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June 2003
No. 163

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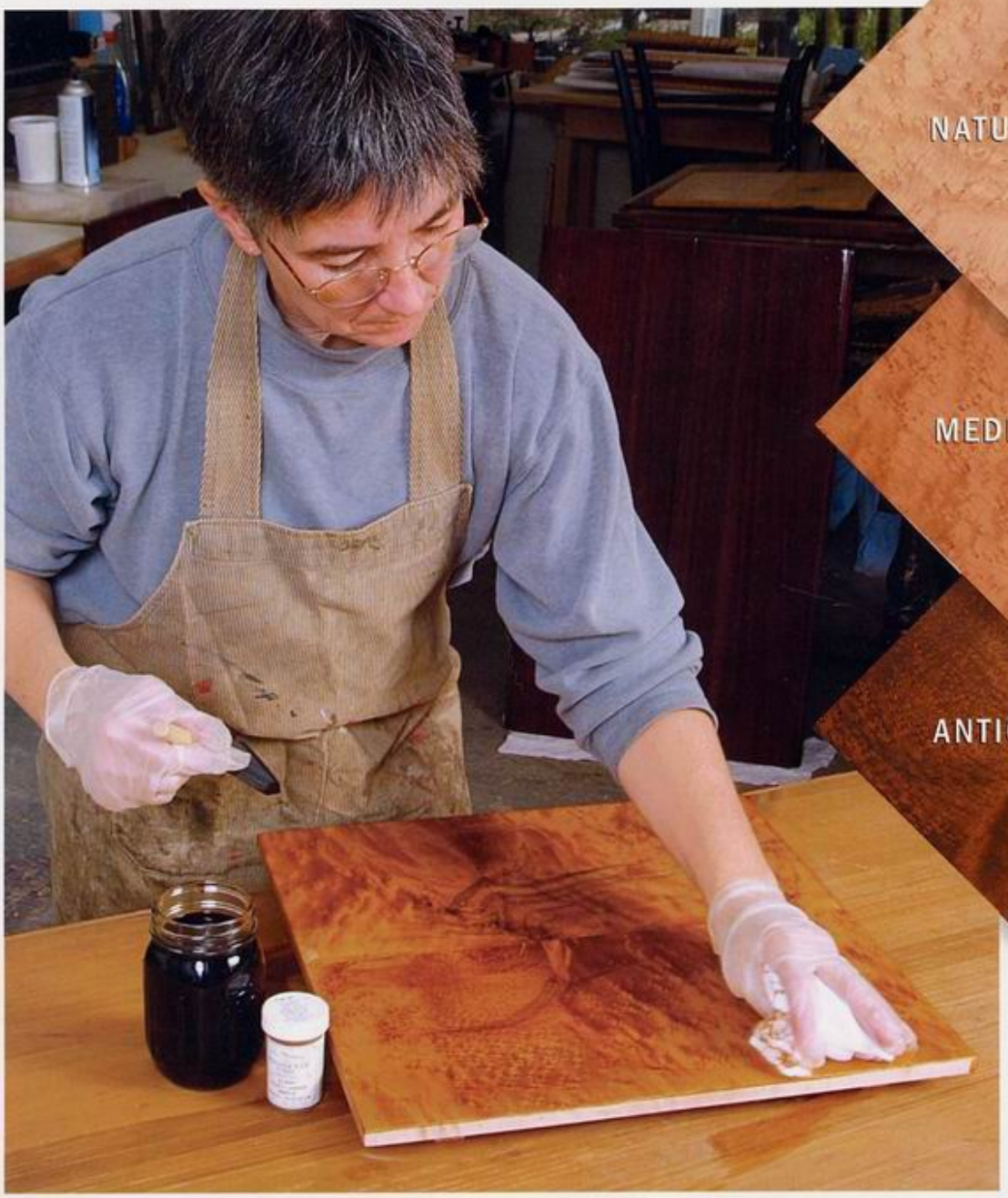

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Contributors

Stephen Hammer ("Small Stand is a Lesson in Curves") came to furniture making by way of the guitar. In 1992 he was a musician looking for a better instrument. But a high-end guitar cost as much as a three-month course in guitar-making, so Hammer grabbed at the chance to make his own. A few years later he moved to New York City to further his playing career but soon learned he needed a day job to make ends meet. He found one as a carpenter and spent the next seven years doing residential renovation. However, he always wanted to get back to the precise craftsmanship he had experienced in luthier school. In 2001, Hammer read about a 12-week program at The Center for Furniture Craftsmanship in Maine. Since taking the course, he has been building furniture on commission as well as high-end cabinetry at his shop in the Red Hook section of Brooklyn.

Dwayne J. Intveld ("Shop-Built Extension Tables") has enjoyed woodworking since high-school shop class. Currently an engineering manager for a construction-equipment manufacturer, Intveld designs and builds custom cabinets and furniture in his free time and particularly enjoys projects that make his shop more efficient. Home construction is another of his passions, and in the late 1970s he spent nights and weekends for two years building his current residence, an octagonal ranch overlooking the Mississippi River. He also maintains a connection to his farm upbringing by collecting miniature farm toys and contemplating restoration of his dad's first tractor, a 1952 John Deere Model A.

Teri Masaschi ("Finishes for Bird's-Eye Maple") has a busy but satisfying life in the dry mountains east of Albuquerque, N.M. Her restoration and refinishing business, The Tijeras Collection, occupies most of her time and is forcing her to expand her shop. She teaches finishing at a Santa Fe college and at various woodworking schools around the country in the summer. She recently adopted a pair of kittens and is hoping Lu Lu Ray Brown and Sneaky Pie Brown stay close to home and avoid the fate of previous cats that met hungry coyotes.

For 18 eventful months, **John Nesset** ("The Mighty Wedge") managed a renovation of his cabin in Nova Scotia, on the shore of the Bay of Fundy. Meanwhile, there were three consecutive solo exhibitions near his home base in Minneapolis, Minn. These exhibitions combined Nesset's photographs, some written pieces and his woodwork, including a bench that was on the back cover of *FWW* #155. Now he's at work on a collaboration with the Russian carvers Svetlana and Leonid Zakurdayev, who live nearby in St. Paul. Nesset said when that is done, he's headed for Nova Scotia to do nothing but watch whales, eat scallops and lobsters and warm himself by the woodstove until he's bored sick enough to start work on a shop there.

Rob Millard ("Scratch Stocks") decided when he was 14 years old that he wanted to be a carpenter. After he finished school and did framing and trimwork for several years, his career path took a turn toward furniture making. It began when he bought a copy of *FWW* #117. He read Randall O'Donnell's article about making a highboy and decided that was something he wanted to do. Millard is entirely self-taught, and he's accomplished an impressive body of work in the past several years. He is a member of the Society of American Period Furniture Makers. You can view some of his work on their web site (www.sapfm.org) or on his own site (www.americanfederalperiod.com).

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Letters

Do you build your own tools?
The next *Tools & Shops* is only a few months away, and we are seeking photos of tools that you have built for yourself: handplanes, marking tools, machine tools, benches and more. Please send an image (print, transparency or high-resolution digital file) to *Fine Woodworking*, Tool Gallery, 63 S. Main St., Newtown, CT 06470, or e-mail digital files to cbaumann@taunton.com.

Correction on math formula—In the Methods of Work department of *FWW* #162 (April 2003), on p. 20 it appears that a set of parentheses is missing in the formula for calculating the radius of a circle with a given chord length and rise. The additional set of parentheses around "8×Rise" should avoid any confusion, and the correct formula should be written as follows:

$$\text{Radius} = (\text{Length}^2/(8\times\text{Rise})) + (\text{Rise}/2).$$

Thanks for a fine magazine. We understand that catching all the typos before you go to press is nearly impossible. *—Vergil Givens, via e-mail*

EDITOR REPLIES: Mr. Givens was one of many who notified us of the error in the equation as it appeared in the magazine. Having tested the tip back in the *Fine Woodworking* shop, we knew it worked and were at first baffled by the confusion. So we called Dr. Sheldon Levy, a mathematician and one of the many people who wrote to us with the correction. Dr. Levy pointed out that some calculators will figure out the answer correctly as it was written, but he concurred that the extra set of parentheses should remove any lingering doubt about how the formula ought to be calculated.

Say no to silicone—Thomas Wisshack's Master Class "Make classic profiles with molding planes" (*FWW* #161, pp. 108-112) advises the reader to clean the shavings out of the throat of a wooden plane by giving the channel "a blast of silicone spray."

Either he has been a lucky man or perhaps he's wondered why his planed profiles have spots that reject a finish. Silicone should never touch wood, especially in its unfinished state, or anything that will touch wood. Being lucky is not the same as being smart: Use a blast of air!

—Jim Shumar, Winchester, Va.

Hollows and rounds—Enjoyed the article on molding planes, but I have to take exception to several points made therein. The plane shown in use is a "hollow," not a "cove." It is part of a set, the other part being, amazingly, a "round." These planes are pretty reasonable on web sites that deal in old planes (don't say "antique"; that doubles the price!). Two that I have had great success with are: www.price lessads.com/tool-guy/planes/planes w.htm (he trades ads with "Grandpa's Chest of Wooden Tools") and www.tool bazaar.co.uk. The English molding planes are more reasonable in price ($10 to $20 for a hollow or round), and the steel in the iron seems better, especially if you buy a Mathieson.

—Bruce Dorn, via e-mail

A disgruntled reader—Where are you going with this magazine? I thought I knew; but recently, I'm not sure. I was looking forward to this year's annual *Tools & Shops* issue (*FWW* #160), especially since the first one was so good. I was extremely disappointed. Simply put, it was a real dud.

I don't care how Matthew Teague manages to work in a small garage. I'd rather see his work and how he does it.

Next, Scott Gibson puts a floor in his shop, and we learn that concrete floors are bad for one's back and legs. This is news?

Trust me when I tell you that people are not grabbing up copies of *FWW* to discover that the jointer and planer are a team. This is too insipid for words.

Then comes the ubiquitous tool comparison. You waste far too much time and space on the endless review of power tools. Give it a rest.

Near the end of the issue, we get to Current Work, which is great. Lots of great craftsmanship is represented in the department. I would really like to see

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who made some of those pieces and learn how they did it.

This magazine needs to be about woodworking: the exploration of craftsmanship, the passing of knowledge and the appreciation of the art of woodworking. *Fine Woodworking* used to be a light to the woodworking world. Recently, it's just lite.

–Duane Yoder, Akron, Pa.

EXECUTIVE EDITOR REPLIES: The woodworking community is made up of people with a wide range of skills and interests. The regular issues of *Fine Woodworking* contain the type of information you seek. *Tools & Shops* is a little friendlier to entry- and intermediate-level woodworkers (remember those days?) and dyed-in-the-wool tool junkies (I confess).

***Tools & Shops* is good reading—**Well, you did it again. I got nothing done around the house this past weekend. I couldn't put the *Tools & Shops* issue (*FWW* #160) down and had to read it cover to cover. Just wanted to say thanks!

–David Platz, Lafayette, N.J.

Sudden impact—I would like to comment on Aimé Fraser's article "Installing Modern Wood Screws" (*FWW* #162, p. 49). She mentioned the problem of cam-out, the tendency of the driver bit to occasionally rotate out of a screw slot, marring it. From reading *Fine Homebuilding*, I learned that with impact drivers, 98% of the time you have no cam-out. If you put to work modern drivers on modern screws, the results are fantastic.

I can't understand why everyone doesn't own an impact driver. Since I purchased my 12-volt Makita, I never pick up a drill-driver. As a carpenter, I have yet to see a screw I couldn't drive effortlessly.

Get the word out. Inform the working public still using drill-drivers about these wonderful tools.

–R.S. Conaway, Blackwell, Okla.

Pondering the complexity of it all—My 6-year-old son has his own small workbench in my shop and is always hard at work at some project anytime we are out there. Recently, I told him that I would buy some better chisels for him given that he is now using a sharpened screwdriver and a stiff-blade putty knife. He glanced up and said, "I already have chisels. I need more wood." I was reminded again how needlessly complicated we make it.

Consider the sharpening debate that rages in perpetuity and how you came upon your method. Mike Dunbar uses a process, "scary sharp," where you use various grits of sandpaper on a flat plate. I've done this: It's fast, cheap, and it works.

James Krenov can cut to the heart of the matter. I've read he prefers Arkansas stones with kerosene drizzled on them. They work well, but it's his caveat that is essential. He says you can carry sharpening too far; and at some point, you are fussing more about your tools than you are working. I've done that.

Toshio Odate would be pleased. I have four waterstones, and they do a fine job. A long time ago, I read that Tage Frid likes Belgian clay stones. The closest I have been to Belgium was Switzerland on my honeymoon; otherwise, I would have one.

On vacation in Hawaii last year, I had my sharpening epiphany. My son and I were watching a street vendor carve detailed figurines out of a dark, fairly dense-looking wood. Then it happened: He paused, poured water on the cement sidewalk and sharpened.

–Rich Arrington, Little Rock, Ark.

Finishing touch to a masterpiece—Jon Leppo's "Rock-Solid Workbench" (*FWW* #162, pp. 50-56) is a real masterpiece. I could only make one recommendation in the hope of making a great bench perfect.

Having had workbench drawers with knobs, I can attest to how they tend to grab every power tool cord at the most inconvenient moments. The improvement that I would propose is to replace the knobs with pulls that can't possibly catch on anything.

–Ted Fink, Shelburne, Vt.

An overlooked moment in workbench history—In his article "The Workbench" (*FWW* #160, pp. 54-59), Graham Blackburn failed to include the epitome of workbench design: the one described by John White.

I've been using my copy of White's "New-Fangled Workbench" (*FWW* #139, pp. 98-101) for about two years, and I assert that it's an example of design genius. Since I'm of the Neanderthal persuasion of woodworking, a good bench is essential.

I didn't realize how essential one actually was until I started using this bench. Some of my workpieces have been strangely shaped, but I've been able to secure every one for cutting or planing on this bench. The long slot down the middle makes it possible to use extra clamps to hold the really weird pieces that would be more challenging on a typical bench.

My hat's off to White for his crowning contribution to 2,000 years of workbench design.

–Bill Beningfield, Lawrence, Kan.

A cleaner air cleaner—I would like to further add to the Methods of Work tip "Inexpensive air cleaner" (*FWW* #160, p. 22). The first thing I would like to share is that the filter works better ahead of the fan, with the fan pulling the air through the filter.

The second helpful hint is to put a piece of Typar (housewrap) over the filter. It will pick up the larger dust particles and reduce plugging the filter, extending its life considerably.

–Matt Dedrick, Carman, Man., Canada

Judge or be judged—In the Letters department of *FWW* #161 (p. 8), Craig Arnold suggested that projects featured in Current Work be ranked during a calendar year, and the best given a prize at year's end. To this, the editor replied that this is an excellent idea.

I don't agree. Can't we, for once, have a section of great work by readers displayed and not begin judging them? This reminds me of a friend who carried a magnifying glass with him and viewed

Writing an article

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displayed photos to see if the grain of the film showed in the print. What is wrong with just enjoying the craftsmanship and beauty of the entire piece as it appears?

I sure hope that someone will give some rational thought to selecting the best of the year before it is written in stone. Perhaps the editor should have polled a few of the readers to get their take on the idea of choosing the best. Isn't being published in such a fine magazine as *Fine Woodworking* honor enough? Also, if someone wants to have their project judged, there seems to be a lot of juried shows available.

–Bob Gilda, Bellingham, Wash.

EDITOR REPLIES: Does anyone else care to comment? We're listening.

More on sloping compressor plumbing—I write in response to the Letter "Sloping compressor plumbing" (*FWW* #162, pp. 10-12). Roland Johnson's initial published statement in which he asserts that air lines should slope away from the compressor was correct, and he shouldn't have conceded to Mr. Smith's suggestion that "it doesn't really matter which way the pipe slopes as long as there is slope."

When installing my shop compressed-air distribution system, the compressor manual was quite specific that proper installation includes sloping lines away from the compressor as well as use of galvanized steel lines to promote condensing of moisture, with a collective drain toward the end. I have seen refrigerated dryers installed to combat poor slope and takeoff problems: The correct method results in only clean, dry air emitted from the line.

One should slope the line away from the compressor so that the flow of air carries any condensed moisture downstream toward the drain. If the line slopes back toward the compressor, a constant flow of air may eventually drive the water uphill and into the tool being used. This will result in a spontaneous blast of water coming out of an air-powered tool.

Granted, if you are using relatively small amounts of air for very short periods of time, sloping the lines toward the compressor probably won't cause much of a problem. On the other hand, in a situation where you are using high volumes of air for long periods of time, for instance spraying on a finish, the results could be disappointing, to say the least. The situation is greatly compounded when there are multiple and sporadic users of the air supply.

–Jon Beuchert, Colgate, Wis.

Bookcase in a day?—After seeing Steve Latta's article "Bookshelves in a Day" (*FWW* #158, pp. 32-35), my husband and I both really liked the design and decided to make one of our own. We are amateur woodworkers and don't have a workshop, but rather a garage that gets converted to a shop and then returned to garage status at the end of each day. This is our story:

Day 1: The article didn't contain a materials list or a measured drawing needed for the project, so we created both. Also, unlike the author, we didn't have "scraps" of walnut and pine in the workshop, so we had to take a trip to the lumberyard and purchase the needed lumber. With all the materials now on hand, we managed to joint and surface-plane one vertical. Elapsed time for the first day of this endeavor is eight hours.

Day 2: Taking five hours, we completed jointing and planing the verticals and managed to biscuit and glue up one vertical. At this point, my husband started lobbying for a larger jointer so we wouldn't have to glue up the boards to make the 10-in. verticals.

Day 3: After work, we spent 45 minutes biscuiting and gluing up the second vertical.

Day 4: Another 45 minutes in the evening was spent biscuiting and gluing up the third vertical.

Day 5: In the five hours spent on the project today, we were able to sort and mark the wood for the shelves, and joint, surface-plane and glue up two of the shelves.

Day 6: Spent four hours jointing, surface-planing and gluing up two more of the shelves. My husband lobbied for more clamps so we could glue more boards at the same time.

Day 7: We managed to dimension the verticals and four shelves and cut the vertical dadoes. Also started sanding with a belt sander, orbital and then palm sander with six different grits. Six hours spent on the project.

Day 8: Four additional hours were spent cutting the dadoes and continuing sanding.

Day 9: The name of the game was four hours of sanding.

Day 10: Another six hours of our time was spent jointing and planing the three remaining shelves and sanding more.

Day 11: In the five hours of work, we glued up the remaining three shelves and continued to sand more of the pieces of the project.

Day 12: Taking four hours, we dimensioned and cut the dadoes in the last three shelves and sanded more.

Day 13: Four hours of sanding, sanding and more sanding.

Day 14: And yet again, sanded for six additional hours.

Day 15: We spent six hours applying tung oil to all of the boards.

Day 16: For the second coat of tung oil, another six hours of labor was required.

Day 17: Allowing drying overnight, it took us 30 minutes to finally install the bookshelves.

After 17 days and a total of 75 hours, we both like the finished product so much that we're planning on building two more in cherry for the family room.

–Sue and John Conklin, Collierville, Tenn.

Water storage of green wood—I would like to comment on Brian Boggs' reply to the Q&A "Keeping wood green" (*FWW* #159, pp. 108-110). Boggs' points are well taken, particularly for craftsmen who, like Boggs, are production wood-

About your safety:
Working wood is inherently dangerous. Using hand or power tools improperly or ignoring standard safety practices can lead to permanent injury or even death. Don't try to perform operations you learn about here (or elsewhere) until you're certain they are safe for you. If something about an operation doesn't feel right, don't do it. Look for another way. We want you to enjoy the craft, so please keep safety foremost in your mind whenever you're in the shop.

–Anatole Burkin, executive editor

workers requiring substantial quantities of wood. For those whose shop work is subject to conflicting time constraints and only need to keep smaller amounts of green wood available, water storage is not quite as grim as Boggs would have it.

First, if possible, use your green wood with the schedule proposed by Boggs. Most wood-destroying organisms prefer the same temperature range that we do. Accordingly, winter storage of fall- and winter-harvested wood presents little difficulty. Leave the logs in the round with the bark on and their end grain thoroughly coated. Keep out of the sun, wind, rain and damp. For use in late spring, handle early-spring harvests the same way. But if you can't adjust your wood supply and schedule to other demands on your time, water storage is doable.

Seal the end grain. Remove all bark, sapwood—unless you are using it—juvenile wood and pith. Rive or saw the wood into approximately the sizes or multiples of the sizes you need. The soaked bark of most woods quickly creates a loathsome liquor. Store as little wood in as small a storage tank as possible.

Mosquito larvicide is available at garden centers. It is safe and imparts no odor to the wood. If things get out of hand, empty the tank, drain out the water and hose off the wood.

Storing and preserving only the highest-quality wood and appropriate stock sizes eases the task. I use a tank made of exterior plywood coated on the inside with fiberglass and heavily framed on the outside. My tank is outside. It freezes up in the winter; but in Maryland, I thaw it out with running water. A submersible electric water heater can be used.

–John Alexander, Baltimore, Md.

Getting rid of epoxy bubbles—I enjoyed the "Epoxy Inlay" article (*FWW* #159, pp. 73-77). It's an interesting way to both hide defects and enhance the finish of wood. The article mentioned the problem of entrapped bubbles. There are two tricks to eliminating bubbles:

1) Do not mix the epoxy too much, just enough to blend the epoxy.

2) After the epoxy has settled for a few minutes, run a high-temperature flame over the epoxy and watch the bubbles run for cover. You can use a micro torch, which is powered by propane.

–Michael Shulist, Bolton, Ont., Canada

Magnetic tack cloth—Regarding the Finish Line "Removing surface dust" (*FWW* #159, pp. 129-130): I have favored 0000 steel wool for a final smoothing of a finish, but vacuuming and tack cloths were only partially effective in removing the fine bits of steel wool, especially from corners and areas where the finish might be soft. It occurred to me to use my "fishing magnet" to remove the fine fuzz of metal filings. The one I use was made for retrieving metal objects, including outboard motors that may have fallen into a lake. It consists of two parallel bar magnets, each about 6 in. in length by ½ in. square, separated in a steel case.

By holding it with the thumb opposite the fingers, it is possible to keep the magnet about 1/16 in. from the work surface.

–Robert B. Young, Williamsburg, Va.

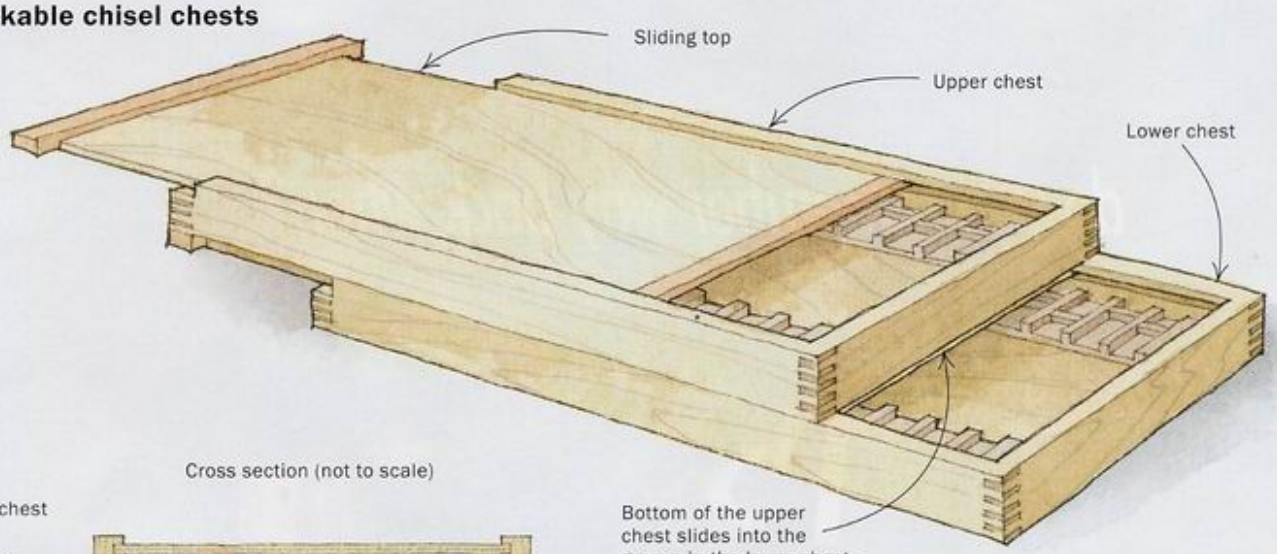
Chafed by wheat board—I don't usually write letters to refute unsubstantiated claims of environmental heresy, but lately I have seen an increase in the number of people who believe that leaf burning causes global warming. In the "Woodworking Trade Shows" write-up (*FWW* #160, p. 38), there is a brief article about furniture from straw. The author claims that using wheat-straw board to make furniture reduces air pollution. What it does do is reduce the carbon balance in the atmosphere. The carbon that the wheat used to grow came from the air. The natural order of nature would be for the carbon to be returned to the atmosphere for the growing process to begin again. This can happen if the straw is allowed to rot or if it is burned—nothing new is added to the air. This is not to be confused with burning fossil fuels, which does increase carbon.

While I agree that leaf smoke is obnoxious, it doesn't make the air dirtier. I'd rather see the leaves composted and used to help grow the next generation of plants, but the same carbon, regardless of how it gets there, will be in the air. Making furniture from wheat disrupts the balance, and may actually cause global cooling.

–Jerry Aiello, Orange, Va.

EDITED AND DRAWN BY JIM RICHEY

Stackable chisel chests



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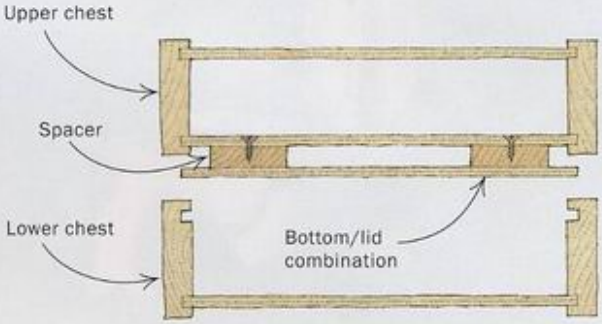
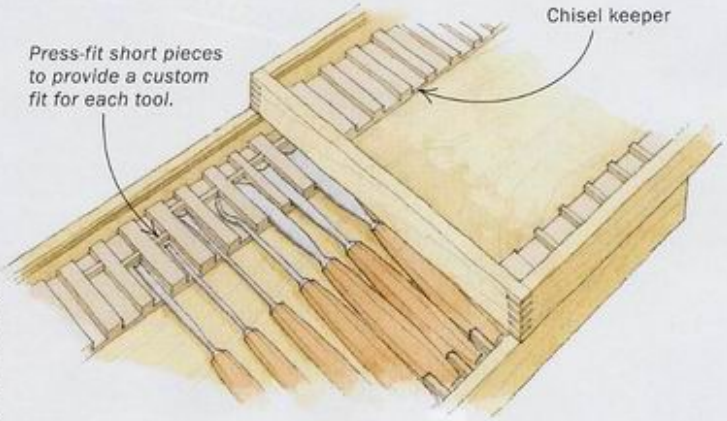




When I made a wooden chest to store my carving chisels, it was constructed to hold about 22 tools and to hang vertically on a wall in my shop. As my collection of chisels grew, I soon ran out of room. I could have built a new chest, but that would have required additional wall space, which is scarce in my shop. So I came up with the solution of building a second chest and stacking it on top of the first chest. Now I can hang these two chests in the same space as the original single chest. And when I need a third chest, it will stack on top of the first two. When I need a particular chisel, I remove the chests from the wall and open them on my benchtop.

The drawings show the construction details. Basically, what you need are two identical finger-jointed chests with ¼-in.-thick plywood bottoms glued into a groove and ¼-in.-thick plywood tops that slide in a groove. To stack the chests, you simply fasten the top of the lower chest to the bottom of the upper chest with appropriately sized spacers between them to provide a small gap that makes it easier to fit the chests together. The spacers can be made of ½-in.-thick medium-density fiberboard (MDF) or scrap strips of pine, milled to a thickness that can size the gap between the two chests. Glue the spacer strips to the top of the lid of the lower chest, and then with the two chests perfectly registered, screw through the bottom of the upper chest into the spacer strips to lock the combination bottom/lid together.

To make the pieces inside that keep the chisels in place, use a dado blade or a router to crosscut ¼-in.-deep grooves in suitably wide stock about ⅝ in. thick. To minimize fore-and-aft movement of a chisel within its location, press-fit a small length of ¼-in. square stock crossways in the groove. These pieces can be

A new reward for the best tip

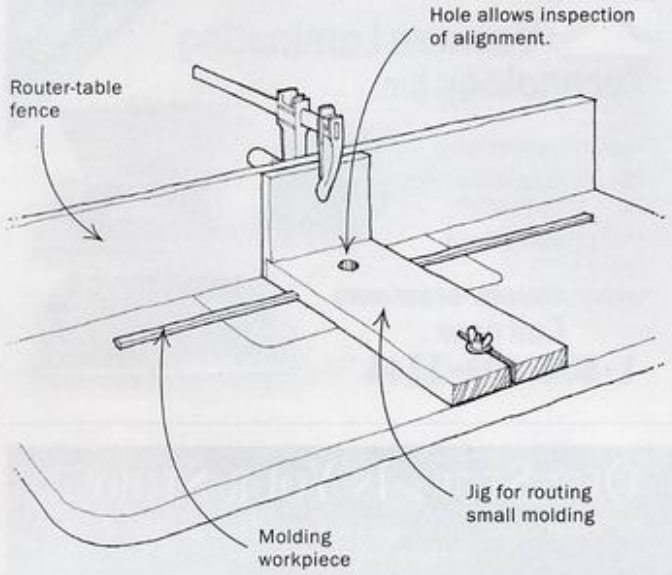
It is fitting that Gerald C. Lauchle provided the winning tip with his design for stackable chisel chests that can accommodate his inventory of tools: Beginning with this issue, we are awarding a set of hand-forged cabinetmaker's chisels made by Barr Specialty Tools (www.barrtools.com) in McCall, Idaho. Lauchle is a professor of acoustics at Penn State University. His woodworking skills are mostly self-taught, and he especially enjoys period-furniture making. Send us your best tip, along with any photos or sketches (we'll redraw them) to Methods of Work, Fine Woodworking, P.O. Box 5506, Newtown, CT 06470-5506.

pried out if you ever need to fit another chisel in that location. If you wish to organize all of your tools more thoroughly, you can mark the sweep and width of each chisel on these stops for reference.

To hang the chests on a wall, attach a couple of picture hangers to the back of the lower chest and slip these over appropriately spaced screws in the wall. It's also a good idea to attach small rubber-bumper feet to the corners of the lower chest to prevent the hangers from marring the benchtop.

—Gerald C. Lauchle, State College, Pa.

Router jig for delicate molding



I recently needed to mill 70 ft. of delicate molding (⅛ in. thick by ⅜ in. wide) for a reproduction of a 17th-century French harpsichord. My first thought was to rout the molding on the edges of larger workpieces and then rip them to size. But for various quality-control reasons I rejected that approach and came up with this router-table jig instead.

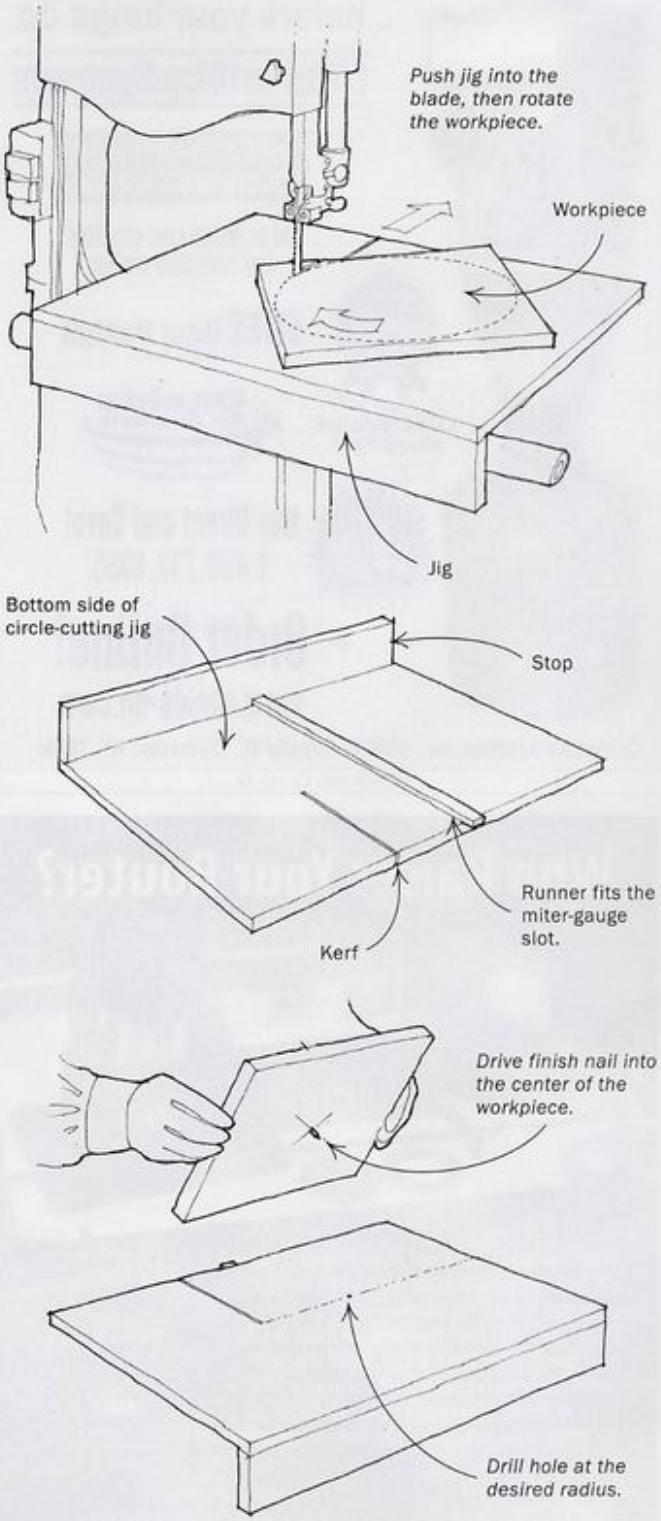
The jig is simply a 5-in.-wide piece of hardwood with a dado cut into the bottom to fit the thickness and width of the workpiece. Drill a 1-in. hole through the top at the location of the router bit to aid in alignment. Finally, add a foot to the fence end of the jig and a slot to the outboard end.

To use, clamp the foot of the jig to the router fence and fasten down the outboard end with a bolt and wing-nut arrangement. This ensures the jig will stay flat on the router table. With a thickness planer, mill the stock to an accurate rectangular cross section that slides fairly snugly through the dado. Adjust the location of the jig relative to the bit using the alignment hole, turn on the router and pull the stock through the jig. It may take several different bits and multiple passes through the jig to make the desired profile.

—Alton H. Clark, Ithaca, N.Y.

Simple circle-cutting jig for the bandsaw

Because the only piece of power equipment I have in my shop is a bandsaw, I try to make the most of it with jigs. When I set out to make a circle-cutting jig, most designs I found were too complicated, too limited or too expensive. So I came up with a simple, effective jig that can be put together in about 10 minutes. It works as a sled in the miter-gauge slot to make a starting cut in the work-



piece tangential to the circle. When the jig stops against the front edge of the saw table, rotate the workpiece to complete the cut.

The sled is a piece of plywood that's ⅜ in. or ½ in. thick and a couple of inches bigger than a bandsaw table. Attach a runner to the bottom that fits into the miter-gauge slot, and attach a stop that will engage the front edge of the saw table. Cut a kerf into the sled by running the jig into the blade until it stops. Mark a pencil line 90° from the point where the kerf ends.

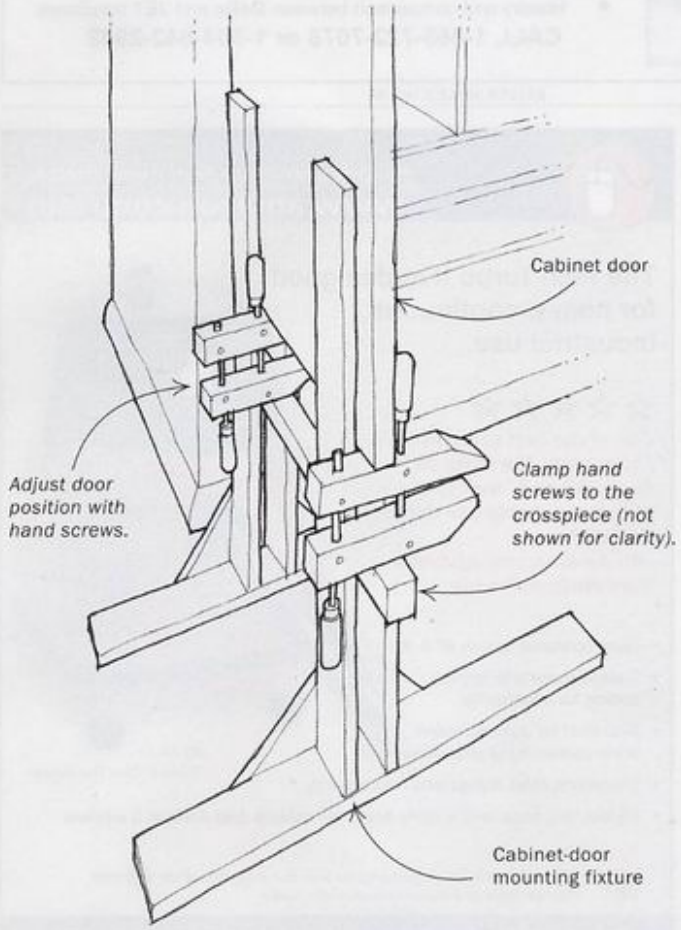
To use this jig, drill a small hole on the 90° line at a distance from the sawkerf equal to the radius of the circle you want to cut. Tap a finish nail into the bottom center point of the workpiece and drop the nail into the hole.

Turn on the saw and run the whole jig into the blade until it stops. Rotate the workpiece to cut a perfect circle every time.

—Benjamin Johnston, Chicago, Ill.

Quick tip: A foam egg carton makes a great carrying case for router bits when you have a project outside your shop. Large bits fit into the compartments just right, and a crumpled paper towel will cradle the smaller bits. *—R.B. Himes, Vienna, Ohio*

Fixture for mounting cabinet doors



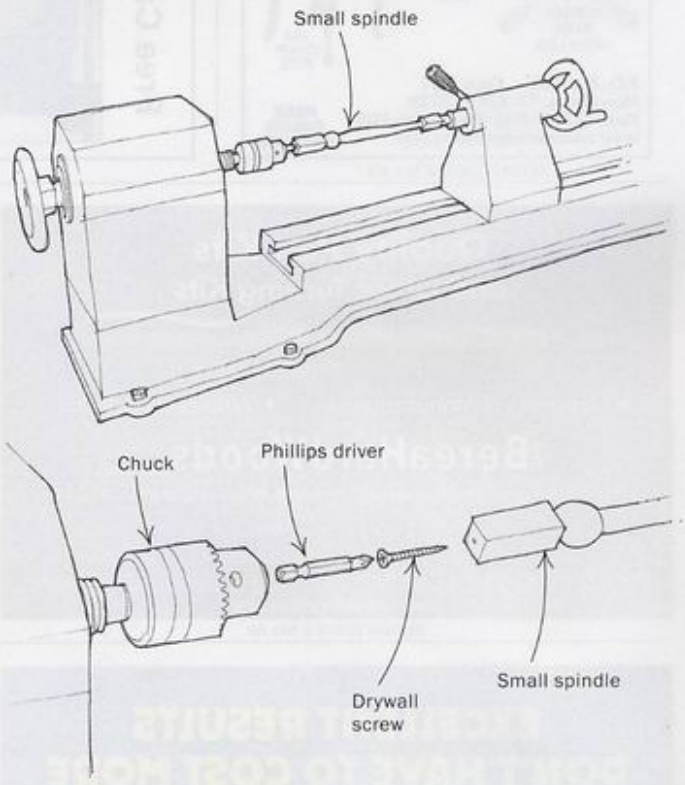
I work by myself and find it awkward to hold cabinet doors in a perfect position while I mark and mount the hinges. So I made the device shown in the drawing (below left) that holds the door and allows small adjustments in and out or up and down to put the door into perfect alignment.

To make this fixture, start by fabricating a simple stand with two uprights and a crosspiece. Each upright should have a pair of arms spaced apart by the thickness of the door. Install the crosspiece several inches below the final door height. Then clamp two hand screws to the crosspiece and use the screws on the hand screws to make fine adjustments in the door's position.

—James Thompson, Union City, Tenn.

Quick tip: To remove sanding dust from a workpiece prior to finishing, cut the toe end off an old wool sock. Slip three-quarters of the sock over the end of a large-diameter shop-vacuum hose and tuck the remaining quarter into the mouth of the hose. Then secure the hose with a rubber band. With this setup you can wipe and vacuum sanding dust directly off the workpiece without marring the surface. *—Ted Baughman, Bothell, Wash.*

Lathe drive center for tiny spindles



The common spur center that fits a lathe headstock is too large for small, delicate spindles. To remedy this, first drive a small Phillips screw into the end of your workpiece. Then mount a small Phillips driver into the headstock using a Jacobs or three-jaw chuck. Mate the driver with the screw, bring up the tailstock, and you are good to go. For very small turnings you can eliminate the screw in the workpiece altogether. Simply sharpen the Phillips driver with a file and drive it into the end of the workpiece.

—Jim Vasi, Williamsville, N.Y.

Notes & Comment

Cancer-fighting tools. *Sanders create the very fine dust particles that penetrate deepest into the lungs. But the use of shop vacuums and dust masks can reduce breathable particulates to negligible levels, a government report says.*

Government names wood dust a carcinogen

If you have been thinking about upgrading your dust-control equipment but need a push, here's a shove: The latest federal report on cancer-causing substances adds wood dust to the list of known human carcinogens. "Strong and consistent associations with cancer of the nasal cavities and paranasal sinuses were observed both in people whose occupations are associated with wood dust exposure and in studies that directly estimated wood dust exposure," the U.S. Department of Health and Human Services 10th Report on Carcinogens states. The report also connects throat cancer and Hodgkin's disease to wood-dust exposure (to read the full report on-line, go to ntp-server.niehs.nih.gov/default.html).

"It is hard to differentiate between particular wood types," said C.W. Jameson, lead scientist on the report, "because the studies were made in real-world situations, where workers dealt with many wood species over their term of employment." Other studies cited in the report concluded that long-term exposure to wood dust led to "enhanced inflammatory reactions in the nasal cavity," confirming what allergy sufferers and those prone to sinus infections already know.

There are effective measures woodworkers can take to limit their exposure. For example, the use of hand-held electric sanders is identified as one of the worst culprits, but the use of dust extraction reduced breathable dust up to 300 times. Dust-control methods have been well-documented in this magazine and others. Dust collectors and vacuums should be connected to as many woodworking tools as possible, especially those that throw off the finest dust, which hangs in the air the longest and penetrates deepest into the lungs. Also, there are replacement bags and filters that will trap dust down to 1 micron in size. The next line of defense is an air cleaner, which filters out some of the dust missed by a dust collector or shop vacuum. And finally, dust masks and air helmets can reduce exposure.

—Asa Christiana, senior editor

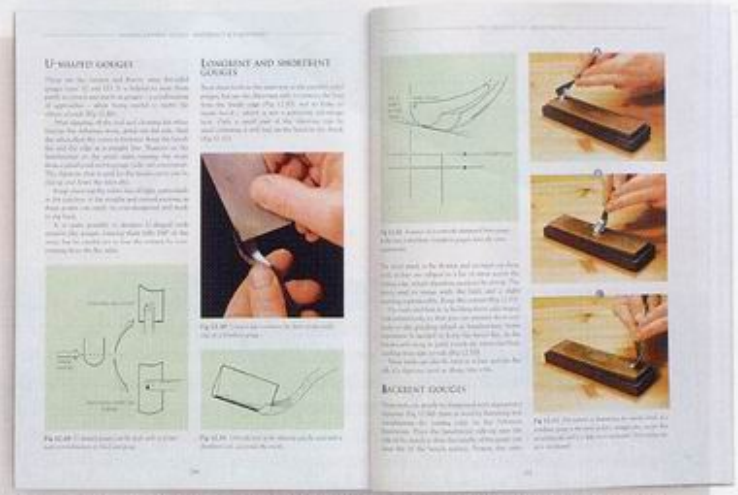
Book review

Woodcarving: Tools, Materials & Equipment *by Chris Pye. Sterling Publishing, www.sterlingpub.com; 2002. paperback; 2 vol., $19.95 each*

First published in 1994, Pye's book has been revised and expanded into two volumes. Both are accessible to those picking up a gouge for the first time yet contain details experienced carvers will value. Subjects range from a description of each type of carving tool to detailed methods of making or customizing your own tools.

Pye is open about stating his preferences (such as oilstones for sharpening), but he also gives thorough descriptions of alternate methods (such as waterstones and diamond plates). Both books convey his wealth of experience and his love for the craft.

—Mark Schofield, associate editor



Everything but the carving. *This two-volume set by Chris Pye covers all of the tools and materials associated with carving—both hand and power—including sharpening and wood, but it stops short of carving techniques, which are discussed in his other books.*

Photos, except where noted: Asa Christiana; this page (top): Kelly J. Dunton

Making furniture behind bars

For more than three years, a group of New Hampshire furniture makers has ventured behind the walls of the state prison to build a top-notch furniture-making program. Members of the New Hampshire Furniture Masters Association (NHFMA), including *FWW* contributors Garrett Hack and David Lamb, volunteer to teach monthly lessons in advanced techniques. (The NHFMA was featured in *FWW* #147, pp. 75-79.)

The prison-outreach program began when NHFMA member Terry Moore accepted an invitation from New Hampshire Superior Court Judge Kathleen McGuire to visit the prison's Hobby Craft Workshop. Other members followed, and today the shop is a well-lit, well-equipped place used by 60 inmates, with 40 more on the waiting list. Participants must have a spotless disciplinary record, and even then they wait 18 months to get in.

Instruction in the fine points. *Tom McLaughlin, center, gives a lesson in smooth-planing to Eric Grant, left, and Allen Eason, right, New Hampshire State Prison inmates. McLaughlin and other New Hampshire Furniture Masters Association members volunteer to teach lessons in the prison's shop.*

The inmates' work is sold at Corrections Creations, the prison's retail store in Concord, N.H., with proceeds split between a charity of the inmate's choice and the prison-workshop program, to keep it completely self-supporting. The inmates also donate many items to Toys for Tots.

Perhaps the greatest testament to the program's success is found in the NHFMA's annual auction catalog, which includes some of the finest work being done today. This year, three inmates' pieces made the cut. Among them was Eric Grant's cherry highboy, which sold for $8,500. Grant sent net proceeds of $2,000 to a local youth soccer program to buy nets and goals. His past pieces have raised money for a young girl's brain operation and for a Christian summer camp.

"Prison is a very chaotic place," said Timothy Eldridge, an inmate whose tall Shaker clock made the catalog. "I embraced woodworking to give my life some focus and learn what I hoped would be a marketable skill [for life after prison]."

"People say, 'Why these guys?'" said Tom McLaughlin, an NHFMA member who coordinates the program with Moore. "The answer is that all but 40 of the 1,400 inmates [at New Hampshire State Prison] will be back out someday and be someone's neighbor."

—*A.C.*

Hidden talents brought to light. *Inmates made furniture that was accepted into the New Hampshire Furniture Masters Association's auction catalog—Eric Grant's Queen Anne flat-top highboy (left) and Allen Eason's Hepplewhite Pembroke table (right).*

Photos, this page: courtesy of New Hampshire Furniture Masters Association, Rixon Photography (top); Dean Powell (bottom)

Furniture maker wins award he helped create

Eugene Landon, a prolific woodworker and teacher who specializes in 18th-century furniture, was honored with the 2003 Cartouche Award, given by the Society of American Period Furniture Makers.

The award is given annually to honor a woodworker for exceptional achievements. The trophy is a copy of a cartouche carving that Landon himself made years ago for one of his projects.

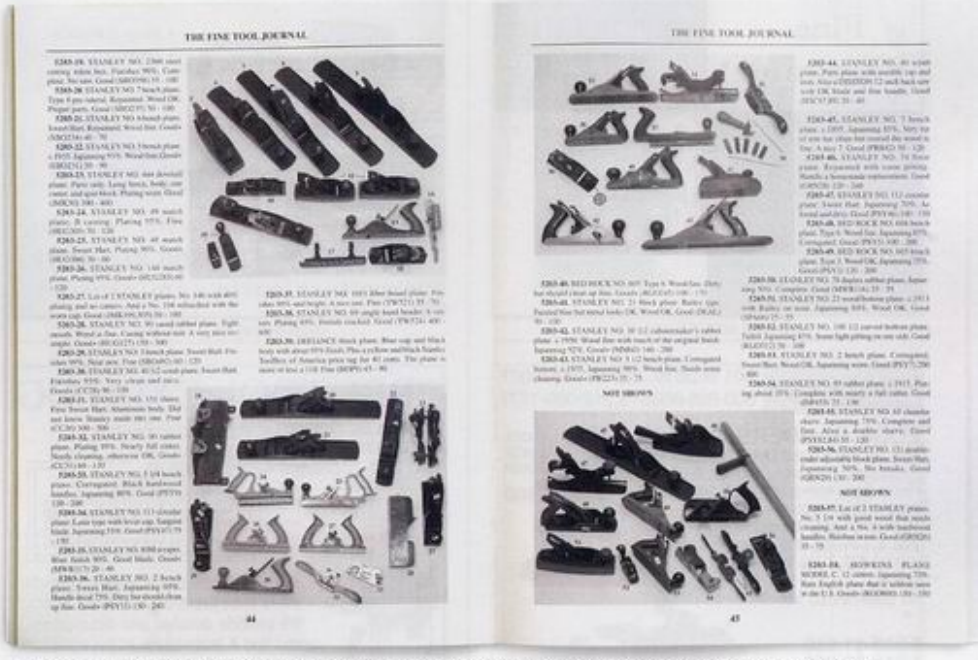
Landon received the Cartouche Award during the group's annual banquet, held during the "Working Wood in the 18th Century" conference at Colonial Williamsburg, which was co-sponsored by *Fine Woodworking*.

Jim Douthat presented the tribute to Landon during the conference and said, "Gene Landon lives his work. His major exhibit is his home. In his shop he averages 20 reproductions and restorations each year. His work can be found in private homes and major museums throughout the country, including the White House."

Chosen by his peers. *Eugene Landon won the 2003 Cartouche Award, given by the Society of American Period Furniture Makers.*

Landon, who lives in Montoursville, Pa., also has written a few articles for *Fine Woodworking*.

—Anatole Burkin, executive editor



A clearinghouse for classic tools. *Along with articles and book reviews,* Fine Tool Journal *offers quarterly tool sales and absentee auctions.*

Quarterly journal offers antique tools, auction info

Fine Tool Journal, aimed at collectors and users of antique tools, is also a clearinghouse for old tools in good condition. A yearly subscription of $29 gets you four issues, each containing articles, book reviews, tools for sale with pictures of most items, and an absentee auction with its own pictures and descriptions. Every tool is rated on a standard scale (Good, Good+, Fine).

"Satisfaction is guaranteed," managing editor Clarence Blanchard said of the sale and auction items. "Our return policy is: Return it."

Fine Tool Journal and its web site (www.finetoolj.com) also contain information about the International Tool Auctions, two large yearly events in Pennsylvania (see *FWW* #135, p. 52) run by Antique & Collectible Tools, the same Pownal, Maine, company that publishes the journal. Each auction weekend is kicked off by a Friday dealer sale, a great place for hand-tool users to nab excellent working tools at good prices. For more information on *Fine Tool Journal* or the auctions, go to the web site or call (800) 248-8114. *—A.C.*

Woodworking exhibitions

We frequently receive information regarding upcoming woodworking exhibitions. Lack of space and a lengthy printing schedule make including all of it impractical.

We publish such time-sensitive information in the events section of our web site (www.finewoodworking.com). Please send the information to fw@taunton.com or mail to *Fine Woodworking* Web Editor, 63 S. Main St., Newtown, CT 06470.

Stories and photographs concerning shows that already have taken place, and winners of prizes and awards, should be mailed to Asa Christiana at the above address or e-mailed to achristiana@taunton.com.

Photo, this page (left): Ronald L. Patton

Tools & Materials

Milwaukee's new fixed-base router has plenty of power

Milwaukee added a new fixed-base router, model 5625-20, to its power-tool lineup.

As shipped, the router had U-shaped handles. But a pair of palm-grip knobs also was included. To change from one to the other is just a matter of turning a few screws.

When cutting dadoes with the router base against a straightedge, I liked the feel and control of the U-shaped handles. But with the palm-grip knobs installed, my hands ended up lower on the machine, a position that seemed to offer a little more control when making edge cuts with bearing-guided bits. Having both options is a nice feature.

The get up and go is provided by a 15-amp, 3½-hp, variable-speed soft-start motor. A quick push of a release button frees the motor, allowing you to lift the motor straight out of the housing, which is handy for changing bits, even when the router is in a table.

But be careful here. If you push the button when the motor isn't supported, the motor immediately free-falls. It can easily bang a finger. Or, if upside-down in a table, the motor is going to visit the floor quickly.

Adjusting the bit is about as painless as things get. While supporting the motor with one hand, push the motor-release button with the other, then raise or lower the motor to get the cutter in the vicinity of the desired depth of cut. At that point, use the fine-adjustment knob to dial in the exact setting.

Milwaukee also provides a T-wrench to fine-tune the bit setting. Slip the T-wrench through a hole in the subbase and use it to turn the fine-adjustment knob. When the router is in a table, the wrench is even more useful. But first, you need to drill a hole in your router table to align with the hole in the subbase.

When checked for arbor runout, the 5625-20 measured 0.0015 in. That compares to an average of 0.0042 in. in a test we did of midsized, fixed-base routers about two years ago. This router is noisier than our average, measuring 100 decibels.

Power to spare. *The 3½-hp Milwaukee cut ¾-in.-wide by ½-in.-deep dadoes with little effort.*

SIDE BY SIDE

Two impressive wooden smoothing planes

I want a smoothing plane to cut a final polished surface consistently with little or no tearout. Two new wooden smoothers, one by Clark & Williams and another by Knight Toolworks, are impressively dependable tools.

Bill Clark and Larry Williams, finish carpenters turned plane makers, have revived the classic styling of 18th-century wooden smoothers. With a coffin-shaped beech body, a rounded-top single-iron precisely wedged in place and a micro-

Smooth-cutting smoothers. *Two new wooden smoothing planes from plane makers Clark & Williams (top) and Knight Toolworks (bottom) were a pleasure to use.*

Photos, except where noted: Tom Begnal

In our vibration test, it received an excellent rating.

This router had plenty of power. With a new ¾-in.-dia. straight bit in the router, and with the bit set to make a hefty ½-in.-deep cut, I was able to cut a dozen long dadoes with little effort. The Milwaukee 5625-20 sells for around $350. For more information, contact Milwaukee (262-781-3600; www.mil-electric-tool.com).

–Tom Begnal is an associate editor.

Adjustment from above. *A hole in the router subbase accepts a T-wrench (supplied), allowing the bit height to be adjusted from above, a feature that's especially helpful when the router is mounted in a table.*

Grr-andiose push block

When ripping stock, a push block or a push stick is an indispensable safety tool. Over the years I've seen versions in all shapes and sizes but none as exotic as the GRR-Ripper from Micro-Jig.

The body of the tool accepts a pair of narrow, fixed side legs and a wider movable center leg. All three of the legs have a rubber sole. Adjusting the center leg side to side between the side legs creates a tunnel through which the sawblade can pass. The handle also adjusts side to side, so the pushing force can be placed where it's going to be most effective. When ripping narrow stock, an adjustable L-shaped plate can be lowered to meet the saw table, which helps prevent the tool from tipping.

In general, the GRR-Ripper worked fine. When cutting narrow stock, the sole bears on both sides of the cut line, so the offcut is carried past the blade, a nice feature.

On the downside, though, when cutting narrow stock, the tool interfered with the blade guard. Also, most pushers have some means to hook over the trailing end of the stock to provide downward and forward pressure. But the GRR-Ripper relies entirely on friction between the sole of the tool and stock, so I had to use more downward force than usual.

The GRR-Ripper also can be used with a router table or jointer. Overall, this was a well-made product. But at $50 to $70 each, depending on the model, I think I'll stick with my shopmade push blocks. For more information, contact Micro Jig (407-696-6695; www.microjig.com).

–Dennis Preston is an engineer, woodworker and writer living in Brookfield, Conn.

High-tech push block. *The GRR-Ripper push block holds both sides of a workpiece against the table during a ripcut.*

scopic throat opening, the design couldn't be simpler or more elegant. The steel of the iron is standard O1, which sharpens easily and holds an edge respectably.

The plane speaks to me of makers who know what they are doing and care a great deal about it. They make smoothers to any pitch you desire (50° is my choice, or 55° for really figured or difficult woods) and some beautiful molding planes as well.

Steve Knight of Knight Toolworks has been tinkering with and improving his bench planes over the past four years. For stability and ease of manufacture, he laminates the plane body; my smoother had a sole of cocobolo with a low body of purpleheart and white oak. While its overrounded shape might not appeal to everyone, I found it very comfortable.

Plane-iron option. *The Knight plane came with an optional Japanese plane iron that sharpened nicely and held an edge well.*

Two important design aspects stand out. At the heart of the plane is a Japanese iron that came sharp and held an edge well. And ahead of the mouth is a wedge that kept the mouth tight, allowing the plane to cut fine shavings for a long time.

Not all woodworkers will be enamored with such wooden planes. Neither plane has an adjuster, but setting the iron was easy and can be quickly learned. Try one of these wooden smoothers, and you will be drawn in by their silky action of wood on wood, or the ease with which they cut 0.001-in.-thick shavings and leave polished surfaces on tough woods such as bird's-eye maple.

The Clark & Williams plane costs about $265. Contact Clark & Williams at (479) 253-7416 (www.planemaker.com). The Knight plane sells for about $200. Contact him at (503) 421-6146 (www.knight-toolworks.com).

–Garrett Hack is author of The Handplane Book *(The Taunton Press, 1997).*

Photos, this page (top) and facing page (top): Rodney Diaz

New drum sander from Craftsman

Faster, more accurate and a lot less physically demanding than using a belt sander, a good drum sander can take the drudgery out of sanding panels and face frames. Recently, Craftsman introduced its model 21518, a drum sander for the home woodworker or one-man commercial shop.

The machine features an 18-in.-wide sanding drum and a frame that's open on the end, which lets you sand stock up to 36 in. wide. The stock must be fed through the machine a couple of times—a first pass sands half of one side of the board, then, with the board turned end for end, a second pass sands the remaining half.

I did all of the sanding for the review using the 80-grit belt that's included with the drum sander. Other grits—50, 150 and 200—can be ordered from Sears Parts (800-366-7278).

With a 13-amp, 1½-hp, 1,720-rpm motor, the sander proved to have adequate power for light sanding duty. Power for the feed belt came courtesy of a variable-speed, low-voltage, d.c. motor. The variable-speed feature made it easy to adjust the feed rate—from 1 to 18 ft. per minute—to suit the material being sanded.

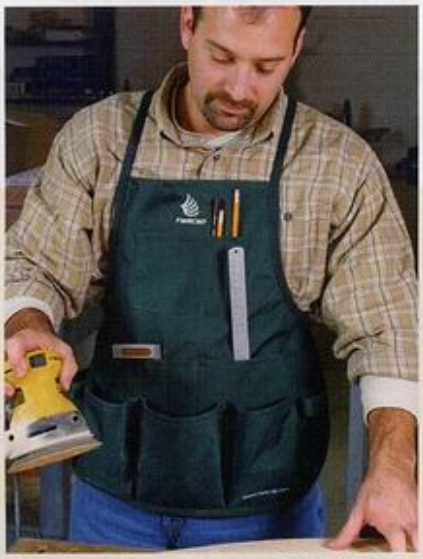
On the downside, this sander required more than its share of adjusting to get it running right. I had to tighten the coupler between the motor and the drum and adjust the drum for parallel with the feed table. Then, after fussing with the tracking of the feed belt, I had to adjust the coupler between the powered feed roller and the gear-reduction motor that drives it.

Also, when sanding full width, the drum sander had to be tilted slightly, effectively creating a wider opening on the outboard end of the drum. This step eliminated the lap mark where the sanding passes overlapped. But it was a tedious process.

All things considered, though, once the machine was tuned, it did an adequate job finish-sanding stock. Model 21518, sold only through the Craftsman catalog, costs about $700. For more information, contact Craftsman at (800) 697-3277.

—Roland Johnson builds furniture in Sauk Rapids, Minn., and is author of Automotive Woodworking *(MBI Publishing, 2001).*

Sander is a time-saver. *With an 18-in.-wide drum, the Craftsman tool can sand a workpiece up to 36 in. wide.*



Comfort and convenience. *Featuring suspenderlike straps, the 15-pocket Ballistic Apron won't irritate the back of the neck, an annoyance common to most shop aprons.*

A better shop apron

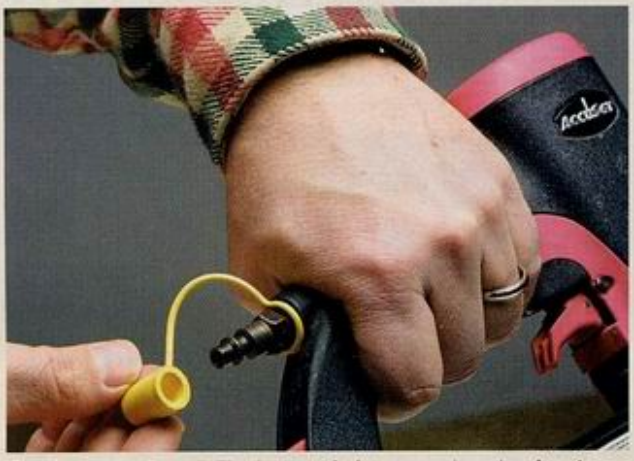
I usually wear a shop apron when woodworking, a matter of habit brought on by a shop class I took many years ago. A shop apron is a great way to keep essential layout and marking tools within easy reach.

The problem with most shop aprons is that they have a strap that loops around the back of the neck, which can be irritating once you've put 5 lbs. of junk in the pockets. But that's not the case with the Ballistic Apron by FastCap. This nylon apron has a pair of straps that go over the shoulder, cross in the back and loop through rings on the sides, finally tying in the back. The design places all of the apron's weight upon the shoulders, not the neck, making it comfortable enough to wear all day. It has 15 compartments in a variety of sizes as well as a pair of hammer loops.

The apron is available in green or black and costs $39. To find a distributor, go on-line to www.fastcap.com or call (888) 443-3748.

—Anatole Burkin is the executive editor.

Photo, this page (top): Roland Johnson



Cap keeps out crud. *The Intacap helps prevent contaminants from getting into the intake connector of a pneumatic tool.*

Caps for pneumatic tools

Air-powered tools spend a life in dusty, dirty and oftentimes damp environments—whether it's the workshop or job site. And once you unplug the hose from the intake connector, foreign material can find its way into your tool, unless you are a neatnik and actually use those plastic storage cases the tool came in.

Somebody came up with a solution for those of us who leave their tools lying around. The Intacap is a rubberlike end cap for the intake connector. When you pull off the cap, an O-ring keeps the cap dangling from the tool so you won't lose it.

Intacaps are available from Woodworker's Supply: (800) 645-9292; www.woodworker.com. A package of five sells for $9.99. I'd like to see the price come down a bit, but considering that most air-powered nailers cost a few hundred bucks, I suppose $2 insurance per gun isn't so bad. —*A.B.*

Plane-setting hammer from Veritas

To understand the need for a plane-setting hammer, one need only look at the abuse that steel hammers have inflicted on vintage wooden planes over the years. Typically, these hard-luck planes suffer from mushroomed blade ends and badly dented bodies, all caused by years of getting struck by a steel hammer.

To protect planes from such a fate, the plane-setting hammer, made by Veritas, might be just the ticket. This tool gets the job done with a softer touch, so it won't damage the blade or the plane body.

The secret to this hammer is its two-faced head—one is brass, and the other is wood. Plus, it's relatively light, weighing only 8 oz.

The brass face is for setting blades. Brass is softer than the blade steel, so any overenthusiastic strikes are less likely to damage the blade.

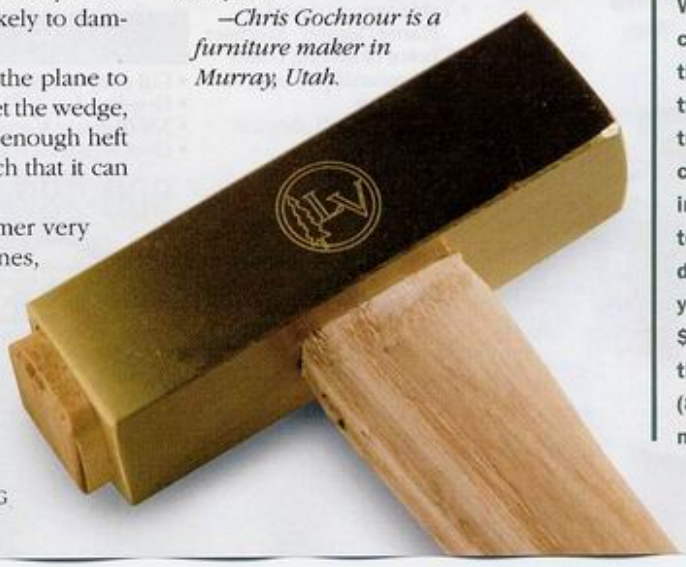
When tapping the body of the plane to decrease the depth of cut or set the wedge, the wood face is used. It has enough heft to be effective yet not so much that it can mar the plane body.

I also have found the hammer very useful for setting bench planes, adjusting molding planes and tuning my infill smoother. Indeed, in the past, I was reluctant to tap the rosewood infill of the smoother with a steel hammer, and my small wooden hammer simply was too light. But by using the wooden face of the Veritas, I was able to make adjustments without fear of damaging the body.

I also found myself reaching for the hammer to do other miscellaneous shop tasks that required the finesse of a light-duty hammer. It was especially helpful for fine-tuning jig setups and tapping dovetail joints together.

If your handplanes have to be set with a hammer, this is a good one to use. It sells for about $15. For more information, contact Veritas at (800) 871-8158; www.leevalley.com.

—Chris Gochnour is a furniture maker in Murray, Utah.



A hammer with a velvet touch. *This two-faced (brass and wood) lightweight hammer is perfect for striking steel blades or wooden plane bodies.*

Glove gets good grip. *A tight grip comes a lot easier when you wear one of these inexpensive cotton gloves with latex-dipped palms.*

Latex-dipped gloves improve grip

When a good grip would be most welcome, such as when you're trying to tighten a clamp just a little more or twist a tight screw another quarter turn with a screwdriver, these gloves can help. The palms have been dipped in latex, so they grip considerably better than bare skin. Plus, your hand doesn't have to squeeze as hard. But you won't get squeezed by the price—$11 for a dozen. For more information, contact ABC Safety Mart at (800) 646-5346; www.abcsafetymart.com. —*T.B.*

Photo, this page (bottom): Rodney Diaz

Anatomy of a Chest of Drawers

TOP
The solid-wood top is usually molded on three sides and is attached to the upper molding frame.

UPPER MOLDING FRAME
This molding frame will not move seasonally, but it allows the top and carcase to do so.

DOVETAILED CARCASE
The heart of a long-lasting case piece is a solid-wood, dovetailed carcase. Note the secondary wood species used in the top and bottom panels.

LOWER MOLDING FRAME
The lower molding frame allows the case to move seasonally and accommodates a variety of bases or feet attached below.

DRAWER-DIVIDER FRAMES
Three common styles offer a variety of looks and different degrees of mechanical strength and ease of construction.

BASE
Whether horizontal-grain bracket (shown here) or vertical-grain feet, the base is attached solidly to the lower molding frame.

DRESSING UP A BASIC BOX

A seemingly complex chest of drawers simply is a stack of components. By varying moldings, feet, drawers and drawer dividers—not to mention proportions and materials—an endless array of case pieces is possible.

Photos: Michael Pekovich

Start with a dovetailed box, then choose among options for drawers, moldings and base

BY WILL NEPTUNE

Case furniture based on a dovetailed box is found in a wide range of styles and periods. While the details vary, many pieces can be built using similar construction solutions. When I build a case, I work from a firm set of ideas—both traditional and modern—that I've found to be reliable and efficient.

The techniques required to make a chest of drawers are mostly common knowledge: dovetails, dadoes, miters, mortises and tenons. The complex appearance is the result of a straightforward sequence of simple steps. At its most basic level, a chest of drawers is a stack of separate assemblies. However, based on moldings (or lack thereof), leg treatments, drawer styles, proportions and materials, a wide variety of case pieces is possible. Like my past articles "Engineering a Table with Drawers" (*FWW* #130, pp. 40-45) and "Sideboard Strategies" (*FWW* #138, pp. 42-49), this one describes a basic, proven construction approach. The execution is up to you.

Start with a dovetailed case

When preparing your primary stock for the sides of the case, put aside strips to be used later to edge the top and bottom case panels as well as the drawer dividers. Using wood from the same board will give a uniform look to the case.

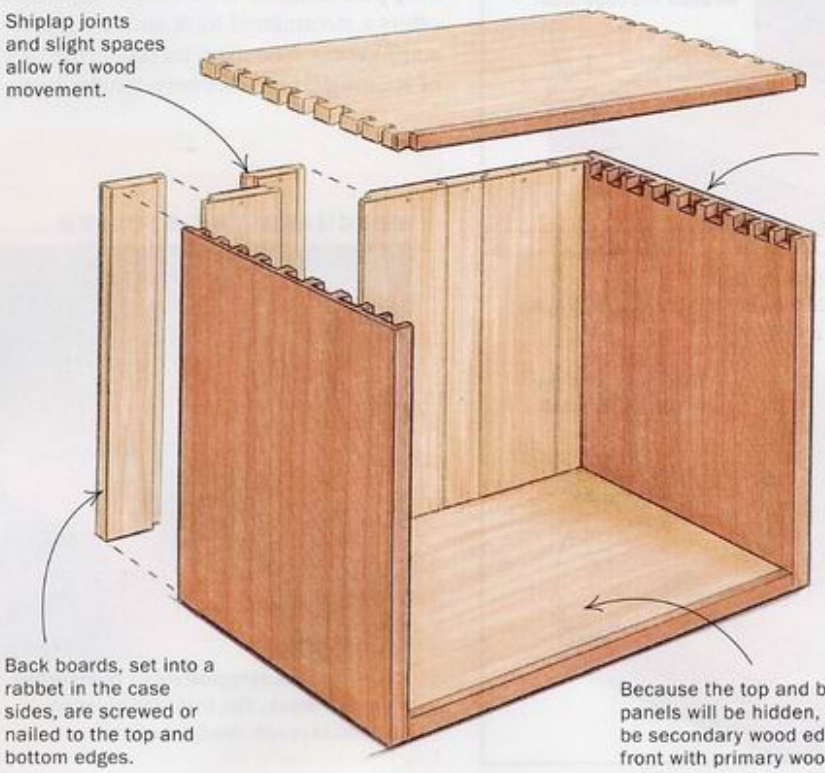
A chest of drawers begins with four panels: top, bottom and two sides. The strips of primary wood that edge the top and bottom can be glued onto the secondary-wood panels after rough-milling. Match the grain direction of all parts during glue-up so they can be finish-milled as one piece.

The case is joined with half-blind dovetails, so lay them out for strength, not appearance. You may want extra tails near the edges, especially the front, to resist loads that could pop the front shoulder.

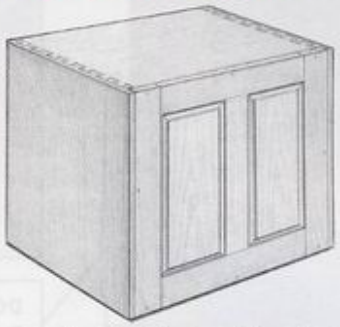
Another trick makes the joinery for the back a little easier. Run the rabbets for the back boards all the way up the sides without stopping. Then rip the top and bottom panels to be flush with this rabbet; the back boards will extend all the way up to the top and bottom of the case but be hidden by the true top, which goes on later. The back

CARCASE AND BACK CONSTRUCTION

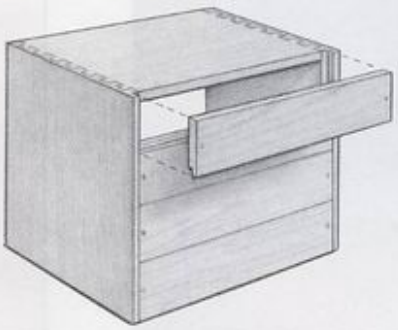
The case is joined with half-blind dovetails, which are hidden from view. Traditionally, the back consists of shiplapped boards.



BACK-PANEL OPTIONS



A more attractive frame and panel can be fit into the rabbet.



Horizontal shiplapped back boards help prevent tall sides from bowing outward.

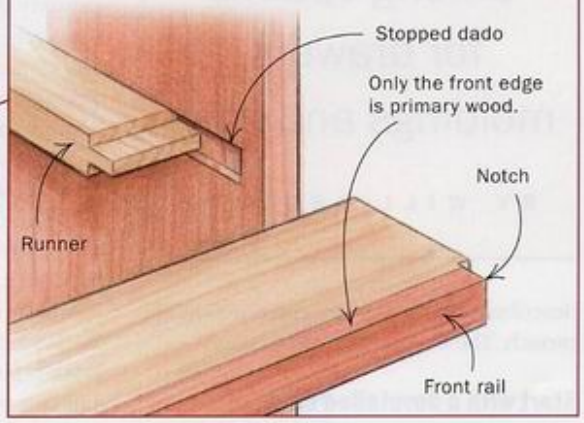
Drawings: Bob La Pointe

DRAWER-DIVIDER FRAMES

Only the front 3 in. or 4 in. are glued to the case, allowing the case sides to move. Choose a frame type based on the desired look and the need for strength.

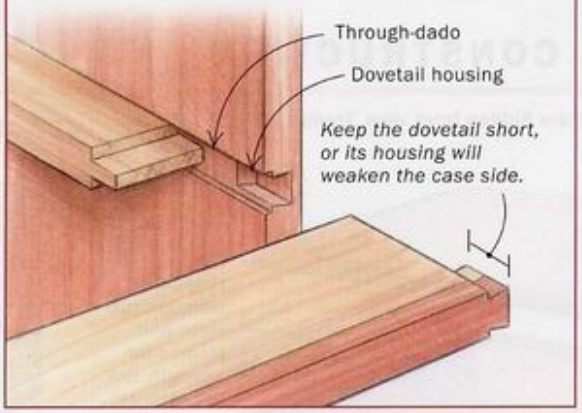
STOPPED DADOES

Basic stopped dadoes offer a clean, contemporary look and the easiest construction.



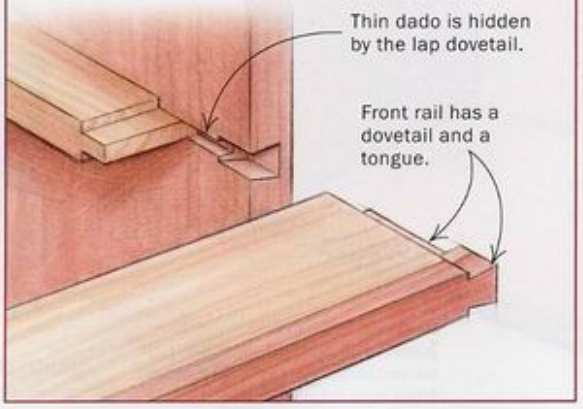
STEPPED DOVETAILS

Stepped dovetails offer a more traditional look and a mechanical connection between the case sides.



DOVETAILS WITH HIDDEN DADOES

Dovetails with hidden dadoes not only tie the case sides together but also offer a clean look.



boards, lapped in some way to allow for wood movement, are screwed to the case.

Drawer dividers: three options

Once the case dovetails have been cut, fitted and dry-clamped, it's time to work on the system of drawer dividers and supports. For function and appearance, the divider frames must stay flat. Again, secondary wood can be used for all but the front edges. Choose the inner secondary wood for stability. Avoid secondary wood that was significantly bowed in the rough, and make the front divider wide for extra stiffness. I make the fronts 3½ in. to 4 in. wide, and the less-critical back dividers 2½ in. to 3 in. The runners can be narrower, about 2 in., because they are held in dadoes. Leave the parts a bit thick to allow for leveling the frame after gluing.

Although there are other divider systems, typically I use one of the three shown at left. For all three types, I prefer to glue up the mortise-and-tenoned frame first and fit the unit to the case dadoes. But you also can fit and glue the pieces together in the case, using the dadoes to align the parts. One last note: The right time to glue up the case is after the dadoes have been cut but before building and fitting the divider frames.

Stopped dadoes—This simple approach offers a streamlined look and straightforward joinery. The main liability is the lack of sound glue surfaces between the frame

NOTCHING THE DIVIDER

A divider in a stopped dado is inserted from the back. *The front rail must be notched to reach the front of the case.*

and the case. Usually this isn't a problem, but for a tall case or one with unstable wood, you may want one of the other frame systems that use lap dovetails to tie the ends of the case together. The other types also offer the traditional look of exposed joinery.

Start by laying out and cutting the dadoes, which are about ¼ in. deep. I do the layout while the case is dry-clamped, using a story stick to avoid measuring errors. The goal is to get the pairs of dadoes at equal height and parallel to the inside faces of the top and bottom. Square up the front ends of the stopped dadoes at an equal distance from the front edges of the case (about ½ in.). The front of the frame should be flush to the case edge, but the back should be inset about ⅜ in. from the rabbets to allow the sides to shrink. Gauge the length of the dividers from the bottom of the dadoes, and cut them about 1/32 in. undersize to make the frames easier to fit.

To join the divider frames, I use mortises with open ends; then the runners need only tenons. When clamping and gluing up the frames, take diagonal measurements to check for squareness, and be sure that the frames are flat. A good tip is to level the joints on the top of the frame first. Then, as you test the frame and slide it into the dadoes, you can do all of your fitting from the bottom. The front 3 in. to 4 in. of the frame should be snug, but the rest can be eased to make it slide in the dadoes with less drag.

DRAWERS

The two common drawer styles are flush and lipped. On the lipped style, the drawer front covers the gap for a more refined look.

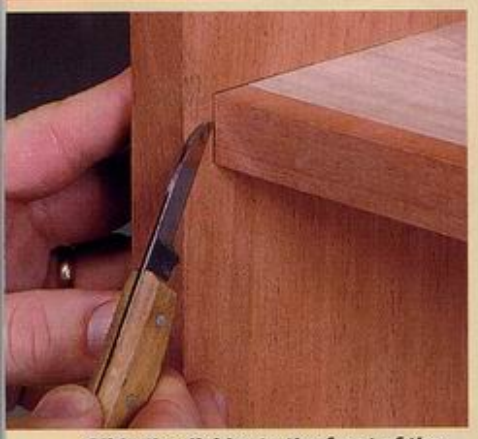
Match the divider to the drawer. *The dovetail with hidden dado offers a clean look for flush drawers (above), while lipped drawers look better with the stepped dovetail (below).*

You still need to cut a shoulder in the front of the frame so it can extend past the stopped dadoes to the front of the case.

Stepped dovetails—Adding lap dovetails to the front of the frame gives it a strong mechanical connection to the case sides. The front rail will resist forces pushing the case sides outward, and it can be used to pull in bowed sides slightly. This traditional solution is called a stepped dovetail because both the dado and dovetail are visible at the front. I like this joint with lipped drawers, where the side lip matches

Scribe for a perfect fit

DOVETAILING THE CASE SIDE

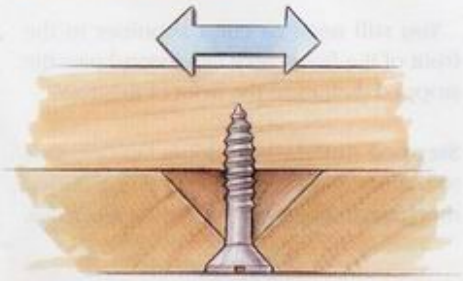


Slide the divider to the front of the dado and scribe the shoulder. *Then cut the notch in the rail.*

Dovetailed dividers go in from the front. *The dado is cut first; the dovetail housing is cut second.*

Slide in the dadoed section as far as possible. *Then transfer the layout of the dovetail onto the case side.*

Elongated screw holes are the answer. *These are elongated along the bottom side only, allowing the pieces to shift against each other without coming apart.*



the dado depth. Be prepared to spend extra time on these joints, though, because there are many surfaces that must fit at the front edge, and gaps will be obvious.

This joint uses a shallow (about 5/16 in. deep) through-dado, with a lap dovetail at the front extending into the case side.

Start by penciling in the lap location on the case sides. This gives the length of the front rail. Before gluing up the frame, notch the front rail to leave the stubs for the dovetails. Now build the rest of the frame and shape the dovetails on the front stubs. This joint will show any gaps, so work carefully and test the dovetail fit as you pare. When you install the frame, rub the rear part of the dado with paraffin wax so that any glue that drags back won't keep it from floating.

Lap dovetail with hidden dado—The third frame type uses a narrower through-dado that is hidden at the front by the lap dovetail. This dovetailed frame gives the same mechanical strength as the stepped version but has a cleaner look. When used with flush drawers, it has a neat, logical appearance. This system has another advantage over the stepped dovetail. Because the dovetail fully covers the dado, there are fewer surfaces that must close up. Use a standard dado size that is 1/16 in. or so smaller than the base of the tail, and make the dadoes about 1/4 in. deep.

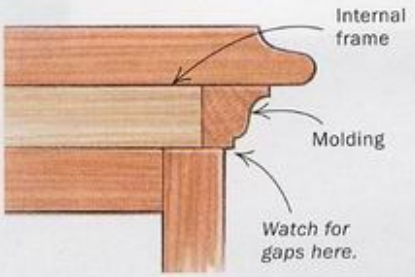
Once the frame has been made, you

The correct sequence. *First, attach the molding frame to the top (above) and then to the case using the elongated holes only. Last, screw all three parts along the front edge (right).*

FLAT VS. RABBETED MOLDING FRAME

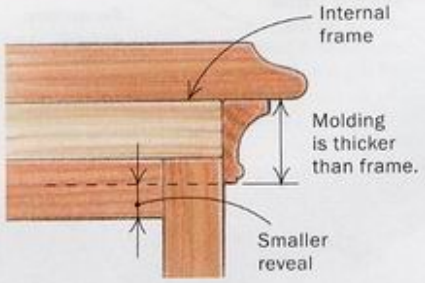
The type of molding frame will determine how much of the top or bottom edge of the carcase is visible.

FLAT FRAME



A flat frame is easier to build and fit. *But it shows the entire case edge and must lie perfectly flat.*

RABBETED FRAME



Rabbeted frame leaves the carcase reveal up to you. *Also, if the frame doesn't lie perfectly flat, the gap won't show.*

need to form the tongues, stopping them at the front and leaving extra wood for the tails. Because the tongues and dadoes will be hidden, only the shoulders for the dovetails need to be tight, and the tongues don't need to bottom out in the dadoes; however, the tongues should be snug in thickness, especially at the front.

A few tips for the drawers

Once the frames have been fitted and glued in, you may build and fit the drawers by any method you're comfortable with. Drawer fronts, of course, have a lot to do with the appearance of a chest, so look over the wood and plan the overall grain pattern before you begin.

This article presents two options: a flush drawer and a lipped drawer (see the top photo on p. 43). Both types need stops (the fragile lip molding is there only to cover the clearance gaps). One reason why I locate the stop blocks on the rear dividers is that it's easy to clamp them in place while testing the drawer. Just remember to size your drawers to make room for the stops. But the great trick here is that putting the stops on a floating frame keeps the drawers flush at the front even as the case changes depth through the seasons.

Ease the transitions with moldings

Visually, top and bottom moldings have a powerful effect. They frame the case with their strong horizontal lines and play of light. Their projection at the bottom gives the base a sense of stability and strength. An upper molding provides a transition to the overhang of the top and also balances the bottom molding.

Many times you'll see old work with moldings attached to the case itself, but these tend to fail over time as the case shrinks. Using separate frames for the moldings will give the same appearance while allowing for case movement.

These top and bottom frames can be built using either of two methods (above). Both can use secondary wood for the inner part of the frame. The first is a simple mitered frame with a molded edge. A more complex, rabbeted frame system wraps over the sides and front edge of the case. With this system you can choose how much of the front case edge shows, giving a wider range of effects.

Both frame systems should overhang the back to allow for expansion of the case. Fasten the frames to the case with screws, tight along the front but with elongated holes along the sides and back to allow the case to move.

Flat frame is quicker to build—The first step for the flat frame is to know the exact dimensions of the molding you want, its projection from the piece and the width of the primary wood. The next step is to glue the primary-wood strips onto the

BASES

A strong bottom molding frame serves as a stable platform for attaching the feet, whether bracket style (shown here) or vertical (see the facing page).

inner-frame stock and then mill the blanks to thickness.

Get the front miters fitting correctly before mortising in the flat, unmolded rear rail. Join the mitered corners with biscuits or stopped splines. Last, mold the desired profile on the outside edge.

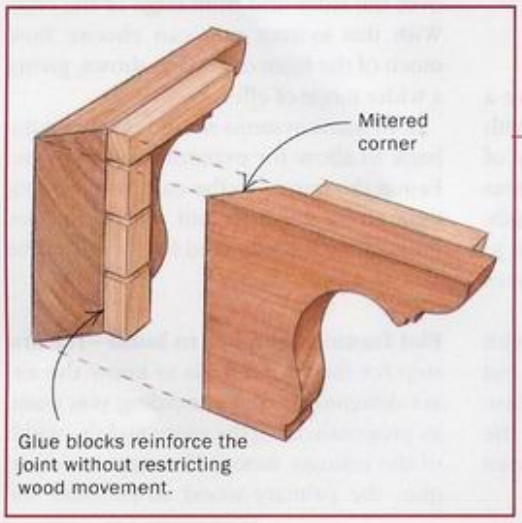
Build the rabbeted frame in two parts—The second frame system is built in two stages. The inner, secondary-wood frame is thinner than the molding, based on how much of the case edge you want covered. I build the frame first, slightly oversize, then trim it to fit the case exactly. Let the back edge overhang to hide seasonal case expansion.

Now form the rabbet with the three thicker molding blanks. Dry-fit the parts carefully, making sure the miters come together exactly at the corners of the case, keeping the end pieces long at first to allow room for adjustment. Then glue the blanks to the edges of the frame and mold the profile. The frame is held with screws as before, with slotted holes to allow for movement.

Attach the top

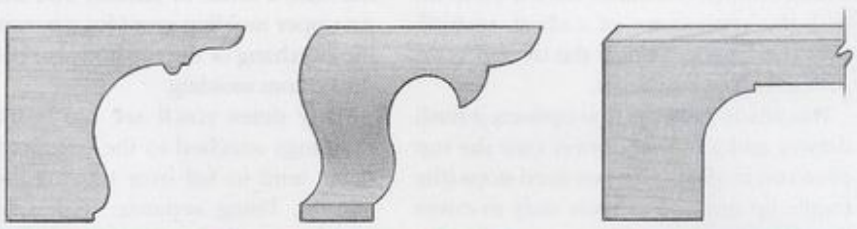
The top of the case is often molded on three edges and usually has an overhanging back to hide shrinkage and to avoid a large gap between the case and the wall.

If a molding is used below the top, it's important to let the case, the molding frame and the top move independently. All three parts are held tight with screws along the front edge to keep the miters and reveals constant. But along the sides and back, use elongated screw holes between the frame and top, as well as the case and frame. People commonly lift cases by the



BRACKET FEET

Molded or unmolded, with a wide variety of cutouts, bracket feet are used in many periods and styles. They are glued to the base molding frame (or attached to the case).



FLAT BRACKET FOOT | OGEE BRACKET FOOT | FLAT BRACKET BASE

Period or contemporary? *The choice of moldings, drawers, feet and hardware offers a wide range of design possibilities.*

Details define the style

This construction system will produce a wide variety of case pieces, depending on the combination of the individual elements. An 18th-century piece (top) combines moldings, drawers and feet common to that period. Lipped drawers soften the line of the front. A wide base molding and classic ball-and-claw feet give the piece a broad stance. The top is carefully dimensioned and molded to relate to the rest of the piece.

The bottom chest of drawers offers a more contemporary look with harder lines and surfaces, including a flush front. The curved, tapered legs flare outward, broadening the stance of the piece without looking heavy. The base and top moldings are beveled to complement the style. And the top is chamfered to make it appear thinner and to match the other elements.

These two examples are the tip of the iceberg. You could make the case taller than it is wide, or use a different array of drawers. And consider the effect of other wood species or figured wood for the drawers.

top edge, so all of these connections should be very strong.

Choose a base

The final bit of woodworking is to prepare a base. For this article I built the two most common systems, each adaptable to many leg styles. Bracket feet are cut from blanks with horizontal grain and are mitered at the front. The other leg style has vertical grain, which usually features narrower legs, often braced by flanking side pieces.

Bracket feet—Start the flat bracket feet with one long board about ¾ in. thick. The six blanks should be taken out of a single board, if possible, so the grain pattern wraps around the base, matching at the miters. It's also nice to use the same board here as you did for the base molding to help hide the joint between the base frame and the feet.

The rear feet are braced with secondary wood. The joint at this back corner can be half-blind dovetails or, more simply, a tongue and dado. The miters for the front parts can be reinforced with a spline, but usually it's enough just to butt them.

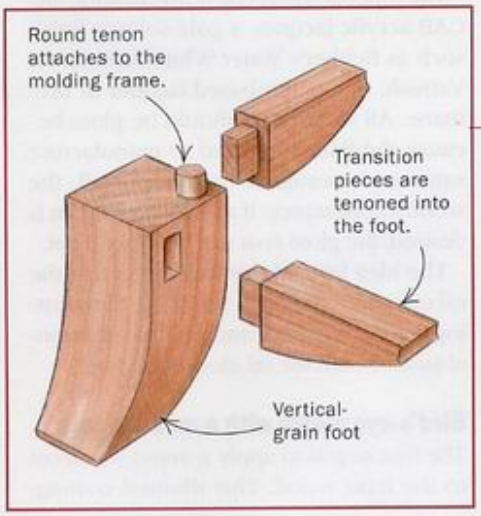
Cut and dry-fit the joints before cutting the foot profile. The assembled feet are glued to the base frame. All of the foot and base joints should be reinforced with glue blocks. A single vertical block can cause the foot to crack, so I use three short blocks with ⅛ in. of space between them.

Vertical feet with support pieces—The second construction system is seen in the saber leg with flanking transition pieces. Its main advantage over bracket feet is that the vertical grain direction allows a strong foot of a much smaller size.

Generally, a round or square tenon is cut in the top of the foot blanks to match a hole or mortise cut through the base frame. The mortise should be located away from the corner of the frame so that the miter joint isn't weakened. The transition pieces are tenoned into the foot. As before, these assemblies are glued to the base frame.

This sums up the approach I rely on for fine-quality casework, but many variations are possible. The great thing about this is that 10 people will use this information to build 10 very different chests, each one a record of that maker's taste and skills. □

Will Neptune is a furniture maker in Acton, Mass.



VERTICAL-GRAIN FEET

Vertical-grain feet come in a wide array of styles, from turned bun feet to 18th-century ball-and-claw feet to more contemporary saber feet. Most have flanking transition pieces.

Three Finishes for Bird's-Eye Maple

Pop the figure of this wood using dyes, stains, glazes and topcoats

BY TERI MASASCHI

I never would claim that working and finishing bird's-eye maple are easy, but few woods can yield such contrasting appearances. At one end of the spectrum is the natural look, with a clear finish bringing out the wood's three-dimensional quality. In complete contrast is the striking look of antique wood, where a century or more of oxidizing and accumulated patina gives it that certain glow and prominent grain. In between, there is the medium-tone appearance, with the eyes highlighted by the finishing process. Using a selection of dyes, stains, glazes and topcoats, I'll show you how to achieve the appearance of your choice.

The natural look, or "bird's-eye lite"

Good surface preparation is especially key to the desired outcome on bird's-eye maple. This wood does have the tendency to tear out during planing. Using a wide-belt sander for larger surfaces and scraping for delicate details, you can eliminate most of the voids. Subsequent sanding with 120-, 150- and 180-grit paper on a random-orbit sander is all that is necessary to prepare the wood for its finish.

If you enjoy the clean, crisp look of unstained maple, wood selection is critical: There can be no sapwood, mineral streaks or widely different colors of stock, because a natural finish can't hide these discrepancies.

For a light finish, use Danish oil or Waterlox Original Sealer thinned with mineral spirits in a one-to-one solution. Pour a liberal amount on the wood and wet-sand with 400-grit paper or a sanding sponge, creating an oil-and-sawdust slurry. This will be driven into the eyes, leaving the surface smooth. One application should be sufficient. Additional coats can be added, but more oil makes the maple more yellow.

The topcoat should be nonyellowing like CAB acrylic lacquer, a pale solvent finish such as Behlen's Water White Restoration Varnish, or a water-based lacquer or urethane. All clear coats should be gloss because the flatteners used to manufacture satin and semigloss coatings dull the wood's appearance. If a lower final sheen is desired, the gloss coat can be rubbed out.

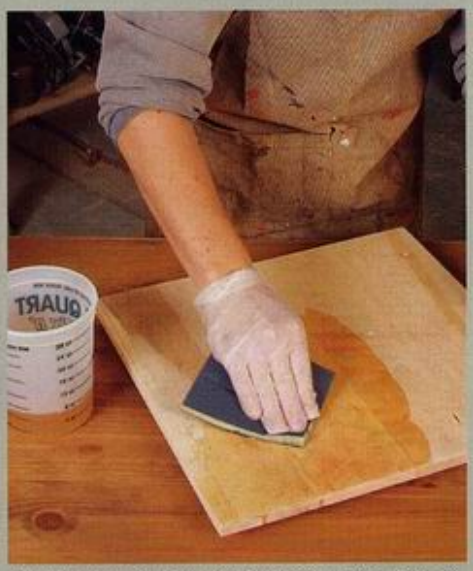
The idea behind this method is that the oil enhances the eyes, while the film coating creates a deeper and more dimensional surface than the oil alone can give.

Bird's-eye maple with a medium tone

The first step is to apply a tinted washcoat to the bare wood. This thinned coating,

A NATURAL LOOK

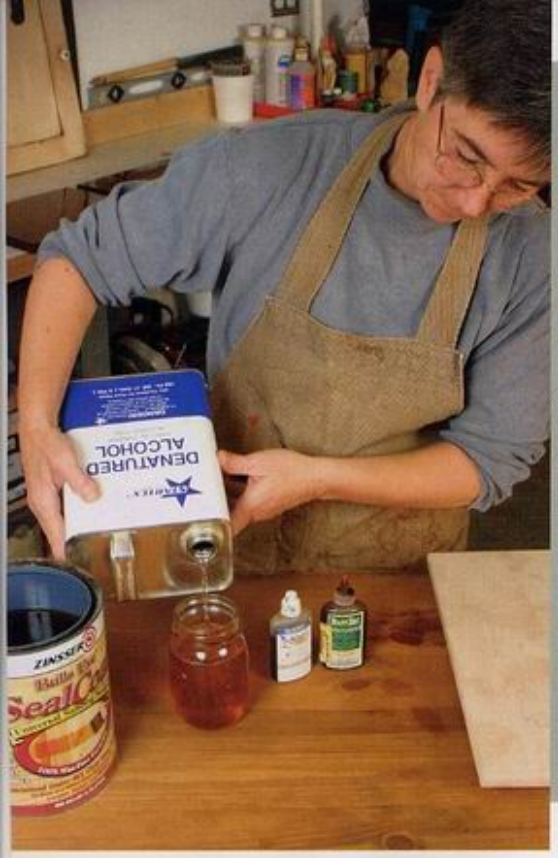
Create a penetrating oil. *Mix equal amounts of Danish oil and mineral spirits. To avoid spills when pouring, keep the opening at the top to allow air to enter and liquid to exit smoothly rather than in irregular gulps.*



Fill the eyes and smooth the surface. *Pour a generous amount of the mixture onto the wood and then sand it in with a 400-grit sanding sponge. The oil-and-sawdust slurry fills voids in the bird's eyes, making them more prominent.*

Topcoat with a clear finish. *To avoid adding a tone to the natural-looking wood, use a nonyellowing finish, such as Behlen's Water White Restoration Varnish.*

Photos: Mark Schofield



A MEDIUM TONE

Combination dye and seal. *This 2-lb. cut of premixed blond shellac is diluted with an equal volume of denatured alcohol (left). A few drops of concentrated dye give this washcoat some color (above).*

First finish layer. *Brush on the dyed shellac. This layer also seals the wood from the next glaze (below).*

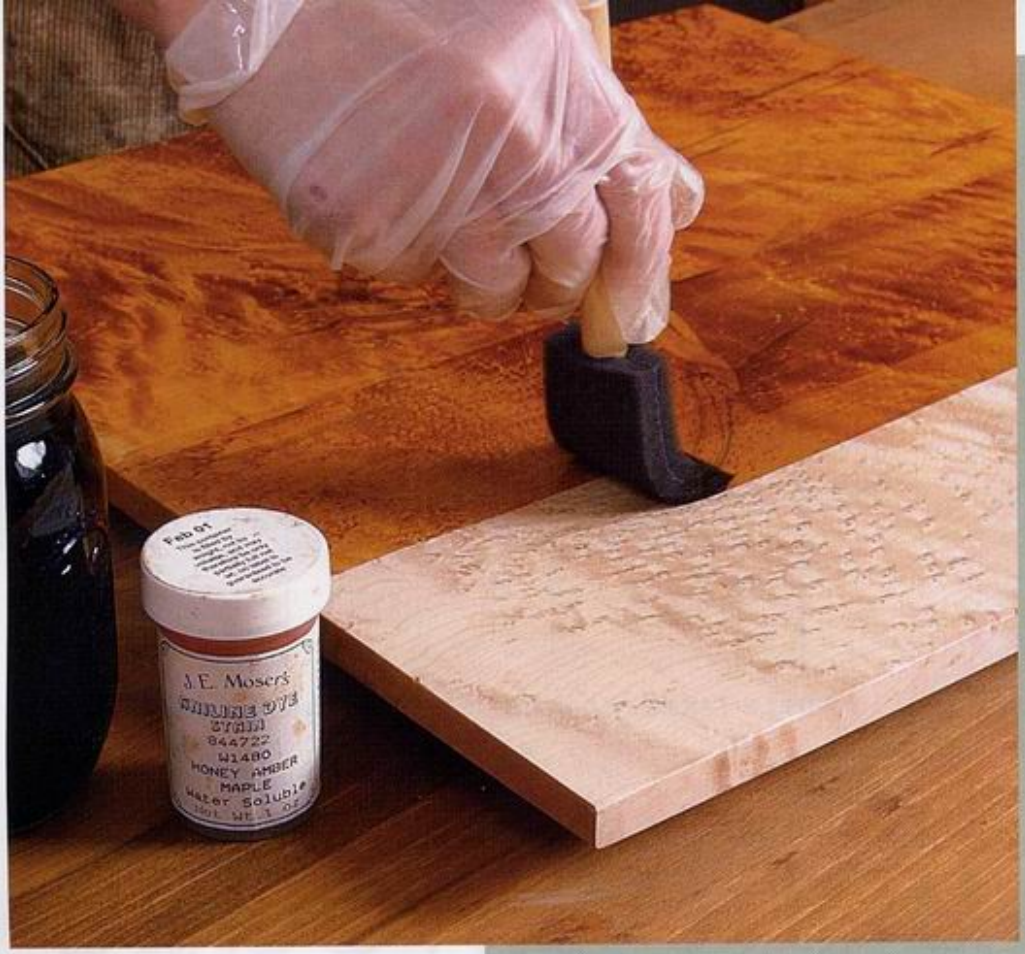
typically dyed dewaxed shellac, adds a layer of color and creates a barrier coat between the bare wood and a layer of glaze.

Either dissolve some blond shellac flakes or cut Zinsser's SealCoat by 50% with denatured alcohol to form a 1-lb. cut. For each 4 oz. of shellac, add a drop or two (depending on the desired intensity) of a concentrated dye such as TransTint or Wizard Tint. Honey amber or Vandyke brown are beautiful colors on bird's-eye maple. An alternative to tinting the shellac would be to use darker shades of shellac, such as orange or buttonlac. In either case, apply the shellac evenly with a brush or spray gun, let dry and scuff-sand with 320- or 400-grit paper.

Now apply a second layer of color using a shading and glazing stain. These heavy-bodied pigment glazing stains are designed to go over sealed surfaces only, being too thick and opaque for raw wood. Glazing stain has enough oil in it to be wiped off a sealed surface easily, leaving only a thin layer of color or glaze. On large surfaces it creates subtle changes in color tones, and if left heavy in corners and profiles, it gives the appearance of built-up patina. I use a warm brown such as Behlen's burnt-umber shading and glazing stain.

After wiping off the surplus, let it dry for at least three hours. Then add another washcoat of undyed dewaxed blond shellac

A second layer of color. *Brush on a shading and glazing stain, then wipe it off. Leave a thin layer of color with a little extra glaze in the corners and voids to give a more interesting look to the piece.*



ANTIQUE MAPLE

Dye, then seal. *Apply a water-based dye (left). When it's dry, seal it with a coat of dark dewaxed shellac, such as buttonlac.*

The first glaze. *Apply burnt-umber shading and glazing stain to the sanded shellac. Allow it to penetrate, then wipe the surface, leaving residue in any voids.*

to set the glaze before topcoating with a solvent- or water-based gloss finish.

Multiple layers of color give an antique look

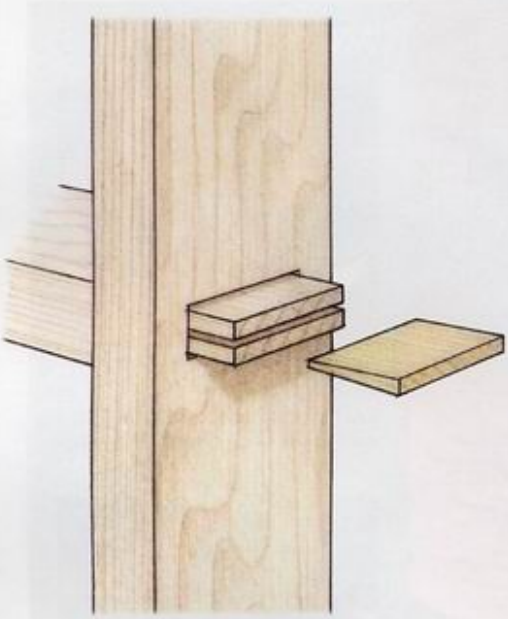
Woodworkers who have built a beautiful period piece with bird's-eye maple face a challenge to re-create the 18th-century tone and, at the same time, pop the figure in a transparent way.

Begin with a coat of water-based honey-amber maple dye. First wet the surfaces with water, and when they're dry, dewhisker them with 220-grit sandpaper on a felt or cork block. This not only eliminates raised grain but also allows greater stain absorption. The dye stain penetrates deep into the wood, creating a perfect tone that will shine through the subsequent layers of color. Washcoat with a dewaxed dark shellac such as garnet or buttonlac, allow it to dry and then scuff-sand.

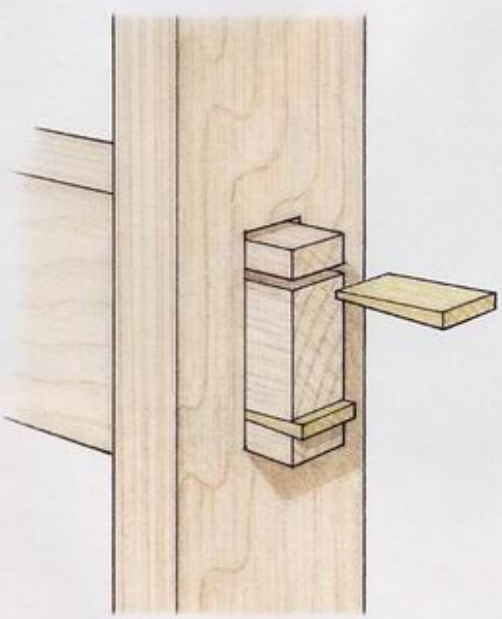
Apply a generous amount of burnt-umber shading and glazing stain, let it sit for a few minutes to bite into the surface, then wipe it off smoothly to leave a thin glaze of color on the surface and more color lodged in any details. Let it dry for three hours and then washcoat with dewaxed blond shellac to set the glaze. Antique reproductions respond well to this process, which can be repeated to deepen the caramel tone that antiques usually have. After the desired tone has been reached, a second glaze can be added to age the piece. Mix raw-umber shading and glazing liquid with black shading and glazing or Sherwin Williams' Gilsonite (also known as asphaltum), and thin with mineral spirits to a brushing consistency. Apply this mixture over most of the piece and into all of the corners and crevices. Wipe off the bulk of the glaze, leaving dark lines in the deep recesses. This completes the visual perception of antique bird's-eye maple. Seal with a washcoat of dewaxed shellac and finish with a gloss clear coat. □

The second glaze. *Mix raw-umber and black shading and glazing stain thinned with mineral spirits. Brush on the mixture and wipe it off. Residue left in crevices imitates an antique look (right).*

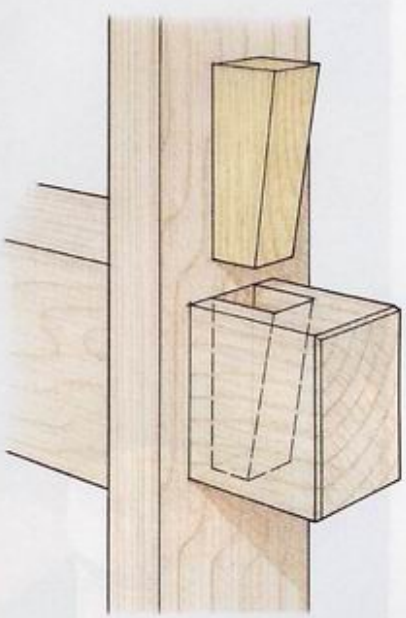
Teri Masaschi is a professional finisher, restorer and instructor who lives near Albuquerque, N.M.



SINGLE FIXED WEDGE



DOUBLE FIXED WEDGES



SINGLE LOOSE WEDGE

The Mighty Wedge

Fixed or loose, wedged joinery adds strength and style

BY JOHN NESSET

Since antiquity, wedges have served as an important means of joining wood. Low-tech but effective, they remain a useful and attractive element of joinery, evoking a rustic past when life (we like to think) was simpler and more straightforward. Like dovetails and other exposed joinery, wedges convey a sense of solid, honest craftsmanship, even to the uninitiated.

A whole book might not be enough to detail every application for the mighty wedge, but I'll cover the two major types in their basic single and double forms. From there, furniture makers can derive other variations.

Wedges fall into two general categories: fixed and loose. Both types are driven into through-tenons to reinforce the joint. Fixed wedges generally are driven into the end grain of a tenon with glue added for reinforcement, then trimmed flush. They are appropriate where the wedge risks working loose.

Loose wedges are driven into a mortise that goes crossways through a protruding tenon. Loose wedges are not glued or fastened, so they must be oriented so that gravity and/or friction will keep them in place. They are used for two reasons: to create a knockdown joint and for decorative effect.

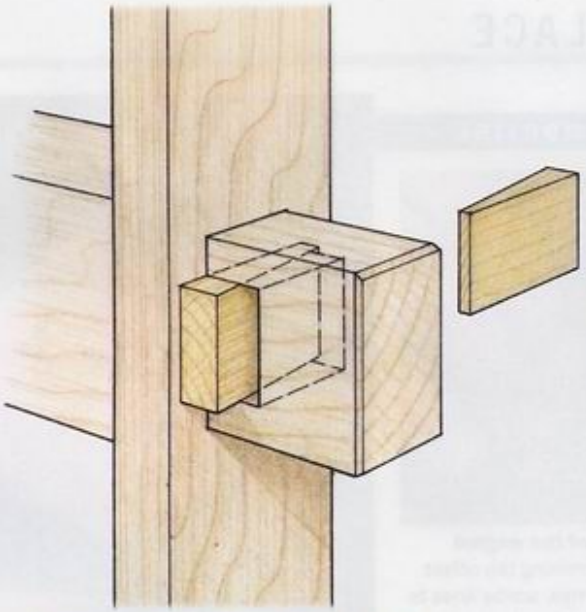
Wedges and grain alignment

Whichever wedge type you choose for your project, you must take into account grain direction. The hard-and-fast rule is that a wedge must be oriented in the mortise so that it applies pressure against the grain, not across it. As young Abraham Lincoln demonstrated in his famous fence-building project, pressure applied across the grain splits the wood. In the case of fixed wedges, this fact of life will determine whether you need a single wedge or double wedges (see the drawings on the facing page).

A single fixed wedge

It's worth spilling some extra ink about this first type of wedge, as it will illustrate many of the general principles for all wedged joints. For example, for any of these wedged joints, start with a carefully fitted, square mortise and tenon. For a fixed wedge (or

Photos: Asa Christiana



DOUBLE LOOSE WEDGES

wedges), leave the tenon just a little long, so it protrudes from the mortise ¼ in. or so.

The magic angle is 5°—The most important thing to know about wedges, fixed or loose, is to cut them at an angle of 5° or less. In this range, friction alone will hold the wedge to the tenon. Also, if the two halves of the tenon are bent too far by a thick fixed wedge, they will be weakened at the base, thus weakening the joint.

Of course, wedges driven into the end grain of a tenon will be subjected to pressure (from racking forces and seasonal expansion and contraction) that would overwhelm friction alone, which is why the bond should be strengthened with glue.

Angle the mortise and slot the tenon—I like to cut a flare into the mortise to accommodate the wedging action, creating a dovetail of sorts and locking the joint. But often it is quite acceptable not to angle the mortise. In this case, just use a thinner wedge—cut closer to 2° or 3°—to increase the pressure against the sides of an already snug mortise.

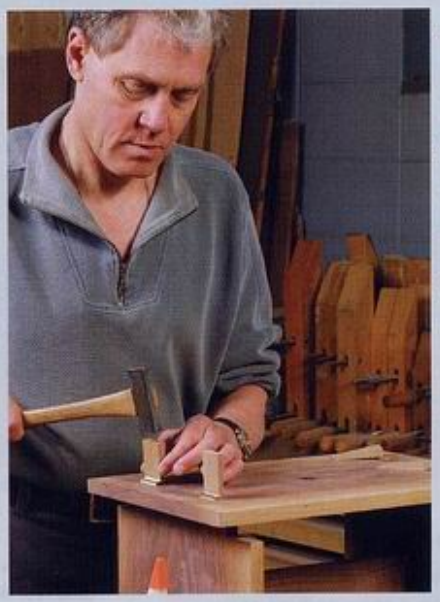
A 5° angle works well for single fixed wedges, spreading each half of the tenon outward 2½° (see the drawing on p. 50). The top of the mortise wall should be angled on each side to accommodate the wedging action. This offset is laid out on the edges of the mortise, on the outside face of the workpiece.

To chop the angled mortise wall, first pare away the edge of the mortise, steadily creeping back toward the scribe line and down toward the bottom edge of the mortise. The goal is to reach the line and the bottom edge at the same time with a straight surface in between. Use the edge of the chisel to check the cut for flatness.

Next you'll want to saw a thin kerf in the tenon to receive the wedge. A handsaw leaves the right size slot. But before sawing this slot, drill a hole a little larger than the kerf through the tenon where the base of the slot should end up: about ⅛ in. from the tenon's

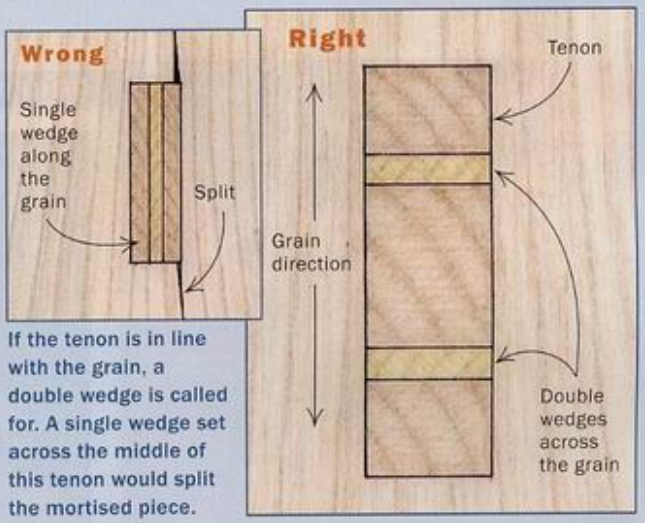
Drawings: Vince Babak

Orient wedges to avoid splitting



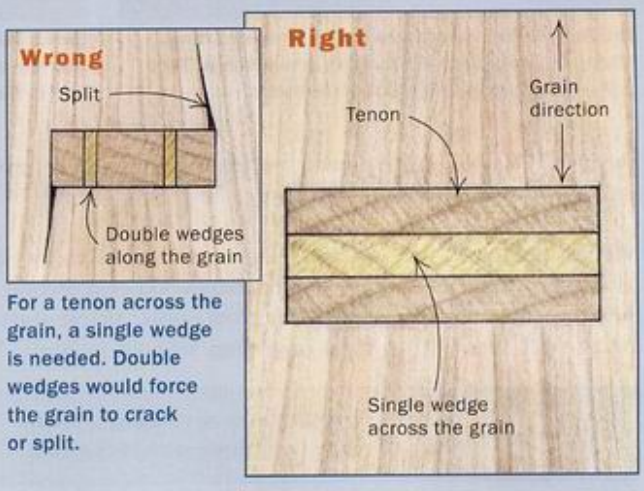
A wedge must push the tenon against the end grain of the mortised piece to avoid splitting the wood. So the orientation of the tenon—along the grain or across the grain—determines the number and orientation of the wedges.

TENONS ALONG THE GRAIN



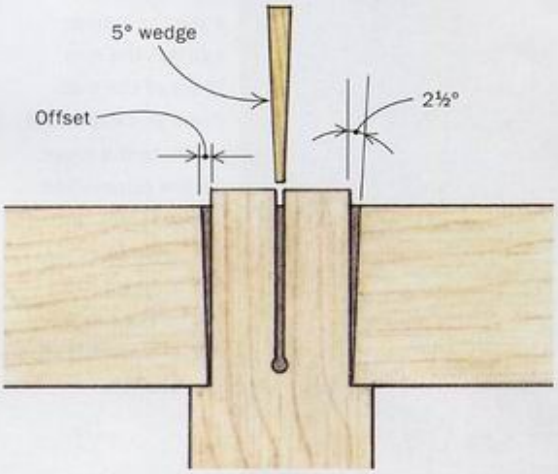
If the tenon is in line with the grain, a double wedge is called for. A single wedge set across the middle of this tenon would split the mortised piece.

TENONS ACROSS THE GRAIN



For a tenon across the grain, a single wedge is needed. Double wedges would force the grain to crack or split.

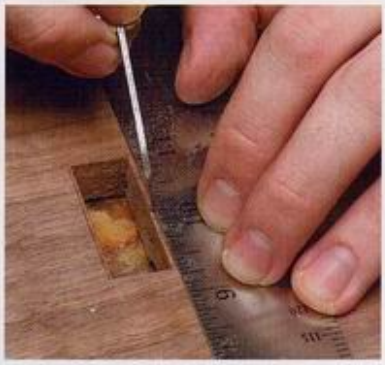
FIXED WEDGES ARE GLUED IN PLACE



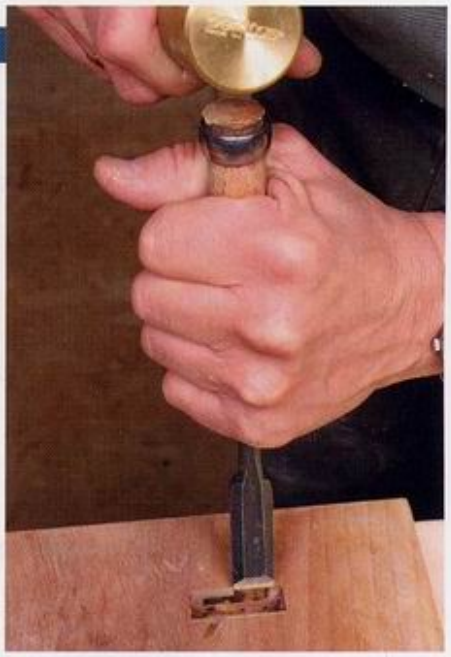
SINGLE FIXED WEDGE

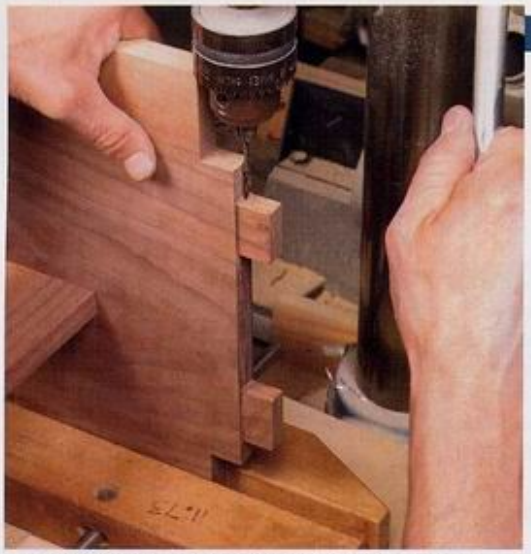
A 5° wedge requires each face of the mortise to be angled at 2½°. Draw a cross section of the joint to determine the amount of offset at the top of the mortise.

ANGLE THE MORTISE



Lay out the offset of the angled mortise. *After determining the offset at the top of the mortise, scribe lines to indicate where the angled cuts begin (above). Work steadily back toward the scribe line (right) and down toward the bottom edge of the mortise.*





Drill a hole to prevent the tenon from splitting. *Clamp the workpiece vertically in a handscrew. Then drill a hole through the width of the tenon.*

PREPARE THE TENON FOR WEDGING

Saw a kerf down to the hole. *A handsaw leaves an appropriately narrow kerf in the tenon.*

A trick for a clean, flush joint. *To prevent tearout when planing a tenon flush, score a line around the base of the tenon.*

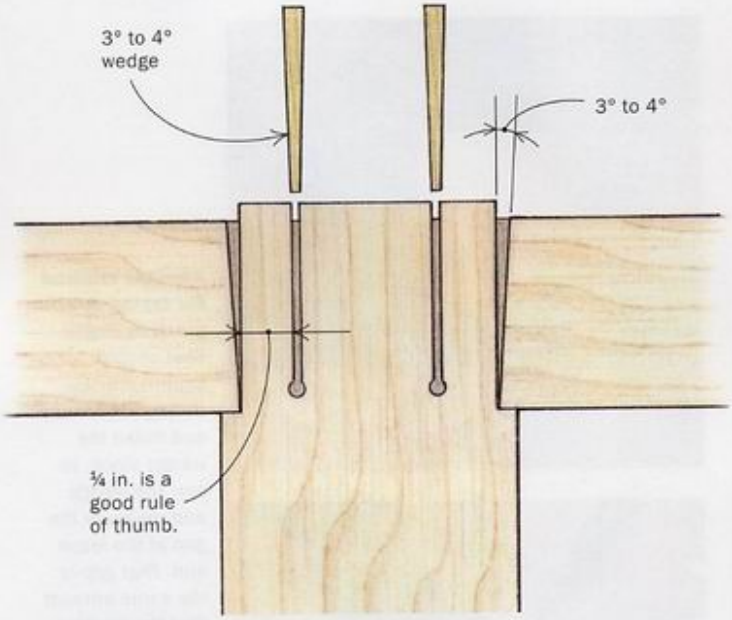
shoulder. This hole helps prevent the tenon from splitting beyond the slot when the wedge is driven in.

Wedge basics—When choosing the wood for a fixed wedge, avoid very soft species such as pine, basswood or redwood. Instead, steer toward species such as yellow poplar, maple and elm, which will stand up to hard pounding without splitting. Use straight-grained wood for the same reason. If you use an oily wood like ebony, clean it thoroughly with acetone immediately prior to gluing.

Cut the wedge exactly as wide as the tenon. Then lay out the appropriate wedge angle and saw it any way you like. Handplane it if the cut is rough. The thickness of the wedge will be determined by where you crosscut it. To allow for the wood to compress slightly, you should add a bit to the overall thickness. There is an easy way to do this: Square off the bottom of the wedge at a point where it is a hair (roughly 1/32 in.) thicker than the sawkerf.

Sharpen the squared edge to a point to make it easier to start in

Watch it on the web — To see a video on wedging a tenon, go to www.finewoodworking.com.



DOUBLE FIXED WEDGES

Each wedge in a double array displaces its end of the tenon by the full thickness of the wedge.

the slot. Then square off the thick end of the wedge at a point where it will protrude from the top of the tenon.

Driving in a wedge—Assembling and gluing-up fixed-wedge joints can be nerve-wracking. I often clamp the assembly to keep the joint square and tight while the wedges are pounded home.

Do a test-run first, making sure that clamps won't come undone when you start waling away with the hammer. Drive in the wedge slightly to check its fit. Then pull apart the joint and apply glue to all surfaces, including some inside the sawkerf and on both faces of the wedge at its narrow end. Then insert the wedge and drive it in with a hammer. The hammering sound will change when the wedge is home, and you should see the tenon halves press tightly against the walls of the mortise.

If the wedge is wider than the head of the hammer that you're using, protect the wedge head with a block of wood as you drive it home. Be careful to hold the block square as you pound on it. When the glue dries, trim the protruding wedge and tenon flush.

Double fixed wedges

With a few additional considerations, the procedures for single fixed wedges apply to double fixed wedges. Like single wedges, double wedges are used in through-tenons both to add strength and to give a decorative touch, but double wedges are oriented across the tenon, making them much narrower.

I use a 3° or 4° angle for double wedges, which is the same amount the tenon sections will bend and the mortise wall will be angled (see the drawing above).

Basically, the wedges go in near the ends of the tenon. But ex-

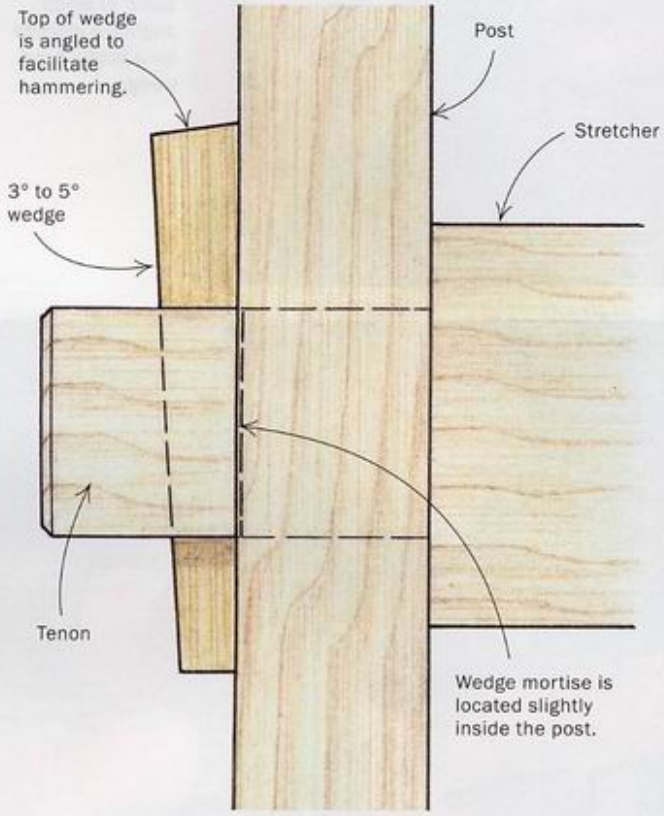
Angle the ends of the mortise. *The layout and chopping techniques are the same as when angling a mortise for a single fixed wedge.*

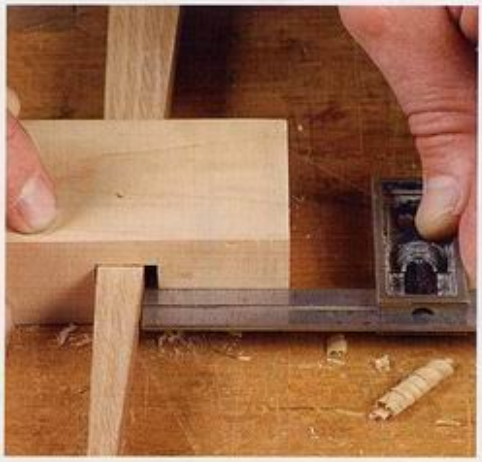
Sometimes clamps are needed. *Nesset uses clamps to keep the tenon shoulders snug and square while he drives home the wedges.*

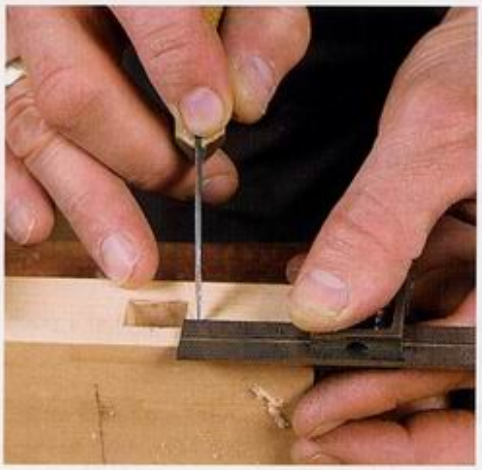
LOOSE WEDGES CAN BE DISASSEMBLED

SINGLE LOOSE WEDGE

This wedge should be oriented vertically so that gravity pulls the wedge downward when the joint wiggles, tightening it. One side of the wedge mortise is angled to match the wedge.



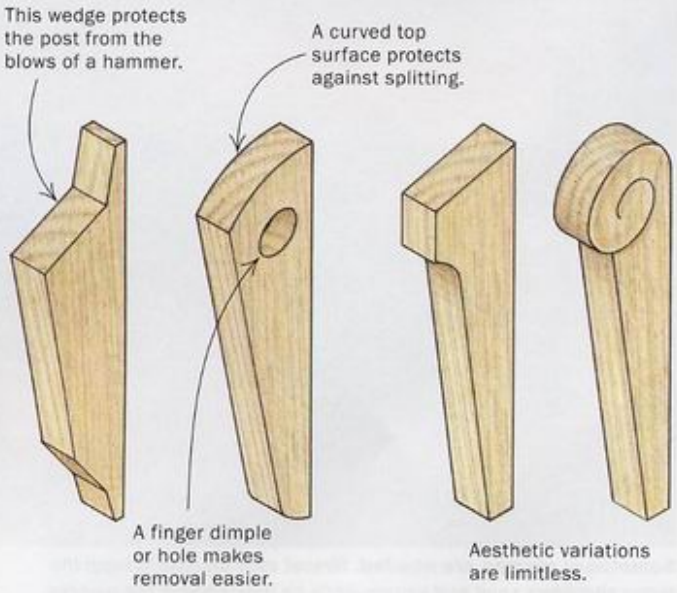




Another method for laying out the mortise angle. *First chop a square mortise through the tenon and make the wedge stock. Insert the wedge and measure the gap at the loose end. That gap is the same amount that the mortise must be offset to match the wedge angle.*

LOOSE WEDGES ADD STYLE

There are many possible variations on the loose wedge, some functional, all decorative.



actly where to place them is a factor of how flexible the wood is. They should not be so close to the ends that the bent pieces will be weak at their base, but they should not be so close to the center that the outer pieces won't spread easily. A good rule of thumb is ¼ in. from the end of the tenon.

Drive in the wedges equally, each a little at a time. Otherwise, the wedges will look uneven when the tenon is trimmed flush.

Loose wedges can be single or double

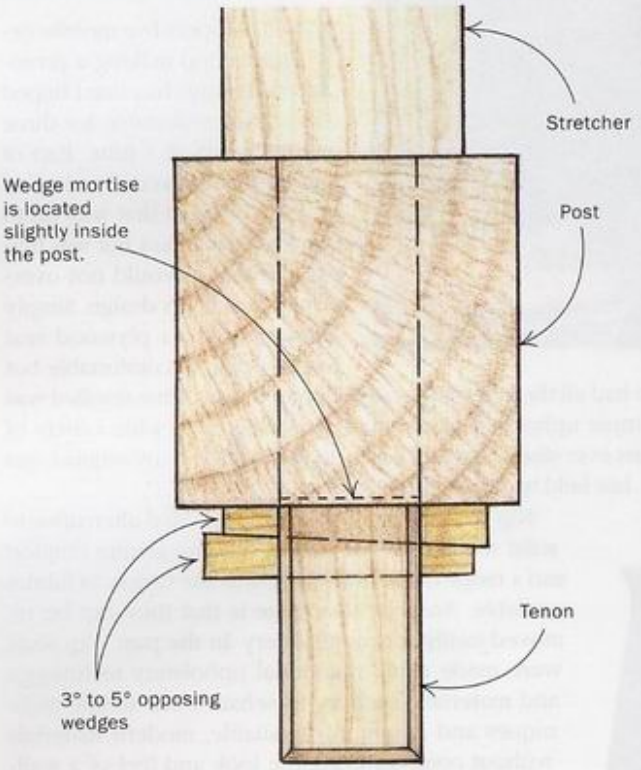
As I said earlier, loose wedges offer a greater decorative effect and a sturdy knockdown joint, suitable for a trestle table, a bed frame or the base of a workbench, among other applications.

Many of the principles that apply to fixed wedges also apply to loose ones. The 5° limit holds true, and the wedging action must apply pressure against the end grain of the mortised piece. However, unlike fixed wedges, which are driven in with the grain of the tenon, loose wedges are driven in perpendicularly to the grain and should be made from wood as hard or harder than the stock that they wedge to minimize compression against the end grain.

Single and double loose wedges are oriented differently. The single loose wedge generally is oriented vertically, allowing gravity to work in its favor. Double loose wedges, on the other hand, are

DOUBLE LOOSE WEDGES

This type is used when the tenon is too tall to hold a long vertical wedge. The wedge mortise is horizontal and is left square because it holds two opposing wedges. Gravity won't tighten the wedges, but the mortise is easier to cut.



Try the fit, looking for gaps. *The wedges may need light planing to adjust their fit in the mortise.*

Then mark them to length. *These wedges will end just inside the edge of the post.*

oriented horizontally in a square mortise, wedging against each other. An occasional tap might be necessary to retighten the joint.

The familiar trestle base offers a typical application—connecting the long stretcher to the posts—for either type of loose wedge. A long, shouldered tenon at each end of the stretcher goes through the post, protruding sufficiently from the other side to accommodate a mortise for a wedge or wedges.

Start with a square, snug mortise and tenon, and a square mortise for the loose wedge(s).

Single loose wedge is vertical—Single wedges, with their thick ends sticking up in plain sight, often are stylized for greater decorative effect (see the bottom drawings on the facing page).

For the single wedge, cut a square mortise vertically through the protruding tenon. Then angle the mortise face that is farthest from the post to match the wedge. I usually go with an angle of 3° to 5°. Cutting a taper into the wall of this long, narrow mortise is trickier than tapering the short mortises for fixed wedges, but the technique is the same. Lay out the offset on the wider end of the mortise, and begin removing the corner, working back toward the bottom edge and your layout line. Check the mortise wall often with a small straightedge to make sure you are keeping it straight. A mortising chisel will work better than a paring chisel, tracking along a straighter line as you chop downward.

It's important to have clean, square corners inside the wedge mortise; otherwise, the wedge will catch and could split the tenon.

Double loose wedges are another solution—If the tenon is just too tall or thin for a long vertical mortise, use double loose wedges oriented horizontally. Double loose wedges work by locking against each other as well as against the mortise. One wedge is inserted from one side and one from the other, and both are driven in until the two angled faces lock. Orientation is horizontal instead of vertical because the bottom wedge would work loose and fall out in a vertical configuration. With each edge of the wedges and the edges of their mortise neatly chamfered, the double wedge makes a useful, strong and attractive joint.

I cut double loose wedges at a similar angle as singles, but I leave them thinner than single wedges when cutting them to length. This way, the two wedges can fit in a smaller, neater-looking mortise. Double wedges also are usually wider than single loose wedges, to offer more friction between their faces. □

John Nesset is a furniture maker in Minneapolis, Minn.

A Slim, Comfortable

This system works for most chairs and uses common materials

In 1979 I spent five months designing and making a prototype dining chair that I hoped would be comfortable for three or four hours at a time. Part of that effort involved creating an upholstered seat that was up to this formidable task but was thin enough that it would not overpower the chair's design. Simply gluing foam to a plywood seat was not only uncomfortable but also had all the grace and style of a muffin top. What resulted was a simple upholstery detail that I have used in a wide variety of chairs ever since, in thicknesses up to 2½ in. And my original seat has held up nicely these 24 years.

Slip seats are an upholstered, padded alternative to solid wood or woven seats, offering greater comfort and a range of looks as endless as the variety of fabrics available. Another advantage is that they can be removed easily for reupholstery. In the past, slip seats were made using traditional upholstery techniques and materials, such as horsehair. I use simple techniques and commonly available, modern materials without compromising the look and feel of a well-made traditional seat.

My slip seat consists of three different densities of foam on a thin plywood platform, which is slotted to allow it to flex and conform to the person using the chair.

An upholstered slip seat complements a beautiful chair. *Using modern materials, it's not difficult to construct an elegant seat that will remain comfortable for decades.*

Cut slots in the seat platform

I use ¼-in.-thick plywood for the seat platform of dining chairs, while larger chairs that are designed to be used in a living room may have ½-in.-thick platforms. I always use Baltic-birch plywood for seat platforms because it has more laminations than other plywoods and the core is free of voids and quite strong.

Cutting a series of slots front to back on the platform makes it much more flexible and thus comfortable. The slots are 3⁄16 in. wide, approximately 2 in. apart and extend to within 2 in. of the perimeter (see the drawing on the facing page). Then install T-nuts on the top side, which allow the upholstered platform to be attached and removed as needed.

For an inset slip seat like the one shown at left, the platform should come up ⅛ in. short all

Photos, except where noted: Asa Christiana; this page (left): Michael Fortune

Slip Seat

BY MICHAEL FORTUNE

around the inside of the seat frame. Foam and fabric added later will fill the gap.

Build up the foam layers

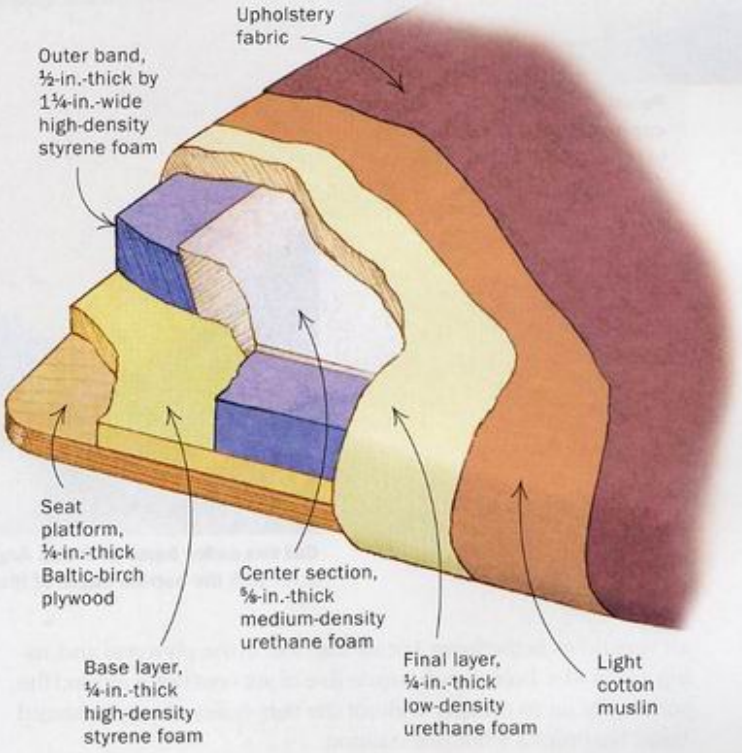
Moving from bottom to top, the foam layers go from high- to low-density (firm to soft). The closed-cell, high-density styrene foam used as the base layer of the seat is sold as sleeping-pad material for camping. It is available at camping-supply stores in thicknesses ranging from ¼ in. to ¾ in. To attach and laminate the foam pieces, I use spray adhesive, following the directions on the can for a permanent bond.

Put down a base layer of dense foam—Start the upholstery sequence by determining how thick (and comfortable) you want the final upholstered platform to be, then choosing the appropriate thicknesses of foam to get you there. For a dining chair, a final thickness of 1 in. to 1¼ in. is appropriate, so I start by attaching a layer of ¼-in.-thick high-density styrene foam to the plywood platform. (The fractional sizes given here are approximate, because the materials I buy in Canada come in metric sizes.) Thicker seats can be made simply by increasing the thickness of this base layer and building up the outer band of firm foam that follows.

Apply the foam oversize, then trim it with a knife, scissors or the bandsaw (fine-tooth blade) so that it is proud of the plywood by 1/16 in. The next step is easily overlooked (to the embarrassment of the person sitting down in the chair), and that is to provide some

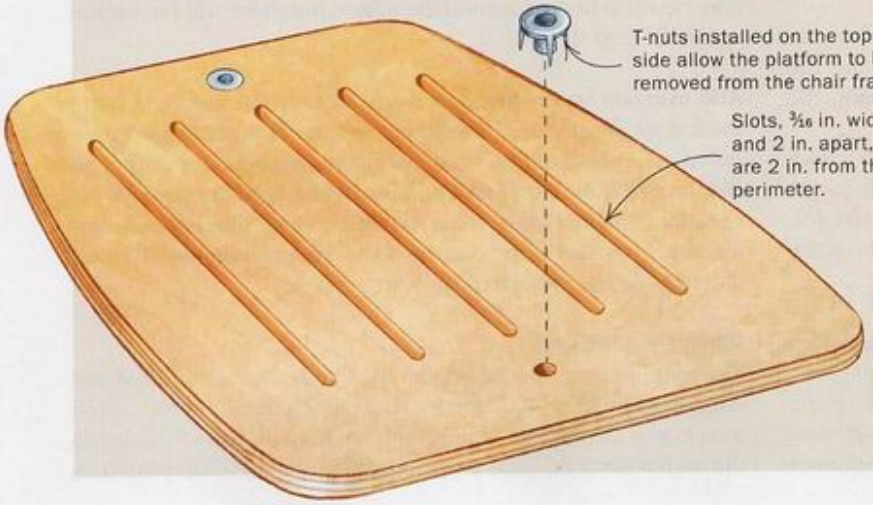
SEAT ANATOMY

This slip seat, made from plywood and a few types of foam and fabric, has a thin, flat profile, yet it's comfortable and durable.



START WITH A FLEXIBLE FOUNDATION

The seat platform starts with ¼-in.-thick Baltic-birch plywood and can be adapted to fit many types of chairs and seat configurations, from versions that overlay the seat frame to platforms that are inset into the seat frame.



Slots add some give to the stiff material. *These can be cut a number of ways, but Fortune prefers to use a template-guided router for consistent results.*

Drawings: Melanie Powell

BUILD UP LAYERS

Punch five holes for air to escape. *Align these with the slots in the plywood platform below.*

Cut the outer band of foam. *Angle the bandsaw table to cut two beveled pieces from a single strip. Apply it flush with the outside edges of the platform, beveling the ends for neat joints.*

air vent holes in the foam. Locate the slots in the plywood and, using a ½-in.-dia. hole punch, create five or six vent holes around the surface for air to escape. Without the vent holes, the upholstered insert becomes a whoopee cushion.

Add an outer band of high-density foam—To avoid the rounded, muffin-top look, the next step creates a firm dam around the perimeter of the seat. This is done by attaching a band of high-density foam, about ½ in. thick by roughly 1½ in. wide. If you are unable to find ½-in.-thick material, you can build up layers of thinner material.

It is important to bevel the inside edge of this outer band to ease the transition between the high-density styrene foam and the medium-density urethane foam that will fill the center. Without the bevel, the change in firmness will be too abrupt.

The high-density foam can be cut on the bandsaw with a fine-tooth blade. First, cut strips 2⅜ in. wide. Then tilt the table to 45° and rip the strips into equal parts. Attach the front piece first, followed by the sides and finally the back. Bevel the ends of the pieces so that they mate nicely with each other.

Fill the center with urethane foam—The next step involves filling the center with medium-density urethane foam. I get low- and medium-density urethane foam from a local fabric store. For the center section, use urethane foam that is slightly thicker than the dense foam used for the outer band. For a perimeter thickness of ½ in., for example, I recommend that the urethane foam be ⅝ in. thick.

Cut the foam about ⅜ in. bigger than the opening all the way around and leave the edge square—not at a 45° bevel. Spray adhesive on one side of the urethane foam and on its edges. Then spray the center surface of the seat, including the 45° edge but not the remaining top surface. Attach the square-cut edges of the urethane foam to the 45° edges of the band, working in from the corners. The center of the urethane foam will form a bubble. Press down the bubble into the center area in a uniform manner. There may be small bumps around the edges, but these will be evened out in the next step.

Add one last layer—The next step is to wrap the surface in ¼-in.-thick, low-density urethane foam. Lay the seat platform upside down on a piece of thin urethane foam cut about 2 in. larger all around. Spray the exposed 2-in. band of foam and the edges of the platform, and then lift the foam so that it bonds to the edges, avoiding large wrinkles at the corners. Lay a knife flat on the plywood and trim the excess foam flush to the surface.

Cover the platform

The seat platform should be wrapped with thin, neutral-colored cotton muslin in preparation for the upholstery fabric. The cotton muslin can be stretched lightly with medium effort and stapled to the underside of the platform, followed by the upholstery fabric. A

Start at the corners. *Using spray adhesive on all of the mating surfaces, attach the corners of the center section of medium-density foam to the corners of the high-density outer band.*

Work in toward the middle of each edge. *Be careful to mate each square edge of the center section as smoothly as possible with the beveled edge of the outer band.*

Last, press down the center section. *Working from the edges toward the center, compress the softer, oversize center section as evenly as possible.*

good hand stapler will work, but an air-powered stapler that shoots narrow staples is much easier to use, particularly if you intend to make a lot of upholstered chairs. I use a Haubold stapler with ¼-in.-long wire staples, which tend to drive in completely, holding the fabric firmly.

Care has to be taken to read the upholstery fabric. There may be a pattern that should be kept centered or stripes that should be kept straight. If the fabric has a nap, it should point toward the back of the chair so that the person using the chair is less inclined to slide out. Use only upholstery fabric to cover a slip seat. Fabric made for clothing or drapery will become threadbare quickly.

The fabric is attached in much the same way that an artist's canvas is stretched onto a frame: Start in the middle, stretching the fabric front to back, and tack down just the center of the front and back edges. Then stretch the fabric side to side and tack down the middle of the side edges. Now work toward the corners, adding a few staples at a time as you move outward. The tension used to stretch the fabric should be equal on all sides. When you reach the

ONE LAST LAYER

First, ease the edges of the dense outer band. *This material is easily machined, sliced and sanded.*

A final layer of foam smooths the bumps. *Lay the seat platform upside down on ¾-in.-thick low-density urethane foam. Apply glue only along the sides of the platform and the exposed foam. Then pull up the foam evenly against the sides, being careful to avoid bumps and gathers.*

WRAP IT UP

The first fabric layer is cotton muslin. *Stretch the fabric across the middle, from front to back, placing a few staples in the middle of the front and back edges. Then stretch it side to side and attach it the same way.*

Work toward the corners, a few staples at a time. *When you are near the end of an edge, skip ahead to the corner before doubling back to fill in the staples between. This should help you avoid deep wrinkles.*

corners, pull the fabric around tightly, trying to avoid overlaps and wrinkles. Finish off this upholstery job by covering the bottom of the platform with black polyester cloth.

Options for installing the seat

The slip seat can be supported in a number of ways, depending on the application. Most of my chairs have slip seats that are fully or at least partially set into the seat frame. To support these, I glue a plywood ring into the seat frame. It serves two purposes: supporting the seat platform and strengthening the seat frame. Like the seat platform, the thickness of the plywood seat ring is determined by the overall size of the chair. As the seat frame is assembled, the ring is set into a deep groove about ⅝ in. below the top edge. Then the upholstered platform is squeezed into the space above the ring, hiding the edges of the platform.

An alternative to insetting a slip seat into a seat frame is to let the upholstered platform hang over the front rail of the seat frame. In this case I usually attach a curved wood lip under the front edge of the platform, strengthening it and creating a plush look. If the slip seat must overlay the seat frame, it can be attached to wood blocks that are glued inside the frame.

To attach the seat platform to the wood blocks or plywood ring, you must locate the attachment holes. I cut pieces of ¼-20 threaded rod about ¾ in. long and sharpen one end of each by filing it. To mark the location of the platform T-nuts, I thread the sharp bolts into the T-nuts and press down the upholstered platform into position. Then I drill the clearance holes in the seat ring and attach the slip seat with round-head machine screws.

The result is a smooth, seamless, low-profile seat that will remain comfortable for many years. □

Michael Fortune is a studio furniture maker in Toronto, Canada.

Staple the upholstery fabric the same way. *The two tabs of white tape indicate the alignment of the stripes.*

Last, cover the back with black polyester. *Staple it down and trim the excess.*

Shop-Built Extension Tables

Side and outfeed tables fold down to save space

BY DWAYNE J. INTVELD

When using a tablesaw to cut a large workpiece or a full sheet of plywood, it's important to provide extra support surfaces for the stock. But like many woodworkers, I don't have enough room in my shop to have extension tables permanently fixed in place. So after I recently added a new fence system to expand the ripping capacity of my tablesaw, I built a side table that readily folds down out of the way when not needed. This foldable table allows easy access to my grinding wheel, which is located adjacent to the tablesaw.

And while I was at it, I replaced my somewhat flimsy portable outfeed roller with a sturdy outfeed table that folds down behind the saw. I have the option of opening it in two stages, depending on my needs at the time. The first stage provides a 36-in. main outfeed table; the next stage produces a secondary outfeed table that adds about another 30 in. to the main table, handy for extralong stock.

Although the side and outfeed tables enhance the versatility of my tablesaw, the impact on shop space has been minimal. With both tables open, a 4x8 sheet of plywood remains supported throughout the entire cut. Yet, when folded, the tables add little to the footprint of the saw.

Foldable outfeed table. *Intveld used torsion-box construction to build the outfeed tables, a technique that makes them both light and strong.*

A few caveats to consider

Remember that the drawing dimensions are based on building the tables to fit my 10-in. Powermatic 66 tablesaw, which sits on a 2-in.-tall wood frame The extra couple of inches raises the top of the table to 36 in., a height better suited to my 6-ft. 4-in. frame.

Also, the rip-fence system on my tablesaw is made by Biesemeyer. If you use a different type, unless it's a Biesemeyer clone, you'll likely need to modify the way the tables connect to the saw, especially at the outfeed end.

Finally, because the outfeed table sits just behind the saw when folded up, the table won't work with a saw that has a motor or any other obstruction sticking out the back. The side table, however, should be adaptable to any saw.

Side table

The side table consists of a tabletop, a connector that joins the tabletop to the saw and a side leg frame that supports the tabletop when it's open.

The table and the connector are made of a maple frame rabbeted to accept ¾-in.-thick particleboard. To create a smoother surface with extra durability, I added plastic laminate to the top face.

To make the leg frame, I cut grooves in 1¼-in.-thick maple rails and stiles to accept a ¼-in.-thick maple plywood panel. For added strength, I glued the panel into the grooves.

Once the leg frame was assembled, I joined it to the outboard end of the tabletop with a piano hinge. When folded, the leg frame ends up neatly housed in the

tabletop frame, held in place by a pair of double-ball catches.

Although not shown here, I added a 1½-in. square leg between my shop floor and the right end of the Biesemeyer front rail. The leg provides additional support for the rail when the side table is opened. To allow for length adjustment of the leg, I installed a threaded insert in the bottom end of the leg, then I added a carriage bolt with a locking nut into the insert. The length of the leg can be fine-tuned to an uneven floor simply by threading the carriage bolt in or out.

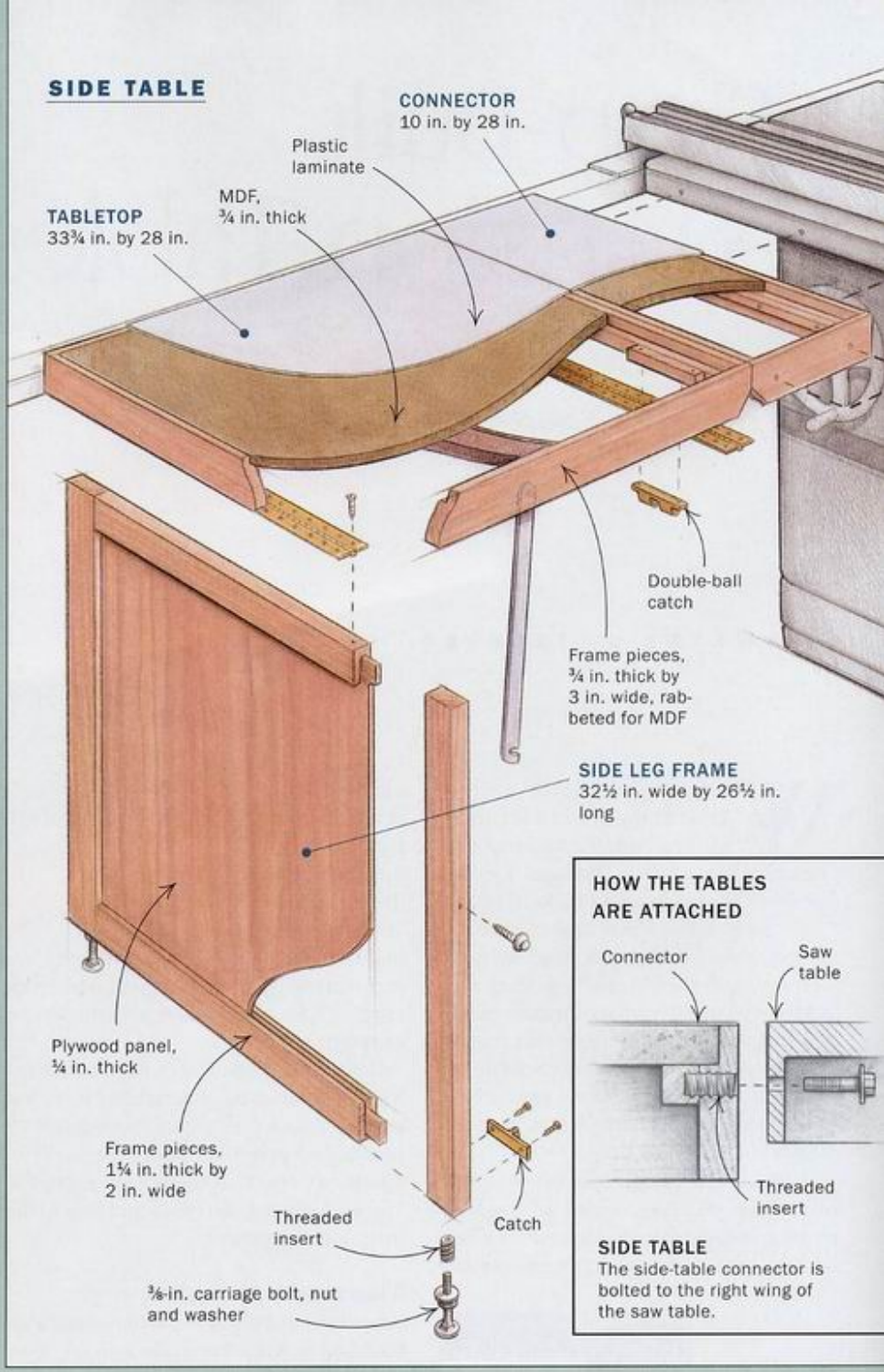
Outfeed table

I built the main and secondary outfeed tables using torsion-box construction, a technique that sandwiches strips of gridwork between thin outer skins. The resulting structure is strong and stiff—much like a honeycomb—yet it's relatively lightweight.

The tables almost disappear. *Shop space grows considerably when the extension tables fold down.*

First I made the four-sided maple frames of the torsion boxes, then I glued one of the ¼-in.-thick medium-density fiberboard (MDF) skins to each frame. I then filled these shallow boxes with strips of ¾-in. by ¾-in. pine, half-lapped and glued to the MDF. On the main tabletop, the grid includes two wider strips. These wide strips align with the two miter-gauge slots on the tablesaw when the tabletop is mounted to the saw. The wider stock allowed me to rout a pair of grooves in the top to provide clearance for the miter-gauge bar.

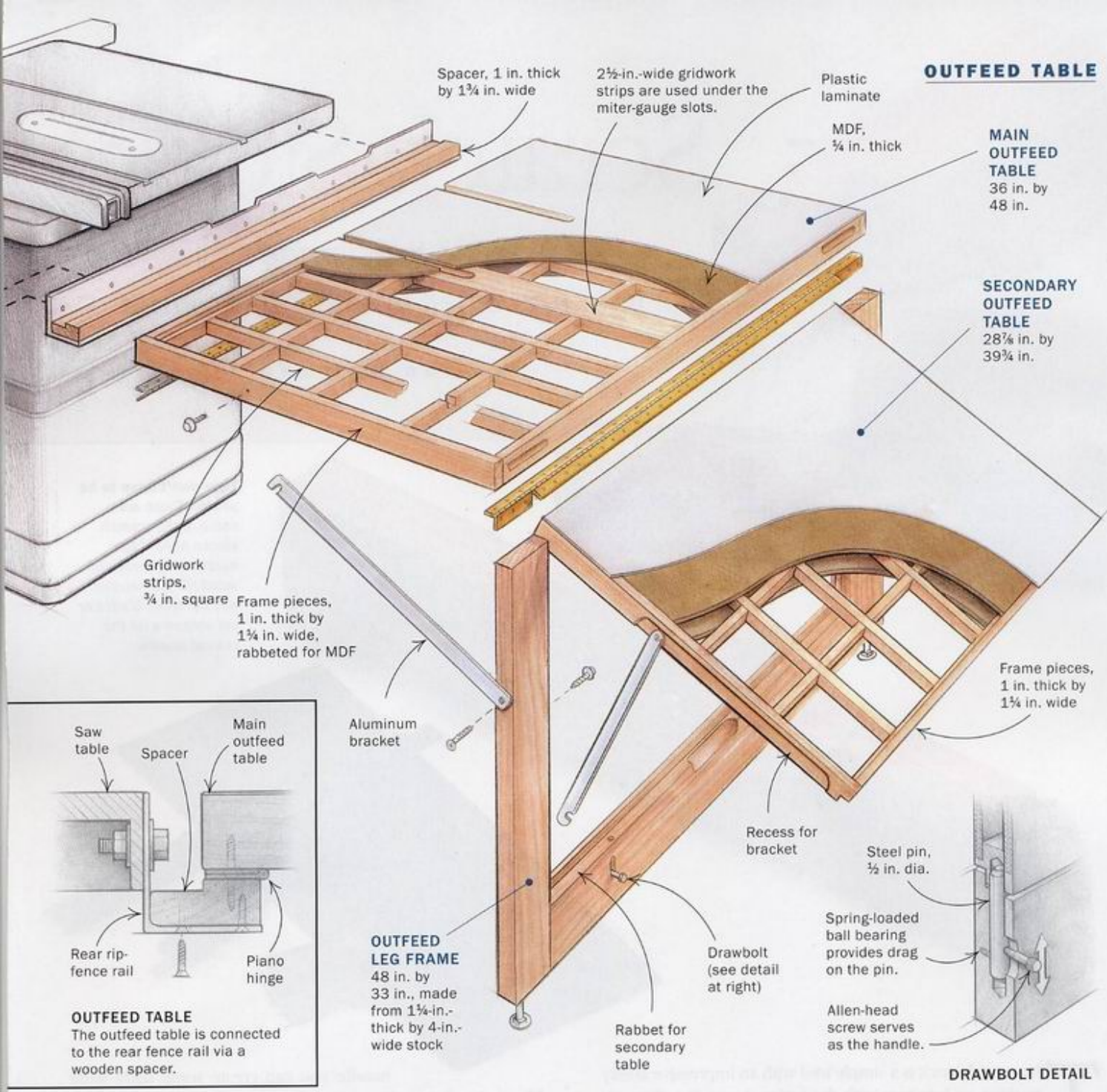
Once the gridwork was in place, I was ready to add the second skin to the top of the boxes. First, a coat of glue was applied to all box and gridwork surfaces that would mate with the skin. I put the skin on top, then added a few bricks, which provided all the clamping pressure I needed. After that, I applied plastic laminate to both faces of each tabletop.



Outfeed leg frame adds support—The outfeed leg frame is made up of a single rail mortised into a pair of stiles. A piano hinge serves as the remaining side of the frame, and it provides a means to mount the leg frame to the main outfeed table.

The secondary outfeed table nests inside the leg frame, mounted to the same hinge. But to allow the top to pivot independently of the leg frame, I cut one leaf of the hinge in two places, with the cuts made just inside the edges of the stiles. By the way, two ½-in. rabbets—one on the rail and one on the secondary table—work together to create a simple stop.

Drawings: Bob La Pointe



A pair of drawbolts keeps the leg frame and secondary table together as a single unit while swinging to an opened or closed position. I couldn't find drawbolts that suited my needs, so I ended up making my own.

Fill gap with a spacer—The outfeed table is supported by the rear rail of the Biesemeyer fence. I shortened the rear rail's length to 45 in. so that it attached only to the table of the saw and the connector piece for the side table. Also, I enlarged the holes used to mount the rail to the saw. The larger holes gave me wiggle room to fine-tune the height of the table.

A spacer, made from maple, was added to the rear rail to elevate the outfeed table so that it ends up flush with the saw table. The lengthwise rabbet in the spacer provides clearance for the bolts that secure the rail to the saw. To attach the spacer, I bored 5/16-in.-dia. holes, spaced 8 in. apart, through the rail. Then I screwed the spacer to the rail with #12 roundhead wood screws.

At this point, I applied varnish to all exposed maple surfaces. Then I adjusted the carriage-bolt feet to get everything level. After that, and probably for the first time ever, I actually looked forward to cutting a full sheet of plywood. □

Dwayne J. Intveld is an engineering manager living in Hazel Green, Wis.

Photos: Tom Begnal

Scratch Stocks

Use these handmade tools to shape small details on furniture

BY ROB MILLARD

They don't have to be pretty. *These are some of the scratch stocks Millard has made using scraps of wood for the handles and bandsaw blades or old scrapers for the cutting blanks.*

The scratch stock is a simple tool with an impressive ability to dress up furniture with distinctive decorative elements that are exactly the right shape and size. I made my first scratch stock years ago from a piece of oak scrap, and I've made a number of others since then. My shopmade tools aren't as fancy as some commercially available beading tools, but they work, which is all that I require of them.

With scratch stocks, you can shape a wide range of moldings in both straight and curved work. The tool does have some limitations, though. Being slow, a scratch stock is not the right tool for a large run of molding. Also, it's hard to start or stop a scratch stock in the middle of a board (leaving you with some handwork); nor does it work as well across the grain or on softwoods. A scratch stock is best suited for smaller shapes, but with a closely matched handle you can create some fairly wide moldings. Another approach is to use several different cutters, in stages, to obtain a surprisingly complex molding.

Start with a basic scratch stock for beads

The simplest scratch stock I make is an L-shaped piece of oak with a bandsaw kerf cut into it and two screws for clamping the cutter in place. I chamfer the guide edges of the handle to facilitate using it on concave curves with a tight radius. I make the cutters from old cabinet-scraper blades or used bandsaw blades. I first apply layout fluid (the metal dye that some people call bluing) to the cutter blank. I use a machinist's carbide-tipped scriber to draw the profile and then begin filing to those lines using coarse files. Don't allow too much of the cutter to protrude above the vise; otherwise, it will

Photos, except where noted: William Duckworth

BEADS

FLUTES AND REEDS

WIDE MOLDINGS

flex, causing the file to screech and dull quickly. I finish with fine files, being careful to maintain a square cutting edge.

You can put a slight bevel on your cutter to improve the cutting action. But the bevel limits you to using it in only one direction, taking away one great advantage of the scratch stock—its ability to handle reversing grain. I also hone the faces to remove burrs. For this I use a fine, pocket-size diamond stone. I usually end up having more than one profile on a cutter, and I always keep them for future use. When laying out the cutter profile, the more the blade is supported by the handle, the better the cutter will work.

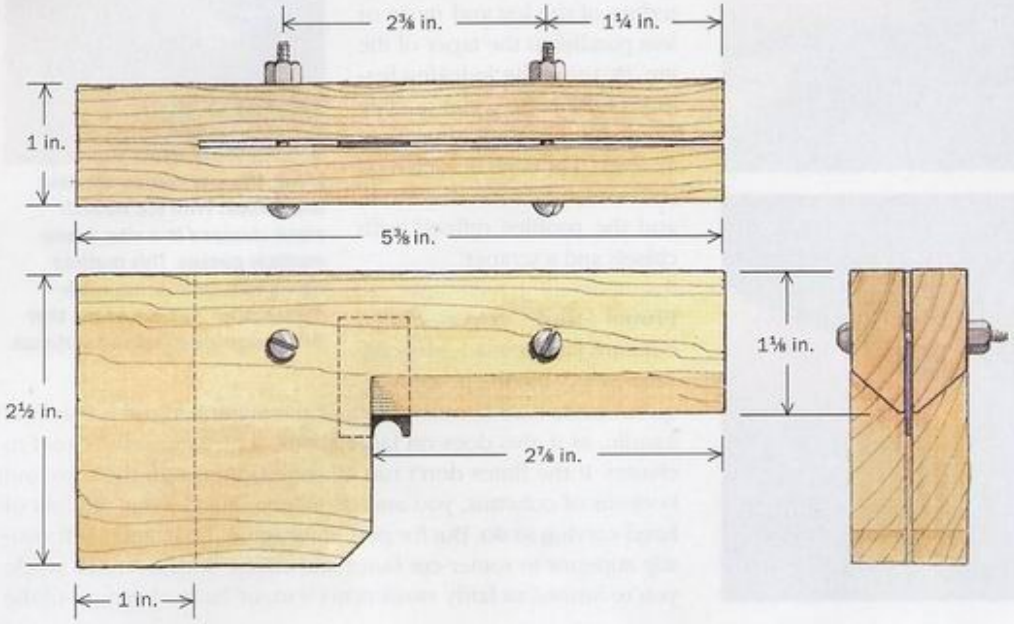
Use scratch stocks for a variety of shapes

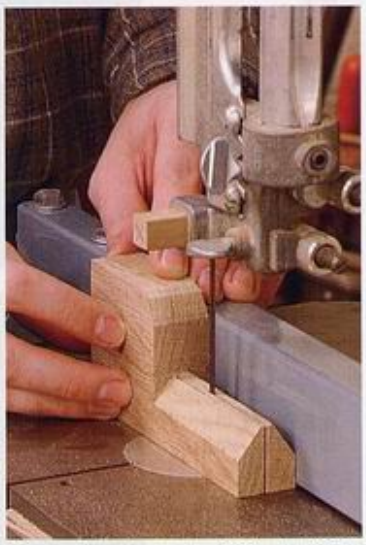
Using a scratch stock couldn't be simpler: Apply light downward pressure as you firmly push the scratch stock forward or draw it toward you. At first, it helps to tilt the tool slightly in the direction of the cut, but you should make the last pass with it as close to vertical as possible to ensure a uniform profile. When possible, the cutter should be installed so that the handle will act as a stop when the full profile has been reached. Once the cutter starts to dull, it will produce dust as opposed to fine shavings. At that point you'll have to file the edge lightly and hone the face again. If I'm making more than one length of molding, I typically go over each piece one last time with a freshly sharpened cutter. Following that procedure keeps the profiles consistent.

Because I make period furniture, I often have to reproduce moldings that don't correspond to profiles available in shaper or router bits, or that I don't have an appropriate molding plane for. I remove the bulk of the waste from a given profile using a router,

A BASIC SCRATCH STOCK FOR BEADING

An L-shaped body works well to make simple beads. The cutter is placed right into the corner, where the two wood edges stabilize the blade for a clean, consistent cut. The long edge is chamfered, so the cutter can be tilted to start the shaping.





Narrow bandsaw kerf is just right. *Split the body of the scratch stock down the middle but stop the cut 1 in. shy of the end. The cutters are pinched in the kerf and held in place with two machine screws and nuts.*

Photo, this page (bottom): Michael Pekovich; drawings: Heather Lambert

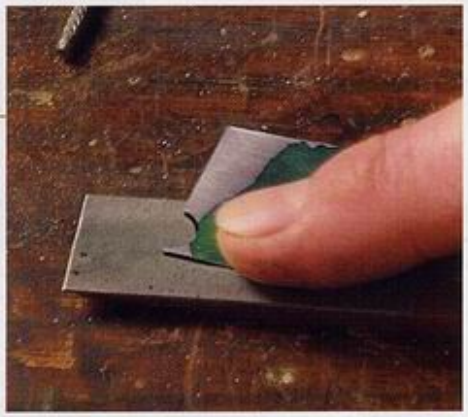
MAKING A SCRATCH-STOCK CUTTER

You can make cutters using scrap metal from card scrapers and old bandsaw or hacksaw blades.

1 *Add some color to the steel cutting blank.* *Layout fluid (also called bluing) makes it easier to see scratch marks that define the shape of the cutting edge.*

2 *Drafting templates come in handy.* *Scribe shapes on the cutting blanks using a machinist's scriber.*

3 *Start with coarse files.* *Remove metal waste quickly with a coarse file, then improve the cutting edge with a finer tool.*



4 *Hone the blank to remove any burrs.* *A pocket-size diamond stone is ideal for sharpening small cutting blanks.*

then refine the profile with a scratch stock. For me, this has the added benefit of giving a handmade look to the molding.

With extremely careful use, the scratch stock can produce moldings that rival those made by machine, and in some cases surpass them, because a steel scratch-stock cutter can be filed to a much finer point than carbide tools. Also, the variety of shapes that you can make is virtually limitless.

Applied cock beads—For making applied cock beads, I use two different methods. One is to work the bead on a piece of wide stock and rip it off, and the other is to clamp the scratch stock in a vise and pull a piece of material already cut to thickness over the cutter. This second method is also the one I use for cock beads that are applied to curved work. Here again, you must be careful of the cutting direction to avoid tearout.

Reeds—My favorite use for the scratch stock is to cut reeds in turned Sheraton legs (see the photos on the facing page). This makes quick work of reeded legs, as long as the profile of the leg is a gentle taper. (A more bulbous turning requires carving the reeds by hand with a chisel because of the dramatic change in its radius.) I made a wood fixture from plywood and lumber scraps that I clamp to the bed of my lathe. The fixture acts as a guide for a scratch stock to keep it running down the centerline of the leg and more or less parallel to the taper of the leg. By using the indexing feature of the lathe, I can quickly shape the required number of 12 reeds. The ends of each reed still need to be carved by hand, and the profiles refined with chisels and a scraper.

Flutes and coves—Fluted columns can be made with the same setup, but the process requires more care because more of the cutter protrudes from the handle, as it also does on large coves, which causes the tool to chatter. If the flutes don't run all the way through the tops and bottoms of columns, you are left with a considerable amount of hand-carving to do. But for period furniture the result is still visually superior to router-cut flutes and coves. With a scratch stock, you're limited to fairly small cuts (¼ in. or 5/16 in.) because of the

TWO OPTIONS FOR APPLIED BEADS

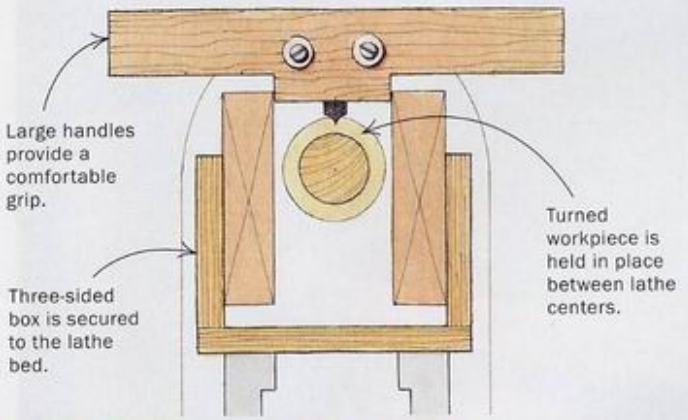
Move the scratch stock against the workpiece. *Make the cut in multiple passes, with light downward pressure as you go. On the final few passes, hold the blade as vertically as possible. Rip the bead from the stock.*

Move the workpiece against the cutter. *With the scratch stock clamped in a vise, make multiple passes. This method works well for delicate workpieces, such as cock beads that will be applied to curved surfaces.*

Photos, this page (top and bottom right): Michael Pekovich

SCRATCH STOCK FOR REEDS AND FLUTES

Millard reeds a leg by mounting an open-ended, three-sided box on the lathe bed. The handle of his scratch-stock beading tool fits within the box and rides along the top edge of the open end. This setup allows him to control the cut better and make reeds that run straight along their length.



Some additional handwork is often necessary. *Transitional areas, such as where these reeds start and stop at the top and bottom of the legs, often require additional shaping with chisels and scrapers.*

flexing of the cutter, unless you construct a shaped handle that provides more support.

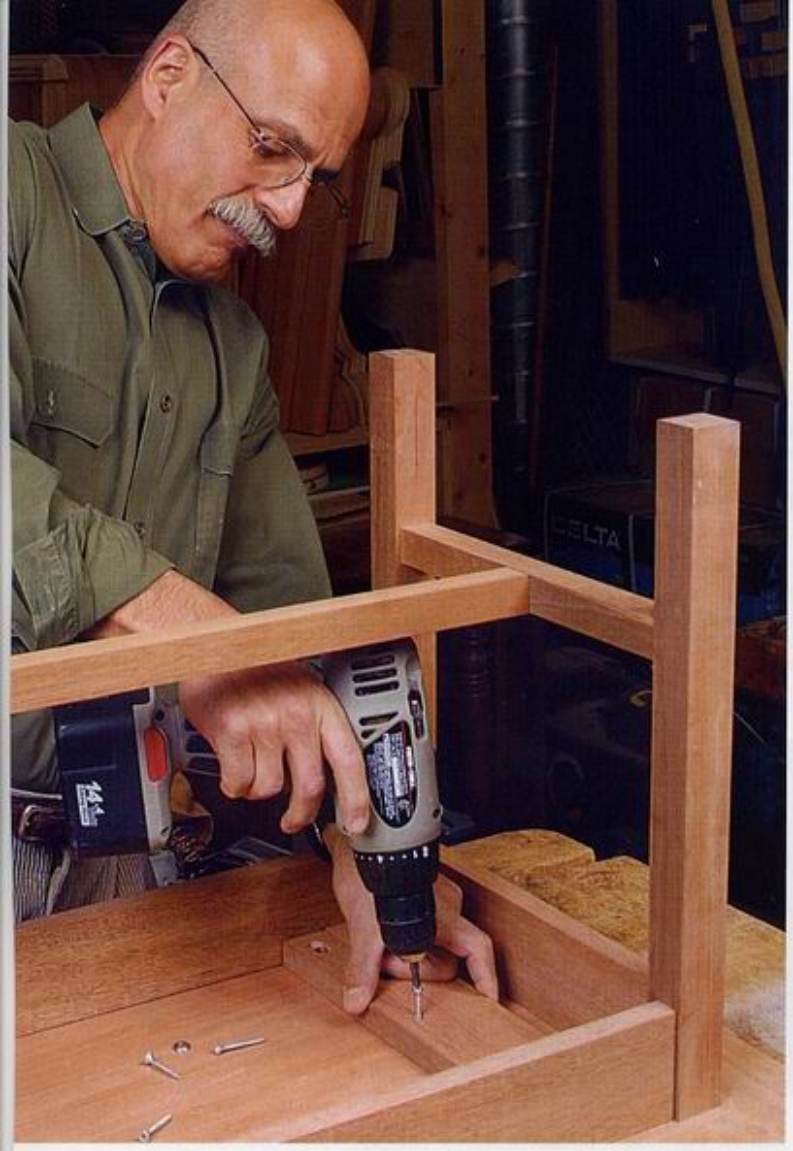
Curved work—For use on curved work, I install the cutter in the scratch stock so that I use the short side of the handle as the driver, to lessen the tendency to rotate the tool too much when turning around a curve. With curved work, the grain changes directions continuously, so you'll have to pay close attention to the direction in which you push the cutter so that you get the best finished surface. And even then, at the areas where the direction changes, you will probably need to refine the shape of the scratch cut with carving tools.

Complex moldings—With a properly made handle, you can work a molding up to at least 1½ in. wide, after removing much of the waste with a series of rabbets using a router, a shaper or a dado set on the tablesaw. The handle should at least roughly follow the shape of the molding profile, leaving about ⅛ in. to 3/16 in. of the cutter exposed. You also can make the profile in stages—much as you would work a complex molding with a series of router bits. The limitation here is that you must have two edges that you can use to guide the scratch stock accurately. □

Rob Millard builds one-of-a-kind reproduction furniture in his garage shop in Dayton, Ohio.

WIDE MOLDINGS

Scratch stocks work best when removing only small amounts of wood. For larger or more complex moldings (such as the cove shown here), Millard often uses molding planes or small routers first, following with an appropriately shaped scratch-stock cutter to scrape the surface clean.



Attaching Tabletops

Six methods to control and direct wood movement

BY MARIO RODRIGUEZ

Attaching a top to its base is a critical aspect of table design and construction. Regardless of the method you choose, it should meet the following criteria: The top must be firmly attached to the base; the top must remain flat; a solid-wood top must be allowed to move seasonally; the attachment method shouldn't compromise the design of the table or complicate its construction. I'll describe six ways of attaching a tabletop that meet these requirements, along with the reasoning behind each method.

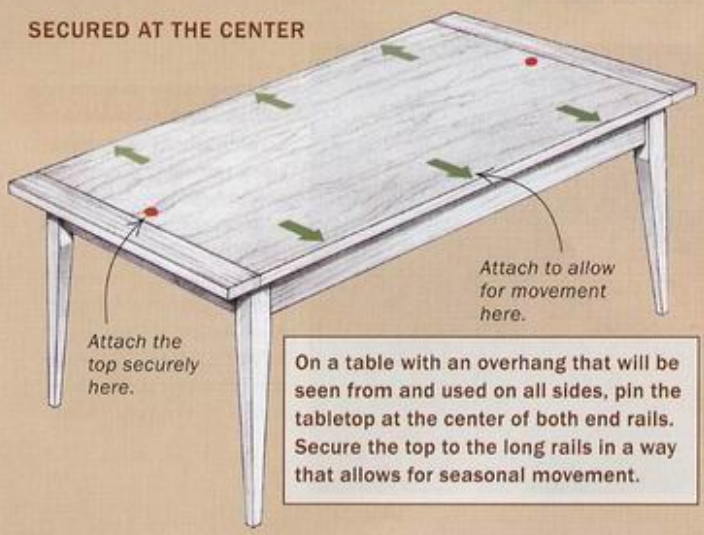
The most important factor to consider when deciding how to attach a tabletop is wood movement. We all know that solid wood

Mario Rodriguez is a contributing editor.

Controlling wood movement

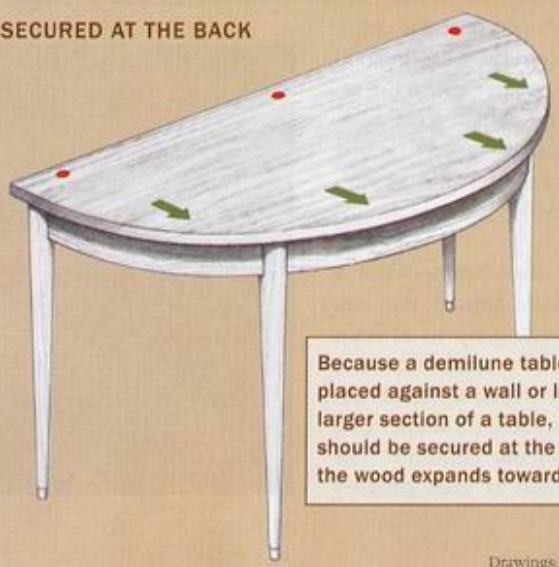
While you cannot prevent a solid-wood tabletop from moving seasonally, you can direct this movement so that it doesn't disrupt the looks or the use of the table. Below are examples of how to secure the tabletop to the frame to control expansion and contraction.

SECURED AT THE CENTER



On a table with an overhang that will be seen from and used on all sides, pin the tabletop at the center of both end rails. Secure the top to the long rails in a way that allows for seasonal movement.

SECURED AT THE BACK



Because a demilune table often is placed against a wall or locked to a larger section of a table, the top should be secured at the rear so the wood expands toward the front.

Drawings: Michael Gellatly

moves seasonally across the grain. It's a fact; you can't do anything to stop it. In the summer, a board will expand across its width because of an increase in humidity. During cold months, the same board will shrink and become narrower. If no allowance is made to control or direct this seasonal movement, a tabletop might buckle, or worse, crack and split.

When calculating how much a board will move, I usually allow from ⅛ in. to 3/16 in. for every 12 in. of width. Therefore, I would anticipate that a 42-in.-wide tabletop might move about ½ in. overall. This is only a general guide, and certain factors must be taken into account. For instance, in parts of the country with low humidity, wood movement might be minimal.

Another factor is the type of wood you're using: Cherry moves less than white oak but more than mahogany, while flatsawn wood moves more than quartersawn. For more on this subject, read *Understanding Wood* by R. Bruce Hoadley (The Taunton Press, 2000).

Once you accept that the tabletop will move, you can control or direct this movement so that it doesn't disrupt how the table works or looks (see the drawings below). For a freestanding table with a uniform overhang, I anchor the top to the base at the center of the end rails. That way, any cross-grain movement will occur evenly along each long-grain side. On a demilune (half-round) table, I pin the back edge of the top, which typically is placed against a wall. Conversely, on a writing table I might fix the top along the front of the table so that movement occurs toward the rear.

For this article, I have illustrated six methods of securing a tabletop (right and pp. 68-71). The methods are listed by ease of installation, starting with the simplest. The hardware for two of the methods can be purchased relatively cheaply from hardware catalogs, while the rest can be made from shop scrap. This is a low-budget process.

POCKET HOLES

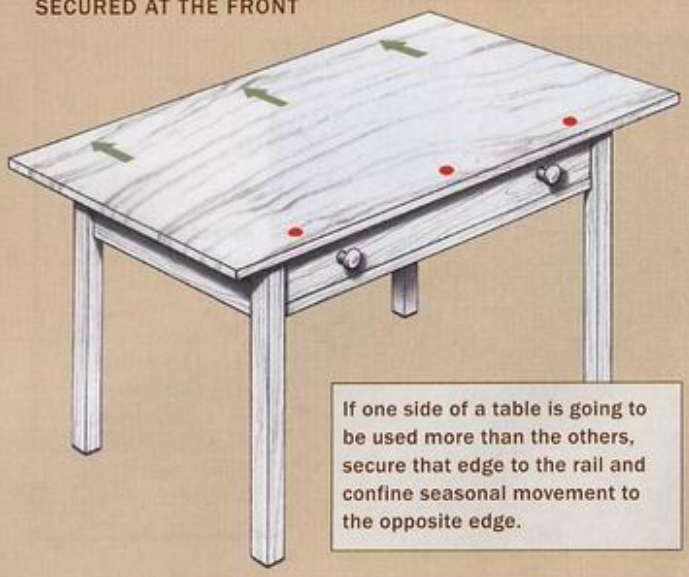
This method is probably the oldest way of attaching a tabletop. It involves drilling into the rail a ½-in. flat-bottomed pocket hole at a 10° angle. Then a smaller pilot hole (to accommodate the shank of a #8 wood screw) is drilled into the center of the pocket hole.

Common on antique furniture, pocket holes make no allowance for wood movement, which may explain the number of cracked and split tabletops. On small solid-wood tops (up to 9 in.) or veneered plywood tops, pocket holes can be the only attachment method. On larger pieces, they should be limited to areas needing movement restricted.

Pocket-hole jig. *Construct a small jig to hold the rail at approximately 10° while drilling pocket holes with a Forstner bit.*

A hole in the pocket. *Drill a smaller-diameter pilot hole for the screw that will be driven into the tabletop.*

SECURED AT THE FRONT



If one side of a table is going to be used more than the others, secure that edge to the rail and confine seasonal movement to the opposite edge.

METAL TABLE CLIPS

These clips, also known as S-shaped clips or simply as tabletop fasteners, are probably the easiest and quickest method for attaching tabletops. They fit into a groove or slot cut on the inside face of a rail.

The easiest method is to cut the grooves in the rails on the tablesaw. The grooves must be cut before the base is assembled.

The clips are installed after the base has been assembled. Place one end of the clip into the groove and screw the other end into the underside of the tabletop. Because the groove runs the length of the rail, any number of clips can be used. This method nicely accommodates any cross-grain wood movement whether the clips are parallel or perpendicular to the tabletop's grain: The clips on the end rails move along the groove as the wood moves, while the clips on the front and back rails move in and out of the groove.

An alternate way to install the clips is to cut slots in the rails using a biscuit joiner. This method removes less wood from the rails, and it has the added advantage of being doable after the base of the table has been glued up.

Grooves or slots. *The clips are installed in grooves cut on the tablesaw or in slots cut with a biscuit joiner.*

Secure but free to move. *Driving the screws too tight will prevent the wood from moving and defeat the purpose of using the clips.*

FLAT TWIN-CIRCLE CLIPS

Also known as a desktop or figure-eight clip, this unobtrusive fastener requires only a shallow flat-bottomed recess in the top edge of the rail. The diameter of the recess should accommodate that of the clip, but the recess should be drilled to place the center of the clip past the edge of the rail. This location will let the clip pivot slightly, allowing for cross-grain wood movement.

For large tabletops, you can increase the clip's ability to move side to side by chiseling away a little of the rail on both sides of the clip. However, because the clips do not handle wood movement perpendicular to the rail very well, they are best confined to end rails. Like the metal table clips (above), these fasteners should be relegated to casual, day-to-day furniture pieces.

Precision drilling. *The recess for twin-circle, or figure-eight, clips, should be close to the inside edge of the rail to allow for movement.*

Attached to the rail. *The twin-circle clips can be screwed to the rail either before or after the base has been assembled. Check that the clips are free to move.*

Attached to the tabletop. *These fasteners are best fitted to either small tables or to the ends of large tables. They do not allow for much wood movement when fitted perpendicular to the grain of the tabletop.*

Photos, except where noted: Mark Schofield; this page (top left, middle left): Kelly J. Dunton

SIMPLE WOODEN BLOCKS

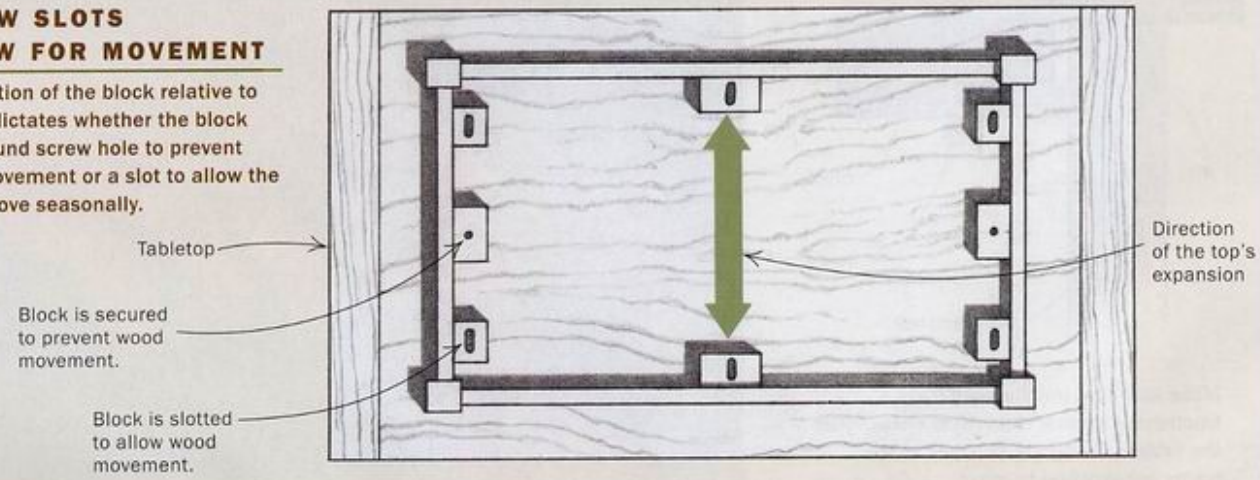
These wooden blocks are either glued or screwed to the inside of the rail and screwed to the tabletop. This type of fastener offers the advantage of using shop scrap that matches the piece.

The blocks need to be tailored to each location around the rails: Blocks at the center of each end rail can have just a single screw hole because there is no wood movement here, and they can keep the top centered on the rail. Blocks at the extremity of each end rail will require a slot that runs parallel to the rail, while those attached to the front and rear rails will have slots perpendicular to these rails. In all cases, ensure that the blocks are designed so that the long grain—not the end grain—is glued to the rails.

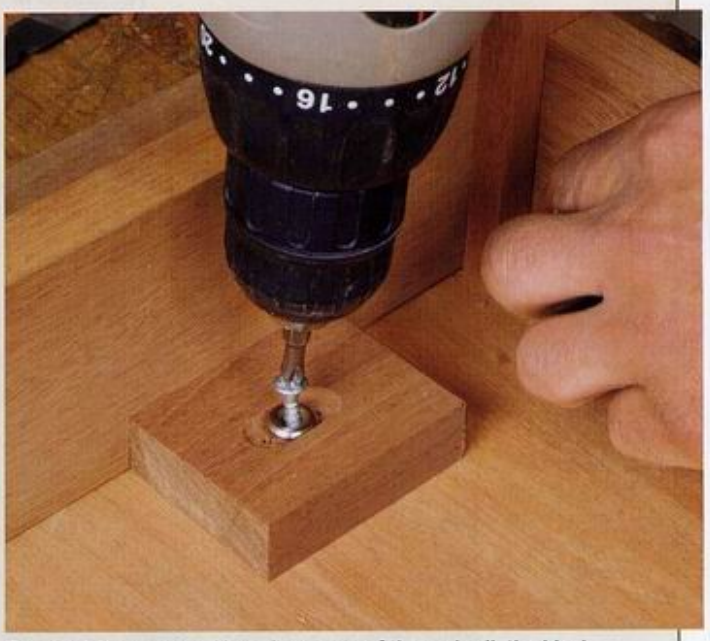
Two methods work well when gluing the blocks to the rails: With the table base the right way up, glue and clamp the blocks using a straightedge to ensure that the block tops are level. The other method is to lay the base upside down on a flat surface covered with wax paper and then rub the glued blocks onto the apron until they stick tight. When the glue has dried, tear off any paper that has stuck to the wood.

SCREW SLOTS ALLOW FOR MOVEMENT

The position of the block relative to the rail dictates whether the block has a round screw hole to prevent wood movement or a slot to allow the top to move seasonally.



Attaching the block. *With the rail sitting on a flat surface covered with wax paper, rub the glued block on the rail until it adheres. When the glue has dried, remove any paper that has stuck to the wood.*



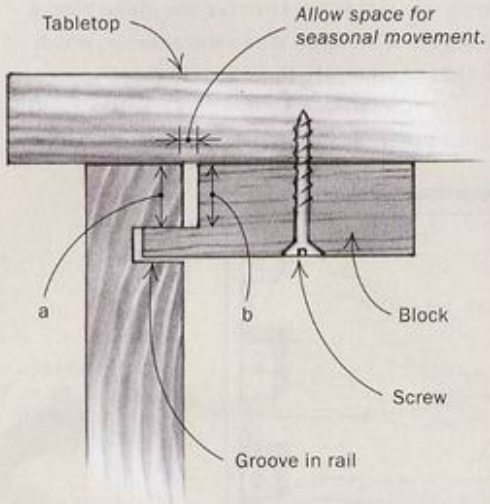
Room at the corner. *Near the corner of the end rail, the block needs to have a slotted hole parallel to the rail. Make sure that the long grain, not the end grain, of the block is glued to the rail.*

Photo, this page (top left): Kelly J. Dunton

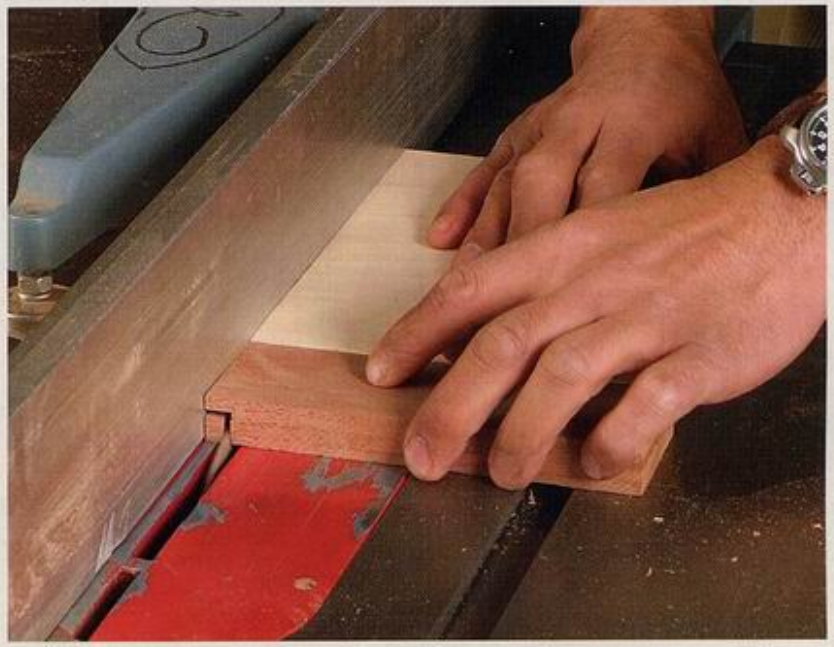
TONGUE-AND-GROOVE BLOCKS

This type of fastener is made from project leftovers. These blocks are attached to the tabletop with screws and have projecting tongues that engage corresponding grooves cut into the rails. The rail grooves are slightly larger than the width of the blocks, allowing for movement and preventing the tabletop from splitting.

By carefully laying out the placement of the blocks and milling properly sized grooves, a more tailored and carefully crafted appearance is achieved. The best way to cut the grooves is with a router guided by a fence bearing on the rail. Properly spaced, tongue-and-groove blocks work very well for all sizes of tabletops.

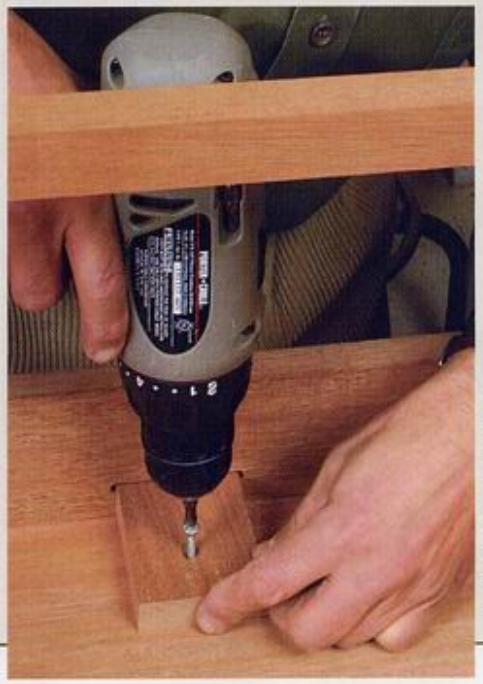


Make sure that the distance (a) is fractionally greater than (b) to ensure that the tabletop is tightly attached to the frame but still free to move.



Two blocks in three cuts. *Make a cut about ⅜ in. deep in each end of a piece of wood. Next, cut perpendicular to the first cut to remove a small block of waste. The push block prevents the waste block from being thrown back when it is cut from the workpiece. Last, cut the piece of wood in half to produce two tongue-and-groove blocks.*

Cut the groove. *Select a straight bit slightly wider than the tongue of the block and, using a guide fence, rout a series of grooves in the rails.*



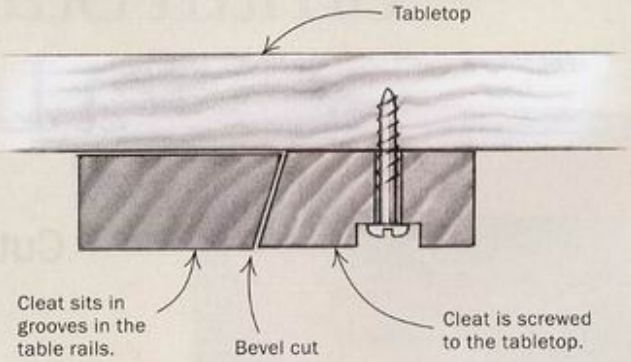
Attach the blocks. *The tongues of the blocks engage with the grooves in the rails. Then the blocks are screwed to the tabletop.*

Photo, this page (top left): Kelly J. Dunton

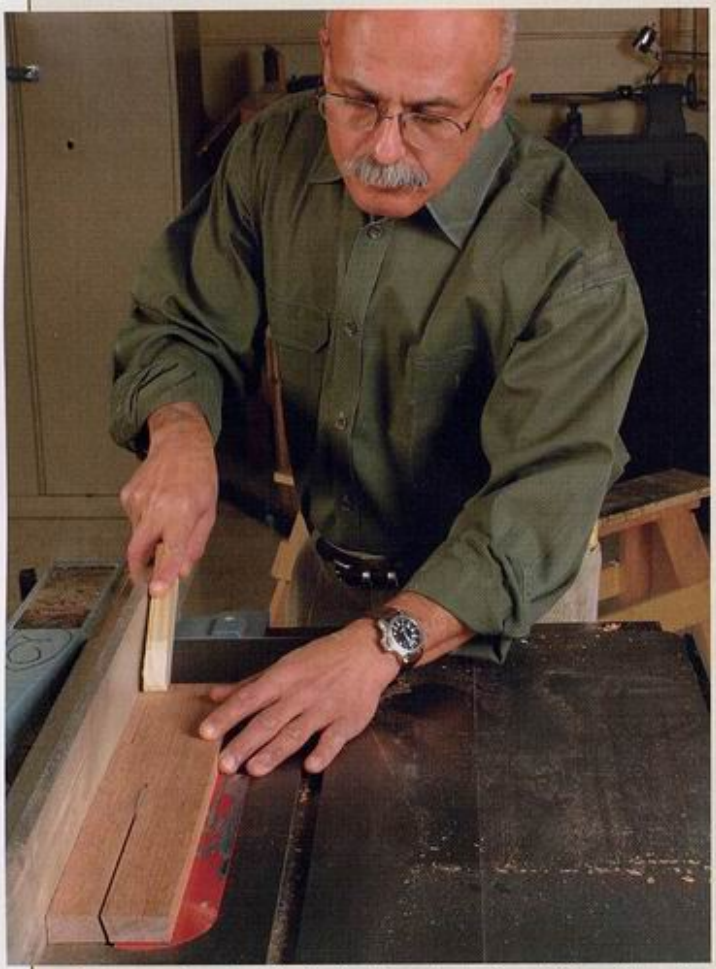
BEVELED CLEATS

This attachment method provides a clean appearance. First, rip a 3-in.-wide hardwood strip with the tablesaw blade tilted to a 15° angle. Then cut tenons on both ends of one piece and rout matching grooves in the side rails.

When the table base has been assembled, the tenoned cleat is inserted but not glued into both rails. Make sure that the wider side of the angled cut is placed against the tabletop. With the base positioned on the upside-down tabletop, take the other section of wood that was ripped, crosscut it slightly shorter than the distance between the rails, and place it next to the other cleat. Screw it to the tabletop using a single hole in the middle and slots near the ends of the cleat to allow for wood movement. On small tables, the top is attached at each end, but for tables more than 48 in. long, a third center support is necessary.



The tenoned half is attached to the rails, and the second half is screwed to the top. The bevel creates resistance to the top being lifted.



One cut makes two cleats. *Select a piece of wood 3 in. wide and a little longer than the end rails of the table. With the blade at a 15° angle, rip the board in half.*

Tenons slide into the grooves. *One cleat sits in grooves in the side rails. The wide side of the board should be against the tabletop.*

Meeting on the bevel. *Slide the second cleat against the first one and screw it to the tabletop. The center screw can be fixed, but screws closer to the edges should be in slotted holes to allow for wood movement.*

Watch it on the web — For a video on making beveled cleats, go to www.finewoodworking.com.

Photo, this page (top left): Kelly J. Dunton

Small Stand is a Lesson in Curves

Cut joinery first, then saw the curves

BY STEPHEN HAMMER

One way to add interest to a case piece is to add a gentle curve to the front plane. I wanted to explore this element of furniture making while attending a 12-week class at the Center for Furniture Craftsmanship in Rockport, Maine, so I designed and built this cherry cabinet, finding ways to curve the door and drawers that did not require steam-bending or veneering. The drawer fronts and the door frame are sawn out of thicker stock, and the door panel is coopered to match that curve—methods well-suited to the average small shop.

Arriving at a final design for a piece of furniture is often a laborious task. However, a few preliminary steps made this process easier and more successful. First, small thumbnail sketches allowed me to visualize the overall form quickly and easily. The thumbnails led me to a curved-body design with an overhanging top. Next, I drew the cabinet at quarter scale, where I set the top height at 35 in., then determined the width of the piece.

The appearance of this cabinet depended upon the leg shape being correct. I based the leg shape on the classical column, which curves slightly inward, starting one-third up the column height. Called an entasis, this narrowing is meant to keep the eye from thinking that the column is concave—an optical

A CASE BOTTOM THAT STAYS PUT

Double stub tenons and tongue-and-groove joinery will keep the bottom panel flat and stable.

First, rout the mortises and grooves in the side assembly. *Move the router in the proper direction, and the cutting force will keep it pressed against its guide.*

Cut the tenons on the bottom panel. *Transfer their layout directly from the mortised side assembly. Make the cheek and end cuts, then saw out the waste.*

Rout between the tenons to form the wide tongue. *Carefully mark the starting and stopping points on the router-table fence.*

Test-fit the joinery. *Trim the joints as necessary to eliminate any gaps between the panels.*

Photo, this page (top): Rodney Diaz

CURVED-FRONT STAND

The stand is cherry, with book-matched, solid-wood panels.

DOOR-FRAME DETAIL

Grooves and mortises in the stiles are square, and the tenons meet the stiles squarely. The curve in the rail is cut on the bandsaw.

Cut half-blind dovetails from square stock before curving the front on the bandsaw.

TEMPLATE FOR THE FRONT CURVE

The drawer fronts, the door, the top front stretcher and the bottom panel all share the same curve. Use a piece of template stock long enough to contain the curve's center point.

Make a simple curve-cutting jig with a stick clamped to the saw table and a screw driven through the pivot point. *The blade should be buried about halfway into the stick. Pivoting the workpiece delivers a smooth, uniform curve.*

illusion that happens when a column's sides are parallel.

A piece often changes when you take it off paper and put it into three dimensions. To work out the leg details, I made a full-scale mock-up in poplar, filling in the rest of the cabinet with cardboard cutouts. I curved the outside of the legs gently to the top, reducing the overall thickness by ⅜ in. The bottom inside edges of the legs taper toward the floor, starting from the case bottom. I tried different door and drawer dimensions by drawing them onto the cardboard.

It may seem like a lot of extra work to build a mock-up, but the process saves time during construction because you can focus on building the piece instead of revising its design. Also, you can refer to the mock-up for dimensions. My final step was a full-scale drawing to work out the joinery details.

Choose wood carefully and then build the case

The case consists of two solid sides joined to the legs, a solid bottom and a frame-and-panel back. (The grain of the top, sides and bottom runs in the same direction, so it will expand and contract together.) The front door is a curved frame and panel, and the two drawers are side-hung.

I often buy 12/4 or larger lumber and resaw everything I need out of a few planks to get consistent grain and color. When milling the stock, leave it ⅛ in. oversize in width and thickness and 1 in. oversize in length, then stack and sticker the pieces for about a week so that air can circulate around them. If the boards move during that time, there still will be enough wood left to correct slight cupping or twisting.

Begin construction of the case by assembling the sides. I used biscuits to register the panel flush to the legs on the inside plane of the cabinet. Before the panel and legs are glued up, shape the legs on the bandsaw and smooth the curves and tapers with a handplane and scraper. Use double-faced tape to mate the legs for

Drawings: Bob La Pointe

First, lay out the curve. *This will determine how deep the dovetails can go.*

Cut all of the tails, then transfer the layout to the drawer front. *Clamp the drawer front flush with the benchtop.*

Cut the front curve on the bandsaw. *Cut right to the line, then smooth the curve with a block plane and sandpaper.*

shaping on the bandsaw, and then clamp them together for the handwork.

Before the sides were glued up, I put a handplaned surface on all parts. I also prefinished as much as possible before glue-up. Prefinishing makes glue cleanup easier and protects the surfaces. I recently have begun using Tried & True Varnish Oil for all of my work. It is pleasant to work with and safe for kitchen pieces.

Joinery is next—Once the side panels have been glued up, do all of the joinery for the case. Two stretchers dovetailed to the tops of the legs anchor the top to the case. The front stretcher is curved with the front plane of the cabinet.

First, cut the dovetails on the ends of the stretchers. Then transfer their shapes to the legs using a sharp knife. I used a plunge router freehand to rough out the sockets in the legs, getting close to the line and then finishing with a chisel.

The bottom stretchers and the case bottom are joined to the legs with double mortise and tenons. This strong joint helps counteract the racking forces that can weaken a cabinet over time. The case bottom is joined to the side panels with a wide tongue and groove to counteract warping.

The bottom stretchers are not needed to support the side-hung drawers, but they stiffen up the cabinet. The front one also acts as a doorstop, so it is set back from the front plane of the cabinet and holds a rare-earth magnet that acts as a catch for the door. The door also receives a magnet.

Use a plunge router fitted with an edge guide and a ¼-in. up-cutting spiral bit to cut

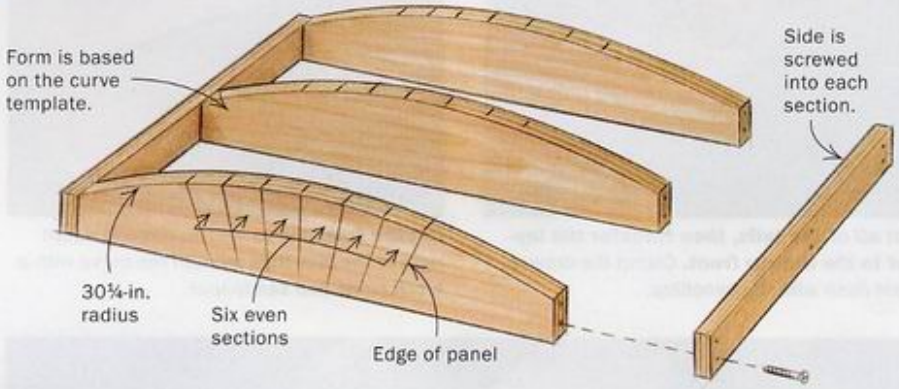
An easy way to cut the inside curve. *Lay out the desired curve. Then ride the rip fence as shown to follow that curve, creating a consistent thickness. Use the offcut as a sanding block.*

Photos, except where noted: Asa Christiana

A COOPERED DOOR PANEL

1. MAKE A CLAMPING FORM AND MARK OUT THE STAVES

Coopering is a way to create a curved, book-matched panel from solid stock. After assembling a clamping form based on the curve template, lay out the overall width of the curved panel, then divide the arc into six even sections.



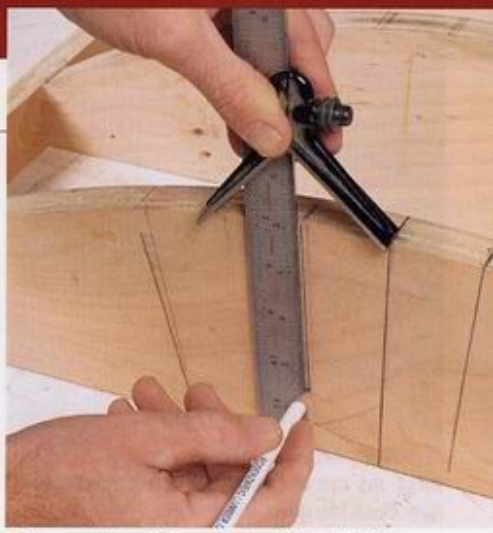


Figure out sections and angles right on the form. *Use a center divider to draw lines straight down from each division.*

all of the mortises. The fronts of the legs can be used as square reference surfaces for the edge guide.

Nothing ruins work faster than a router gone awry, so move the router in the direction that keeps the fence pulled tightly against the leg. Plunge-cut the front and back of each mortise, then remove the center material. Finally, take a pass through the entire mortise to clean up the sides.

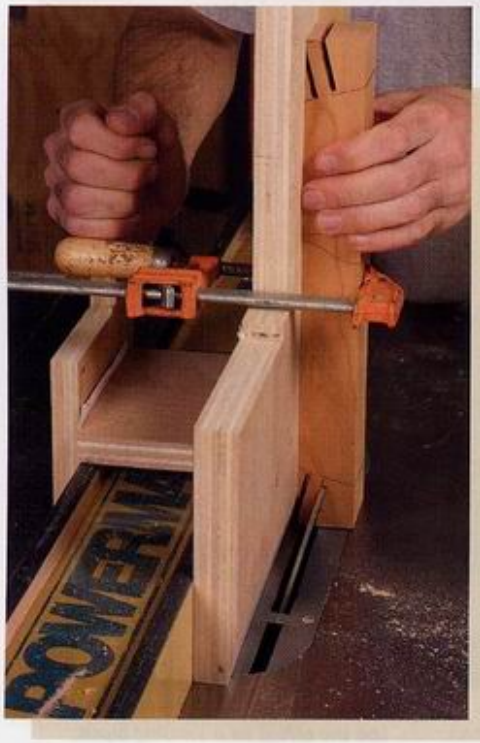
Next, cut ¼-in. grooves into the bottom of the side panels to accommodate the tongue on the case bottom.

With the mortises and grooves complete, it is time to cut and fit all of the double tenons and tongues. First, use a marking knife to transfer the measurements for the tenons directly from the mortises. Cut and dry-fit all of the joinery. If any of the shoulders are not tight, use a chisel to pare them back, angling the shoulder inward so just its edge meets the mating piece.

Finally, shape the front edge of the bottom panel to the 30¼-in. radius of the cabinet's front plane. I made a template first, large enough to hold the center point.

Make the back and assemble the cabinet

Before the case can be assembled, you must make the frame-and-panel back, cut a tongue around its outside edge and cut a groove for it in the back of the case—in the bottom, in the legs and in the stretcher. Another option would be to forgo the tongue and glue the back into a simple rabbet in the back of the case.

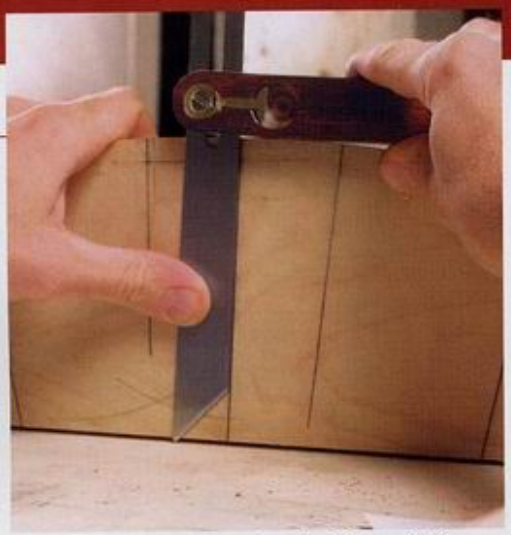


A curved door frame

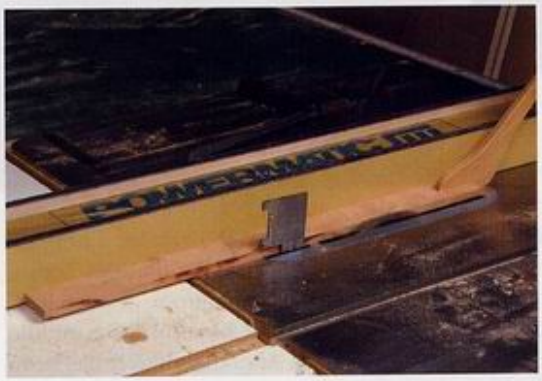
Because the stiles are basically square, cutting their grooves and mortises is straightforward. But the curved rails—with angled tenons and a groove that follows the curve—are trickier.

Cut the tenons on the rails while the stock is square. *Make the cheek cuts first (left), then make the shoulder cuts (above).*

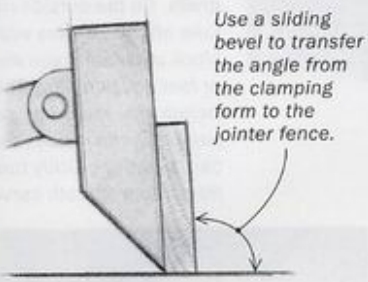
Curved fence to rout a curved groove. *After cutting and smoothing the curves in the rails, use the curve template to make a curved fence for the router table. Keep the workpiece steady on the table as you slide it along the fence.*



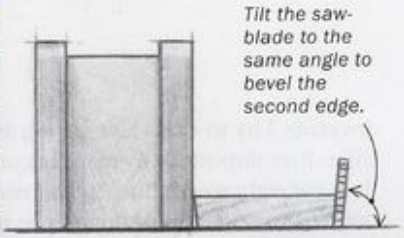
Use a sliding bevel to find the angle for jointing and ripping the staves. *Balance the tool on the center of a section as shown to find the angle.*



2. BEVEL AND GLUE THE STAVES



Joint and rip the staves. *First, rip the staves on the bandsaw to minimize waste and preserve the grain match across the panel. Next, bevel one edge of each strip on the jointer (above). Finally, bevel the second edge on the tablesaw (below) to ensure parallel edges.*



During glue-up, assemble everything but the back panel and the top back stretcher. Then you can slide in the back panel and glue the stretcher in place on top of it.

For the back panel, I resawed a board to create a book-match, and then I crosscut the panel to form top and bottom sections. I used mortise-and-tenon joinery for the frame. Rabbet the edges of the panels to fit a groove in the frame, but leave a ⅛-in. gap all the way around for expansion and contraction. It also makes an attractive shadow line.

Build the curved-front drawers

The main feature of this cabinet is the curved front. You should start with the drawers, then fit the door once the drawers have been installed.

It is important to cut all of the dovetails for the drawers before shaping the curved fronts. It is much easier to lay out and cut dovetails in square parts. I used standard half-blind dovetails in the front and through-dovetails in the back. Mark the curves on the fronts before laying out the half-blinds. This ensures that the tails don't break through when you are shaping the front. I prefer the pins to be very narrow and unequal in their spacing so there is no mistaking that they are hand-cut.

For the half-blind dovetails at the front, mark the pins from the tails with a knife, then use a router freehand to waste out as much of the socket as your nerves can handle before finishing with a chisel. For all

Glue up the panel. *Lay the staves on the form to make sure all of the joints close perfectly. Use bar clamps and strap clamps as shown to draw the staves together and down against the form. Use a yellow glue with extended working time.*

Smooth the panel across the grain. *On the outside (right), take off the corners with a block plane until you don't hear or feel any bumping. Then switch to scraper and sandpaper. On the inside (below), a card scraper quickly turns six flats into a smooth curve.*

dovetails, I try to do as little paring as possible. It is important to mark accurately, then cut right to the line. By the way, lay out the dovetails so that the groove for the drawer bottom doesn't hit any of the pins.

With the dovetails cut, you can shape the drawer fronts. Rough-cut the shape on the bandsaw, and then finish the work with a handplane and scraper. I like to curve the inside of the drawer front as well for a more refined look, although this means the drawer bottom also must have a curved edge. After laying out the inside curve, use the bandsaw's rip fence to make the cut (see the bottom photo on p. 75). Then use the offcut as a sanding block.

Next, cut the groove in the front and the sides for the drawer bottom using a ¼-in. bearing-guided slot cutter in the curved drawer front. Cut the drawer back short enough to let the bottom run under it. The grain must run across the width of the drawer so that the bottom can expand toward the back.

The drawers ride on runners that are screwed to the interior of the cabinet, so you'll have to rout grooves into the sides of the drawers. After the drawers have been assembled, use a spacer block to locate the drawer runners. Then use the same spacer block to set up the tablesaw for a stopped groove in the sides of the drawers. Locate the runner for the bottom drawer first, placing the spacer block on the middle frame member. After that drawer has been hung, use the spacer to measure up from the top of it. For each of the runners, the front screw can be fixed, but the rear screw hole must be slotted to let the case side expand and contract.

Cut the door joinery, then add the curves

As with the drawer fronts, the door curve is shaped after the joinery has been completed. Mill the rails and stiles thick enough to contain the curve, then mark out the curve and mortise-and-tenon joinery. Lay out the tenon shoulders on an angle that will meet the stiles squarely. That way, the edges of the stiles can be square, and its mortises and groove will be easy to cut. The rail is where the joinery gets more complex.

Now you can cut the frame members to rough shape on the bandsaw. The inside and outside of each rail can be shaped and smoothed with the same techniques used on the drawer fronts.

When the curved frame is smooth and even, cut the grooves for the door panel. Be careful here: You must cut a curved groove in the rails and a straight groove in the stiles, and the grooves must mate precisely at the corners. The groove in the curved rails can be made on the router table, using a curved fence (see the bottom right photo on p. 76).

Coopering the panel—The panel is coopered to fit inside the shaped frame. Using the frame as your pattern, trace the curve on paper and build a simple clamping form (see the drawing on p. 76). The form curves outward, not inward, so you can see if the visible glue joints are coming together properly.

Use the form to determine the size and bevel angle for each piece, or stave. I wanted the panel to be book-matched, so I resawed a board into two thinner pieces and then cut three strips from each. I used a combination of bandsaw, jointer and tablesaw to mill the pieces to size and bevel the edges, minimizing waste to maintain the grain match between them.

Position the boards on the form to check the joints. If necessary, do some fine-tuning with a handplane to ensure the joints fit perfectly. You can glue up the entire panel at once, using bar clamps to pull all of the

With the concave side down, trim the panel to size. *Use a sled for crosscutting, with the blade at its highest point.*

Rabbet the curved edge. *Use a good dado set and keep the panel in contact with the table at the cutting point. The rabbet also may be cut on the router table.*

pieces together and strap clamps to keep them from opening outward.

After the panel has been glued up, smooth the beveled surfaces to a fair curve. Shape the panel using a handplane and a scraper, then sand. After sanding I used Abralon pads up to 4,000 grit to give it a polished look. Last, glue up the door and bevel its edges to fit the opening.

Rare-earth magnets serve as door catches. Bore a hole in the door and cabinet frames to accommodate the magnet and a wood plug above. With the magnet in place, bore a larger hole for the plug to create a better glue surface. Trim the plug flush and cover it with a circle of leather, which gives the door a soft stop.

Attach the door using high-quality butt hinges mortised into the frame (see *FWW* #159, pp. 52-57). I inset the door ⅛ in., making the necessary adjustment to the hinge mortise on the door.

Prefinish the panel and dry-fit the door. *Use a shoulder plane to fine-tune the joinery.*

Top off the cabinet

The only things left to do are the top and the pulls. The top is book-matched, glued up and then shaped. Bevel the underside of the right and left sides. The front edge overhangs the drawers by 1⅜ in., so its radius is that much larger.

The finish on the top is critical, because any flaws will be reflected. Make sure you have lots of light when doing the smoothing. Then screw the top onto the top stretchers from beneath. It will move in the same direction as the rest of the case, so you don't have to slot the screw holes.

The final touch for this piece is to add carved ebony pulls. Getting the design right for these was a long and frustrating ordeal, but they are one of my favorite elements. I cut the facets on the bandsaw and formed the curves with a sanding drum. Leave small tenons on them to mortise into the door and drawers. □

Stephen Hammer is a furniture maker in Brooklyn, N.Y.

TOOL TEST

Shop Vacuums

Newest machines are quieter and offer more features

BY ROLAND JOHNSON

Dust is an unfortunate by-product of woodworking. One of our best defenses is the shop vacuum. Woodworkers appreciate the vacuum for its versatility in the workshop. It can pick up as well as blow dust out of hard-to-reach corners and is commonly used as a dust collector for small power tools.

From the legion of shop vacuums on the market, I selected 13 that range in price from under $100 to about $700: Alto Wap SQ and SP; Craftsman 17922 and 17924; Fein 9.77.25; Festool CT 33 E; Milwaukee 8927 and 8955; Porter-Cable 7814; Ridgid WD16650 and WD1735; Shop-Vac QL60OD and QUL625.

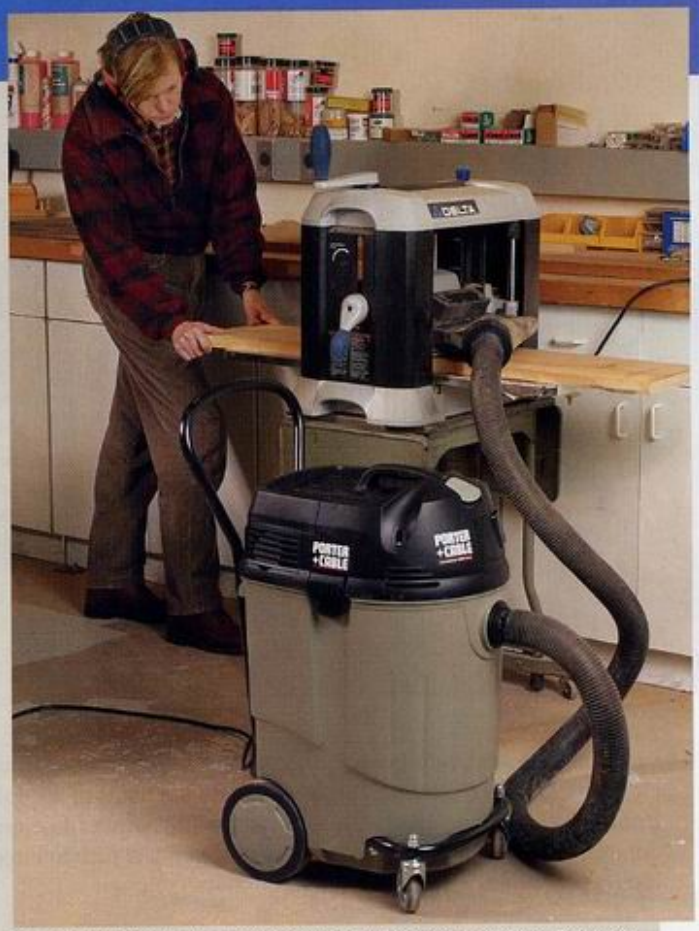
A number of new features distinguish today's crop of shop vacuums from their predecessors. For one, significant strides have been made to reduce that shrieking whine that grates on the ears and nerves of the operator. My old shop vacuum could reach decibel levels of about 94—nearly the same level as thunder. It could drown out even the loudest woodworking machine in my shop. Though all of the vacuums I looked at were quieter

ALTO WAP SQ AND SP

CRAFTSMAN 17924 AND 17922

Photos, except where noted: Anatole Burkin

Vacuum as dust collector



The shop vacuum also serves as a portable dust collector. Depending on the shop, it may be the only means of dust collection or it may be a backup to a larger system.

than those of a few years ago, the Fein, the Festool, both Alto Waps and the larger Craftsman all were paragons of aural restraint. With decibel levels ranging from 58 to 69 (the level of a normal conversation), cleaning the shop became an almost serene experience.

Other noteworthy features available on many of the machines presented here are auto start and variable-suction force. Though not new, these often overlooked features are worthwhile for people who work a lot with orbital or belt sanders. Auto start allows you to plug a machine into the power outlet on the vacuum's control panel. Then, as you switch the machine on or off, it will cue on or cut off the vacuum's motor. The auto-start feature isn't appropriate for use with a larger tool because it will draw too many amps and blow fuses, but it comes in handy for light-duty applications. Variable-suction force allows the user to adjust the speed of the vacuum motor, which lets you clean off your benchtop without worrying about sucking up hardware.

For this comparison, I looked at the utility of each machine based on endurance, adaptability and ergonomics. This sampling will provide you with a pretty good idea of what to expect from a variety of available brands and help you decide what size and features are best suited to your needs.

Vacuums all have adequate power

No shop vacuum has the power or longevity to replace a dedicated dust-collection system. But a number of them will work well enough as portable dust collectors for benchtop machines in small shops or as backups to larger systems.

To collect wood dust from machines that generate significant amounts of it, a vacuum requires a moderately powerful motor, the ability to take a large-diameter (2½ in. dia.) hose and a good-size collection tank that's reasonably easy to empty.

Some manufacturers test power by seeing how tall a column of water the machine can suck. But my approach to testing was more low tech; I used each of the machines in a variety of situations around the shop and noted my observations. I found that all of the

FEIN 9.77.25

FESTOOL CT 33 E

MILWAUKEE 8955 AND 8927

Photos, facing page (bottom) and this page: Kelly J. Dunton

Filter types affect airflow

Pleats increase efficiency. *Pleated paper filters offer a sizable increase in surface area, which allows the machine to breathe easier.*

Gravity works. *Milwaukee's quarter-sphere-shaped filter utilizes gravity to keep big particles of dust from collecting on it.*

More room for debris. *Filters located at the top of the vacuum (Festool, shown, and Porter-Cable) don't take up valuable space inside the dust-collection tank.*

vacuums had adequate power, as long as I kept the filter from clogging. And then it hit me. What separated the titans of suction from the rest of the pack was not necessarily power but endurance. The design of the filtering system is a critical path to long-lasting performance.

Filter types and designs affect performance

As the vacuum tanks filled with sawdust, some of the machines proved better at maintaining good suction than others. In general, the better performers had filters situated horizontally above the tank, away from the debris, so they came in contact with debris only when the tank was nearly full. From an engineering standpoint, this design was a clear winner. Placing the filter on top of the unit keeps it breathing right and does not rob the tank of volume because its filter is not taking up interior space.

Within my test group, only the Porter-Cable and the Festool have the filtration systems above the tank. In addition to having an optimum filter location, both the Porter-Cable and the Festool have filter-shaking mechanisms that work with their pleated paper filters. The base of the filtration compartment holds a push rod with small fingers that protrude between the filter pleats. By pulling and pushing the rod, the operator can knock off big stuff from the filter without opening the tank. The Porter-Cable goes one step further, providing an access door for easy removal of that filter without having to open the tank.

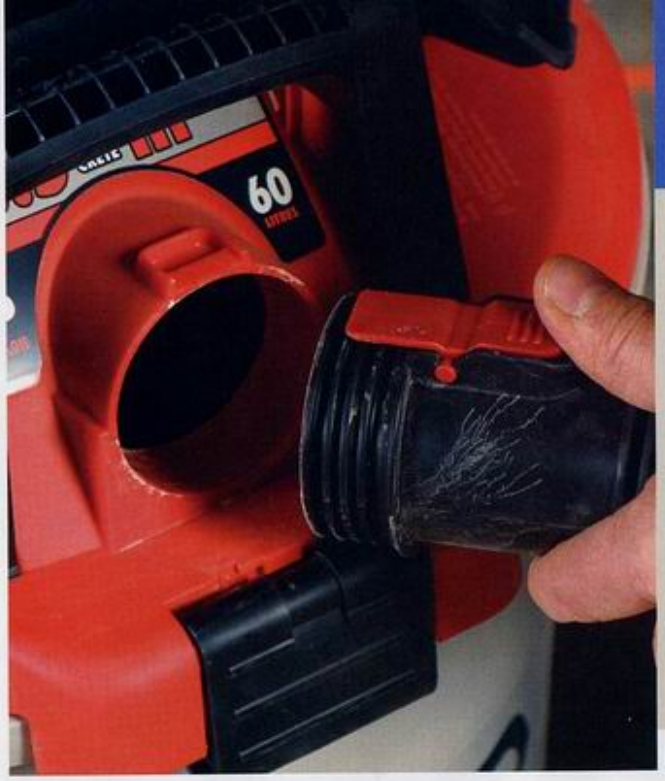
Most of the vacuums I looked at have cylindrical, pleated paper filters that attach to the base of the motors and project downward into the tanks. This type of filter gets phys-

PORTER-CABLE 7814 **RIDGID WD16650 AND WD1735** **SHOP-VAC QL600D AND QUL625**

ically submerged in sawdust, ultimately reducing its airflow.

Some of these filters can be covered with a foam sleeve to extend filter life. The Fein and both of the Alto Wap machines offer these sleeves. In addition, the Alto Waps have a couple of cloth covers available that line the tank. They were great at collecting fine wood dust, and the cloth was simple to shake out when dust overload caused a noticeable loss of suction.

Though not located entirely above the collection tank, the filtration system of the Milwaukee 8927 was ingeniously simple and effective. Its quarter-sphere-shaped filter hangs from the top of the collection tank. The round shape utilizes gravity to keep debris from building up on it as the tank fills, but the tank was cumbersome to empty. Overall, though, the 8927 was solid. Every switch and connector had positive action. For use as a dust collector, it requires an adapter to fit a standard 2½-in.-dia. hose. It carries a hefty price tag, yet it remains a popular choice among home-based woodworkers.



Making a good connection

A fast and firm grip. *The push-and-lock spring catch connection on the Ridgid models is fast, easy and keeps a good grip.*

A tight fit. *Threaded screw-on ports on the Shop-Vacs hold fast, even when they're pulled around by their hoses.*

When to use large vs. small hoses

Hose diameter is critical to the function of a vacuum, particularly when the machine is used as a dust collector. A 2½-in.-dia. hose will carry the volume and size of debris that planers and router tables produce. All of the units, except the big Milwaukee (which needs an adapter), are equipped with either a port or an adapter to accept a standard 2½-in.-dia. hose. This hose size will handle most debris. Larger hoses, coupled with extension wands, are best for sweeping the shop floor.

A small hose diameter, however, is best for using a shop vacuum with small portable tools, such as sanders and saws. The Festool, designed for light-duty dust collection, is a convenient size and has a variable-speed motor, auto-start capability and the most flexible hose of the bunch. Its 7-gal. tank proved more than adequate for light-duty dust collection and had plenty of suction power to sustain hours of sanding. The Festool combines a thumb-controlled slide gate with a motor-speed switch that allows you to tweak suction force. It gave me good latitude while attacking a variety of jobs around the shop.

Exhaust should be a breeze

The Craftsman 17924, both Milwaukees, the Ridgid WD1735, the Shop-Vac QUL625 and the Festool have exhaust outlets that can be used as a source of high-velocity air. The Ridgid WD1765, made by the Emerson Tool Co., has a detachable blower that could be handy for clearing leaves or blowing chips into a pile.

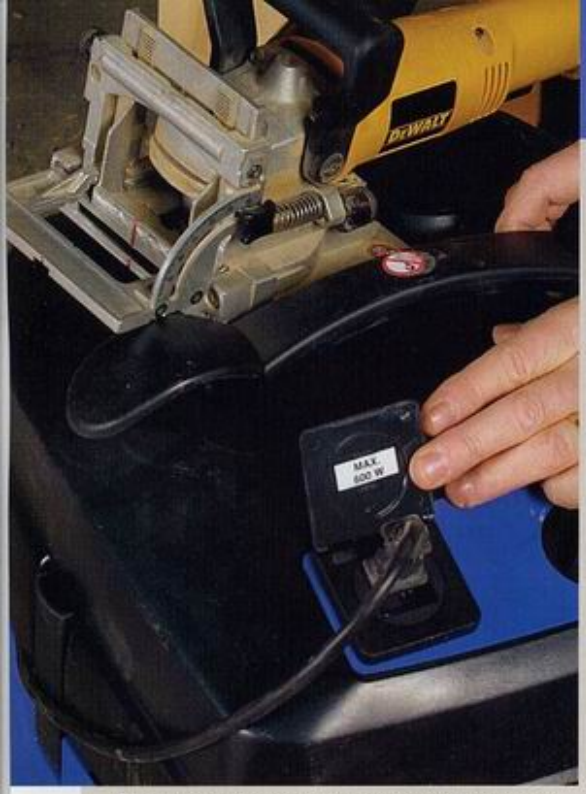
Unfortunately, those exhaust outlets can increase the airborne dust in your shop. I don't like skyward exhaust ports; inevitably, I will lean over the blast and get a face full of dust. Side exhaust ports can send billowing clouds of wood flour through the shop should I inadvertently point it at a dusty shelf.

The Shop-Vac QUL625 and the Festool have ports that, when not used for high-velocity air, are closed, and the air is diverted through diffusers for a "soft" exhaust. The Alto Waps, the Fein, the Porter-Cable and the Shop-Vac QL60OD also have diffusers that turn the exhaust blast into a gentle breeze.

Details that make a difference

Five of the shop vacuums that I tested get around on four casters, while the other eight rely on front casters (or, in the case of the little Milwaukee, a single front caster) and two fixed wheels at the rear, like a shop cart. Most of the dolly-style carriers also have a handle. If you have a habit of leading around your vacuum by its

It's a leaf blower, too. *Ridgid's two-in-one detachable blower can be used in the shop or around the yard to blow sawdust or debris.*



Plug into auto start. *A receptacle right on the vacuum will turn the machine on and off in concert with the tool.*

Variable suction adds control. *Regulating motor speed gives scope to cleaning and light-duty dust collection.*

Shop vacuums head to head

MODEL/CONTACT INFO	COST	AMPS	CAPACITY	AUTO START
ALTO WAP SQ (201) 262-0412 www.ultimategarage.com	$495	13	10 gal.	Yes
ALTO WAP SP	$695	13	15 gal.	Yes
CRAFTSMAN 17922 (800) 349-4358 www.craftsman.com	$79.99	11	12 gal.	No
CRAFTSMAN 17924	$449.99	9	12 gal.	No
FEIN 9.77.25 (800) 441-9878 www.feinus.com	$415	10	14.5 gal.	Yes
FESTOOL CT 33 E (888) 337-8600 www.festool-usa.com	$445	10	7.9 gal.	Yes
MILWAUKEE 8927 (262) 781-3600 www.milwaukeetools.com	$599.95	7	21 gal.	Yes
MILWAUKEE 8955	$227	8	10 gal.	No
PORTER-CABLE 7814 (888) 848-5175 www.porter-cable.com	$306	9	15 gal.	Yes
RIDGID WD16650 (800) 474-3443 www.ridgidwoodworking.com	$119	12	16 gal.	No
RIDGID WD1735	$139	12	16 gal.	No
SHOP-VAC QUL625 (570) 326-3557 www.shopvac.com	$119	11.9	16 gal.	No
SHOP-VAC QL600D	$314.95	10	12 gal.	No

*Decibel readings taken at low and maximum power

hose, you'll need a machine that does not ride on a rear-axled cart. Also, look for a hose that locks into its port. Each of the smaller units presented here followed me without resistance. The Festool and the Alto Wap SQ, with their built-in rear axles, proved to be smooth, hose-driven come-alongs. The large Craftsman, both of the Milwaukees and the Porter-Cable are not built to be used this way.

Emptying the tank was a chore with some of the machines. I had to remove the accessories from their various mounts or lift their tanks out of their caddies before emptying them. If I failed to do this, I wound up fishing the tools out of the sawdust bin. The Ridgid WD1735 has tool mounts on the tank cover but still relies on a cart-handle-mounted caddy for storage. I found the best solutions to this annoyance on the Craftsman 17924 and the Festool. The Craftsman has a caddy that can be removed and a tank that can be separated from its cart. The Festool has storage boxes that clamp onto the vacuum base and are easily removed.

Most of the vacuums come with two-piece extension wands for floor sweeping, but with the exception of the Craftsman 17924 and the Alto Waps, the wands are annoyingly short.

Forcing quantities of wood dust through a plastic tube is a good way to demonstrate how static electricity is produced. If you end up being the conduit for that discharge, the shock won't hurt you, but it is irritating. The Porter-Cable, the Alto Waps and the Festool all have grounding devices for the hose, eliminating shocks.

How do you choose?

Every one of the shop vacuums tested provided adequate performance. So, even though we all have a different approach to de-

VARIABLE-SPEED MOTOR	NOISE LEVEL*	WEIGHT	HEIGHT (ON BASE)	EXHAUST	COMMENTS
Yes	59-66 dB	24 lbs.	20 in.	Diffused around motor housing; very soft	Quiet; has variable-speed motor; overall, was a standout in the crowd
No	63 dB	33 lbs.	26 in.	Diffused around motor housing; very soft	Well-designed feel, from base to hood latches; unfortunately, has no variable-speed motor
No	76.5 dB	27 lbs.	19 in.	Side port; adequate	Low center of gravity gives good stability; good value for the price
No	69 dB	52 lbs.	34 in.	Side port; adequate	Body and accessories prone to rust; motor draws fewer amps than others of its size
No	65.5 dB	36 lbs.	29⅛ in.	Diffused around motor housing; very soft	Removable cloth filter gave good performance while vacuuming dust; quiet; fairly priced
Yes	58.5-68.5 dB	32 lbs.	22 in.	Diffused around motor housing; very soft	Loads of accessories available; quiet; has variable-speed motor
No	75 dB	56 lbs.	40 in.	Side port; adequate	Designed for commercial use; should last a lifetime; good filter design
No	79 dB	32 lbs.	38½ in.	Exhaust port on top; harsh	Three-wheeled base was awkward at times; durable; noisy; skyward exhaust port was annoying
No	74.5 dB	34 lbs.	30 in.	Side diffuser; very soft	Good filter location; well-engineered filter-removal system; impressive commercial design at reasonable price
No	75 dB	26.3 lbs.	27 in.	Side port; adequate	Removable blower capability makes model an especially good value
No	78.5 dB	21 lbs.	27 in.	Side port; adequate	Large latches and light, no-lip tank made emptying a breeze
No	74.5 dB	25 lbs.	26 in.	Diffused side port; very soft	Easy-to-use switches; 2 dB quieter than its predecessors
No	72 dB	25 lbs.	29 in.	Diffused side port; soft	Motor is less powerful than others in this price range but is fine for light-duty dust collection

ciding which vacuum is best for our workshops, I'll share a few of my favorites.

I found the Porter-Cable 7814 to be a well-designed machine. Though a little louder than some, its accessible filter system, relatively light weight, large collection tank, bayonet-style locking hose connector, exhaust diffuser, static grounding and auto-start feature made it a strong finisher. I just wish a larger-diameter hose were standard equipment.

If I needed another shop vacuum and money were no object, the Alto Wap SQ would be my choice. Its purring, quiet motor, auto-start feature and variable-speed motor made it hard to beat. The small tank and small hose were drawbacks for all of the heavy-duty dust collection I require, but the machine felt like it had been built for the long haul. A close second to the Alto Wap SQ was the well-appointed Festool. However, it came with more accessories than I needed.

Finally, there is the Craftsman 17922. With this basic, low-cost machine ($79.99), you can clean your shop and then easily store the vacuum. It's a good bargain.

Like any machine, the design of a shop vacuum is a study in compromise. No single unit carries every perfect characteristic. But in learning of the advent of new features and gaining a better understanding of the strengths and weaknesses that are inherent in today's machines, you should be able to proceed with confidence as you choose which shop vacuum will provide the best overall value for you. □

Roland Johnson runs a custom woodworking shop in Sauk Rapids, Minn.

Current Work

Current Work provides design inspiration by showcasing the work of our readers. For more details and an entry form, visit our web site at www.finewoodworking.com. Send photos and entry forms to Current Work, *Fine Woodworking*, 63 S. Main St., Newtown, CT 06470.

John C. Packard Sea Cliff, N.Y.

This entertainment cabinet (27 in. deep by 54 in. wide by 96 in. tall) made of crotch mahogany took 400 hours to complete. Built for a client who lives in New York City, the cabinet's design was inspired by the interior of the 1920s classic revival elevator that services the client's building. "I duplicated most of the details, right down to the reeded Gothic columns and teardrop detail at the crown," said Packard. The cabinet has a rubbed-out lacquer finish.

Joe Stearns Traverse City, Mich.

The design for this coffee table (23 in. deep by 46 in. wide by 17 in. tall) evolved through several variations. "My design ideas come from my formal study of architecture," Stearns said, "as well as general observations of good functional art and graphic design and a decided leaning toward organic forms." The table is made from panga panga with a four-way book-matched curly cherry veneer top that features ebony inlay. The finish is oil and varnish with a sprayed-lacquer top.

Jim McLain Socorro, N.M.

After the tragic events of Sept. 11, 2001, McLain was inspired to create this wood turning. The 12-in. sphere, titled Windows to the World, is made of spalted maple, holly, bloodwood and ebony and took 100 hours to complete. The segmented form comprises 320 pieces of wood. The finish is Waterlox and tung oil.

Lauren Waters Nelson, B.C., Canada

Waters made this china cabinet (20 in. deep by 43 in. wide by 78 in. tall) as her year-end project for Selkirk College's fine-woodworking program. The piece, made of cherry and curly maple, took 350 hours to complete. "I chose the graceful form of a tree to give shape to this cabinet, with the flowing lines, tree trunk and etched-glass branches to support an arched top that echoes the curve of a mature tree's canopy," said Waters. The cabinet has a lacquer finish.

Dale Kirstine Magalia, Calif.

Kirstine built this reproduction mahogany lowboy (18½ in. deep by 29 in. wide by 30 in. tall) for his daughter and son-in-law, to be used as a bedside table. The piece's cabriole legs are accentuated with slipper feet, while the bottom center drawer features a carved shell, which was Kirstine's first attempt at shell carving. The lowboy has an oil-and-varnish finish.

Casey Jones Schofield, Wis.

Jones' daughter needed something with a lot of room to store all of her jewelry, so he built this cabinet (8½ in. dia. by 18 in. tall) for her. Made of cherry, maple and cocobolo, the cabinet has a cylindrical design because Jones felt that would be the most efficient use of space. The nine drawers and the necklace compartment have magnetic catches. The magnets countersunk in the drawers and door correspond with magnets countersunk in the divider. The finish is sprayed polyurethane.

Mark Bellonby Mason Neck, Va.

"This piece has a strong architectural character with an Art Deco flavor," Bellonby said. The cabinet (22 in. deep by 45 in. wide by 82 in. tall) is constructed out of solid and veneered Honduras mahogany with a solid Gabon-ebony top cornice and ebonized Honduras-mahogany moldings and cock beads. The MDF-substrate doors feature veneered marquetry of Macassar ebony, pommele sapele, redwood burl and figured pear and maple. The design is an adaptation of the Deco elevator doors at the Chrysler Building in New York City. The cabinet has a varnish finish. Photo by Carol Bellonby

Bo Hagood Portland, Ore.

"Simple is hard to do," said Hagood. "When I designed this piece, I challenged myself to keep it simple, focus on proportion and elegance and have a natural finish." The product of Hagood's self-imposed challenge is this chest of drawers (16 in. deep by 27 in. wide by 36 in. tall). Made of pearwood, the piece features slight finials on the legs and turned and sculpted African-blackwood drawer pulls. The finish is wipe-on polyurethane.

Taimi Barty Fort Bragg, Calif.

Based on the silver chest cabinet that James Krenov made 40 years ago, this stand of drawers (15 in. deep by 19 in. wide by 53 in. tall) was built to serve as a room divider. Barty used narra, western maple and Port Orford cedar to make the piece, which took 650 hours to complete. Titled Ode to Full Circle, the stand has nine through-drawers that slide in both directions. The piece has a shellac-and-oil finish.

Milton K. Arrow Binghamton, N.Y.

Arrow built this Bible box (22 in. deep by 14 in. wide by 9 in. tall) after reading an article in *Antiques* on Lancaster County Bible boxes. The box is made of walnut and features inlays of holly, maple and cedar. "The biggest challenge in making the box," said Arrow, "was creating the design in the given space, because some of the arcs have three different centers." The box has an oil finish.

J. Albert Hudson
Knoxville, Tenn.

Hudson, a woodworker of some 60 years, built this reproduction Newport tall clock (11 in. deep by 22½ in. wide by 94 in. tall) for himself because he had always wanted one. Eventually, it will be left to one of his grandsons. Made of fiddleback and crotch Oregon black walnut, the piece features a broken-arch top with carved capitals and fluted leaf finials and a block-and-shell carved waist door flanked by fluted quarter columns. The crotch-panel base is chamfered and has lamb's-tongue corners. The ogee bracket feet feature blind-dovetail miters. The clock has a hand-rubbed oil finish topped with three coats of wipe-on varnish.

Troubleshooting problem joints

BY PHILIP C. LOWE

Wondering why your edge joints don't line up or why that dovetail drawer won't sit flat? Or why your perfectly cut mortise and tenons in that table base leave the legs splaying? Often the fault lies not with the way the joint was made but in the way that you initially prepared the stock. The key is properly milling the stock to avoid problem joints.

Edge joints

When joining two boards edge to edge, four common errors can occur.

One such problem is when two boards placed edge to edge reveal spaces at one or both ends of the boards. Gaps at the end mean that one or both edges have a convex shape along their length. But a gap in the middle means one or both edges have a concave profile. In both cases the solution is to check the profile by using a dedicated straightedge or by testing the edge of the boards on a flat machine top such as that on a jointer.

Sometimes the two boards have edges that meet perfectly, but the surfaces fail to line up. You can align the boards by pressing on the one that is higher, but this can transfer irregularities from one board into the whole panel. The problem is that one of the boards has a bow in it. A straightedge will reveal one surface to be concave and the opposite surface to be convex. The best solution is to return to the jointer and planer to reflatten the stock.

The fourth defect in an edge joint is when the two edges meet perfectly but rock when placed on top of each other. If the edges are square, you will need to trace the problem back one step further. Check the surface of the board for flatness. More than likely, you will find that the surface against which you placed the head of the square has a wind or twist in it. The

EDGE-JOINT PROBLEMS

To obtain a seamless joint, both boards must be perfectly straight, flat and square.

GAPS AT THE END

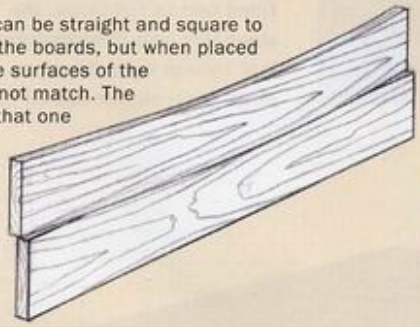
A convex edge on one or both boards is caused by poor or insufficient planing. A small gap in the last 2 in. of the joint probably is an indication of snipe from the jointer.

A GAP IN THE MIDDLE

A concave edge on one or both boards often is caused by handplaning, where the tendency is to put more pressure into the middle of the board.

UNEVEN FACES

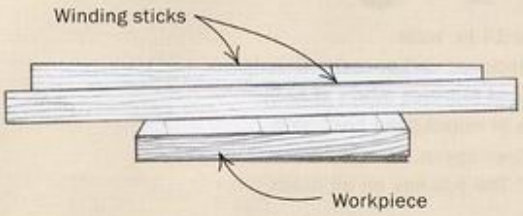
The edges can be straight and square to the face of the boards, but when placed together the surfaces of the boards will not match. The problem is that one or both boards are bowed.



No bow here. *To test whether a board is bowed, use a straightedge that is longer than the board.*

BOARDS THAT ROCK

The edges can be straight and square to the faces of the boards, but when placed together the boards will not lie flat. The problem is that one or both boards are twisted.



Twist detective. *Winding sticks laid across each end of a board magnify any twist in the board.*

Photos: Mark Schofield; drawings: Kelly J. Dunton

square shows the edge of the board to be square to the surface, but the square cannot reveal a twist in the surface. This can only be revealed on a flat surface or by using a pair of winding sticks.

Mortise-and-tenon joints

There are numerous ways a mortise-and-tenon joint can be affected when the lumber is not prepared correctly. For example, when you assemble a table frame and dry-fit the legs to one rail, one or both legs angle inward or outward and are not parallel.

Track down the problem, disassemble the legs from the rail and check that the shoulder is square to the edge of the board. Splay can be introduced into a leg by the end of the rail not being square. A lot of people cut a board to length and assume that it is square. They then use the end of the board as a reference to scribe the shoulder lines using a marking gauge, or using this end against the fence or the table if cutting the tenons on the tablesaw. The unsquare end will be transmitted into unsquare shoulders, which in turn will introduce splay or twist into the leg. The solution is to use a square to check the ends of the boards.

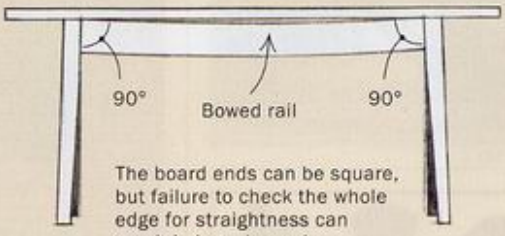
If the end of the rail is square, examine the straightness of the rail's edge. Check the one you placed the head of the square against when laying out the shoulders. Use a long straightedge or place the board on a machine tabletop. A curved edge will introduce an angle into the shoulder. If the lower edge of the rail is convex, the legs will splay; if it is concave, the legs will angle inward. The reverse is true when testing the top edge.

Another common problem is a mortised and tenoned face frame that doesn't lie flat. After taking apart the joint, make sure the tenon is parallel to the surface of the board. If it checks out fine, you then need to test the rail for flatness. If you find the reference surface has a twist, you transfer this twist into the tenon because you are working off an imperfect surface.

MORTISE-AND-TENON PROBLEMS

Not all flared legs are intentional. Poorly prepared stock can leave legs canted in and out.

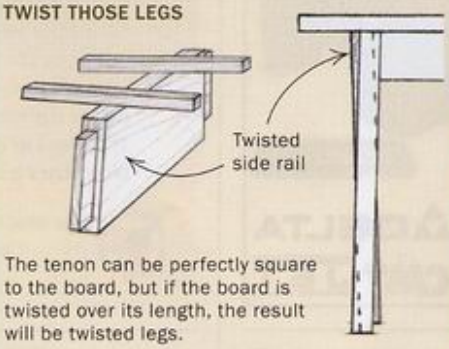
SPREADING LEGS



The board ends can be square, but failure to check the whole edge for straightness can result in legs that splay.

Square but not straight. *A combination square will show you that the end is square to the board's edge. It will not reveal whether the edge is flat over its entire length.*

TWIST THOSE LEGS



The tenon can be perfectly square to the board, but if the board is twisted over its length, the result will be twisted legs.

Right angle, wrong tool. *A combination square can tell you if a board's edge is exactly 90° to its adjacent sides, but it will not be able to detect twist in a board.*

Dovetailed drawers

Frustration can mount when you assemble a drawer and find a space in the end of the dovetails, or when you have a drawer box that is twisted and doesn't sit flat. As with previous joint problems, the faults can be traced back to the improper preparation of the lumber. A gap at the end of the dovetail is most likely created by the end of the board not being square.

If the overall edge of a drawer side is concave or convex, the drawer box will twist when assembled. Once again, check the overall straightness of the edge before cutting the joint.

The other way in which a twist can occur is when the drawer side is planed with a twist in the surface. This always puts the drawer front and back in wind to one another. Once the drawer has been assembled, planing material from the bottom edge of one side in turn makes the drawer front tilt; if enough material is removed from both sides of the drawer, the bottom can rub on the frame. □

A PROBLEM DRAWER

If the end of the board is not square to the edge, one or more corners of an assembled drawer will not sit flat.

Q&A

Calculating wood movement in a design

I am building a table out of quartersawn red oak. The tabletop is 90 in. by 42 in., and the grain runs parallel to the short dimension, not the long one.
I would like to border the table with a separate frame—not unlike a picture frame—so that the lumber core of the table floats within the frame, which also will hide the end grain on the edges. Can this be done without having expansion and contraction problems later on?
—Russell Seaman, Bluffton, S.C.

Christian Becksvoort replies: It sounds as though you like to flirt with disaster. When it comes to wood movement brought on by changes in humidity, red oak is a pretty bad actor. You're certainly going in the right direction by choosing quartersawn stock, but that alone will not be enough to bring you success with the design you described.

I can think of only two circumstances under which this might work using solid lumber. First, at a time of year when moisture in the air is at its maximum, you could make all of the boards in the panel very narrow, and not glued but splined together (sort of like an old barn door). That way, the movement would be better contained within each piece, and you could end up with a series of small gaps between each splined board.

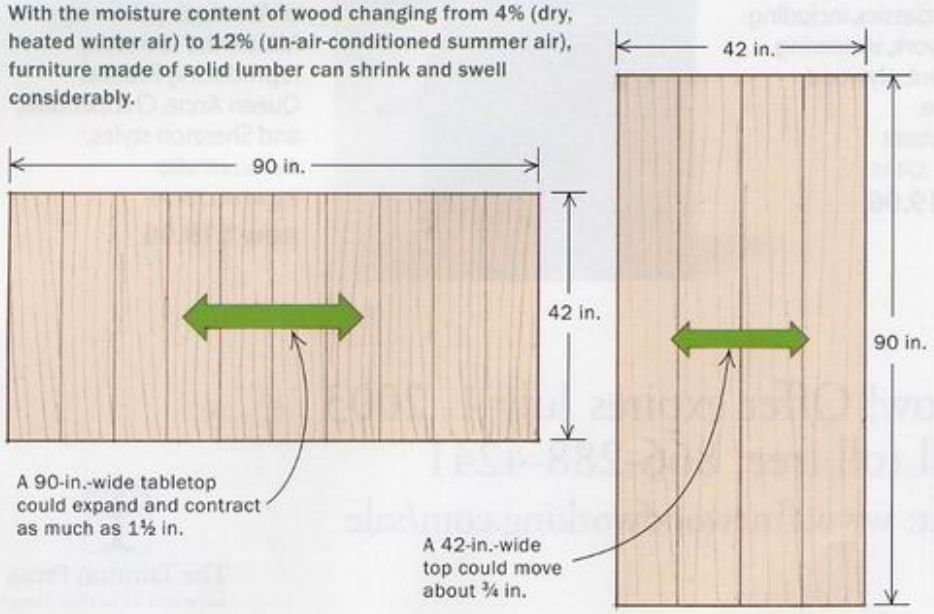
Second, this design might work if the entire tabletop is encased in a thick layer of liquid plastic to stop all moisture gains and losses.

But let's face the facts: Even quartersawn red oak, 90 in. wide, will move roughly 1½ in. given that the moisture variation between damp summers and dry winters will change the moisture content in the wood from 12% to 4%, an overall difference of 8% between the seasons. In most parts of the country, those figures are fairly typical. If these boards are glued into a solid panel, you will need at least a ¾-in.-wide expansion slot at both ends of the table—quite a gap for dust and crumbs to collect in. Putting a frame around that much solid lumber is not a plan that I would ever be comfortable with. You can understand why so many antique dining tables were made with veneered tops.

As an alternate (and more conventional) design using solid lumber, I would recommend that you forget about building the frame around the tabletop and that you run the grain with the 90-in. length of the top. Then you will have only a little less than ¾ in. of movement across the 42-in. width to deal with when deciding how to go about attaching the top to your table base.
[Christian Becksvoort is a contributing editor.]

HOW MUCH WOOD MOVEMENT TO EXPECT

With the moisture content of wood changing from 4% (dry, heated winter air) to 12% (un-air-conditioned summer air), furniture made of solid lumber can shrink and swell considerably.



Jointer and planer sizes

I recently read the articles in your* Tools & Shops *issue (FWW #160) on 6-in. jointers and 12-in. planers. One of the articles states that the first step in preparing a square board is to joint one flat face and then run the board through a planer with the freshly jointed face down against the planer bed, which will produce a flat, uniformly thick board. My question is this: With planer widths starting at a minimum of 12 in. for portables, and going up from there for the larger industrial units, why are most of the jointers advertised only 6 in. to 8 in. wide? You would think that a 12-in. jointer would be an ideal companion for a 12-in. planer. Am I missing something? Also, is there a technique that would allow me to joint the surface of a 12-in.-wide board by making two passes on a 6-in. jointer?
—Al Gegaregian, Portola, Calif.

Gary Rogowski replies: I've had a theory for years that the people who work at tool companies don't see discrepancies like the one you just pointed out as a problem, because most of them are engineers or sales staff. They're not woodworkers, so thinking through the process of how to make wood flat and straight just never occurred to them.

I don't think you're missing anything, and your reasoning is correct: A 12-in. jointer is the ideal companion for a 12-in. planer. The problem is, I think, partly one of economy and partly one that exists because of uneducated consumers. I've been told that in the 1960s, Sears sold a 6-in. planer for a time, but the company

Drawings: Vince Babak

couldn't sell enough of them to make the product line profitable, so it was discontinued. A 12-in. planer is only slightly larger than a 6-in. version, and both need feed rollers, chipbreakers and pressure bars. So inch-for-pound, it's cheaper and more economical to make the larger sizes. Jointers are simple machines in some ways, but larger jointers need much larger (and heavier) bed castings. Those larger beds add considerable costs to the manufacturing and shipping expenses.

Here's the background on my mention of uneducated consumers: I called a machinery dealer, Rand Robinson of Barbo Machinery in Portland, Ore. He said that about half of the people buying a jointer want one strictly for edging purposes. As an example, he cited calls he's received asking for 2-in. jointers. So it seems fair to conclude there are a number of woodworkers who don't know they must face-joint wide boards before sending them through a planer.

To answer your other question, I know at least two techniques for flattening wide boards on a narrower jointer. The first is a method that I seldom use and that I even hesitate to recommend, but it often is listed in the owners' manuals that come with 6-in. and 8-in. machines. You must remove the cutterhead guard to joint the wide board as if you were taking a big rabbet off one side of the board. After as many passes as it takes to get that part of the board flat, you are left with a ledge that must be brought down with a handplane. The second (and more common) technique is to rip the stock into two widths, face-joint them separately, and then glue them back together before planing them to thickness. If you use this technique, it's a good idea to leave some extra length on the boards so that you can slide them back and forth to get the best grain match possible when gluing them back together. [Gary Rogowski is the director of the Northwest Woodworking Studio in Portland, Ore.]

How flat is flat?

I've noticed lately that a lot of people seem to be advocating wet-or-dry sandpaper on glass or a granite slab lubricated with water as a method for

WHEN THE WOOD IS WIDER THAN THE JOINTER

Flat faces on wide lumber. *If you cannot afford to mate a 12-in. jointer with a 12-in. planer, there are other solutions to getting flat faces on wide lumber. One method requires you to remove the cutterhead guard, which is not safe. The easier and safer technique—cutting the board into two smaller pieces—is shown here. Joint one edge and place the board on the jointer to mark where to make the rip cut.*

Cut to a manageable size. *Establish a straight edge by jointing one edge and then ripping the board in half.*

Then joint the lumber. *Joint the same face and mating edges on each of the two pieces. Glue them back together, matching the grain (right), and then plane the reassembled board down to its desired thickness.*

Photos, this page: Kelly J. Dunton

sharpening chisels and plane blades. This method seems to work great, but I'm left wondering just how accurate the substrate needs to be. For example, I noticed one of the catalogs selling a granite slab ground to a tolerance of no more than 0.0001 in. over the span of its surface. My question is this: How flat is flat enough? Couldn't you just use a benchtop or a piece of plastic laminate glued to particleboard as the surface for the sandpaper?

—Greg Spencer, Fort Collins, Colo.

Garrett Hack replies: Let me preface my answer to your question by posing another one: Why is flatness of your sharpening surface (stones or sandpaper) important? As long as the back surface of your chisel or plane iron meets the bevel at a distinct line, you will end up with a sharp edge. After a single sharpening, a slightly convex line to the back—which you can produce easily on a stone worn hollow or on a sandpaper lapping plate not flat—really won't affect the performance of either a chisel or a plane.

The problem comes with resharpening time and again. A curved back or a sharpening surface not flat means you will have a hard time getting an even polish on the back and maybe on the bevel, too. You'll be rocking the cutting blade, polishing some areas and missing others. Sharpening will take more time, it will be frustrating, and over time the edge will become inconsistently sharp.

Because the back of your tools will conform to the surface they're sharpened on, the flatter your stones or sandpaper lapping plate, the better. A benchtop or plastic laminate on particleboard is probably not very flat. Thick plate glass often is used because it's fairly cheap and reliably flat. Granite is even better because it is stiffer. Then there is the reality that the sandpaper isn't made to a precise thickness (plus there could be uneven bits of grit or glue under it). That is why I recommend sandpaper lapping plates only for rough-flattening of your chisel or plane irons, and moving to a stone of some kind for more precise polishing. Years ago I found a cast-iron machinist's table at a tag sale, and I use it with sandpaper for rough-sharpening. I always follow that process by sharpening cutting blades on stones.

How flat is flat enough? I regularly polish down to 3 microns and sometimes to 1 micron, which is about the equivalent of 0.000039 in. I doubt that the entire surface of my finest stone (or strop) is as flat as this, but to get a consistent polish on the back again and again, some parts of them must be. To make your sharpening easier and more consistent, keep your stones flat with regular maintenance on a diamond plate. [Garrett Hack is a woodworker in Thetford Center, Vt.]

FLATTER IS BETTER FOR FINAL SHARPENING

Hack uses sandpaper on an old cast-iron machinist's table for rough-sharpening chisels and plane irons. He follows that process by honing edges on various sharpening stones, and he periodically flattens those stones on a diamond plate. A short time spent flattening the stones saves more time later when sharpening cutting edges.

Dealing with mothball odors

I have a maple dresser that is approximately 30 years old. My grandparents used mothballs in the lower three drawers. Any clothes that I put in these drawers smell like mothballs within a day or so. The drawer sides are solid maple, and the drawer bottom is maple-veneer plywood. Is there any way to get rid of the mothball smell for good?

—John Walsh, Kensington, Conn.

Chris Minick replies: Mothballs rank right up there with the worst ideas of all time. They are smelly, the vapors permeate everything that comes in contact with them, the stink persists for what seems like forever, and there is evidence that suggests they may be a health threat, too.

There are two different types of mothballs sold today—those that contain naphthalene as the main ingredient, and those that are made from paradichlorobenzene. Both chemicals are unique in that they transform, at room temperature, directly from a solid to a gas without going through a liquid state. It's the gas that kills the moths. But those vapors also absorb into the wood, the clothing and anything else that may be in the dresser. Once the solid mothballs are removed from the dresser, the wood will eventually "off gas" and return to its natural nonstinky state, but that process can take decades. Applying a finish coating over the stinky wood to encapsulate the smell is a good solution; but you must choose the correct finish, or the stink will return. Varnish will not work because the vapors eventually will migrate through the coat of varnish and back into the air inside the drawer.

Do not despair, though: There is a simple solution to your smelly problem—shellac. Shellac has a unique chemical structure that forms a vapor-impenetrable barrier that effectively traps the mothball smell inside the wood. No vapor transmission, no stink. Simply finish the inside of the drawers with two or three coats of shellac, and the problem will be solved. Incidentally, a coat or two of shellac also will eliminate that musty mildew smell often found in antique furniture.

[Chris Minick is a consulting editor.]

Photo, this page: Bill Duckworth

BY LONNIE BIRD

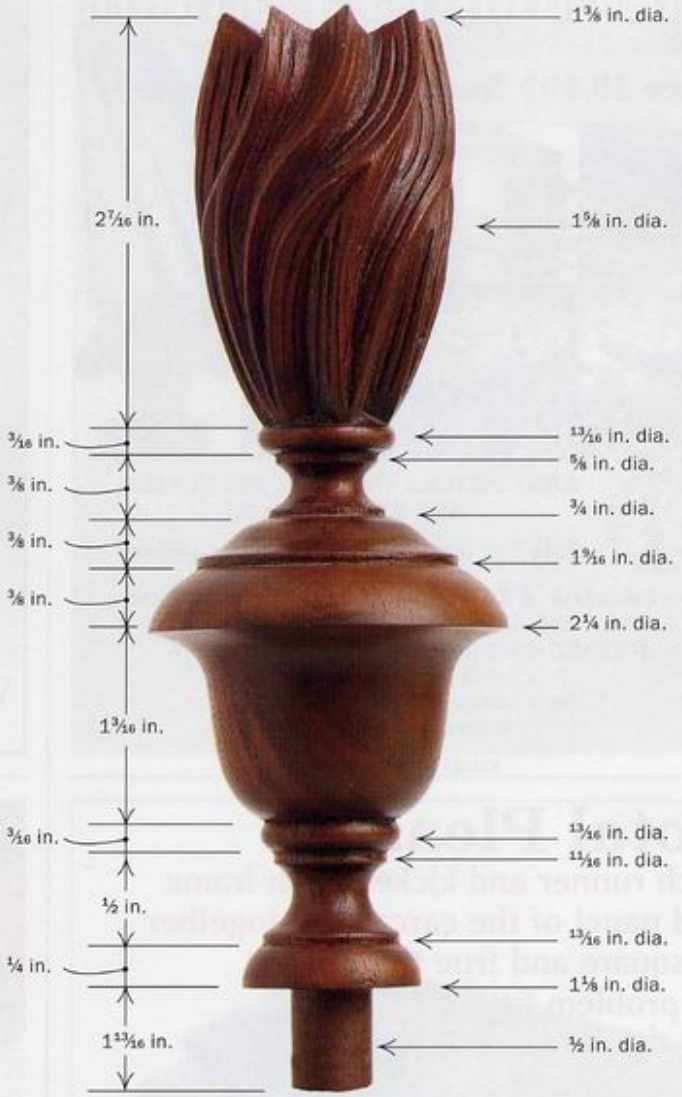
Carve a flame finial

Finials have been used for centuries as finishing touches on the pediments of case pieces. During the 18th century, as wealth increased in the American colonies, elaborately carved furniture became popular as a display of opulence.

Cabinetmakers in each colony developed furniture and carved motifs for their clientele that were unique to their region. This flame finial is an example of the style found on Pennsylvania furniture from the third quarter of the 18th century.

Although a finial appears to be a complex form, it's not difficult to carve when a logical approach is taken. Making this flame finial involves only four steps: turning, sketching, carving and detailing.

Turning is always made more precise with a story stick. This simple tool speeds up layout and helps ensure that multiple turnings will be identical. The stick is marked with perpendicular lines at the location of each bead and fillet. I chisel a small notch where each line intersects the stick's edge.

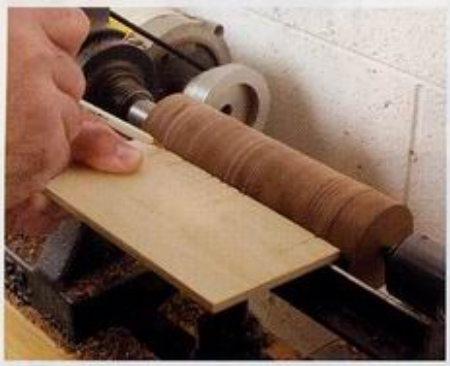


Start by turning the blank

Begin by selecting clear, straight-grain stock for a turning blank. Solid stock is the best choice; glued-up stock has seams and mismatched grain and color that will distract from the completed turning. Also, it's more difficult to carve glued-up stock because the grain direction makes abrupt, unpredictable changes at the gluelines.

When making finials for large casework such as chests

FORM THE FINIAL



Dimension the turning. *First turn the blank to the largest diameter. Then use a story stick to mark out the dimensions.*

Form the flame and urn. *Complete the turning of the finial, leaving a tenon at each end. The tenons will be used later to secure the work during carving.*

Smooth things out. *Burnishing the completed turning with chips closes the grain and gives it a nice, natural polish.*

Photos, except where noted: Matthew Teague; this page (top right): Michael Pekovich

and secretaries, I prefer to turn the flame and urn separately because the narrow cove at the base of the flame weakens the turning. This method also allows you to turn another flame easily if you're not satisfied with the first. After carving, the two can be joined with a mortise-and-tenon joint formed on the lathe. This small clock finial can be made as one piece.

Sketch the flame

Drawing the design is an important first step in carving. Good layout allows you to work through the design details and proportions beforehand, and also gives you direction as you're working.

Fortunately, the layout for this finial is relatively easy. It involves repeatedly sketching cyma curves around the turning perimeter. Spacing the curves is important, and it's easily accomplished with dividers.

Begin the layout by penciling in the first curve. You'll find it easier to sketch the curve if you pivot the pencil from your wrist or the knuckle of your little finger. The transition point at which the curve changes direction is just below the midpoint of the turning. You'll probably find it easier to invert the turning to draw the upper portion of the curve.

When you're satisfied with the first curve, use it as a guide to sketch in the 14 remaining ridges around the turning's perimeter.

Before carving, study your layout and check for spacing and irregularities in the curves. The layout doesn't require mechanical precision, but the lines should flow gracefully as they spiral toward the top. Spacing should look somewhat uniform, but it doesn't need to be perfect. The idea is to create a carving that is well proportioned with pleasing free-form curves.

Carve the design

The flame finial is really just a series of ridges and Vs. Each of the cyma curves that you sketched earlier becomes a ridge, and the area between a pair of ridges forms a V. Carving the flame is now simply a matter of removing the area between the ridges.

If you keep some key points in mind as you carve, success is virtually assured. First, keep the tools sharp: Sharpness is critical to control of the tool. I keep a leather strop on my bench and hone the edges periodically. Second, always carve with or across the grain, not against it; oth-

LAY OUT THE FLAME

Divide to conquer. *Mark out six points at the flame base with a pair of dividers.*

Sketch the first curve. *It's important that this curve be pleasing to the eye.*

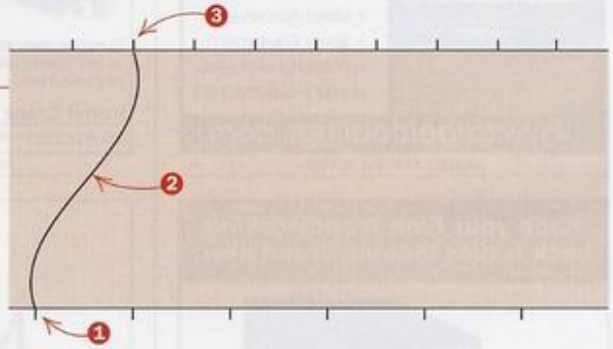
Locate the flame tips. *Step off and mark nine equal spaces with dividers at the top.*

DEMYSTIFYING THE FLAME DESIGN

The completed pattern for this carving consists of 15 ridges formed from six points at the base and nine points at the top. If you follow the three-step approach below, what seems complex will become easy. The layout is presented here as if it were a flat design.

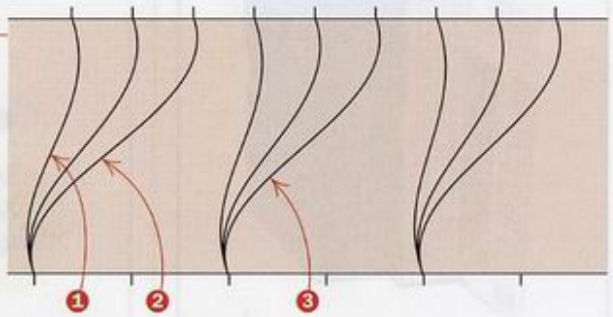
STEP ONE

1. *Mark off six equidistant spaces at the base of the flame.*
2. *Draw a smooth, flowing cyma curve, beginning at the base and working upward.*
3. *At the top of the curve, mark off nine equally spaced points.*



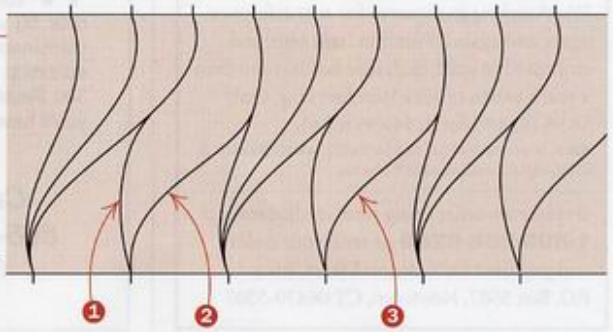
STEP TWO

1. *Starting at the same point at the bottom, sketch a second curve upward and to the left of the first, connecting to a point above.*
2. *Draw a third line from the same point upward and to a point at the right.*
3. *Skipping a bottom point, repeat this three-curve pattern twice.*



STEP THREE

1. *Starting at an unused point along the bottom, pencil in a curve that merges with the ridge to the left.*
2. *Draw a second curve and have it merge into the ridge on the right.*
3. *Repeat for the remaining unused points along the bottom.*



Drawings: Michael Pekovich

erwise, the wood will splinter and tear. As you carve, remember that each layout line becomes a ridge. Also, it's important that the line formed by the bottom of the V is smooth and flows in harmony with the ridges. As you deepen each V, adjust this line, if necessary, to flow smoothly.

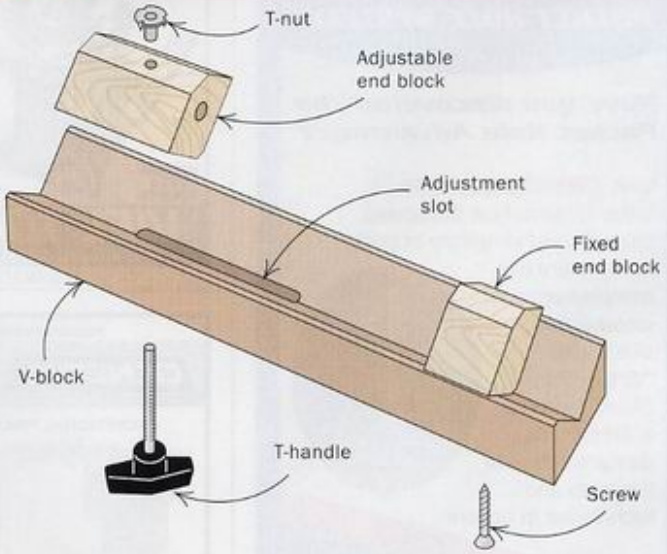
Avoid carving too deep at first. Once you've carved the entire circumference of the turning, you'll have a better feel for the look you're trying to achieve, and you can deepen the cuts as necessary. Unlike many other areas of woodworking, carving isn't a process of cutting to precise dimensions. Instead, it's a matter of creating balanced, flowing lines, which can't be gauged or measured but are judged by a critical eye. In this case, each line should spiral along its length in an uninterrupted cyma curve.

As the carving progresses, the only remaining portion of the original turned surface will be each ridge. Be careful to leave the ridges intact, or you'll spoil the flow of the curve that you created on the lathe.

CARVE THE FLAME

A SIMPLE, EFFECTIVE CARVING JIG

Before you begin carving, take a few minutes to build this jig. Essentially a V-block with a built-in clamp for securing your work, the jig can be held in your bench vise.



Where and how to start. *Begin by carving with a ½-in. #2 gouge across the grain toward the bottom of each V. Alternate the cuts from both sides to remove the wood cleanly.*

A flowing V takes shape. *Work from the center of the V out toward the ridges and from the base of the flame to the tip. Cutting across the grain will leave the surface slightly coarse, but the technique removes wood quickly.*

Refine your work. *When you're satisfied with the initial carving, smooth the surface of each curve by cutting with the grain using the same gouge. Then sever the end grain at the base between the flames with a ¼-in. bench chisel.*

Add the details

The final touch is to carve the tiny veins on the surfaces of the flame. These shallow grooves break up the otherwise flat surface and give the finial greater visual interest.

When applying a finish, bring out the details with a glaze; either dark wax or a thick stain in a dark color that matches the rest of the finish works well. Brush the glaze over the finish and remove the excess with a rag. The trapped glaze that remains will emphasize the details of the carving. □

Give the flame character. *Draw each vein, beginning at the outer edges. Depending on the width, each surface has two to three veins. With a steady hand, carve each vein with a 1.5mm #11 gouge. The veins toward the inside may not flow entirely from top to bottom but fade out as the surface narrows.*

BY MARK SCHOFIELD

A starting kit for finishing

Just as a Goddard-Townsend chest can't be built with only a saw and a chisel, a good finish requires more than a can of boiled linseed oil and a few rags.

Many woodworkers lavish attention on their woodworking tools but don't give much thought to their finishing supplies. With that in mind, I asked four finishing experts—professional finishers Jeff Jewitt, Peter Gedrys and Teri Masaschi, and consulting editor Chris Minick—what they recommend as a basic tool kit for finishing.

Start with good surface preparation

POWER SANDING
You'll need a 5-in. or 6-in. random-orbit sander with some form of dust collection. Go with a hook-and-loop attachment system.

There was unanimous recommendation to buy a random-orbit sander, either a 5-in. or 6-in. model. Whatever model you pick, make sure it has an option for dust collection. You may be tempted to purchase a sander that accepts pressure-sensitive adhesive (PSA) discs because they are cheaper than hook-and-loop discs. Don't: It is a false economy for most amateurs. Unless you are sanding huge projects, you will find yourself moving up to the next grit with half the life still left on the disc you just used. A hook-and-loop disc can be remounted and reused, but a PSA disc most likely will not adhere again and must be thrown away. You'll need a supply of discs with grits of 100, 120, 150, 180 and 220.

Hand-sanding is inevitable—Not only will you need to hand-sand small areas and molding, but you'll also have to hand-sand between coats of finish. A cork or felt block helps you maintain a flat surface while sanding, and it saves your fingers. An alternative suggested by Minick is to use 1½-in.- or 2-in.-thick rigid foam insulation, usually colored blue or pink. You'll find plenty of insulation scraps in construction-site trash containers. A benefit of the foam is that it can be sawn to match contours.

For the final sanding before applying a finish, use 180- or 220-grit garnet paper; for sanding between coats, use aluminum-oxide paper in grits of 220, 320 and 400. Make sure the paper is stearated, or nonloading; otherwise; the finish will clog the paper quickly.

HAND-SANDING
A cork block wrapped in sandpaper helps flatten surfaces, while rigid foam insulation can be cut to match molding profiles.

Don't be afraid of dyeing

Some may question why beginning finishers should dye or stain their work. All four finishers believe that adding color to some woods is such an integral part of finishing that it should be learned early on.

Gedrys favors water-based dyes for their light-fastness, arguing that it is very little extra work to raise the grain prior to the final sanding. The others say premixed non-grain-raising (NGR) dyes, such as those made by Solar-Lux, are easier to use and compatible with all clear finishes.

ADDING COLOR
Dye concentrates are the most flexible way to add color. Non-grain-raising dyes are easiest to use, and water-based dye powders are cheapest.

These are the first half-dozen colors that you will need in a basic finishing kit:

1. Green—to kill the salmon pink color often found in mahogany as well as to tone down the overly red color of many cherry stains
2. Medium yellow—the first dye applied to a piece to unify the color tone of different boards
3. Medium brown—to lower the brightness of a stain and make it look more natural
4. Dark brown such as mission brown
5. Reddish cherry brown
6. Black—in most dyes this is actually a very dark blue and will cool down other colors.

You'll need a few clear finishes

Unlike fine wines, finishes don't age well, so don't let your shop resemble a cellar with dozens of cans gathering dust. Shop-mixed shellac has a shelf life of about six months. Premixed shellac, if unopened, can be used until the expiration date on the can; but once the can has been opened, the finish should be used within about a year. Solvent-based varnishes last about two years, as the metallic driers deactivate over time. Apply any doubtful finish to a piece of scrap and see if it dries hard or remains sticky. To avoid wasting finish, purchase quarts rather than gallons and start with one of the following three finishes.

Danish oils are easy to apply—For a close-to-the-grain appearance, apply one of the many oil/varnish/solvent blends known as Danish oil, such as those made by Watco

Photos: Mark Schofield

AN ASSORTMENT OF FINISHES

Oil/varnish combinations. *Generally known as Danish oil, these finishes can be applied and wiped off with a rag for a low-luster, open-pore finish.*

Shellac comes in two forms. *Premixed is easier to use but has a limited shelf life. Dry flakes last much longer and come in a variety of colors.*

Tough finishes. *For surfaces subject to frequent contact, alkyd varnish or polyurethane provides a durable finish.*

or Waterlox. They require minimal skill to apply and give an acceptable appearance, but on the downside, they provide minimal protection.

Shellac is the most versatile finish—Shellac is sold in flake form or premixed varieties. It can be used as a barrier coat to seal softwood knots, as a sanding sealer, as a stain controller to minimize blotching, as a layer between incompatible finishes (in its dewaxed form) and as a beautiful finish in its own right.

BRUSHES

From the top: A 3-in. synthetic-bristle brush covers large surfaces. A 1½-in. angled sash brush copes with smaller areas. An artist's wash brush can lay down a final thin coat of finish, leaving almost no brush marks.

The best way to start is with Zinsser's SealCoat, which has a slightly orange tone. It is dewaxed and comes as a 2-lb. cut (the equivalent of 2 lbs. dry shellac flakes to 1 gal. denatured alcohol). For best results, dilute it with one part denatured alcohol to two parts SealCoat. For the last coat, cut it to a 1:1 ratio.

Once you get accustomed to using shellac, sample the variety of colors available. These range from almost-clear super blond to dark buttonlac and seedlac that instantly give an aged appearance to a piece. The dry flakes last almost indefinitely.

Varnish is a durable tabletop finish—Neither Danish oil nor shellac provides sufficient protection for tabletops subject to heavy use. For maximum durability, apply a solvent- or water-based polyurethane varnish. Minick favors Minwax Fast-Drying Polyurethane because it flows nicely off the brush, dries quickly and does not have the plastic look of many polyurethane varnishes.

If, like Gedrys, you have a strong dislike of polyurethane, try an alkyd varnish. However, you must be prepared to thin it with mineral spirits to get the alkyd varnish to flow out evenly from the brush. If you are planning to rub out the finish, avoid using spar varnish, which is formulated to remain softer and more flexible to survive outdoor elements.

Buy a quart of denatured alcohol and a quart of mineral spirits to thin the respective finishes and to clean the brushes when you're done.

A good finish needs a good brush

It is best to match the brush to the finish and the project. Synthetic bristles are cheap and easy to clean, and today's synthetic brushes are equal in quality to all but the most expensive natural-bristle brushes. The bristles should be 2½ in. to 3 in. long and taper to a point to facilitate proper flow from the brush and to minimize bubbles in the finish. Buy a 3-in.-wide brush for large, flat areas, and a 1½-in.-wide angled sash brush for detail areas such as legs, moldings and edges.

If you favor water-based finishes, try a foam brush that costs only a dollar or two. For solvent-based varnishes, you may want to invest in a 2-in. or 3-in. natural-bristle brush, either china (hog) bristle or a more expensive blend of bristles. For applying the final thinned coat of shellac or varnish, Masaschi recommends a brush with Taklon bristles, such as that used for watercolor washes.

Tools for rubbing out the finish

To degloss a finish, it's easiest to rub it out with 0000 steel wool, preferably Liberon's brand, which lasts longer and cuts evenly. To achieve a high-gloss finish, you can use the traditional pumice and rottenstone or the newer Abralon abrasive pads. Start with 500 grit and work your way through 1,000, 2,000 and finally 4,000 grit, using mineral oil as a lubricant. A final step can be to use automotive compounds to give a swirl-free, wet-look gloss.

Applying a good paste wax protects the surface from scratches as well as improves the feel.

Your total outlay for the above supplies will be a few hundred dollars, and as Winston Churchill said in another context: "Give us the tools, and we'll finish the job." □

RUBBING OUT

An easy, low-luster finish. *Rubbing out the finish with good-quality 0000 steel wool lubricated with wax polish yields a smooth, low-luster finish.*

High-tech high gloss. *For a glossy finish, use cushioned abrasive pads starting at 500 grit and moving up to 4,000 grit. Buffing with an automotive compound gives the highest gloss.*

Nature's Bounty

For Debey Zito, woodworking comes out of her respect for nature. "You buy a piece from me, and yes, a tree was cut down. But every day that it's used, for a couple of hundred years, that's a tree that doesn't get cut down," she said. With a naturalistic form, this black walnut server is one of many pieces that Zito and wood carver Terry Schmitt (right in photo) have collaborated on. Steeped in English Arts and Crafts and Art Nouveau traditions, Zito accentuated the leg-to-rail intersections with Gothic arches.

Zito's rise in the woodworking community wasn't easy. "I must have called every cabinet shop in Los Angeles, and the owners just laughed at me, asking if I was applying for my husband." Eventually, she found part-time work at a cabinet shop, and in 1981 she branched out on her own. Today, Zito makes a special effort to teach and offer apprenticeships to women.

Photos: Richard Sargent (top and left); Faith Echtermeyer (right)