Fine WoodWorking

July/August 1988, No. 71, $4.50

Building a Credenza

Shellac Finishes

Testing Miter Trimmers

Wooden Lamps

Curved Drawer Fronts

Making Period Doors

Plans for this credenza call for a number of different joinery techniques, each with its purpose. The author explains his choice of biscuits, dowels and tenons in the article beginning on p. 42. Cover: Period doors can be made with a combination of hand and power tools, as described in the article beginning on p. 60.

Fine Woodworking is a reader-written magazine. We welcome proposals, manuscripts, photographs and ideas from our readers, amateur or professional. We'll acknowledge all submissions and return within six weeks those we can't publish. Send your contributions to *Fine Woodworking*, Box 355, Newtown, Conn. 06470.

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DEPARTMENTS

ARTICLES

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Warning on engine valves—The May/June issue (*FWW* #70) carried a "Methods of Work" item on using discarded engine valves as drive centers for turning deep bowls or goblets.

Many gasoline and diesel engines use valves manufactured with a hollow core that is filled with elemental sodium, which facilitates rapid heat transfer from the head of the valve to the stem, and eventually out to the engine head or block itself. Elemental sodium reacts violently when brought in contact with water, however, and can cause severe caustic burns if allowed to contact the skin. Anyone working with the valves should wear goggles and a full-face shield. Although engine valves are very strong, using them for anything but their intended purpose is inviting an accident to happen. I'd emphatically recommend your readers be discouraged from using engine valves as shop tools or anything else. *—B.R. Smith, Keyser, W. Va.*

Sawblades for radial-arm saws—I'd like to expand on Jim Cummins' observation that low-set carbide blades can make bad machines cut better (*FWW* #70). My Craftsman radial-arm saw was a rugged workhorse that served me faithfully for years. Its main drawback was not so much motor vibration as the roughness of its cylindrical tracks. When crosscutting, the motor carriage would rumble along like an old trolley car, leaving a cut whose predictable meanderings I had come to know by heart. Painstaking adjustment of the carriage bearings had little or no effect on this problem.

After giving up all hope of ever getting a really good cut on this machine, I tried a Freud LU85M. The cut was not only smooth, it was straight. The blade's lack of set causes it to fence in the cut like a Japanese handsaw, compensating for all the slop in the track. A corollary benefit is that the rigidly confined blade virtually eliminates tearout and face-veneer chipping.
—Scott McBride, Irvington, N.Y.

Your article on carbide sawblades didn't do much for woodworkers who use radial-arm saws. All the radial saws I've seen or operated are just not rigid or powerful enough to use most carbide sawblades. The result is frequent stalling, and worse, inaccurate cutting. Most carbide blades have thick kerfs and require a larger motor than radial saws are equipped with.

One solution is to cut a board a third at a time, lowering the blade after each cut. A far superior method is to use a thin-kerf blade that has about half the thickness of a standard blade, thus requiring half the horsepower. I've never seen the deep gouging Cummins refers to. All my cuts with thin-kerf blades are unusually smooth. The increases in performance of radial-arm saws with the right blade is dramatic. *—William Wheeler, Demarest, N.J.*

EDITOR'S NOTE: You'll see gouging mostly on rip cuts.

Responsibility for deforestation—I suspect that many woodworkers would much rather leave a problem like deforestation (*FWW* #70) to the environmental groups. We, as direct consumers of exotic woods, regardless of the amount we use, should feel some responsibility in conserving and replenishing these forests, if only to guarantee a steady supply of lumber for the coming years. We can hardly go on ignoring the fate of these trees. Some experts estimate as much as 7 sq. acres of these rain forests are cleared every minute. Stockpiling these woods, as George Putz suggests, is useless and will only aggravate the problem. Unfortunately, I don't have the magic solution that would keep us all waist high in rosewood and ebony, but support for some of these "environmental groups" we pass the buck to wouldn't be a bad place to start. *—Carlos E. Voss, Colton, Calif.*

Feedback on mail-order companies— I'd like to respond to Douglas Peterson's letter (*FWW* #70) decrying the "buy-or-else" marketing approach taken by some mail-order firms. I am a woodworker who buys by mail, but I'm also a direct marketing consultant, with many clients in the catalog field. I'd like to shed some light on some practices Peterson found objectionable.

Catalog marketing is expensive. On a typical mailing list, perhaps only two or three people out of every 100 will order. A company will send the "last catalog" notice only to people who have not ordered for a very long time, to whom it cannot afford to continue mailing catalogs. It is not sent to a good customer, unless perhaps the customer is inadvertently on the computer more than once. Rather than a "buy-or-else" threat, the notice is a "We'll send you more catalogs if you show us you're still interested" message.

As for companies that seem to send too many catalogs, they aren't stupid. They keep careful track of the sales those other catalogs produce. It's a case of voting with your checkbook: Customers, through their orders, show that those extra catalogs are wanted. And by generating profits that help subsidize other mailings, these extra catalogs actually help keep prices down.

True, a store owner doesn't charge you for the privilege of walking in the door. However, it costs him nothing for you to do so. Instead, compare the catalog to an estimate in your business. You may not charge for them now, but if you found yourself giving 50 free estimates for every job you landed, I think you would change things quickly. Actually, most companies give free catalogs to regular customers, and those that charge for the first one generally give an equal or greater credit with an order. Your suggestion about companies sending out summaries instead of catalogs is well-intentioned, but it won't work. The cost of printing and mailing a summary is almost as high as that of the catalogs, and a summary produces few orders.
—John Martin, Cumberland, Me.

Advice for businesspeople—The article "Making and Marketing Multiples" (*FWW* #70) provides good advice for the novice or would-be businessperson. There are two points I would like to make, however. Tony Lydgate says that in working up the costs for your goods, you must include labor, and he suggests that you pay yourself a realistic wage. My business planning philosophy has always been that the owner's labor should be valued at the market cost for having an unrelated employee provide the same services. For example, an unskilled laborer might cost $5 per hour while a skilled designer who can sell might cost $30 an hour. It should be noted that labor cost is separate and

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apart from the profit each entrepreneur should be looking for.

Lydgate suggests that a good-quality rubber stamp will suffice for graphics, stationery, labels and such. I disagree. A supply of inexpensive printed stationery to last most starting businesses for a year can be ordered for less than $100 from several discount mail-order suppliers. I believe a rubber stamp leaves an impression that one is a rank amateur. For better or worse, these images are important. *–David Grant Willemain, Towson, Md.*

Chair Loc for chair building–James Collins, in *FWW* #70, inquired about using Chair Loc instead of glue in new chairs. I've been experimenting with Chair Loc on new tightly fitting rungs, and one chair is still tight after five years, although the humidity variation has not been high. I begin by turning rungs 1/32 in. full and drying them either in hot sun for a day or heating them to 135°F for 30 minutes. Then they are turned to size, maybe a few thousandths over, and fitted in the hole with a file. Rungs this tight will not take glue, so I tried Chair Loc. Whether it swells the wood enough to crush the fibers, I can't say. Caution: Do not allow such a tight fit to set long, or even dry, as it may be very difficult to remove. For more information on the complexity of fitting and gluing chair rungs, I recommend Bruce Hoadley's article in *FWW* #21.

–John W. Wood, Tyler, Tex.

Danger: children in workshop–I'd like to talk about a recent shop accident in hopes that your readers might avoid a similar situation.

Early one evening, my four-year-old daughter sat with me as I cut wood letters on a workbench-mounted 10-in. bandsaw. I put her on a small adjacent workbench three feet away–as I was later to measure–so she would be up high enough to watch me cut out the letters of her name. I felt alert and comfortable with this safety distance.

As I removed the block with the partially completed fourth letter to turn it around, she started to climb down from her perch to get a letter she'd dropped on the floor. In doing so, she turned around, as children do, to descend ladder-style. At that moment, she had effectively spanned half of the distance to the bandsaw. To lower herself to the floor, she then reached over for something to lower herself from, and (she told me later in the emergency room) she tried to grab the corner of the bandsaw table. Her hand overshot and the tip of her left hand's middle finger slid along the table and under the blade guard, 1/4 in. into the moving blade. In that instant, as I started to move over to her, I saw her finger move into the blade. The damage to her finger was fortunately minor, especially considering what it could have been. And although she takes it all very well, I am hurt inside, and I've relived the accident many times.

From that day I learned two primary lessons: Younger children *should not* be in a shop while any work is being done or any equipment is operating. And, *no safe distance* is in fact a safe distance. *–Chuck Green, Ashland, Mass.*

First woodworking lesson–Reading your article on how pencils are made in "Notes and Comment" (*FWW* #70) brought back fond memories of teaching young boys in the early 1960s, for the first time, the basics of woodworking in a junior-high industrial-arts woodworking shop.

Young boys eager to take their first project home bubbled with enthusiasm but had virtually no concept of the manufacturing process. Their first lesson in seventh grade consisted of holding up a pencil and discussing how difficult it must be to drill a hole clear through the wood without the bit coming through the side and the difficulty of inserting the lead without breaking it. This, of course, brought cries of "That's not how a pencil is made," which lead (excuse the pun) to their first lesson on the manufacturing process.

I can't help but wonder whether any of the students, now 25 years later, have read your article and reflected on that first woodworking lesson. *–John G. Williams, Norristown, Penn.*

Ultra-light canoes are nothing new–Fred Stetson's article on Tom Hill's ultra-light canoes (*FWW* #69) extols the virtues of modern European plywood, marine epoxy, glued lapstrake planking and "ingenious methods" as the route to create extremely light and durable canoes for backpacking to remote locations. I'd also like to cite the pioneering achievements of John Henry Rushton of Canton, N.Y., a century earlier. Although Hill's canoes represent a welcome improvement to some of the heavyweight barges being offered as camping vehicles, we must give due credit to Rushton.

In the 1880s, Rushton created the strongest, lightest and most durable wooden canoes ever. Even today, with the highest-tech materials available, we barely equal his work. In 1880, he built "Nessmuk #1," which was 10 ft. long and weighed in at 18 lbs. This was followed in 1881 by "Susan Nipper" at 16 lbs. These canoes made summer excursions of more than 500 miles and remained staunch and tight. In 1883, a masterpiece called "Sairy Gamp" was constructed at 10½ lbs. A later boat, called the "Rushton-Fairbanks," was under 10 lbs. The planking thickness on the later canoes is comparable to the 4mm plywood used by Hill.

The major difference in weight between the Rushton and Hill boats can be attributed to the vast difference in density between marine plywood and white cedar. I believe the 4mm plywoods run about 0.4 lbs. to 0.5 lbs. per square foot, while the white cedar (*Thuja occidentalis*) used by Rushton ranged from 0.23 lbs. to 0.27 lbs. per square foot. Unfortunately for ultra-lights, modern adhesives are not light. From the above, it is clear that Rushton's best were about half the weight of Hill's for comparable sizes.

Many of Rushton's canoes and other craft have survived, many of them in superb condition, and can be seen at The Adirondack Museum and the Mystic Seaport Museum. He is rightfully recognized as the Dean of the Go-Light Brotherhood.

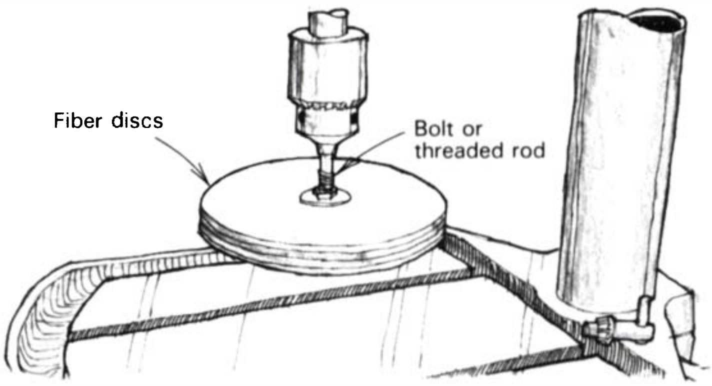
–J. Niel Spillane, Mystic, Conn.

Clean mortises with milling cutter–In Gary Rogowski's fine article "Building a Stool" (*FWW* #69), he discussed having difficulty using a four-flute milling cutter while mortising on his drill press. It's true that if one tries to mill the entire mortise with the cutter set at full depth, the cutter will chew up the mortise. If, however, the cutter is used as a drill, moving the workpiece about 1/8 in. at a time so as to produce a series of overlapping holes, a mortise can be cut cleanly and rapidly. The cutter has no tendency to wander and leaves clean walls and a flat bottom requiring no clean up.

For my own work, I prefer a two-flute cutter, as I believe it has better chip-removal characteristics and cuts more rapidly.

–David T. Furuli, El Rito, N.M.

Two drill-press sharpening systems



This drill-press stropping wheel cost me about $2 to make and is handy to use because it spins horizontally and allows me to take advantage of the machine's low speed setting. To make the wheel, cut up four 6-in.-dia. circles of ¼-in.-thick cardboard or fiberboard. Stack the discs, drill a hole through their center and use a ½-in.-dia. bolt or threaded rod as an arbor, with washers on both faces of the wheel. Mount the wheel in the drill press, true the rim of the wheel and remove any projecting fuzz with coarse sandpaper. With a pocket knife, score a spiral groove on the wheel's face from a point near the arbor to the edge to catch honing compound. With the wheel spinning, apply rouge or tripoli to its face and edge.

To sharpen a chisel, I buff its flat side first on the wheel's face, with the wheel's rotation running away from the cutting edge. I hold the chisel at an angle to the wheel, and for greater control, work near the center of the wheel where its speed is slowest. I sharpen the edge of the chisel on the edge of the wheel, once again, with the wheel running away from the cutting edge. Two or three passes on the chisel's edge leaves it beautifully polished and razor sharp.

—Leslie H. Blair, Rocky River, Ohio

With my interests in furniture building, turning and, lately, chip carving, I always have many chisels to sharpen. This simple system helps me sharpen my tools quickly. The system consists of a 9-in.-dia. aluminum disc with an arbor made from a bolt or threaded rod and chucked in my drill press. I glue a circle of 200-grit wet-or-dry abrasive paper to the disc with Glop, an adhesive sold at many auto-parts stores. Rubber cement also works but breaks down sooner. I adjust the drill-press table so the disc spins about an inch or two above the water level in a plastic wash basin that contains an inch of water.

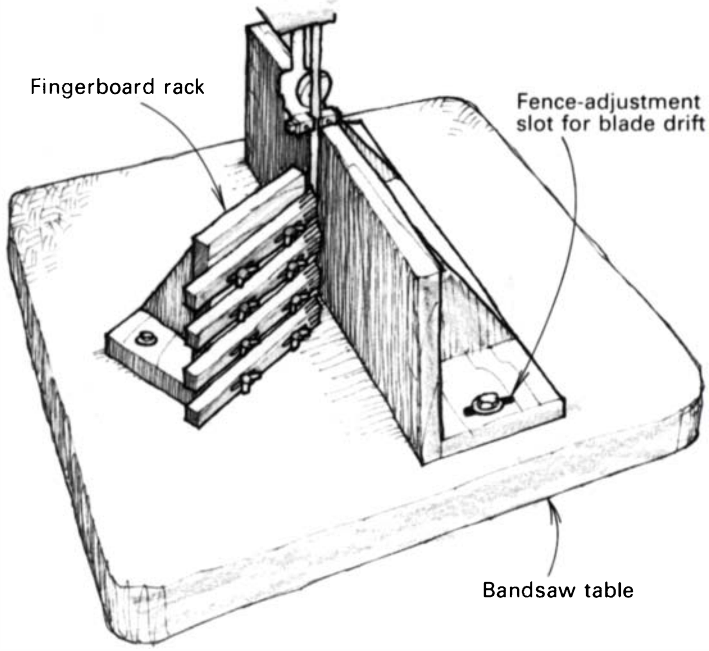
To sharpen a chisel, I set the drill at 300 RPM and wet the wheel's face with a squirt from a large bulb-shape syringe and then lay the bevel on the wheel's face. I sharpen the chisel for a bit and then squirt on some more water. It works so well that even sharpening my lathe tools on it has become a pleasure.

—Robert D. Panza, Canoga Park, Calif.

Quick tip: I use an electric branding iron on my wood crafts. To make sure that the iron prints clearly, I clamp a steel square where I intend to brand my name and use the inside corner of the square to guide the iron. If the first brand does not come out clearly, I have a chance to darken the mark in exactly the same place. *—Joseph Wilson, Wappingers Falls, N.Y.*

Sawing veneers on the bandsaw

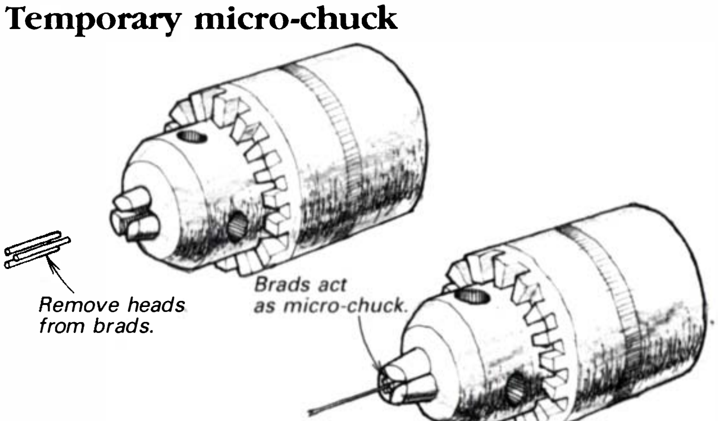
To produce veneer slices on the bandsaw, we use a sharp blade, a tall rip fence aligned with the line of cut for each particular blade and an easily adjusted fingerboard rack. The fingerboard rack, which is the real secret to producing quality veneer, exerts even, soft pressure against the stock. This allows the sawyer to concentrate completely on pushing the stock smoothly and evenly through the blade. Because the cut is made in one continuous motion, you get a much cleaner piece of veneer. In fact, the veneer can usually be glued directly to the ground without having to thickness-sand errant sawmarks. Also, because the technique reduces the thick and thin spots in the slices, your veneer stock goes further.



Make the rack platform from ¾-in. plywood and the fingerboards from springy hardwood, such as ash or hickory. Cut sawkerfs in the end of the fingerboards both vertically and horizontally to soften the pressure, and fasten them to the platform with bolts through slotted holes. Leave the wingnuts on the back bolts loose so you can adjust and tighten the fingerboards easily with just the front wingnuts. With the fingerboards touching the veneer stock just in front of the blade, angle the rack about 60° from the line of cut and clamp the rack in place. If you intend to do much veneering, you may wish to drill and tap holes in your bandsaw table for mounting the fixture.

—Jeff Simon and Mark Darlington, Steamboat Springs, Colo.

Temporary micro-chuck



When I needed to drill several tiny holes but didn't have a micro-chuck for holding a tiny drill bit, I used three brads as a micro-collet. I first clipped the heads off the brads, then slipped them and the bit into the chuck as shown in the sketch.

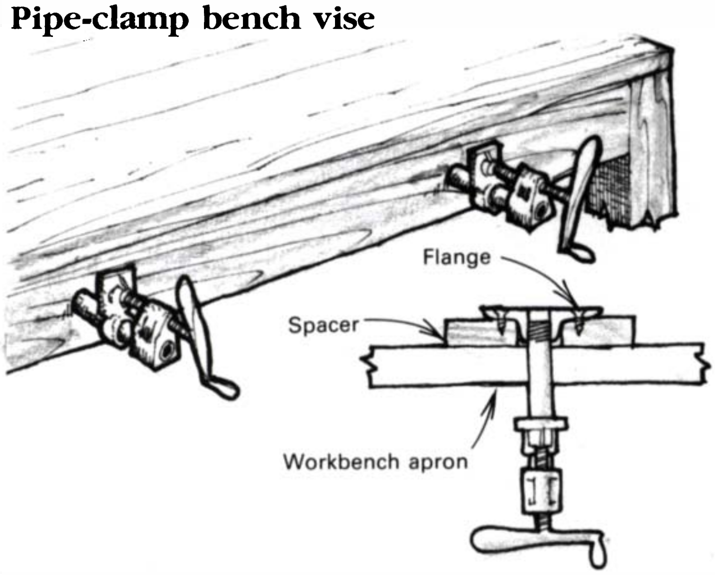
—Paul Schulman, Belle Harbor, N.Y.

Foam sanding block

I don't know why, but we have a hard time keeping sanding blocks around our college shop. One evening, as time for class approached, I suddenly found myself out of them. In desperation,

I quickly bandsawed a number of blocks from 1½-in.-thick plastic-foam insulating board, figuring they would last just long enough to get through that class. To my surprise, the fragile foam blocks held up well and proved to have unanticipated advantages. They were not only lighter than wood blocks, but they also conformed to uneven surfaces better than the felt blocks I had been using. *—Mark White, Kodiak, Alaska*

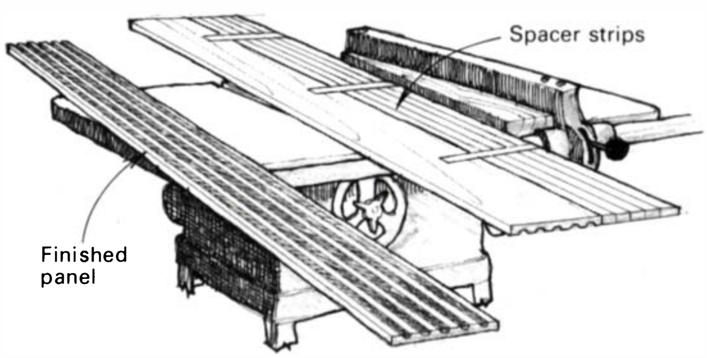
Pipe-clamp bench vise



This simple but effective clamping system can be well-adapted to a workbench with a sturdy frame member that runs across the front. The system uses two pipe-clamp heads, two 8-in. pipe nipples and two pipe flanges. The pipe flanges are screwed to the back side of the frame, as shown above, with a plywood spacer between the flange and the frame. The spacer allows the pipe holes through the frame to be the same size as the pipe rather than the larger size that would be required to accommodate the flange. I locate the pipe holes so the clamp heads do not stand above the benchtop, but this decision is based solely on personal preference. *—Don Rosati, Easton, Conn.*

Quick tip: If your regular cabinet scraper won't fit in a tight spot, you can file off the back of an old knife and pull a satisfactory burr on it. *—Jamey Hutchinson, Warwick, R.I.*

Making fluted panels revisited



Here's an improvement to Wayne Kulesza's method for making fluted panels (*FWW* #67, p. 8). First, determine the proper fence angle to produce the flute width desired, then clamp an auxiliary fence to the saw. Tape several spacer strips to the side of the workpiece; the width of the spacer strips determines the distance between flutes. Push the workpiece and spacers through the saw to cut the first flute. If your blade is sharp and the flute not too deep, it should be possible to cut each flute in one pass. After you have sawn the first flute, slice off the outermost spacer by cutting the tape with a utility knife. Continue making passes and removing spacers until you have completed the panel. The spacer strips eliminate the time required in resetting the fence for each pass through the blade.

If the blade binds and prevents you from cutting each flute in one pass, there are two alternatives: You can raise the blade in increments as you cut each flute, or you can make a series of shallow flutes across the width of the board, then replace the spacer strips, raise the blade and repeat the series until full depth is achieved. To ensure equal depth on all flutes, I would choose the second alternative. *—Joe Videtic, Joliet, Ill.*

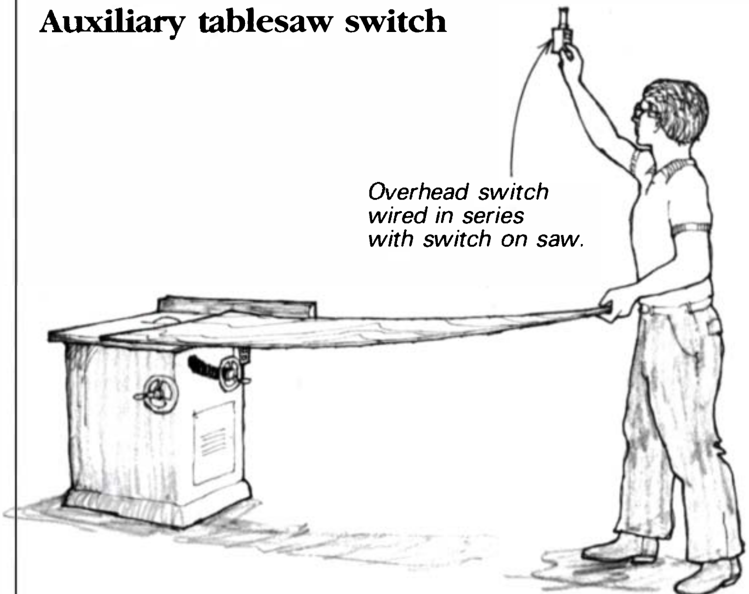
Quick tip: You can balance bandsaw wheels with automobile wheel-balancing weights. They press on where needed and stay put. *—Donald E. Wigfield, Moneta, Va.*

Modifying drill bits for brass

Here's a tip well known in the metalworking field, but perhaps not common knowledge among woodworkers. When drilling soft metals such as brass, always grind or stone a small flat on the bit's cutting edge. This flat prevents the drill from chattering and results in much cleaner drilling. *—Thomas J. Tidd, Springfield, Pa.*

Quick tip: Instead of stick-on felt bumpers for cabinet doors, I recommend you try bumpers cut or punched from vinyl-foam weatherstripping, which is sold in ⅜-in.-wide rolls in local hardware stores. *—Charles J. Cetti, Pensacola, Fla.*

Auxiliary tablesaw switch



Here's how I solved the problem of operating the start/stop switch on my tablesaw when ripping large sheets of plywood. I installed a switch identical to the one on the saw at a convenient overhead location near the front of the saw. I wired this switch in series with the saw's switch so that both have to be "on" to let the saw run, but either switch will turn the saw off.

In use, I first make sure the overhead switch is off, and then I switch the saw on. I get the plywood into position and then reach up and flip on the auxiliary switch. For normal operations, I leave the overhead switch in the "on" position and use the saw's switch. *—Charles W. Leffert, Springfield, N.J.*

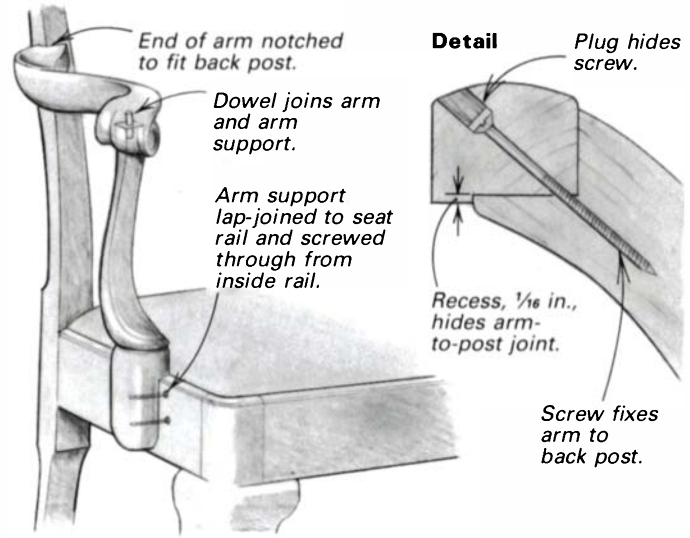
Methods of Work buys readers' tips, jigs and tricks. Send details, sketches (we'll redraw them) and photos to Methods, Fine Woodworking, *Box 355, Newtown, Conn. 06470. We'll return only those contributions that include an SASE.*

Arming a Queen Anne chair

I have built two Queen Anne chairs from Carlyle Lynch's plans, and I intend to make two more chairs that I'd like to make into armchairs. What joinery should I use to join the arm supports to the seat frames and the arms to the backs?

—William H. Sears, Vero Beach, Fla.

Carlyle Lynch replies: First of all, you should make your armchairs wider and deeper than the side chairs in my original plans; otherwise, the arms won't look right. Armchairs are generally about 2 in. wider and deeper than side chairs, but this is not an inflexible dimension. Some of the old chairs had arms that were too high to be really comfortable, but if you put them about 7 in. to 8 in. above the seat—the most comfortable height—they may not fit in with the old design of a Queen Anne-style chair.



As far as joinery is concerned, the arm posts on Queen Anne chairs are usually attached with lap joints to the seat rail sides, with screws driven into them from inside the rail. The arm itself is doweled to the top of the arm post, unless you want to shape a tenon on the end of the post that fits into a hole in the arm's underside. The rear end of the arm is notched to fit the contour of the back post. On the front-facing side of the post, cut a very slight recess—only about 1/16 in. deep—to act as a shoulder and hide the arm-to-post joint. The arm is fixed with a single screw through the back of the post as shown above. A plug hides the screw in back.

[Carlyle Lynch is a designer, draftsman and retired teacher in Broadway, Va.]

Radial-arm ripping

When ripping on my radial-arm saw, I always seem to get burn marks. What am I doing wrong?

—Richard Sahulka, Woodstock, N.Y.

Jim Forrest replies: Assuming that your blade is correctly aligned with the fence, burn marks are probably being caused either by ripping with a blade that has too many teeth or by having too many of the teeth buried in the work, which amounts to the same thing. If the blade just penetrates through the stock, each tooth must take a long, shallow path through the work, and there will be many teeth in the work at once. This robs power, causing slow feeding and excessive heat buildup. The solution is to make a false table that will fit atop the regular table and raise the wood being ripped high enough to allow the blade to penetrate an inch or more below the stock. For safety's sake, always use a hold-down when ripping; many sawyers rotate the blade hood forward to serve this purpose.

[Jim Forrest manufactures sawblades in Clifton, N.J.]

Reviving a teak dining table

I have a Danish dining room table made of teak. In the past, I have cleaned the table and removed surface blemishes by rubbing it with fine steel wool and oil. I tried removing deeper blemishes with sandpaper and oil, but this turned the wood dull and gray. What would be the best method to restore this table to its original warm golden-brown color and finish?

—W. E. Wistehuff, Saginaw, Mich.

Bob Flexner replies: One of the biggest myths in the furniture trade is that teak furniture from Denmark has an oil finish and should be periodically reoiled and occasionally rubbed with steel wool or sandpaper. In fact, almost all the Danish teak furniture I can remember seeing in the last dozen years or so had a thin catalyzed lacquer finish. Assuming this is the case with your table, you removed some of the finish every time you rubbed it with steel wool. Though this process is an effective way to refresh a film finish, such as lacquer, it should be done very sparingly or you will rub through, as you have finally done with sandpaper in those areas that are now dull.

Unfortunately, the only way you'll be able to return your table to its original appearance will be to refinish it. Any finish will work, but to achieve the same luster you had, you'll have to use a film finish such as varnish or lacquer. A satin sheen is probably closest to that of the original. After you have stripped the old finish, sand the entire table lightly with 180- or 220-grit garnet paper to even the color of the wood. This will be necessary because teak is one of the woods that mellows very quickly, and you have surely cut through the color of this surface aging with your previous sanding. Be sure to sand the top carefully, it's probably veneered.

You could try faking the patina you have sanded off by staining with a yellowish-orange dye stain, but you'll probably be happier if you just make the table look new again. After a few years, your warm golden-brown color will be back.

[Bob Flexner is a professional finisher and restorer in Norman, Okla. His video, "Repairing Furniture," is available from The Taunton Press, Box 355, Newtown, Conn. 06470]

Understanding shagreen

I recently worked in a private residence that contained two tables with a unique surface veneer. The veneer was described to me as "shagreen," which the dictionary defines as "untanned leather...usually dyed green, from certain species of sharks and rays." I would like to know where shagreen can be purchased and how to apply it to wood. —Kenneth Burney, Rocky River, Ohio

Michael Podmaniczky replies: Shagreen, also called galuchat, is a textured covering that has been used for centuries to wrap sword handles and cover boxes and other small containers. The earliest use of the material was in the Orient, where the pebble-grain skins of sharks and rays were tanned and often dyed before application. Shagreen was imported to the Mediterranean area until demand exceeded supply and the first substitutes were developed in Turkey and Persia, using the hide from the rump of a species of wild ass. To simulate the pebble finish of the older Oriental product, the skin was first tanned, then soaked in water, strewn with a type of fine, hard seed and pressed between layers of hard felt. Once dry, the seeds were shaken out of the pockmarks formed by the pressing, and the entire surface was scraped down flush with the bottom of the seed impressions. Next, the hide was rewetted, causing the impressions to rise above the surface. As you can imagine, the tanning and finishing processes varied depending on the source, type, quality and end use of the particular skin.

Aside from the unparalleled beauty of the finest examples (the most attractive shagreen, in my opinion, is dyed sharkskin

that has been scraped smooth to the appearance of a fine white and green mosaic), all shagreen displays a surprising durability; even centuries-old objects show very little wear.

I am not entirely familiar with the exact procedure of applying the skin to the small, round-edge boxes where it is so commonly found, except that the references I checked say it requires a high level of skill. Shagreen that appears on flat surfaces was usually applied like veneer with high-quality hide glue and a tool not unlike a veneer hammer, which may explain why shagreen is often referred to as a veneer rather than a covering. [Michael Podmaniczky is a contributing editor to *Fine Woodworking* and a furniture conservator at The Winterthur Museum in Winterthur, Del.]

How hard is the Rockwell scale?

The Rockwell scale is often used as a measure of hardness when discussing the cutting edge of various woodworking tools. Having a background in only wood, not metalworking, I find myself at a disadvantage. Could you please elaborate on the origin of the scale and the relationships of the numbers used?

—Alan C. Sandler, Garnerville, N.Y.

Tim McCreight replies: The Rockwell Hardness Test is a relatively simple method of measuring the surface hardness of a sample, such as a steel chisel or carbide sawtooth. The measuring device used in the test presses a 1/16-in.-dia. hardened-steel sphere into the sample and measures the depth of the impression. Then, a chart is used to translate the depth of the indent into a hardness number. The less the indent, the higher the number and the harder the material.

The Rockwell tester uses two scales (calibrations) in order to expand the range of hardness it can measure. The "B" scale is used to test the hardness of a softer range of materials, such as annealed steel. The scale more familiar to craftsmen is the "C" scale, because it registers in the range relevant to tools with hardened-steel cutting edges. The scale runs from 0 to 100, and typical tool steel values are between 20 and 80.

A very high-quality chisel blade might have a Rockwell hardness of 60, written simply as Rc60 (or sometimes 60Rc). A poor-quality tool might be around Rc52 and might show varying hardness along its length. It must be noted too that hardness is not the single factor in determining the quality of a steel. Resistance to wear (edge-holding strength), flexibility and the ability to withstand shock are equally or sometimes more important than hardness. Just as no single wood is right for every purpose, no particular steel is perfect for every application. In the case of simple carbon steels, thin tools such as narrow chisels should favor flexibility over hardness or the edges will snap off with frustrating regularity. More complex steels will allow better tailoring of the heat treatment to the demands of the tool. When buying from a reputable source, you'll get what you pay for in a sophisticated steel, whatever the Rockwell hardness. [Tim McCreight is a metal craftsman and teacher at the Portland School of Art in Maine.]

Drying almond wood

I live in Northern California where there are many almond trees. I admire the hardness and deep, rich red color of this wood, but I have been frustrated by the way it warps and checks when I attempt to air-dry it. Despite its beauty, I haven't seen it used for anything except firewood. Can you give me some helpful hints on how to dry it? ***—Walt Mazen, Chico, Calif.***

Jon Arno replies: As an avid wood forager with a fondness for the beautiful color and figure of orchard-grown woods, I can appreciate your frustration. Unfortunately, the woods of most orchard-grown trees are notoriously difficult to dry. The reason for this is that orchard trees are managed to increase fruit production and simplify harvesting, *not* to produce quality lumber. Trees are aggressively pruned to stimulate fruit-bearing shoots, and as a result, virtually all orchard wood is branch stock grown under gravitational stress. This produces abnormal tissue called reaction wood, which has shrinkage properties very different from normal wood. Boards containing reaction wood are almost certain to warp and check as they dry.

There are a number of preventive measures, none of which provide a totally acceptable solution. First of all, you can limit your foraging to only the bole or central stem of the tree. The problem here is most orchard plantings are made with grafted saplings and the wood produced near this union is not particularly stable either. This is especially true of almond trees, *Purnus amygdalus cultivars,* since they are routinely grafted onto the root stock of their more hardy cousins: bitter almond and peach.

A more certain solution is available in the form of polyethylene glycol (PEG). This substance comes in a can and is used to impregnate the wood with a plastic-like substance that virtually locks the wood tissue in place before it dries. It most definitely works, but it adds cost to the drying process and indelibly alters the character of the wood.

Perhaps the best solution is to concentrate on the finer points of air-drying wood. With care and patience, much can be done to minimize degrade. The three basic principles are as follows: 1. Make sure the endgrain is thoroughly sealed as soon after cutting as possible, using glue, melted paraffin or a nonporous paint. 2. Make sure the stickered boards are well-weighted to prevent them from lifting during drying. 3. Season the wood slowly by limiting its exposure to hot, dry air; use a tarp or sheet of plastic as a cover to control air flow.

With orchard-grown woods, there will still be considerable degrade, even when the drying process is expertly controlled. However, because the cost of the raw material generally runs somewhere between cheap and free, a usable yield of as little as 50% can make the effort both rewarding and cost affordable, especially considering that almond isn't commercially available. [Jon Arno is a woodworker and amateur wood technologist in Schaumburg, Ill.]

Finishing a hunting bow

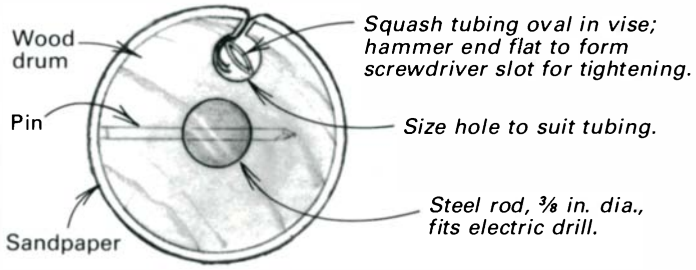
I'm making a hunting bow and have a problem with what kind of finish to use. The bow has a hardwood handle and limbs that are two pieces of maple veneer sandwiched between two pieces of fiberglass. I need a finish that will adhere to wood as well as the fiberglass and withstand the flexing of the bow during use, plus withstand the rigors of outdoor use in rain, heat and cold. What finish should I use?

—Bill Blackburn, West Yellowstone, Mont.

Jim Cummins replies: I think the best finish for your hunting bow would be five very thin coats of Minwax Antique Oil (Minwax Co. Inc., 102 Chestnut Ridge Plaza, Montvale, N.J. 07649). It will penetrate the wood somewhat, providing a good moisture barrier, but will wipe off the nonporous fiberglass, so you won't end up with cracking. The finish is nonglossy and flexible, and it can be patched up every year without problems with one or two more thin coats. The trick is to flood the finish on with a brush or rag, wait a little, then wipe as dry as you can with a clean rag. Do this every day for a week, and I think you'll be happy.
[Jim Cummins is an associate editor for *Fine Woodworking.*]

Send queries, comments and sources of supply to Q&A, Fine Woodworking, *Box 355, Newtown, Conn. 06470. We attempt to answer all questions, but due to the great number of requests received, the process can take several months.*

Drum sander–Tim Hanson's shopmade sanding drums (*FWW* #67) drew a letter from Lloyd Humiston of Sun City, Calif., who has been making his own drums for some time. The neat feature of Humiston's drums is the sandpaper-holding device, which is merely a length of tubing (radio antenna works fine) flattened in a vise to form an oval. Humiston hammers the ends to make screwdriver slots for tightening the paper. Most of his sanders accept 2-in.-wide cloth-backed sandpaper, which he purchases in 25-ft. rolls. He's made sanders up to 6 in. in diameter, with ½-in. shanks for drill-press use. The sketch below is based on the sample he sent, as viewed from the outboard end. The angle of the sandpaper slot indicates the drum was designed for counterclockwise use. Yet when I tried it in my shop, it worked fine in both directions, powered by a Makita 600-RPM drill.



Humiston passed along another tip as well. For a while, he turned small handles that had a through hole down the center. To ensure concentricity in case of drill-bit drift, holes were drilled first, leaving the problem of how to center the blank accurately on the lathe. Humiston simply removed the lead point from his drive center (it's held in with a setscrew) and substituted a metal rod with its end turned to fit the hole in the handle. He turned rods of various diameters to suit each job, then stepped-down one end to fit the center. In use, the handle blank slips tightly over the rod until the spurs can grab. The V-shape of the tailstock center automatically aligns the other end. Humiston notes that a hollow handle can be used in conjunction with his sanding drums; just make the shank of the drum extend a few inches past the outboard end of the sander. Slip a handle over this and you have two-hand control. Humiston adds as a final note that he used to get three cents apiece for small handles, and made good wages at it.

Tool steel source–Every once in a while, we run an article on making tools, sometimes using high-carbon steel, sometimes alloy steel. Avrum Silverman of Wellesley, Mass., wrote to say that woodworkers looking for various tool steels can find what they need from Manhattan Supply Co., 151 Sunnyside Blvd., Plainview, N.Y. 11803. The nationwide number is (800) 645-7270; in New York State (800) 632-7198; in New York City (718) 895-1474; or Long Island (516) 349-7100. Also, don't neglect your local industrial hardware stores, listed in the Yellow Pages. For the scroungers in the audience, automobile leaf springs are excellent high-carbon steel. For small chisels and gouges, try masonry nails.

Custom cutters–While we are on the subject of shopmade tools, here's an alternative for readers who would rather let someone else grind away. Jeff Weiss of Ossining, N.Y., says he has had good success with custom shaper cutters and router bits from Charles G. Schmidt & Co., 301 West Grand Ave., Montvale, N.J. 07645; (201) 391-5300. In addition to cutters for edges and moldings, the firm will also grind custom knives for molder/planers such as the Williams & Hussey.

Another source for custom router bits and shaper cutters is Fred M. Velepec, 71-72 70th St., Glendale, N.Y. 11385; (718) 821-6636. They can work from a sample molding or a sketch. Delivery averages between three to six weeks.

Photo: Joseph Kutchma

***Teamwork boxes**–Reminiscent of Po Shun Leong's crescent-shape boxes (FWW #65), this pair of 8-in.-high jewelry boxes was made by Joseph Kutchma and Scotty Bennett of Kewanee, Ill. For the finish, they enlisted the aid of a friend, Pete Rieff, who applied nine coats of lacquer.*

More dust–George Vondriska, a woodworking instructor for Shopsmith who lives in Brooklyn Park, Minn., has sent us what's probably the last word on turning dust collectors on and off. He uses a Radio Shack remote switching device, similar to a garage-door opener, that sends out radio waves to a module plugged into an electrical outlet. The dust collector plugs into the module. A touch of the button turns the module, and hence the dust collector, on and off from anywhere in the shop.

A call to Radio Shack confirmed the availability of the gadget (part #61-2675, about $40), but Radio Shack cautioned that it was designed for ⅓-HP and smaller motors, and the module might well burn out when used to control a dust collector. Another phone call revealed that Vondriska's dust collector is the Shopsmith, rated at ½ HP. Although Vondriska reports no problems over the past few years, it's unlikely that the Radio Shack modules would survive a dust collector with a larger motor. The alternative, suggested by Radio Shack, is to use a remote module with 15-amp capacity, part #61-2685 at $15.95. Another source for remote systems is X-10 (USA) Inc., 185A LeGrand Ave., Northvale, N.J. 07647; (800) 526-0027 or (201) 784-9700. Total cost for X-10's system is about $75 ($25 for the module, $50 for the remote control), and 230v models are available.

Because X-10 manufactures Radio Shack's unit, the two are compatible. Additional modules can be added to both systems, each controlled by a different radio frequency–three for the Radio Shack remote, seven for the X-10.

If you would like to try the Radio Shack unit, either for a small dust collector or for other uses, you'll have to find the nearest store in the white pages of the phone directory; Radio Shack doesn't sell by mail order. However, the company has 7,000 outlets, so the search should not prove too difficult.

Bending in Anchorage–*FWW on Bending Wood* contains a number of high- and low-tech steaming and bending ideas from earlier issues of this magazine. Low-tech bending may require nothing more than a length of green wood and a fulcrum. But for serious bends, the best process seems to be using a metal tension strap on the outside of the bend, with the length of wood trapped between two endblocks that prevent it from elongating. When it comes right down to doing the job, however, there is always something to be learned. Michael D. Schall of Anchorage, Alaska, wrote to tell of his experiences bending with a tension strap and a winch while making a set of 12 chairs with 60 bent slats in their backs. The material was ¾-in.-thick red oak, 4 in. wide by 18 in. long, with a bending radius of 16 in. Because Schall went through many trial bends that ended up in the scrap pile, he wanted to pass along some observations

that might help other first-time benders. Rather than my relating it second-hand, here's his account:

"Winch puller: The forces encountered in bending are far greater than most of us imagine. My first attempt was with some 'bargain basement' winches that were on sale. The first bend crushed the wire drum. I ended up purchasing some good-quality two-ton winches, which are adequate but do not appear to be oversize for this job.

"Eye bolts: My first attempt utilized ½-in. hardware-store eye bolts of the type that are cold-formed, with a gap at the end of the eye. I straightened out these. I next tried some forged ½-in. eye bolts, which survived about a half dozen bends before cracking in a thread root. The final solution was ½-in. forged eyes designed for lifting.

"Mounting bolts: The hardware-store variety bolt is fairly soft and will stretch. I used automotive grade-5 bolts and grade-8 nuts, which allowed the endblocks to be securely fastened.

"Endblocks: My first endblocks were ¼-in. by 2-in. channel iron, which soon failed. I switched to ⅜-in. by 2-in. channel, and after drilling the mounting holes, heated the supporting edge to white hot and quenched it in salt water. These have proven to be very durable and tough.

"Adjustable endblocks: I found these to slip and allow cracks in the outer radius of the wood being bent. I recommend non-adjustable blocks and steel shims (hacksaw blades).

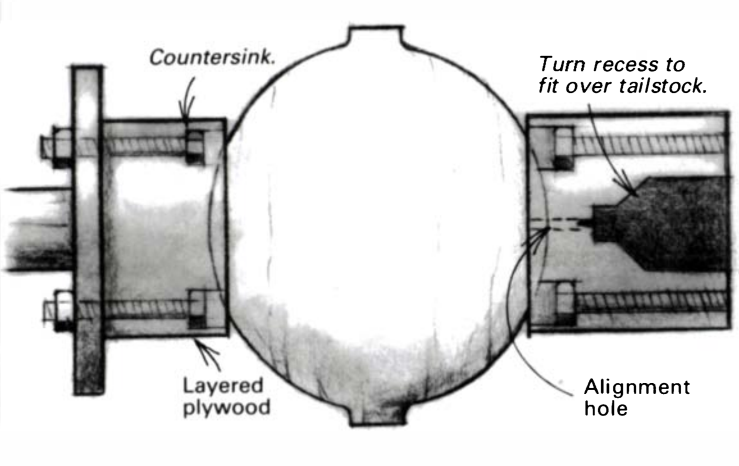
"Bending form: To eliminate every irregularity in the form from being pressed into the oak, I glued Formica on the form, which has worked very well.

"Wood growth: The 4-in.-wide oak grows to about 4¼ in. after steaming. I had to go back and add thickness to my form to accommodate this unplanned extra width. Luckily I had made my tension strap 4½ in. wide, or I would have had to replace it as well.

"Fabric softener: I have been using fabric softener in the steam water ('Methods of Work,' FWW #37) and it appears to help in the bending, although I have no firm evidence of this. It should be used sparingly as it has a tendency to foam. Even if it doesn't help with the bending, it sure makes the garage smell fresher!"

Turning spheres—Calvert Dawson of Slaughter, La., noticed the sphere-turning tip in "Methods of Work," *FWW #67* and wrote to tell of an improvement. Instead of using the spur center and tailstock to hold the half-turned ball, he turns a pair of shallow cups from layered plywood, each large enough to cover about one-sixth of the ball's circumference. One is attached to a faceplate to drive the work, the other is hollowed out so it can be press-fit over the lathe's ball-bearing tailstock. Pressure between these two cup centers provides a secure grip and allows reorientation for sanding.

A straightforward way to make the tailstock cup is to bolt layers of plywood to a faceplate, turn them round, and drill and turn the recess for the ball-bearing center. Next, reverse the plywood on the faceplate, using the same bolt holes, and turn the cup. Remove the plywood and bolt the layers together permanently, with the bolt heads countersunk so as not to get in the way. Then proceed to make the drive cup.



Wood roe? The use of the word roey to describe the wood figure produced by interlocked grain (*FWW #69*, p. 70) prompted another editor to comment that roey sounded fishy to him. He suggested "rowed grain" instead, because of the way the figure pattern lines up in rows. Out of curiosity, I looked it up and found that roey is correct. The word has its origins in a bunch of European languages, including Old English, Old Norse, Old High German, Lithuanian and Old Irish. In most of these, the word refers to the roe deer, but in Old Irish it means mottled or blotchy. A glance down the page to "roe deer" yielded a description of the animal, but there was no mention of spots. Maybe that Old Irishman was looking at a fawn and simply mistook the meaning of the word the Old High German used to describe the animal. I mention all this just in case anybody out there was wondering what I do all day.

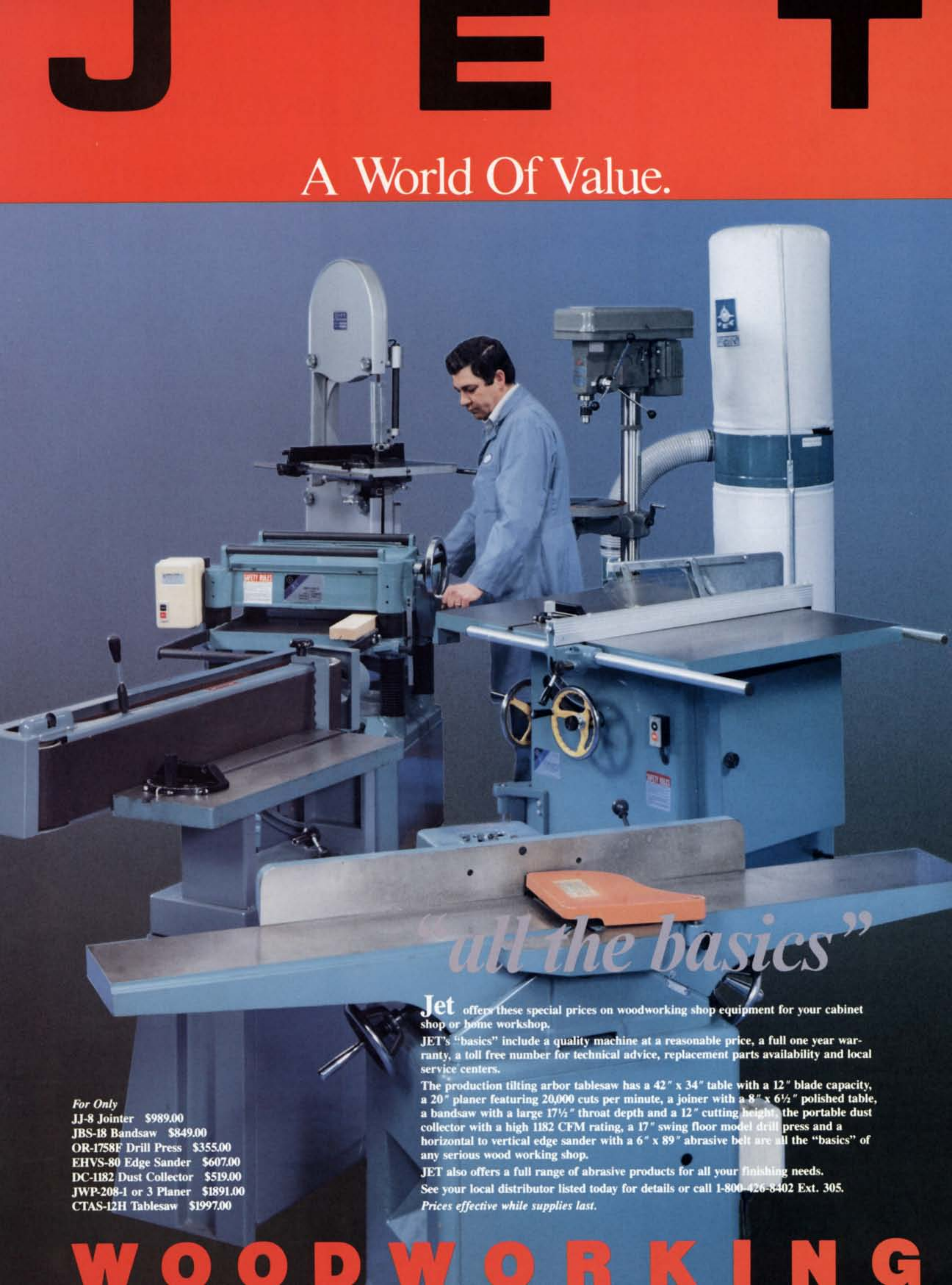
Moisture-content update—A standing hardwood tree may contain half its weight in water, almost all of which must be evaporated away before the wood is usable for cabinetmaking. The evaporation rate must be carefully monitored to avoid damage to the wood. Even after the lumber is dry, it will continue to shrink and swell in size depending on its mositure content and the relative humidity of the air around it. All the way from log to finished project, a wood's mositure content is important, and although electronic moisture meters are fairly accurate, those who *really* need to know moisture content (or calibrate a meter) rely on the oven-dry method for testing.

In the oven-dry test, a small sample of wood is weighed to within 0.2% accuracy, then baked for 24 hours in a 200° oven until it is bone-dry. It is then weighed again. To determine moisture content, or %MC, the wet weight is divided by the dry weight, then multiplied by 100.

Gene Wengert of the Department of Forest Products at Virginia Tech, Blacksburg, wrote that by using a microwave oven, you can dry test samples in minutes rather than days. The microwave should be set on low power to avoid scorching the sample, and it must have a carousel tray that will slowly spin the sample to ensure even drying. Cut a sample, typically 1 in. long along the grain, and weigh it immediately. Place it on paper towels at the edge of the carousel and cook it for 10 minutes. Weigh it, then cook for one minute more. If the weight is the same, the sample is oven-dry. If not, continue the process; green wood may take up to 20 minutes.

This use of the microwave will depend on your oven's power rating, but it should not take much experimenting to get reliable results. Other microwave drying schemes, such as zapping green bowls to hasten their drying, take more practice because the goal is not to dry a piece completely but to get it to a range ready for finish-turning and sanding. Some turners have noted that the typical oval distortion of a drying bowl may be corrected by bending the steam-filled wood as it comes out of the oven, and this is probably worth experimenting with. The danger of checking is minimal in a microwave because the wood heats clear through. Even so, proceed cautiously at first. When drying a piece of maple in my mother-in-law's microwave a couple of years ago, all seemed going well until the sugar in the maple sap burst into flame and the oven filled with smoke. The wood looked fine, with no checks at all, but when I sawed it open, I found that the interior was charred hollow. Nancy has not suggested that I try this in her microwave again. □

Jim Cummins is an associate editor at Fine Woodworking.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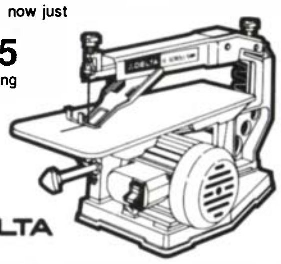

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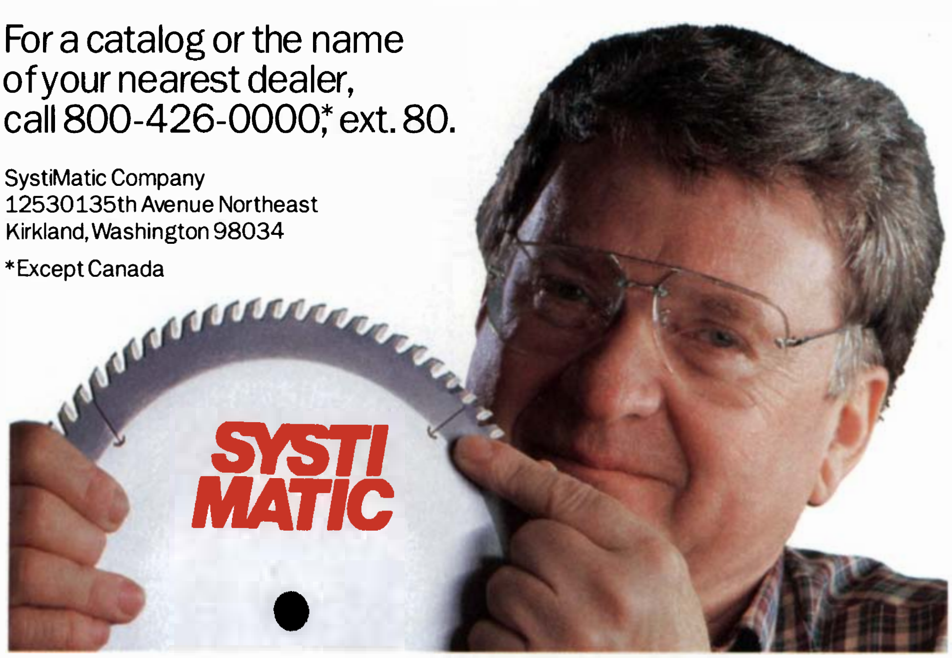
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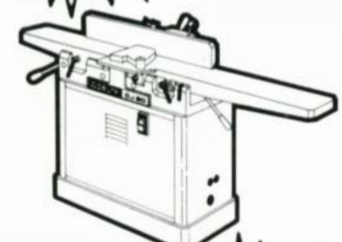


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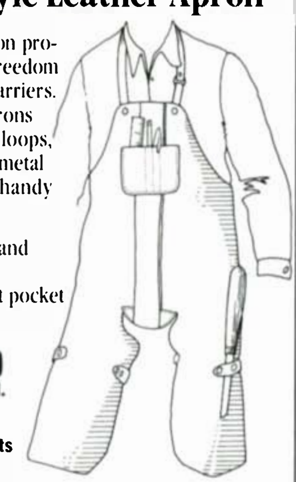

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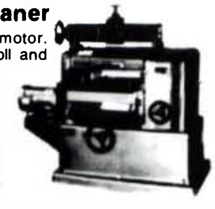

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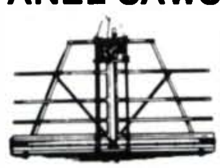

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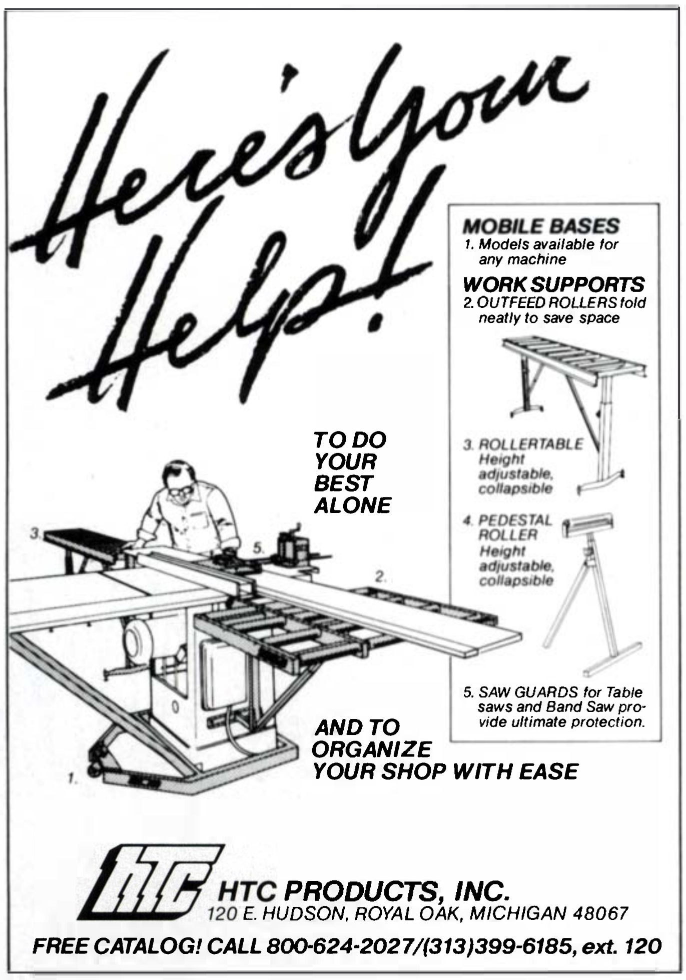

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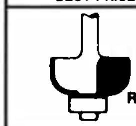		COVE				
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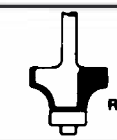		ROUND OVER				
	#04	1/4" R	1/4"	1"	1/2"	15.00
	#05	3/8" R	3/8"	1¼"	5/8"	16.00
	#06	1/2" R	1/2"	1½"	3/4"	19.00
		ROMAN OGEE				
	#07	5/32" R	5/32"	1¼"	15/32"	18.00
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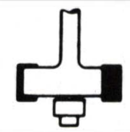
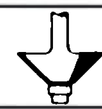
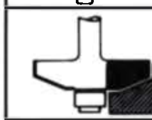
	#11	3/8" RABBETING	Deep 3/8"	1¼"	1/2"	14.00
	#09	1/8" (KERF) SLOT CUTTER		1¼"	1/8"	14.00
	#10	1/4" (KERF) SLOT CUTTER		1¼"	1/4"	14.00
	#12	45° CHAMFER	45° Angle	1½"	5/8"	15.00
	#15	RAISED PANEL	20° Angle	1-5/8"	1/2"	25.00
	#35	1/4" V Groove 90°		1/4"	1/4"	8.00
	#36	3/8" V Groove 90°		3/8"	3/8"	9.00
	#37	1/2" V Groove 90°		1/2"	1/2"	11.00
	#16	3/8" Dovetail 9°		3/8"	3/8"	7.50
	#17	1/2" Dovetail 14°		1/2"	1/2"	8.50
	#18	3/4" Dovetail 14°		3/4"	7/8"	10.50
		CORE BOX (ROUND NOSE)				
	#19	3/8" Core Box	3/16"	3/8"	3/8"	11.00
	#20	1/2" Core Box	1/4"	1/2"	11/32"	14.00
	#21	3/4" Core Box	3/8"	3/4"	5/8"	18.00
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	#22	1/2" Grooving Ogee		1/2"	3/8"	16.50
	#23	3/4" Grooving Ogee		3/4"	7/16"	21.00
	#24	1/4" Straight Bit		1/4"	3/4"	7.00
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	#26	3/8" Straight Bit		3/8"	1"	7.00
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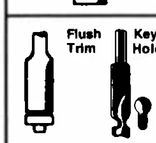 Flush Trim / Key Hole	#13	1/2" FLUSH TRIM		1/2"	1"	8.50
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The New England Windsor Chair

A tradition captures the imagination of contemporary makers

by Jeremy Singley

Fig. 1: Windsor engineering

The work of Michael Dunbar, one of the leading makers in the rebirth of the handmade Windsor, demonstrates some of the adaptability of the concept: a shaped plank seat bored with sockets to accept an undercarriage and superstructure that are lightweight yet strong. Rear, from left to right: continuous-arm chair, fan-back armchair, high oval-back desk chair, birdcage sidechair. In the foreground are two stools and a child's fan-back.

Had George Nakashima taken his work less personally, my chairmaking career might never have begun. A woman who bought two of his very first captain's chairs, years before, feared to return them to their source for repairs because she knew the famed contemporary-style woodworker was known sometimes to revoke ownership of work he thought the owner had abused. Instead, she dropped them off, in pieces, at my daddy's shop one serendipitous day some 17 years ago. I was fascinated. The chairs were all of oiled walnut and showed signs of being handmade. The spindles bore heavy spokeshave marks like facets on a cut diamond, and the joints were precisely turned and pegged in place. But when the chairs were restored, I found them uncomfortable to sit in. My attempts to better them ensued, and I began developing my own versions of sleek all-hardwood spindle-back chairs (see *FWW* #46 and *FWW* #50).

It was years before I began to realize I was developing variations of Windsor chairs, a form that certainly didn't start in my lifetime or Nakashima's. My ignorance of the style's pedigree could only be a liability to my work, perhaps bordering on arrogance. I hit the books and talked to people who knew, and I was happily humbled.

The Windsor chair, a shaped solid-wood seat into which are socketed wood legs and spindles, appeared in England sometime in the late 17th century. While the Queen Anne designers were dogmatically building rigid chairs founded on their refined understanding of mortise-and-tenon joinery and the strength of materials, Windsor makers had begun drawing on an intimate knowledge of the *nature* of materials, much of it learned in other woodworking trades, to build comfortable, flexible chairs that could sell at half the Queen Anne price. Figure 1 on the facing page shows how these mass-producible parts work together as a team, like the parts of a suspension bridge or a bicycle wheel, branching together into a single tension/compression unit. Where the Queen Anne chair, built like a post-and-beam house, required eight or more braces (four disguised as ear pieces at the knees), the Windsor needed none. The whole chair was itself a brace.

Cherchez la femme?—It was a timely idea, and a woman may have been its inspiration. After the fall of Rome, only great men sat in chairs, or more properly, thrones—heavy, complicated and expensive. It wasn't until the 16th century that women, leading their own lives for the first time, demanded chairs of their own, specifically lightweight, portable chairs to take into their all-female bed-chamber social gatherings. Among these were the first crude precursors to the Windsor.

I sometimes wonder if they weren't collusions between the woman of the home and the one branch of the woodworking trade that was her domain. Historians generally agree it wasn't a city chairmaker who invented the Windsor. Some suspect a turner, and others a wheelwright, but as one who has repaired both old Windsors and old spinning wheels, I can say that to a spinning-wheel maker, building a Windsor would have been as easy as making the flyer 10 sizes too big and shaving the wheel spokes into spin-

Photo: Andrew Edgar; drawings: David Dann

Michael Dunbar

Dunbar uses traditional methods and tools to make his chairs, a low-overhead approach that produces two chairs per week and allows a comfortable profit.

dles. Everything else—the splayed, turned legs in tapered sockets beneath, the wheel posts (translated to arm posts) in similar sockets above, and even the ornamentation—is identical with the parts of Windsor chairs. In fact, a wheel's functional reels, rings and tapers translate into one of a Windsor's main production economies. All the decoration on a Windsor can be done by machine.

At any rate, wherever it may have originated, it was almost certainly near Windsor, England, that the design matured, for from the 1720s onward, it was to the southern counties, and Chipping Wycombe in particular, one went to buy these green-painted "stick" chairs that were becoming all the rage as garden seats.

Storming the colonies—With a name like "Windsor," the chair might have become synonymous with tea and crumpets, but by 1750 it was the American Windsor that was known worldwide. Given the circumstances, such a flourishing was inevitable. First, a burgeoning American population—in Philadelphia alone, from 13,000 in 1740 to 40,000 in 1776—had reached a degree of civilization that required fashionable chairs, and furniture then, as now, was not easy to ship.

Second, we had the wood. English Windsors were almost always all of hardwood, an expensive material not conducive to easy production. After centuries of shipbuilding, they had few large softwoods left, while we had—still have—whole forests of clear, straight pines, poplars and basswoods wide enough to make more than 50 18-in.-wide seat blanks per tree. (I can look out and count 10 in the Vermont woods outside my window right now.)

Third, we had the technicians. In the previous century, essentials were the priority, giving rise to a massive guild of turners and spinning-wheel makers. Many of these had by now begun to slip into the niches opened by the more genteel life-style, offering rush-bottom and banister-back chairs and daybeds among their wares, then advancing to Windsors as these began arriving from abroad. At first these domestic copies were considered stopgaps for those who couldn't afford the real thing from England (George Washington dismissed them as too flimsy "for common sitting" and ordered his from England), but by 1755, things British were already becoming tainted. Washington, in fact, eventually canceled his order and furnished Mount Vernon with American Windsors.

Finally, our developing democracy was a fertile social milieu for mass production, a concept in its infancy elsewhere. The rising middle class created such a huge market for mid-price furnishings, that advertisements from the 1760s onward described batches of *thousands* of Windsors—often all from one shop—for sale in major ports all along the coast, the West Indies and Europe. These chairs, made by the likes of Francis Trumble and Joseph Henzey, were often branded with the maker's name to prevent mix-ups during shipping, the beginnings of the "brand name." Virtually all of the early advertisements originated at Windsor "manufactories" in Philadelphia, the mid-century Windsor center of America. In fact, Philly enjoyed such a monopoly, that by the 1760s *all* American Windsors were becoming known as "Philadelphia chairs," a trend New York and New England makers found distressing.

They set out to rectify their subordinate position in the good old American way: by building a better product. By introducing crisply executed turnings, bold carvings and daring splays and proportions, the northern Windsor makers gradually weaned their neighbors from out-of-state shipments of standardized mass-produced designs. Along the way, their experiments toward a more appealing Windsor led to the development of the continuous-arm design, perhaps the boldest of them all and one apparently never made south of New York.

North of New York, today: Dunbar in Portsmouth—You can't research the history of Windsors very far without bumping into the name Michael Dunbar. Dunbar didn't just write about traditional Windsors, he built them—a lot of them. From 1970 to 1985 he built well over 1,000 chairs using the original methods and tools. Along the way, he wrote several books on the subject and became something of a Windsor guru, inspiring a subculture that now includes at least 100 Windsor makers across the country. Here was the man to see.

I met with Dunbar at the art museum at the Rhode Island School of Design (RISD), where we looked over the museum's collection of antique Windsors and talked shop. Much of what Dunbar said addressed modern misconceptions. "In the 20th century we're in love with wood, to the point where 'the natural beauty of the wood' has become a cliche. Everybody says: I want to make a Windsor chair, but I want to make it all out of walnut. But a Windsor is an engineered product—the wood has been selected for its properties, not for what it looks like." Which is why the old-timers chose only tough, resilient woods like oak, ash and hickory for their spindles. Besides having the strength to support and the flexibility to conform to the sitter, these woods rive and shave easily enough to enable a good worker to turn out a set in an hour. The legs and armposts were made of maple, beech or birch, woods that, when turned green, cut so cleanly an experienced turner could knock out a turning every three minutes. For the seats, they chose a single slab of clear white pine, basswood or poplar, wide enough to avoid the extra step of edgegluing and soft enough to saw and adze into shape easily.

These tricks work as well today as they did then, but we power toolers have become so conditioned to doing things by machine that we tend to work with machines even when it doesn't make sense, to the point where some of us end up reinventing the wheel.

Dunbar went on to say, "I once read an article by a fellow who began by saying: 'It may be more satisfying to carve out seats with an adze and inshave, but I run a production shop....' He then goes on to describe how he uses a chainsaw to rough out his seats, and his last sentence is: 'And doing it this way I can make a seat in two hours.' Hell, I can do it in half an hour using traditional tools! Which brings up a point about business. Too many people believe unless you've got the drill press, the jointer, the bandsaw, the lathe, etc., you can't be a woodworker. I make two chair seats a week using a $45 bowsaw. It takes me from five to seven minutes to cut out the two seats, after which the saw goes back on the wall 'til next Monday. A bandsaw takes up space and has to be cleaned off, and it costs a lot more than $45. It's ridiculous for two or even six chairs a week. You have to decide what level of production requires setting up machinery."

Dunbar is able to turn out two chairs a week in his New Hampshire shop because the Windsor was conceived not as a show piece but as a production piece, built of the easiest-to-work woods by the fastest methods. The unfinished product, a mix of wood colors with tool-marked surfaces, was brought together visually and made smooth with paint, which Dunbar feels adds to the challenges. "Anybody can take crotch mahogany and make it interesting. That's no real achievement; it's pretty to look at anyway. Now take a product that's going to be painted and make it look interesting. You've narrowed yourself down to a very tight range of possibilities, and one of them is line. I'm convinced that among the 'mysteries' of the trade, those things handed down by oral tradition, were instructions on consciously working in the element of line."

The Windsor is a composition in which each of the parts moves the eye to the next in a continuous linear flow. Because the eye is always moving through the chair, individual parts need not be perfect. Dunbar pointed out some alarming discrepancies on RISD's old Windsors. He suggested some chairs had one or two skinny legs because of rough blanks that were rived too small from the log, or because the turner tried to shave away a slipup with the skew chisel. Discards? Those legs were made the hard way: "Once we've got it chucked up and roughed round, there's no way we're gonna throw that thing away. It either blows up on the lathe or it goes on the chair."

You'd think the maker would at least have sorted his legs so that each chair had, say, two fat legs in the front and two skinny ones in the back, but generally in the period they seem not to have recognized that as a convention. "We've grown up with machine-made uniformity, but back then if a leg had a flaw (he points out a thumb-size knot hole on a leg's front), it went where it went and there was no conscious effort to turn it to the back."

The fact is, they didn't have the time, because these guys were making them by the thousand. The profit margin was too slim to allow for finickiness and still is, as Dunbar's experience shows.

"You learn these things the hard way. For the first five or six years in business, I'd make anything anybody wanted, until I realized I was losing my shirt. Finally I got kind of hard-ass about it. I made the kid's chair, the oval-back side chair, the sack-back and the continuous-arm, and that was it. Not only did you have to come to the shop to pick up the chair, you had to come in to order it, because I didn't want someone to order a chair and then come in and say 'My god, this isn't what I wanted at all!' So you'd come in, look at the model chairs I'd work from, and that's what you'd get." Dunbar's only display was in his kitchen. His deposits were nonrefundable, he refused to ship and he sold the chairs painted or unfinished only.

Buyers weren't deterred. Collectors who couldn't afford antique Windsors paid $450 each for his chairs, and he turned them out like a one-man production line. But he kept his sanity, too. "I almost always made them in pairs. I'd bend the backs on Monday so they'd be ready to go on the chairs by Thursday. I'd turn the legs and by the time I got done with the eighth one that was about all I wanted to turn. The same with the seats. Two was enough." Was it worth it?

"It's a wonderful way to make a living...."

Dunbar wasn't the first modern Windsor maker to revive the style—that honor probably goes to Wallace Nutting of a prior generation—and he wasn't the first living Windsor maker I'd ever met in person.

Sawyer in Calais—In the summer of 1982, I served on the jury at Frog Hollow Craft Gallery in Middlebury, Vt. Dave Sawyer, a tall, slim, prepossessing and affable gentleman with lantern jaw and expressive gray, bushy eyebrows had just lugged into the jury room two of his early efforts, a blue sack-back and a red youth chair. The chairs were okay, but they lacked charm. As the woodworker on the panel, my "no" vote was the clincher for Dave's rejection.

About six months later, he returned with a beautiful continuous-arm and one of the most beguiling and comfortable fan-backs I've ever tried—obviously a fast learner. The gallery has been showing his work proudly ever since, and Dave and I have been on close terms, visiting and following one another's work from time to time.

Sawyer graduated from the Massachusetts Institute of Technology with a mechanical engineering degree in 1959. He'd taken up the profession because, after helping his dad, a commercial artist, in his professional workshop since childhood and working in a boat yard while in high school, he knew he wanted to be involved in building things. He took a nine-to-five job as an engineering draftsman in 1963, but says: "It put me to sleep, so I gave it up. It was all pretty far removed from actually making something."

As an antidote to pencil pushing, he built an 8-ft. by 10-ft. house from scrap lumber in a week on six acres in Quaker City, N.H. Having no room for woodworking, he proceeded to make leather belts, then candles. After adding onto the house, he graduated to woodworking with a line of wooden pitchforks.

In 1970, a thousand or so pitchforks later, he built a shop. Having found a ladder-back he liked at a friend's house, he went into ladder-back chairmaking, a trade he chose because he "liked the idea of starting with a tree and a few hand tools one day and having a finished product the next."

Sawyer eventually took a trip to see Dunbar, who at the time was giving all comers measured drawings remaindered from one of his books. Dave took a set home and finally built his first Windsor, a sack-back.

Sawyer constantly experimented with improvements. He curved the back of his continuous-arm more deeply than those of antique models, making it more inviting to sit in, "more like sitting in a basket and less like sitting against a wall." A more daring experiment was to try an oak back on a butternut seat and cherry undercarriage (see the middle photo, next page). Showing through a clear oil finish, this makes a pleasing combination, and

Photo: Eric Borg

Photo: Jay O'Rear

Dave Sawyer

Dave Sawyer, left, captures the flavor of Windsor style in overall proportions as well as in crisp details. Sawyer's comb-back rocker, above, is a style that may have never existed in the period; rocking chairs were rare. Sawyer's reproportioning of the cherry legs, necessarily short and wide-splayed, is pleasingly well-balanced. The seat is butternut and the superstructure oak. The Windsor accepts stylish detailing without sacrificing its underlying integrity of structure. In the beginning of the 19th century, when things Chinese were in vogue, bamboo-pattern side chairs, such as the one above right, were popular. Simplified detail streamlined production.

since butternut is as easy to carve as pine, and cherry as easy to turn as the traditional white woods, it adds little to the construction time. Sawyer himself still prefers his Windsors painted, but says, "I like them both ways. A lot of customers like to look at wood, and I don't mind humoring them."

Sawyer's comb-back rocker, shown above, is truly an avant-garde chair, since there's almost no such thing as a traditional Windsor rocker, rockers being invented and popularized later. To me, it's an intriguing taste of where Windsors might have gone had they kept going. Always on the lookout for new ideas, Sawyer travels from Quebec to North Carolina to talk to his fellow craftspeople, constantly learning and often teaching about ladder-backs and Windsors. Ironically, he met one of his closest Windsor-making friends, Robert Chambers, just over the mountain in Corinth, Vt.

Chambers in Corinth—A fellow engineer, Chambers started really high-tech as an aerodynamic designer of jet missile engines. "I was making lots of bucks in aerospace but also suffering a big dose of questioning what I was doing. From the earliest times, I remember being with my father in his woodworking shop—he didn't make much furniture but was always doing something. I'd get a real craving to do something and find out right away if I did it right or not."

Chambers picked up a copy of Dunbar's old book. "I found it tremendously appealing that I could go knock some trees down one day, stand against the lathe with spray in my face the next, and in between fool with the design."

He took his first sack-back to Dunbar, who pronounced it one of the best first efforts he'd seen, but Chambers, his own harshest critic, was convinced Dunbar was just being polite. He soon got a chance to try again when a friend asked if he'd make him a pair of sack-backs and four side chairs. It was then that it occurred to Chambers that he might be able to sell these things. "I made the decision to jump out of my comfortable position and move to Vermont," says Chambers. "I took out ads in a few trade journals, and since my prices were low ($175 to $275) and there weren't many other Windsor makers at the time, I got myself terribly busy, more than I wanted to be." He dropped the ads and cut back to take a teaching job at Vermont Technical School in nearby Randolph until, a year ago, he felt ready to regroup.

Meanwhile, his sack-back design evolved. He bent the back bow on his arm-crest form so that, with the same curve to both bends, the chair looked unified. He took the same kind of thinking further with his undercarriage layout.

Many Windsor makers, like Dunbar, "know all the angles" and simply eyeball their leg angles. Chambers prefers to stand a block with a guide mark on his seat blank to help him align the bit when he bores his leg holes, using a modern bit and brace rather than the spoon bit of old. Then, to ensure symmetry, he bores the rear leg holes using the block to set his side-view angles only. The rear legs' rear-view angles are always bored in the same planes as those of the front legs, like a rocking chair's, so they can be sighted directly from legs plugged into the front holes. Besides facilitating boring, this trick seems to serve equally well as a design formula, for the result, in Chamber's hands at least, is a chair with strikingly well-balanced proportions. All his Windsor styles, with their rear-leg tenons set well in toward the seats' centerlines, remind me of lithe dancers up on their toes.

Museum of Art, Rhode Island School of Design; gift of the estate of Mrs. Gustav Radeke

Robert Chambers

Robert Chambers, left, here drilling tapered sockets with a reground spade bit, is a former aerospace engineer who continually refines his Windsor designs. Typical of Chambers' Windsors, shown above, is an uncluttered, unified look, much in contrast to some early chairs (example top left). Homely furniture from the past is a reminder that utilitarian forms weren't always built by design geniuses.

"Each time I go to make a chair, it's an opportunity to make it better. While some of my chairs are pretty close to standardized, most are variations on a theme.

"I accept a lot of the given," concludes Chambers. "I haven't invented any new styles, but I still find it a big challenge to put together something that works, that's pleasing, and harmonious with an earlier time."

Over all, it takes Chambers about 40 hours to build a continuous-arm from tree to paint. When I hinted this was a mite longer than the old-timers took, he replied, "I've hewed one side of a 26-in. 8 x 8 in an hour and a half, so I can see where it could be done in the six hours it was supposed to have taken 'those old-timers'–if you could keep it up. But, you know, a friend of mine told me once, 'Hey, Bob, I've seen an old photograph of some of those old-timers. They're about 26.'" Chambers is a bit more mature than that.

Both Sawyer and Chambers have restored "bodgering"–turning Windsor parts–to the fine art it once was. But to my eye, there's a man who has taken a step beyond.

Franklin in Easthampton–Born in Burlington, Vt., one of Peter Franklin's earliest memories is buying his first antique while accompanying his parents to an auction as a small boy. When he grew up, his interest in things old led him to a career as a contractor in Nova Scotia, where he restored buildings. But one winter day, standing on a half-finished roof in a freezing rain, he found himself asking, "Why am I doing this to myself?" A friend suggested an apprenticeship with a man who made Windsors in Bristol, R.I. Franklin made the move.

As an apprentice, Franklin made thousands of parts, but no chairs. Since there was a master turner in the shop, producing a leg every three minutes, Franklin was left to figure out the lathe on his own, after hours. After leaving his apprenticeship and moving to his present shop in Massachusetts, he continued to fine-tune the skill, beginning with a reproduction of a New England-style leg he'd measured from a chair belonging to a couple in Westchester, N.Y. He learned well. His turnings are so perfect it's hard to believe he hand-turns these patterns by eye, again and again, for every chair he builds.

His shapes are crisp, delicate, bold and daring all at once, but it's a feat he had to work a compromise to achieve. Franklin turns kiln-dried maple, which he chose for its great strength and density. "These turnings can be light in form yet retain great strength. Additionally, maple's density permits a sharpness of detail not possible in softer woods," says Franklin. By turning the wood dry, he avoids the crumbling and fuzzing of green stock, enabling him to turn clean curves with razor-fine rings and shoulders. He admits it's a trade-off, as it takes considerably longer to turn dry stock, particularly maple, than it does to turn traditional woods.

Franklin spent the first few years after his apprenticeship collecting designs. One of his best is a variation on a continuous-arm that had come into the Leeds Design Workshops, in the same building as his shop on 1 Cottage Street, for repair. After acquiring permission from the owner, he applied his standard routine. "I take a tape measure and paper and draw little lines corresponding to significant features. Then I walk away from the chair." The result is an interpretation, not an exact duplicate.

In the shop, Franklin tranfers the chair's seat outline to particle-

Photos above and below right: Peter Franklin

Peter Franklin

Peter Franklin, above left, who works with a couple of helpers, combines high production with snappy detailing that's almost audible. Franklin's settee, above right, is a Windsor form still evolving: The vibrant undercarriage appears to be impatiently waiting for the sedate top to catch up. Franklin's corner chair, at right, is a form that probably never existed, but it clearly carries on the tradition toward ever more buoyant design. The earliest Windsor precursors, drawing below, a handful of which survive from the 16th century, were mired in Gothic heaviness. Lightweight intermediate forms, photo below, realized the possibilities of tension/compression engineering.

Museum of Art, Rhode Island School of Design; gift of the estate of Mrs. Gustav Radeke

board and cuts it out on the bandsaw. Then he glues hardwood blocks at the leg locations and uses the leg angles he's recorded to bore rough guide holes. This unit becomes a combination seat pattern and boring jig. Or, if the seat shape is one he already uses, he may grab a finished blank from his stock, glue on the blocks and bore it directly so he can stick in whatever legs he was kicking around and see how it looks. It doesn't always look right, but Franklin is philosophical: "You can't be paralyzed by fear of ruining a good seat. You've got to take a chance, hold your breath and drill it."

Even if an experiment comes out looking good, it still may not be right, because for Franklin, the chief determinate is comfort. "The philosophy of the early makers was to make chairs to sit in. They weren't making art furniture or chairs to set aside in collections, and if it's not comfortable, you can't use it."

Nor were they pedagogues. Thus Franklin feels invention is justified. "I just built something that may never have been made before, a Windsor corner chair, for a show in Holyoke, Mass. If the original makers had had access to as many things as we do, I think they'd have been as whimsical as we. Just because you're working in traditional elements doesn't mean you can't incorporate new ideas into traditional design."

To my eye, Windsor design is not only flourishing, it's healthier than ever—a 200-year-old tradition that's just now getting its second wind. □

Jeremy Singley of East Middlebury, Vt., makes Windsors and other furniture. He wrote about logging and sawmilling in FWW *#61.*

Birds of a feather: in foreground from left to right, AMT, Lion and Grizzly. While differences are minor, parts are not interchangeable among the three machines, whose common ancestor sits in the background, stamped Lion Universal Cutter No. 4, Pootatuck Corp., Shelton, Conn. The design has been virtually unchanged since the early part of this century.

Miter Trimmers

Slicing cuts for picture frames and trim

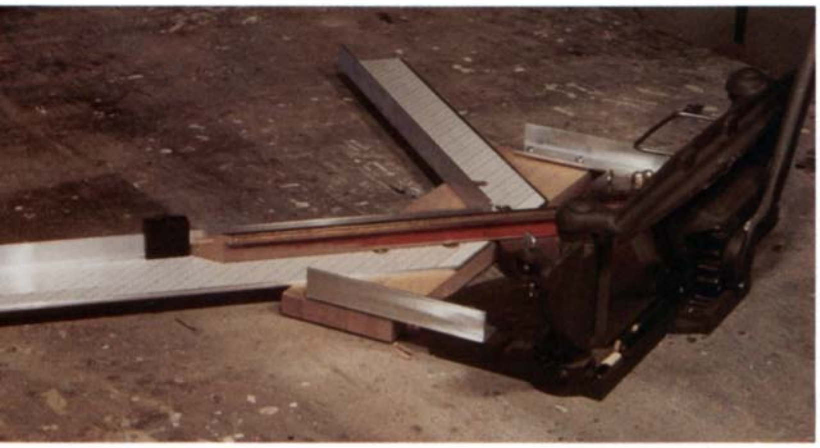
by Jim Cummins

As soon as I received two of the three guillotine-type miter trimmers on the market, I jumped at the chance to have some fellow woodworkers try them out. We all sliced up an assortment of woods and molding scraps until the chips half-filled a shop-vac. "Hey, that's great!" was heard more than once. "It doesn't take any force at all; how can it cut like that?" "It cuts smooth as glass and it's *quiet,* too." The machines looked almost identical in every feature and adjustment, and both sliced wood about the same. Yet after a few cuts on one machine and a few cuts on the other, each volunteer would generally pause, step back, then point decisively and say: "I like *that* one better." That *one* was the venerable, American-made Lion, which is the obvious inspiration for the two contending imports from Taiwan. These three machines are so alike that whether the Lion can survive the invasion depends, I think, on people's sensitivity to some subtle factors. I hope these will be clear by the end of this article.

With that aside for the moment, I have no doubt that a miter trimmer would be a handy tool to have around if you do a lot of applied moldings for interior trim, cabinets, clocks or what-have-you. In fact, trimmers have some curious uses that don't quickly spring to mind. Wood technologists find the cut is clean enough to allow endgrain analysis for wood identification. Telephone companies use them for slicing plastic cable housings during inspections. But of course the main market is finish carpenters, cabinetmakers, part-time frame shops and individual artists. I say part-time framers because if you're serious about making picture frames or doing much other commercial mitering, you'll want a full-size, foot-operated $1,500 chopper. This article focuses on trimmers, but if you're intrigued with the idea of a chopper, literature on the two best-known machines, both made in Denmark, is available from S&W Frame Supplies, 120 Broadway, Garden City Park, N.Y. 11040, (516) 746-1000; and Juhl Pacific, 7585 Equitable Drive, Eden Prairie, Minn. 55344, (612) 937-3200.

I bought my Lion used for $25, 20 years ago, intending it to be only a backup for my chopper. The rusty, paint-spattered machine had a broken handle, which had been fixed by wedging the

Moldings must be rough-cut to size before the trimmer can start to work. The secret to perfect joints (here with the Grizzly) is to finish up with a series of light slices.



The Lion trimmer has an optional length gauge ($50) that can be adapted to fit the other machines by drilling mounting holes in their beds. While it saves pencil-marking each length, perfect cuts can be made without it.

Moldings that tend to tip or tear out when cut normally may be sliced using the Lion's optional top trimmer ($38), which also allows compound miters. Note that the same results can be achieved with a shopmade angled block.

pieces into a length of pipe. And one of the wings had the lip cracked off the front edge, a result of overtightening the locking screw. Despite this, the trimmer still works fine at 45° and 90°, the only drawback being that it can't be locked at other angles without using a C-clamp. The foreman of my picture-frame shop, Mike Densen, uses it even more than I do and finds it the ideal tool for slicing strippings, which are unrabbeted frame moldings that have to be individually, and perfectly, fitted around a canvas. He also reaches for it whenever we have to frame work at a customer's home (some pictures are too big to move easily). Densen's first experiences with a Lion came long before he ever worked with me; the trimmer was the tool of choice for fitting window trim when he worked for a contractor back in the early 1960s. "Nothing can touch it for a joint that *fits,*" Densen maintains.

Operation—Unlike the usual fuzzy sawcut, a miter trimmer works like a giant paring chisel, slicing miters or cleaning up endgrain. The trimmer's two knives—one for left-hand cuts, one for right-hand—are fastened to a carriage that slides in grooves in the back of the cast-iron bed. The knives are powered by a hand lever that turns a cast-iron gear wheel. As the knives cut, they apply pressure that squares the work down against the bed and against a fence, or wing, at each side; clamping the work is usually unnecessary. The wings butt up against adjustable stops at 45° and 90°, or they can be clamped at any angle between. When trimming a room that is not quite square, it's easy enough to shim the moldings slightly askew against the wings to change the angles slightly and achieve perfect fits.

The photos show the essentials of how a trimmer is used: Work is precut slightly longer than final size using tablesaw, handsaw or whatever means is convenient, then a series of thin slices on the trimmer brings the ends to a perfect miter at the correct length. It's recommended that the trimmer be screwed down or clamped, which is probably necessary if you are taking heavy cuts in wide moldings, but I've never clamped mine.

You can stand (or kneel if you're working on-site on the floor) directly in front of the tool, working the lever to the left and right as necessary, or you can stand at one end, as I usually do. This position is less fatiguing, because you use your stomach and back muscles to pull or push the lever. I make the pull cuts first on all pieces, mark the lengths on the other ends, then make the push cuts last. By standing at the end of the machine, I have a clear line of sight down the knife as it approaches the pencil line, which is difficult to gauge when in front of the machine, particularly if the molding is rabbeted and the pencil line is in the rabbet.

The Lion accepts an optional length gauge that might be useful (see the middle photo at left), but I've never felt the need for it. Also, directions for using the gauge call for very accurate precutting, and I'd rather let the quality of the wood determine how accurate I have to be at the roughing stage. For example, you can take very heavy cuts in pine. When mitering a 2-in.-wide clamshell molding flat on the bed, anything up to an inch long can be speedily hogged off in one chop, then a couple of finer slices can be taken to ensure a straight, glass-smooth surface with no tearout. Fussing much with measurements at this stage is more time-consuming than profitable. Hardwoods are another story. Trying to take a 1/16-in. slice in maple may be too much, so here it's a good idea to make accurate rough cuts at the proper angle.

Another thing, quickly learned through experience, is that there must be a certain minimum thickness to the shaving; otherwise, the work will slide away from the knife. This minimum thickness varies from wood to wood. As you approach your pencil line in a series of slices, you have to leave just the right amount of wood for the last cut. Too far from the line, and you won't get the cleanest cut possible; too close, and the knife may enter the work all right, but it will ride out of it before the cut is completed, ruining the cut's accuracy. Shaving thickness is especially important when cutting very hard woods, where there may be little difference between the maximum and minimum shavings possible.

Some moldings are difficult to cut because their shapes leave poor bearing surfaces against the bed and wing; under cutting pressure, they tend either to tilt or to slide. Other moldings may tear out when cut in the usual way. As a cure, Pootatuck makes a "top trimmer" for the Lion that changes the orientation of the molding, as shown in the bottom photo on the facing page, so that its best bearing surface may be used. Another idea is to make an angled block to back up troublesome moldings so they will be sufficiently supported when cut at the normal wing position.

Safety and maintenance—If your hand should brush against a knife, you'll draw blood so easily you may not even feel the cut until it is very deep. These machines weigh about 26 lbs., and the new models all have a simple but very effective carrying handle to keep hands out of the danger zone. I've cut myself twice on my old model—once badly, when I picked it up by grabbing the two projecting knife guards, not realizing that the knife was all the way to one side. Another time, I picked it up by the guards and the handle swung to one side under its own weight, forcing the knife's top corner hard enough into my hand to gouge it.

For best results, knives should be kept razor sharp. You can periodically refresh the edge by honing a secondary bevel using regular benchstones, working off the burr by honing the knife's flat side flat against the stone. The process is much like chisel sharpening, as described in *FWW* #61. However, I advise you to send knives off for grinding when the secondary bevel gets too wide for practical honing. It's not a good idea to grind them yourself, because there's too much danger of overheating the steel. AMT and Grizzly suggest finding a local sharpener to do the job—anyone who sharpens jointer and planer knives can do this work. You can send Lion knives back to the factory. Pootatuck sharpens 16 pairs at a time on a Blanchard grinder. To ensure a fast turnaround, usually next-day, they exchange knives. When a customer's knives arrive, they are measured for width, 1⁄16 in. is deducted as a sharpening allowance, and a pair that size is shipped out from stock. The cost is about $20 postpaid, but these tools don't dull all that fast. Commercial picture framers average close to a year between sharpenings, Pootatuck says. Their most regular customer is a millwork shop that sends knives back two pairs at a time every six months or so.

In fact, I have had my knives reground only twice so far, and I even spoke with one Lion owner who has been hand-honing the same set of knives for 30 years. These machines are somewhat tolerant of abuse and neglect. In a torture test, slicing particleboard, the imported knives and the Lion knives dulled at about the same rate. Afterward, they still cut wood accurately but did not achieve the glass-smooth surface.

All told, trimmers are easy to learn to use and maintain. Their lifetime is practically unlimited, and they may prove handier than expected: They make outstanding endgrain chamfers, for example, and can be coaxed into nibbling corners round. But now that you may want one, how do you choose which to buy?

Rating the tools—The Lion is made in Claremont, N.H., and is sold for about $250 by Pootatuck Corp., P.O. Box 24, Windsor, Vt. 05089; (802) 674-5984. It may also be purchased from a number of mail-order houses. AMT (American Machine & Tool Co., Inc., Fourth Ave. and Spring St., Royersford, Pa. 19468; 215-948-3800) introduced their Taiwan copy two years ago for about $150. Grizzly (Box 2069, Bellingham, Wash. 98227; 206-647-0801 or 2406 Reach Road, Williamsport, Pa. 17701; 717-326-3806) followed with theirs just last November for $120.

Is the Lion worth $100 more than the AMT and $130 more than the Grizzly? Maybe yes, maybe no. The question boils down to a series of gives-and-takes. To help you make up your mind, here are some impressions:

Woodworker Larry Green of Bethel, Conn., bought an AMT trimmer two years ago. He had been bandsawing mitered boxes, then tediously handplaning the miters smooth. He thought the AMT would save that step and be more accurate in the bargain. Having seen and used a Lion since, he says he wishes he had bought the Lion instead. Green's main complaint with the import was the condition of the knives, which were incompletely ground, leaving a rough and pitted inclusion on the cutting edge. AMT has a good reputation for dealing with defects, but Green wanted to get on with his work. So instead of sending the tool back, he painstakingly reground the defective knife himself, which took the best part of a Saturday afternoon. He also notes that his machine's main casting shows severe pitting and inclusions, cosmetic defects that trap dirt and may also prove potential breaking points in the iron.

The AMT we borrowed from the importer had very minor pitting, and its knives were razor sharp. But the knife carriage had noticeable play in it and the action wasn't as smooth as the Lion. A $100 difference? To my eye, not if judged pound for pound, nut for nut, spring for spring. But such subtle differences do begin to add up, at least in my mind.

The Grizzly arrived in excellent shape. Castings were clean, and knife movement was a little smoother than the AMT. In fact, it was so good that my suspicions were aroused: How could something as nicely finished as this possibly sell for only $119.95 postpaid?

I asked another editor to order one off the shelf and have it shipped to his home address. It arrived in a week, and to my surprise, was almost as nice as the one we'd borrowed. Minor shipping damage cracked one wing nut, whereby the "brass" revealed itself to be plated pot metal. There was inconsequential pitting along the front of the casting, one of the knives was slightly off-line (shimming would fix it), the knives had a couple of minor chips and the handle wouldn't seat fully in the slot in the gear (just like the first one, whose handle has fallen out a couple of times; the mis-fit is visible in the top photo on the facing page). The importer had clearly looked over the machine we'd borrowed, cleaning up the Cosmoline shipping grease and possibly honing the knives, but you can't blame a company for trying to put its best foot forward.

As noted earlier, everyone who compared the machines preferred the Lion, not just for its slightly neater castings and general look of quality, but for its clearly smoother action and precise feel. The other machines could be made to work about as well, but it would take some time with a file, some time to hone the knives, and a trip to the hardware store to replace cheap screws and fittings. That may well be the route a lot of woodworkers will choose; the price war is clearly on and the imports give a lot for the money. My personal vote, however, still goes to the Lion. Price differences soon depreciate away and are forgotten, while a manufacturer's initial attention to quality affects a tool's whole working life, and hence the satisfaction of owning and using it. □

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Two-Door Credenza

A case of dowels, dovetails and tenons

by John McAlevey

Most of my furniture designs begin as simple sketches. I draw on a regular basis, sometimes entire pieces, other times just certain curves or details. When finished, I date the drawings and stack them with drawings from previous sessions. Then, when I need ideas, I rip through the stack.

The two-door credenza shown here began that way. I was asked to build the credenza as a companion piece to a South American mahogany conference table I had made for a law firm's library. When I dug out my first drawings of the table, the rough sketches showed how I had experimented with slight curves, plain round edges and large overhangs as I designed. I knew the credenza would need similar curves and an overhanging top for it to relate visually to the table.

I like to plan all my joinery and construction details before I even touch the wood. After rough-sketching the credenza, for example, I made a complete set of working drawings, including joinery details. Since this credenza has a top that overhangs the sides, I couldn't use dovetails, my usual method for casework, to join the corners. I knew I could have added an applied top to overhang the dovetailed case, but this seemed a waste of wood. Stub tenons would have worked, but they seemed a waste of time.

So, I began to rethink my ideas on joinery. Why not mix traditional joints, like dovetails and mortises and tenons, with production-oriented joints, like dowels or plate joints? These joinery combinations would save time while maintaining the structural integrity of the piece. For example, I planned to dowel the top to the case, and to have a frame-and-panel back. The back would sit in rabbets in the sides of the case, but I did not wish to rabbet it into the top for two reasons. First, I thought it would put unnecessary racking strain on the dowel joints, and second, I wanted to overlap the top at the back a little bit, and thought that a rabbet here would look unattractive. The solution was a dovetailed back stretcher to which I could screw the back. Through mortises and wedged tenons could fasten the bottom stretchers to the sides, as well as add a nice design feature. I could simply plate-join the bottom panel to the sides to keep this joint tight, and then use cabinetmaker's buttons, as shown in the detail on the facing page, to fasten the bottom panel to the stretchers.

Photo: Timothy Savaro, Photoworks

Combining traditional and production joining techniques allowed the author to build this credenza economically while maximizing structural integrity.

Since the conference table was made of South American mahogany, I used mahogany to build the credenza. I like the wood's grain and color. There are few knots and checks, and little sapwood. I view wood's figure as a beautiful landscape, and as I cut it into parts and edge-match pieces, I try to get the grain to reflect the abstract view of a hilly countryside.

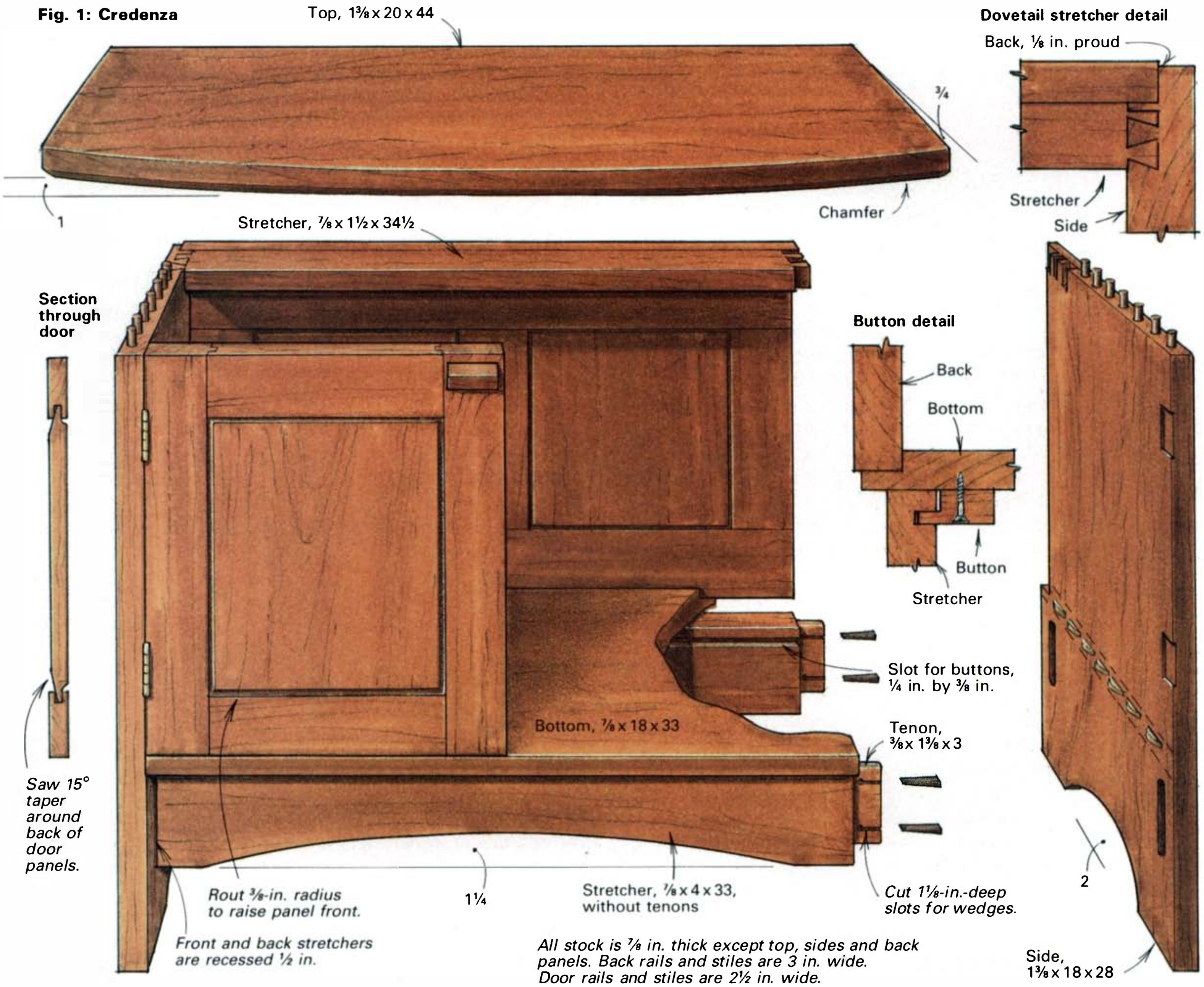
For this project, I cut the door's two center stiles from the same board so the grain would match across the gap. I prepared the stock for all parts shown in the drawing at once and labeled each piece so I could keep track of the grain patterns and orientations. I milled the slab sides and the credenza top from 6/4 stock and the bottom panel, stretchers, doors and back panel from 4/4 stock.

Building the carcase—The squarer a carcase is, the easier the pieces will fall into place, the better the glue joints will hold and the less time it will take to build and fit doors and panels. I follow a logical order in doing joinery, beginning with the joints that will govern how square the rest of the carcase will be.

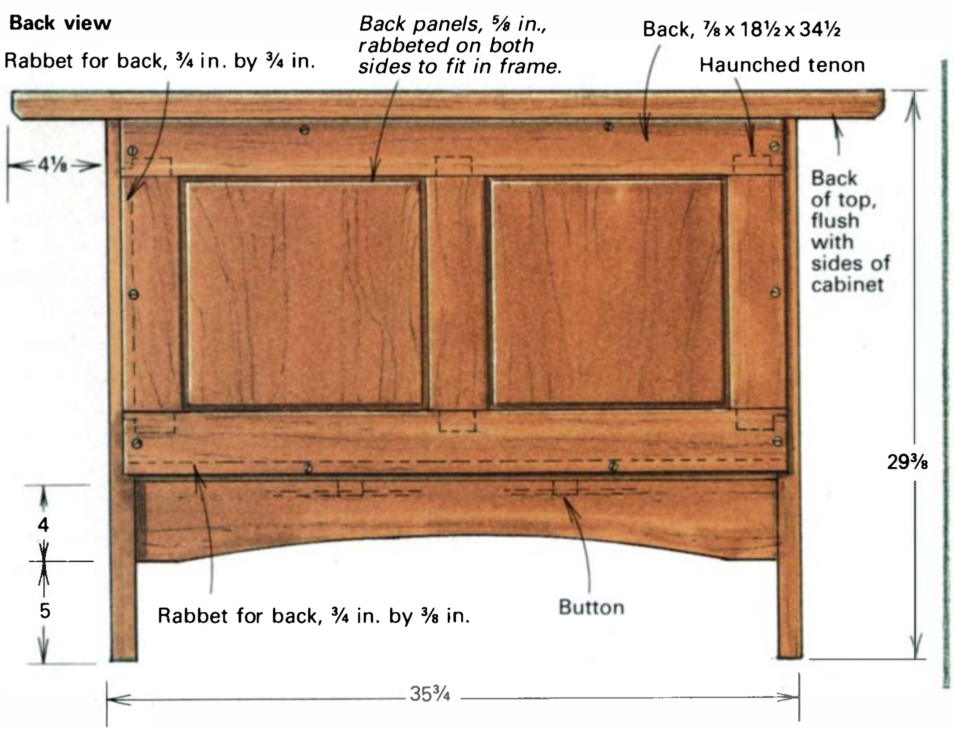
Here's an overview of the process: When building the credenza, I cut the through mortises in the sides and then cut tenons in the mating stretchers. The large shoulders on the tenons make these joints easiest to square. After cutting the tenons, I ripped slots inside the stretchers for the cabinetmaker's buttons. Then, after dry-assembling the sides and stretchers, I cut the bottom to size, routed the rabbet for the back and dovetailed the blind stretcher across the top.

I used my mortising machine as a horizontal borer to dowel the sides. Normally, I do mortises on this machine as well, but the sides were too heavy and awkward to clamp to the machine. It was easier to cut them with my plunge router. I installed the stock fence guide and an Inca, ⅜-in. slot mortise miller bit (available from Precision Woodwork Machines, Mount Tabor Avenue, Danby Vil-

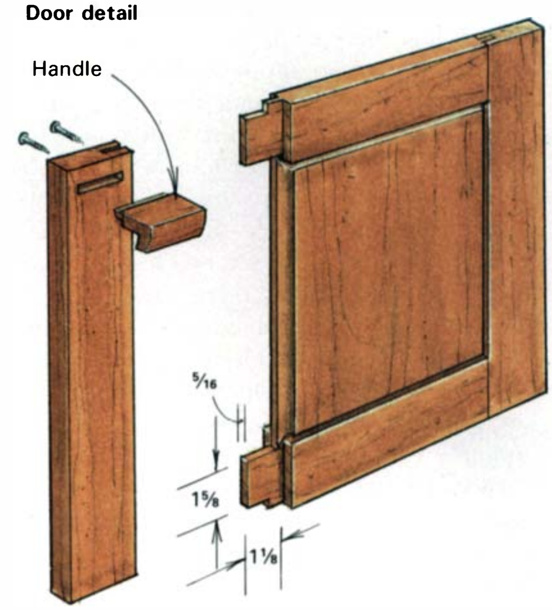
Fig. 1: Credenza



Back view



Door detail



A temporary glue-up stick attaches over the dowels at the top to keep the sides from toeing in or out as glue dries.

lage, Vt. 05739; 802-293-5195) in my router. The Inca bit plunges deeper than a spiral-flute end-mill bit and leaves a cleaner mortise.

I began by carefully marking the mortise location, then clamping a scrap of poplar underneath to prevent tearout. Next, I ran the router fence along the edge of the wood and plunge-routed the mortise from the outside in three or four passes, bringing the bit to the marked edge of the mortise.

I cut the tenons on my tablesaw, first crosscutting the shoulders, then standing the piece on end in a tenoning jig to cut the cheeks. I filed the tenon cheeks round to match the radius of the mortises instead of chopping the mortises square to match the tenons. It's not necessary to match the radii exactly. The tenons will expand slightly to fill the mortises as you drive the wedges in. To accept the wedges, I handsawed two slots down each tenon to a depth of ¼ in. from the shoulders. I then drilled 1⁄16-in.-dia. holes in the bottom of each slot to prevent splitting and to permit the slot to open fully during wedging. To give contrast to the joint, I made rosewood wedges, 1 in. long, tapering down from about 3⁄32 in. to a featheredge.

Next, I routed rabbets on the inside edges of the sides and on the bottom panel so I could fit the back. I cut the rabbet with a spiral end-mill bit and the same fence I used to rout the side mortises. Because the rabbet in the bottom panel goes all the way across, I routed it first. The rabbets in the sides are stopped flush with the rabbet in the bottom panel. Rather than measuring to locate the bottom of the rabbets in the sides, I assembled the sides to the stretchers and placed the rabbeted bottom panel in the carcase. Then, I marked a line on each side flush with the rabbet in the bottom panel. After disassembling the carcase, I routed the rabbets just short of the lines. To achieve the neatest joint where the rabbets met, I planned to wait until the carcase was glued to square up the ends of each rabbet with a chisel.

Before blind-dovetailing the stretcher, I reassembled and squared the carcase. I then measured between the two sides and added another 1½ in. to determine the total length of the stretcher. The extra 1½ in. is for ¾-in. dovetails at both ends. I ripped the stretcher 1½ in. wide, then crosscut it to length before cutting one full and one half dovetail pin at each end of the stretcher, as shown in the detail in figure 1. The purpose of the half-pin, of course, is to avoid undercutting the rabbet for the back. I cut the pins on my bandsaw, then marked matching sockets in the sides while holding the back of the stretcher flush with the back of each rabbet. I then sawed and chopped the waste from the sockets and test-fit the stretcher in place.

Next, I rested the bottom panel on the stretchers and lightly clamped the sides to be sure that the length of the bottom was correct. With all the parts lined up, I marked the edges of the bottom panel and the side. These marks would be the reference points for laying out the plate joints. With the case disassembled, I used the standard 90° fence on my plate joiner to cut the kerfs in the ends of the bottom panel. To cut matching kerfs in the sides, I removed the stock fence from my plate joiner and used a board clamped to the case side as a fence.

These plate joints deserve careful layout and precise cutting, because the case bottom must align with the tops of the stretchers. If things don't work out exactly, there are two cures: You can plane down the tops of the stretchers, or you can reshape the tenons slightly so the wedges will drive the stretchers up.

If you don't have a plate joiner, substitute ¼-in. by ¾-in. wooden splines for the plates. Dry-assemble as above, then mark the location for the splines. After disassembly, clamp a straightedge on the side as a fence and rout a ¼-in.-wide by ⅜-in.-deep slot in the side, stopping 1 in. short of the front and back edges. Rout the other side, and then rout matching slots in the ends of the bottom panel.

The next step is to lay out and bandsaw the curves in the stretchers, sides and top. Drawing the gentle curves is easy when using spline weights and a spline. (For more information on splines, see the sidebar on the facing page.) These curves are not necessarily segments of a circle, but can be varied to complement the overall design. Along the same lines, I prefer not to use standard router-bit profiles when rounding edges. On the underside of the top, for example, although I began with a chamfering bit and pilot bearing, I finished the job with files, planes and scrapers. This allowed me to maintain the feeling of the top's curve in the edge profile. Before glue-up, I finish-sanded the pieces on my stroke sander.

Gluing up the cabinet—The final glue-up of a cabinet can be one of those all-at-once procedures where everything goes very right or very wrong. I planned to slow things down a bit by gluing the cabinet in two steps: first the sides, stretchers and bottom panel, with the top being applied only after the other parts had dried. Gluing up in two steps would not only let me check for square twice, it would also allow me enough time to apply glue carefully, thus reducing squeeze-out.

In order for step one to work, though, I had to come up with a way to keep the sides from toeing in or out at the top-front corners as the glue dried. As a solution, I fashioned a temporary glue-up stick to fasten between the sides (see the photo above, left). I drilled dowel holes in the sides to accommodate the top, then placed dowels in the first hole of each side. I then drilled holes in the glue-up stick at each end and slipped the stick over the two dowels. The holes in the stick must be carefully spaced to hold the sides square: If the holes are not far enough apart, the sides will toe in; if they're too far apart, they'll toe out.

When gluing up, it's important to drive the wedges into the through tenons before the glue sets. After the glue dries, remove the clamps and glue-up stick. Before going to step two of the glue-up, dowel holes must be drilled in the top. To mark the locations for the holes, place dowel centers in the holes in the sides. Locate the top on the centers so that it overlaps the corners at the front and the back equally. Press down hard enough for the centers to mark the top, then bore at each mark. After drilling the holes in the top, glue the dowels in place and clamp the top to the carcase.

Making the doors and back panel—You don't often see a cabinet with a frame-and-panel back anymore, but I decided to install a finished back for two reasons. First, it added versatility to the credenza. Having an attractive back means the piece can be used away from the wall. Second, since the credenza has no

Laying out curves

A lot of my furniture has curved edges, which lend a subtle simplicity to my designs. But drawing large, smooth curves can be difficult. I solved this problem when I learned about splines and spline weights architects often use. They are available from Charrette, 31 Olympia Ave., P.O. Box 4010, Woburn, Mass. 01888; (617) 935-6010 or (212) 683-8822 in New York.

The spline is nothing more than a 5/16-in.-wide strip of clear plastic. Spline weights are cast, felt-bottom weights with hooks in their ends to hold the spline. Pulling or pushing on the spline after each end is hooked in a spline weight bends the spline in a smooth arc, which can then be easily followed by a pencil.

Each spline weight costs about $14. Four splines are available in lengths of 23½ in., 35½ in., 47 in. and 59 in. They range in price from $3 to $7.

Because splining shallow curves requires very little bending, you can substitute a narrow strip of oak for the plastic spline. That's what I did to mark the credenza's top.

To lay out the curved edge in the front of the credenza, as I'm doing in the photo at left, I marked a line at midpoint along the front edge of the top. Next, I penciled marks ¾ in. back from the front edge on each side and placed the spline weights near those marks. I put each end of my oak spline under a spline-weight hook, placed a finger on the spline at the point where I had marked the center, and then pulled the spline to the edge. While doing this, I moved each spline weight so the ends of the spline lined up with the marks on each side. With everything aligned, I ran my pencil along the spline to transfer the curve to the top.

The author uses his spline weights and an oak spline to lay out the curve in the top front of the credenza.

With minor variations, I used this same procedure to mark all the curves on the edges of the credenza. For instance, because I wanted the curves in the sides of the top to arc more heavily toward the front, I pulled the front spline weight back to tighten the radius in front and pushed the rear spline weight forward to open up the radius in the back. To make the tighter concave curve at the bottom of each side, I used a short plastic spline and pushed it away from the edge to form the arc. *–J.M.*

drawers or shelves, you're likely to see the inside of the back when the doors are open, unless the credenza is chock-full.

The stile-and-rail frames for the doors and back are of standard haunched mortise-and-tenon construction. To raise the door panels, I sharply radiused the edges in the front of each panel with a ⅜-in.-radius cove bit in a router mounted in my tablesaw extension. I stood the panel vertically and guided it against the tablesaw fence. Because the edge was fairly thick, and my cuts were shallow, I didn't take the trouble to use an extra-high fence, which would have provided more support and made the work much safer and easier.

I also raised the backs of the door panels slightly. I set the tablesaw blade to 15° and again held the panel vertically against the fence. I made the panels in the back from ⅝-in. stock. Instead of raising these, I rabbeted the edges to create a centered tongue to fit the frame. After scraping and sanding, I gave each panel one coat of Watco oil, front and back, to keep it from adhering to its frame during glue-up.

Finishing the credenza–Because I sanded the carcase pieces on my stroke sander before glue-up, the only sanding left to do was on the frames of the doors and back. Machine-sanding certain components gives them a sanded-to-death look. I find this to be especially true of the frames surrounding raised panels, because there are so many lines that must remain parallel or square to each other. As such, I spent a lot of time scraping and hand-sanding the door frames to give them crisp, sharp lines.

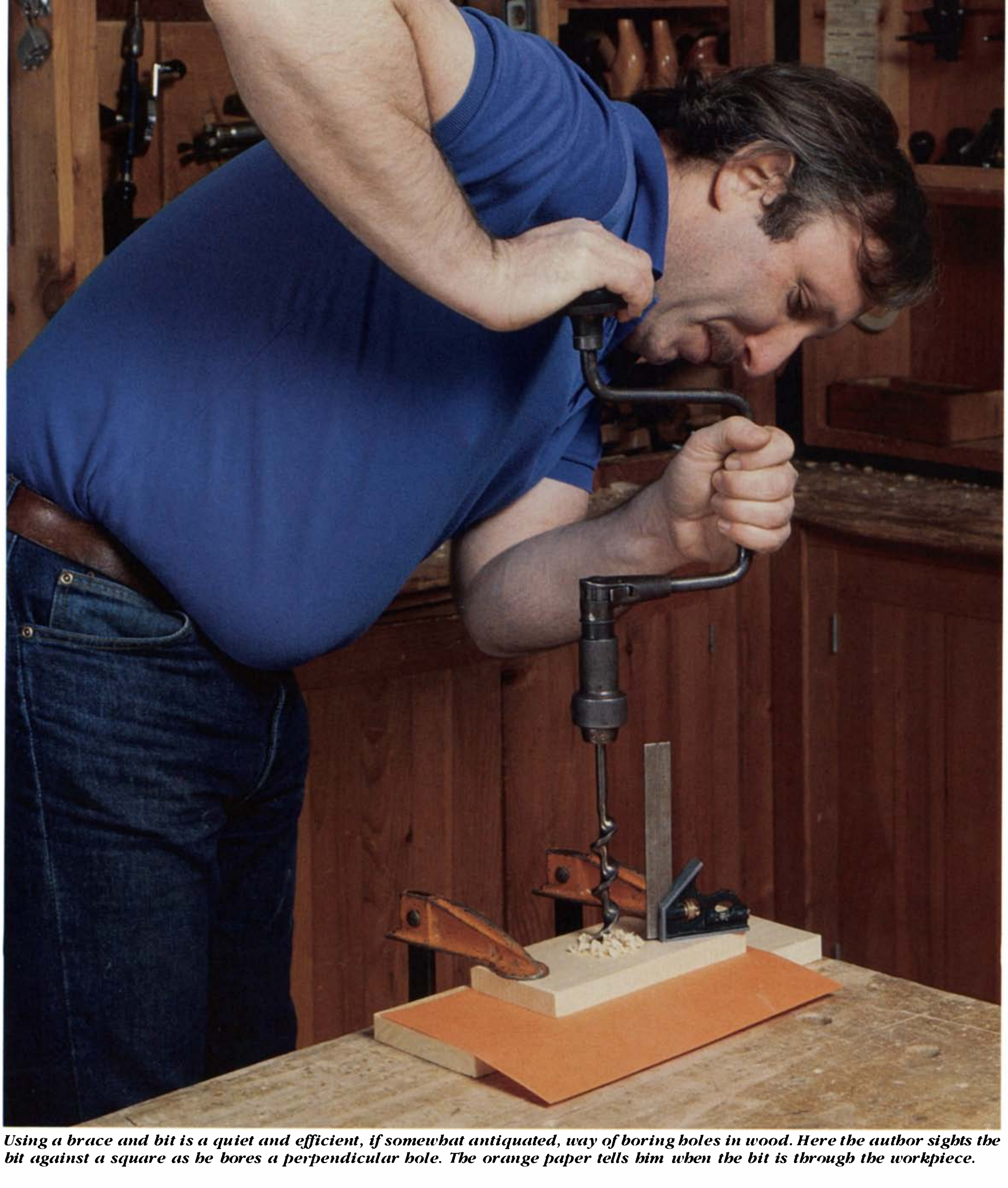
Once that was done, I mortised the doors and sides for the brass butt hinges, made and installed door handles and fastened the panel on the back with brass flat-head wood screws. To keep the doors closed, I installed simple magnetic catches to the underside of the top.

I agonized over where to put the door handles. If I mounted them at midpoint on the stiles, they would balance the look of the credenza but would obstruct the beautiful figure that continued across the door gap. I finally decided to tuck the handles up under the top where they would be unobtrusive and easy to reach without bending down. To make the handles, I roughed a long blank on my tablesaw, cut the handles to length, then smoothed the surfaces with files and block plane. In the past, I had simply mortised this sort of handle in place, but I found the tenons on the handles occasionally broke off. So, on this credenza, in addition to mortising the handles, I fastened them with screws from the back.

I never put less than three coats of oil on a piece I've made, but there are times when I apply many more: It all depends on how long the piece hangs around the shop. I apply the first coat of oil and let it dry for a few days. Between subsequent coats, I rub down the wood with 0000 steel wool. Before delivery, I apply a coat of Watco satin wax.

There's a secret advantage to using Watco oil and wax. Clients will be bound to call me some day complaining of a scratch, expecting me to drive to their home or office to make a repair. It's certainly easier to explain that they can not only do the repair themselves with products available at any hardware store, but they can also maintain the finish with ease. □

John McAlevey designs and builds furniture in Franklin, N.H.



Using a brace and bit is a quiet and efficient, if somewhat antiquated, way of boring holes in wood. Here the author sights the bit against a square as he bores a perpendicular hole. The orange paper tells him when the bit is through the workpiece.

The Brace and Bit

This old standby can do more than just bore holes

by Richard Starr

Despite all the motorized drills available to woodworkers, the old-fashion bit brace is still a useful tool in today's shop. I use mine for boring holes when I don't want to mess with a power cord, and it's fun to use, too. I also use it for driving screws, tenoning, chamfering dowels and doing other jobs you might expect to do on a lathe or with a drill press.

Before the brace was invented, early craftsmen drove large boring bits with a simple cross handle, something that looks like a giant corkscrew. Although the cross handle may still be the most powerful tool to use for boring a big hole, it is hard to steer and the hand-over-hand motion is slow. It's also difficult to apply pressure on the cross handle to advance the bit through a hole. The brace is a surprisingly recent improvement, appearing in Europe only 600 years ago. Its design overcomes the problems of the cross handle by providing a top handle to push down on and another handle to drive the bit around in a circle. A simple crank that multiplies the rotating force of your arm, the brace's sweep (sometimes called swing) is the diameter of the circle your powering hand travels around the tool. To determine the sweep, measure the horizontal distance from the chuck to the handle and double it. The wider the sweep of the brace, the more your efforts are multiplied and the more torque (or rotary force) the brace puts out. Although a wide-sweep brace is more powerful, there is a trade-off: Your hand must travel in a larger diameter circle, so a wide-sweep brace bores slower than a brace with a narrower sweep. Thus, wide-sweep braces bore big holes better, while narrow ones bore smaller holes more quickly.

Unlike cross handles, which have one bit permanently attached to the end of a shaft, braces have an adjustable chuck that allows them to hold and drive different bits of varying shank styles and diameters. Bits used in braces may have round or square shanks, but most have a threaded leadscrew in the center that pulls the bit through the wood during boring. Some braces even feature a ratchet that powers the brace with a short reciprocal stroke instead of a full-sweep cranking motion. This feature is helpful for boring in a cramped location.

Choosing the right brace—In the days when they occupied a more prominent spot in the woodworker's tool chest, braces came in many sizes, and you could find one exactly suited for the job. Braces are still readily available in two sweep sizes: 6 in. and 12 in. A 6-in.-sweep brace is just the ticket when you don't need much torque, such as when boring holes up to ½ in. in diameter or when driving screws. The brace most commonly found in shops today, however, has a 12-in. sweep, which works fine for boring holes up to about ⅞ in. dia. in hardwoods or for forming up to ½-in.-dia. tenons. But you'll get frustrated if you try to use it for driving a large expansion bit. For that job, you'll do better with an old 14-in.-sweep brace. This brace will easily bore a 2-in.-dia. hole in hardwood, or with a hollow auger, will gnaw a 1-in.-dia. tenon on a chair leg. Unfortunately, as far as I know, 14-in. braces are no longer made. You might get a welder to modify a smaller one for you. Just make sure he keeps the alignment of the head and chuck perfectly straight, or the brace won't turn true. Otherwise, you'll have to scour the flea markets for an old 14-in. brace. With luck and for not much money, you may find a tool better made than any today.

Many braces feature a built-in ratchet that's handy in tight spaces where you can't make a full turn with the brace's handle. Located just above the chuck, it works like a mechanic's socket wrench, driving the bit only in one direction, then allowing the handle to return freely in the opposite direction. You can set the ratchet to work in either direction, for instance, to drive or remove screws. The ratchet allows you to use the your arm muscles in their most powerful direction, pulling toward your chest to drive the brace. There's also a tool that's built especially for ratcheting bits called a joist brace, so named because it is designed for drilling holes between joists. Joist braces are available from Woodcraft Supply Corp., 41 Atlantic Ave., Woburn, Mass. 01888; (800) 225-1153, or (617) 935-9278 in Massachusetts; part #01G11. Instead of having a crooked drive handle like a regular brace, the joist brace has a 10½-in.-long nearly straight handle you drive with a back-and-forth ratchet action (see the photo above). Besides allowing you to bore in a tight corner, the joist brace's long drive handle gives you tremendous torque—equivalent to a 21-in.-sweep brace.


A joist brace, with it's ratchet action, can work in spots too tight for even an electric drill. The brace's relatively short height allows it to bore even inside a box, and the long drive handle provides exceptional power to drive the bit.

The most important thing to consider when buying a brace is the chuck. A good chuck is one that opens and closes easily and holds a bit securely. Most chucks will easily grasp a square-tang bit, because the bit's tapered, square shank is designed to center and drive without needing a super-tight grip from the chuck. Round-shank bits, however, are harder to grasp and slip more easily than square-tang bits in most brace chucks, and some of the older split chucks can't accept them at all. The chuck used on most modern braces has alligator jaws that are held together at the base by a spring, which spreads them at the open end of the chuck—like a hungry reptile's mouth. V-shape channels on the jaws' inner surfaces taper down at the tip to allow the chuck to engage square-tang or round bits.

If you decide to buy an older brace, you'll be confronted with an astounding variety of chuck designs. In my collection, I have at least eight very different styles ranging from split chucks that tighten with wing nuts to chucks that use ball bearings to reduce friction between the jaws and the collar, making tightening easier. Before you buy an older brace, examine the chuck to make sure its jaws and the collar surrounding them aren't cracked and that the spring that retains and spreads the jaws is in good shape—it can be difficult to replace. The threads between the collar and threaded core (at the end of the brace's shaft) of most chucks are meant to fit loosely to make the chuck easier to tighten, but check to see if they've been damaged from overtightening or worn so they don't tighten at all. But don't necessarily reject a brace just because it has a bad chuck: I once resurrected a hard-to-come-by 14-in. brace by welding on a good chuck from an old junker. My woodworking students now use it every day at school.

The most-abused parts of old braces are usually the wooden handles. Drive handles often split and fall off. Screws that hold

These old braces from the author's collection illustrate the variety of chucks found on older or antique tools you may encounter at flea markets. The split chuck, at far left, will hold only square-shank bits, and it locks them in place with a thumbscrew. The chuck next to it and the one at far right are both more modern designs, with alligator-type jaws with grooved inner surfaces that can hold square- or round-shank bits. Both have rotating locking collars that tighten against the threaded end of the brace, but the chuck at right has ball bearings inside the collar to make tightening the chuck easier. The chuck that's second from the right is a peculiar design in that its jaws project forward of the locking collar and are tightened by rotating the collar outwards—exactly opposite of an alligator-jaw chuck.

the top handle to its collar sometimes wear their way loose, the handle can then fall off and often ends up "missing." Fortunately, new wood parts can usually be turned and fitted. If the brace's handles are in reasonable shape but won't turn freely, a drop of oil may get them moving again. A bent brace can usually be wrestled back into alignment by clamping it in a vise and levering the braces with a monkey wrench with its jaws padded.

A brace should be properly lubricated. There's usually an oil hole in the collar below the top handle, but on better braces, including premium Stanleys, these handles turn on ball bearings, which need lubrication less often. A couple of drops of oil should also be applied to the ratchet mechanism where it meets the chuck shaft and on the pawl pivots. A touch of white grease on the threads of the chuck and on the jaws is also a good idea. The drive handle doesn't usually need lubrication.

Boring a hole—Using a brace and auger bit to bore a hole is smooth, quiet and safe. Regardless of how awkward cranking a brace seems at first, with a little practice, you'll be able to bore as straight and true with a brace as with a drill press. First, chuck up a bit by holding the bit between the chuck's jaws, keeping the locking collar from turning with one hand and rotating the brace to close the jaws with the other hand. Make sure the chuck's jaws are grabbing the bit concentrically as you tighten, because tightening the chuck on a misaligned bit can stress and fracture a jaw or damage the spring. Tighten the collar until it's hard to turn, but never use more than hand pressure.

When boring a perpendicular hole, the bit must be kept aligned in two planes. I set up a square next to the bit and sight along the axis of the bit to the square's edge. I also peek from the side to see that the bit lines up in that direction, and I check both views frequently as I bore. I use the same method for boring angled holes, except I use a bevel gauge instead of a square to align the bit.

Once you've engaged the bit in the wood by the first few turns of the brace, the auger's threaded leadscrew should drag the bit through the wood with very little down pressure as you crank. Hold the brace's head steady while you crank the handle: If you allow it to wobble, the leadscrew may lose its grip in the wood. Some craftsmen prefer to rest their forehead on the hand grasping the brace's top handle, but I like to bend my elbow far enough to let my shoulder bear on that hand (see the photo on p. 46). If you want to bore horizontally, rest the head of the brace on your belly or thigh. If you find it very hard to turn the brace, try one with a wider sweep. Switching to a larger brace for boring a big hole is like shifting your bicycle to a lower gear for climbing a hill—it gives you more mechanical advantage. If you only have one brace, use your pull stroke with the ratchet on to ease the work.

Any bit will leave a ragged exit hole as it bursts through the far side of a board. To avoid this, clamp your stock to a scrap backing board to support the wood fibers as the bit cuts through. A quick way to determine when the bit has gone through the workpiece is by using a backing board of a different color wood or by clamping some brightly colored paper between the boards. Watch for the signal shavings to show you are through. If you're boring at an angle, crank the brace a few extra turns to be sure you are completely through. Another way to ensure a clean exit hole is to bore until the point of the leadscrew protrudes from the other side of the board, then bore back in from that side. You can tell that the screw is through by pulling gently up on the brace when you are nearing the bottom of the hole. If the screw is out, the auger will simply stop boring. When you bore in from the other side, extra pressure is needed on the brace to drive the bit through, because the screw is chewing air, not wood. To bore a stopped hole to a specific depth, stick a tape flag or a piece of a dowel to the bit's shaft. When the tape flag sweeps away the shavings or when the end of the dowel touches, the depth has been reached.

Auger bits—For general hole boring, auger bits are the most commonly used and come in lots of lengths and diameters. An auger bit's main cutters slice away wood at the bottom of the hole. The spiral body of the bit removes chips from the hole with a screw-like action as the boring progresses. The spur cutters, located on the outside edge of the main cutters, shear the wood fibers at the circumference of the hole. For the smoothest holes and easiest boring, all the cutting edges should be kept as sharp as possible. You'll know the bit is dull if it produces crumbly looking dust rather than clean, spiral-shape shavings or if it takes excess pressure to advance the bit. A light touch-up with a file is usually all that is needed to sharpen a bit, filing on the beveled edge of the cutters and the inside edges of the spurs. You can modify an auger bit for boring endgrain by simply filing off the spurs, just don't use the bit for cross-grain boring, because it will leave a very ragged hole. If it takes a lot of down pressure to keep a sharp bit advancing into the cut, the leadscrew probably needs some filing. The screw's tip must be sharp-pointed, and the threads should be clean and unbent. If the threads are damaged, you may be able to restore them with a needle file. For more on sharpening auger bits, refer to my article in *FWW #44*.

If you accidentally bore an undersize hole, don't just plunge in with an auger bit to enlarge it: The bit won't center properly and will cut eccentrically. Instead, bore the larger hole in a hardwood scrap and clamp it concentrically over the smaller hole. The scrap will keep the larger bit from wandering as you bore, but you'll have to use more down pressure to advance the bit, because the leadscrew won't engage the wood. You can also chuck a regular twist drill—the kind used for drilling metal—in your brace. It has a conical end that will center in the auger hole and bore an enlarged hole that's clean and concentric with the original. The brace's low speed and high torque are helpful here.

Expansion bits—If you want to bore a hole that's larger than any of your standard auger bits or a hole of precise size that falls between standard bit sizes, an expansion bit is the answer. Unlike a regular auger bit, which has fixed cutters and spurs, an expansion bit has a moveable cutter that adjusts in or out to change the diameters of the hole. Setting the bit to an accurate size, especially with a cheap bit, is a trial-and-error effort. Use the scale on the cutter to get into the ballpark, and check each setting by boring a trial hole in scrapwood before doing critical work. Be sure to lock the setting securely so it won't slip.

While boring with an expansion bit, try to keep the brace true and smooth-running. Since the bit has only one cutter rotating around the leadscrew, even a little wobbling at the head of the brace can cause the cutter to dig in and jam. If you're boring a deep hole, stop periodically and clear the shavings from the hole. The expansion bit has no spiral body to lift shavings out of the hole, and if you let them accumulate, you'll have a dreadful time yanking the bit out when you're done. If you bore through the workpiece, you *must* use a backing board. Without one, the leadscrew quits guiding the cutter in a circle before the hole is through, and you're left with half a hole to whittle clean.

Cutting tenons—One job you might not think of doing with a brace is cutting tenons. An adjustable jig called a hollow auger can cut round tenons on the end of sticks for chair legs or rungs. The hollow auger, with its plane-like blade that's adjustable for tenon diameter, cuts tenons quickly and with far less skill than it takes to cut them on a lathe. Unfortunately, hollow augers are becoming increasingly hard to find—even at old tool sales. I wish someone would manufacture them again.

A tool used in the brace that's more commonly available is the dowel pointer. A scaled-down version of the old-time spoke pointer (often used for chamfering the end of a stick before tenoning with the hollow auger), the dowel pointer is a hollow cone-shape tool that works like a kid's school-bag pencil sharpener. You can use it to neatly chamfer the end of a dowel or round tenon—up to about ¾ in. in diameter—to make it easier to insert into its hole or mortise. I usually set the stock in the vise so the axis of the dowel or stick is vertical. Then, I do my best to keep the brace plumb as I shave down the chamfer. (For more information on using hollow augers, see *Woodworking with Kids*, Taunton Press, 1982.)

Driving screws—Although high-tech cordless screwdrivers are rapidly becoming the standard tool for driving screws in the woodshop, many craftsmen prefer using a brace fitted with a screwdriver bit. Unlike a motorized driver, a brace lets you sense just how tight the screw is, and with a little practice, you'll never again snap the head off a screw or have its threads tear out of the wood.

A brace with a 6-in. sweep is ideal for driving screws, because you can turn it quickly and its driving torque is limited. A larger brace will work, but is less sensitive, so use some extra care during those last few turns. A 6-in. brace is also great for boring small pilot holes or for countersinking with a rose-head countersink.

It's best to use Phillips head screws and the appropriate-size screwdriver bit when using a brace, because the bit stays centered in the screw head. If you must drive slotted screws, try to keep the top of the brace aligned with the screw's axis as you crank. You'll also need to put extra down pressure on the brace to keep the screwdriver's blade from sliding sideways out of the slot and gouging the work. □

Driving dozens of screws is a breeze with a small-sweep brace, like the 6-in. model shown here. The brace provides more than enough torque for the job, yet provides a sensitive feeling, so screws can be driven to precise depth.

After chamfering the end of a chair rung with a spoke pointer, fitted in the brace in the foreground, the author uses an adjustable hollow auger to form a tenon on the rung. A plane-like blade on the bottom of the auger cuts the tenon by paring a shoulder around the tenon.

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*Richard Starr is an author (*Woodworking with Kids*, Taunton Press, 1982), teacher and woodworker in Thetford Center, Vt.*

Guide blocks and full-size templates ensure accurate joinery and simplify the construction of the curved drawer fronts used in this desk. Each drawer is made up of four layers of 3/32-in.-thick maple and a 5/32-in.-thick layer of pear wood.

Drawers with Curved Fronts

Templates and guide blocks simplify the joinery

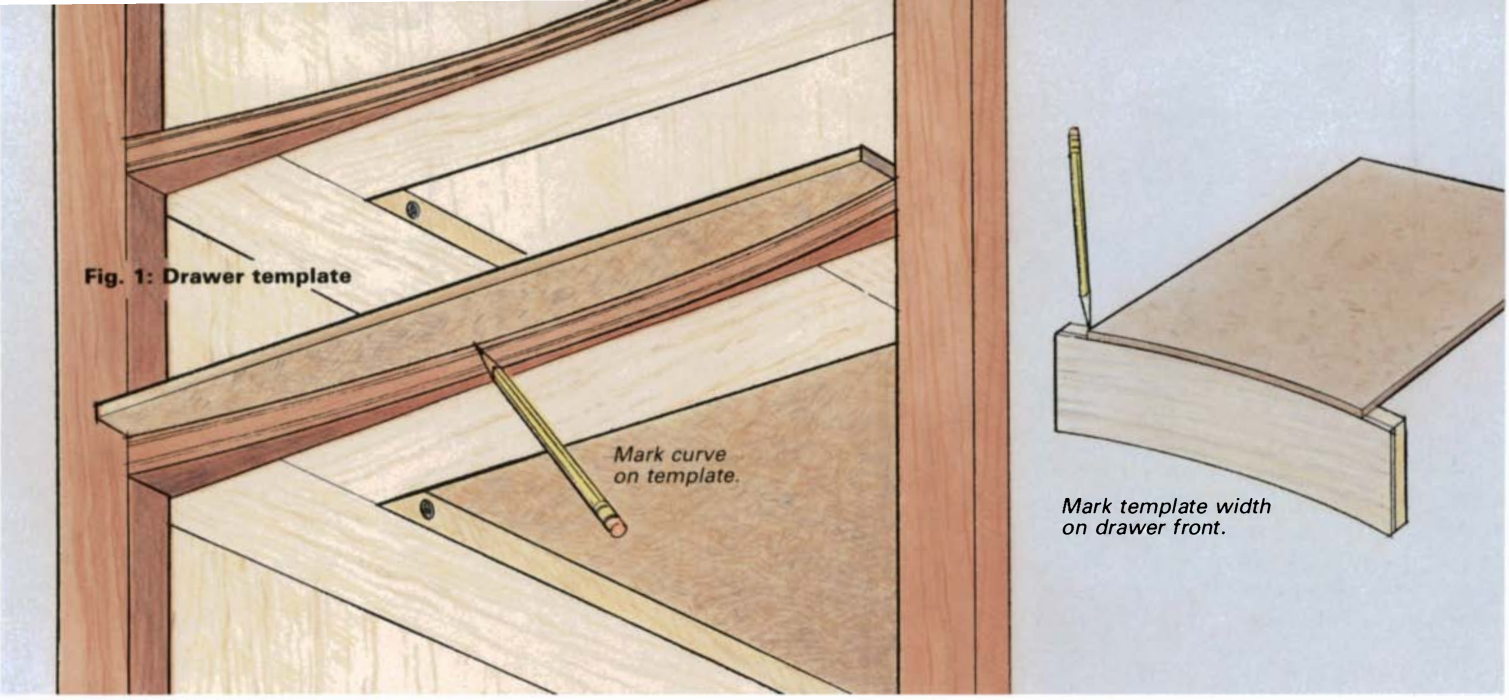
by Paul Harrell

Most of my ideas for furniture involve curves, and this eventually leads me to make curved drawer fronts. These drawers seem intimidating, but actually they are not much more difficult to build than standard drawers. It's a little more work to form-laminate a curved drawer front and to cut joints at angles other than 90°, but the template method I'll describe here simplifies the process. This template technique can be applied to drawers with simple convex or concave fronts, as with the desk shown above, or adapted to the serpentine drawers found in some period casework.

In order to concentrate on getting a pleasing shape without worrying about measurements and angles, I work with templates whenever possible. Here I began with a full-size Masonite template of the top. I drew and redrew the curved front edge until I liked the shape. After sawing that curve, I refined the profile with a plane and spokeshave. Then I worked directly from this master template to size the parts of the desk (drawer dividers and pedestal). After milling out the parts for the basic carcase, I assembled the case and used the desk itself as a guide for making templates of the drawers and their fronts, as shown in figure 1 on the next page.

Because this article deals primarily with building drawer fronts, I'll only discuss the ways in which curved drawers differ from standard ones. I recommend James Krenov's ***The Fine Art of Cabinetmaking*** (Van Nostrand Reinhold Co., New York, 1977) and *FWW on Boxes, Carcases and Drawers* as excellent references on drawer construction. The lamination techniques for making curved drawer fronts are pretty conventional (see *FWW on Bending Wood*), but I would like to add a few points.

First, make sure the form is well-faired with no flat or high spots, because any defects in the form will be mirrored in the drawer fronts. To allow for springback of the lamination, the radi-

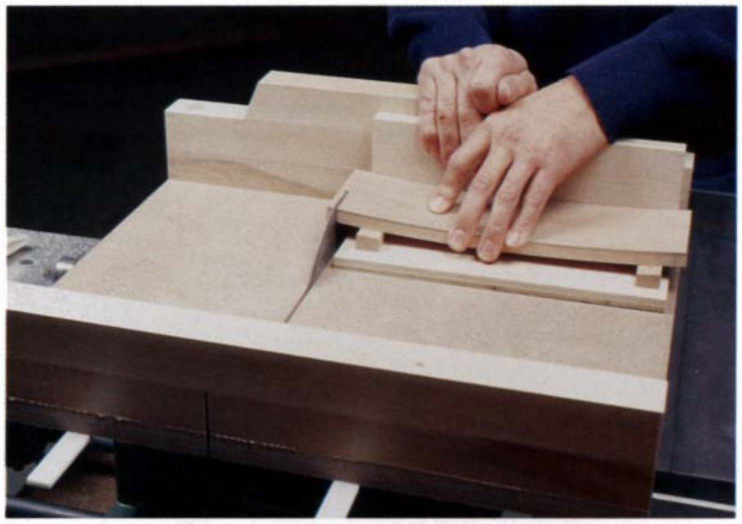


us of the form's curve should be slightly smaller than the drawer template. The form can't have any wind from end to end. Wind is a disaster in a drawer front: One side of the drawer will angle up as it leaves the carcase and the other side will go down, causing the drawer to twist and bind. I always check the form with winding sticks and do a test lamination.

Since it's impossible to gauge springback precisely, I make the outside lamination slightly thicker than the rest to allow for slight adjustments after assembly. This outer layer can be of a different wood. For my desk, I had only a small piece of pear with the grain and color I wanted, so I sawed this into $\frac{5}{32}$-in.-thick layers for the drawer faces. The inner four layers are $\frac{3}{32}$-in.-thick maple. The layers are glued together and clamped down to a form to create the shape. The front is removed from the form after the glue has dried and is left to cure and stabilize for a week before the joints are cut. The air must freely circulate around the curing fronts; they may warp if left flat on a bench.

Cutting the parts—When the drawer fronts are dry, joint the bottom edge. The convex side should ride against the jointer fence as you push each drawer front through in an arc. Next, by carefully feeding the fronts through the tablesaw, convex side down, rip each to a width that allows for a snug fit in the carcase opening. Later, when the drawer is fitted, you can plane off some wood to allow for shrinking and swelling. As I rip each drawer front, I rip a pair of drawer sides to the same width. I like to use very thin stock for the sides (about $\frac{5}{16}$ in.), because it makes a finer-looking drawer. To keep the thin sides from warping, I use quartersawn stock, which I resaw, sticker and stack well in advance so it will have time to acclimate to the shop's humidity. I suggest you saw a few extra drawersides so you can discard any that warp.

Each front must next be crosscut to length so its ends are parallel to the run of the drawer. The drawer sides must be crosscut at an angle where they meet the fronts. This is where the next template comes into play. Instead of puzzling out the angles, I make a Masonite or plywood template that precisely matches the size and shape of the drawer. To make the template, I first rip a piece of $\frac{1}{4}$-in.-thick tempered Masonite slightly longer than the drawer's depth to a tight fit in the drawer opening. The template should slide without any side play. Mark out the front curve directly on the template, then bandsaw it. Decide on the drawer's length, allowing room for stops if you decide to use them, and trim the template accordingly, as shown in figure 1.



To prevent rocking, a curved drawer front must be held in a cradle clamped to a miter gauge or jig when being crosscut. A test cut is made near the line that marks the front's end. If the line and the cut are parallel, the line is split on the waste side; if they are not parallel, the front is shimmed with masking tape until the line is parallel to the sawblade.

If you've built the carcase carefully, you should need only one template, because the radius or direction of the curve doesn't change across the desk. I check the template in each opening to make sure. I don't worry if there are very slight variations; they can be faired out during final fitting.

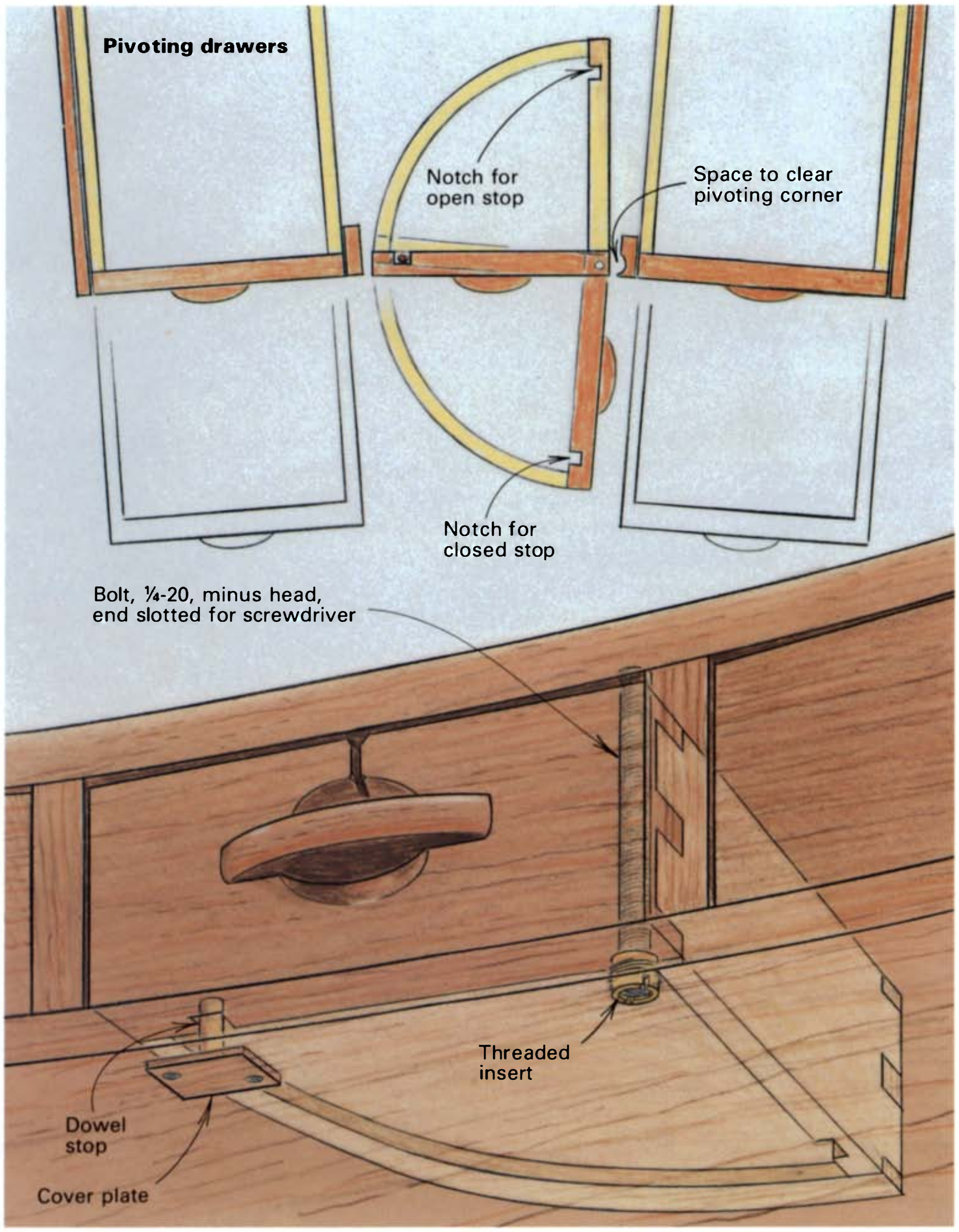
Next, I position the template on a drawer front with the curves aligned, as shown in figure 1, then mark the final length on the front with a knife. To crosscut the fronts, I use a cradle clamped to my tablesaw's crosscut jig, as shown in the photo above. With a drawer front resting on the cradle's support blocks, I stand a try square on the jig and shift the blocks until the scribed mark on the front's edge is perpendicular with the jig's surface. I mark the blocks' positions, remove the front and nail the blocks to the cradle. I unclamp the cradle and move it into cutting position.

Because springback and differences in laminate thickness may cause slight variations from front to front, I first make a test cut outside the scribed line. If this cut is parallel with the line, I make a final cut, splitting the line on the waste side. If the test cut is off, I shim one side of the front by putting a piece or two of masking tape on one of the blocks and then make another test cut. I do

Pivoting drawers

by Mark Webster

Drawers don't necessarily have to slide in a straight line; they can just as easily swing open, like a door. The drawing at right shows how I used a pivoting drawer in a tight spot. If the center drawer were conventional, its travel would be blocked by the neighboring drawers. The pivoting drawer can swing open freely. Since the drawer's pivot rod is concealed, the drawer appears no different than its neighbors.



The first step is to draw a full-size top view of the casepiece and sketch in the position of the pivoting drawer, dividers and adjacent drawers. To determine the size and shape of the pivoting drawer, use its pivot point as center and draw an arc back from the front into the case. This arc represents the back of the curved drawer side. To avoid a clumsy look, the thickness of the curved side shouldn't be much thicker than a standard drawer side. You can either laminate the curved side or bandsaw it from solid stock. The drawer here was so small and light that its curved side didn't require great strength, so I bandsawed it from a woodblock. If the drawer had been larger, the side would have needed to be stronger and stiffer, so I would have bent-laminated (see main article) the side to avoid weak short-grain areas found on the sawn sides.

Next, make a full-size Masonite pattern of the pivoting drawer. Tape the casepiece drawing to a sheet of plywood, position the drawer pattern on it and bore a small hole on the pivot point. Using a screw or nail as the pivot rod, test-pivot the drawer pattern. Note that the front, left side of the drawer rubs against the drawer divider next to it. Carve clearance for this from the divider before installing the pivoting drawer.

Mark the block from the drawer template and saw out the curved side, leaving its back flat to add extra strength during assembly. Bandsaw off this flat after the drawer is assembled. Square up the side's ends and cut two flats on its inside face perpendicular to the ends to act as bearing surfaces for the drawer joints. I bandsaw the inside curve, clean it up with a spokeshave and sand it smooth.

The drawer has half-blind dovetails on the corner that's visible when the drawer is open and finger joints on the two corners that don't show. I cut the drawer-bottom groove in the front and sides with a slotting cutter on the router table. I use a straight fence for the grooves in the two straight pieces and a convex fence for the curved side.

I didn't use exotic hardware for the pivoting mechanism (see the drawing above). The pivot rod is a ¼-20 bolt, minus the head, set in a threaded insert. If the drawer is to swing smoothly, the three holes that affect the drawer's swing must be bored accurately. The threaded insert hole in the drawer frame, the hole in the desktop for the pivot rod and the pivot-rod hole in the drawer front should all be bored on the drill press to ensure they are perpendicular to their respective surfaces. A brad-point bit works best to drill these holes because it drifts less than standard twist drills.

Finally, you need to test-fit the drawer and plane or sand it where necessary. Don't install the dowel stop and the cover plate until the drawer is swinging smoothly. □

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Fig. 2: Marking drawer fronts

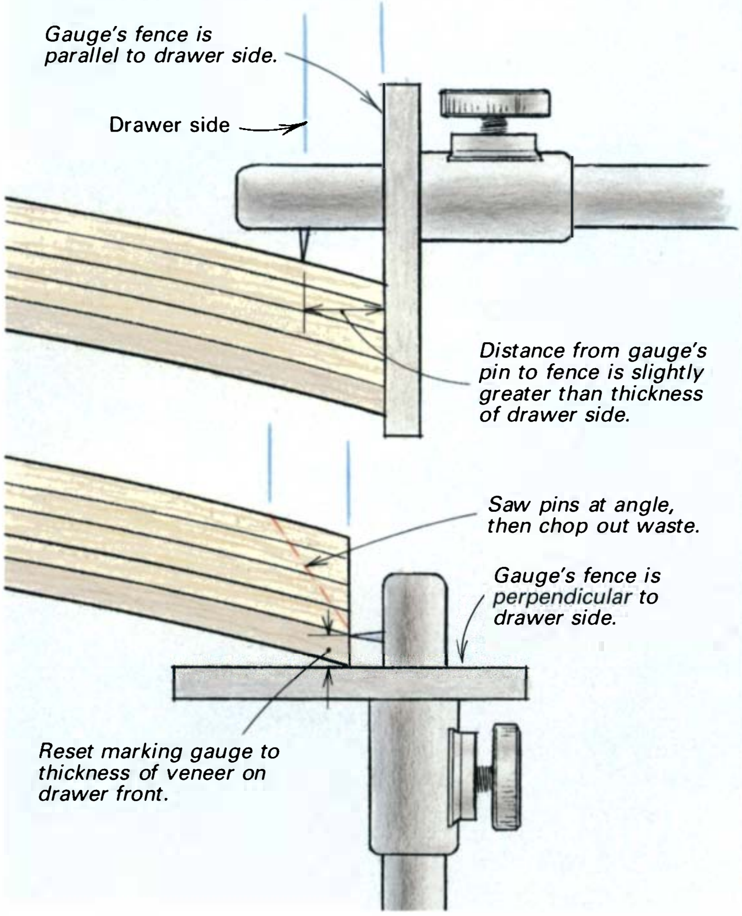
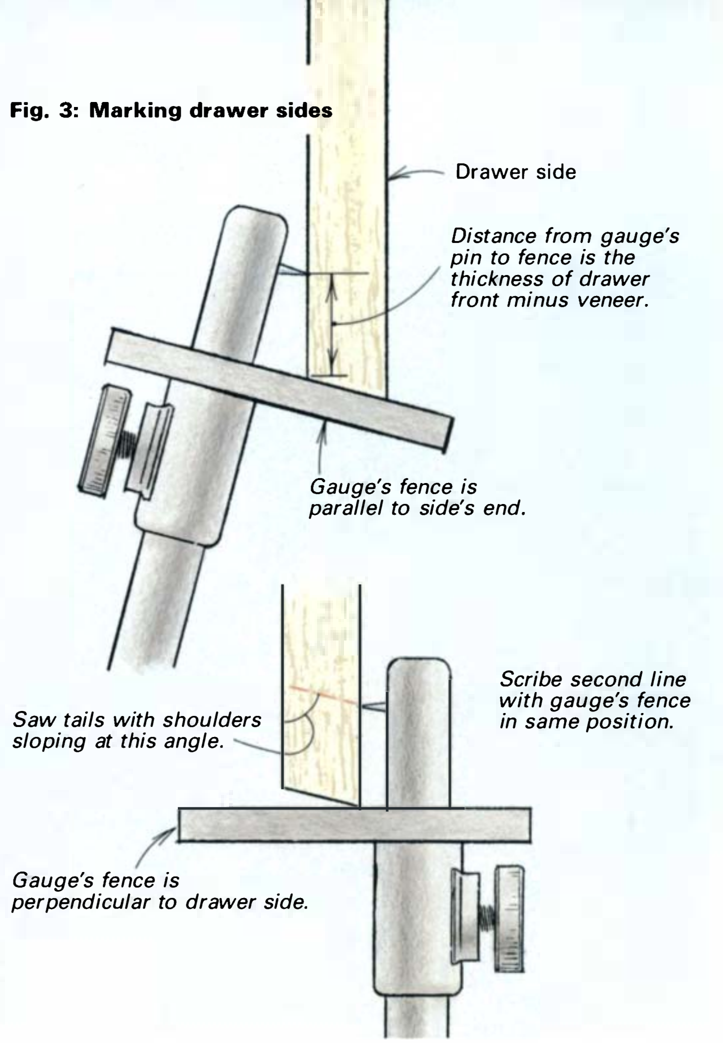


Fig. 3: Marking drawer sides



this until the cut is parallel with the line. I cut all the drawer fronts on one side of the jig, then move the cradle to the opposite side to make the second cut. Splitting the line on the waste side leaves about a millimeter (.04 in.) of excess width to be planed off during final fitting.

The angles on the drawer sides can also be marked from the template, then sawn on the tablesaw with a miter gauge and with the arbor tilted. You can also transfer this angle with a bevel gauge. After cutting one side, I double-check the angle by locating the front and side in proper position on the template; the two pieces should butt tightly. I don't cut the sides to length until I dovetail the front corners, assemble the front and sides and check them against the template. If everything lines up, I mark out and crosscut the drawer sides. Conventional through dovetails join the drawer back to the sides.

Angled dovetails–Cutting dovetails on curved and angled drawer parts is not very different from standard dovetail joinery: You just have to work to the angled shoulder lines. To lay out the angled shoulders, I scribe around the front's ends with a marking gauge (see figure 2 above), then mark out the pins as usual with a sliding bevel gauge and pencil. Saw the pins, as you would standard half-blind pins, on a diagonal from scribe line to scribe line. When you're chopping out the waste, set the chisel on the scribe line and cut down with the chisel parallel to the ends of the front. To secure the front when I chop the pins, I clamp the front on a piece of glued-up particleboard bandsawn to its outer curve (see the photo at right). A piece of fine sandpaper glued to the plywood creates an anti-slip surface.

I also clamp a guide block to the workpiece to guide the chisel. The block, a scrap crosscut at the same time as the sides, is clamped so its angled face is parallel to the front's ends. When

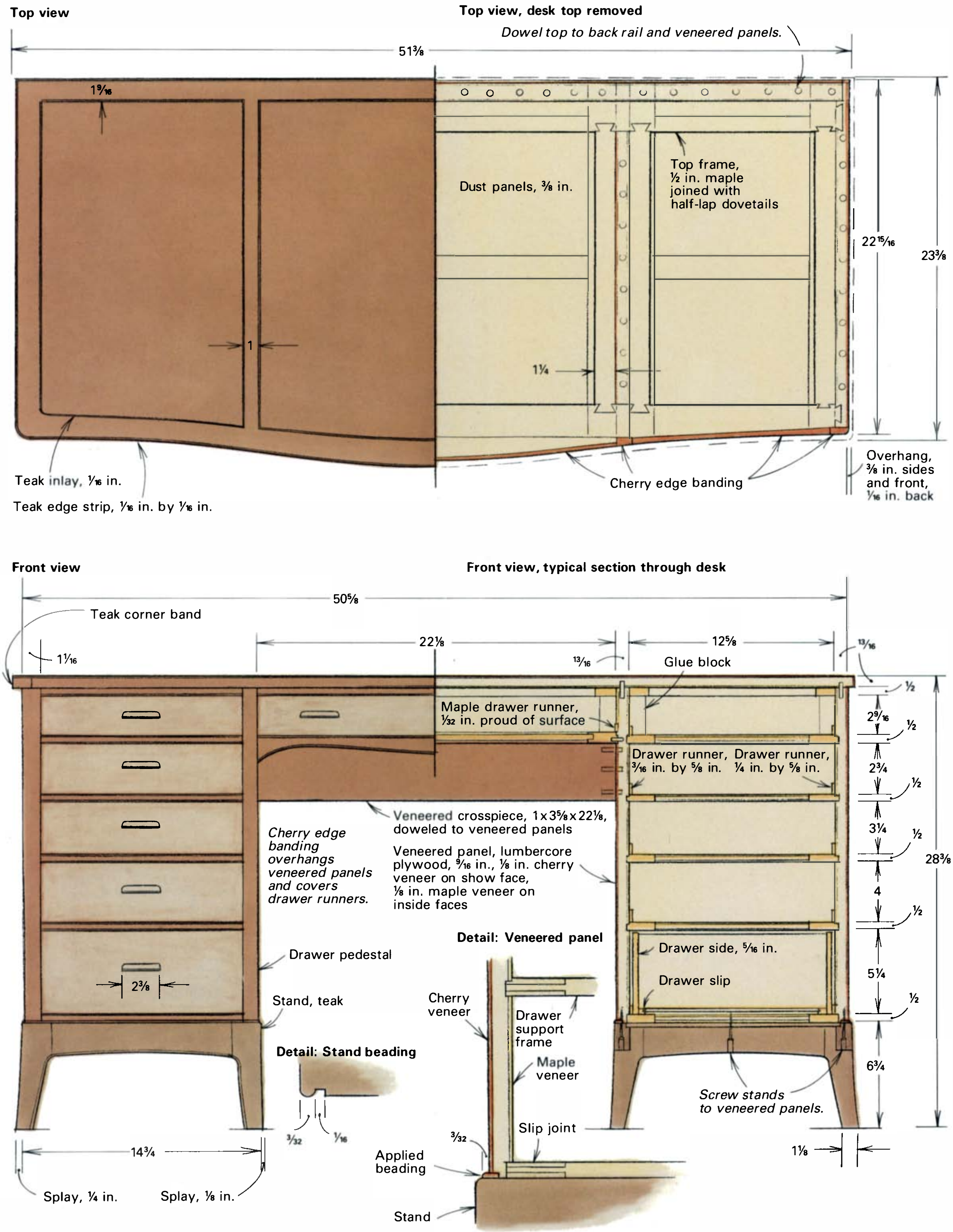
The author leans the chisel against an angled guide block while chopping waste from the pins in the drawer's front. The front is clamped on a piece of glued-up particleboard bandsawn to match the curve of the front. Sandpaper glued to the block stops the front from slipping.

the pins are finished, I lay a drawer side down on the bench, then scribe the tails from the pins. A marking gauge set to the pin depth, as shown in figure 3 above, scribes the line for the depth of the tails.

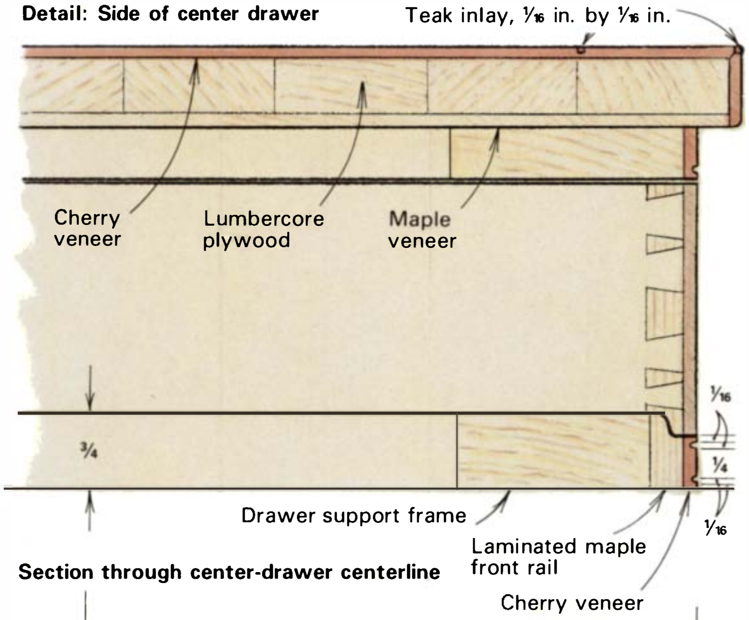
When sawing the tails, angle the saw so the cut ends on the scribed lines. To chop out the waste, the chisel is again butted against the guide block. Chop halfway through the side, then flip the side over. Finish chopping with the guide block turned upside down so its face is again parallel with the side's end.

Assembly and fitting–I dry-assemble the parts, and if the drawer doesn't match the template, I hold opposite corners of the drawer and gently rack it until everything lines up. This is a run-through for what you'll have to do to square up the drawer

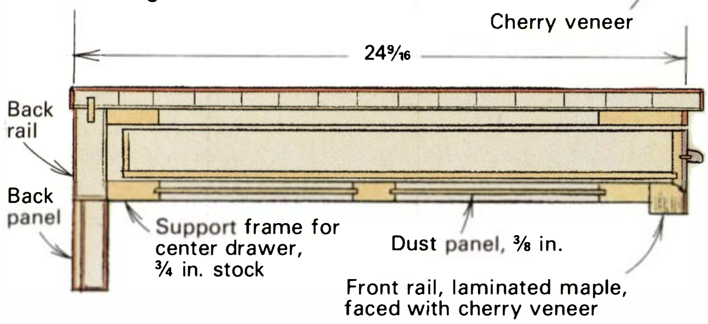
Fig. 4: Curved front desk



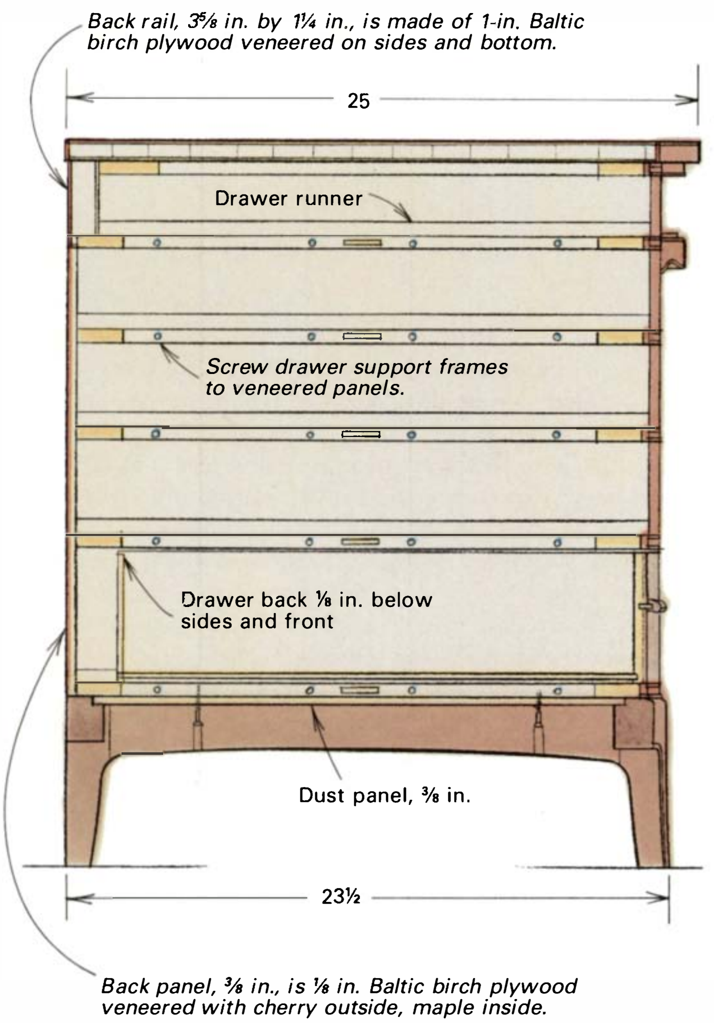
Detail: Side of center drawer



Section through center-drawer centerline



End view, section through center of drawer pedestal



After the glue joints have dried, the drawers are supported on a piece of slotted plywood clamped to the benchtop, then planed to fit. Each drawer is test-fitted and judiciously planed until it slides smoothly. The bottoms are slid in place after the drawers are fitted.

during glue-up. After disassembling the drawer, I round its inside edges with a small plane, and rout grooves or glue on grooved slips for the bottom. The bottom groove on the front is cut on a shaper or router table using a three-wing slot cutter. If the inside curve of the front is convex—as with the drawer shown here—the router table or shaper should have a straight fence. If the drawer front curves in the other direction, the fence must be convex so the cutter can follow the curve.

After assembly, I plane the top and bottom edges of the drawer flush, then take a few passes on each side to clean up the dovetails. If the drawer sticks when opening, I remove it and plane any burnished areas until the fit is just right.

When the drawer slides smoothly in its opening, I cut and fit the solid-maple bottom (long grain running side to side). I try the drawer once more with the bottom in place and make any minor corrections with a finely set plane. The drawer should run smoothly all the way in and out without side-to-side play. Finally, I plane off the sharp outside corners and lightly wax the outside and bottom surfaces of the drawer sides with paraffin.

When all the drawers are fitted in the case, I fair the fronts with a compass plane and scraper. The bandsawn and carved pulls are attached to the drawers with a loose tenon. To avoid mortising the small pulls, I cut a row of mortises in the edge of a long board, then bandsaw the pulls. I mate each pull to the drawer by holding a piece of 220-grit sandpaper on the front and sliding the pull back and forth until it fits. □

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As a furniture conservator, the author keeps many grades of shellac on hand for matching finishes. In the foreground is a dish of sticklac, short sections of twigs encrusted with the secretion of the lac bug. To the left of that is some wool yarn and the lac dye, once commercially important, used to color it. The round disc in the center, partially obscured, is a piece of buttonlac.

Shellac Finishing

A traditional finish still yields outstanding results

by Donald C. Williams

Almost everybody has heard the old wives' tales about shellac: It's not easy to use, it doesn't look good, it isn't durable, and so on. These notions are easy to refute. Shellac, for starters, is the main ingredient in most contemporary French polishes, arguably the most beautiful finish known. In addition, shellac resists ultraviolet-light degradation better than most unpigmented finishes, and it is tough enough for floors and bowling alleys, two traditional uses. It is more resistant to water-vapor transmission than polishes, oils and many lacquers and oil varnishes, making it a good choice where humidity levels swing widely (see *FWW* #64, p. 59). Moreover, shellac is an excellent sealer, able to cover waxes, knots and many existing finishes. Shellac dries quickly by evaporation and doesn't need the curing time required by oils and oil-base varnishes. Also, and it's no minor point, damaged shellac finishes are easy to repair because hardened shellac can be redissolved in alcohol.

Shellac is the most widely used finish in the conservation of historic furniture and is also a good choice for finishing contemporary woodwork. It can be used as a finish without needing any other sealers or topcoats. If applied as a sealer only, most other finishes will adhere to the shellac either with a chemical or a mechanical bond, provided the sealer coat is applied thinly enough that it dries matte rather than glossy. Shellac can also be padded over many finishes for spot repairs. A heavy shellac coat over an existing oil-base floor finish, however, would very likely crack because the materials "move" differently. Combining layers of finish that have different solvents and resins is risky, unless common sense, experience and testing tell you otherwise.

The only "secrets" to successful shellac finishing are to mix your own solution using quality shellac flakes, which ensures that the shellac is fresh and will dry properly, and to use an alcohol solvent of sufficient purity. Application methods don't require sophisticated equipment. Any careful beginner can produce a surface of remarkable clarity, depth and luster. In fact, in my opinion, shellac is the most attractive finishing material around.

Before discussing some techniques of shellac finishing, I would like to talk briefly about the history and properties of shellac and the methods of its preparation. This overall picture will go a long way toward explaining the varieties of shellac—both ancient and modern—that you may encounter in the marketplace today.

The shellac trade between the Orient and Europe began in the early 17th century with lac dye—a scarlet by-product of shellac (see photo above)—as an inexpensive substitute for costly cochineal dye. The resin itself did not achieve widespread use in the

West for nearly two centuries. Shellac finishes on furniture became fashionable at the beginning of the 1800s, and their popularity continued unabated until the development of synthetic resins, particularly nitrocellulose lacquers, in the 1920s and 1930s.

Late in the 19th century, aniline dyes replaced lac dye, thus eliminating a large part of lac commerce. Coincidently, new production methods made shellac resin available in great quantity. This led to its increased use in a number of applications, including electrical insulators and gramophone records (most old 78s are solid shellac). Following the discovery of the first synthetic resin, Bakelite, the importance of shellac as an industrial resin diminished. Nevertheless, it's important today as a coating for such diverse things as electric-motor windings, fruit (shellac wax is what makes supermarket apples shine), candy (M&Ms, for one), pharmaceuticals (time-dissolving capsules), leather and wood.

Shellac processing and properties—Lac, the raw material from which shellac is made, is refined from the secretions of the tiny insect *Laccifer lacca,* which is indigenous to Indochina and India. Lac bugs live on trees, sucking out nutrients from the sap and secreting a protective shell that eventually covers the twigs and branches. When these deposits are abundant, the branches are cut off and the resin is prepared for processing. This raw material, "stick-lac," is crushed and washed in water to remove twigs, dirt and the lac dye in the insect carcasses.

Sticklac is a complex mixture of several resinous components that fall into two major groups: one soft and the other very hard. The soft resins (along with another natural component, shellac wax) act as a natural plasticizer, giving shellac a great deal of flexibility; the hard resins give shellac its toughness and durability. Shellac can be bought as either a solid or a liquid, which is simply solid shellac dissolved in alcohol by the manufacturer. Solid shellac is available in various grades in three forms: flake shellac, which looks like amber or orange cornflakes; buttonlac, which comes in a variety of diameters and thicknesses; and crushed or ground shellac, which is a coarse powder. None of these forms is appreciably different from the others when used in finishes. What is important is not the form of the shellac, but how it has been processed.

After the initial processing and cleaning of sticklac to remove the lac dye, it is called "seed-lac." Seedlac looks like dirty maroon beads and can be used in the same manner as refined shellac in finishes, although it should be filtered to remove dirt particles. Seedlac is further refined to become shellac through two main processes: heat refining and solvent extraction.

In heat refining, seedlac can be refined through hand processing or industrial processing. In hand processing, seedlac is placed in cloth filtering tubes near a fire hot enough to slowly melt the resin. As the resin softens and begins to liquify, the cloth tubes are twisted and the molten resin, now called "shell-lac," is wrung out. (Processing by this method limits the purification to the porosity of the cloth used in the filter tubes.) If the desired end product is flake shellac, the semi-molten material is stretched by hand into large sheets and crushed into flakes when cooled. To make buttonlac, the material is pressed into molds and allowed to cool.

Varnish made from hand-refined shellac will appear cloudy because of the presence of shellac wax, which cannot be removed by this method. Hand-refined shellac is still a cottage industry in India, although it has been superceded almost completely by two industrial refining processes. One of these, industrial heat refining, is essentially the same as hand processing, with the exception that the seedlac is melted with steam.

The other industrial method, solvent extraction, is the primary refining process today, and it provides an end product that can be fundamentally different. Seedlac is dissolved in methanol and then filtered. The solution is then heated to remove the alcohol, and the remaining shellac is stretched and pressed in rollers. All or part of the natural lac wax can be removed, yielding dewaxed shellac with greater clarity and moisture resistance.

The final refining step is the assignment of grade, or quality, which is based on host tree, time of year the sticklac is harvested, wax content, color, clarity and hardness. Grading is usually done by eye, and there may be minor differences between shellacs of the same grade. There appears to be general agreement that the most prized resins from India are the Kusmi Aghani, coming from the kusum tree during the month of Aghan (late November to early December). The grades of hand-processed shellac range from TN, which is the lowest grade, to Kusmi Superior, which is the highest. TN resin is reddish-brown, tough, with moderate hardness. Kusmi Superior is amber in color, with excellent clarity. Intermediate grades are known as Lemon #1 and Lemon #2. These are available from WoodFinishing Enterprises, 1729 N. 68th St., Wauwatosa, Wis. 53213; (414) 774-1724.

The shellacs found in most woodworking catalogs are supplied by Behlen and rated by color and wax content. The higher the color number, the darker; the higher the wax number, the more wax. The following are the four available Behlen grades: ButtonLac, which varies because it is essentially unrefined; GarnetLac (roughly equivalent to TN), with a color of 30 and a wax content of about 3%; Orange (equivalent to Lemon #1), with a color of 13 and a wax content of 4.5%; Super Blonde (derived from grades such as Kusmi Superior), with a color of 0.8 and virtually no wax. One source for Behlen products is Wood Finishing Supply Co., 1267 Mary Drive, Macedon, N.Y. 14502; (315) 986-4517.

Natural wax particles present in the dried shellac film make it less resistant to water, and they slightly dull the gloss. Super Blonde would be a good choice when gloss and the clarity of the wood surface matters. Orange would be a good choice when power-sanding the surface is anticipated, because waxes act in a manner similar to stearates (dry lubricants added to lacquer sanding sealers), preventing the film from overheating and becoming gummy when sanded. The darker colors of GarnetLac and ButtonLac can be blended with the other shellacs to match old finishes, although I use alcohol-soluble dyes for this purpose so as not to change the properties of the shellac I'm using.

Super Blonde is clarified by filtering it through active carbon; shellacs known as "bleached" have been treated in an alkali bath with chlorine. Such bleaching makes the dry resin unstable and drastically shortens its shelf life—both dry and in solution—and accelerates the degradation of the finish. Despite these shortcomings, bleached shellac made from high-grade resins remains a favorite among French polishers because of its clarity, although its inherent instability makes it unsuitable for any of my needs.

Drawbacks—Shellac resists water-vapor penetration very well, but water in liquid form presents problems. The most frequently expressed complaint about shellac is the formation of white rings from water condensed on drinking glasses. The severity of the damage is frequently dependent on the amount of wax in the shellac, just as water spots in other finishes are sometimes in the wax polish rather than in the finish itself. Repairing water damage can be easy, particularly with newer finishes (less than 20 years old) that are in good overall condition. Apply alcohol to dissolve the surface, as shown in the photo on the next page, and the water will evaporate as the surface dries. However, it is critical to note that the application of solvent may change the texture and

Although shellac may turn white from water or heat, in many cases the damage is easily repaired by redissolving the surface with alcohol. In cases of severe damage, a subsequent coat or two of shellac may be needed to restore the surface.

appearance of the finish, which may need further attention. The success of this technique declines if the film is degraded. In addition, indiscriminate intervention with historically important surfaces is to be discouraged as unethical.

Another drawback is that shellac begins to plasticize, or become malleable, at about 150°F. Imagine the damage caused by a steaming tureen of stew carelessly placed directly on a beautifully French-polished surface. Yet even this damage can be speedily repaired with alcohol and perhaps a subsequent padding of more finish.

Perhaps the worst complaint against shellac is that it sometimes fails to dry hard. Anyone who has had experience with shellac that would not dry is unlikely to recommend it or use it again. The cause of this problem is age: Shellac is acidic, and if left too long in alcohol, it produces esters, which are chemical compounds that leave the shellac gummy. This problem can be entirely avoided by mixing your own shellac and using it within a reasonable period of time, as will be discussed shortly.

Shellac's final characteristic is that it remains soluble in alcohol, which is both an excellent feature (allowing future removal, repairs and color blending) and a drawback (liquor acts as paint remover). Shellac can be made more alcohol resistant with the addition of nitrocellulose, and most commercial French-polishing varnishes (padding lacquers) contain lacquer, but even these are not impervious to alcohol damage.

Preparing and using shellac—Solid shellac can be purchased in all grades and as waxed or dewaxed, bleached or unbleached. Liquid shellac is generally available only as white (bleached) or orange (unbleached). Liquid shellac comes in solutions with designations such as "4-lb.-cut shellac" or the like. This indicates a solution of four pounds of resin per gallon of solvent, but is no clue to the grade of the resin. The primary problem with purchasing liquid shellac is that the consumer usually has no idea when the liquid was formulated. Some manufacturers date the containers, but this does not guarantee the environment in which the container has been stored. If the temperatures are too high, even shellac that's just a few months old can degrade to the point where it will not harden. This is particularly true of bleached shellac. In moments of desperation while working away from home, I have purchased liquid orange shellac, but I wouldn't buy premixed bleached shellac under any conditions.

Dry shellac has an indefinite shelf life if kept cool and dry. If exposed to moisture, the resin may solidify into a block, but this can be broken up and used. If dry shellac has chemically degraded because of improper storage, it will not dissolve in alcohol.

The extreme toxicity of shellac's best solvent, methanol (wood alcohol), prompts me to use ethanol (grain alcohol), the alcohol in liquor, instead. I find that the alcohol generally sold as "shellac thinner" in hardware and paint stores contains contaminants and is useful only as a cleaner for my brushes and the surfaces of objects on which I am working. I don't recommend alcohol sold by finishing supply companies, because I have had more than one bad experience with contamination, which ruins the varnish (one exception to this is Behkol, a Behlen product).

The best bet for making good spirit varnish is to use either reagent alcohol or pure grain alcohol. Reagent-grade alcohol is denatured alcohol sold by chemical companies and is pure enough to be used in laboratories. "Denaturing" of alcohol means contaminating the alcohol so it becomes non-drinkable and therefore exempt from liquor taxes. Generally, reagent alcohol is 95% ethanol and 5% methanol or other toxic additives.

You can buy reagent alcohol if you choose, but grain alcohol is never farther away than the closest liquor store. Just ask for 190-proof grain alcohol, pay the man, go home and mix up some shellac varnish. Be prepared for alcohol in this form to be more expensive, because you are paying liquor taxes. Keep in mind that an open container of any alcohol rapidly absorbs moisture from the air, regardless of how pure it may have been when first bought.

As mentioned earlier, shellac varnish is rated in pound cut. You can mix precise proportions by volume and weight, but I seldom bother. As a furniture conservator, I like to keep a number of grades on hand in concentrated solution. This allows me to blend colors as needed and then immediately dilute the mixture to proper viscosity for the job. To make the concentrated solution, roughly equivalent to a 6-lb. cut, I fill a small glass container with shellac flakes. Then, I fill the container with alcohol and allow it to stand in a cool, dark place for a couple of days. I may speed up the process by occasionally shaking the container vigorously. I increase the alcohol content by one half for powdered shellac and double for buttonlac, because they are both denser than flake.

I keep only a couple of months supply of orange shellacs on hand. While I never use bleached shellac, if you need to use it, mix only what you need for the next couple of weeks, after which, discard it. The minor inconvenience of preparing new solution pales in comparison to the aggravation of using old shellac that won't dry properly.

There are three main techniques of applying shellac finishes: spraying, padding and brushing. I'll discuss the particulars of each in a moment. Regardless of the application method, there are some characteristics of liquid shellac that are beneficial. Alcohol-soluble dyes can be added to shellac, allowing very careful manipulation of the finish color for touching up, shading or controlling overall tone. Because shellac remains soluble in alcohol, mistakes in the application procedure can be corrected easily.

Spraying—I spray shellac when I am using it as a sealer or when I want a surface that can be finished off simply by rubbing with 0000 steel wool. Spraying shellac is much like spraying nitrocellulose lacquer (see *FWW* #62), so if you spray lacquer, you can spray shellac. I spray a 1½-lb. to 2-lb. cut, which means I dilute one part of my stock solution with three or four parts alcohol. I set the pressure to about 30 lbs., use a moderately wide fan pattern and keep the gun moving constantly.

There are a couple of problems in spraying shellac that can be avoided easily. First, don't apply shellac heavily, or you will get drips and runs. Shellac doesn't always set as fast as lacquer, so don't always assume that similar applications will dry the same as lacquer. If the gun is too far away from the surface, the pressure too low or the material flow inadequate, the result will be an uneven surface called "orange peeling." If the gun is too close to the surface or the pressure too high, you can get runs and possibly pinholing, which is the result of the sprayed shellac being agitated so much that it froths and air bubbles get trapped in the film as it dries. Shellac, like any other solvent-release finish, can blush if the finish is applied when the humidity is too high or when there is too much moisture in the solution or on the surface. Finally, take special care to clean out the gun frequently. Shellac reacts with metal, a reaction that makes the shellac turn dark and interferes with its drying. My gun is aluminum, which is less reactive than steel. If I'm spraying shellac on a daily basis, I disassemble and soak the gun in alcohol every couple of days. I'd clean a steel gun every day. If you spray infrequently, the gun should be cleaned thoroughly after each use.

I smooth the surface as necessary between coats with sandpaper, pumice or 0000 steel wool. If the shellac is dewaxed, use steel wool; sandpaper may overheat the surface, although this is not likely if you are sanding by hand. Steel wool is not a bad idea on waxed shellac either, as the wax may clog very fine paper. The shellac dust from smoothing can be left in the pores of the wood as a filler. The introduction of alcohol with new coats will dissolve the dust and lead to a smoother surface.

Padding–Applying shellac with a cloth is known as padding, or more popularly as French polishing. This process, the application of a great many very thin coats, was covered in *FWW* #58, so I won't give a long exposition on my technique, but instead I'll give you a quick review of the build-up process.

French polishing is possible because shellac is a solvent-release finish with excellent adhesion qualities. As the polishing rubber is moving over the surface, several things are happening simultaneously. First, shellac is being deposited on the surface. Second, the solvent in the shellac is softening the layers below, allowing some of the shellac already down to be pushed around from high areas to low areas, filling the grain. Starting with a 1½-lb. cut, the amount of resin in the varnish is decreased by adding alcohol–not shellac–as the varnish is consumed. Eventually, the surface coating is simply being moved around by the solvent and the abrasion of the fabric (or pumice), resulting in the familiar mirror-like smoothness.

Parts of a piece that cannot be easily padded, such as intricate carving, certain table pedestals, etc., may be sprayed or brushed thinly as described below. A final treatment using steel wool and wax, buffing hard enough to produce heat, will get the finish close to the high gloss of the French-polished areas. If carved areas are adjacent to padded areas, do all brushing first, then pad, overlapping onto the brushed parts to blend the two.

Brushing–The best brush for shellac is a very fine artists' brush, the kind usually employed in watercolor painting. The bristles should be flat and moderately soft: golden nylon, badger or red sable. Artists' brushes come in a variety of sizes up to 2 in., which is as big as you'll ever need. New brushes should be thoroughly washed in mild soap and water to get out any dirt, oil or loose bristles. Brushes should be cleaned with solvent after use.

The importance of the shellac cut cannot be overstated. Many people make the mistake of applying a couple of heavy coats of shellac followed by laborious rubbing out after drying. Although I have seen finishers use up to a 5-lb. cut with success, my own experience suggests that anything heavier than a 2-lb. cut can lead to an uneven, streaky finish. I use a 1-lb. cut for most brushing, so my stock solution is cut 5:1 with alcohol. The light cut allows for excellent flow-out of the shellac, providing a smooth, glossy finish. Admittedly, the buildup of finish can seem slow, but the coats can be applied in rapid sequence. Besides, the objective is to produce a beautiful finish, not a thick one.

Shellac can be refined to various grades. From the left: bleached, dewaxed; dewaxed blonde; Kusmi Superior; Siam seedlac. Note that shellacs containing wax will appear cloudy and may settle into strata with hard resin on top.

Have enough shellac in the brush so it'll flow well, but not so much that it drips. Determine an application pattern and stick to it. Aim to cover all the surface evenly without having to go back over areas where shellac has already been applied. Unlike oil varnishes, where you can rebrush the wet surface to even it out, all this will accomplish with shellac is the pulling back up of the semi-wet finish. This produces a lumpy, ribbed surface. If the brush is worked too vigorously and froth builds up, pinholing may result.

When you've come to the end of the application pattern, test the beginning point with your fingertip (first clean any tacky shellac off your finger). If the shellac at the beginning point is stiff (slightly tacky) or dry to the touch, begin again and apply a complete new coat. Repeat this process until the starting point is too tacky to apply more finish. I can generally apply six or eight successive coats on large objects. Allow the final application to dry overnight, then rub the surface down. You may choose to leave this as a final rubbed finish, or you may apply another coat or two of shellac without rubbing to achieve a finish of high gloss. Two coats of paste wax completes the job. □

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Further reading

Try large libraries for these out-of-print books:

Shellac and Other Lacs by William Howlett Gardner. Chapter in *Protective and Decorative Coatings Vol. I.* John Wiley & Sons, Inc., New York, NY 10158; 1943.

Shellac: Its Origin and Applications by Edward Hicks. Chemical Publishing Co., New York, NY 10011; 1961.

Shellac by James Martin. Chapter in *Treatise on Coatings Vol. I, Part 2.* Marcel Dekker Inc., New York, NY 10016; 1968.

Shellac: Its Production, Manufacture, Chemistry, Analysis, Commerce and Uses by Ernest Parry. Sir Isaac Pitman & Sons, London, England; 1935.

Shellac (referred to as the "Blue Book") by M. Russell. Angelo Brothers, Calcutta, India; 1965.

Fig. 1: Evolution of period doors

Making Period Doors

Through tenons and scribed cope joints

by Malcolm MacGregor

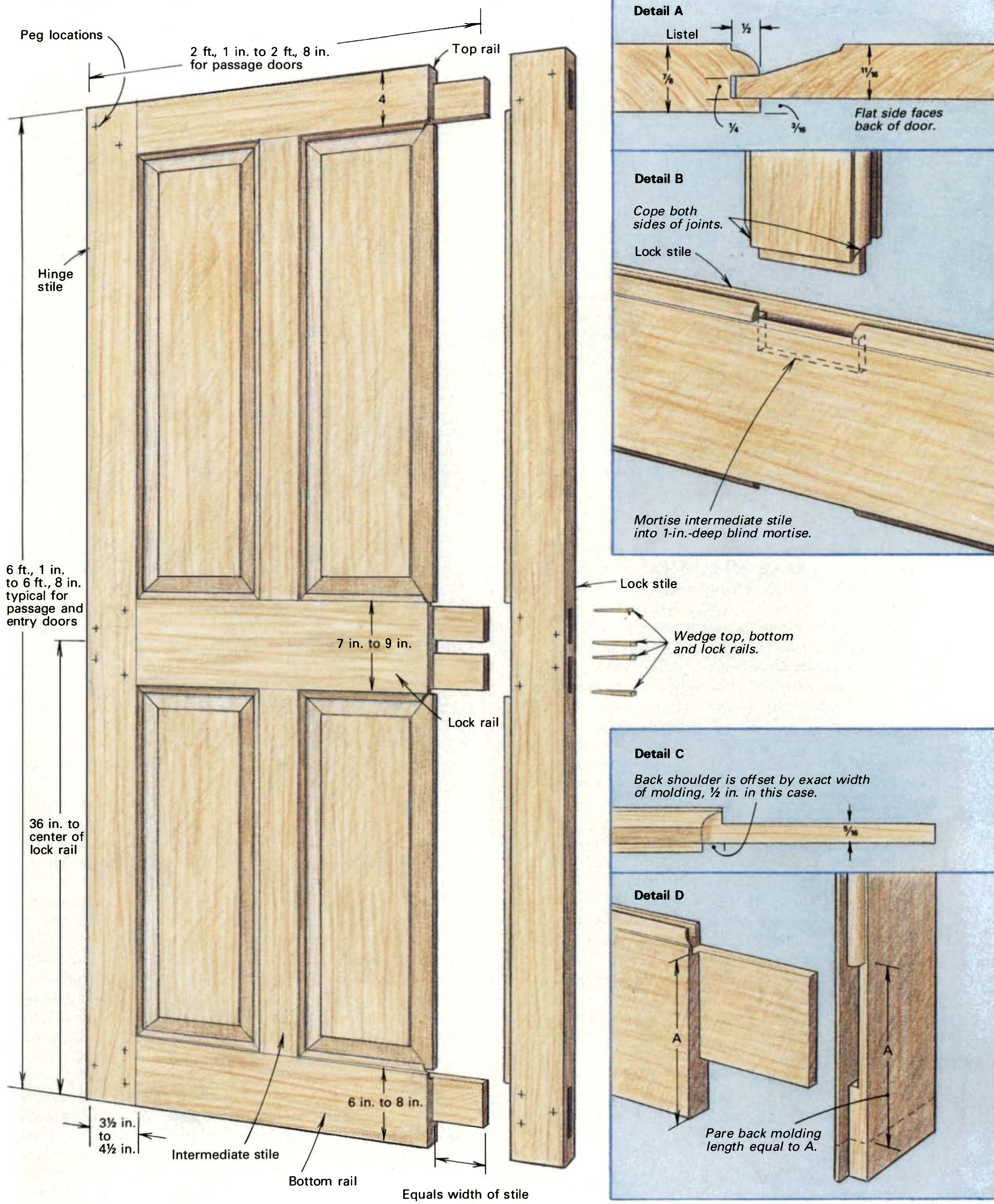
The New Hampshire seacoast region where I live was one of the first to be settled by the early colonists. By the 18th century, Portsmouth was a busy port and a commercial center. Local merchants and sea captains invested their wealth in elegant homes, many of which still stand today. Thanks to a renewed interest in restoring these fine homes, about half of my woodworking business consists of making authentic period moldings, sash, trim and doors, mostly with traditional hand tools.

In this article, I'll concentrate on building frame-and-panel entry and passage doors. I'll also discuss the simpler doors found in humbler dwellings or in the less important rooms of more-formal homes. Over the years, I've acquired quite a collection of wooden molding planes, which figure prominently in the hybrid hand/power tool techniques I've developed. For tedious work—thicknessing and ripping stock to size or cutting a dozen mortises—I rely on power tools. But, I make all my moldings and panels with handplanes. Using the original 18th-century tools ensures authenticity. There is always a great deal of variation in molding and panel details from house to house. I have at least a dozen thumbnail planes and 15 different panel-raising planes so I can duplicate any 18th-century look. These planes, plus about 400 molding planes, are sharp, set and ready to go: I don't have any time-consuming setup time or wasteful trial runs. For custom restoration work, I can beat any production shop hands down. Also, a hand-cut molding run on straight, clear pine approaches perfection: Corners and fillets are square and sharp and the wood needs little or no sanding.

Period door design—When most people think of early woodwork, an elaborately paneled wall complete with crown molding and chair rail comes to mind. But during the mid-1650s to early 1700s, often called the First Period, buildings were not ornate. Common houses were usually of timber-frame construction. Interior partition walls were made of floor-to-ceiling boards whose edges were molded in a pattern called featheredge, which is a very

Drawings: Lee Hov

Fig. 2: Typical Georgian-period panel door



shallow, slightly curved bevel or panel section (see figure 1). The featheredge on one board usually fits into a groove in the edge of the neighboring board. Doors were simple affairs. Most consisted of two or more featheredge boards fastened together by clench-nailed battens. Butt hinges weren't widely used until about 1780, so these doors were hung on strap, H-and-L hinges.

I've seen many variations of batten doors, including entry doors made of three or four vertical boards on the exterior side clench-nailed to a layer of horizontal boards on the interior side. This double thickness (about 2 in.) makes a strong, weatherproof exterior door. Many other early doors were a refinement of the featheredge design: The edge of each vertical board was grooved to accept a loose spline, and instead of the featheredge, a bead or shadow molding was run along the joint.

By the 1720s, the early Georgian Period, many colonists could afford more stylish homes. Elegant fireplace surrounds and formal paneled walls and doors embellished with trim inspired by classical Roman architecture came into vogue. Despite the new style, the featheredge paneling and batten doors found use in back rooms and attics well into the 19th century. Georgian paneled doors typically had four or six raised panels set into frames decorated with thumbnail moldings. If the doors themselves were somewhat stylistically uniform, their settings certainly were not. The Georgian style allowed for many variations in trim. The joiner's toolbox and the client's pocketbook actually determined how elaborate the work would be. By the time the style reached its peak around 1770, a formal entry door might have been flanked by stop-fluted Corinthian pilasters capped by an elaborate broken pediment. Similarly, interior architraves (door casings) were trimmed in varying widths of classically derived moldings.

During the Federal Period, which began around 1790, the six-panel door became more widespread in New England. Figure 1 shows the proportions of a typical Federal pattern, commonly known as a Christian door because its frieze rail and intermediate stile form a cross. This design became so popular that it's usually what you'll get today if you order a machine-made paneled wood or steel paneled door. The stiles and rails of Federal doors were usually decorated with ovolo moldings. The panels were both flat and raised, but any raised panels were turned toward the least important side of the door. By about 1820, when the Greek Revival Period began, six-panel doors were still popular, as was the four-panel door shown in figure 1—a design more in keeping with the vertical scale of Greek Revival houses.

Making a paneled door—Despite variations in style, period paneled doors are all constructed the same way: Loose panels are set into a molded rail-and-stile frame, which is held together with wedged-and-pinned tenons, not glue. Apart from the joints themselves, the chief technical problem is mating the molded edges where rail and stile meet. In the modern woodshop, router and shaper cutters can cut a perfect-fitting cope joint in a few seconds. However, they cannot make doors in the traditional manner. These tools didn't exist in the 18th century, so a traditional joiner had to cut the cope by hand, using chisels and an in-cannel gouge whose radius matched the molded profile. I use the same method in my shop.

Before I get into joinery specifics, I'll offer some general comments on the door dimensions given in figure 2. In First Period houses, ceilings were usually quite low, thus it was not unusual to find doors as short as 6 ft. During the Georgian and Federal periods, doors got taller, nearing the usual standard for modern doors—6 ft., 6 in. to 6 ft., 8 in. Widths varied with the application. A typical Georgian passage door ranged from 26 in. to 32 in. in width. The modern standard is 30 in. Main entry doors of the 18th and 19th centuries, although shorter than today's, were often just as wide at 36 in. to 48 in. If you are making a door for a new house, I'd suggest referring to the local building code. A replacement door should be sized to fit the original opening.

For passage doors, a rail and stile thickness of ⅞ in. works well with 11/16-in.-thick panels raised on one side, flat on the other. Very few period doors were raised and molded on both sides, primarily, I suspect, because a double mold-and-raise meant both sides of each joint would have to be coped, requiring twice as much work. Because of this, main entry doors are often a composite construction. This is actually two doors in one: a conventional frame-and-panel door clench-nailed to a separate vertical-board door. Besides being quicker to make, a composite door is up to 2 in. thick and is therefore more secure and weatherproof. If I'm making a regular paneled entry door without composite construction, the rails and stiles will be 1¾ in. thick to 2¼ in. thick. Single-raised panels are ⅞ in. thick; double-raised panels are usually two single-raised panels set back to back.

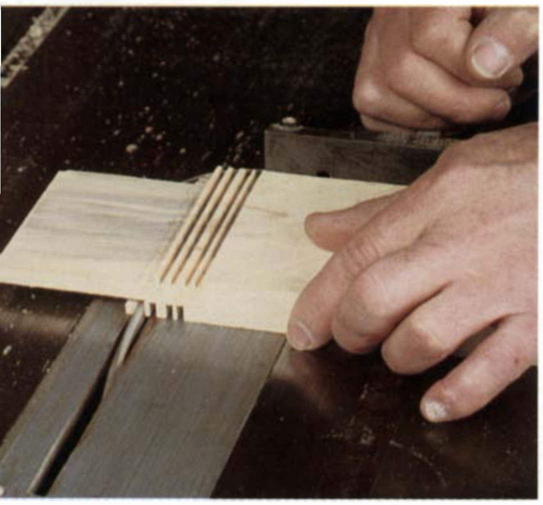
I begin a door by selecting stock. Period woodwork is almost always painted, so eastern white pine is the wood of choice. Pine is also soft enough to mold nicely with handplanes and compresses enough at the cope to produce a tight joint. I prefer quartersawn stock, or at least nearly quartersawn, for the rails and stiles because of its stability. In any case, to avoid warping later, select straight boards without wild grain. Figure 2 shows the overall dimensions for a typical Georgian passage door, and these of course, should be varied to match any existing original woodwork.

Layout and joinery—I begin construction by ripping and crosscutting the rails and stiles. To reduce the chances of their splitting, the stiles should extend 2 in. or 3 in. beyond the mortise. This excess, called a horn, is trimmed flush after assembly. Through tenons are used, so the rails should be cut to a length that equals the total width of the door, plus ⅛ in. to ¼ in. for trimming.

The panel grooves are cut first. I do this with a vintage plow plane, but it can be done with a router or tablesaw. Note that in a door with single-raised panels, the groove is offset, as shown in figure 2, detail A. This means that the molded side of the door has a deeper relief than the back, allowing enough thickness for the molding and positioning the groove so the panel's raised field is flush with the front faces of the rails and stiles. A double-raised door, with moldings on both sides, would be thicker (about 1⅛ in.), with the groove centered. Once the groove is plowed, I mold the thumbnail molding with a handplane. This operation can also be done by machine, but to my eye, the results aren't as appealing.

In handwork, it's usual to chop the mortise before making the tenon. Since I use machines for both operations, I find it easier to saw the tenons on the tablesaw first and use them as guides for laying out the mortises. As figure 2, detail C shows, to allow for the cope, the tenon's back shoulder is offset by the exact width of the stile's molded edge, and the cheeks are offset within the stock thickness in such a way that the back cheek aligns with the back of the stile's panel groove. I lay out the 5/16-in. tenon with a mortise marking gauge, then measure and mark the offset shoulders with a square and knife.

I cut the tenons on the tablesaw, sawing the cheeks first by feeding the stock vertically against the fence. This is not a particularly dangerous operation if you keep the stock perfectly upright and your hands well away from the blade. The cheeks also can be cut using a tenoning jig, as described in *FWW* #66, p. 70. The offset shoulders also are cut on the tablesaw, using the miter



After the stock is ripped and cut to length, grooves for the panels are plowed with an 18th-century plow plane, above. The same operation can be done with a router or on the tablesaw. Left, the rails (and intermediate stiles) are tenoned on the tablesaw. The cheeks are cut first by feeding the stock vertically against the fence. Because the blade's vertical reach is limited, wasting up to the shoulder is done with multiple crosscuts, which are then pared off. The cope on the molded rail, right, is cut with a ½ in. in-cannel, in a series of shallow, slicing cuts. To ease the fit, it's undercut slightly.

gauge and with a stop block clamped to the fence, as shown in the photo above. Through tenons for doors are as long as the stiles are wide (usually at least 4 in.)—quite a bit more than a 10-in. tablesaw can cut vertically. To finish off the cheek, I make closely spaced multiple cuts when I saw the shoulders and then pare off the waste with a slick or chisel. The width of the tenons isn't critical, but traditionally, the wide lock rail has a pair of side-by-side tenons instead of a single wide one. Some craftsmen believe this is for wood movement, but I think the real reason is that the load in a door is carried not by the tenon cheeks, but by the top and bottom edges of the tenons. The more tenons, the stronger the door will be. Also, the space between the tenons leaves wood for the lock set to be mortised into, without weakening the joint.

After cutting the tenons, I position the rails where they'll join the stiles and mark the mortises directly from the tenons. With the same marking gauge setting I use for the tenons, I mark each mortise position on the outside edges of the stiles too. This way, when I cut the through mortise with a hollow chisel on the drill press, I can cut in from both sides. To allow room for wedges, the mortises should be about ⅛ in. longer than the tenons. While the mortiser is set up, I cut the blind mortises for the intermediate stiles, as shown in figure 2, detail B. The intermediate stiles themselves are cut to length and tenoned after the principal frame copes are cut and the door is test-assembled.

Cutting a hand cope—Two moldings can be joined at a corner by cutting or coping one to the exact reverse section of the other, allowing the moldings to nest together. It's time-consuming, but not difficult if you have a sharp in-cannel gouge (mine is ½ in. radius) that closely matches the molding profile. Before coping on a door, I'd suggest a few practice joints. I begin by using a chisel to pare off the molding on the stiles where the rails will meet them, as shown both in the photo above and in figure 2, detail D. The molding is pared off to a depth even with its fillet or listel.

I mark out the cope cut with a miter square. Although the joint isn't really a miter, it looks like one when it's done, and a 45° angle closely approximates the correct profile. The layout line (and the cut itself) should just intersect the very end of the rail at the point where the molding's listel or fillet meets the tenon's shoulder. Cut the cope with a series of shallow paring cuts until your gouge just reaches the layout line, then try the joint. Undercutting a bit as you approach the line will provide some extra clearance. If the cope won't seat, the offset back shoulder needs to be trimmed back a little with a shoulder plane. If the cope seats with an open back shoulder, deepen the cope until the shoulder pulls down. Remember, soft pine will compress at the cope, so a hairline opening at the back shoulder usually isn't a problem. Use the same method to fit the two copes that mate the intermediate stiles to the lock rail.

With the copes done, I test-assemble the door and check for proper fits. Test the door's squareness by measuring diagonally from corner to corner. There should be enough play in the joints to make minor adjustments. At this point, I measure between the top, bottom and lock rails, fillet to fillet, and add 3 in. to get the exact length of the intermediate stiles, which I then tenon and

MacGregor's associate, Stu Worthing, assembles the door. Assembly proceeds from the inside out by first inserting the intermediate stiles into the lock rail, followed by the panels and the top and bottom rails. Last in place are the lock and hinge stiles.

Above, wedges and pins lock the tenons securely without glue. The wedges are driven in above and below the tenons until they seat firmly. Below, pins made from rounded square stock are driven into ¼-in. through-bored holes.

cope. The tenons are 1½ in. long. When all the rails and stiles are in place, I determine panel sizes by measuring the actual frame openings, again fillet to fillet. I allow ¹⁄₁₆ in. on the length and nothing to ⅛ in. on the width, depending on the season, to allow for wood movement. I raise the panels with a wooden plane (see the profile in figure 2), but this operation can be done with machines as well. For more on panel raising, see *FWW* #57, p. 72 and *FWW* #67, p. 65. After trying the panels in their grooves, I smooth-plane the fields, rails and stiles and sand as needed.

Final assembly—Since the door won't be glued, you can proceed directly from test assembly with the panels in place to wedging and pinning the tenons, assuming everything fits. You might be tempted to glue the tenons, but there's no need. I've seen old doors that have stood up to two centuries of wear and weather without a drop of glue.

I begin by clamping the door lengthwise to pull the intermediate stiles tightly against their shoulders. The intermediate stiles are not wedged or pinned, so the tightness of their shoulders depends on their being held slightly in compression against the lock rail. Clamps placed widthwise pull the rails home. With the clamps still in place, I use a razor knife to slice wedges from a scrap as thick and as long as the tenons. The wedges taper from about ³⁄₁₆ in. to perhaps ⅛ in. and are driven in at the top and bottom of each tenon. I tap the wedges in as far as they'll go without breaking off, then trim them flush with a backsaw. To further lock the joint, each tenon is pinned with a pair of round-cornered square pegs driven into a ¼-in. hole bored through both mortise-and-tenon cheeks.

To finish up, pare the pegs flush, finish the stiles and rails with a smooth plane and cut the horns off. The door is now ready to hang. Once hung, a couple of coats of primer followed by a coat or two of good-quality oil paint completes the job. □

Malcolm MacGregor operates Piscataqua Architectural Woodwork Co., in Durham, N.H. For more on doors, see FWW *on Joinery.*

Belter Furniture, 1840-1860

A man who lent his name to a style

by Stacia Gregory Norman

A 19th-century cabinetmaker once described Belter furniture as "those heavy over-decorated parlour suites with round, perforated backs." Fashionable in America between 1840 and 1860, these ornately carved, bent and often laminated pieces were a revival of the European 18th-century rococo style. The best-known designer of this revival furniture is John Henry Belter, because of the quality and number of his labeled pieces and the survival of 19th-century patent records awarding his innovation in design. Belter developed a technology that would evolve into products as diverse as jewelry boxes and hulls for PT boats. While at first glance the furniture seems overly opulent to a modern eye, his designs exemplify the spirit behind Victorian-era tastes, and some of the individual elements are exquisitely wrought.

Belter and other craftsmen working in the rococo-revival style transformed 18th-century rococo to the scale preferred in the 19th century. They made the characteristics–foliate carving and C- and S-scrolls–bolder and fuller by carving them in greater relief. Furthermore, 19th-century cabinetmakers often augmented the earlier floral motifs with carvings of plump fruits and vegetables, garden imagery popular during the Victorian era.

The rococo revival was just one of many 19th-century furniture styles prompted by the Victorian interest in historicism. This century saw a series of design revivals, including Greek, Roman, Gothic, Elizabethan, Renaissance and Egyptian, but the rococo emerged as one of the most popular. While this ornately carved furniture decorated some bedrooms, dining rooms and libraries, it was most frequently placed in parlors and drawing rooms.

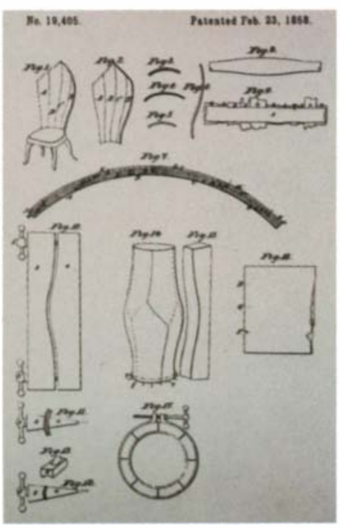
The rococo-revival style was well-known in Germany by 1833, the year that Belter emigrated from his native city of Ulm in Württemberg. Arriving in the United States at the age of 29, he settled in New York City, where he eventually built a furniture factory in the 1850s. After his death in 1863, the factory continued under his name for two years and then finally closed in 1867. During Belter's 30-year career in New York City, he produced a considerable amount of rococo-revival furniture, some of which bears labels or stamps. The survival of these pieces has prompted attributions to Belter for furniture with natural motifs carved in high relief and S- and C-scrolls carved as intertwining vines.

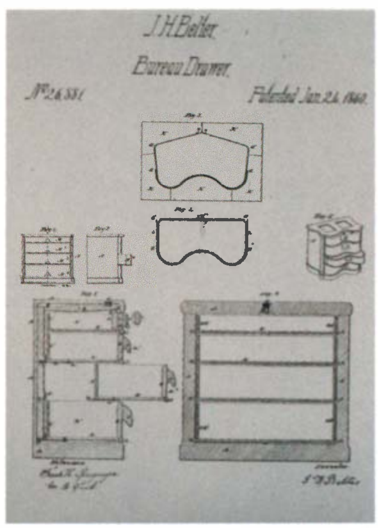
Today, craftsmen and furniture historians recognize Belter as one of the premier cabinetmakers in American history because of the quality of his workmanship and his innovative use of laminated and bent wood. In the past, Belter has been popularized as the "inventor" of plywood furniture, although he probably learned the techniques during his early training in his native country: Cabinetmakers in Germany were laminating and bending wood in the 1820s. These techniques, which Belter called "presswork," allowed chair backs and some other curved parts of furniture to be glued and bent to rough shape rather than carved.

In a patent application for his bedstead, which he submitted to the U.S. Patent Office in 1856, Belter described the process:

> The veneers...being spread on the table, and liberally covered with glue, each successive layer should...run at right angles to the grain in the last. The whole mass of sheets should then be immediately pressed between hot 'calls,' which bend it to the form required. The superfluous glue will exude at the edges of the sheets, and after remaining seven hours or more, under pressure the 'calls' may be carefully separated but the compound must be allowed a few days to become thoroughly dry. After this period the work may be finished by ordinary tools, gluing on more wood to form a sufficient thickness for the carved portion when necessary.

Photos right, photo below: Wade Lawrence





Left, the patent drawing for 'Improvement in the Method of Manufacturing Furniture' by John Henry Belter, February 23, 1858. There is some doubt that this process was ever implemented exactly as described. Some of Belter's patents seem fanciful and optimistic, designed to conform to patent office formalities more than to sensible workshop practice. At right, however, is one that clearly worked out. The drawer shown in the photo below was bent up exactly as Belter specified.

As Belter admitted in his patent application, this design for a bedstead did not claim the invention of lamination, a technique cabinetmakers had long practiced, but instead introduced a new method of joinery. Belter's laminated-and-bent bedstead replaced traditional mortise-and-tenon joints secured by bolts with notch-and-dowel joints secured by hooks. Recognizing this innovation in design, the U.S. Patent Office awarded Belter a patent.

Belter received three other patents during his career. In her article, "A Patent Model by John Henry Belter," (*Antiques,* May 1977), Rodris Roth illustrates the process of patent application and reveals that patents were not always readily awarded. In 1857, Belter submitted a patent application for "Improvement in the Method of Manufacturing Furniture." With this invention, he claimed the process for constructing pressed work curved in two planes rather than the plane bent by previous designers. For chair backs, his method began with gluing and pressing two layers of veneer together, with the grain running at right angles. This laminate was trimmed into a narrow vertical strip, or stave, four of which would butt together to form the chair back. Additional layers of laminate were then added and clamped up around a compound-curve cylindrical caul to create a chair back usually six veneers to eight veneers thick.

Officials twice rejected Belter's application, ruling that his method for pressed work did not meet their criteria—novelty, usefulness and importance. The patent office denied Belter's application for the first time in November of 1857 because officials claimed that "the principle of moulding wood into particular form is well known and in common use by Cabinet makers and others as admitted by yourself." One week later, with the help of a patent agent, Belter resubmitted his application, which was rejected again. Belter's third application included affidavits from cabinetmakers and designers who supported Belter's contention that no other patents existed for pressed work with a compound curve. These claims finally convinced the patent office to award Belter a patent in February of 1858.

In January 1860, Belter received a patent for "Bureau," shown in the bottom-right photo at left. This invention claimed serpentine drawers, each made of a single piece of laminated wood. By extending the bottom of each drawer beyond the drawer sides, Belter eliminated the need for dust boards and dividers between drawers. Belter's patent application for his bureau design included a description of the drying characteristics of presswork:

> I have discovered that pressed work, although very rigid and unchangeable in every respect after it is dried, changes its form within a brief period after it is removed from the cawls, and that the change is uniform, or nearly so, and is of such a character as to increase its curvature.... It will after being removed from the cawls exhibit a tendency to spring into the form shown in Fig. 2 which is the form proper for the entire four sides of my drawers.... Were it not for this property of the material, to bend more in drying, such a result could not be attained, because the ends of a sheet of pressed work are from the nature of the manufacture ragged and imperfect and a portion always requires to be removed, which would leave an open gap unless forcibly sprung together.

Because it is difficult to know if Belter actually followed each of the construction techniques outlined in his various patent applications, the patents may be more important as evidence of 19th-century attitudes toward production—the quest for greater output and improved technology—than as processes of production (see accompanying article below).

Expensive furniture of the mid-19th century, such as Belter made, was in fact an amalgam of machine production and skilled handwork. An 1847 Belter patent, for example, was for an apparatus to guide and steady the saw while piercing a chair back with interlacing, serpentine lines. Its use still depended on handwork to guide and periodically readjust the saw, and the final ornaments depended on the skill of the carver, which no carving machine could duplicate. □

Stacia Gregory Norman was co-curator, with Donald Fennimore, of the Belter exhibit. For information, contact Historic Houses of Odessa, Main St., Odessa, Del. 19730; (302) 378-4069. Photos courtesy of The Henry Francis du Pont Winterthur Museum, George & Gloria Manney Collection, except where noted.

Building Belter

by Michael Podmaniczky

Apart from minor cleaning, the five dozen pieces of Belter and Belter-style furniture The Winterthur Museum acquired a few years ago didn't really need much work to prepare them for exhibition. But the furniture conservation shop, where I work, was asked to build a four-part display to demonstrate how Belter layed out, laminated and carved a representative chair back from the collection.

What we hoped to gain was a greater insight into how Belter really produced his furniture. The fading memory of an aged cabinetmaker or the wishful thinking of a manufacturer petitioning the patent office with a prototytpe don't make very reliable research sources.

Examining Belter work from a 20th-century perspective raised some interesting questions about heretofore accepted ideas about Belter's technique. Although none of the originals have survived, production cauls of the 19th century were often wood but were occasionally steam-heated metal. Which did Belter use? Well, the laminations in the originals are so good and the gluelines so thin that it's difficult to imagine iron cauls being manufactured to such close tolerances over such a broad expanse, especially since most backs are sections of a cone rather than easier-to-mold cylindrical sections. Although wood is easier to shape and fine-tune, it's not as easy to heat for glue-curing. A written account of Belter breaking up a set of cauls in a fit of rage over patent infringement is no help. Does this imply a sledgehammer on cast iron or an axe to wood?

Another Belter claim is similarly puzzling. One patent drawing (see facing page) depicts cutting multiple backs from a great laminated cone, nesting the backs side to side and reversing their orientation around the cone so the crest of one back has a greater curve than the waist, and vice versa. From the many backs we examined, it seems as if the geometry would not work. Also, virtually all the backs have book-matched seams in the face veneer, something that would be impossible if the patent was followed.

For our demonstration chair backs, we saved the time and trouble of making precision mating molds by making only one precisely shaped caul that fit a frame with layers of loosely attached ⅛-in. plywood. The loose plywood settled to uniform pressure when the laminations were clamped. With no practical way to heat the caul, and not wishing to work in a 100° room, we opted for epoxy to provide us with adequate working time.

Once out of the mold, the profile and carving details were marked on the chair back, and it was then sawn to shape. At the same time, the openings that pierced the back defining the fruit, foilage and whatnot were cut out. Belter's proposed saw for doing this, really a variation on a marquetry donkey, allowed him use of the 19th-century public-relations grabber "patented," but in fact, a normal hand-held fretsaw is more versatile, works just fine and best of all, is cheap. Besides, although marquetry requires perfectly accurate cuts, carved chair backs do not.

Final shaping was as straightforward as carving plywood could be, with the epoxy adding that extra degree of difficulty the old timer avoided by using hide glue. We did not fully carve the chair back, because the chair itself represented the finished product. Our final display seemed to make clear most of the subtleties of this specialized construction technique, but couldn't seem to get across the answer to the oft heard: "Gee, why don't you make a set of these?" Right. □

***Michael Sandor Podmaniczky is a conservator at The Winterthur Museum and a contributing editor to* FWW.**

Fig. 1: A river whistle

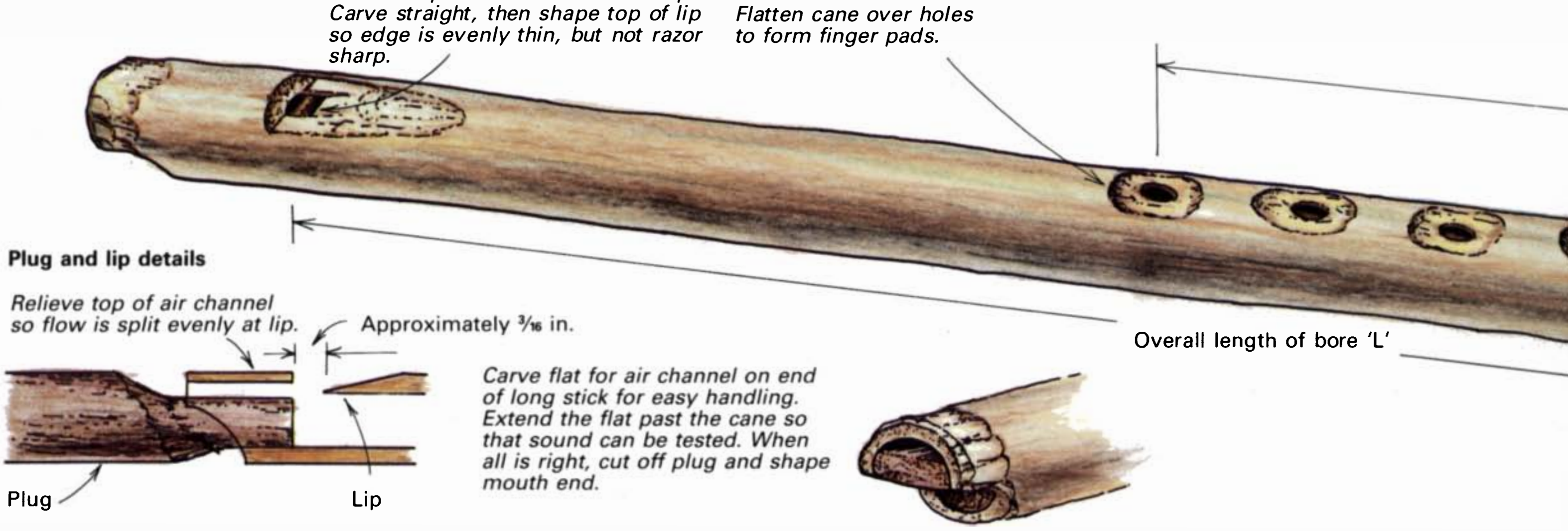
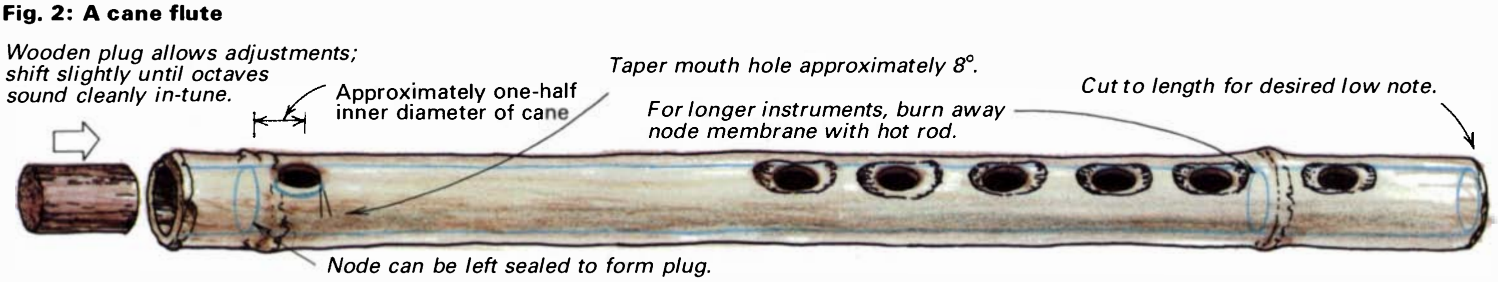


Fig. 2: A cane flute



River Whistles and Cane Flutes

Pastoral pipes for plaintive tunes

by Delbert Greear

Music is a child of many parents, and surely many forces must conspire to bring forth a musical instrument. I like to think that the flute was born in a cane patch—inspired by the wind rustling the hollow reeds and brought to being by the essential spark of human inspiration.

In fact, the origin of the flute is a matter mostly of conjecture. The oldest known flutes are made of bone and date from prehistory. Pipes of hollow reed must also have been developed in the Stone Age, as they're common in the Stone-Age cultures of which we've unearthed traces. Perhaps the antiquity of the reed or cane flute helps explain why it is associated with magic and why it has been a symbol of the rustic pleasures of pastoral life since the days of ancient Greece.

Then too, a flute of reed, cane or some other sort of hollowed-out wood is light in weight and takes rough treatment well. These qualities helped make it, before the days of harmonicas (and transistors), a traditional instrument of shepherds, travelers and country revelers.

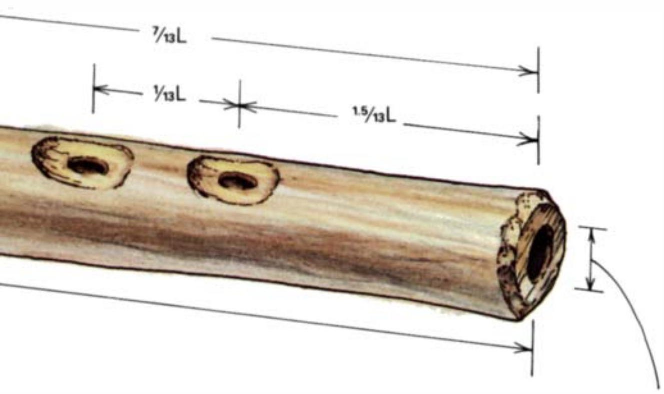
River cane—The river cane I use for making whistles and flutes is a bamboo that grows in dense groves along rivers and streams throughout the southeastern United States, ranging as far north as New Jersey and as far west as Oklahoma and Texas. It looks just like the cane seen in Chinese ink drawings.

Mature canes can be harvested any time with just a sharp knife, but watch for snakes in warm weather. The plant has little economic value, and most landowners are not jealous of a few canes—but of course, it's polite to ask.

I'm told that in parts of the country where cane doesn't grow, you might try gardening centers and even junk shops. Cane was once widely used for garden stakes and fishing poles—and is hardly ever thrown away—so it's worth a look. In fact, don't be surprised if you find that you have a suitable piece stashed away forgotten in your attic, basement or garage. For those without such resources, small quantities of suitable bamboo can be ordered from Bamboo and Rattan, 470 Oberlin Ave. S., Lakewood, N.J. 08701; (201) 370-0220.

Drawings: J. Willard Whitson

The river whistle is tuned by ear. The 'rule of thirteenths' is an approximation based on small finger holes and a bore slightly constricted at the open end. Increasing the diameter of a hole raises its pitch, as does positioning it farther up.



Length 'L' and the constriction of the bore at the lower node determine the fundamental (lowest) note of the whistle.

The river whistle—River cane is a hollow tube that's sealed at each node with a thin, hard membrane. A river whistle is typically made from a single "joint." Cut the cane into pieces just above, or right through, each nodal membrane. You can do this with a knife or a small backsaw. I generally use the upper end of the joint for the mouth, because the cane is more evenly round at this end: Use a small sharp knife to ream the membrane out of the node until its diameter is the same or slightly larger than the inside of the cane. At the other end, leave enough of the node so the tube is slightly constricted.

The next step is to cut a notch about 5/8 in. to 3/4 in. from the end of the joint, as shown in figure 1. The upper end of this notch should be square with the end. The lower end of the notch is at a shallow angle, forming a rounded lip where it intersects the inner diameter of the cane. For good results, the sharp lip thus formed must now be squared off with respect to the upper end of the notch and then trimmed to an even thickness and taper. This means the top of the lip needs to be contoured to match the curve of the inside of the cane. This lip should be fairly thin and free of fibers at its leading edge, but a super-sharp edge is not desirable—it tends to create shrill overtones. The inside of river cane is fragile, so it's not a bad idea to back up the lip while shaping it with a round piece of wood inserted into the cane.

The distance from the square edge of the notch to the lip is important. If it's too small, the whistle will lack power and refuse to play the low note. If this space is too great, the little whistle will be raspy and won't play its high notes. The distance varies with the cane diameter. For a cane with an inside diameter of 1/2 in., a good average distance is about 5/32 in. to 3/16 in. If a longitudinal crack develops in the lip, or if something else goes wrong at this stage, it's best to discard the blank and start fresh.

The lip needs to extend down into the air channel of the mouthpiece. It will draw down into the cane a little as the cane dries, but usually one needs to scrape a little off the top of the inside of the mouthpiece, thus inletting the air channel into the cane (figure 1).

The lower side of the air channel is formed by a round plug of wood flattened on the upper side. I like to experiment with different shapes of air channels—tapering the wood to concentrate and direct the air or carving a little chamfer at the inner end—but a simple straight passage will suffice; the objective is to form a smooth stream of air that is split evenly by the lip.

Of course, before the air channel is formed, the plug must first be carved to fit snugly in the end of the cane. Plug stock may be split out of a small cut of hardwood. Walnut and maple make good whistle plugs because they don't seem to expand and contract a lot with moisture changes, and they have close, even grain as well. Carving the plug on the end of an 8-in. to 10-in. piece of wood saves the obvious hassle of holding the small plug while you carve it. Carving the flat that forms the air channel back a little past the end of the cane makes it possible to test the whistle before you cut the plug off its stock.

A smooth, soft breath should cause the river whistle to sound its low note, or fundamental. Blowing just a little harder should make it jump to its second harmonic. Harder yet and it should play its third and fourth harmonics. When you're satisfied with the response and tone of the whistle, cut the plug off at the end of the cane and shape the mouthpiece. I never glue the plug into place until the whistle is well-seasoned, as the air channel usually needs reshaping. Beeswax can be used to seal any gaps.

Tuning a whistle—The fundamental, or low note, is determined principally by the overall length of the instrument. If you want to tune a river whistle to a particular pitch, it must be done before any note holes are made. Gradually cut out the remains of the node at the open end until the whistle sounds the note desired. If this doesn't bring the note up to the pitch you want, gradually shorten the length of the tube.

The traditional, and still the best way to make the finger holes, is to burn them. I use a 1/4-in. steel rod about 20 in. long, which is ground to a point. Heated in a fire to a red glow, this tool has no trouble burning through the cane. In fact, a dull rod would burn through almost as well, but the taper allows me to size the holes according to how deep I push the point.

Such a tool can inflict a serious burn and must be handled with care. One safety tip is to make a pilot hole with a knife point to prevent the rod from slipping off the cane. One could use a knife or drill for the whole job, but this leaves splinters that dull the tone, whereas the scorched edge is clean. Also, the hot steel can be used to clean and scorch the inside of the cane (any tiny loose fibers inside the tube can dull the tone) and can be used to burn out nodes as well, should you want a longer pipe.

The proportions for tuning in the drawing above are approximate. In practice, each hole should be burned out small at first, then widened until the desired pitch is reached. Essentially, each higher hole shortens the effective length of the whistle, and the shorter the whistle, the higher the note. Six holes are sufficient to produce the eight-note octave, because the eighth note can be achieved by closing all the holes and blowing a little harder.

The transverse flute—The river whistle is a pleasant companion, but it does have some shortcomings. For one thing, its volume is limited by the small size of the air passage. Also, its two-piece construction makes it prone to fall apart when it gets too dry or choke up when too moist. Once you're comfortable with the burning rod, you may want to attempt a regular transverse flute.

Generally speaking, the transverse flute is a more powerful instrument whose simplicity belies its elegance. This same simplicity also hides some difficulties. Location, size and shape of the mouth hole, or embouchure, are of prime importance in fashioning this flute. For myself, I must admit, these subjects are more a matter of constant experimentation than of strict rules. The proportions given here are therefore only a general guide.

Because the embouchure needs to be small relative to the bore, it's best to choose fairly large canes for transverse flutes. I like to saw the cane an inch or two above the node so the embouchure can be located close to the node, yet still be comfortable for the lips. A good alternative is to ream out both ends of the cane, burn the mouth hole a comfortable distance from one end and fill the end with a wooden plug. This allows some measure of control over the distance from mouth hole to plug, which can be fine-tuned for best response. By the way, if the plug is too far from the mouth hole, the flute will still play its low register, but it won't play well in its second octave.

The embouchure must also be undercut, tapered wider toward the inside of the cane. A very small amount of trash or fuzz in the hole is enough to keep the instrument from sounding. As with the river whistle, it pays to be sure the flute works well in its fundamental mode before attempting to supply it with finger holes for additional notes. Finger holes are made as they were for the river whistle. It's a little harder to make this style of flute jump to its second octave, so you may wish to furnish it with a few extra holes for additional notes (but of course, no more than you have fingers for).

The transverse flute is a difficult instrument to master. Sometimes I think it's the source of the old saying, "You're not holding your mouth right," as an explanation for a failed endeavor. And indeed it does require more skill to obtain a pure tone from this instrument than from the river whistle: I hope you'll enjoy both the practice and the making. As with most true handcrafts, monetary profits in the flute business are somewhat elusive. For a camp-fire craft, however, and pleasant hours on the riverbank, cane flutes and whistles are hard to beat. □

Delbert Greear lives in Sautee, Ga.

Twig whistles

by John Marcoux

Whistle making is a wonderful, magical experience for children. I know, because my grandfather taught me how to make whistles in Vermont when I was very young. I made them for years as a child, but as I grew older, I forgot how.

I was vaguely disquieted about this for a couple of years: I kept asking people about whistles, hoping to meet someone who knew about them and remembered how to make them. One day my wife, Alice, brought home a library book with instructions, and the process was just as my grandfather had shown me. That was six years ago, and every spring now we have three or four whistle-making sessions at our house with friends, their children and our grandchildren.

The drawings show the process. I have made successful whistles from alder and white ash, and I'm told that willow works well, too. There's not much effort involved, so experiment with whatever woods are convenient. I can tell you from experience that some woods don't work, because you can't get the bark off in one piece, but many woods do work fine.

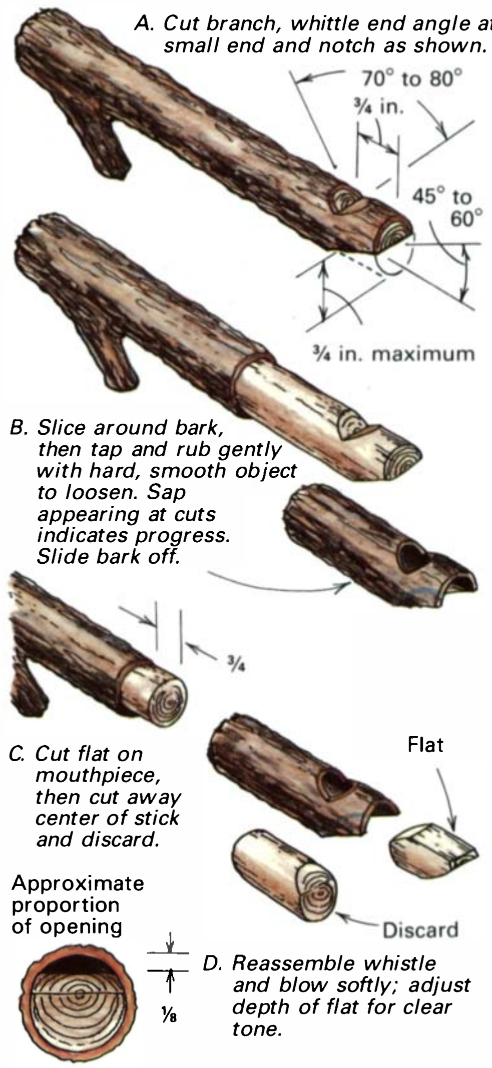
Spring is about the only time of year when there's enough sap under the bark for it to slip off. Clip off a section of branch with pruning shears, then whittle the stick as shown. Next, tap and rub the bark with something smooth and hard, such as the handle of a table knife, to help it break loose. Close your whole fist around the bark section and try to twist it. If it seems to stick, tap and rub some more, but not so much that you damage the bark. If there are any splits or cracks, the whistle won't work.

Gradually whittle the flat to size until you get a pleasantly surprising noise. If it doesn't work, try again with different proportions. Infinite variations are possible; both of the whistles in the photo have pleasant tones. Try various shapes and you'll soon discover that the larger and longer a whistle, the lower its note.

Sometimes whistles last very well and work for a long time, but more often, they don't whistle for more than a day or two. The bark dries out and splits, and the openings' sizes change. You can extend a whistle's life by keeping it in a sealed plastic bag, but this defeats the concept somewhat. Give your whistle to a child, who'll make the most of it for as long as it lasts and remember it a good while longer. □

John Marcoux lives in Providence, R.I.

Fig. 3: Making a whistle

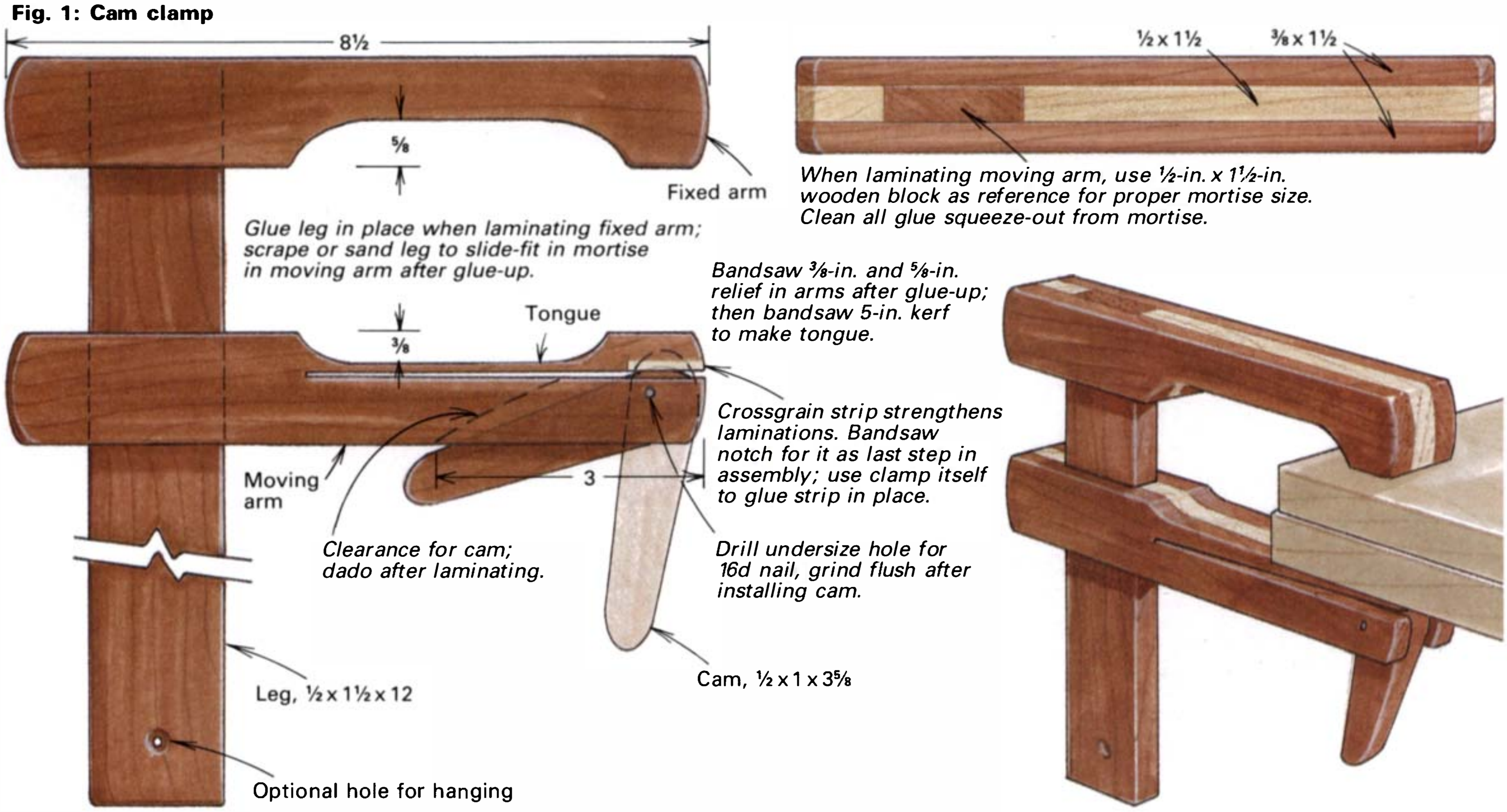


To give a sense of scale, the larger whistle is 11/16 in. in diameter and 6 in. long.

Cam Clamp

by Dave Flager

Fig. 1: Cam clamp



A while ago, I made a list of items that would improve the efficiency and earning power of my shop. More C-clamps came to mind, but these little tools are expensive and mostly they just hang around. They didn't seem to be a good investment for my limited cash resources. Thumbing through magazines, I saw a number of clever shopmade clamps, but they all required cash layout for hardware such as reverse-threaded rods and aluminum knobs. Spending money was something I wanted to avoid.

Then I came up with this all-wood cam clamp, which can be made from scraps that would otherwise be destined for the kindling pile. Best of all, the only metal needed is the shank of a 16d nail.

The design for the cam clamps is a budget version of the Klemmsia clamps seen in catalogs. Cam clamps are typically called instrumentmakers' clamps, but I've found them very useful in general cabinetmaking as well. In use, the fixed arm of the clamp is held against one side of the work to be clamped, and the moving arm is positioned against the other side. When the cam is tightened, the moving arm wedges itself in place on the leg, and the cam then bears against the flexible tongue to exert clamping force on the work. While cam clamps can't exert the bone-crushing force of a C-clamp, they are surprisingly powerful.

I've made several batches so far. By laminating the arms, I avoid having to cut precise square mortises in solid stock. The center layer of the laminations should be a hardwood, such as maple or cherry, to resist wear. The two outer laminations can be made from any knot-free, stable wood. I've used Philippine mahogany, alder and cedar with success.

The leg must be a slip fit in the mortise in the moving arm. One way to achieve the necessary clearance is to make the center lamination in the moving arm a hair thicker than the leg and the other center laminations. Instead, to avoid confusion, I make all center laminations the same thickness. To allow clearance for the leg, I gauge the size of the through mortise in the moving arm by installing a ½-in. by 1½-in. wooden block while laminating. When this block is pushed out (before clamping the laminations tight), it produces enough lengthwise clearance for the leg, and I am able to achieve the necessary side clearances by scraping or sanding the leg after assembly. The drawing explains my work sequence, but feel free to devise your own.

When laminating my latest run of clamps, I used air-driven nails during glue-up. This sped the assembly time considerably, but didn't affect the cost. If you want to take the other approach, cam clamps can be made from beautiful exotic woods and inlaid with decorative brass or contrasting wood. Whatever your approach, a dozen or so cam clamps will find many uses in your shop. In fact, I've made a set of 10 clamps, 40 in. long, that I absolutely love. The only necessary change for the longer version is to make the cam itself capable of about twice the displacement of the short ones. The longer leg flexes under load, just like a steel bar clamp does, and you need the extra throw to compensate. Similarly, the looser the fit of the moving arm on the leg, the more throw you will need on the cam. This is no problem, as you can drive out the nail whenever you need to adjust or replace the cam. □

Dave Flager is a renovator, custom cabinetmaker and guitarmaker. He lives in Placerville, Calif.

Drawing: Bob La Pointe

The oval coffee table, above, is one of 15 designs students choose from to build their first piece of furniture at the Leeds Design Workshops. The table has a solid-wood top and pedestal base, with edges that are profiled with rasps and spokeshaves.

Building Coffee Tables

Student projects from Leeds Design Workshops

by Suzanne Burns

A coffee table can be a challenging project for any woodworker. It can be as intricate in design or as demanding in technical difficulty as any dining table or desk. Yet it is a small and manageable undertaking, well-suited for a relatively inexperienced woodworker. Because of this, a coffee table is the first major piece built by students at the Leeds Design Workshops, a two-year school in furnituremaking and cabinetmaking in Easthampton, Mass.

Though students come to Leeds anxious to explore design, they don't design their own tables for this assignment. Instead, they choose, with the instructor, from 15 different tables, all designed and drawn by David Powell, who, with John Tierney, directs the school. The students use mostly hand tools and an occasional portable power tool to build their tables, because one project goal is to teach the proper and precise use of these tools. Design comes later, when the students have mastered basic woodworking techniques. Tierney says, "Customers will seek out these students in the future, when they are craftsmen, for the skills and versatility that can be fostered by hand tool use. Working by hand changes one's perspective of what is possible—you don't limit yourself to just what a machine is able to do. The control is more with the craftsman."

Powell designed each table to emphasize a different construction technique. While all the tables require basic joinery and shaping skills, some designs involve more advanced joinery or require coopering, carving or veneering. The instructors try to steer the student to the design that best suits the student's skill level. The objective is for a student to learn techniques while building a functional and attractive piece of furniture.

Each table created by Powell fulfills basic design criteria for a coffee table, yet the tables cover a wide range of styles—from Craftsman to Art Nouveau. The coffee table is simply a 20th-century piece of occasional furniture designed to hold drinks or books. It probably came into use with the advent of sofa seating or perhaps as a spin-off of the tea table. A coffee table is built long and low to match the height of a sofa. The top can be any size, but it usually isn't much more than 3 ft. or 4 ft. long and 2 ft. wide; otherwise, it takes up too much space in front of a sofa.

Despite the fact that students start from complete plans and are given all the dimensions, even the simplest table is not that easy to build: Students have just six weeks to make the table and are required to do everything but go out and harvest the tree themselves. Given rough planks of lumber, they must dimension the wood with a handplane, handsaw the joints, shape the edges, and sand and finish everything without the stationary machine tools they'll be taught to use after they've mastered hand tools. It's a tedious process and demands most students to push their abilities to the limit. Tierney says, "Nobody gets it right the first time, but by the time a student is done, he's developed a kind of confidence with handworking techniques that can't be had any other way."

When complete, the coffee table is reviewed by Powell and Tierney, who check every edge and surface against the measured drawing. They even use calipers and templates to make sure the student's work is within a hair of the correct thickness or shape. A table must be close to perfect before Powell and Tierney will pass it and allow the student to go on to the next assignment—a piece of casework such as a vanity or a display case.

Besides being good designs for student projects, Powell's coffee tables are also good-looking pieces of furniture. A close look at how students handle the construction of the tables can be very instructive. I'll describe three of my favorite tables and give you an idea about the technical difficulties you're likely to encounter if you decide to build one.

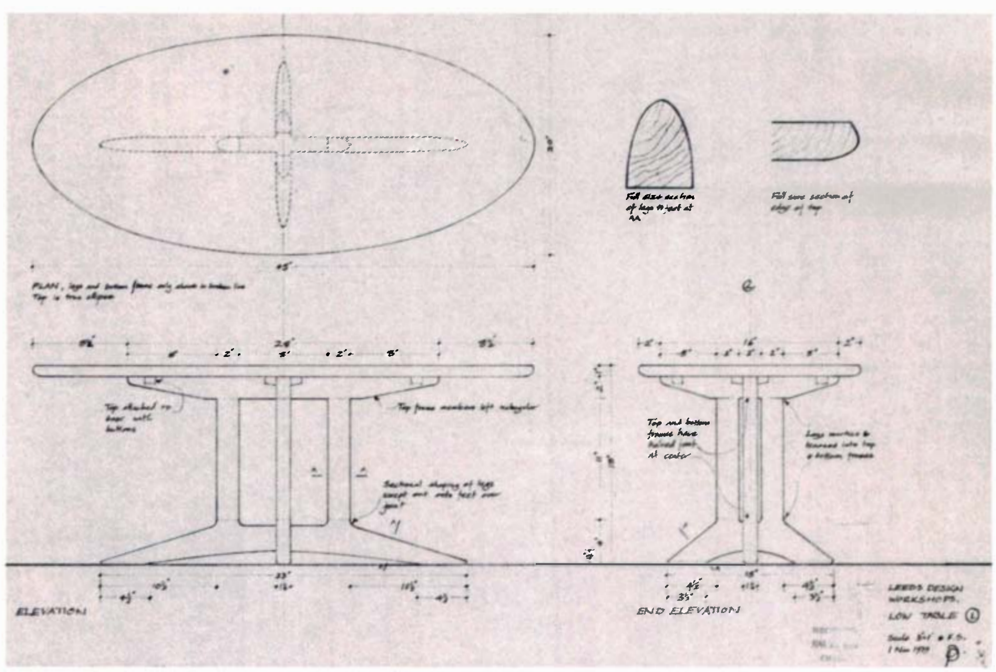
Oval table

This table consists of an oval-shape solid cherry top supported by a pedestal-type base. The base has two crossmember frames connected with four uprights to form the pedestal. One frame attaches to the underside of the top, and the other frame is shaped to form four feet that rest on the floor. Making this table involves basic handplaning and joinery skills, as well as spokeshave and rasp work to shape the edges of the top and base.

The 20-in.-wide top requires several boards to be jointed and then glued together. The Leeds students use jack planes and jointer planes to plane each board accurately to dimension and then to true the edges before gluing. They use smooth planes and block planes to level the top. The students cut the oval out with a bowsaw. If you don't want to use hand tools, you can joint and thickness the boards with a jointer and thickness planer and cut the oval with a jigsaw. The top's edge is shaped to a profile that's called an accelerating curve—one with a radius that changes around the edge. Although it takes longer to shape, the accelerating curve appears more dynamic to the eye than the fixed-radius curved edge you'd get with a roundover bit in a router. To hand-shape the edge, students make a cardboard template of the profile from a full-size blueprint, pictured at right, and then rough-shape the edge with a spokeshave and rasp, checking progress against the template. They refine and smooth the shape with sandpaper.

The eight pieces that make up the base must be cut to length, have their joinery done and be glued up before the edges get shaped. Waiting with the shaping makes it easier to clamp the base members, since the edges of the frame members opposite the joints will be square and flat. The two identical crossmember frames are made from the same wood as the top: 2 in. wide for the top frame and 4 in. wide

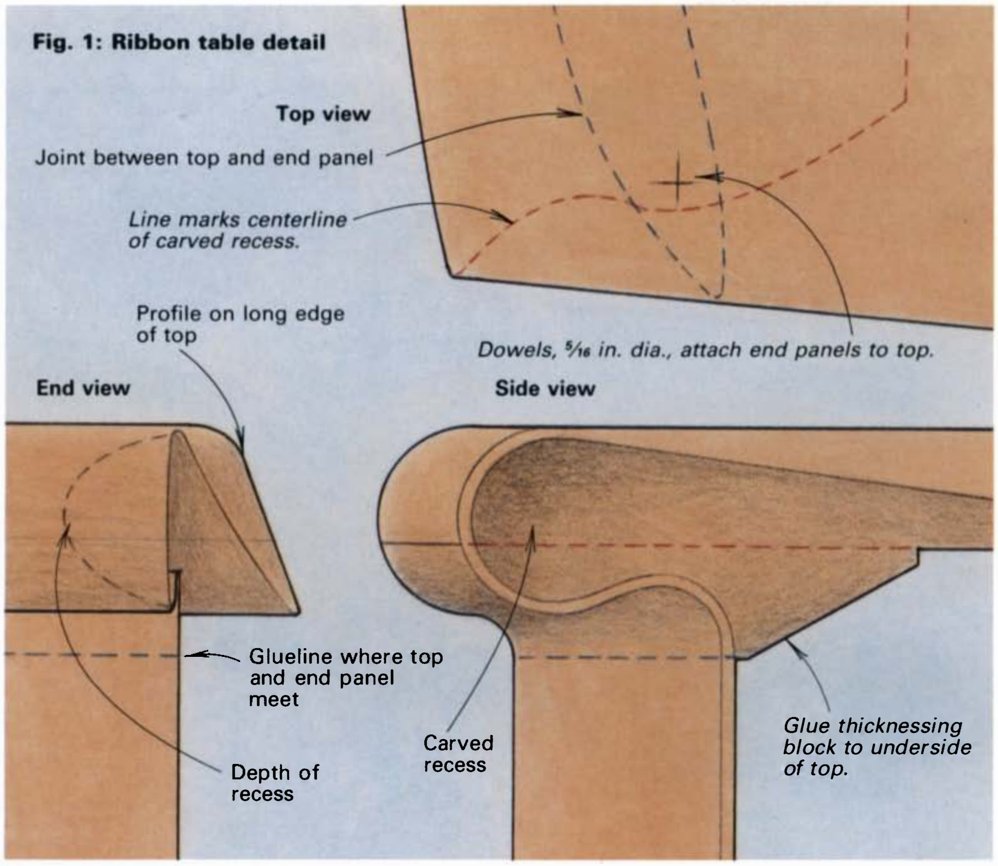
On the underside of the oval table, above, small buttons fit into grooves in the frame to hold the top rigid and flat, yet allow it to move across the grain in response to changes in humidity. A scaled-down blueprint, below, gives students all the information, dimensions and cross-section details they need to build the table.



for the bottom frame. The frames have a simple lap joint where they meet in the middle. Before gluing up the frames, chop the eight mortises and cut and fit the tenons in the ends of the uprights. The trick here is to keep everything perfectly square in every dimension by keeping the distances the same between the tenon's shoulders on the uprights' ends. If one length is off, either the top won't be level or the feet won't sit flat on the floor. Glue up the crossmember frames first, then glue in the uprights to connect the two frames.

Before shaping the edges of the base members, taper the ends of the upper and lower frames toward the ends with a spokeshave or drawknife. You could also taper these ahead of time with a taper jig on the tablesaw. Like the top's edge, the profile on the base's edges is not a regular curve. Powell designed the base members to be elliptical in cross section for more visual interest. Shaping it requires a template, to check the shape, and a lot of patience with a spokeshave, rasp and sandpaper. There are also recessed areas on the top and bottom sides of the legs that must be removed with a coarse file before shaping the elliptical edge profile. The bottom of the feet are chamfered slightly, after the edge shaping is done. The finished base is attached to the top with small buttons that screw to the top's underside and engage slots in the top frame, as shown in the photo on the previous page. This allows the solid-wood top to expand and contract freely.

Building the sinuous-line ribbon table requires coopering of the end panels as well as extensive carving of the ribbon-like edges. To build up thickness for the carving, extra wood is glued to the underside of the top around its edges.



Ribbon table

The second coffee table, known at Leeds as the ribbon table, is a graceful and very popular piece. Besides being a student project, the table is one of the Leeds shop's regular production models. With lines that make the wood seem like an undulating, continuous piece of fabric, the power and elegance of this table comes from the shaping that's done to the ends and edges of the top. Building the table is an exercise in coopering and carving, as well as planing and doweling.

Because this table has carving only on its ends and edges, you don't need to start with a 2-in.-thick plank. By using 6/4 lumber instead, the table will be lighter and you'll not waste as much carving time or material. Glue up an extra-large panel for the top that's about 10½ in. longer and 3 in. wider than the dimensions of the 4-ft.-long by 16-in.-wide finished top. This extra wood is sawn off and laminated to the ends and edges where needed to provide the necessary thickness for the carving. For the closest grain match, flip the pieces over before gluing them to the underside.

The end panels are glued up and shaped from the ends of the same boards used to make the top—so the grain will match. These panels are planed to an even-thickness curve, just like the end panels of the curved-dovetail table described on the next page. But the ribbon table's panels taper in thickness from ¾ in. down to ¼ in. at the sides so the thin edges meet the line of the carving at the top. After shaping, the panels are doweled into the thicknessing pieces, located as shown in figure 1. This glue-up should be done before the top is carved so the carving will create a smooth transition from the top's ends and edges into the tops of the end panels and will maintain a continuous ribbon illusion.

The shape of the ribbon-like details at the top's four corners is shown by the three views in figure 1 at left. To begin the carving, rough-out the inside of the hollow in each corner by drilling away the waste in the deepest parts with a ½-in.

Fig. 2: Curved dovetail table

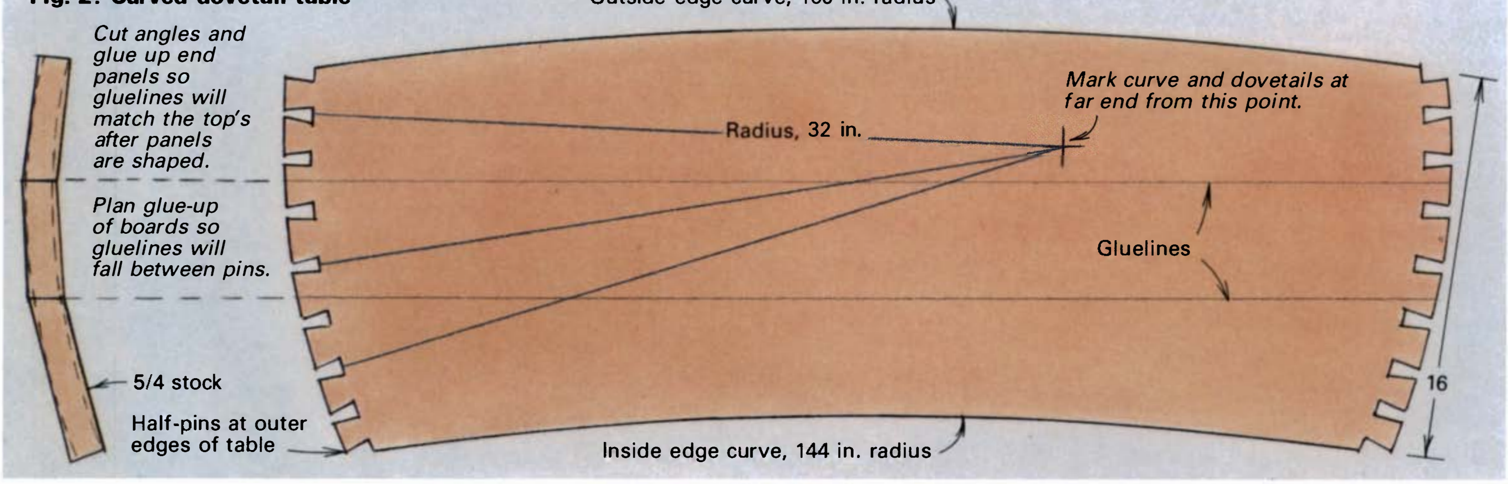
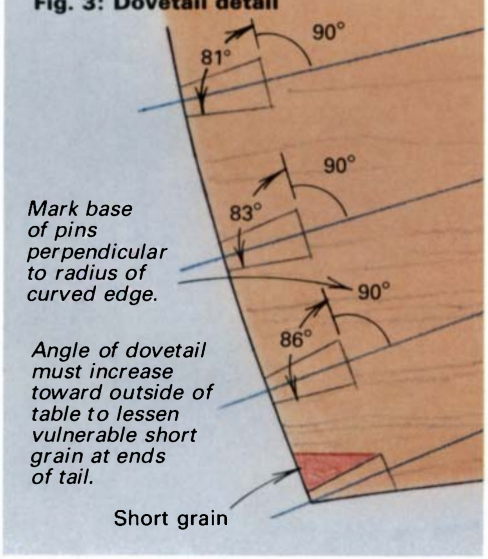


Fig. 3: Dovetail detail



This simple-looking table challenges the builder with laying out and cutting dovetails around a curved edge, as well as gluing up and coopering curved end panels. A subtle, large-radius curve along the table's length makes it more visually interesting than if it were straight.

twist drill chucked in a power drill or brace. The concave profile of the hollow can then be carved by scooping out the majority of the waste with gouges and then refining the shape with rifflers. The hollow tapers away as it wraps around under the top, as traced by the red profile line shown in figure 1. Next, carve the outside of each corner to define the recurving ribbon edge. Then, rough-out the curved overhanging lip on the table's ends with whatever seems to work best for you—a drawknife, a plane, gouges, or rasps and files. Take care not to undercut into the side grain of the end panel when carving the cove where the thicknessing piece meets the end panel: It'll spoil the smooth transition of the top flowing into the end. Refine and smooth the curves with scrapers and sandpaper. The profile of the long edges of the top are shaped last, using either a hollow-bottom plane, a regular plane or a spokeshave and sandpaper. Try not to overdo it with the sandpaper, and keep the ribbon edge crisp and well-defined.

Curved dovetail table

With its bench-like top and curved ends, this coffee table challenges its maker not only with tasks like coopering and handplaning a curved panel and cutting dovetails around a curved edge, but with a tricky layout as well. The table's 4-ft.-long top and ends must be made from the same boards so the grain will run continuously through the sides and top. But, the top and end panels can't be glued up into one big panel and then sawn apart into three separate pieces, because the top, viewed from above, is subtly curved. If you glue up a surface large enough to cut off the end panels adjacent to the top's ends, the grain in the panels will run diagonally instead of straight. Also, the end panels must be coopered so the same 5/4 lumber used for the top will allow the curve to be shaped (see figure 2). Carefully plan the layout of the top and end panels so the boards for these pieces can be cut out and glued up separately. When shaped and joined, the end panels' grain will match the top.

After the edge angles of the end panels are coopered with a jointer plane, the panels are glued up and then shaped into smooth curved surfaces. After marking the radius on the endgrain with a cardboard template, use a convex-sole plane to shape each panel's concave inner surface. Take long, even strokes so the curvature will be even and not dip in the middle. The outside of the radius can be shaped with a regular jack plane: Start by planing a series of facets to follow the radius. When close to the final shape, switch to a scraper and then sandpaper to refine the curve and smooth the surface.

The curved dovetails that join the top to the ends are laid out radially around the top's ends. Once these are marked correctly, they're easier to cut than they appear. Take a straightedge aligned to a point that's at the center of the end's 32-in.-radius curve and mark the centerline of each pin on the table's top. Space the pins evenly around the curve. Next, draw the tails on the top. There's a bit of realignment you must do to the tails closest to the top's concave edge at both ends: Skew the angles of these dovetails, as shown in figure 3, so that the short grain at the outermost corners of the tails won't break off when you chop out the waste. Because it's easier to mark the dovetails on the table's top, it's best to cut the tails of curved dovetails first, then mark and cut the pins on the end panels. Tierney advises his students to saw for a perfect fit without trimming. He says it's easier to saw to the line than to try and clean out these dovetails with a chisel after sawing. After gluing, any unevenness is planed flush, and the top is planed flat with a smooth plane. ☐

Suzanne Burns is a reporter for The Valley Advocate *in Hatfield, Mass. David Powell and John Tierney assisted in the preparation of this article.*

Bullnose Edge Sander

A low-cost method for sanding in tight places

by Lynn McSpadden

Fig. 1: Sanding table

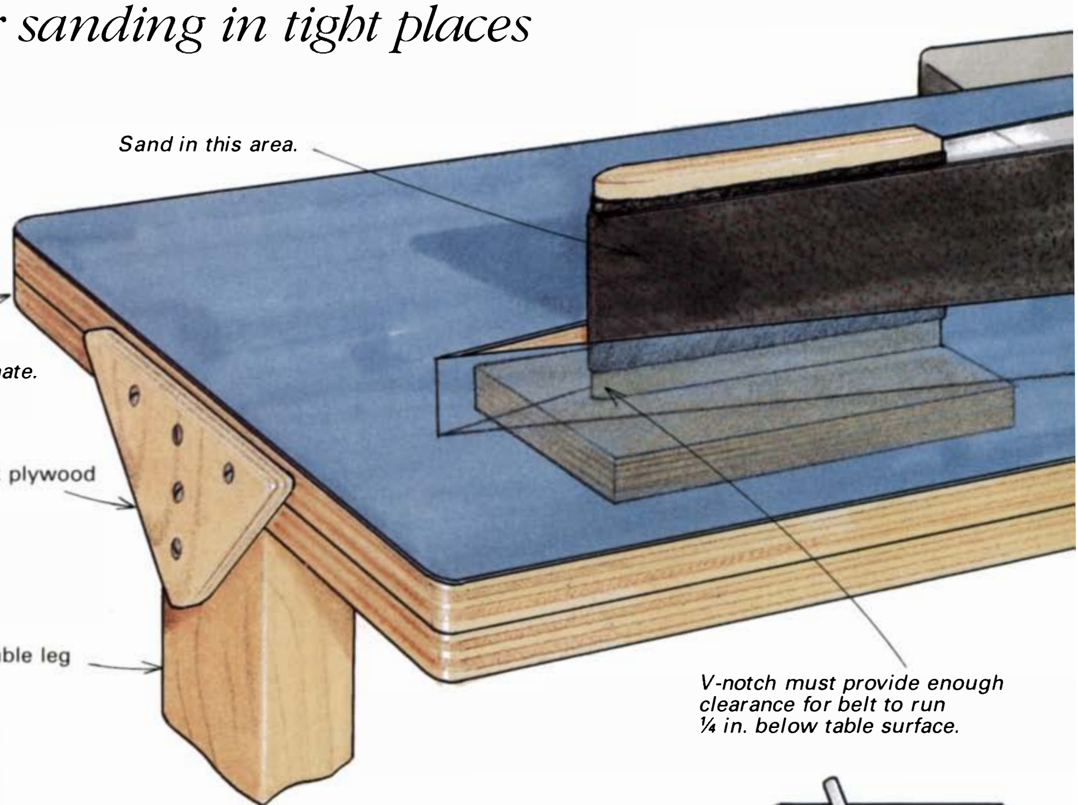


Fig. 2: Making the bullnose block

Make bullnose block by joining ¾-in. plywood strips to form an inverted T.

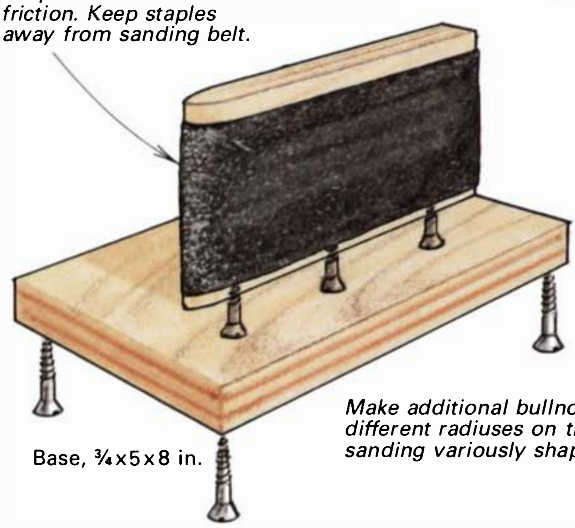
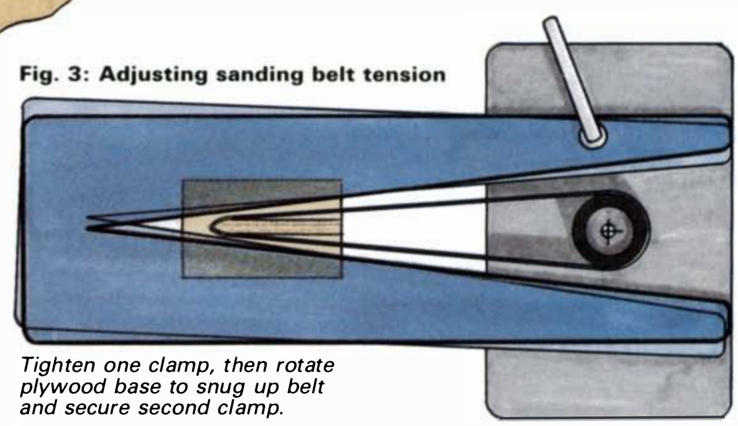


Fig. 3: Adjusting sanding belt tension



Tighten one clamp, then rotate plywood base to snug up belt and secure second clamp.

My company builds more than 1,500 mountain dulcimers a year. Until recently, we hand-sanded the scroll on every peg box. Since hand sanding was as boring as it was time consuming, I decided there had to be a power sander that could do the job more efficiently.

I first tried an oscillating spindle sander, but it proved to be just as slow as hand sanding and it left a bumpy surface. The edge belt sander I purchased operated at 3,030 sanding feet per minute (SFPM), and the belt tended to cut right through our delicate dulcimer parts. Flexible brush-style sanding wheels didn't work either, because they rounded edges too much.

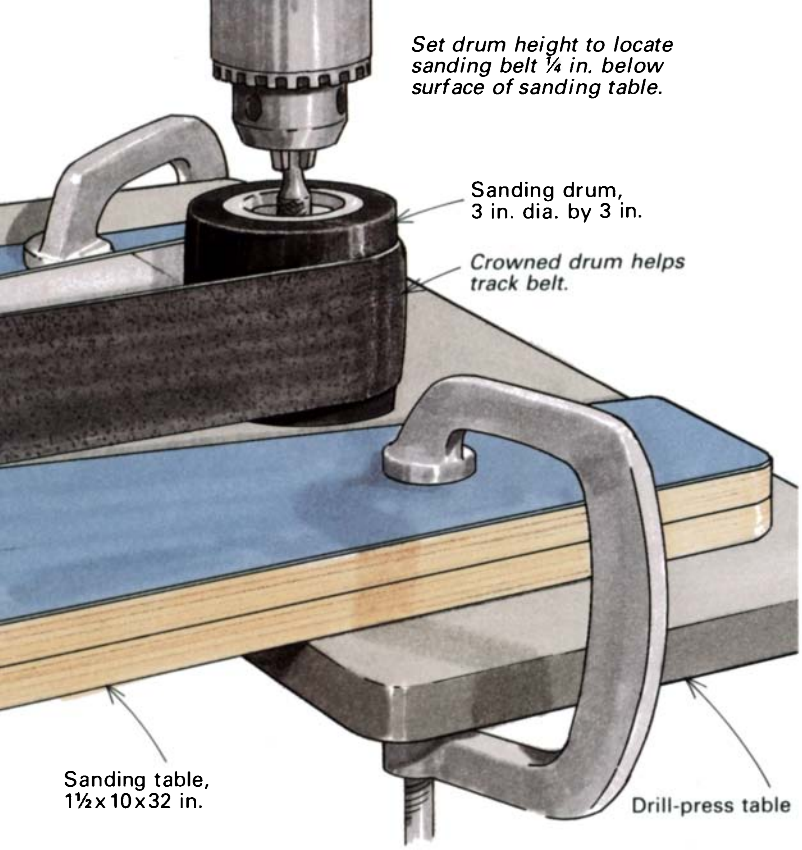
Since none of the commercial sanding machines could end the boredom of hand sanding without sacrificing quality, I finally decided to build my own power sander. It cost me about $10 and is nothing more than a sanding belt that travels around a "bullnose" block, a radiused and tapered plywood strip that's mounted upright through the crotch of a deeply V-notched plywood base. The plywood base clamps to a drill-press table. The sanding belt is driven by a 3-in.-dia. rubber sanding drum chucked into the drill press. The belt rides just below the surface so the pieces will sand flush to the table.

I use the radiused end of the bullnose block to sand inside curves and its tapered sides to sand flat places. Adjusting the drill-press spindle RPM allows me to sand at 800 SFPM to 1,000 SFPM, a speed range that's slow enough to control material removal and slow enough to avoid burning the wood. Because the bullnose block is held in place with four wood screws, it is easily removable, making it simple to install differently radiused bullnose blocks to sand differently shaped workpieces.

Building the sanding table—I glued and screwed two ¾-in. pieces of plywood together to make a 1½ x 10 x 32-in. table. The dimensions depend on the size of your drill-press table and the length of your sanding belt. I V-notched the table to a length that would accommodate a 48-in. sanding belt, and I made the mouth of the V wide enough to accommodate a 3-in. sanding drum.

I found that clamping the long sanding table to the drill press caused the drill press to tip easily while sanding, so I mounted a leg to the front of the table. In addition to adding support, the leg also reduces vibration while sanding. Simply screw the leg to the end of the sanding table with a gusset made from ½-in. plywood (see figure 1).

Drawing: Bob La Pointe



Because I wanted the pieces to slide easily, I cemented plastic laminate on the sanding table's top. A laminate trimmer or router with an edging bit works well for trimming the laminate to size and for notching it to match the base. So the bullnose block will seat properly and there will be adequate clearance for the sanding belt, file the crotch of the V in the laminate to a point that matches the crotch in the plywood base.

Making and mounting the bullnose—The base of the bullnose is made from ¾x5x8-in. plywood. The bullnose block is made from ¾-in. plywood, and it should be 8 in. long and tall enough to accommodate the width of the sanding belt. Radius the bullnose block with a belt sander, making sure the block remains square to the top and bottom. Sand the sides of the bullnose so the block tapers smoothly from the wide back edge to the radius in the front. This radius is determined by the size of the workpieces to be sanded. My bullnose block has a ¼-in. radius that fits the inside curves of the bandsawn dulcimer scrolls. Generally, the radius should be slightly smaller than the inside curve or recess to be sanded so the workpiece won't wedge against the belt. A smaller radius also gives more control, because the workpiece can be moved around on the bullnose block.

Glue and screw the bullnose block at 90° to the base and let it dry. The belt won't track properly unless the bullnose block is mounted at exactly 90°, front to back and side to side, so check both planes with a try square. Before using the bullnose, staple graphite cloth around the bullnose block (available from many supply houses, such as Derda Inc., 1195 E. Bertrand Road, Niles, Mich. 49120; 616-683-6666). This graphite cloth reduces friction between the back of the sanding belt and the edge and sides of the bullnose block. Locate the staples at the back of the bullnose block so they won't contact the sanding belt (see figure 2).

To ensure pieces are sanded flush to the table, the belt must travel at least ¼ in. below the sanding table's surface. This means the bullnose block must be mounted so the sanding belt can easily pass between the sides and crotch of the V and the radiused end and sides of the bullnose block. Push the bullnose block through the bottom of the table, with its radius facing the V crotch, so it protrudes through the sanding table's top. Then, back the bullnose block away from the crotch until there is enough clearance for the sanding belt, and secure it in place.

Setting up the sander—To mount the sander, loosely fasten the plywood base to the drill press with a couple of clamps. On a radial drill press (one with a tilting head) or on a drill press with a tilting table, the spindle must be squared to the table or the belt won't track correctly. Install a drill in the chuck and use a small try square to square the bit to the drill-press head or table.

Mount the rubber sanding drum in the drill-press spindle. A 3-in.-dia. by 3-in.-high sanding drum is available from Garrett Wade, 161 Ave. of the Americas, New York, N.Y. 10013; (800) 221-2942, or (212) 807-1757 in New York, Arkansas and Hawaii. Normally, rubber sanding drums are used with a sanding sleeve. A nut or screw on one end of the drum is tightened enough for the drum to expand and hold the sleeve in place. Instead of using a sanding sleeve on the drum, I overtighten the drum until it crowns in the center. Crowning increases the drum's center diameter, creating more tension in the belt's center, which helps the belt track straight. Install the sanding belt and raise or lower the quill until the belt is at least ¼ in. below the surface of the sanding table and the bottom edge of the belt is parallel with the entire length of the V in the sanding table.

After the belt is aligned, tighten one of the clamps, then rotate the plywood base until the belt tension is just tight enough so the sanding belt won't slip on the drum when the drill press is turned on (figure 3). If the tension is too high, the belt won't track properly, the sanded surface will be rough and the graphite cloth will wear out more quickly. Properly adjusted, the belt should run smooth and true and only slip when you apply excessive sanding pressure.

I used to make my own 48-in. sanding belts out of J-weight, 120-grit garnet paper, because its backing was strong yet flexible enough to travel around the tightly radiused bullnose block. (For more information on making sanding belts, see *FWW on Making and Modifying Machines*, p. 51.) Now I find it simpler to rip up standard J-weight, aluminum-oxide belts to the width I want. Using a sanding belt with the narrowest width possible for the work you're sanding will reduce friction at the bullnose block and help the belt track better.

It might be possible to use a shorter belt, but a wider bullnose block would be required to fit a wider and shorter V notch. A longer belt means a longer table must be made, and I don't think a longer belt would sand any better than a shorter one.

Adjusting sanding speed—The slower the sanding speed, the more control you'll have and the smoother the finish. The circumference of a 3-in.-dia. sanding drum is about 9½ in. So, with the spindle running at 1,000 RPM, the sanding belt is traveling 9,500 in. per minute. Dividing by 12 gives you 791 SFPM. Raise or lower the spindle RPM to adjust the belt to the SFPM you need.

When my company's production is in high gear, we run our bullnose sander eight hours a day for four consecutive days. The graphite cloth must be replaced every three to four hours. We go through about six sanding belts, but we make short work of the 1,500 peg boxes we used to hand-sand.

There was a time when I planned on making a much fancier model, complete with inlays and a couple of racing stripes to match our drill press. But, this first bullnose sander has worked so well from the start, I've decided to stay with it. □

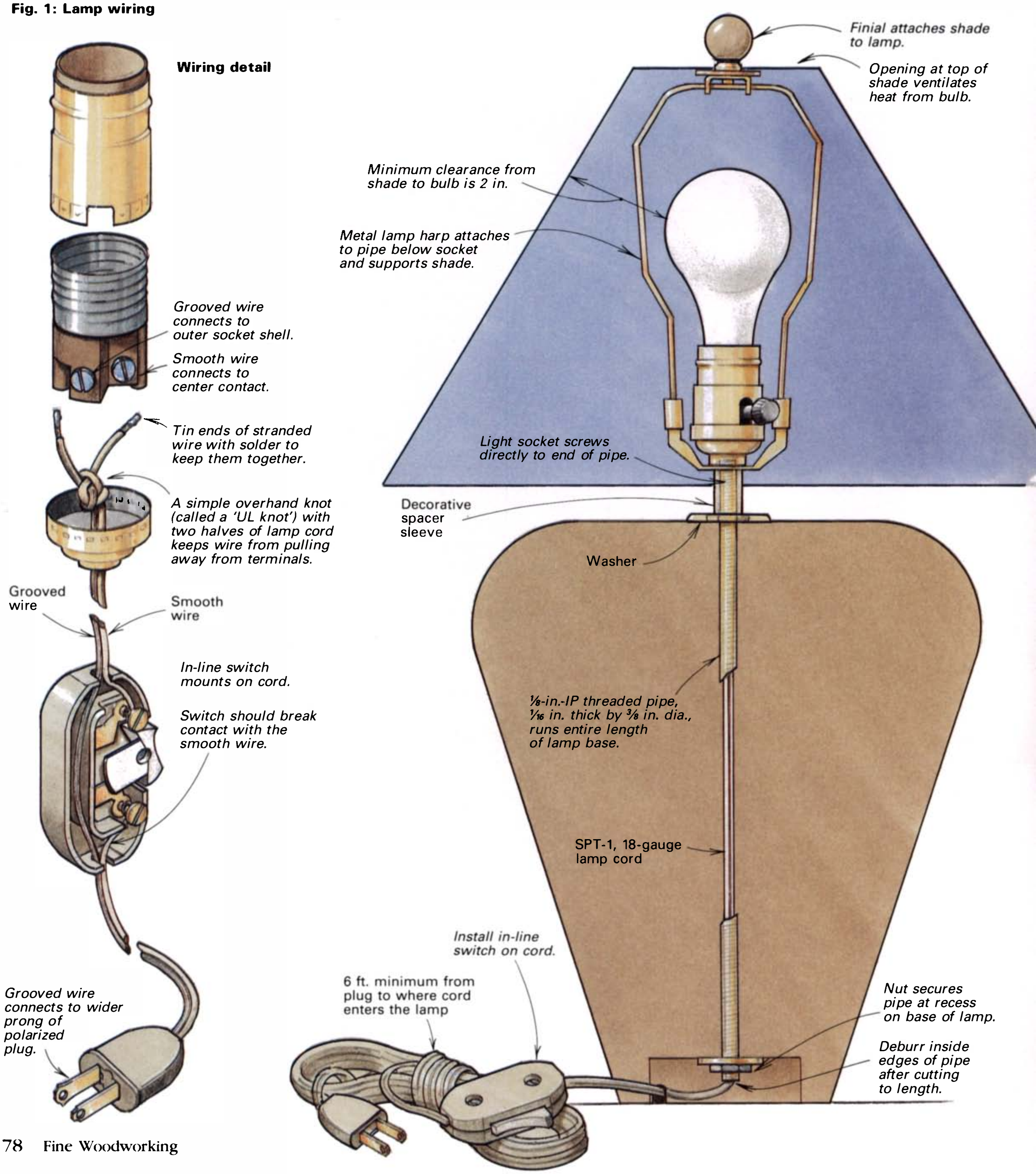
Lynn McSpadden builds dulcimers and dulcimer kits. He lives in Mountain View, Ark.

Wooden Lamps

Safe wiring for shop-built lighting

by Sandor Nagyszalanczy

Fig. 1: Lamp wiring



A well-designed and skillfully crafted wooden lamp easily rivals the design sophistication and complex construction of even the fanciest furniture: The wooden parts can be turned, carved, stack-laminated, steam-bent, veneered, carcase-built or produced by any combination of woodworking techniques. The lampmaker must be something of a jack-of-all-trades, because fitting lamp hardware involves some metalworking or at least plumbing ability, and making a custom shade may require sewing or glassworking skills. The most important factor, though, is knowing how to wire the lamp safely. An improperly installed cord or a shade too near the bulb can send the lamp, and perhaps the house, up in flames.

Fortunately, you can minimize the fire and electrical hazards by observing some well-established wiring principles. Safety guides for lighting devices, both portable and built-in, are available from the Underwriters Laboratories Inc. (UL), a for-non-profit public safety organization that tests and certifies lamps and other appliances by evaluating the potential fire, electrical and casualty hazards (base stability, sharp edges, etc.). These safety guides are not "how to" books, but they give exact precepts for properly engineering a safe lamp. While UL certification isn't usually required to make or to sell a lamp (check your local electrical building codes), it's foolish to build one without following these nationally recognized safety requirements. Here I'll only deal with the basics of safely wiring a wooden lamp, but for the whole story, order the safety guides listed below.

As you design your lamp, you must consider all the required electrical components. You must decide what wire to use, how to connect it and how to pass the wire through the lamp. Methods for attaching the bulb socket and other lamp parts, such as shades and switches, to the lamp base must be developed. You must provide clearance between the bulb and the shade and a way to vent the bulb's heat. The electrical factors may influence the proportions of your lamp, the size or shape of the shade, or even the way you'll build the wooden body. If you want the wire to pass through the wood base or column, for example, it would be simpler to laminate the column with an open channel in the middle, instead of drilling a long hole through a solid block.

Wire for a lamp must be of the correct gauge and insulation type so the current won't overheat the wires and cause a fire. The most commonly used wire is SPT-1, a two-wire cord often called lampcord or zipcord (because the two individually insulated wires easily peel or "zip" apart). Eighteen-gauge is the recommended size (thickness) wire for lamps with a single bulb smaller than 100 watts. Multiple-bulb lamps may require 16-gauge or larger. Wire is also rated for its insulation qualities as 60C, 75C, 90C and 105C, standing for heat resisitance in degrees Celsius. Wire that's 60C is most commonly available from lighting stores, but UL specs for wooden lamps often require 105C-rated wire: The higher-rated insulation will give a wooden lamp more protection from heat and prevent a possible fire. (SPT-1 wire that's 105C-rated is available from local lighting shops or electrical supply houses.) If you're in doubt about which wire to use—or any other specifics about wiring your lamp—consult the proper UL safety guides.

To prevent accidental overloads or short circuits, a lamp should be lined with metal—either pipe, tubing or sheet metal—wherever wires pass through wooden parts. The standard conduit for lamps is a special threaded pipe called ⅛-in.-IP (the IP stands for "inside perimeter") available from lamp shops or electrical supply houses. Most standard lamp sockets screw directly onto ⅛-in.-IP, making it a convenient way to secure a socket to a lamp. The pipe fits through a ⅜-in. hole in a lamp and should be made long enough to extend at least 2 in. past the wood at the socket end. This keeps any possible shorts that might occur in the socket from igniting the wooden base. Threaded nuts on the ends lock the pipe/socket assembly to the lamp. To prevent jagged edges from slicing into the cord, always deburr inside the pipe's ends with a reamer or sandpaper after the pipe is cut to length with a hacksaw.

Wiring—The socket, plug and switch must be wired for correct polarity (yes, AC current has hot and neutral wires, like DC). First, thread the wire through the lamp, leaving at least 6 ft. of wire for a cord—a UL safe minimum. Notice that the rubber insulation of the SPT-1 cord has a smooth side and a grooved side. At the wallplug end, connect the grooved wire to the wider prong of a polarized 110v plug (I use a Leviton #205). Some plugs have screw terminals, others just clip over the end of the cord. Regardless of the plug type or brand, always use UL-listed lamp plugs and parts for safety. At the lamp-socket end of the cord, pull apart the cord's two halves and tie a "UL knot," as shown in the drawing. This prevents the wires from being pulled off the socket terminals and out of the lamp. If the knot won't fit at the socket, you can provide this "strain relief" by tying a knot anywhere before the cord exits the lamp. A ceiling lamp is sometimes hung entirely from its cord, but this requires a special kind of wire. Consult the UL-57 safety guide on fixtures for details.

To keep the stranded SPT-1 wire from frazzling, apply a little solder to the stripped ends of each wire before screwing them to the socket terminals. The grooved wire goes to the screw feeding the bulb socket's outer shell and the smooth one goes to the center contact. Avoid splicing wires inside the lamp, unless wires from several sockets must be joined together. In that case, use either special UL-rated connectors (I use 3M #557), or solder the wires together and use wire-nut connectors and house the splices in a metal junction box. If there isn't room in the lamp for a metal box, as might happen with a ceiling lamp with several sockets, you can lead the separate wires out of the fixture and then wire these together to the feed wires inside the metal box in the ceiling.

Unless your lamp will be permanently mounted and controlled by a wall switch, you'll need an on/off switch on the lamp or on the cord. You can use a light socket with a built-in rotary switch or pull chain or install an in-line switch right on the cord. In-line dimmer controls are also available so the bulb's brightness can be adjusted. Make sure to use a switch with a current rating higher than the wattage of the bulb or bulbs. When connecting the switch, make sure it breaks contact with the smooth wire of the cord for correct polarity, as shown in the drawing.

Shade design—Lamp shades can be made from just about any material, as long as a few rules are observed. Design the shade so the bulb will stay at least 2 in. from any combustible material, including wood, paper, plastic or fabric. When using a flexible shade material that may sag, make sure the shade frame keeps it from contacting the bulb. The easiest way to attach a shade to a lamp is with a metal lamp harp. The harp's two legs slip in and out of a special clip that fits on the ⅛-in.-IP, just below the socket. A short, threaded rod secures the shade on top. Harps come in different sizes and heights to work with almost any shade-and-bulb combination. If you decide to support the shade with a wooden frame, make sure the base attachment is secure and the shade can't be easily tipped off the base and onto the bulb. Because incandescent bulbs produce a lot of heat, the lamp shade needs an opening at the top to allow the heat to dissipate. A 6-sq.-in. opening at the top of a shade will be more than enough for a 75-watt bulb, the maximum bulb strength I recommend for a wooden lamp.

The size and type of bulb you use can influence the size and proportions of the lamp base and shade, as well as determine the amount and the quality of light. Bulbs and their corresponding sockets come in a multitude of shapes and sizes to fit the application. For example, a large globe-type bulb is decorative enough and gives off a soft enough light to be used without a shade, while a tubular bulb, the kind often found in aquarium hoods and display cases, may fit a lamp design that has little shade clearance. Although I've limited my talk to incandescents, there are many other light sources appropriate for wooden lamps. A cool-burning fluorescent or neon fixture may be the ticket for a lamp design that doesn't allow much ventilation, while a quartz halogen bulb gives off tremendous amounts of light—great for a floor lamp used to flood a whole room. There are still other light sources such as LEDs (light emitting diodes) or DC-powered fixtures. While these light sources may fit your lampmaking needs better than garden-variety incandescents, they require different lamp hardware and wiring know-how. If you want to use these, it's best to consult someone from a local lighting shop. □

Sandor Nagyszalanczy is an assistant editor for Fine Woodworking. *Lampmaker Ellis Walentine contributed to this article. Safety guides UL 57 on lighting fixtures, UL 153 on portable lamps, UL 1571 on incandescent lighting fixtures and a free catalog of other lighting publications can be ordered from Underwriters Laboratories Inc., Publication Stock Dept., 1285 Walt Whitman Road, Melville, N.Y. 11747; (516) 271-6200.*

Bright ideas

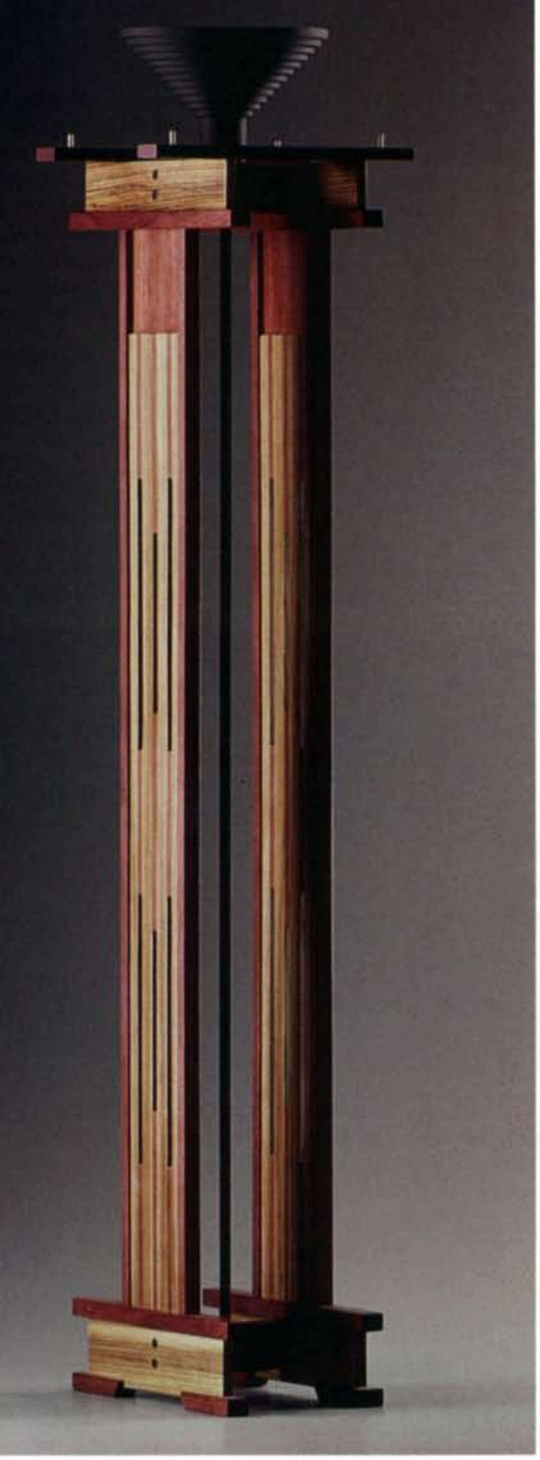
A well-designed lamp is more than just a good-looking furnishing: It must also provide good light. The definition of good light depends on the lamp's function. A successful floor lamp should give off enough light to flood a room, while a sconce usually only needs to deliver dim, mood lighting. The lampmaker can control the quality of the light a lamp produces by first choosing the appropriate strength and type of bulb. Most bulbs create white light with a more limited color range than sunlight. For example, an incandescent bulb's color will appear warmer than a cool-white fluorescent bulb's color. Secondly, the lampmaker can choose the shade material and control the shape of the shade. A shade made of paper, fabric or thin wood may diffuse and soften the light passing through it and give it a warm color as well. An opaque shade or reflector serves to deflect the harsh light of the bulb and keep it out of our eyes—important for a good reading or desk lamp. The smaller or more open a shade is, the more direct light from the bulb bounces off the walls and ceiling. This not only diffuses the light, but it can create some interesting light patterns as well.

Like a piece of furniture, a wooden lamp can be designed to fit a particular look or style, such as art nouveau, Queen Ann or Post-Modern. Some lamps are designed to harmonize with the furnishings or architectural elements of the room they light. Other lamps are purely sculptural and produce light only as an incidental effect. Consider the lamps pictured in the following pages as illustrations of the many possibilities. The makers range from architects to cabinetmakers to professional lampmakers. —*S.N.*

Photo above: Anthony Kamadulski; photo below: Paul Schraub

The 21-in.-high lamp, above, built by Matthew Beardsley of Ennis, Mont., has a shade made from 1/32-in.-thick basswood veneer and reinforced with battens. The tic-tac-toe rosewood base is joined by lap joints, with bridle joints attaching the base to the eight vertical members. The lamp features a copper plate sandwiched into the base and one built into the frame supporting the shade, providing a light-socket platform.

Roy Johnson of Santa Cruz, Calif., is proud that no store-bought hardware shows in any of his lamps. In fact, he makes most of the parts himself, including the glass shades. The stained-glass shade on this table lamp at right has a wood rim supported by four curvacious arms atop a two-piece turned base. All the wood parts are Honduras mahogany, except the ebony pegs in the rim and the carved ebony switch handle out of sight under the shade.



Anthony Beverly of Stephentown, N.Y., built this 76-in.-tall floor lamp, left, with wooden components that bolt together, both to allow the lamp to knock down for shipping and to make finishing easier. The zebrawood and purpleheart lamp is topped by an aluminum shade that's been painted black on the outside with an electrostatic coating process that prevents the heat of the 500-watt quartz halogen bulb from harming the paint. Beverly designed the shade and had it spun to shape by a local metal-spinning shop.

This 18-in.-high wall sconce, right, by Geoffrey Warner, an Exeter, R.I., woodworker, is made from curly maple with padauk line inlay. A turned-padauk knob on the front operates a built-in dimmer switch that adjusts the brightness of the light. Blue European-made glass backs a cutout on the front of the sconce. Warner sandblasted the glass so it would transmit a more diffuse light. A triangular box at the base houses the dimmer and lamp socket. The sconce mounts to the wall by means of a sliding metal bracket normally used to attach bed rails to their posts.

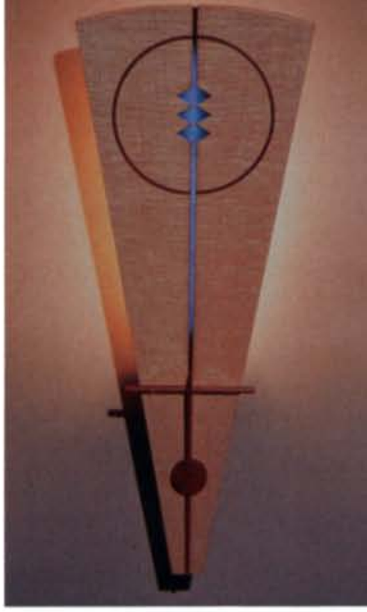
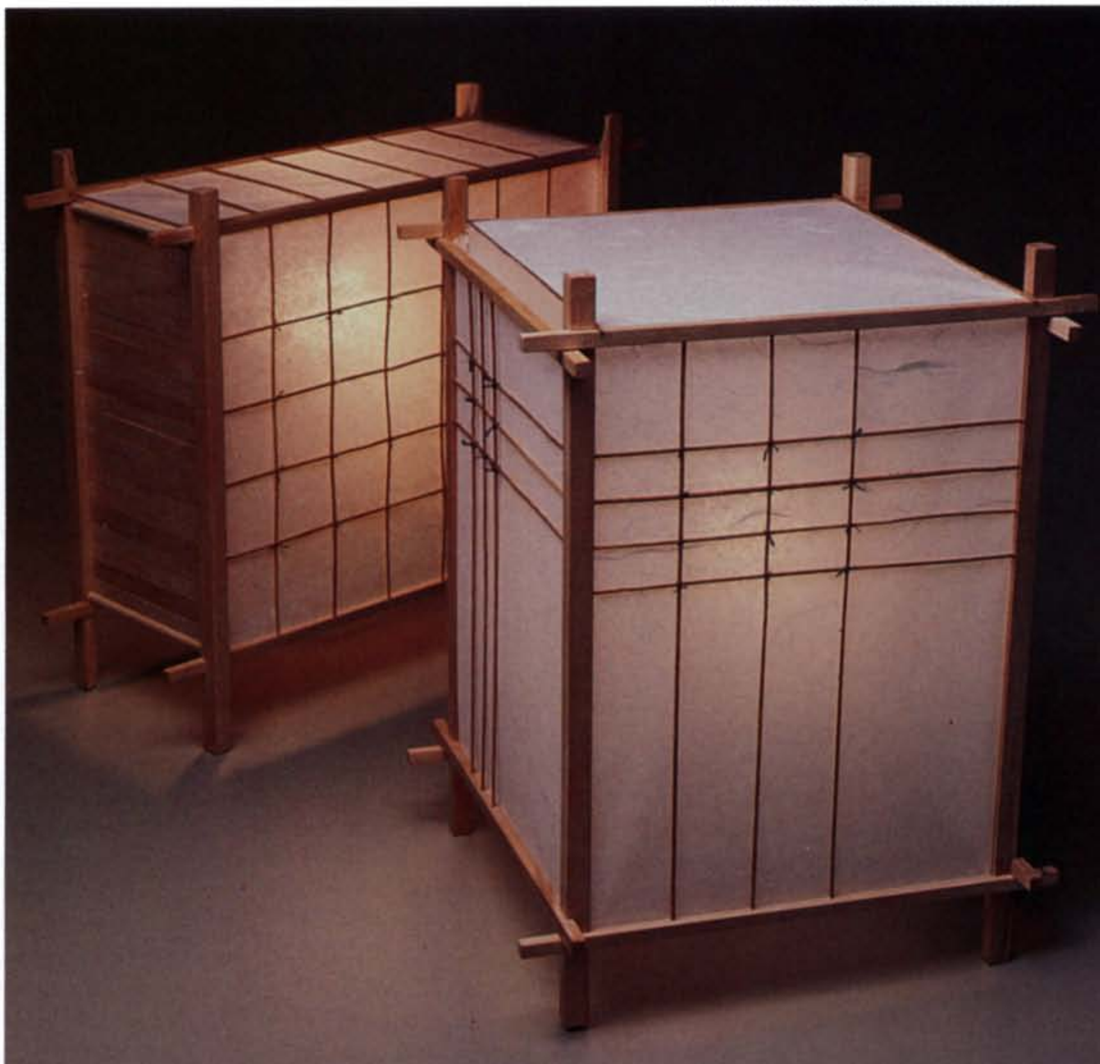


Photo below: Ron Forth; photo above: Paul Ladd

Photo above: Bill Murphy; photo below: Chip Mochel



Tapping into the style and materials commonly found in his ceramic/mixed-media sculpture, Thom Maltbie of Dillsboro, Ind., created these two rice paper and maple Japanese lanterns, above. Maltbie used pinned lap joints for the corners of his lamp frames and let the slats into grooves in the frames for the sides of the narrower lamp at the rear. The latticework is made from split bamboo sticks let into holes in the frame and tied with thin strips of linen. Although Maltbie often uses flourescent fixtures to reduce heat, the bulbs in these two lamps are low-wattage incandescents.

A woodworking school project to design a lamp resulted in Chip Mochel's 'Disclamp.' The spherical lamp, left, is made up of 13 hardwood discs, ⅛ in. thick, with walnut veneer laminated on one side and white plastic laminate on the other. A tubular, incandescent bulb (the kind used for a display case or aquarium hood) mounts vertically in a socket in the crescent-shape arm that holds the discs, and it pierces each of the discs through a 2-in. hole in the center. Mochel lives in Roswell, Ga.

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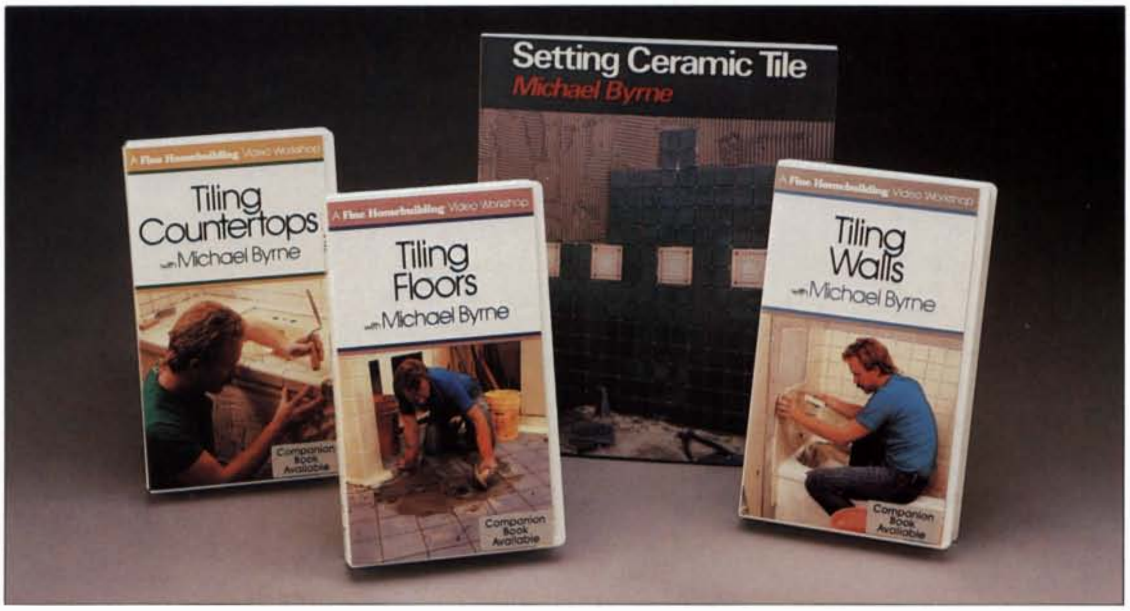

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Note: The tapes are keyed to Byrne's book with page references right on the screen.

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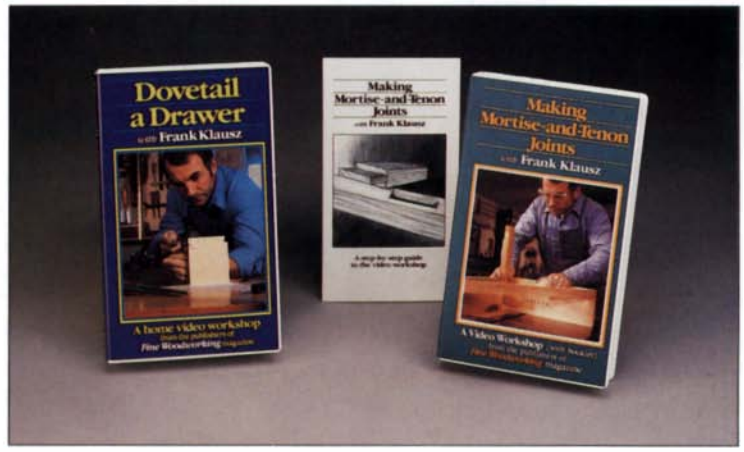

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You'll also find out how to determine which joint is best for which application, and how to work with a variety of common tools and machines, including the tablesaw, bandsaw, router, hollow-chisel mortiser, and basic hand tools. An illustrated booklet that outlines all the procedures Klausz covers is included with the tape. This guide will help you take what you've learned back to your own workshop. *60 minutes, $29.95 (Rental: $14.95)* ***#621 (VHS), #622 (Beta)***

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You'll also learn about tools and techniques that will come in handy on a variety of other woodworking projects. Klausz shows you how to use a backsaw, chisel, and smoothing plane confidently; and how to rip, crosscut, and dado safely and efficiently on power machinery. Throughout the tape, Klausz slows down his work deliberately, showing and explaining exactly how he handles each step. *60 minutes, $29.95 (Rental: $14.95)* ***#601 (VHS), #602 (Beta)***

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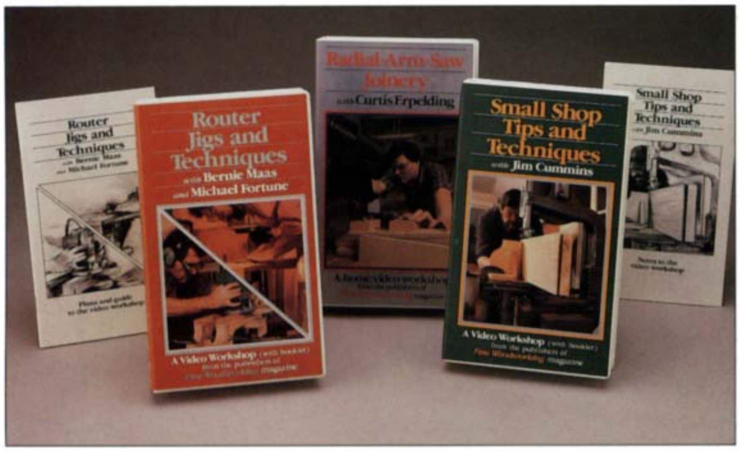

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Find out what your router can really do. Experts Bernie Maas and Michael Fortune show you dozens of ways to increase your productivity and creativity with this versatile tool. Maas focuses on basic router joinery, covering mortise-and-tenon joints, sliding dovetails, and spline joints. He also explains why the router is safer, cheaper, and easier to use than stationary machines.

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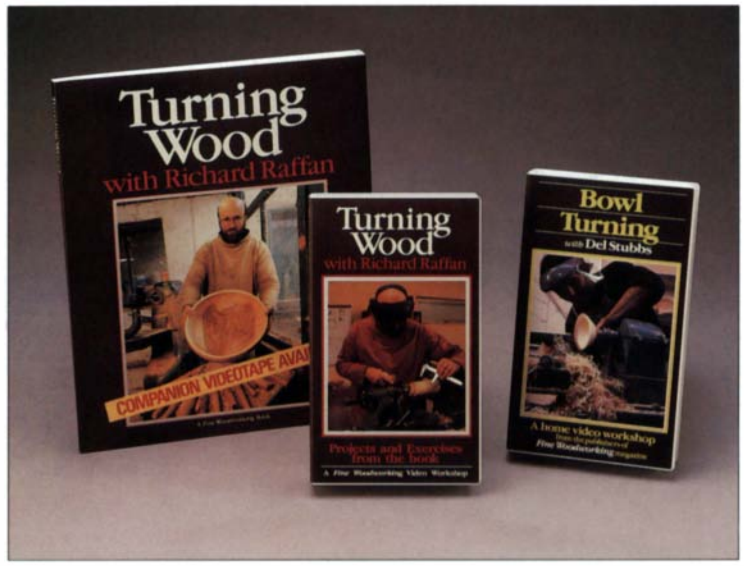
Turning



Turning Wood with Richard Raffan

Produced and directed to complement the dynamic details of Raffan's book, this video lets you experience the work of a master woodturner from a variety of useful perspectives: up close, over Raffan's shoulder, and from a distance. Raffan demonstrates his tool-sharpening techniques and a series of gouge and skew exercises. He then takes you through six complete projects: a tool handle, light-pull knob, scoop, box, bowl, and breadboard. Page references right on the screen refer you back to the book. *117 minutes, $39.95 (Rental: $14.95)*
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What's more, the video format lets you get up close to see the careful contact of edge on wood and then step back to study the various tool positions, grips, and stances that are so important to good turning. Stubbs's easy-to-follow approach and polished techniques are sure to help you become a better bowl turner. *120 minutes, $39.95 (Rental: $14.95)*
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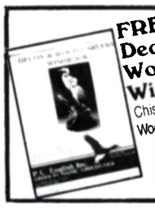

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Listings of gallery shows, major craft fairs, lectures, workshops and exhibitions are free, but restricted to happenings of direct interest to woodworkers. We'll list events (including entry deadlines for future juried shows) that are current with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

***ALASKA:* Seminars**–A number of seminars and workshops offered by the Alaska Creative Woodworkers Association for its members. For more information, write 2136 Alder Drive, Anchorage, 99508, or call (907) 278-2455.

***ARKANSAS:* Show**–2nd Annual "Turned Wood Objects Show," Oct. 1–Nov. 6. For more info., contact Tony Bilello, Gallery B, 11121 N. Rodney Parham Road, Little Rock, 72212. (501) 221-0266.
Workshop–Furniture design and construction by master woodworker and furniture designer Frank Ferraro, July 11–15. Contact Frank Ferraro, Gallery B, 11121 N. Rodney Parham Road, Little Rock, 72212. (501) 221-0266.

***CALIFORNIA:* Show**–Woodcarving fiesta, Sept. 10–11. The Barn, Pacific Ave., Livermore. Free admission; 10 A.M. to 5 P.M. For info., contact Liz Finigan, Tri-Valley Chapter, Calif. Carvers Guild, 587 South N St., Livermore, 94550.
Show–"Wood Carvers Expo '88," 2nd annual benefits show, Aug. 27–28. Devonshire Downs, Northridge. Admission: $2.50 adults, 75¢ children 5–12. For more info., contact Calif. Carvers Guild Headquarters in San Simeon at (805) 927-4718; Los Angeles residents call DandeR Productions at (818) 363-0420.
Class–Building the petaluma, a 19½ ft. rowing shell, with Simon Watts, July 23–30. Contact National Maritime Museum, Crissy Field, San Francisco, 94129. (415) 929-0202.
Craft fair–1988 American Craft Council (ACC) Craft Fair for wholesale buyers, Aug. 10–11. Fort Mason Center, San Francisco. For more info., buyers may call the buyers-only phone at (800) 527-3844; in NY and outside the U.S., call (914) 255-0039 between 9 A.M. and 5 P.M. EST.
Exhibition–"New Furniture '88." Deadline for entries, July 25. Work will be exhibited in Oct. '88 in downtown San Diego and in San Diego Home/Garden Magazine. Call (619) 233-4567 for applications. Entry fee: $25/pros; $15/amateurs and students. Sponsored by Ilan Lael, 4131 Redwood "D," San Diego, 92105; (619) 294-9222 and San Diego Home/Garden Magazine.
Workshop–Lumber drying, Aug. 1–5. Univ. of Calif. Forest Products Lab, 1301 S. 46th St., Richmond, 94804. Call Tom Breiner at (415) 231-9487 for information.

***COLORADO:* Workshop**–Greenwood chairmaking with Drew Langsner, Sept. 26–30. Pingree Park, Colo. State Univ. Mt. Campus. Contact Peter Haney, Box 581, Ft. Collins, 80521. (303) 224-3324.
Workshops–17 one- and two-week summer workshops, the 1988 furniture design symposium "Making a Living," and a weekend workshop with Sam Maloof, June–August. Anderson Ranch Arts Center, 5263 Owl Creek Road, Box 5598, Snowmass Village, 81615. (303) 923-3181.

***CONNECTICUT:* Exhibition**–Beginning of a series of designer showcases, Sept. 13. Gallery for Fine Contemporary Crafts, 14 Liberty Way, Greenwich, 06830. (203) 661-0014.
Classes–5-day courses and over 70 one- and two-day workshops, June–Aug. Call or write for free catalog, Brookfield Craft Center, 286 Whisconier Road, Brookfield, 06804. (203) 775-4526.
Juried show–31st annual crafts exposition, July 11–16. Historic Guilford Green; 12 P.M. to 5 P.M. For information, write Guilford Handcrafts Expo., Box 589, Guilford, 06437, or contact Fernn Hubbard or Joyce Wright at (203) 453-5947.

***GEORGIA:* Juried exhibit**–1988 (35th) Arts Festival of Atlanta "Artists Market," Sept. 10–18. Interested participants must write the Arts Festival of Atlanta, 1404 Spring St., N.W., Suite 1, Atlanta, 30309, or call (404) 885-1125 to obtain prospectus and application procedures.

***IDAHO:* Juried show**–20th annual "Art on the Green" festival, Aug. 5–7. Deadline for entries, July 21. For entry blanks, contact Citizens Council for the Arts, Box 901, Coeur d'Alene, 83814.

***ILLINOIS:* Seminar**–Walt Mayer, handcarving wooden feathers, July 24. Free; 12 P.M. to 5 P.M. Tom's Woodshop Inc., 106 South 3rd St., Bloomingdale, 60108. For more info., call (312) 894-6282.
Workshops–34 summer workshops in architectural, decorative arts & maritime conservation studies, 2 and 5 days in length, June 4 thru Aug. 26. For catalog, contact R. H. Seitner, executive director, Campbell Historic Preservation Studies, Box 66, Mt. Carroll, 61053. (815) 244-1173 or 244-1619.
Show–17th Annual Midwestern Wood Carvers Show, Nov. 5–6. Belle-Clair Exposition Hall, 200 South Belt E., Belleville. To obtain info. on space for dealers and exhibitors, write Don Lougeay, 1830 East "D" St., Belleville, 62221, or call him at (618) 233-5970.
Juried show–1988 Evanston/Glenbrook Hospitals' American Craft Exposition, Sept. 8–11. The Henry Crown Sports Pavilion, 2379 N. Sheridan Road, Evanston. For taped info., call (312) 492-3938.

***IOWA:* Show**–Holzfest '88, Aug. 20–21. Colony Village Restaurant, I-80 Amana Exit 225; Sat. 9 A.M. to 8 P.M., Sun. 10 A.M. to 5 P.M.; free admission. Exhibitors' product line must have at least 80% wood content. For information on Holzfest and also the Rural Crafts Fair arts and crafts section of the World Ag Expo, Sept. 7–10, write Holzfest, Box 193, Amana, 52203 (Administrator RC) or call (319) 622-3100; (319) 668-1223 (on event day).
Show–13th Old-Time Country Music Contest & Festival and Pioneer Exposition of arts and crafts, Aug. 31–Sept. 5. Pottawattamie County Fairgrounds. Exhibitors' deadline for open space is Aug. 15. For information and reservation forms, write Bob Everhart, director, 106 Navajo, Council Bluffs, 51501.

***LOUISIANA:* Juried show**–13th annual fall crafts festival, Sept. 21–23. Outdoor show, North Blvd., Baton Rouge; booth fees: $100–$110. Application deadline is July 15. For prospectus, send SASE to River City Festivals Assoc., 427 Laurel St., Baton Rouge, 70801, or call (504) 344-3328 for more info.
Juried show–"Made in the Shade," a regional juried crafts exhibit and folk art invitational, July 24–Aug. 12. Baton Rouge Gallery. Louisianna Crafts Council, Box 1287, Baton Rouge, 70821. (504) 928-1980.

***MAINE:* Workshops**–Marine carving, July 25–29; plane making, pattern making and more, Aug. 1–5. Write or call for details, The Rockport Apprenticeshop, Box 539F, Rockport, 04856. (207) 236-6071.
Exhibition–1988 Summer Exhibit, featuring a number of artists in jewelry, paper, glass, wood, furniture & lighting, ceramics, July 1–Sept. 5. Nancy Margolis Lee Gallery, 367 Fore St., Portland, 04101. (207) 775-3822.
Workshops–2- and 3-week summer craft classes, June 5–Sept. 2. For detailed course info., faculty and workshop listings and fee info., write Haystack Mountain School of Crafts, Deer Isle, 04627-0087 or contact Howard M. Evans, director, (207) 348-2306.
Classes–Post & beam building, Sept. 18–23, and 2- & 3-week design and build classes through Nov. For specific class dates and more information, contact Shelter Institute, 38 Centre St., Bath, 04530. (207) 442-7938.

***MARYLAND:* Juried show**–25th annual Havre de Grace Art Show, Aug. 20–21. Tydings Memorial Park. Free to public; 10 A.M. to 5 P.M.. Applications require photos or slides. Call (301) 879-4404 or 939-3303, or write Box 174, Havre de Grace, 21078.

***MASSACHUSETTS:* Exhibition**–"On Your Rocker," an exhibit of rocking chairs by American craftspeople, June 1–July 24. Daily 10 A.M. to 6 P.M. and Sunday 12 P.M. to 5 P.M. Skera Contemporary Crafts, 221 Main St., Northampton, 01060.
Workshops–Timber framing, July 11–15, Aug. 15–19; cabinetmaking, Sept. 12–16, Oct. 17–21. Contact Heartwood Owner-Builder School, Johnson Road, Washington, 01235. (413) 623-6677.
Juried exhibition–"The Craft of Containment: Vessels in All Media," July 22–Sept. 18. Berkshire Museum, Pittsfield. Contact The Berkshire Museum, "The Craft of Containment," 39 South St., Pittsfield, 01201. (413) 443-7171.
Show/workshop–9th annual miniature show and sale, Aug. 21; workshops, Aug. 20 from 10 A.M. to 5 P.M. For details and advance registration, send SASE (business) to Cape Cod Miniature Society, Box 691, Hyannis, 02601.
Workshops/seminars–Numerous events. Contact The Woodworkers' Store, 2154 Massachusetts Ave., Cambridge, 02140. (617) 497-1136.

***MICHIGAN:* Juried fair**–Ann Arbor Street Art Fair, July 20–23. Downtown area and next to Univ. of Mich. campus. Contact the Ann Arbor Street Art Fair, Box 1352, Ann Arbor, 48106. (313) 994-5260.
Juried show–Woodworking '88, Oct. 27–30. Application deadline: July 1. For application, write Somerset Mall, 2801 W. Big Beaver Road, Troy, 48084. (313) 643-6360.

***MINNESOTA:* Classes**–Basic log-building classes and masonry workshops. For specific dates and more information, contact Great Lakes School of Log Building, 3544½ Grand Ave., Minneapolis, 55408. (612) 822-5955.
Juried show–6th annual Upper Midwest Woodcarving Exhibition, July 25–30. Blue Earth. For more info., contact Harley Schmitgen, 311 E. 14th St., Blue Earth, 56013. (507) 526-2777.
Workshop–5th annual Villa Maria Woodcarving Workshop, Aug. 7–13. Frontenac. For info., write to Villa Maria Workshop, Box 37051, Minneapolis, 55431.
Exhibition–6th Annual Guild Sponsored "Northern Woods Exhibit," Oct. 6–9. Bandana Square, Energy Park, St. Paul. Deadline: Sept. 1. For info., contact Bruce Kieffer, Kieffer Custom Furniture, 2269 Ford Pkwy., St. Paul, 55116. (612) 698-5033.
Workshops/seminars–Numerous events. Contact The Woodworkers' Store, 3025 Lyndale Ave. S., Minneapolis, 55408. (612) 822-3338.

***MISSOURI:* Show**–"Works Off The Lathe: Old and New Faces '88," July 10–Aug. 16. Craft Alliance Gallery, St. Louis. Tues. thru Fri. 12 P.M. to 5 P.M. and Sat. 10 A.M. to 5 P.M.. For more info., contact Barbara Jedda, gallery director; Valerie Miller, education director; and Albert LeCoff, director of the Wood Turning Center, at (215) 844-0151.

***NEW HAMPSHIRE* Show**–30th Annual Canterbury Fair, July 30. Canterbury Center, 9 A.M. to 5 P.M. Free admission, $1 parking. Canterbury Fair, Box 5, Old Tilton Road, Canterbury, 03224. (603) 783-9024
Show–"League Foundation's 55th Annual Craftsmen's Fair," Aug. 6–14. Mt. Sunapee State Park. Festival of New England crafts, art, performing arts and culture. $5 admission good for two days. League of N.H. Craftsmen, 205 Main St., Concord, 03301. (603) 224-1471.

***NEW YORK:* Class**–Building the sailing pram with Simon Watts, Aug. 13–20. Sea Lion. Contact Dr. Laurie Rush, Thousand Islands Shipyard Museum, Clayton, 13624. (315) 686-4104.
Exhibition–Young Americans 14th National Competition, winners on exhibit beginning in Sept. American Craft Museum, 40 W. 53rd St., New York, 10019.
Workshops–Craft students league summer 1- and 2-day workshops beginning June 6. For more info, contact the YWCA of the City of New York, 610 Lexington Ave., New York, 10022, or call Ken Coleman at (212) 735-9731.
Workshops–Hand tool workshops by Robert Meadow, learn to use Japanese tools, sharpening techniques, joinery, furnituremaking, instrumentmaking and more, June 25–26, July 9–10, 23–24, Aug. 6–7, 21–22. The Luthierie, 2449 W. Saugerties Road, Saugerties, 12477. (914) 246-5207.
Juried show–Chautauqua Crafts Festival '88, July 2–4, Aug. 12–14. Bestor Plaza, Chautauqua Institution. Contact Gale Svenson, director, Chautauqua Crafts Festival '88, Box 89, Mayville, 14757.
Exhibition–Architectural Art: Affirming the Design Relationship, May 12–Sept. 4. American Craft Museum, New York. Admission: $3.50 adults; Tues. 10 A.M. to 8 P.M., Wed.–Sun. 10 A.M. to 5 P.M.. Contact the Museum Education office for special events at (212) 956-3535. American Craft Museum, 40 W. 53rd St., New York, 10019.
Juried show–New Paltz arts & crafts fair, Sept. 3–5. Ulster County Fairgrounds, New Paltz. Holiday crafts fair at Old Westbury, Jul. 2–4. Ambrose Clark Estate, SUNY College at Old Westbury. Contact Scott & Neil Rubinstein, Quail Hollow Events, Box 825, Woodstock, 12498. (914) 679-8087 or 246-3414.
Juried show–12th Annual American Crafts Festival, July 2–3, 9–10. Lincoln Center, NYC. Contact Brenda Brigham, American Concern For Artistry and Craftsmanship, Box 650, Montclair, NJ. (201) 746-0091.
Juried show–5th Annual Autumn Crafts Festival, Aug. 20–21, 27–28, Sept. 3–5. Lincoln Center, Fordham Univ. Plaza, NYC. Contact Brenda Brigham, American Concern For Artistry and Craftsmanship, Box 650, Montclair, NJ. (201) 746-0091.

***NORTH CAROLINA:* Show**–41st Annual Guild Fair '88, July 21–24 & Oct. 21–23. Asheville Civic Center, Asheville. Adults $3.50; children under 12 free with parent. For more info., contact Guild Fair, Box 9545, Asheville, 28815. (704) 298-7928.
Juried show–"Summerfest Art & Craft Show (9th annual)," Aug. 19–21. Asheville Civic Center. All media, all categories; original work only; no kits, molds, plastics. Juried by slides/photos; $140 fee ($125 HCA&CG members). Send legal SASE. Contact Gail Gomez, High Country Crafters, 29 Haywood St., Asheville, 28801. (704) 254-7547 or 254-0070.
Classes–Various courses in woodworking and woodcarving. For calendar and course description info., contact the John C. Campbell Folk School, Brasstown, 28902. (704) 837-2775 or 837-7329.
Workshops–5- and 6-day-long classes in 11th annual summer program, June thru August. For details, contact Drew Langsner, Country Workshops, 90 Mill Creek Road, Marshall, 28753. (704) 656-2280.

***OHIO:* Workshops**–Summer courses in turning, Windsor chairmaking, Shaker boxmaking techniques and Nantucket basketmaking. For schedule and info., contact the Conover Workshops, 18125 Madison Road, Parkman, 44080. (216) 548-3481.

***OKLAHOMA:* Show**–12th annual national woodcarving show, July 8–10. Kensington Galleria shopping mall, 71st and S. Lewis, Tulsa. Sponsored by Eastern Okla. Woodcarvers Assoc. For more info., contact Tom R. Ferguson, Show Chairman, 3421 S. 95th East Avenue, Tulsa, 74145. (918) 627-5169.

***OREGON:* Workshops**–Furniture design with Seth Stem, June 20–24; furniture design: techniques and construction, Tage Frid, July 7–10; Tage Frid lecture, July 8. For more info., write Oregon School of Arts & Crafts, 8245 S.W. Barnes Road, Portland, 97225. (503) 297-5544.

***PENNSYLVANIA:* Exhibitions**–Numerous exhibitions and travel programs. For more info., contact the Brandywine River Museum, Brandywine Conservancy, Box 141, Chadds Ford, 19317. (215) 388-7601 or 459-1900.
Symposium–1988 American Association of Woodturners Symposium–Form, Function & Fantasy, Sept. 15–17.

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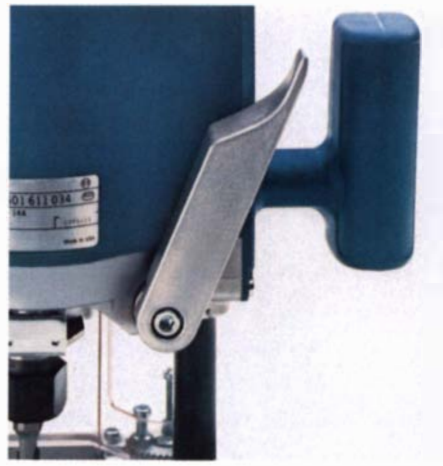
Now there's a new plunge router that has everything you could ask for—and more. Use its velvet smooth plunging action and power for making blind mortises and dadoes; cutouts and template routing; or intricate freehand routing and inlays. And the bit can be set and locked to maintain a constant depth of cut. The Bosch Model 1611 may be the one and only router you need!

Plunge And Lock.

Bosch ergonomic engineering puts every control within easy reach. No need to take your hands off the handles. For greater safety and ease of operation, the right handle trigger switch, with lock button, lets you keep both hands on the router for positive control—starting or stopping. The spring-loaded plunge lock lever, at your left thumb, depresses at a touch.



Convenient spring-actuated plunge lever locks in place when thumb is removed.

Release it and the body locks securely into place at any height.

The 3-position turret's variable depth settings let you step down to the final cut depth precisely. Great for making light finishing cuts on decorative grooves. Its scale, calibrated in inches and metric, simplifies adjustment. Power? A 14 amp, 3 H.P. motor gives you the added power for heavy-duty cutting in the toughest materials.

Trigger switch, with lock button, lets you keep both hands on the router for positive control.

Other carefully thought-out features make your life easier. The shaft lock lets you change bits with one wrench. Oversized opening in base and sub-base provides better view of cutting, and allows use of larger edge-forming bits. And the flat side of the base lets you trim close to vertical surfaces.

The 1611 accepts up to ½″ shank router bits, with their smoother, cleaner cutting action. For smaller bits with ¼″ or ⅜″ shanks, simply install a Bosch ¼″ or ⅜″ collet.

See the 1611 plunge router—and the full line of quality Bosch power tools for woodworkers—at your nearest Bosch Power Tool Distributor. He's listed in the Yellow Pages under "Tools—Electric". Once you take the plunge with Bosch, you won't want to use anything else.

BOSCH

"Quality You Can Hold On To."™

Holiday Inn, Center City, Philadelphia. Registration fee of $185; after Aug. 15, $200. Limited to 250 registrants on first-come-first-serve basis. Contact the AAW, Box 982, San Marcos, TX, 78667 for registration info.
Seminars–Kids in woodworking, July 20; finishing period American furniture with Eliud Rios, Aug. 27; woodworking with Tage Frid, Sept. 9–11; making a continuous arm Windsor chair with Michael Dunbar, Sept. 24–25. Olde Mill Cabinet Shoppe, RD3, Box 547 A, Camp Betty Washington Road, York, 17402. (717) 755-8884.
Juried exhibition–Luckenbach Mill Gallery Juried Exhibition of Contemporary Crafts, Oct. 1–30. Application fee: $10. Application, slides and SASE due July 15. Send for application: Janet Goloub, Historic Bethlehem, Inc., 459 Old York Road, Bethlehem, 18018. (215) 691-5300.
Juried show–41st State Craft Fair, July 28–31. On the campus of Franklin & Marshall College, Lancaster; 10 A.M. to 6 P.M.; adults $4, children 12 and under free. For more info., contact Penn. Designer–Craftsmen, Box 718, Richboro, 18954. (215) 860-0731.
Classes/show–Realistic bird carving, June 20–24; relief woodcarving, July 4–8; woodcarving in the round, July 11–15; 4th annual woodcarving show, July 9–10. Sawmill Center for the Arts, Cook Forest State Park, Cooksburg. For brochure, write Sawmill Center for the Arts, Box 6, Cooksburg, 16217.
Workshops–Numerous workshops, exhibits and shows through Dec. 4. For information, contact Penn. Guild of Craftsmen, Box 820, Richboro, 18954. (215) 860-0731.

TENNESSEE: **Classes**–One- and two-week wood workshops, June 6–August 8. For info. or a summer brochure, write Arrowmont School of Arts and Crafts, Box 567, Gatlinburg, 37738. (615) 436-5860.

VERMONT: **Exhibitions**–For listing of special exhibitions, retail gallery information, craft instruction programs, classes and workshops, write: Vermont State Craft Center at Frog Hollow, Middlebury, 05753. (802) 388-3177.
Exhibition/sale–Exhibit and sales space available in year-round open market for arts, crafts and antiques. Kennedy Brothers Marketplace. Contact Win Grant, Kennedy Bros., 11 Main St., Vergennes, 05491. (802) 877-2975.

WASHINGTON: **Exhibitions**–Emmett Day's newest work, June 2–July 2; and "Chests," a show of cabinetry with drawers, doors & other decorative wood artisanry, July 7–31; "Exotic Edge,"collaborative show by furnituremaker Hank Holzer and woodturner Michael Peterson, Aug. 4–28. Daily 10:30 A.M. to 5:30 P.M., Sunday 12 P.M. to 5 P.M. Northwest Gallery, 202 First Ave. S., Seattle, 98104. (206) 625-0542.
Seminar–Annual Kasha Design seminar with luthier Richard Schneider for interested guitarmakers, Aug. 6–14. Write Todd Bryant, Lost Mountain Center for the Guitar, Box 44, Carlsborg, 98324.
Workshops/show–Quick and simple plywood pram, Aug. 1–5; Maine guide canoe, July 11–23; and lapstrake boatbuilding the "Lawley Tender," Aug. 20–27. Also, Lake Union Wooden Boat Festival, July 2–4. Contact The Center for Wooden Boats, 1010 Valley St., Seattle, 98109. (206) 382-BOAT.
Workshops/seminars–Lofting seminar, July 11–15; small boat construction seminar, July 18–22; art of marine surveying seminar, Aug. 1–5; and wooden boat repair, Aug. 22–26. For info., contact The Northwest School of Wooden Boatbuilding, 251 Otto St., Port Townsend, 98368. (206) 385-4948.
Workshops/demonstrations–Tools-In-Action series, free, every Saturday, 10 A.M. Boatbuilding, woodcarving, sharpening, other woodworking topics. The Wooden Boat Shop, 1007 N.E. Boat St., Seattle, 98105. (206) 634-3600.

WEST VIRGINIA: **Exhibition**–Exhibition of work and seminar on making a living in the woodworking field by traditional furnituremakers, June 25–August 21. Seminar on June 25, 12 P.M. to 3 P.M.; $3 fee. Contact John Ellis, Stifel Fine Arts Center, 1330 National Road, Wheeling, 26003. (304) 242-7700.
Workshops–Augusta Heritage Arts Workshops, July 10–Aug. 12. For detail info., write Augusta Heritage Center, Davis & Elkins College, Elkins, 26241-3996. (304) 636-1903.

CANADA: **Show**–"The Wood Show," Aug. 12–14. Durham, Ont. Woodworking tools & machinery, sculpture, carvings, turnings, marquetry, custom furniture, log homes; 16 free seminars; logger sports; wood art exhibit. For brochure, contact The Wood Show, Box 920, Durham, Ont., N0G 1R0. (519) 369-6902.
Exhibition–"The Wonder of Wood," a national travelling exhibit by the Manitoba Museum of Man and Nature. Premier showing at museum, Apr. 29–July 4. Free admission. For more info., contact Kathy Roos Pavlik or Zora Simon at (204) 956-2830, ext. 147/140. Manitoba Museum of Man and Nature, 190 Rupert Ave., Winnipeg, Manitoba, R3B 0N2. (204) 956-2830.
Exhibition–"Summer Celebration '88," a mixed media of fine Canadian crafts, including songbird wood carvings by Joanne Mallen, June 23–Sept. 7. Heritage Crafts, Sheridan Mews, 182-186 King St. W., Brockville, Ont., K6V 5Y4. (613) 342-2521.
Classes–Numerous sessions in log building, April thru Nov. Contact the Allan Mackie School of Log Building, Box 1205, Prince George, B.C., V2L 4V3. (604) 563-8738.
Exhibitions–Various exhibitions, June thru Dec. The Craft Gallery. Contact the Ontario Crafts Council, 346 Dundas St. W., Toronto, Ont., M5T 1G5. (416) 977-3551.
Workshops–1987-88 workshop series. Mixed media & business topics. Contact Anne Fox, New Brunswick Craft School, Ecole d'Artisanat du N-B, Box C/P6000, Fredericton, N.B., E3B 5H1. (506) 453-2305.
Exhibition–12th Canadian Int'l Wood Carving Exhibition, Aug. 17–Sept. 5. Exhibition Place, Toronto, Ont. For info. booklets, write Mrs. Orysia A. Gay, attractions coordinator, Canadian Nat'l Exhibiton, Exhibition Place, Toronto, Ont. M6K 3C3. (416) 393-6083.

ENGLAND: **Seminar**–International woodturning seminar, featuring Richard Raffan, Vic Wood, Bonnie Klein, Bengt Gustaffson, Anthony Bryant & Liam O'Neill, July 29–31 & Aug. 5–7. High Peak College, Buxton. For more info., contact Nick Davidson or Carolyn Tasker at 0298 871636. Craft Supplies Ltd., The Mill, Millers Dale, Buxton, Derbyshire SK17 8SN.
Classes–Numerous summer courses, July 17–23, 24–30, July 31–Aug. 6, & Aug. 7–13. The Parnham Trust, Parnham House, Beaminster, Dorset, DT8 3NA. (0308) 862204.

ITALY: **Study tour**–Seminar on Italian furniture with George Frank, Oct. 12–26. Visits to craft, art and restoration centers of Milan, Verona, Florence and Rome; and seminars on the artistic Renaissance furniture made in the Tuscany craft centers. For details write Eva Frank, 3504 Beneva Rd., Sarasota, FL 34232. (813) 923-3377.

SCOTLAND: **Workshops**–Training in woodturning with Michael O'Donnell, exploration into woodturning, Aug. 15–19 & 19–23; turning green, Aug. 22–26, Sept. 5–9 & 12–16; instructor training, Aug. 29–Sept. 2. Contact The 'Croft,' Brough, Thruso, Caithness, KW14 8YE. 084-785-605.

SWITZERLAND: **Tour**–Woodworking tour hosted by Gottlieb Brandli, Sept. 6–20. Departs from Boston, New York or Chicago; $2,600 per person. For details, call 1-(800)-521-7623 (outside N.H.). The Image Group, 1575 Logan St., Clearwater, FL, 34615. (813) 447-3050.

Field Guide to American Antique Furniture by Joseph T. Butler, illustrated by Ray Skibinski. ***Henry Holt & Co. Inc., 115 W. 18th St., New York, N.Y. 10011; 1985. $12.95, paperback; 400 pp.***

In 1967, as a student of American period furniture, the first book I purchased for my library was *Field Guide to Early American Furniture*, by Thomas H. Ormsbee; Little, Brown & Co., Boston, Mass.; 1951. A "Bantam" edition softcover, the book was loaded with line drawings of pieces from all the historical periods, in all genres. For a short period of time, this small book was my professor, teaching me about furniture style and critical characteristics. My appetite was whetted, but I needed to see and learn more, so I graduated quickly to more specific, and of course, more expensive books on period furniture.

From time to time, however, I would think back to that little "Bantam" book and how much it offered me in my early stage of interest. Recently, while examining Butler's *Field Guide to American Antique Furniture*, I immediately had a classic *déjà vu* experience. It was incredible just how much the two books appeared to have in common. Both are, of course, field guides, comprehensive surveys of American period furniture. Each contains hundreds of line drawings copied from actual museum or other photographs. In fact, most of the drawings are probably reductions of actual tracing overlays. The drawings, though not as realistic as photos, are a great tool in illustrating certain identifiable characteristics, because the drawings can be made to emphasize design and construction features.

The texts are quite informative, Butler's book more so on overall period essays, Ormsbee's on captions for each individual piece. Each book, however, contains an overall discussion of the different periods, as well as a glossary of terms for quick reference, making both works valuable reference sources for the beginning student.

In spite of the similarities, there are some subtle yet important differences. Butler's *Field Guide* is more up-to-date and the illustrations are of well-documented, important examples. The drawings, including those of individual details, are of a larger format and are clearer than those in Ormsbee's guide. Sources for the pieces illustrated are given in an appendix in case you might like to see some of these in the flesh.

Ormsbee's guide has seen at least 13 printings since 1951. So judging from the apparent popularity of this type of guide, Butler's book should be around awhile. ***–Norman L. Vandal***

The Frugal Woodworker: Woodworking for the Beginner on a Budget by Rick Liftig. ***TAB Books, Inc., Blue Ridge Summit, Penn. 17214; 1986. $22.95, hardcover; $12.95, paperback; 240 pp.***

Rick Liftig has written a book with a laudable ambition: to make woodworking accessible to those without the cash to buy expensive power tools. What's more, he's taken a fair stab at accomplishing his aim. The nine projects in this book, including a wood moisture meter, a computer table and a microwave stand, are attractive–simple, but good-looking.

First, Liftig advises, get a good work surface. He includes plans for a very adequate workbench built onto a Black & Decker Shopmate. Next, he says, buy the highest quality tools you can possibly afford. And, he recommends beginners read everything about woodworking in sight.

Most important, Liftig encourages the hesitant woodworker to actually *do* woodworking rather than just read about it. He advises not to wait until the "dream shop" is financially affordable. Liftig speaks with authority here; he manages to get along very well without a tablesaw.

The Frugal Woodworker is tautly written and well-indexed. It contains everything you need to know to complete any of the projects, but it is geared to the woodworker just starting out. This is reflected in the simplicity of the projects and in the kinds of subjects Liftig covers: buying wood, finishing, sandpaper, glue, basic joinery. In all this, Liftig does a real service to the amateur woodworker. ***–Richard Griffin***

The Windsor Style in America, Vol. II by Charles Santore. ***Running Press Book Publishers, 125 S. 22nd St., Philadelphia, Penn. 19103; 1987. $46.50 ppd., hardcover; 240 pp.***

If you've already read Santore's *Windsor Style in America,* you might wonder why there should be a Volume II. Surely Volume I, justly recognized as "the definitive work on the subject," says it all? Hardly.

There are as many variations on the Windsor theme as there have been chairmakers, and new information about the style's development emerges daily. In this second book, Santore confines his examples to the American colonies from 1730 to 1840 so he can take a tighter look at each region's contributions. He demonstrates how some features are sometimes so distinctive that we can guess the colony, the city and sometimes even the maker of the particular chair. He also makes an intriguing case concerning the invention of the continuous-arm style, along with a few nuggets on the regional origins of the writing arm and other styles.

Mostly, though, Santore shows rather than tells, with more of those deliciously engaging sepia drawings of his and 275 excellent color and black-and-white photos. Where in Volume I we toured a collection of more typical examples, here we get a look at the interesting ones. Quite a few are striking masterpieces of proportion; some are samples from the "zany" end of the scale–an important addition for those who want a really complete overview. As in the first book, Santore runs a tight spotlight over each chair with his pithy comments on turnings, carvings, proportions, successes and failures. With his guidance, I almost always spot a feature I missed at first glance.

Of course Santore's Volume II is a must for all collectors and others interested in antique Windsors, but there's a good deal here as well for anyone who designs furniture, whether antique or modern. ***–Jeremy Singley***

From One Sheet of Plywood by John Reid. ***Sterling Publishing Co., Inc., 2 Park Ave., New York, N.Y. 10016; 1987. $12.95, paperback; 128 pp.***

I hesitated whether to review this book because it's mostly quick-and-dirty plywood stuff that would not appeal much to an experienced cabinetmaker, and might even give offense. Many of the projects fold, for example, and if you're dead-set against piano hinges, this book won't be for you at all. On the other hand, most of these designs are fresh and invigorating, with very nice proportions. The overall feel is of Post-Modernism taking a nap, and I like it. If you know somebody who needs some inexpensive, easy-to-make cabinets, tables, desks and chairs, this book's 30 project ideas with cutting diagrams and assembly instructions may be just what's needed. Refinements such as iron-on edgebanding and more expensive hardware could dress things up acceptably, and other adaptations and variations no doubt will spring to mind. Several of the plans require more than one sheet of plywood, by the way, but who's counting? ***–Jim Cummins***

Norman Vandal is a consulting editor for FWW. *Richard Griffin is an amateur woodworker, minister and former librarian from Sumner, Neb. Jeremy Singley makes furniture in East Middlebury, Vt. Jim Cummins is an associate editor of* FWW.

Tilt-top tables

What you see in the photo happens when a woodworker asks a children's book illustrator for help in designing tilt-top tables. Linda Schiwall and Lee Schuette were in Hamilton House, an antique-filled landmark in Berwick, Me., when Schuette, the woodworker, spied a Chippendale tilt-top table. "It was the first time either of us had seen an antique tilt-top, and we began discussing ways of updating the idea into a contemporary design," Schuette said.

Schiwall suggested tree imagery, and soon Schuette was building a whole forest of the colorful tables, which look more like they sprang from a fantasy of the brothers Grimm than from Schuette's Kittery Point, Me., studio.

These tables might have a fairy-tale look, but they're held together by more than fantasy. The hand-painted, poplar plywood top connects to the tree branches via a wooden hinge Schuette makes on his tablesaw. The bases are built up from poplar plywood blocks epoxied together. After turning, the base is covered with a thin layer of fine-mesh fiberglass to prevent gluelines from telegraphing through the paint.

The zebrawood branches and trunk are routed to shape, then the trunk is mortised into the base. To overcome the inherent weakness of joining the tree trunk to the base, Schuette plunge-routs a 3-in.-deep mortise up inside the bottom of the trunk, then installs two T-nuts in the top end of a loose tenon before gluing the tenon into the mortise. Holes in the tenon allow through bolts from the base to be fastened to the T-nuts in the trunk. Schuette epoxies the trunk into the base mortise, then uses the through bolts to clamp the base and trunk together.

In addition to the trees shown above, Schuette has built 15 other fanciful tilt-tops, including a potted red cedar, a palm tree and a cactus complete with thorny points made from dental massagers gleaned from the backs of toothbrushes.

These tables may not be everyone's cup of tea, but Schuette has a definite hit on his hands. Prices for the 18 tables range from $6,500 to $12,000, and nine of them were sold when they were displayed last March at the Alexander F. Milliken Inc. gallery in New York City. *—John Decker*

Vibration syndrome

According to the Center For Occupational Hazards, vibration syndrome (also known as Raynaud's disease, "dead fingers" or "white hand") has been showing up in a significant number of people who use vibrating tools for long periods. The first symptoms are persisting tingling and numbness after using a machine, which can progress to intermittent tingling and to blanching (turning white) of fingertips, especially when it's cold. In later stages, blanching goes beyond the fingertips and occurs at any temperature. Advanced stages, in addition to being painful, can cause ulcerated and even gangrenous fingers.

A National Institute for Occupational Safety Hazards (NIOSH) study concluded that vibrating tools can cause advanced stages of the disease in as little as a year's time. But fortunately, the NIOSH study also concluded you can reduce the risk of getting vibration syndrome by taking 10-minute breaks for every hour you use a vibrating tool, by not using vibrating tools in cold weather and by not holding the tool any tighter than absolutely necessary. Padded gloves may be a good idea as well.

Humor

EDITOR'S NOTE: It's risky to kid around about tools and machines, because one man's tongue-in-cheek remarks may seem merely frivolous to the temperament of another. However, this short essay by toolmaker J.R. Beall has scenes that most of us have encountered at one time or another on those quests where nothing ever seems to go quite as intended.

I've got this little woodworking business on the side. Some people think the things I choose to build and sell are rather odd. I prefer to think of my construction choices as eclectic. In addition to building upscale doghouses (and an occasional pet casket) for the yuppie set, I build French provincial waterbeds—a specialty of mine.

I'd gotten along fine with my tablesaw, jointer, drill press and bandsaw, until the day I decided buying a planer to mill stock for my waterbeds would be a great idea. Knowing that old, used machines are often sturdier and cheaper than new ones, I checked the local classifieds.

The first planer ad I came to looked quite promising: FOR SALE, 36-in. planer, $250, U remove. Okay, so it was big, but I knew it would be well-constructed, and the price was right in the intended ballpark.

When I got to the guy's house, he took me around to his basement, and there it was: a 4-ft.-tall, black cast-iron planer that must have been built sometime near the end of the French revolution. I figured it weighed about 17 tons, and I noticed a huge flywheel stuck out of the side where an electric motor should have been. "My grandfather used to run this thing with an old traction engine," the fellow said. I had no idea what a traction engine was, but I told him I didn't have one handy. He allowed as how it would probably work okay with a horse-and-a-half motor jury-rigged to the side. I thanked him for this little glimpse of woodworking history and said I'd think about it and get back to him.

"Listen, you can have it for 100 bucks if you'll just get it out of my basement," he pleaded. "Are you kidding," I said as I headed for my car, "you couldn't get that thing out of there with three traction engines and a railway crane."

A few weeks later, I came across a Japanese planer called a "Super-Surfacer." It was the slickest thing I'd ever seen: It had only one fixed blade. You just stuck a board in one end and before you could say

spit, it came out the other end all slick and shiny as a great big curl of wood spilled out the top. Best of all, I could get this planer home in my station wagon. Not realizing that Super-Surfacers are intended only to finish-plane stock, not thickness it, I bought the machine on the spot, raced home and began thickness-planing a ¾-in. pine board. After running the board through a few times, it still measured ¾ in. After 20 passes, the board was only 1/16 in. thinner. By supper time, my arms ached from shoving that board through the machine and the board still measured ½ in. thick. As I opened the garage door to let the shavings spill out, I wondered how the Japanese had enough time to do all those complicated puzzle joints we can't do, and don't really care about, if they spend all their time thickness-planing lumber. Determined to put at least the shavings from my Super-Surfacer to some use, I took junior down to the pet shop after dinner and bought him a guinea pig.

I didn't think about buying another planer again until a gentleman from the city ordered four waterbeds for his motel. I made a half-hearted effort to find a used planer again, but the only thing I found was another oddball. This one was called a "Uniplane." The guy didn't want much for it, but you had to feed the board through vertically while a bunch of itty-bitty cutters gnawed material from one side. I told him I'd had enough of weird planers and decided right then and there to buy a brand new conventional planer.

That weekend, a huge tent-covered woodworking tool show came to town, so I went over there on Saturday morning, along with about 45,000 other people. I looked at plain planers, fancy planers and planers combined with saws and jointers. By the end of the day, I had seen each one about 15 times and had talked to salespeople until my ears were sore. I definitely needed some time to think all this over.

I may buy a planer when the tool show comes to town next year. I might even try to sell my Super-Surfacer there. I could demonstrate it all weekend using only one small pine board and junior would have enough bedding for his guinea pig to last an entire year. *—J.R. Beall, Newark, Ohio*

Product review

Bullet Pilot Point Drill Bits, *Black & Decker, 10 North Park Drive, P.O. Box 798, Hunt Valley, Md. 21030-0748.*

Black & Decker has announced a new bit (shown at left in the photo below) that they claim is superior for drilling metal and also excellent for drilling wood.

Black & Decker says Bullet bits drill four times faster in metal, last seven times longer than other drills, reduce splintering in wood, require less force when drilling and bore more holes per charge when used with cordless drills.

These advantages are attributed to a combination of features that include modified cutting-edge and flute-clearance angles, expanded flute size for better chip removal and a special leading center point that's ground to produce two cutting edges. Because the bit has true center cutting edges, unlike the wedge point of a regular twist drill, there's no need to center-punch or drill a pilot hole in order to get the bit accurately started.

Photo: Michele Russell Slavinsky

Black & Decker says their new Bullet bit (left), which can be used in wood and metal, outperforms cone-shape as well as brad-point bits.

I used a ⅜-in.-dia. Bullet bit and a portable drill to bore holes in steel, cherry, maple and pine. In steel, it cut much better and faster than the standard cone-shape twist drill. Best of all, it didn't bind when I broke through the other side. In wood, the Bullet bit leaves a smoother, rounder hole than a twist drill, but it was no match for my brad-point bit, which bored faster, didn't tear when breaking through and also left a perfect hole.

Bullet bits appear superior to conventional twist drills in some ways, but they share some of the drawbacks of brad-point bits. Because of its stepped end, you can't easily use a Bullet bit to enlarge a hole. And because the outer circumference cuts first, the drill makes a small disc as it breaks through the work. This isn't a problem if you're drilling through a single piece. If, however, you're drilling through two pieces sandwiched together, the disc has no place to go when the drill breaks through the first piece. The disc may spin, covering up the edge of the bit so it can't cut deeper. You have to remove the bit and pull the disc out by hand before it will cut again.

Although Black & Decker says Bullet bits can be sharpened, it would seem a tricky proposition, requiring a grinding wheel with its face dressed to a 5° angle. The hardest part would be retaining the split cutting lip, one of the bit's nicest features.

Bullet bits cost more than twice as much as most other bits. Although they won't replace the brad-points in my shop, they seem a very useful design for specialized tasks. They're perfect for drilling metal without center-punching first. They're also good for drilling in pipe or round stock, because they won't scoot off the mark as you try to start the hole. *—John Decker*

Spalting story

Spalted wood, that rare delight woodturners treasure so highly, doesn't come looking for you, you have to go looking for it. At least that's what I thought until I accidently created some spalted wood right in my own barn.

It all started when I got a call from a local contractor. He offered me $100 and the wood if I'd take down two old roadside maples—city trees planted about 100 years ago. As a professional woodworker who looks at the cost of wood pretty carefully, I readily agreed. After felling the trees, I had the logs carted to a small mill west of town. Custom cutting was not on the list of high priorities at this mill. In fact, my maple sat in the mill's log yard for the better part of two years before my biyearly phone calls spurred them to action.

In April, the mill finally called, wanting me to get my maple out of their way. I noticed the grain in each freshly cut board looked beautiful as I lifted 650 bd. ft. of it into my truck. By the time I got home, it was late in the day and I was bone-tired from all that lifting. I didn't bother stickering the wood as I dropped it into the center bay of my barn. Surely, stickers could wait until the weekend.

I had the best of intentions, but it was late August before I noticed the stickerless clump of maple sitting in my barn. The wood on top looked good, but my heart sank as I lifted the boards to reveal the second layer. Those boards and the boards in the rest of the pile were black with mold. Even so, my never-say-die spirit prevailed, and I carefully stickered the entire pile of maple with the hope that at least some of the boards would be good after planing.

A year or two later, when I decided it would be a good idea to make a few dozen sets of children's blocks to sell, I remembered the stack of maple in the barn. I was

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fairly certain my pile of black, moldy maple was no good, but I didn't want to spend money buying kiln-dried stock until I was sure. The rough maple board I fed into my planer looked as black as the inside of a Jack Daniels whiskey barrel, but I'll never forget my delight as the wood came out the other side.

There in front of me danced a lacy network of fine black lines across a backdrop of beautifully figured maple. As I planed board after board of the inky black stuff to reveal the wonderful marble-like surface, I began to feel a little guilty that my inattention and neglect had brought me such luck.

In fact, I took most of it down to another mill shop and had it resawn into pieces suitable for the bent sides of large Shaker boxes, which are one of my staple craft items. I've made many another piece from the spalted maple I created by accident. But I'm almost out of the stuff now, and I'm wondering if I shouldn't start piling some freshly cut, unstickered maple in my barn again. Who knows? Shabby treatment of another pile of maple might bring me another spalted harvest.

–John Wilson, Charlotte, Mich.

Titan turning

The next time you worry about your lathe shaking apart as you turn a 12-in.-dia. bowl, think of Mark Knudsen, a guy who has to worry about serious things–such as being tumbled around like a cat in a clothes dryer or having his work spin off the faceplate and plow its way through a wall or two.

Knudsen is an architectural turner in Des Moines, Ia., and author of the article on production techniques in *FWW #68*. The photo below proves that there's more to architectural turning than knocking out bushels of balusters. In fact, Knudsen faces so much large-scale work that he's installed a chain hoist on a track that runs across the ceiling of his shop.

The 54-in.-dia. by 29-in.-deep bowl was turned at the request of a local furniture builder who planned to cut it in half. The end result would be two quarter-sphere shells for the top of a 9-ft.-high china cabinet (which now resides in the ballroom of the Marriott hotel in Jacksonville, Fla.).

Photo: Linda Knudsen

It took Mark Knudsen four and a half days to turn this mahogany bowl, using nothing but a 3/8-in. gouge. The bowl was destined to be cut in half to form two shells atop a 9-ft.-high china cabinet.

The furniture builder made the blank for the bowl by bricklaying 16/4 Honduras mahogany blocks together. When the blank arrived at Knudsen's shop, it was so heavy that four men carried it inside. Knudsen affixed his shopmade faceplate–a 1-in.-thick, 20-in.-dia. disc–to the 3-in.-dia. outboard shaft on his shopmade lathe, and then the workmen muscled the blank up in place.

"At least the bricklaid construction made the inside of the bowl partially hollow," Knudsen said, "but it still took me three and a half days to turn the inside and a day to turn the outside." In all, Knudsen estimates he cut 150 lbs. from the bowl, enough shavings to fill twenty 30-gal. trash bags. His main tool was a ⅜-in. gouge, which he could trust to take controllable bites.

Because it was so large, Knudsen didn't think it wise to rotate the bowl any faster than 65 RPM, and he had to spend hours leaning inside the bowl as he turned the deepest portions. "The worst thing about turning that slow is there isn't enough centrifugal force to hold the chips against the inside, so they shower down on your head the whole time you're turning," Knudsen said. To overcome the problem, Knudsen draped a towel over his head and wore a face shield. Even so, he had to hold his breath at times as he turned.

After roughing the bowl to size, Knudsen removed bumps and ridges with an auto-body grinder, then smoothed the entire bowl with a slightly round cabinet scraper. "I got the bowl within ⅛ in. of the size they wanted," Knudsen said, "but the bowl kept changing size on me as the weather changed." Knudsen had anticipated the sizing problem, however, so he told the furnituremaker not to build the cabinet until the shell was done. This made the most efficient use of lathe time, allowing the bowl to stabilize at its own rate later.

Is this the biggest thing Knudsen has ever turned? "Probably the heaviest," he said, "but the biggest was an experimental mold I turned once for a tire company: It was 5½ ft. in diameter."

Toothpick turning

No, what you see below isn't a new money-making production item guaranteed to break records at craft fairs. Instead it's an exercise in pushing a skew chisel to its limits. The turner, Alan Dorr of Chico, Calif., is encouraging some students to try their hand at taming this notoriously "catchy" tool. Dorr drives the blank with a collet chuck, supporting the work by hand while its far end simply rattles around in the cup of the lathe's tailstock. The toothpick shown reached about 9 in. before some short grain caused it to shatter.

The scene took place last August at Harvey Mudd College in Los Angeles, where I attended the second annual Southern California Woodworking Conference, an event I recall with great pleasure.

The first year's emphasis was strictly turning, but in the one I attended, a number of top furnituremakers from around the country lent a broader air. Nevertheless, most of the 150 or so students were primarily interested in the lathe, and there was plenty for them to get excited about. This year's faculty will be pretty evenly balanced to cover the whole woodworking spectrum. The conference will run from August 11th through the 14th. If you're interested in attending, write or call SCWC, c/o Howard Lewin, 3825 W. 139th St., Hawthorne, Calif. 90250; (213) 679-2485 for a brochure.

–Jim Cummins

Alan Dorr turns long toothpicks as an exercise in using the skew chisel. This one reached 9 in. before breaking.

Notes and Comment

Do you know something we don't about the woodworking scene in your area? Please take a moment to fill us in. Notes and Comment pays for stories, tidbits, commentary and reports on exhibits and events. Send manuscripts and color slides (or, black-and-white photos–preferably with negatives) to Notes and Comment, Fine Woodworking, *Box 355, Newtown, Conn. 06470.*

TOOL CHEST LEGACY

If the workmanship in a tool chest is any indication of the maker's talent, then the craftsmanship of master carpenter and stonemason H.O. Studley must have been awe-inspiring. In an oak clamshell box adorned with rosewood, ebony, pearl and ivory, Studley kept both tools he made and a collection of the finest hand tools made prior to 1900, including a complete set of woodworking tools as well as machinist and stonemasonry tools. To pack the 300-plus tools into a case only 19½ in. wide, 39 in. long and 9½ in. deep, Studley devised a jigsaw-puzzle arrangement of flip-up trays, fold-out layers and hidden compartments. Maine native Pete Hardwick now owns the chest, which has been in his family since it was bequeathed to his grandfather by Studley. Hardwick acquired the chest from his brother by trading a 1934 Ford sedan for it. A good trade? It would seem so: Just one tool–the Stanley #1 plane housed in the ebony archway in the upper-left part of the chest–was appraised at $700. Hardwick, a nonwoodworker, plans to sell the chest.