTS-10JF 10" Saw With Jet Fence
$514*

JCS-10A 10" cab. saw w/Jet fnc 969
JSS-20VS **NEW** 20" VS scrll saw 299*
JDP-14M 14" bench 16 s. press 349
JDP-17MF 17" floor 16 s. press 389*
JDP-20MF 20" floor 12 s. press 729

JWB-37P 37" x 60" Wide Belt Sander
$10,795

JWB-25P 25x60 w. belt sndr 7895
JWB-13P 13x60 w. belt sndr 5795
JWL-34L 2 hp wood shaper 1149
JSS-26 26" 2 speed scroll saw 319

JWL-1236 12" VS Wood Lathe w/Stand
$524*

JWP-15H0 15" planer 3 hp 1129*
JWP-208-1 20" plnr 2sp/3hp 1899
JWP-20H-1 20x7 planer 3hp 2999

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34-782 3HP unisaw w/unif &mc 1599
34-763 3hp Jet-Lock unisaw 1499

34-445K 10" Contractor's Saw w/30" Unifence & Table Board
$779*

34-444 10" contractors' saw 619
34-670 10" motorized table saw 399
34-330 8-1/4" bench table saw 239
33-890 12" radial arm saw 1399
33-990 10" radial arm saw 619

28-283K 14" 3/4 HP Bandsaw w/Fence & 3 Blades
$749*

33-055 8-1/4" sawbuck w/legs 599
37-280 6" motorized jointer 399
37-154 6" jointer, DJ-15w/stnd 1099
17-900 16-1/2" floor drill press 399
34-080 10" mitre saw 199

43-379 3 HP HD Two Speed Shaper
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43-355 1-1/2 HP wood shaper 709
31-730 6" belt/12" disc sander 1199
37-350 8" jointer,DJ-20 w/stnd 1529
46-541S 12" V.S. wood lathe 1499
40-601 18" V.S. scroll saw 759

36-220 10" Compound Mitre Saw
$229

50-181 2 hp dust collector 619
50-180 1 hp dust collector 419
50-179 3/4 hp dust collector 334
34-897 50" Delta unifence 289
34-915 30" Delta unifence 229
32-100 plate jointer 255

22-661K 13", 2 HP Planer w/Stand
$1094*

37-190New 6" jonter with stand 469
34-995 3 phase stock feeder 849
34-994 1 phase stock feeder 899
34-985 1 phase stock feeder 539
20-150 14" cut-off saw 249

31-280 NEW Sanding Center w/Stand
$749

36-755 10" cabinet saw 949
36-751 10" cab.w/30" Unifence 1099
36-752 10" cab.w/50" Unifence 1199
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50-902 5 hp3 ph cycln collectr 1799
50-903 5hp 230v cycln collectr 1999
34-777 5hp Jetlock unisaw 1699
34-778 5hp unisaw w/uni 1799

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690 Air Palm Finish Sander
$134

690V air sander w/vacuum 164
8000 3/8" VSR 0-1300 drill 119
8020 1300 rpm electric scrdrvr 168
8030 kls 3/8" R.A. drill 0-1500 139

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$99

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AM99-HC4V **New** 2hp ver.twn.tnk 389
AM99-HC4 2hp twin tank 379
AM78-HC4 1-1/2hp twin tank 299
AM39-HC4V 3/4hp v twin tank 289
K15A8P 1.5hp wheelbarrow 599
K2A8P 2hp wheelbarrow 669
K5HGA-8P 5hp Honda whlbrrw 749
K4WGA-8P 4hp Wisc whlbrw 599
045 3/8" x 50' Goodyear hose 20

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1660760 66 Saw 3 HP W/50" Biesemeyer (Acc'y Pkg.)
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1270100 #27 shaper3hp 1ph 1949
1000099 #100 planer/12"/2hp 2299
1800205 5hp,18" pl. w/knife gr 5099
1500040 6" jointer 3/4hp 1 ph 1249
1610050 8" jointer 1.5 hp 1ph 1599
1300134 6x48 belt/12" disc sdr 1249
1152825 15"VS dr. press 3/4hp 1469
1410040 14" bndsw 3/4hp 1ph 1379
1790808 25" wide belt sndr 7999

1791000 63 Artisan Saw W/Vega Fence
$669

1791001 63 Artisan w/50" Vega 769
1791020 3/4" wood shaper 1hp 479
1791040 14" floor drill press 369
1791050 6" jointer with stand 499
1791060 14" bandsaw w/stand 599
1791070 1-1/2hp dust coll 399
1791200 6x48 belt/10" disc sndr 449
1791100 6"x89" edge sander 639

HITACHI

C8FB 8-1/2" Compound Mitre Saw
$599

P12RA 12" planer/6" jointer 999
D10DFK 9.6v vsr drill kit w/2 bt. 169
C12FA 12" mitre saw 319
C10FA 10" mitre saw 299
C7BD 7-1/4" circular saw w/brk 139
M12V 3-1/4 hp VS pl. router 249
TR12 3 hp plunge router 189
CB75F resaw bandsaw 1679
F1000A 12" planer/6" jointer 1579

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COBRA NEW Jointer 289

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VC-8 8" Versa Cut II Tile Saw
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PT1075 10" 1 hp tile saw w/bld 779
PT10100 10"1-1/2hp tile sw w/bl 829

SKIL
2736-04 12 V, 3/8" VSR Keyless Drill Kit W/2 Batteries
$134
3400 10" table saw w/dado set 189
7484 5" random orbital sander 99
1605 plate jointer, case & bisc. 129
77 7-1/4" worm drive saw 144
5525 New! 6-1/2" circular saw 99
5660 8-1/4" 60° pro bevel saw 139
5860 8-1/4" 60° rafter master 169

makita
6095DWE 9.6 V. 3/8" VSR Keyless Chuck & 2 Batteries
$139
5007NBK 7-1/4" saw w/case 119
5007NBA 7-1/4" saw w/elct. brk. 124
2711 10" table saw w/brake 569
2708W 8-1/4" table saw w/ct bl. 299
LS1030 10" mitre saw 199
2012 12"port. planer w/dust cht 529
B05000 5" random orb. sander 69

LS1011 10" Compound Mitre Saw
$549
6201DWE 9.6v Makpak kyls 2 bt 159
6011DW 12v keyless vsr kit 169
6211DWE12v MakPac kit w/2 bat169
3612BR 3 hp plunge router 209
9820-2 blade sharpener 209
HP2010N 3/4", VSR hammer kit 179
JR3000V VS recip. saw kit 138
N1900B 3-1/4" planer w/case 134
2040 15-5/8" stationary planer1699

Husqvarna FORESTA GARDEN
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$329

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2694 7-1/4" Super Sawcat w/Brake & Case
$154
2695 8-1/4" super sawcat w/br. 164
3034 7-1/4" circular saw 99
79-034 # 400 workmate 109
79-039 New #2000 workmate 159
3680 12" compound miter saw 349
3660 12" mitre saw 299
2765K-2 12v, kylss supr cyclone 169
1311 1/2" HD VSR Holgun drill 124
1180 3/8" HD VSR Holgun drill 109

5014 3/4" Rotary Hammer w/Case
$189
2037 0-4000, VSR, 5A scrugun 99
2054 0-2500, VSR, 5A scrugun 148
2059 0-2500, VSR, 5A tek gun 119
2670 1/2" HD impact wrench 149
5073 1/2" VSR hammer drill kit 168
1703 10" miter saw, bag,&CT bl 188
3158K VS orbital jig saw kit 134
3105 VS orbital cutsaw kit 134
4076 Wildcat grinder 6000rpm 144
2750 4-1/2" angle grinder 84

qual-craft
2200 Pump Jack
$58
2201 top brace 20
2203 guard rail holder 21
2204 work bench 38
2601 NEW wall jack 109

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$969
EB3500XK1A 3500 w generator1449
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GX340K1QA 11 hp horz. engine 599
For optimum performance & safety we recommend you read the owner's manual before operating your Honda Power Equipment. Connection of generators to house power requires transfer device to avoid possible injury to power company personnel. Consult a qualified electrician.

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121482 12' Multimatic Alum. Ladder
$129
121499 16 foot ladder 149

AEG
TXE-150 6" EVS Random Sander
$142
FSPE-100X 3x21 VS belt sander 169
BSPE-100XNew barrel grip jigsw 169
BSPE-100K New top hdle jigsaw 169

shop-vac
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BOSCH
1370DEVS 6" H.D. Random Sander
$219
1370DEVSK 6" rand. sndr kit 269
3272 3-1/4" planer 4.2 amps 89
1608U underscribe lam. trmr 134
1609KX laminate trimmer kit 199
1195VSR 3/8" 6amp hmr drill 139
1194VSR 1/2VSR 6amp hmr dr. 149

1613EVS NEW! Microfine Plunge Router
$184
1614EVS 1-1/4 hp,vs, pl router 148
1613 1-3/4 hp 25,000 pl router 164
1614 1hp 27000 rpm pl. router 128
1289DNEW 1/4sheet plm sander 64
1347AK 4-1/2" grinder kit 99

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$389
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NV45AB coil roofing nailer 399
N5008AA 5/8" to 2" HO stapler 314
NT65A 1" to 2-1/2" brad nailer 319
NT45A 5/8"to 1-3/4" brad nailer 274

Elu
3339 NEW! 3 HP Electronic VS Plunge Router
$269
3338 2-1/4 hp vs plunge router 254
3380 joiner/spliner w/case 245
2721 1.5hp fixed base router 139
3379K plate joiner w/case 225
3375 3-1/8" universal planer 159
4024 3x21 VS sander 179

BOSCH
1581VS Top Handle Jig Saw w/Case & 30 Blades
$179
1581VS top handle jigsaw 139
1582VS barrel grip Clic jig saw 139
1632VSK VS recip saw kit 144
3051VSRKkyls3/8VSRkit w/2bat 144
3258 3-1/4" power plane 139
1654 7-1/4" saw w/ct blade 104

3283DVS Dustless Random Orbital Sander
$95
3283DVSK5" random sander kit 119
1348AE 5" elec. mini grinder 119
1608 laminate trimmer 89
1609 offset base laminate trmr 122
1942 heavy duty heat gun 75

1273DVS 4x24 V.S. Belt Sander
$204
1273D 4x24 sander with bag 195
1272D 3x24 sander with bag 184
3270D 3x21 sander with bag 149

1615EVS 3 -1/4 HP, VS Plunge Router
$244
1615 3 hp plunge router 229
1604 1-3/4 hp router 134
1606 1.75 D-handle router 169
1609K 3 in one trimmer kit 174

1003VSR 3/8" Keyless 0-1100 Drill
$94
1021VSR 3/8" VSR 0-1100 drill 104
1022VSR 3/8" 0-1100 XHD VSR 109
1023VSR 1/2" 0-550 hd VSR dr. 119
1024VSR 3/8" 0-1000 m. midget 109
1025VSR 1/2" 0-650m. m drill 119

1404VSR 0-4000 Drywall Driver
$84
1405VSR 0-2500 drywall driver 94
1420VSR 0-4000 hd drywall dr 84
1421VSR 0-2500 hd drywall dr 99

11212VSR 3/4" Bulldog SDS Rotary Hammer
$198
11214VS 1.75 VS rotary hmr 669
11304 Brute breaker hammer 1189
11305 demolition hmr 10 amp 699
11220EVS 1-1/2" spline hmr 469
11219EVS 1-1/2" spline w/stop 589
11310EVS vs demolition hmr 479

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BD5200 NEW! Quantum 5" VS Random Orbital Sander w/Bag
$89
BD3200 7-1/4" saw w/bag ct bld 109
BD5900 vs 1/2" belt sander 79
BD6200 1-1/4 hp 1/4" router 134
BD6500 3-1/4" 8 amp planer 124
BD5500 3x21 vs sander w/bag 109

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3088 Construction Master III Calculator
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3391Scale Master Plus dig.scale 99

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N12B-1 coil roofing nailer 399
N80C-1 coil nailer 359
N100S-1 6d-20d nailer 569
T31-1 5/8" to 1" brad tacker 149
T50S4-1 sheathing/deck stapler 369
T40S2-CT roofing stapler 299
MIIIFS floor stapler 549

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SLP20NEW 5/8"-1-5/8" brad nlr 279
SN70 6d-16d frame nailer 479
SFN-1 1"-2" finish nailer 309
SFN-II 1-1/2 to 2-1/2 fin. nlr. 374
SKS 1/4" crown finish stapler 248
M-II 1-3/8" to 2" HD stapler 348
SPS-RFR roofing stapler 344

BAUER CORPORATION
30406 6' yellow, 300 lb Fiberglass Stepladder
$79
30405 5' fiberglass ladder 69
30404 4' fiberglass ladder 59

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501 floor face nailer 198

Radius
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DAVIS Davis Instruments
7425 NEW Weather Wizard III
$189
7440 weather monitor II 359

DEWALT
DW682K NEW Plate Jointer Kit w/Biscuits
$225
DW360 7-1/4" saw w/brake 129
DW304K 6amp vs recip saw kit 138
DW318K top hdl vs jigsaw kit 144
DW70512" compound mitre saw 349
DW704 12" miter saw w/brake 299
DW3647-1/4" saw w/brk rear pvt 148
DW675K 3-1/8" planer w/case 164
DW431 3x21 vs belt sander 184
DW947K 13.2v 3/8" vsr drill kit 209
DW160 3/8" RA shorty drill 139

DW625 3 HP Electric VS Plunge Router
$269
DW945K-2 12v 3/8 vsr kit w/2 bt169
DW944K 9.6v 3/8 vsr kit w/2 bt 149
OW106 3/8"4 amp keyless drill 74
OW250 0-4000 drywall driver 92
OW2540-2500 deck screwdriver 88
OW610 1-1/2 hp, 1/2" router 148
OW510K 1/2" vsr hammer dr kit 168
OW615 1-1/4 hp vs plng router 159

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$194
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LTP6-900 level transit pkg. 374
ALTP6-90018 auto lvl trnst pkg 459
AL8-22 22 x auto level 424
LT6-900 20 x level transit 244
LT8-300 26 x transit 445
LT8300P 26 x opt. transit 519
ALT6-900 18x auto level transit 399
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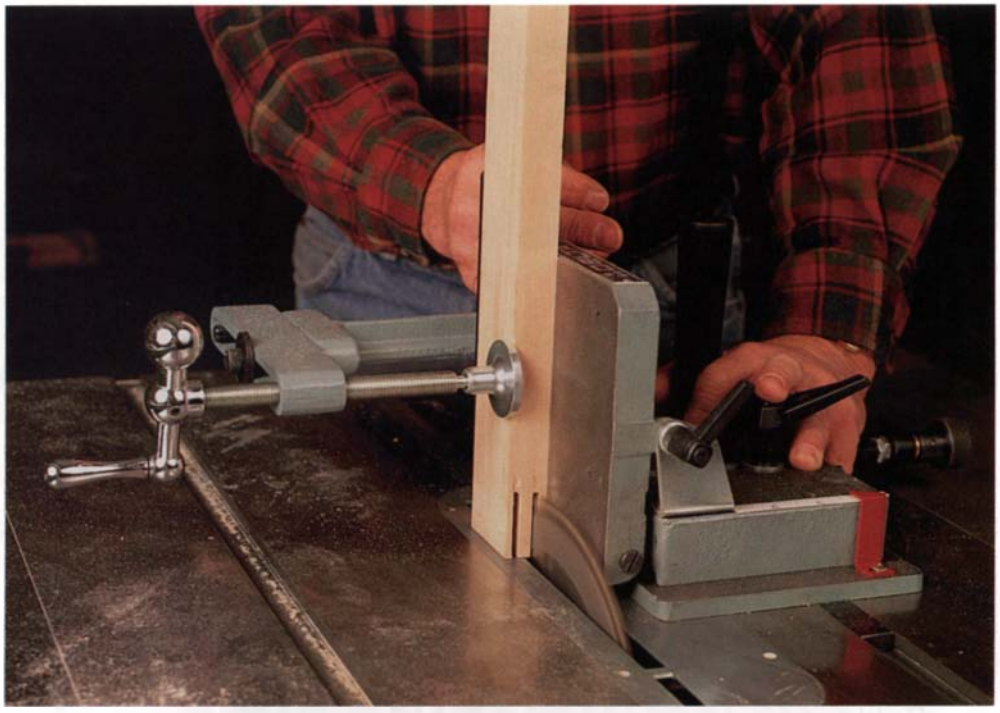
Delta's new tenoning jig

New and improved usually means anything but. That's not the case with Delta's new tenoning jig (Model #34-182). It is a totally new tool, and it's a good one at that. It weighs in at 21 lbs., or about one-third less than Delta's old behemoth of a tenoning jig (Model #34-172). Listing for $95.95, it is less than one-third the cost of the old model.

The jig consists of a fixed cast-iron subbase atop a standard ⅜-in. by ¾-in. miter-gauge bar, a cast-iron sliding base that's moved by turning the knob at the end of a finely threaded rod, a vertical fence that tilts to about 74° and a clamping screw with an old-fashioned hand crank that extends outboard from the vertical fence (see the photo at right).

The two most impressive aspects of the jig, besides its price, are its versatility and its adjustability. In addition to the tilting vertical fence, which allows you to cut angled tenons in one plane, there's also a small stamped-steel backstop that allows you to cut tenons on mitered corners up to 45°. Also, the jig will accept a piece to be tenoned up to 3¼ in. thick. Maximum shoulder width will vary depending on the distance between your miter-gauge slot and blade, but for our saw, it was about 1⅛ in., more than wide enough for most furniture applications.

But all this versatility wouldn't mean a thing if you couldn't cut an accurate, straight tenon. Fortunately, Delta has designed this jig to be thoroughly adjustable. You can zero the vertical fence at 90° and position a setscrew to stop it there; you can adjust the sliding base to align its vertical fence with your sawblade; and you can adjust the backstop and vertical fence to cut angled and compound-angled tenons.



***Delta's new tenoning jig** is a great value at under $100 and is adjustable and extremely versatile. It improves on Delta's previous version, which costs three times as much.*

The only negative comments I have about the jig are that its weight isn't ideally distributed and that the miter-gauge bar was less than snug in the miter slot on our General tablesaw.

When you use the jig, especially for tenons in narrow stock, the weight of the clamp bracket and arm causes the jig to list toward the blade. This is easily compensated for by leaning on the left side of the jig's base, but the condition could result in your tenon's cheeks varying slightly in thickness if you don't lean hard enough. Although the cast-iron clamp arm and bracket have a nice heft and add to the perceived value of the tool, Delta would do well to investigate some means of making the tool a little better balanced.

As for the miter bar, tablesaw miter slots vary slightly in depth and width, so what is ideal for one table may not be for another. Several generations of craftsmen have gotten around this by peening the sides of the bar when necessary, causing the steel to flare slightly, thereby producing a tighter fit.

The bottom line on this jig is that it's the best value for the money on a commercially available tenoning jig. Even setting aside the issue of cost, it's a well-designed and well-built tool that could make your woodworking easier and more enjoyable. You can bet I'm going to buy one.

—Vincent Laurence

***Timberline Tools' scraper burnisher** is an attractive, functional and reasonably priced tool. The hardened-steel dowel pin set at a fixed angle ensures a consistent burr every time, making scraper preparation no longer a hit-or-miss affair.*

Timberline Tool's scraper burnisher

I burnish all of my scrapers with the shank of a ¼-in.-dia. drill bit. The shank has a high polish from years of use. I keep the bit separate from my other drills, though I use it occasionally to drill holes, too. Like many of the tools in my shop, this one is simple and effective, and through the prejudice of habit, I'm unlikely to replace it even if a better tool should come along. It's natural then that I've always been skeptical of the various burnishers on the market. Not that they don't work, but so what if they do? Why spend $20 to $30 when a drill bit shank already does a perfectly satisfactory job? True, most of these devices have the advantage of putting a

consistently optimal angle on a scraper's edge without ever having to gain the hand skill required to do it with a drill bit or chisel shank, but isn't the challenge of developing new skills at least part of the attraction of woodworking?

I mention all this as evidence that I'm not an easy sell on new gadgets. Recently, however, I had the chance to try out Timberline Tool's scraper burnisher (see the bottom photo on p. 112). Its immediate advantage is that at $14.95 (plus $1.50 shipping and handling), it's about half the price of its commercial brethren. The tool is simple and ingenious—a hardened steel dowel pin set at an angle in a wooden handle. Drawing the dowel pin across the flat of the scraper draws out the burr; running the dowel pin next against the scraper's edge automatically turns the correct hook angle. The burnisher comes with two pages of thoroughly lucid instructions, obviously borne of some long and hard thought about scrapers. These instructions are the best treatise on the sharpening and use of scrapers that I have ever seen.

Burnishing with the Timberline tool, I was able to put as good a burr on my scrapers as I always have with my drill-bit shank. Not better, but just as good. When I used the Timberline to burnish the iron of my old Stanley scraper plane, however, I noticed a major difference. To prepare the blade in the Stanley, it's necessary first to hone it to 45° and then to turn the hook. I was never entirely satisfied with the results I was able to achieve using my drill bit as a burnisher, and now I know why. Using the Timberline to turn the hook on the iron, I was instantly getting tissue-thin shavings nearly 3 in. wide. And the edge held much longer, too. I suspect the hook angle is especially critical on the scraper plane, and the Timberline produced that angle better than I ever could freehand.

I won't be putting my low-tech burnisher back with the rest of my drill bits any time soon. But you can bet I won't be throwing away the Timberline burnisher either. Not when I need to get out the Stanley to tame some particularly cranky grain. The Timberline scraper burnisher is available in a few catalogs and retail outlets or by contacting Timberline Tool (P.O. Box 673, Medanales, N.M. 87548; 505-685-4830).

—Curtis Erpelding

Where to find it

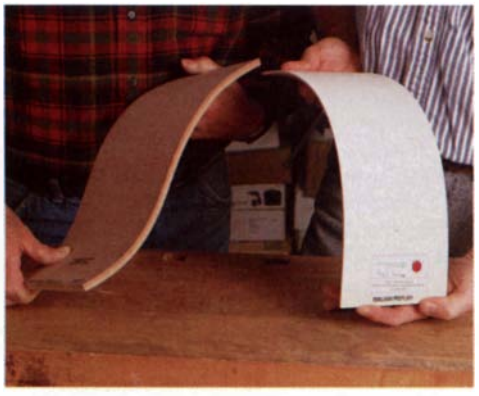
Bendable plywood

Curved solid-wood parts are easy enough to fabricate, either by steam-bending or laminating. But what about curved panel work? A couple of products used by professional woodworkers, especially those who do large commercial architectural work, are wiggle wood (also called wacky wood or bendy board, depending on where in the country you live) and Italian bending poplar (see the photo below).

Wiggle wood comes in thicknesses of ¼ in. and ⅜ in. and in 4x8 and 4x10 sheets. It bends only one way, though, so you have to choose the axis.

The Italian bending poplar is 3mm thick and is available in 4x8 sheets only. You can get it so that it bends along either axis—but only one.

For prices and the address of a supplier near you, call (310) 941-7575 if you live west of the Mississippi or (201) 420-0440 if you live to the east. *—V.L.*



***Curved panels are a lot easier** to build when you start with a material that's meant to curve. Wiggle wood (left) and Italian bending poplar (right) both take curves naturally.*

In praise of a Chinese vise

I'm generally a very careful, discriminating catalog shopper. Like most woodworkers these days, I compare prices and specs back and forth to get exactly what I need for the best price.

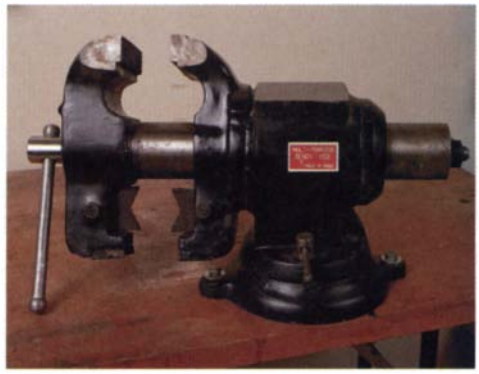
Looking through Harbor Freight Tools' catalog a couple of years ago, I came across a multi-purpose metalworking vise for $40. I couldn't believe it. It was exactly what I'd been looking for and at this unbelievable price. I succumbed. I ordered the vise with some utility blades and two lump hammers, driving up the tab to $50 to qualify for free shipping. I didn't want to pay freight on a 66-lb. vise being shipped from California to New York.

Two years later, I still can't believe the bargain that vise is (see the photo above). I use it daily and have since ordered another for my shop, as well as one for the college where I teach. The vise is a compound-swivel vise: Base and jaws both turn 360°. The base can be locked in place with two levers, and the jaws can be locked in position simply by closing them. To change the angle or to swivel the vise upright, all you need to do is loosen the vise jaws slightly.

In addition to the regular metalworking vise jaws, the vise has V-shaped jaws for cutting pipe at 180°. The jaws are 9½ in. up from the base, bringing the task at hand up to a comfortable working height. In addition, there is a small anvil at the back of the vise for flattening or straightening jobs. I have my vises bolted to the corners of workbenches for easy removal in case I need a larger work surface.

While the quality of the materials used or the precision with which the casting and machining have been done may make this vise less than ideal for heavy-duty use in a machine shop, the vise is perfect for woodworkers who may occasionally do some metalwork or just need a versatile second vise. Harbor Freight calls the vise a multipurpose 5-in. adjustable vise, part #05655-2CXB, and sells it for $39.99. To get a current catalog or to order the vise, call Harbor Freight Tools at (800) 423-2567.

—Mario Rodriguez



***This hefty Chinese-made machinist's vise** may not be pretty, but it's a steal at less than $40. For the occasional metalworking that a woodworker has to do or just as a secondary vise, you'd be hard-pressed to find a better deal.*

EDITOR'S NOTE: Similar vises are available at many home centers and building supply stores. Weights and prices vary slightly. We recently picked up a 75-lb. version for our shop at a building center for less than $30.

Vincent Laurence is an associate editor of Fine Woodworking. *Curtis Erpelding is a furniture designer and maker in Port Orchard, Wash. Mario Rodriguez is a woodworker and teacher living in Warwick, N.Y., and he is a contributing editor to* Fine Woodworking.

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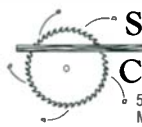

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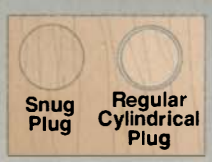

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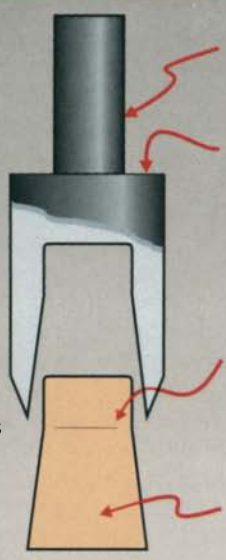

(Amount of taper exaggerated for illustration.)

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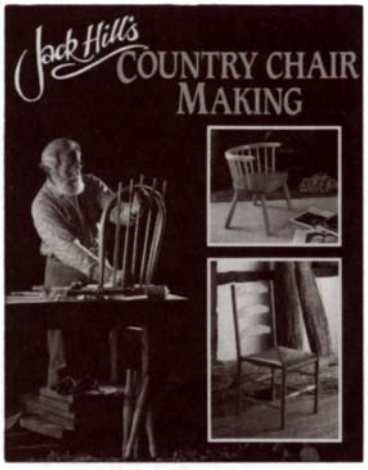
Jack Hill's Country Chair Making by Jack Hill. *David and Charles, publishers. Distributed by Sterling Publishing Co., Inc., 387 Park Ave. South, New York, N.Y. 10016-8810; (800) 367-9692; 1993. hardback; 152 pp.*



It has been a few years since Michael Dunbar wrote his classic book on Windsor chairmaking (*Make a Windsor Chair,* The Taunton Press). Since then, the popularity of American Windsors and Windsor chairmaking has grown and with it the need for good books on the subject. Jack Hill, a writer and authority on English country woodworking and chairmaking, has written an attractive book featuring over a dozen traditional English chair designs. English Windsors, from which American Windsors descend, have been ignored in this country. They are distinctly different: more restrained and dignified than their exuberant American counterparts.

Jack Hill's Country Chair Making is divided into two sections. The opening section covers materials, tools and techniques for making Windsors and includes a concise history of English chairs and an interesting description of early 20th-century chairmaking illustrated with some fascinating photos. The second section, which comprises the bulk of the book, presents a series of projects arranged in escalating order of difficulty and complexity. Hill starts the reader with simple elm stools, proceeds to a few elegant ladder-back chairs and a couple of comb-backs, and ends with a full-blown double-bow Windsor. This is the pièce de résistance: a spectacular chair with robust turnings and a wonderful burled elm seat.

Unfortunately, the author's step-by-step directions are a little thin and slightly vague. For instance, his description of seat carving is very brief, and there is nothing on shaping spindles. Hill assumes the reader possesses a degree of knowledge and skill gained elsewhere. He does, however, supply information on some jigs designed to help the beginner and ensure accuracy. He also provides a generous number of photos and detailed measured drawings.

In many ways, Hill's book is not as instructive as Dunbar's, but it is an interesting and much needed look at English country chairmaking and provides enough information to encourage and guide an aspiring chairmaker. *—Mario Rodriguez*

Gunstock Woods and Other Fine Timbers by Virgil M. Davis. *SouthLand Press Inc., Kenner, La.; 1988. Available from the author at 228 Brian Drive, Slidell, La. 70458; (504) 649-3190. $20 softback; 238pp.*

As Virgil Davis points out in the introduction to his book, a thorough treatment on the subject of gunstock woods is a tough item to find. There are plenty of works on gunsmithing and the history of firearms and hunting publications that dance around the subject, but this is the first book I've seen that plunges into the merits of various species solely from the perspective of their functionality and beauty as gunstocks.

Gunstock Woods and Other Fine Timbers contains superb color photography, which strikingly illustrates the author's skill as a fine craftsman. The text is thorough, with chapters addressing every technical aspect of harvesting, seasoning, cutting, fitting, checkering, decorating and finishing gunstocks.

Davis provides a table that lists test data on more than 70 of the most popular species, cataloging their hardness, shock rating, weight, volumetric shrinkage and strength. The topic of how to select the most appropriate stock for a specific type of gun based on both the technical and aesthetic properties of the wood is covered exhaustively.

The book's readability suffers somewhat from excessive and occasionally confusing cross-referencing of common and scientific timber names. Yet Davis' system, if not perfect and not particularly scholarly, might actually be a boon for readers who are unfamiliar with scientific names.

In addition to all its other information, *Gunstock Woods* contains an appendix listing the names, addresses and phone numbers of 60 gunstock blank vendors with notations as to the species they carry. That's a little bonus that makes the book an even more valuable reference for readers with a serious interest in gunstock making. *—Jon Arno*

The Next Step by John R. McPherson. *T-Line Design, 7249 Pomelo Drive, Canoga Park, Calif. 91307; 1992. $29.95, softback; 234 pp.*

John McPherson believes the most cost-effective way for a small shop to increase income is to increase efficiency. To this end, McPherson shows the reader of *The Next Step* how to build a series of tool carts—his panacea for small-shop gridlock. He argues that because woodworking processes have changed so drastically in recent years (primarily due to the ubiquitous use of the tablesaw and router), the traditional joiner's bench no longer answers the woodworker's needs. McPherson recommends using mobile workbenches or work stations that serve the dual functions of bringing the tools to the work and providing surfaces for using power tools and stacking parts. McPherson suggests that these sophisticated tool carts, used individually or rolled together, are all the bench a modern small-shop woodworker needs. For the most part, I agree. This assumes, though, that you don't do much hand joinery or carving because none of these work stations seem particularly suited to these processes.

Not all the ills of working in a small space are curable by tool or workbench arrangements, though. And I was disappointed that *The Next Step* didn't address the problem of how to cope efficiently with the flow of material and work processes in the small-shop environment.

But the book does clearly illustrate and describe the building of the work stations. The designs are well thought out, relatively easy to build, and attractive to boot. I have some contention with the author's emphatic use of glue and dado case joinery—biscuit joinery coupled with screws or knockdown fasteners is stronger and certainly much faster. You'll appreciate, however, McPherson's forethought in designing each station to come out of one 4x8 sheet of ¾-in. plywood.

Even if you don't wind up building work stations precisely to McPherson's models, the ideas behind them could well provide the means to increase the efficiency of your shop. *—Jim Tolpin*

Mario Rodriguez practices and teaches traditional woodworking in Warwick, N.Y., and is a contributing editor to Fine Woodworking. Jon Arno is a wood technologist and amateur woodworker in Troy, Mich. Jim Tolpin is a writer and woodworker in Port Townsend, Wash.

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

NATIONAL: **Symposium**-The American Association of Woodturners Eighth National Symposium, June 23-25, Colorado State University, Fort Collins. For more information, call (612) 484-9094.

ALABAMA: **Exhibition**- Magic City Art Connection, April 29-30, Birmingham Cultural District, Linn Park. For more information, call Eileen Kunzman (205) 595-6306.

ARIZONA: **Show**-Grand Canyon State Woodcarvers Desert Woodcarving Show and Sale, March 11-13. Phoenix Civic Plaza, Phoenix. For more information, call Frank Gacnik, (602) 345-9020.
Shows-Ed Moulthrop and Phillip Moulthrop: Turned Wood; Howard Werner: New Wood Furniture; David Ellsworth: Small Exotic Wood Vessels, Feb. 1-26. For more information, contact Joanne Rapp Gallery, 4222 N. Marshall Way, Scottsdale, 85251. (602) 949-1262.
Show-Arizona Woodworking Show, April 8-10. Youth Center, 1826 W. McDowell Road, Phoenix. For more information, contact The Woodworking Shows, 1516 S. Pontius Ave., Los Angeles, CA 90025. (310) 477-8521.

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

CALIFORNIA: **Workshops**-Woodworking for women. Furnituremaking with hand tools using traditional joinery, weekends. San Francisco. For more information and schedule, contact Debey Zito (415) 648-6861.
Workshops-Various workshops including Japanese woodworking, joinery and sharpening. For further information, contact Hida Tool Co., 1333 San Pablo, Berkeley, 94702. (415) 524-3700.
Show-1994 California Wildfowl Arts Festival, Feb. 19-20. Sheraton Industry Hills Resort, 1 Industry Hills Parkway, City of Industry. For more information, contact Connie Faltys, 1637 No. Fern St., Orange, 92667. (714) 974-3067.
Exhibition-Sleeping Beauties: A Juried Art Exhibition, Jan. 23-May 15, UCLA's Fowler Museum, Los Angeles. For more information, call (310) 825-4288.

COLORADO: **Classes**-Woodworking and related classes, year-round. For more information, write Red Rocks Community College, 13300 W. 6th Ave., Lakewood, 80401, or call (303) 988-6160.
Seminars-Woodworking seminars, Sept. thru April. For more information, contact Schlosser Tool and Manufacturing Co., 301 Bryant St., Denver, 80219. (303) 922-8244.
Exhibition-Ninth Annual American Craftsmen Custom Woodworking Exhibition, Jan. 17-29. Vail Public Library, Vail. For more information, call Tim O'Brien, (303) 328-7253.

CONNECTICUT: **Workshops**-Woodworking by Hand, Basic Router Technology, Tool Sharpening, American Furniture Survey, Veneering, Woodturning, Segmented Woodturning, Woodworking Smorgasbord, Woodshop Designs, Adirondack Chairs, Innovative Furniture Designs, Jan. thru March. Brookfield Craft Center, PO Box 122, Brookfield, 06804. (203) 775-4526.

DISTRICT OF COLUMBIA: **Exhibition**-The Arts and Crafts Movement in California, thru Jan. 9. Renwick Gallery, National Museum of American Art, Smithsonian Institution. For further information, call (202) 357-2247.
Show-The 25th Annual Smithsonian Craft Show, April 14-17, Andrew W. Mellon Auditorium, 1301 Constitution Ave., N.W. Washington, D.C. For more information and application, call the Smithsonian Women's Committee, (202) 357-4000.

FLORIDA: **Meetings**-Central Florida Woodworkers Guild meets the second Thursday of each month, Winter Park. For more info, call (407) 862-3338.
Competition-31st annual Coconut Grove Arts Festival, Feb. 19-21. For further information, contact Coconut Grove Arts Festival, PO Box 330757, Coconut Grove, 33233-0757. (305) 447-0401.
Meetings-South Florida Woodworking Guild meets every second Monday of each month, 7 p.m. Constantines, 1040 East Oakland Park Boulevard, Ft. Lauderdale. For further information, contact Woody McLane at (305) 565-2729.
Exhibition-41st Florida Craftsmen Traveling Exhibition, thru Jan. 9, Florida Gulf Coast Art Center, Belleair. For more information, contact Michele Tuegel, executive director, (813) 821-7391.
Exhibition-Global Carving Challenge: Aquatic Life 1994, March 25-27, Holiday Inn Airport Marina, Sarasota. For more information, call Wood Carvers Supply, Inc., (813) 698-0123.
Show-Central Florida Woodworking Show, March 4-6. Florida State Fairgrounds, Special Events Center, 4800 U.S. Highway 301 N., Tampa, 33610. For more information, contact The Woodworking Shows, 1516 South Pontius Ave., Los Angeles, CA 90025. (310) 477-8521.

GEORGIA: **Workshops**-Japanese woodworking by Toshihiro Sahara. One Saturday each month. Sahara Japanese Architectural Woodworks. (404) 355-1976.
Classes-Woodworkers Guild of Georgia, PO Box 8006, Atlanta. For info, contact John Gorrell (404) 460-1224.
Show-Atlanta Woodworking Show, Gwinnett Civic Center, Hall B, 6400 Sugarloaf Parkway, Duluth. For more information, contact The Woodworking Shows, 1516 S. Pontius Ave., Los Angeles, CA 90025. (310) 477-8521.

ILLINOIS: **Show**-St. Louis Woodworking Show, Feb. 11-13. Gateway Center, Center Hall, One Gateway Drive, Collinsville. For further information, contact The Woodworking Shows, 1516 S. Pontius Ave., Los Angeles, CA 90025. (310) 477-8521.
Exhibition and seminar-Third Annual Custom Woodworking Business Conference, March 25-26. Woodfield Hilton & Tower, Arlington Heights. For more information on seminars or exhibiting, call Harry Urban (800) 343-2016.

INDIANA: **Classes**-Various woodworking classes and workshops. For further information, contact the Woodworking Unlimited, 6038 E. 82nd St., Indianapolis, 46250, or call (317) 849-0193.
Show-Indianapolis Woodworking Show, Jan. 28-30. Indiana State Fairgrounds, 1202 E. 38th St., Indianapolis. For more information, contact The Woodworking Shows, 1516 S. Pontius Ave., Los Angeles, CA 90025. (310) 477-8521.

IOWA: **Call for entries**-Art in the Park, May 14-15. Four Square Park on Main Ave. and Roosevelt St., Clinton. Juried by 5 slides. Deadline: Feb. 15. For further information, write Art in the Park, PO Box 2164, Clinton, 52733, or call (319) 259-8308.

KANSAS: **Auction**-26th annual Mennonite Relief Sale, April 8-9. State Fairgrounds, Hutchinson. Antiques, furniture, tools and woodwork. For information, call (316) 283-0518.
Show-Kansas City Woodworking Show, Feb. 18-20, Merchandise Mart, Hall A, 6800 W. 115th St., Overland Park. For more information, contact The Woodworking Shows, 1516 S. Pontius Ave., Los Angeles, CA 90025. (310) 477-8521.

KENTUCKY: **Workshops**-Woodturning and joinery instruction. For further information, write Jim Hall, Adventures in Wood, 415 Center St., Berea, 40403, or call (606) 986-8083.
Meetings-Kyana Woodcrafters Inc. meets the first Thursday of each month. Bethel United Church of Christ, 4004 Shelbyville Road, Louisville, 40207. For more information, call (502) 426-2991.
Workshops-Traditional Windsor chairmaking instruction. One-week courses. For further information, contact David Wright (606) 986-7962.

LOUISIANA: **Show**-LFIA Fine Furnishings and Art Showcase, March 16-20, New Orleans Superdome. For more information, call (504) 386-0471.

MARYLAND: **Call for entries**-The Crafts Collection 1994. Deadline: Feb. 25. For more information, contact Ruth Gowell at the Creative Crafts Council (703) 532-8645.
Show-Baltimore Woodworking Show, Jan. 7-9, Maryland State Fair, Exhibition Hall, 2200 York Road, Timonium, 21093. For more information, contact The Woodworking Shows, 1516 S. Pontius Ave., Los Angeles, CA 90025 (310) 477-8521.
Festivals-Sugarloaf Craft Festival, April 15-17, Nov. 18-20 and Dec. 9-11. Montgomery County Fairgrounds, Gaithersburg; April 29-30 and Oct. 7-9. Maryland State Fairgrounds, Timonium. For more information, contact Deann Verdier, Director, Sugarloaf Mountain Works, Inc., 200 Orchard Ridge Drive, Suite 215, Gaithersburg, 20878. (301) 990-1400.

MASSACHUSETTS: **Instruction**-Full-time program in fine furniture construction. Complete facilities. For further information, contact Wm. B. Sayre, Inc., One Cottage St., Easthampton, 01027. (413) 527-0202.
Exhibition-The Domestic Object, thru Jan. 9. Fuller Museum of Art, 455 Oak St., Brockton. (508) 588-600.
Classes-Woodworking classes, throughout most of the year. For information, contact Boston Center for Adult Education, 5 Commonwealth Ave., Boston, 02116. (617) 267-4430.
Exhibition-First National Exhibition of the American Association of Woodturners, Feb. thru March, Fitchburg Art Museum, Fitchburg. For more information, call (508) 827-4314.
Call for entries-The 24th Annual Craft Fair at the Worcester Center for Crafts. Deadline: Feb. 14. Show dates: May 20-22. For more information and entry form, contact Worcester Center for Crafts, 25 Sagamore Road, Worcester, MA 01605. (508) 753-8183.
Show-Work of Jack Alberti, Jan. 4-28, Clark Gallery, Lincoln. For more information call (203) 683-8805.

MICHIGAN: **Meeting**-Michigan Violinmakers Association, Jan 30. Scott Tribby's shop, Kalamazoo. RSVP Scott Tribby (616) 373-4511. For more information, call David Brownell (313) 665-4255.

MINNESOTA: **Classes**-Woodcarving classes year-round. For information, contact the Wood Carving School, 3056 Excelsior Blvd., Minneapolis, 55416. (612) 927-7491.

MISSISSIPPI: **Classes**-Various woodworking classes. For more info, contact Allison Wells School of Arts & Crafts, Inc. Canton. (800) 489-2787.

NEBRASKA: **Meetings**-Omaha Woodworkers Guild meets at 7 p.m. the third Tuesday of every month. Westside Community Center, Omaha. For more information, call John M. Cahill, 334-5550.

NEW HAMPSHIRE: **Classes**-Fine arts and studio arts. Manchester Institute of Arts and Sciences, 114 Concord St., Manchester, 03104.
Classes-Various woodworking classes. For information, contact The Hand & I, PO Box 264, Route 25, Moultonboro, 03254. (603) 476-5121.
Auctions-Antique and craftsman's tool auctions, year-round. For further information, contact: Richard A. Crane, Your Country Auctioneer, 63 Poor Farm Road, Hillsboro, 03244. (603) 478-5723.
Workshops-Week-long Shaker-style furniture and chairmaking workshops, year-round. For more info, contact Mary Sweet, Dana Robes, Wood Craftsmen, Lower Shaker Village, Enfield, 03748. (603) 632-5385.
Meeting-Guild of New Hampshire Woodworkers winter meeting, Jan. 22. New Hampshire Technical Institute Auditorium, Concord. Business meeting and panel discussion "What is Good Design?" For more information, call David Lamb at (603) 783-9912.

NEW JERSEY: **Exposition**-The New England Worlds Fair and Crafts Exposition, June 11-12. Great Gorge Resort, Vernon Valley, Vernon. For more information, contact Paul Weingarten, American Concern For Artistry and Craftsmanship, PO Box 650, Montclair, 07042. (201) 746-0091.
Show-New Jersey Woodworking Show, Jan. 21-23, Raritan Center, Exhibit Hall, 97 Sunfield Ave., Edison. For more information, contact The Woodworking Shows, 1516 South Pontius Ave., Los Angeles, CA 90025. (310) 477-8521.
Call for entries-Sugarloaf Craft Festival, May 13-15, Sept. 30 and Oct. 1-2. Garden State Exhibit Center, Somerset. Juried by 5 slides. Deadline: Jan. 14. For more information and applications, send three loose stamps to Deann Verdier, Director, Sugarloaf Mountain Works, Inc., 200 Orchard Ridge Drive, Suite 215, Gaithersburg, MD 10878. (301) 990-1400.

NEW MEXICO: **Classes**-Woodworking classes. For information, contact North New Mexico Community College, El Rito, 87520. (505) 581-4501.
Classes-Fine woodworking classes. For further information, write Santa Fe Community College, Santa Fe 87502, or call (505) 438-1361.

NEW YORK: **Classes**-Various beginning and advanced woodworking classes. Constantine's, 2050 Eastchester Road, Bronx, 10461. (718) 792-1600.
Exhibition-The Ideal Home: 1900-1920, thru Feb. 27. For info, contact American Craft Museum, 40 West 53rd St., New York City. (212) 956-3535.
Classes-Traditional 18th-century woodworking techniques with Mario Rodriguez. For more information, contact Warwick Country Workshops, PO Box 665, Warwick, 10990. (914)-986-6636.
Meetings and classes-New York Woodturners Association meets bi-monthly. YWCA, 610 Lexington Ave. (53rd. St.) New York City. For more information, contact Howard Alalouf (914) 337-0226.
Classes-Various gilding classes for fine furniture, antiques, frames, carvings, restoration. Center for the Gilding Arts, 381 Park Ave. South, New York City. For more information, call (212) 683-4822.
Classes-Intermediate Woodworking and Furniture Design, Jan. 25-May 10. For more information, contact the Division of Continuing Education, SUNY Purchase, 735 Anderson Hill Road, Purchase, 10577-1400. (914) 251-6514.
Juried show-Crafts at West Point, Jan. 22-23. Hotel Thayer, West Point. For more information, contact Quail Hollow Events, PO Box 825, Woodstock, 12498. (914) 679-8087.
Exposition-Northeastern Woodworkers Association annual woodworking exposition March 19-20. Shenendehowa High School, Clifton Park. For a copy of the guidelines, contact EXPO 94 Northeastern Woodworkers Association, PO box 94, Rexford, 12148-0094. (518) 393-8804.
Classes-Beginning and advanced woodworking, turning, and finishing courses with Maurice Fraser and Bill Gundling, starting Feb. 7. The Craft Students League, YWCA, 610 Lexington Ave (53rd St.). (212) 735-9732.

NORTH CAROLINA: **Meetings**-North Carolina Woodturners, second Saturday of each month. Contact: PO Box 2968, Hickory, 28603. (704) 324-5960.
Show-Showcase of woodcarvings--Pre-Civil War America Feb. 26-27. The Charlotte Woodcarving Club. Grady Cole Center, 310 North Kings Drive, Charlotte. For more information or entry forms, contact Bonita Heffner, event coordinator, (704) 336-2584..
Workshops-Ladder-back chairmaking, Windsor chairmaking, Swiss cooperage, Swedish woodenware, Jan. thru April. For exact dates, contact Country Workshops, 90 Mill Creek Road, Marshall, 28753. (704) 656-2280.
Classes-Rustic chairmaking, woodturning, bentwood boxes, carving, Jan. thru Feb. For more information, contact John C. Campbell Folk School, Route 1, Box 14A, Brasstown, 28902. (800) 365-5724.
Show-Charlotte Woodworking Show, Jan. 14-16. Merchandise Mart, Freedom Hall, 2500 E. Independence Blvd.,

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Charlotte. For more information, contact The Woodworking Shows, 1516 S. Pontius Ave., Los Angeles, CA 90025. (310) 477-8521.

OHIO: **Workshops**-Earl Richards and the Park District of Dayton and Montgomery County. Stationary Shop Tools, Jigs and Fixtures, Jan. 8; Traditional Finishing Techniques, Feb. 12. For more information, call (513) 836-4976.
Workshops-Hand-tool joinery and bandsaw and tablesaw techniques, March 7-11; Machine Tool Joinery and Wood Finishing & Restoration, March 14-18. Conover Workshops, 18125 Madison Road, PO Box 679, Parkman, 44080. (216) 548-3491.

OREGON: **Meetings**-Cascade Woodturner's Association, third Thursday of each month. For information, contact Cascade Woodturners, PO Box 91486, Portland 97291.
Classes-Oregon School of Arts and Crafts, 8245 S.W. Barnes Road, Portland, 97225. (503) 297-5544.

PENNSYLVANIA: **Classes**-Windsor chairmaking, weekly and weekends. For further information, contact Jim Rendi, Philadelphia Windsor Chair Shop, PO Box 67, Earlville, 19519. (215) 689-4717.
Call for entries-Central Pennsylvania Festival of the Arts, July 14-17, State College. Deadline: Feb. 26. For application and more information, send a SASE to Katherine Talcott, Visual Arts Director, PO Box 1023, State College, 16804-1023, or call (814) 237-3682.
Exhibition-The Pennsylvania Delaware Valley Wood Carvers Association Mid-Atlantic Woodcarving Show and Competition, April 8-9. Pennsylvania State Abington campus gymnasium, Woodland Road, Abington. For more information, call Al Ritter at (215) 757-2152.
Classes-Woodturning with David Ellsworth. Three-day weekend workshops in private studio. Limit 4 students. Jan 7-9, 21-23; Feb. 4-6, 11-13; Mar. 4-6, 18-20. Contact: David Ellsworth, Fox Creek, 1378 Cobbler Road, Quakertown 18951. (215) 536-5298.
Show-The Furniture Market at Valley Forge, Feb. 11-14 and June 11-13. Valley Forge Convention Center, King of Prussia. For further information call Robert Goodrich (717) 245-9051.

RHODE ISLAND: **Exhibition**-Conservation by Design, thru Jan. 16. The Museum of Art, Rhode Island School of Design, Two College St., Providence. (401)454-6348.

TENNESSEE: **Workshops**-Techniques for turned lidded vessels, woodturning, design in turning, coopering, March thru April. For more information, contact Arrowmont School of Arts and Crafts, PO Box 567, 556 Parkway, Gatlinburg, 37738-0567. (615) 436-5860.

TEXAS: **Meetings**-North Texas Woodworker's Association meets the third Tuesday of each month. For more information, contact Bruce May. NTWA, PO Box 831567, Richardson, 75083. (214) 271-0125.
Show-Wood Sculpture by Robert Longhurst, thru Jan. 10. Judy Youens Gallery, 3115 D'Amico, Houston. For further information, call (713) 527-0303.
Exhibition-The Santa Fe Furniture Expo in conjunction with the Dallas Winter Furniture Market, Jan. 8-13. For more information, contact the Mayfair Group, Inc. (505) 984-7080.
Exhibition-The 19th Texas Crafts Exhibition, April 9-10. The University of Texas at Austin, Winedale Historical Center, PO Box 11, Round Top, 78954. For more information, call (409) 278-3530.

VERMONT: **Courses**-Yestermorrow Design and Building School, Route 1 Box 97-5, Warren 05674. (802) 496-5545.
Workshops-The direct approach to craftsmanship, design and shop math, machine setup and use, Japanese hand tools, sharpening. Jan. 8-9 and Feb. 5-6. For information, contact Trillium School of Woodworking, Route 2, Box 4015, Middlebury, 05753. (802) 545-2266.

VIRGINIA: **Exhibition**-Tools exhibition, Jan. 14 thru June. Colonial Williamsburg, PO Box 1776, Williamsburg, 23187-1776. For more information, call 1-800-HISTORY.
Exhibition-Masterworks: Alex Dunton Retrospective, April 1-May 27. The collected carved bowls of Alex Dunton, master bowl carver. For more information, write the Hand Workshop, 1812 West Main St., Richmond, 23220, or call (804) 353-0094.
Call for entries-Sugarloaf Craft Festival, Sept. 9-11. Prince William County Fairgrounds, Manassas. Deadline: Jan. 14. Juried by 5 slides. For more information and application, send three loose stamps to Deann Verdier, Director, Sugarloaf Mountain Works, Inc., 200 Orchard Ridge Drive, Suite 215, Gaithersburg, MD 20878. (301) 990-1400.
Show-Virginia Woodworking Show, March 11-13. Norfolk Scope Exhibit Hall, 201 E. Brambleton Ave., Norfolk, 23510. For more information, contact The Woodworking Shows, 1516 S. Pontius Ave., Los Angeles, CA 90025. (310) 477-8521.

WISCONSIN: **Show**-The Greater Milwaukee Woodworking Show, Wisconsin State Fair Park, Trade Mart Building, Interstate 94 and 84th St., Milwaukee. For further information, contact The Woodworking Shows, 1516 S. Pontius Ave., Los Angeles, CA 90025. (310) 477-8521.
Show-The Northeastern Wisconsin Woodworkers' Guild 11th annual spring show, Feb. 19-20, Port Plaza Mall, Green Bay. For info, send a SASE to Curt Andersen, 2942 Jack Pine Lane, Green Bay, 54313. (414) 434-1288.
Juried Show-22nd annual festival of the arts, April 17. For further information, contact Festival of the Arts, PO Box 872, Stevens Point, 54481

AUSTRALIA: **Call for entries**-The National Woodturning 1994 Exhibition, May 28-June 12. Melbourne. Deadline: May 13. For more information, contact Peter Robson, 12 Gidgee Court, Forest Hill, VIC 3131 (03) 878-7211.

CANADA **Meetings**-West Island Woodturners Club (Montreal, Que.) meet every Tuesday, Sept. thru May. For more information, contact Dennis Brown, 8817 Cure Legault, Lasalle, Que. H8R 2V9. (514) 366-6071.
Workshops-Five days of intensive hands-on Ultra-Lite-Sawmilling in a rain forest on a small N.W. Pacific Island with Will Malloff. The North Island College, Box 320 Sointula, B.C. V0N 3E0. (604) 974-5429.
Juried exhibition-Explorations in Wood, Jan. 4-12. Presented by the Vancouver Island Woodworkers Guild at the Maltwood Gallery, University of Victoria, Victoria, B.C. For more information, contact Vancouver Island Woodworkers Guild, PO Box 6584, Postal Station C, Victoria, B.C. V8P 5N7.
Exposition-The Calgary Woodworking Expo, Jan. 14-16. Roundup Centre, Calgary. Free tool draws. Free seminars. Admission $6.50. For more information, contact DJC Enterprises (403) 236-5834.
Show-Canadian Workshop Show, Feb. 25-27. International Centre Mississauga, Ont., For further information call, (416) 292-2784.
Call for entries-The Wood Show, Aug. 5-7. Deadline: June 1. Five categories: chairs, birds, bird houses, turning and miniatures. For application, contact The Wood Show, Box 920, Durham, Ont. N0G 1R0. (519) 369-6902.
Show-Wood Show, March 4-6, Lansdowne Park Civic Complex, Bank & Holmwood, Ottawa. For more information, contact John K. Cryderman Productions, Inc., 136 Thames St., Chatham, Ont. N7L 2Y8. (519) 351-8344.

ENGLAND: **Workshops**-Traditional hand finishing for cabinetmakers: Finishing new surfaces, Jan. 30-Feb. 4. West Dean College, Chichester. For more information, contact Alexi Stuart, West Dean College, West Dean, Nr. Chichester, West Sussex, PO19 0QZ. 024-363-301.

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345	SAW BOSS 6" CIRCULAR SAW	104
347	7 1 4" FRAMERS SAW 15 AMP, 10.25 LBS	128
351	3" X 21" BELT SANDER	142
352	3" X 21" BELT SANDER W DUST BAG	147
352VS	3" X 21" VS BELT SANDR W DUST BAG	158
360	3" X 24" BELT SANDER W DUST BAG	182
361	3" X 24" BELT SANDER	174
362	4" X 24" BELT SANDER W DUST BAG	188
363	4" X 24" BELT SANDER	184
410	UNDERSCRIBE LAMINATE TRIMMER	150
411	MITER FOLD LAMINATE TRIMMER	165
447	7 1 4" FRAMERS SAW W BRAKE 15 AMP	138
505	1 2 SHT FIN SANDER	118
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556	BISC JOINER W CASE & TILT FENCE	177
556K	SAME AS ABOVE W 1000 BISCUITS	199
690	1 1 2 HP ROUTER W 1 4" & 1 2" COLLETS	130
690K	690 W CS, EDGE GUIDE, & TEMP GD KIT	169
9690	1 1 2 HP ROUTER W CASE	139
691	1 1 2 HP "D" HANDLE ROUTER	143
693	PLUNGE BASE ROUTER, 1 1 2 HP	164
695	SHAPER TABLE W 1 1 2 HP ROUTER	213
696	SHAPER TABLE	123
2620	3 8" VSR DRILL, 0-1200 RPM W CHK	99
5008	DOVETAIL TEMPLATE	76
5009	MORTISE & TENON JIG	44
5116	OMNI JIG	258
6931	PLUNGE ROUTER BASE	74
7116	*NEW 24" OMNIJIG*	289
7310	LAMINATE TRIMMER, 5.6 AMP	88
7312	OFFSET TRIMMER	122
7319	TILT BASE TRIMMER	99
7335	5" RANDOM ORBIT SANDER, VS	128
7335K	7335 W CS, DUST EX SYS, 100 SHTS PPR	172
7336	6" RANDOM ORBIT SANDER, VS	132
7336K	7336 W CS, DUST EX SYS, 100 SHTS PPR	179
73333	RANDOM ORBIT DUST EXTRACTION	24
7518	3 1 4 HP FIXED BASE ROUTER-5 SPEED	262
7519	3 1 4 HP FIXED BASE ROUTER-1 SP	228
7536	2 1 2 HP FIXED BASE ROUTER	197
7537	2 1 2 HP FIXED BASE "D" HNDL RTR	207
7538	3 1 4 HP PLUNGE ROUTER-1 SPEED	228
7539	3 1 4 HP PLUNGE ROUTER-5 SPEED	262
7549	TOP HANDLE BAYONET SAW	143
7649	BARREL GRIP BAYONET SAW	143
7700	*NEW 10" LASERLOC MITER SAW*	338
9118	PORTA PLANE KIT W CASE, CRBD BLD	203
9314	4 1 2" TRIM SAW KIT	148
9315	7 1 4" BUILDERS SAW KIT	138
9345	SAW BOSS 6" CIRCULAR SAW KIT	122
9637	TIGER SAW VAR SPD RECIP SAW KIT	138
9647	TIGER CUB RECIP SAW KIT	115
9840	CRDLS DRILL KIT W 2 BAT, CS KYLS CK	158
9853S	SAME AS ABOVE BUT W 2 BATTERIES!	177
97310	LAMNT TRIMMR KIT W 4 BASES & CS	189
97751	1 2" VS, 2 SPD HAMMER DRILL KIT	145

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0407-1	SAME AS ABOVE BUT 12 VOLT	174
6010	1 2 SHEET FINISHING SANDER	119
6017	1 4 SHEET FINISHING SANDER W BAG	55
6125	5" RANDOM ORBIT SANDER	112
6126	6" RANDOM ORBIT SANDER	115
6256	TOP HANDLE JIG SAW	145
6365	7 1 4" CIRCULAR SAW, 13 AMP	120
6490	*NEW* 10" MITER SAW INC 80T CARB BLD	249
6507	VAR SPEED SAWZALL W BLADES & CSE	143
6508	SAME AS 6507 BUT W PERMANENT CRD	143
6527	SUPER SAWZALL W BLADES & CASE	169
6528	SAME AS 6527 BUT W PERMANENT CRD	169

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DW360	7 1 4" SAW W BRAKE	139
DW430	3" X 21" DUSTLESS BELT SANDER	164
DW431	3" X 21" DSTLS BELT SANDER VAR SP	182
DW610	1 1 2 HP ROUTER, 9 AMP	147
DW614	1 1 4 HP PLUNGE ROUTER	143
DW615	1 1 4 HP PLUNGE ROUTER, VAR SP	158
DW624	3 HP HVY DUTY PLUNGE ROUTER	245
DW625	3 HP HVY DTY PLUNGE RTR, VAR SP	275
DW682K	BISCUIT JOINER KIT W 100 BISCUITS	224
DW705	12" COMPOUND MITER SAW	358
DW944K2	9.6V CORDLESS KIT W 2 BATTERIES	148
DW945K2	12V CORDLESS KIT W 2 BATTERIES	168

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DS10DVAKBE	12V CORDLESS DRILL KIT W 2 BAT	189
D10VC	3 8" DRILL VAR SP, REV, 3.2 AMPS	59
SV12SA	43 8" PALM GRIP SANDER	49
SB75	3"x21", 2 SPEED BELT SANDER	136
SB10T	4"x24", 2 SPEED BELT SANDER	180
CJ65V2	TOP HANDLE JIG SAW W CASE	155
P20SB	3 1 4" PLANER, 3.4 AMP	89
TR6	LAMINATE TRIMMER	92
M8V	VAR SPEED PLUNGE ROUTER, 1 4"	149
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1273	4" X 24" VS BELT SANDER	182
1273D	4" X 24" DUSTLESS BELT SANDER	195
1273DVS	4" X 24" VS DUSTLSS BELT SANDER	199
1370DEVSK	6" VS DSTLS RNDM ORB SNDR KIT	259
1581VS	TOP HANDLE JIG SAW, VS	144
1581DVS	SAME AS ABOVE BUT DUSTLESS	167
1582VSC	CLIC BARREL HANDLE JIG SAW, VS	144
1582DVS	SAME AS ABOVE BUT DUSTLESS	167
1604	1 3 4 HP ROUTER	134
1608	LAMINATE TRIMMER	84
1608U	UNDERSCRIBE TRIMMER	117
1609K	INSTALLERS KIT WITH 3 BASES	173
1609KX	DELUXE INSTALLERS KIT W 4 BASES	197
1613	1 3 4 HP PLUNGE ROUTER	163
1613EVS	2 HP VAR SP PLUNGE ROUTER	183
1614	1 HP PLUNGE ROUTER	127
1614EVS	1 1 4 HP VAR SP PLUNGE ROUTER	148
1615EVS	3 1 4 HP VAR SP PLUNGE ROUTER	243
1655	7 1 4" CIRCULAR SAW	109
3050VSRK	9.6 V, VSR CRDLS DRILL W 2 BAT, CS	134
3282DVS	5" VS DUSTLESS RANDOM ORBIT	98

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1875	2 1 4 HP EVS PLUNGE RTR W BIT SET	174
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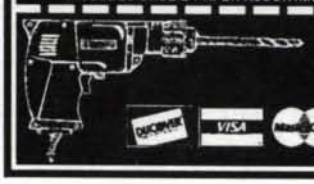

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***Maloof's eye for line** flows easily from his furniture to his house. The graceful spiral stair in this photo seems almost an outgrowth of the characteristic curves of his rockers, chairs and settees, such as the curly maple piece at the foot of the stair.*

***A courtyard view of Maloof's house** reveals its maker's architectural preferences: simple, clean lines, natural, unprotected wood left to weather, and harmonious plantings and stone and brick work.*

***Little scraps of exotic woods** have often found their way to become door latches or hinge pins in Maloof's house.*

The house that Sam built: endangered

Most woodworkers are familiar with the distinctive, sculpted furniture that marks the work of Sam Maloof. Those pieces can be found in the collections of major museums and even in the White House. But fewer woodworkers are aware of an equally spectacular work in progress that Maloof has labored over for decades and that may now be threatened: his home.

Maloof's first shop, purchased in 1952, was a converted chicken shack with a dirt floor, his first house a tiny cottage. As time and money—especially early on—allowed, he steadily added on, demolished, rebuilt, remodeled and landscaped. The result today, though by no means "finished," is a compound consisting of house, shop, guest house, garage (complete with bell tower) and a number of wood storage sheds, all built by Maloof and those who have worked with him over the years (see the top right photo above). Not one to neglect his natural environment, Maloof, along with the help of his wife, Alfreda, has also planted scores of trees, shrubs and flower beds on the property.

Maloof's touch is evident throughout the house, from the floors, walls and ceilings themselves, to the secondary elements like stairs, doors and windows, right on

Photos this page: Charles Miller

down to the hinges, door latches and other minor elements that determine a building's character, as shown in the photos at left and at right on p. 122).

Over forty years of sculpting a landscape and creating a lifestyle are in danger, though. From the time in 1952 when Maloof bought his property, which was then smack in the middle of lemon groves, to 1994, Southern California has changed. Greater Los Angeles has grown unrelentingly, and traffic in the area has gained legendary notoriety. A proposed highway project—Route 30 from San Bernardino to Claremont—designed to shorten commute times and ease the burden on nearby Interstate 10—threatens to come right through Maloof's idyllic enclave.

Where exactly the highway will be routed and how Maloof's house will be affected, has been the subject of controversy for nearly three years now, ever since an environmental impact statement on the project was released. Fortunately, in the interim, Maloof's house was placed on the National Register of Historic Places, entitling the house to protection.

The status of the house and freeway plans were still up in the air as of October 1993, with no clear solution in sight. A number of plans have been put forth by the California Department of Transportation. But the two most likely outcomes are moving Maloof's entire compound, virtually stone by stone and stick by stick, to another location on the same property (he has nine acres) or to move everything to another nearby lemon grove. Either scenario will cost the state millions, but it will still be cheaper than rerouting the highway. For Maloof, after more than forty years of creating a little Eden in a lemon grove, even the best outcome is likely to be somewhat bittersweet.

–Vincent Laurence, associate editor

Photos: Jonathan Binzen

Instant gallery: Just add turners—*The turnings in these photos were among several hundred pieces on display at Instant Gallery, a three-day exhibition of work by those attending the 1993 symposium of the American Association of Woodturners. The dyed and filled red oak bowls are by Thomas Kamila; the threaded lid boxes are by Jack Rogers.*

Turners of the New World unite

Turning is a solitary pursuit, but it doesn't necessarily follow that turners prefer to keep to themselves. That was clear after I attended the 1993 symposium of the American Association of Woodturners, held June 25-27 on the campus of the State University of New York at Purchase. Five hundred people attended the three-day event, and scores of them displayed their work in an informal, unjuried show called Instant Gallery. The photos above are a few of the many superb pieces in the show.

Seventy-five demonstrations of techniques, tools and materials, given by turners from around the world, crammed the symposium's schedule. There were also lectures, panel discussions, slide presentations and plenty of spirited extra-curricular interchange.

I saw excellent demonstrations by Bonnie Klein (making threaded-lid boxes), Michael Peterson (hollowing a large, narrow-necked vessel) and Michael Mode (turning raw-edged pieces by strobe light).

In the Instant Gallery, pieces by well-known turners sat casually on the long tables beside the work of lesser known turners, and the mixture produced the same vibrant atmosphere that prevailed elsewhere at the symposium.

It was clear that turners have established a strong identity through the AAW, which currently has 57 chapters and upward of 4,000 members nationwide.

This year's AAW symposium will be held June 23, 24 and 25 on the campus of Colorado State University. For information or reservations, contact the Office of Conference Services, Rockwell Hall, Colorado State University, Fort Collins, Colo. 80523; (303) 491-7501.

–Jonathan Binzen, assistant editor

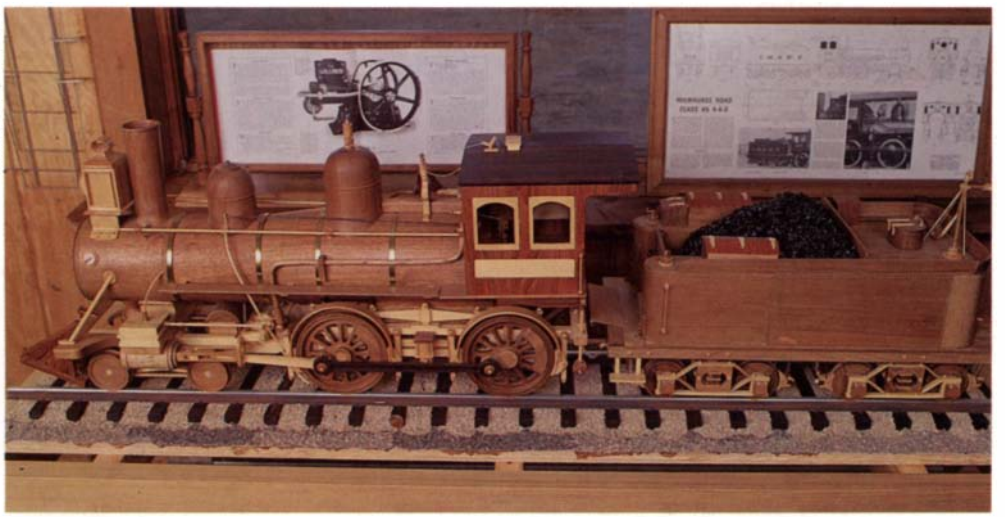

Photo: Charley Robinson

Scrapwood locomotive—*An overflowing supply of scrapwood led John Freeborn into modelmaking. His reproduction of an 1890 steam locomotive and coal tender is made entirely from scraps of 20 different species. All working parts move.*

Take a ride on the scrapwood line

I had accumulated boxes of scrapwood—I just couldn't throw it away. I had a special box for big scraps, another box for medium-sized pieces and several more for small cutoffs. Finally, with storage bins overflowing, I decided I had to do something, but what? Scraps make excellent kindling for the fireplace or wood stove, but I shuddered to think of all that exotic wood going up in smoke.

I started using my scraps for all the inevitable jigs and fixtures one uses in the course of a project. Pretty soon, I had a shop full of bending blocks, chock and clamp blocks, glue blocks and filler strips, saw boxes, drilling guides and assorted

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router guides all cobbled together with amaranth, bubinga, teak, ebony, rosewood, walnut and pear, just to name a few. Beautiful jigs indeed, but still I had an overwhelming supply of scrap.

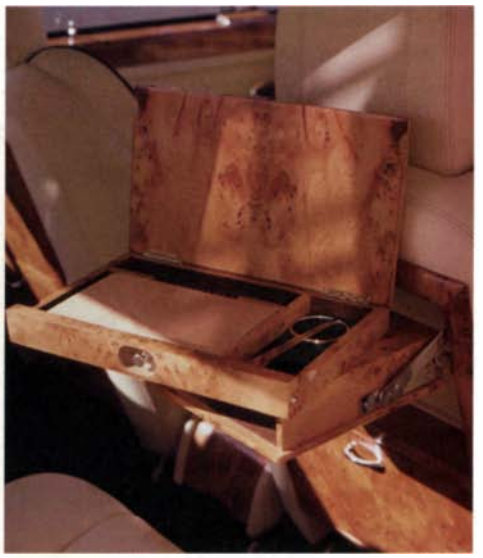
Finally, I struck on what I thought was the perfect use for my scrap pile: I began making toys. It started innocently enough. I made some blocks and some push toys and some pull toys and then some rocking toys. And the scrap pile began to dwindle.

Then I got into models and miniatures. Little did I realize where this would lead. My scraps became an obsession as I spent about 1,000 hours poring over drawings and making the jigs and fixtures that I would use to convert more of my scraps into the one-twelfth scale 1890 steam locomotive shown in the photo on p. 124. Another 1,000 hours later, and there it was, brass accents gleaming against a background of 20 different species of scraps, all shaped, smoothed and polished into a faithful reproduction of a locomotive and coal tender. All the working parts moved just as they were supposed to, and the handcrafted brass rivets, banding and chains were the perfect finishing touch.

Completing the locomotive, however, changed my attitude toward scraps. Now all I wind up with after completing a project is shavings, sawdust—and firewood.

—John Freeborn, New Fairfield, Conn.

Complete interior of wood and leather—*In addition to leather seats, curved veneer trim and door pockets, this Hooper limousine's custom woodwork includes a burr yew console, which elegantly houses a television, VCR, compact disc player and crystal ware.*



Riding and writing in style—*Opening this cabinet drawer reveals a writing desk with a book-matched burl lid.*

Super Hooper woodwork

To many Europeans, the name Hooper is synonymous with hand-built luxury cars. Hooper & Co. (Coachbuilders) Ltd. specializes in custom Rolls-Royce and Bentley limousines. But what has this to do with woodworking? Well, if you open the door of any Hooper limousine, you'll find a dazzling interior of fine wooden fittings—everything ranging from cocktail cabinets, to crystal-holding compartments, to fold-away writing desks.

Because the cars are cut in two and then stretched (up to 40 in.) in length, the original woodwork has to be remade.

The driver compartment leather trim and woodwork are often left intact, but most owner compartments undergo dramatic changes. For instance, a rear window will receive a wooden surround and the rear door pockets will be replaced with veneered equivalents. Or a rear quarter panel may be re-formed just above the wheel well to house a veneered console of switches that control air conditioning and electric seats and windows. Similarly, an armrest may be fitted with a cellular telephone or with an intercom. Even a tiny refrigerator can be installed in a panel.

For stability and convenience, most Hooper carcases are made of plywood, and veneer base panels are made of medium-density fiberboard (MDF). To construct curved sections, like frames for windows or mirrors, three pieces of MDF are laminated, cut to the shape of the recess and secured with metal brackets.

On average, 24 leaves of veneer are allocated to each car so that the left interior will reflect the right. Adjacent panels are matched from consecutive leaves (see the photo at left), which ensure the continuity of grain and color. Stringing and banding inlays are also used to enhance the more ordinary veneers.

To prevent the veneers from splitting, panels are first cross-veneered with sapele. The backing also keeps the panels from bowing, and it stiffens areas that have cutouts for clock dials, drawers or television screens. For concave and convex surfaces, craftsmen apply a thin coat of glue to both the skin (bending) plywood and to the veneers before placing the assembly in a vacuum press. Flat burl veneers are book-matched in the traditional manner. However, instead of paper-taping the joints, cellophane tape is used, which lets a worker clearly see the entire joint and it allows the leaves to be pulled tightly together, as shown in the desk lid in the photo at right. Gentle heat from a household iron is used to soften the tape's adhesive while residue is removed with a bit of mineral spirits.

In the final stage, cork blocks covered with sandpaper are used to smooth the delicate hardwood veneers. After working from 150- to 320-grit paper, workers apply three coats of polyester finish and hand-rub this to a satin luster. Occasionally, a client will prefer French polishing. Regardless of the finish, any woodworker can appreciate the labor necessary to achieve such fine cabinet work. So the next time you're in England and you see a limousine, look for the Hooper badge on the boot (trunk). *—Andrew Murch, Surrey, England*

Notes and Comment

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

Photos this page: Andrew Murch

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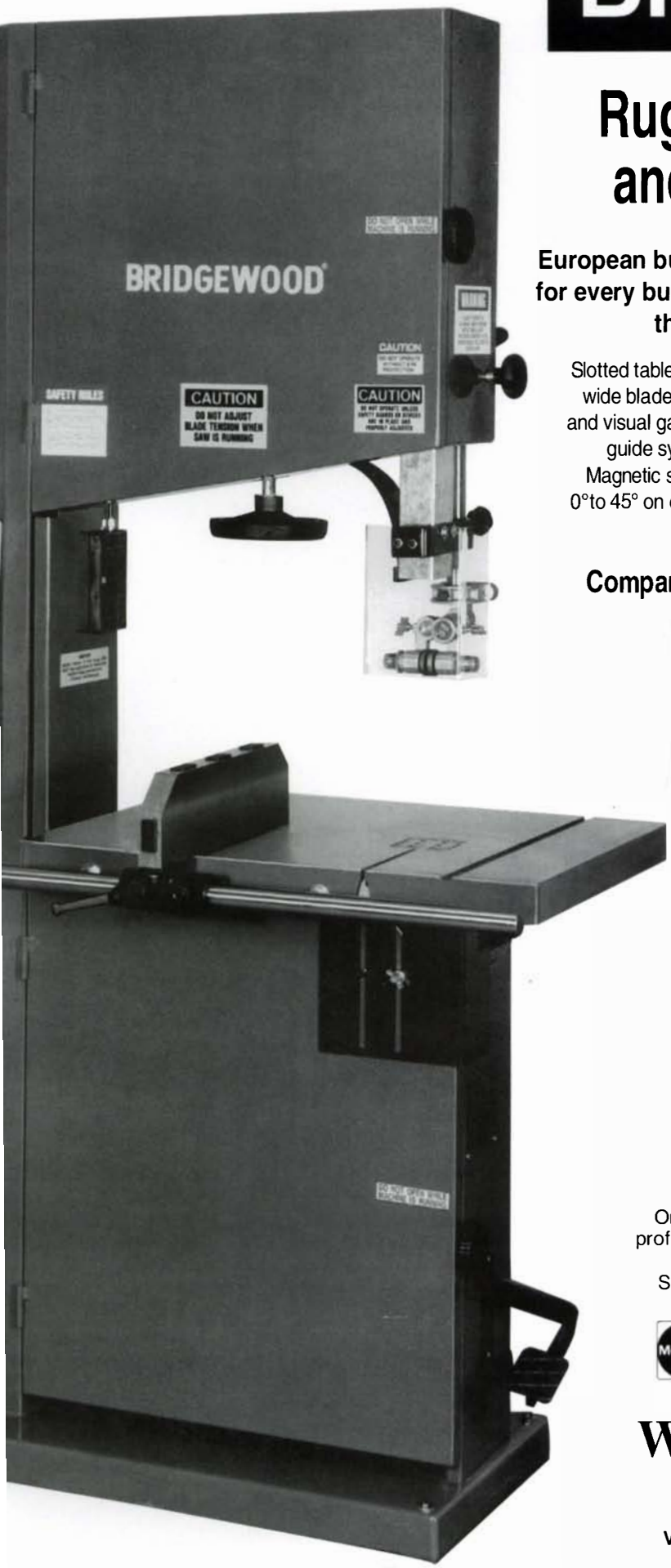

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Photos: Alec Waters

Sleeping Dragon

Del Cover got an unusual commission from Dino Pionzio of La Jolla, Calif., who wanted an artistic hammock stand sculpted of wood. Cover, an experienced boatbuilder, constructed the stand (see the photo above) similarly to the hull of a Viking long boat. The striped hammock resembles an early Viking sail, which adds to the nautical appearance. The dragon's bent-laminated tail and carved head are teak (see the photo at left). Its eyes are paloverde, its teeth are maple and the horns are ash. Walnut feet, bubinga floor timbers and ash ribs and bands stabilize and strengthen the teak keel and neck. Nose to tail, the spar-varnished creature is 19 ft. long, and it stands 8 ft. high. To allow the 450-lb. carcase to be broken down for moving, Cover included bolt-together scarf joints. Cover consulted with a structural engineer before he sized and located the most critical joints, making sure they could handle the high stresses exerted on the neck and tail sections.