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October 2001
No. 151

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Fine WoodWorking®

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This Colonial cupboard by Mike Dunbar is highly adaptable and can be built with only hand tools.
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Photo: Erika Marks

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Contributors

Roland Johnson ("Biscuit Joiners") started his woodworking career by repairing and refinishing garage-sale furniture to furnish his apartment. The refinishing work led to starting a repair and restoration business in 1976. In 1977 he purchased 40 acres of central Minnesota pastureland and built his own shop and home, where he still resides. The pasture is now a forest, and Johnson still enjoys restoring furniture, creating custom millwork and building furniture. You can view some of his restoration work by visiting www.antiquebilliardtables.com. When he's not working with wood, you can find him working on his 1928 Model A Roadster pickup.

Kim Carleton Graves ("Tackling Large Tabletops") designs and builds custom furniture at his business, Carleton Woodworking (CWWing.com), in Brooklyn, N.Y. This is his second article for *Fine Woodworking*. In February 2002, The Taunton Press will publish his book, "Dining Tables," co-authored with his wife, Masha Zager. In case you're wondering why he's wearing the same shirt in this article as he did in the last one, he says that's because it's his favorite. Graves welcomes questions and comments to him at kcg@CWWing.com.

Eugene Landon (Master Class) is a member of the Society of American Period Furniture Makers. He is an instructor, builder and restorer of 18th-century furniture. Landon lives and works in Montoursville, Pa., where his two German shepherds, appropriately named Chippendale and Queen Anne, keep a watchful eye on visitors.

Gary Rogowski ("Master the Miter") has designed and built furniture since 1974, showing his work in galleries nationwide and in five Taunton Press Design Books. In 1991 he was awarded the Oregon Arts Commission fellowship in crafts. He is the director of The Northwest Woodworking Studio in Portland, Ore., which is dedicated to teaching the art and craft of traditional woodworking. He is a contributing editor to *Fine Woodworking* and has written a number of books for The Taunton Press. He is just completing his latest book for Taunton, tentatively titled "The Complete Illustrated Guide to Joinery," done with the patience and generous cooperation of his two dogs, Buck and Jimmy. His latest hobbies are a 1952 Chevy pickup, gardening and tasting discreet amounts of single-malt scotch.

Fred Sotcher ("Peak Power for Cordless Tools") is a retired electrical engineer and business owner. For 30 years he managed Sotcher Measurement Inc., a manufacturer of electrical test equipment, with his wife, Marion. A lifetime woodworker, he created his first shop at the age of 9 in a small storage room. The shop has moved and grown and now consumes half of his home in San Jose, Calif. He works on a wide range of woodworking projects, from children's toys to fine furniture. Sotcher said his greatest rewards come from woodworking with his grandchildren and his work as volunteer teacher at a local elementary school, where he started a woodworking program.

J. Crate Larkin ("Build a Bowsaw"), a former portraitist and technical writer, developed an interest in woodworking when he began reproducing period furniture as a hobby. It has since evolved into a full-time occupation.

Working mostly alone in his Woodsboro, Md., shop, he makes 18th- and 19th-century-inspired case and cabinetwork. He also teaches hands-on classes on making traditional hand tools and period joinery.

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Letters

More discourse on routers for router tables—With regard to Pat Warner's article on router-table routers (*FWW* #142, pp. 86-89) and the letters that followed (*FWW* #143, p. 12, and *FWW* #144, pp. 8, 10): To use plunge routers in router tables, remove the return springs and you will discover a greatly increased ease of use. I have a small business making precision parts in plastics, composites, wood and nonferrous metals. To a surprising degree it is router-driven.

The shop has 10 routers in use. We have two router tables. One is freestanding, and the other is in a wing on our old Rockwell Unisaw. In both applications we use a Veritas steel plate system with quick mount and disconnect. Our router of choice is the DeWalt 625. I like three horses under the hood, and its longer throw-plunge for bigger cutters.

Our saw-mounted router table is tied into the shop's dust collector. When using small cutters and a small throat plate, heat buildup is a problem—even with an auxiliary port opened in the vacuum enclosure. Blow the tools out with high-pressure air after every setup. Learn to replace the router bearings. They will launch on you.

I had to laugh at the mention of foreign objects falling into table-mounted routers. This has been our experience as well. Things just seem to roll and leap into the motor housing. What a nasty, ugly sound. I cover the throat plate as much as possible and park the saw fence over it when the fence is not in use. I would like manufacturers to put a screen mesh over the exhaust ports so that it would be better suited to an inverted application.

Plan on a short life expectancy for any table router and incorporate that cost into your overhead. I consider routers a consumable item in the total scheme of things. Lastly, a router table is a poor substitute for operations that can be done on the shaper.

—Richard A. Melloh Jr., Cornish, N.H.

Notes & Comment beefs—I am writing in regard to your Notes & Comment write-up "Turned lampshades from green wood" (*FWW* #150, p. 22).

New Hampshire turner Peter Bloch's idea of turning 200 lbs. of wood into 90 gal. of scrap to make a lampshade weighing a few ounces is downright immoral. This is not an example of skill, but rather one of wasteful and totally inappropriate use of material.

Perhaps for his next display of waste, Mr. Bloch might consider making a toothpick out of a giant sequoia.

—C. Robert Alexander, Tallmadge, Ohio

While I am never disappointed in the issues I receive, I do feel that the Notes & Comment write-up "Furniture Society recognizes lifetime achievement" (*FWW* #150, p. 26) should have made mention of the designer of this prestigious award.

The award was conceived by Gord Peteran, a most ingenious and creative

Fine WoodWorking .... around the country

If we're in your neck of the woods, come by and see us

Sept. 28-30: *Fine Woodworking* Editor-in-Chief Tim Schreiner will help kick off the new season of The Woodworking Shows at The Odeum in Villa Park, Ill., near Chicago. *FWW*, along with the Marc Adams School of Woodworking, sponsors the educational seminars and free Masters' Demonstration Stage at all 54 of The Woodworking Shows through May 2002.

Oct. 26-28: A representative of *Fine Woodworking* will be at the Long Beach Convention Center for The Woodworking Shows weekend. *FWW* will sponsor seminars and the free Masters' Demonstration Stage; *Fine Homebuilding* magazine will sponsor a trial run of a building-related seminar.

All fall: If you weren't able to attend the biggest woodworking show of the year in Anaheim Aug. 2-5—The Association of Woodworking and Furnishing Suppliers show—visit www.finewoodworking.com to check out the new tools and materials we found at the exhibition.

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Toronto artist whose work has, I believe, on several occasions been mentioned in *FWW*. Anyone worthy of designing an award for makers of this magnitude is surely deserving of their own small accolade.

—Frederick A. Wright, Toronto, Ont., Canada

Two ways to use a drawknife—In Rules of Thumb (*FWW* #150, pp. 90, 92), Mike Dunbar writes: "Use the drawknife with the bezel (the ground surface often called the bevel) and the manufacturer's stamp up. Many woodworkers use the knife upside down, because they think it gives them more control. However, because they cannot take a heavy chip in this position, they sacrifice the tool's most important ability: fast stock removal."

I have been using drawknives for almost 30 years—for cooperage, shaving chair parts (ladder-backs and Windsors) and shaping tool handles and parts for wooden boats. I generally work with the bevel down. Although, I also use my drawknives bevel up.

The design of the specific drawknife and how it's sharpened may dictate how it's used. I often flip the tool over depending on the kind of wood being worked and the type of cut being made (flat, concave or convex). How the handles are oriented relative to the bevel can also make a difference. Sometimes I turn the drawknife over just to get the handles out of the way or in a more comfortable working position.

Some drawknives work better one way or the other.

—Drew Langsner, Marshall, N.C.

Inspiring the future generation—I am writing to let you know how excited my 36 seventh- and eighth-grade students were to construct the blanket chest you featured in the February 1999 issue of *Fine Woodworking*. Inspired from my recent writing arm Windsor class, I wanted my students to complete a project using traditional hand tools. In addition, I felt a blanket chest could be used in a number of ways around the house.

As I built my demonstration piece, I scaled down the plans 25%. This gave the chest a comfortable seating height and made it a little easier to carry and store in our shop. Working primarily with planes, chisels, a coping saw and an occasional spokeshave, the students smoothed the glued-up panels, cut the required rabbets and shaped the boot-jack ends. Since we only had a trimester to complete the project, we were forced to use a router to cut the ⅜-in. grooves for the till and shape the thumbnail molding on the lid. To assemble the chest and add authenticity we used old-style cut nails and wrought-iron hinges. The project was a huge

A new woodworking season

Every autumn, as the days begin to shorten and we put away our lawn mowers and swimsuits, most serious woodworkers start thinking about what projects they'll tackle through the colder months that keep us indoors. Usually those projects include something that will make us stretch our accumulated talents just a little: a more difficult finishing technique, a complex piece of furniture or an original design based on some inspiring work we've seen recently.

the WOODWORKING shows Every year, autumn also brings a new season for The Woodworking Shows, which travel the country bringing woodworking classes, tools, jigs, demonstrations and inspiration to two communities every weekend. *Fine Woodworking* and the Marc Adams School of Woodworking will be starting their second year of sponsoring the seminars and free Masters' Demonstration Stage at these shows.

Many of our regular authors teach half-day and full-day classes at the shows. And when they're not teaching in the seminar rooms, they're out on the Masters' Demonstration Stage giving short lessons on the essential woodworking techniques they've developed over years of building furniture.

New management took over the shows last year and has raised the level of the shows. Since getting involved, *Fine Woodworking* and Marc Adams have worked to improve the educational seminars. Attendance at the seminars is up, and the shows are growing. Check out The Woodworking Shows next time they're in your area, and introduce yourself to the instructors, who might be familiar faces from the magazine.

Tools & Shops FIRST ANNUAL ISSUE The new season will also bring a special new issue of the magazine. In early December, we'll publish our first annual Tools & Shops issue, an extra issue that will be delivered to subscribers as part of their annual subscription. The staff is busy putting together the issue, visiting great shops and gathering tips, techniques and tool articles from some of the best woodworkers in the country.

We have some special things in the works for this issue—a great tool cabinet, the ultimate router table you can build yourself, a discussion of which machines are really essential for woodworking, a workshop in a bag, a new comparison of 14-in. bandsaws, a tour of two unique shops, an investigation of PVC pipe dust collection, tips on using workshop cutoffs and waste, a gallery of inspiringly beautiful tools made by our readers, an inexpensive and easy-to-build downdraft table, a Federal workbench and lots more.

We hope this new issue inspires you to get back into your shop with renewed energy. We also hope that this special publication improves your workshop and, by extension, your woodworking. *—Timothy D. Schreiner, editor-in-chief*

Writing an article

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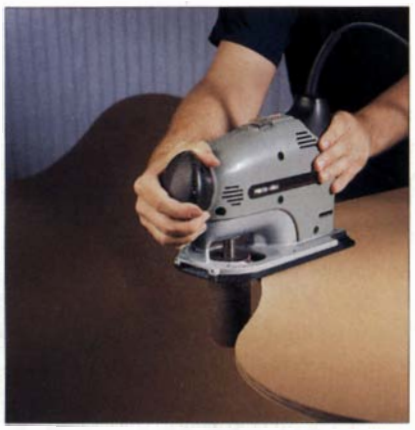

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success. The students not only took home an attractive and useful project, they learned how enjoyable and rewarding woodworking can be using traditional tools and methods.

–Peter McKenna, The Greenwich Country Day School, Greenwich, Conn.

Two hands are better than one—I thoroughly enjoy *Fine Woodworking* and look forward to every issue. I gain a lot from the wisdom, experience, and knowledge contained in the articles and in the reader-supplied tips and tricks. However, the usual emphasis on safety in the shop went missing in the latest issue (*FWW* #150, p. 16) in regards to the right-angle fence used for trimming solid-wood edging on plywood. While the jig depicted and described is simple yet ingenious, it requires that the user keep one hand on the jig, leaving only one hand to hold the router, which concerns me. Were the jig attached to the router, the user could maintain better control and perform the operation more safely.

–Ron Klassen, Elm Grove, Wis.

Festool plunge router not available in the United States—I would like to apologize to the editors of *Fine Woodworking* and its readers. Due to an internal miscommunication, we sent the OF 2000 E-Plus router to Tom Begnal for review. Unfortunately, this router is not for sale in the U.S. A smaller router, the OF 1000 E-Plus, is actually for sale in the U.S.

–Christian Oltzscher, CEO, Festool USA

More on Grizzly's drum sanders—I read with great interest the letter from M. Allan Horton on the Grizzly drum sander (*FWW* #150, p. 10).

I own the double drum sander from Grizzly and am totally unhappy with the machine and the attitude and service of Grizzly.

Upon receiving it, I was disappointed in its construction. The housing is flimsy and poorly constructed. Even after it was assembled and fine-tuned, the housing rattled and added to the noise level. The protective covers over the chain drive sprockets on the front are poorly designed and over a short period of time will be ineffective at best.

The instructions for fine-tuning the machine are inadequate and poorly written. It took a lot of head scratching and pondering to adjust the drums so that they would do the job that they were supposed to.

When I started up the sander and ran a piece of wood through it, I could tell immediately that I was not going to be happy with it. I contacted the company and was given the runaround about what a fine piece of equipment it was and that I should be totally happy with it. I assured them that they were incorrect in this assumption, and that I was not now nor would I ever be happy with it.

Grizzly said they would take the machine back, but at a cost to me. There would be a 10% restocking fee, and I would also have to pay the return freight. This amounted to about one-third the cost of the machine. So I kept it.

I was outraged that they would not stand behind their product and pointed out that I had not noticed these penalties listed with the tool in their catalog. I was told that it was in the fine print in the back of the publication.

Unlike Mr. Horton, most of us that are skilled in woodworking are not mechanical engineers. I must point out that he had to make considerable changes to his drum sander that should not have had to be made if Grizzly manufactured a drum sander of any quality.

Hopefully anyone who reads this letter will take heed from someone who learned the hard way. Just as anything in life, you get what you pay for. Buy cheap, and you get cheap. As soon as I can sell this machine, I will buy the Woodmaster. At least they will stand behind their product and give a 30-day trial to prove it.

–Dale W. Epling, La Grande, Ore.

Another way to remove excess glue—Well, you finally got me to write the letter I've been tempted to send for years regarding the Q&A "Removing excess glue" (*FWW* #150, pp. 94, 96). I had not written sooner because I thought I was likely the only obsessive compulsive on the loose in the woodworking world with the patience to use my technique. It involves lots of cheap masking tape and a little bit of extra time at glue-up.

Prior to assembly, tape all the pieces to be joined as close to all joints as possible, anywhere excess glue is likely to squeeze out, but especially in all plainly visible locations where it might interfere with a stain and/or finish. Burnish down the edge of the tape nearest the joint line with a fingernail to ensure that it is tight to the surface. Apply glue and clamp. Let the squeeze-out skin over or, better still, wait a little longer until it's dried to that "soft rubber" stage (which is well before the "crispy" stage) all the way through to the tape. Lift an edge of the tape and gently ease it up from both sides of the joint.

With a bit of practice, all of the still-flexible glue residue comes off with the tape. I have never had to sand or scrape out raised grain in tight corners caused by washing off the glue with water or had finish or stain blotching in areas where PVA glue (or diluted glue mixed with water) soaked into the surface and later resisted the stain or finish coats.

The trick is in the timing and in using the right amount of glue. Too much glue or pulling the tape too early or too late results in a bit more work with a very sharp chisel to clean up the corner. Still, in my experience, that's faster, cleaner and more certain to prevent finish problems than any method that involves applying water to bare wood.

–Jim Marsh, Stockton, Calif.

Correction—In our anniversary issue (*FWW* #146), credit for the photograph of Sam Maloof's house on p. 54 was incorrect. The photo should have been credited to Sioux Bally, Heartstone Arts.

About your safety

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

–Timothy D. Schreiner, editor-in-chief

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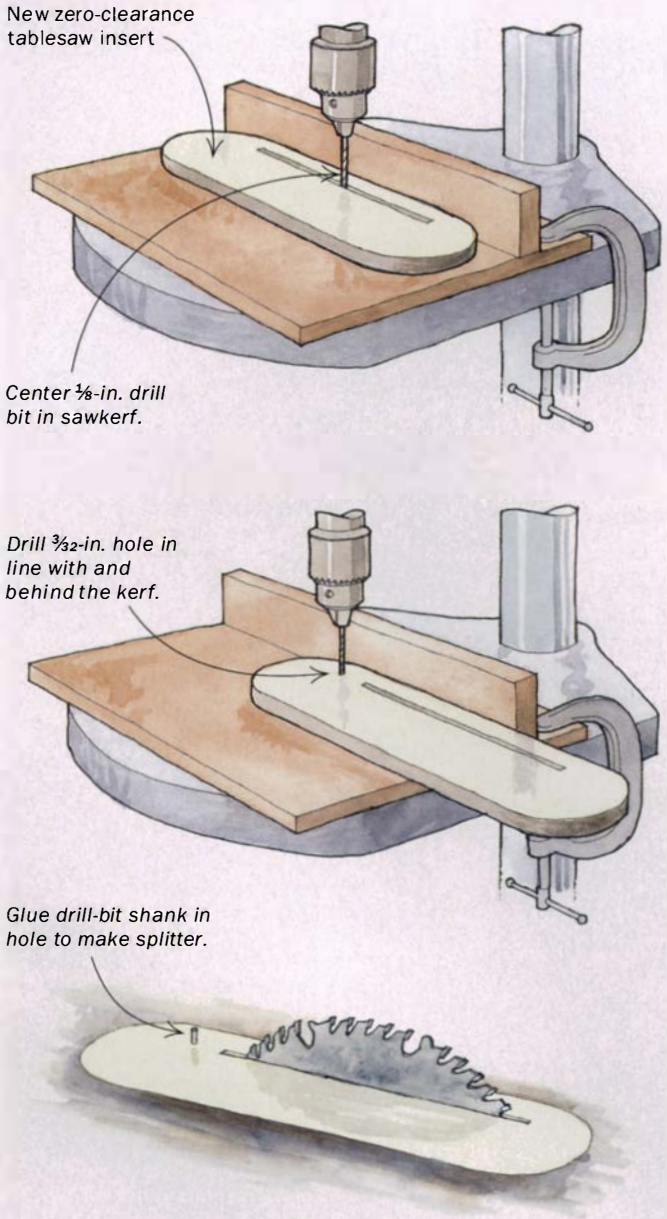
READER SERVICE NO. 23

Methods of Work

EDITED AND DRAWN BY JIM RICHEY

A tablesaw splitter you will actually use

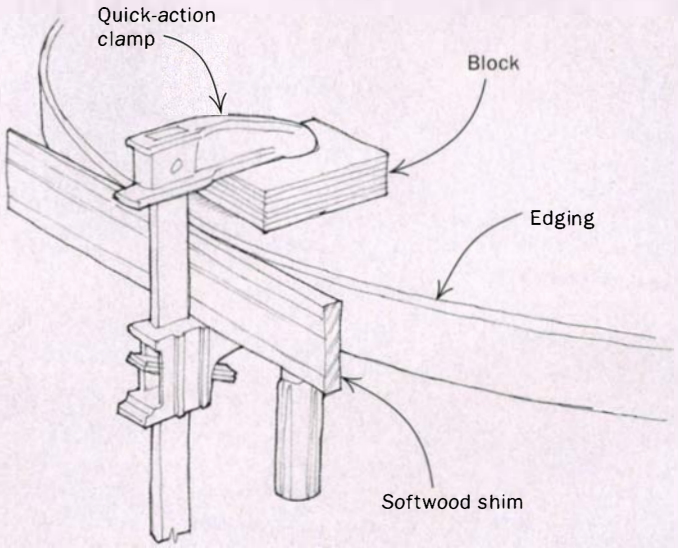


Adding a splitter to a new tablesaw throat insert is an excellent safety practice. Once installed, neglecting it requires a conscious effort, so the odds are that it will see everyday, real-life use.

I've found, though, that the usually recommended procedure of extending the kerf behind the blade and gluing in a wooden tongue is hard to pull off without introducing miniscule errors. And the slightest error will result in a device that snags the workpiece. This method solves those problems.

Raise the sawblade through the new insert. Then place the insert against a fence on a drill-press table. Align things by lowering a drill bit of a diameter that is equal to the blade thickness (usually ⅛ in.) into the kerf. When the bit is centered in the kerf, lock the fence, change to a drill bit 1⁄32 in. smaller, switch on the drill press and bore a hole near the outfeed end of the kerf. Now push that same drill bit into the hole, shank up, along with a dab of cyanoacrylate glue. The drill bit will now serve as the splitter pin. It will be aligned perfectly with the sawkerf and should have about 1⁄64 in. of clearance on each side. —*Michael Standish, Roxbury, Mass.*

Wedge shims for edge-gluing



Glue-ups are among the most frustrating procedures in woodworking. When you expect it to be a bear, it's a lamb, and when you expect it be Little Bo Peep, it turns out to be a grizzly bear. This tip was born out of desperation during what was perceived to be a Little Bo Peep procedure—gluing a wood edging strip to a curved top.

I know there are several kinds of dedicated clamps designed for gluing edges. In my opinion these clamps are too pricey, take up too much precious real estate when they're not being used, and they're too limited in the thickness they can accommodate. Not so with this simple technique (above), which requires only the quick-action clamps you probably already own and a package of door-installation shims.

Simply tighten your quick-action clamp close to the edge of the

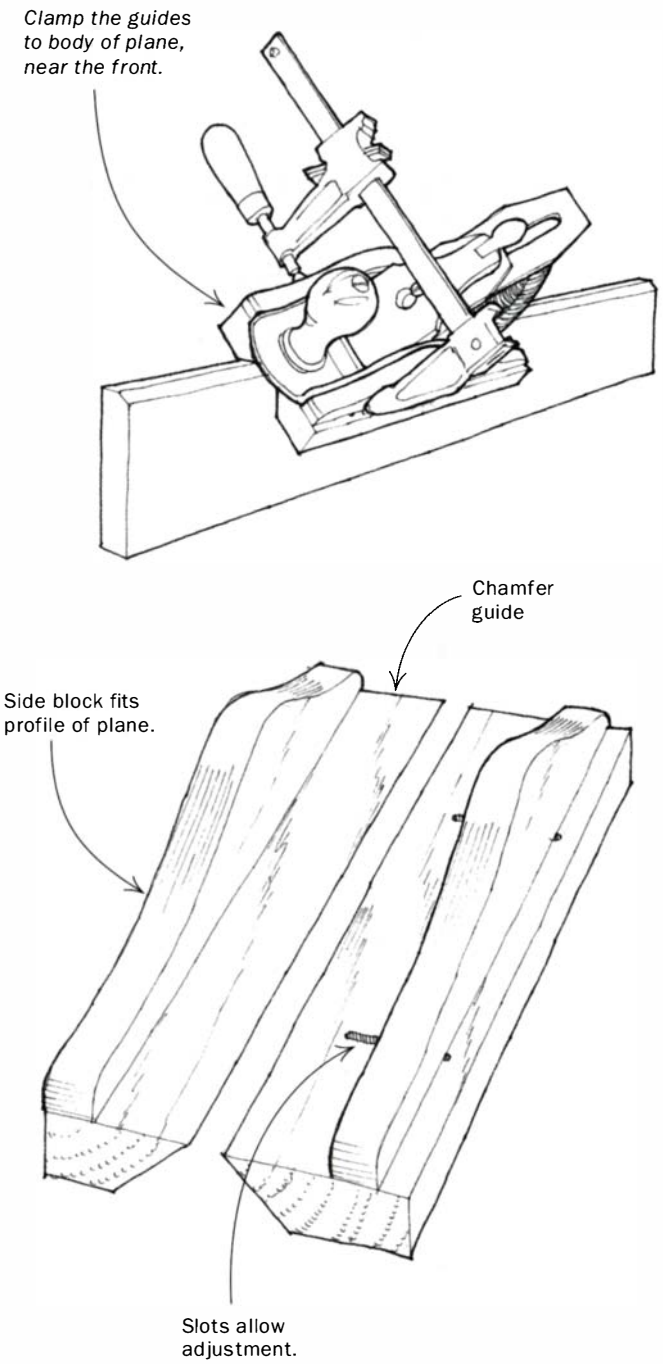
A reward for the best tip

Michael Standish won an engraved Lie-Nielsen handplane for his winning tip about making a splitter for the throat plate on a tablesaw. His design is one of those ideas that reveal an elegance grounded in simplicity, and it makes a tablesaw safer to use. Standish earns a living as a finish carpenter, architectural millworker and occasional furniture maker. Send us your best tip, along with any photos or sketches (we'll redraw them) to Methods of Work, Fine Woodworking, *P.O. Box 5506, Newtown, CT 06470-5506.*

top to be glued, accounting for the thickness of your edging and the shim. Apply some decent pressure to the clamp. Add some sandpaper blocks and really cinch down the clamps if you need a lot of pressure. Apply glue and set the edging in place. Then smack a softwood shim between the edging and the bar of the clamp to hold the edging tightly in place until the glue sets.

—David Guarino, South Plainfield, N.J.

Handplane chamfer guide



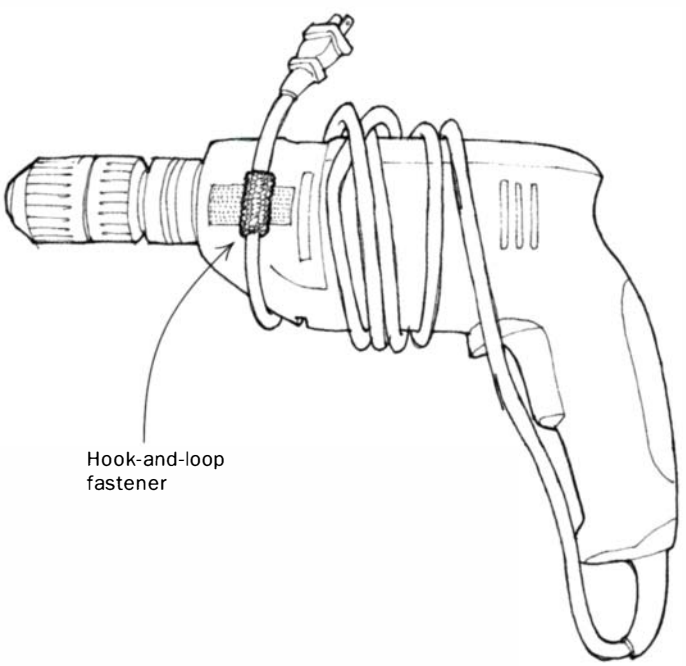
I took on a project at my summer cottage to make 90 ft. of window trim. My options were limited because I was able to bring only a few basic hand tools. The design called for chamfered edges. On a test run I marked the top and sides of the stock and planed down to the pencil lines. The results weren't too bad, but they just weren't consistent enough for the longer boards I needed.

To solve that problem, I built a chamfer guide to attach to the sole of my jack plane (see the drawings at left). I first planed the edge of a length of scrap to 45° and then cut it in half lengthwise, to make two pieces for the base. To the tops of those I added a couple of side blocks screwed on tightly to fit against the body of the plane. I cut slotted mounting holes in one of the base pieces to allow for adjustments.

I clamped the guides to the sides of the plane—ahead of the mouth where there is a support rib—so that I wouldn't crack the casting. Loosening the screws on the adjustable guide and sliding it one way or the other controls the width of the chamfer. Once I had the size of the chamfer set, the planing went very smoothly.

—Darrell LaRue, Oakville, Ont., Canada

Taming unruly power cords



Most portable power tools, such as drills, saws and routers, have no provisions for holding the power cord in place. Try this.

Wrap a strip of hook-and-loop fastener (like Velcro), with a self-adhesive backing, around the cord about 2 in. or 3 in. from the plug end. Then wrap the cord around the tool to determine where the strip will come in contact with the tool body and adhere the mating half of the strip at that location. Now you can wrap the cord around the tool and press the hook-and-loop strips together to fasten the cord. No knots, loops or unraveling cords get in the way when you need to store or transport the tool.

—Leonard Feldberg, Chestnut Ridge, N.Y.

Quick tip: To make a pattern for duplicating a complex turning, first turn a prototype. Then cut a piece of ⅛6-in.-thick Plexiglas to

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6546-6	Screwdriver 200 & 400 rpm	89
6547-22	6546-6 Kit with 2 batteries	115
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6095DWBLE	30th Anniversary 9.6 volt 3/8" Drill Kit with light	145
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N1900B	3-1/4" Planer with case	142
1912B	4-3/8" Planer	215
N9514B	4" Disc Grinder 4.6 amp	65
DA3000R	3/8" Angle Drill	185
9404	4" x 24" Belt Sander w/bag	209
5007NBK	7-1/4" Circ Saw w/ case	125
LS1011N	10" Slide Compound Saw	429
3612C	3 HP Plunge Router	249
LS1040	10" Compound Miter Saw	259
LS1013	10" Dual Compound Slide Miter Saw	529
BO5010	5" Random Orbit Sander	69
LS1220	12" Compound Miter Saw	335
9227C	7/9" Polisher	195
2703	10" Table Saw	319
LS1212	12" Cmpnd Slide Miter Saw	699
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CR13VA	Recipro Saw-11 amp	165

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DW705	12" Compound Mitre Saw	299
DW621	2 HP Plunge Router	199
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1275DVS	3"x24" var. speed Belt Sander	209
1276DVS	4"x24" v/s Belt Sander	219
1194VSRK	1/2" var. speed Drill w/ case	159
1613EVS	2HP var. speed Plunge Router	199
3107DVS	5" Random Orbit Sander	98
3725DVS	5" Random Orbit Sander	145
3727DVS	6" Random Orbit Sander	149
3915	10" Slide Compound Saw	479
3912	12" Compound Mitre Saw	299
11224VSR	7/8" SDS Rotary Drill	229
1347AK	4-1/2" Grinder with case	92
1617	1-3/4 HP Router - 2 handle	159
1617EVS	2 HP Router with variable speed, 2 handle	184
1618	1-3/4 HP Router "D" handle	179
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6931	Plunge Router Base	89
693PK	690 and 6931 plus case	199
691	1-1/2 HP Router D-handle	172
698	Heavy Duty Shaper Table	138
352VS	3"x21" v/s Belt Sander with bag	182
360	3"x24" Belt Sander with bag	235
360VS	360 Sander w/ variable speed	239
362	4"x24" Belt Sander with bag	229
362VS	362 Sander w/ variable speed	255
9125	3-1/4" Planer Kit with case	149
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330	Speed Block Sander 1/4 sheet	78
557	Plate Jointer with tilt fence. Includes 2" & 4" blades for use with standard & face frame plates	205
5563	Face frame plates for 557	7.99
5554	1000 assorted biscuits	29
7529	2 HP variable speed Plunge Router	209
97529	Above router with guide, dust collection, and case	249
7519	3-1/4 HP Router 2 Handle	294
7518	3-1/4 HP 5 speed Router	309
7539	3-1/4 HP v/sp Plunge Router	319
7310	5.6 amp Laminate Trimmer	109
97311	Laminate Trimmer Kit with underscribe base	225
7335	5" Random Orbit Sander	119
97355	7335 w/ case & dust pick-up	145
7336	6" Random Orbit Sander	124
97366	7336 with case & dust pick-up	148
332	Palm Grip Rndm Orb Sander	65
333	Above sander with dust bag	68
333VS	Random Orbit Sander - variable speed	88
334	333 Sander with PSA pad	68
335	Palmgrip Random Orbit Sander with dual flip pad	88
310	Production Laminate Trimmer	154
347K	7-1/4" "Framers" Circular Saw with plastic case	129
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BN200A	Brad Nailer -18 ga. 3/4" to 2"	104
FN250A	Finish Nailer -16 ga. 3/4" to 2-1/2"	169
DA250A	Nailer -15 ga. 1-1/4" to 2-1/2"	204
FC350	Framing Nailer - clipped head	239
FR350	Framing Nailer - round head	239
RN175	Roofing Coil Nailer	275

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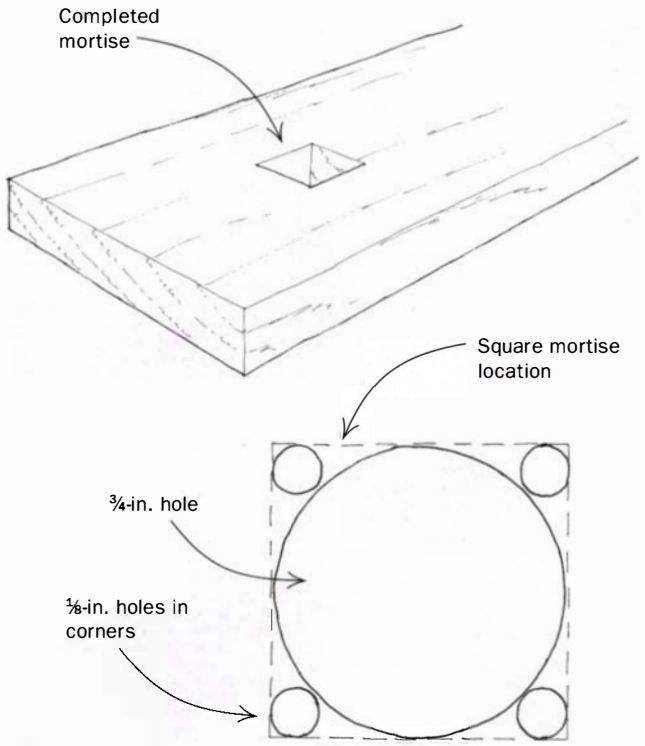
roughly the same shape. With the lathe set at a high speed, press the plastic into the turning spindle. The plastic will melt into an exact, reverse pattern of the spindle shape.

—Bernie McMellon, Taft, Tenn.

An easy way to chop square mortises



When I had to chop several ¾-in. square holes in a workbench top, I first tried removing the center of the hole with a ¾-in. bit. Then I had the idea to remove even more waste by drilling ⅛-in. holes in each of the corners left by the ¾-in. bit. The holes in each corner remove a significant additional amount of waste and made cleaning them out by hand easier and quicker.

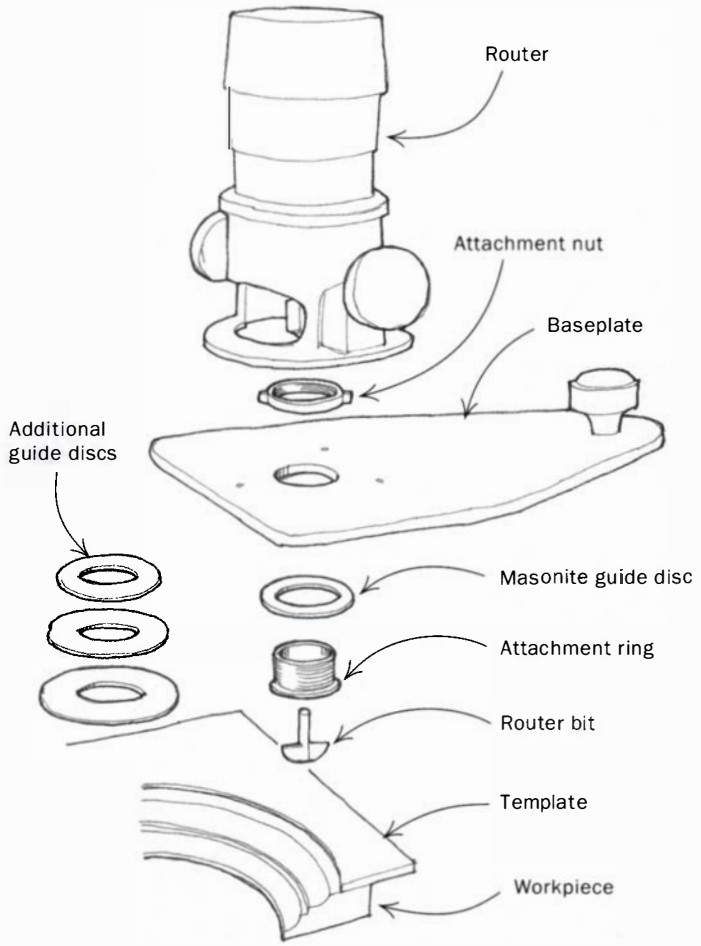
—John Adam Jones, Norman, Okla.

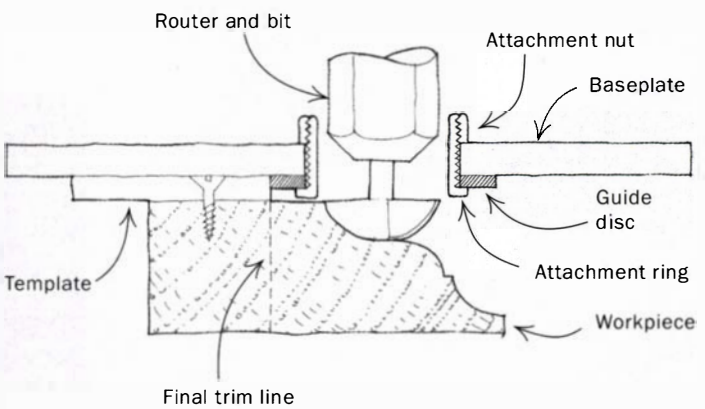
Making curved moldings with a router

With this router template and guide fixture (see the drawings at right), you can easily make fancy curved moldings, such as oval picture frames and gooseneck moldings for grandfather clocks. The critical elements of this fixture are an extended ⅜-in.-thick Lexan baseplate and a number of ⅛-in.-thick Masonite guide discs in various diameters.

The discs can be attached to the baseplate in one of several ways. Because I have access to metal machining tools, I made a threaded, lipped brass ring and a matching nut. However, a common 1½-in. PVC slip-joint adapter (also called a trap adapter) makes an inexpensive, though less elegant, substitute. You will need to cut off the end of the PVC adapter to make it fit. Whatever attachment device you come up with, make sure that the largest router bit you intend to use will pass through the inside diameter.

To make the guide discs, first make a special faceplate for your





lathe with a stub to fit the inside diameter of the disc. Drill out a ⅛-in.-thick Masonite blank to fit the stub, attach the blank to the faceplate and turn the disc to the desired diameter. If you know the exact sizes you need, you can make up only those sizes. I use the guide for many molding profiles, so I made a large number of discs in ⅛-in. graduations, ranging from 1¾ in. to 4¾ in.

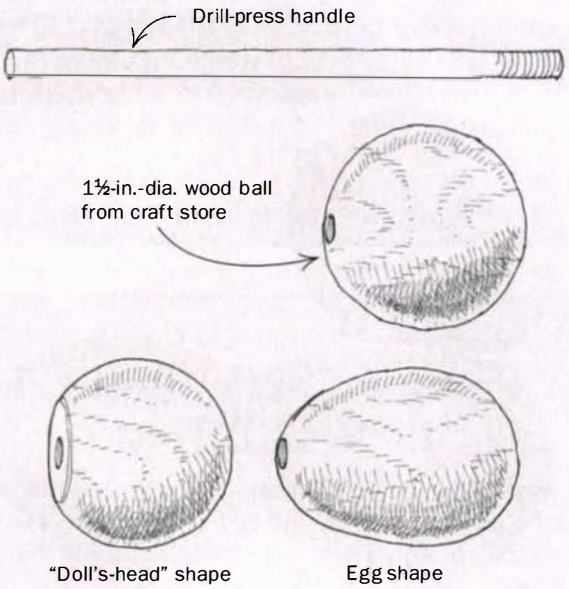
Before you can use the fixture, you need to cut out a curved template the shape of the molding you want to make. I use ¼-in.-thick material for the template. An outside or an inside template will

work equally well. Because you want to have the template nearest the thickest edge of the molding, this will dictate whether the template should be an outside or an inside form. I usually make the template the same size as the final trim line of the molding.

Screw the template to the workpiece. (Clamps can get in the way.) Now place the extended part of the router baseplate on the template, with a guide disc riding against the edge of the template, and begin routing the first profile—the one that is outermost from the template. Deep cuts must be done in several passes. When necessary, I modify corner-rounding bits and other pattern bits by carefully grinding off the ball-bearing stem.

After the first profile is done, change the bit and install a new guide disc to step the bit in on the workpiece. Rout the second profile. Continue this process in several steps until the desired molding profile is complete. *—Leslie Zielicke, Fond du Lac, Wis.*

Cure for puny knobs



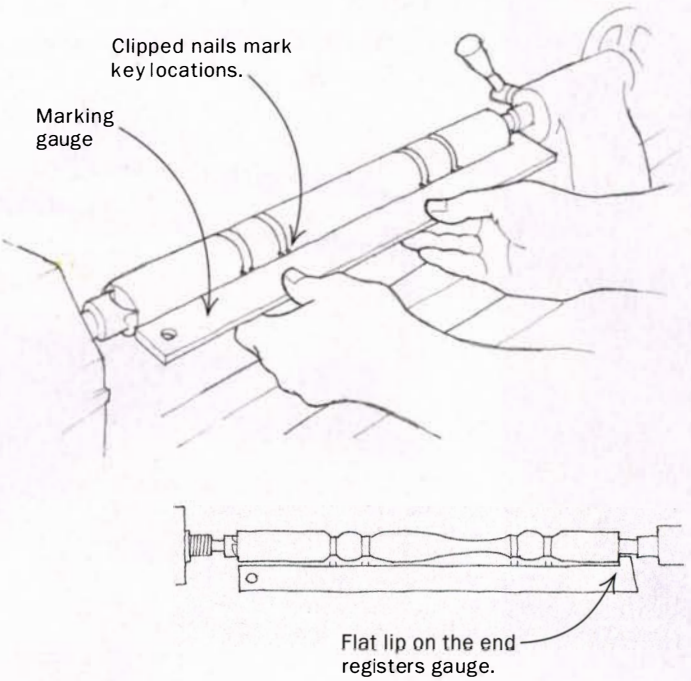
If you find the puny knobs on your benchtop drill press (or any other tool) difficult to grasp, here's an easy solution. Buy some 1½-in.-dia. hardwood balls from a craft store, drill a hole in the balls the same size as the handle shafts and force-thread them onto the shafts. Secure the balls with some epoxy. Wipe on a couple of coats of finish, and you're set.

For variation, craft stores also carry egg-shaped and "doll's-head" wooden balls. A complete set should cost you less than $2.

—R.B. Himes, Vienna, Ohio

Dedicated marking gauge for duplicate spindles

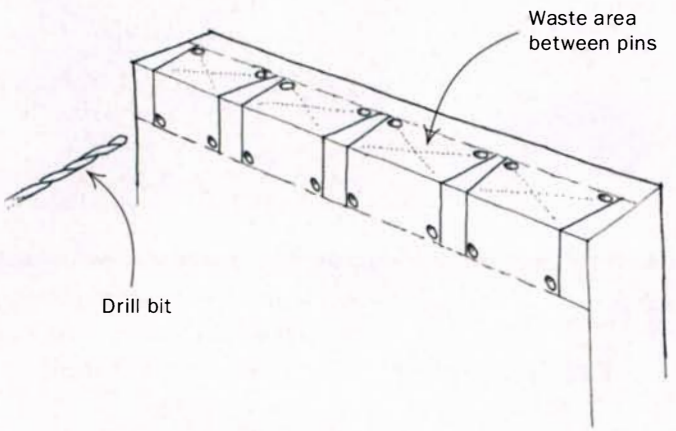
If you have to turn a large number of identical spindles, this simple marking gauge (above right) will save you time and increase your accuracy. Make the gauge from a ¼-in.-thick scrap of straight stock about 1½ in. wide. Cut a lip on one end and drive small finish nails into the edge at key marking points for the spindle. Snip the nails to about ⅛ in. long and sharpen them with a file. Make sure all nails will touch the workpiece. Add a label and drill a hole



to hang the gauge on the wall for future use. To use the gauge, first turn the spindle blank to a cylinder and square off the tailstock end. Place the lip of the gauge flush with the tailstock end and push the gauge into the turning stock so that the nails mark the spindle locations. Deepen each mark with the point of a skew so you won't lose them. Now you can turn your duplicate spindles with both confidence and consistency.

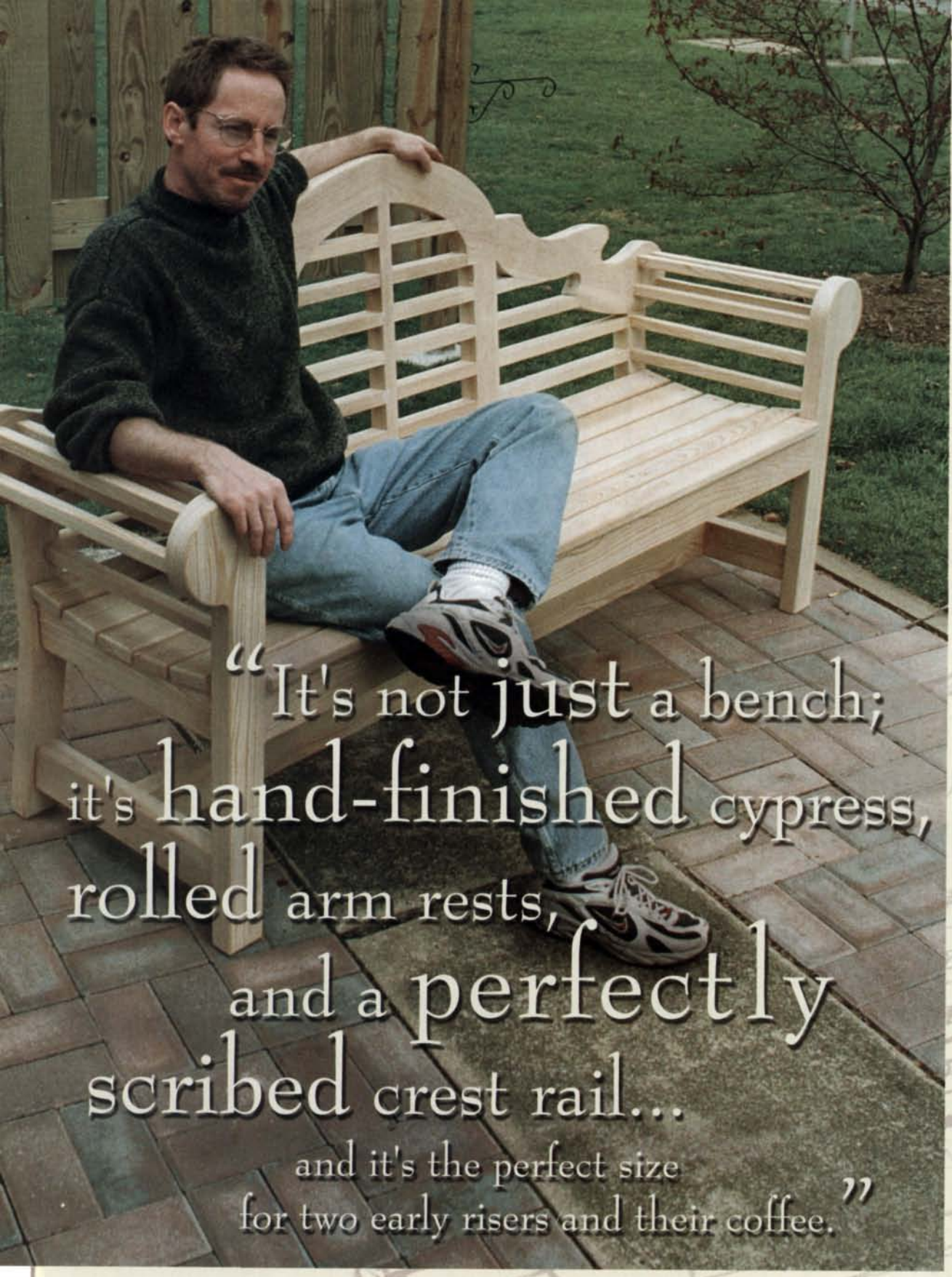
—Richard Dieterle, Millersville, Pa.

Aid for chopping dovetail pins



When I make half-blind dovetails in drawer fronts, I use the following technique to chop out the waste between the pins. I chuck a small bit in an eggbeater-type hand drill and then drill four holes in each tail recess, as shown above. I sight the angles by eye. The holes allow me to chop out the waste material more quickly and neatly, particularly when I'm working with hardwood.

—Bruce Cowen, Kalamunda, Western Australia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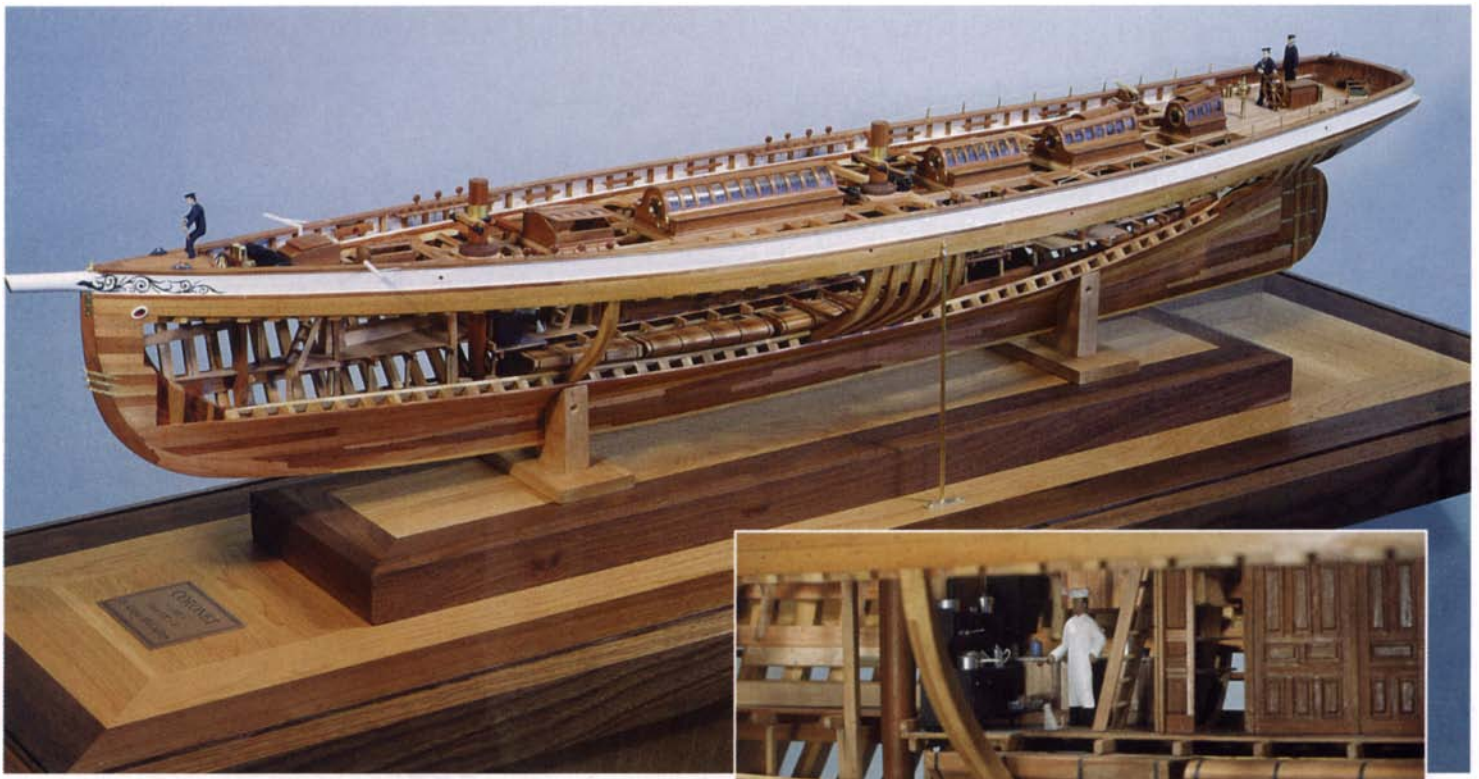


Life below decks. *The ship's cat salivates as the chef takes a turkey out of the oven.*

A masterpiece in miniature

Once in a while I come across a woodworker whose work makes my projects look as if I made them with an ax and a sledgehammer—while wearing boxing gloves. One such person is Lloyd McCaffery, who has devoted his life to creating exquisite work on a very small scale.

His specialty is ship models, and his latest work is a Victorian schooner yacht, the Coronet. Built to a scale of ⅜ in. = 1 ft., the model is about 4 ft. long. McCaffery used fine-grained woods, and where possible, employed the same construction methods used on the original. The frames were made of poplar, and the keel from apple wood, with most of the interior cherry or apple. McCaffery's tools include air turbine dental drills, jeweler's tweezers, and a number of miniature planes, chisels and knives he has made.

Exact to the nearest detail. *Photographs of the actual yacht were used to re-create the captain on the poop deck with a crewman at the wheel. The wheel is made of three layers of apple wood, with turned spokes of apple.*

The original Coronet is being restored by the International Yacht Restoration School in Newport, R.I., and is open for public tours between May and October. For further information on the school, log onto www.iyrs.org/coro1.htm.

—Mark Schofield, assistant editor

Wood webs

www.rbrc.org

If Fred Sotcher's article "Peak Power for Cordless Tools" (see pp. 50-53) came too late to save your rechargeable battery, then at least dispose of it properly. This site, funded mostly by the North American portable rechargeable power industry, tells you where to recycle your nickel-cadmium (Ni-Cd), nickel-metal-hydride (Ni-MH), lithium ion (Li-ion) and small sealed lead (Pb) batteries. Simply type in your zip code to find the nearest drop-off center.

www.cleanup.org

The average American household has 50 lbs. of hazardous materials sitting in cupboards, basements and garages. Reading Jeff Jewitt's article "All About Thinning Finishes" (see pp. 86-91) may provoke you to go through your old supplies and weed out those you will never use again. At this web site, type in your country or your zip code, and the nearest center for collecting hazardous household waste will appear. The web site also gives ideas for recycling, as well as reducing your use of toxic chemicals.

Photos, except where noted: Mark Schofield; this page: Lloyd McCaffery

Rough at the edges, smooth in the middle. *The tabletop will have natural edges, but Odate is using a power plane to smooth both sides of the slab.*

Long wait for a large table

Toshio Odate has more ambitious energy than some people half his age. At 71 years old, Odate recently started working on a project that he estimates won't be completed until he's 80 or so. From a single 215-year-old white oak tree—what he calls that "majestic oak"—he plans to build a large table and a dozen chairs. The tabletop will have live edges, and the chairs will be made of varying dimensions to accommodate people of different shapes and sizes.

The oak tree was struck by lightning, killing the pulpwood, but the heartwood remained clear and intact. Freshly cut, the log had a moisture content of 58%, and it weighed more than 4 tons. The butt end of the 11-ft.-long log is more than 5 ft. dia. Odate milled it by first cutting the log in half, lengthwise, with a chainsaw. Then he cut a 6-in. slab for the tabletop, working from both sides of the log, and milled the surfaces with a handheld power plane and handplanes. Because the slab is too large to fit into his shop, Odate plans to build a small shed over it to protect it from the weather for the five or six years required to air-dry the lumber. *—William Duckworth, associate editor*

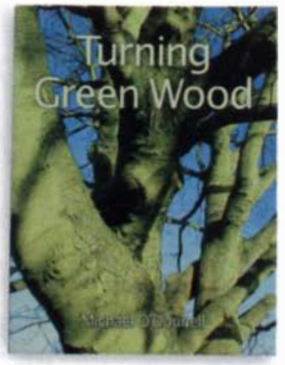
Carving by sight alone

Since the age of 12, when he made his first piece of furniture, Howard Johnston has always relied solely on a photograph or an illustration to guide him. Johnston finds inspiration in the pages of antiques catalogs and is not shy of tackling projects many woodworkers would think twice about, even with a full set of measured plans. He has made no less than three Newport-style desks for his children.

Johnston, who was born deaf, learned woodworking while attending Clarke School for the Deaf, located in Northampton, Mass. He has spent his entire career as a furniture finisher and refinisher, but his love has always been making furniture. *—M.S.*

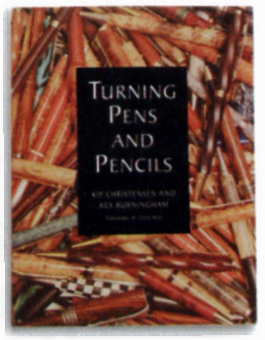
Picture perfect. *Howard Johnston carves a replica of a Queen Anne chair that caught his eye in a magazine advertisement. He makes no other plans before launching into the chair's construction.*

Two books for turners



Turning Green Wood *by Michael O'Donnell. Guild of Master Craftsmen, dist. by Sterling. $17.95 softcover; 144 pp. (800-367-9692).*

Michael O'Donnell takes the reader in easy steps from the different configurations of wood in a single tree, imagining what turnings would suit each blank, to the types of tools needed. He shows how to turn translucent cross-grain and end-grain bowls, as well as natural-edged bowls. A more challenging project is a natural-edged end-grain goblet with a stem less than ⅛ in. dia. When dyed and finished, it appears to be made from metal or even glass. With its combination of practical and artistic works, the book will appeal to those new to turning as well as to those already proficient on the lathe but are looking to venture beyond squared-up, kiln-dried blanks.



Turning Pens and Pencils *by Kip Christensen and Rex Burningham. Guild of Master Craftsmen, dist. by Sterling. $17.95 softcover, 168 pp. (800-367-9692).*

I had not realized quite what a detailed process making a turned pen was, nor how many choices there are when it comes to blanks: These include plain and exotic woods, antler, tortoiseshell and various synthetic materials. The book by Kip Christensen and Rex Burningham covers every aspect of pen turning from lathe specifications to how to personalize the finished product.

After you have become addicted to turning pens, the last chapter gives suggestions on marketing your production. *—M.S.*

Photo, this page (top left): William Duckworth

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10" x 30 T (1/8" or 3/32" Kerf)	~~$ 99~~	$ 89	$ 84
8 1/4" x 40 T (3/32" Kerf)*	~~$ 99~~	$ 89	$ 84
8" x 40 T (3/32" Kerf)	~~$ 99~~	$ 89	$ 84
7 1/4" x 30 T (3/32" Kerf)	~~$ 89~~	$ 62	$ 59
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14"x40Tx1", 14"x30Tx1", 12"x30Tx1", 9"x40T, 9"x30T, 8"x30T(3/32"K), 6"x40T(3/32"K) also available. Call for prices.

The 10"x40T earned the Editor's Choice for the best performance regardless of price. *American Woodworker April 1998, pp 68-69.*

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8 ½" x 60T x 5/8" *Hitachi, DeWalt, Ryobi, Freud TR125*	~~$119~~	$107	$101
10"x80Tx5/8" *Delta, Bosch, Hitachi, Makita, Ryobi, AEG & all*	~~$139~~	$125	$118
12" x 80T x 1" *Delta, Hitachi, Makita, B&D, Sears & all*	~~$149~~	$134	$127
15" x 100T x 1" *Makita, Ryobi*	~~$199~~	$179	$169

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7 1/4", 8", 8 1/4" x 60T	~~$109~~	$ 98	$ 93
10" x 60 T	~~$129~~	$116	$110
12" x 60 T	~~$139~~	$125	$118

9" x 60T, 14" x 60T also available. Call for prices.

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Cuts melamine perfectly. 220mm & 300mm available. Our best plywood blade.

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10" x 80 T (1/8" or 3/32" Kerf)	~~$159~~	$143	$135
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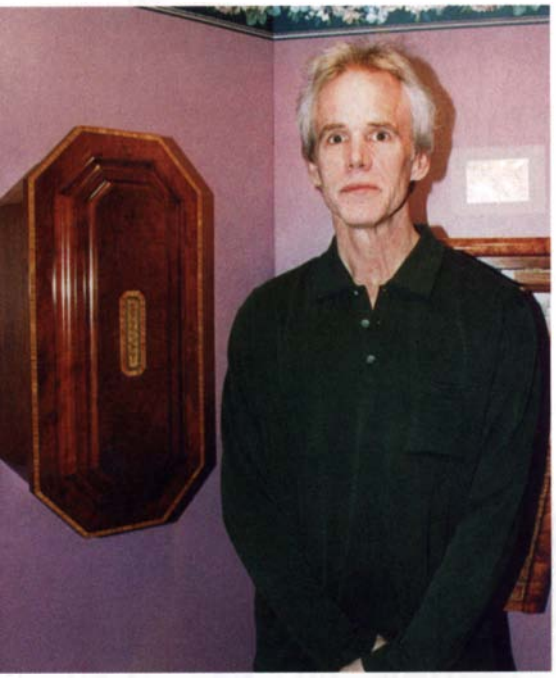

Fine Woodworking *prize winner.* *Robert Arnold stands near one of the wall cabinets that won him the Best New Artist in Wood award at the 2001 Philadelphia Furniture and Furnishings Show.*

FWW artistry award goes to jewelry-box maker

Robert Arnold, a woodworker from the Albany, N.Y., area, won the Best New Artist in Wood award at this year's Philadelphia Furniture and Furnishings Show. The award, which is sponsored by *Fine Woodworking* and includes a check for $1,000, is given to a woodworker in the first or second year of exhibiting at the show.

Arnold has been a hobbyist woodworker for 30 years and a professional for the 16 years since he retired from his first career as a telephone-company worker. He mostly makes wall-hung jewelry cabinets and clocks, which he decorates with gemstones, amethysts and other jewels.

Woodworkers are often good at one thing, such as joinery, finishing or design. It's rare to find a wood artisan like Arnold who is accomplished at several skills. His cabinets are a pleasure to ponder because he has a strong design sense, yet his pieces are very functional. He incorporates inlay, veneer, great finishing, tight joinery and a meticulous attention to detail in his work.

The Philadelphia Furniture and Furnishings Show is nationally acclaimed as the finest for-consumers exhibition of studio-made furniture for the home and office. More than 250 artisans are juried into the show that was held the weekend after Easter this year.

For more information, visit the show's web site at www.pffshow.com. Robert Arnold can be contacted at (518) 734-6008.

—Tim Schreiner, editor-in-chief

Notes & Comment

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Tools & Materials

Large top is a plus. *With more than 7 sq. ft. of surface area, the top on the RA1200 provides good support for most workpieces.*

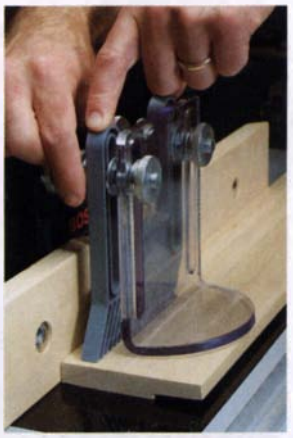
New router table from Bosch

The new router table from Bosch, model No. RA1200, is a well-made product. The table is built for medium-duty work, but the construction is sound, so I expect it to last many years.

The 1-in.-thick medium-density fiberboard (MDF) top is sturdy. At just under 24 in. by 44 in., it gives steady support to large workpieces. The fence is also sturdy, though the two sliding faces were not perfectly aligned. I trued them up by slipping a paper shim under a single bolt on one of the faces.

The insert for the router is leveled using six nylon bolts. The top also features a T-slot for a miter gauge.

The thin legs make the table look wobbly, but in heavy use it is surprisingly steady. The legs fold under the table for transportation or storage. To me, the table is too heavy to be called portable (it weighs around 65 lbs. without the router). But, then again, some people consider a contractor's saw to be portable.



Safety features. *A featherboard and blade guard quickly adjust to accommodate various thicknesses of stock.*

The top of the table measures 36 in. from the floor, although all of my other stationary tools are closer to 34 in. high. Bosch describes its height as "optimal," though I didn't find the added height either better or worse.

I appreciate the easily reached switches, but the concept can be taken too far: If you lean against the edge of the table near the switch, the router shuts down. Relocating the switch a little farther under the table would probably solve the matter.

The RA1200 router table sells for $360 (router and dust hose not included). For more information, contact Bosch at (877) 267-2499.

—Strother Purdy

A 3-in. right-angle random-orbit sander

Metabo recently introduced the SXE400, a variable-speed, random-orbit sander with a couple of unique features. First, a right-angle head puts the motor/handle parallel to the work instead of at a right angle. And second, rather than the 4-in.-dia. or 5-in.-dia. disc, the size found on most random-orbit sanders, this one has a 3-in.-dia. disc.

A hook-and-loop system makes it easy to mount the sandpaper to the disc. And a variable-speed feature allows the sander to run between 5,000 and 10,000 rpm.

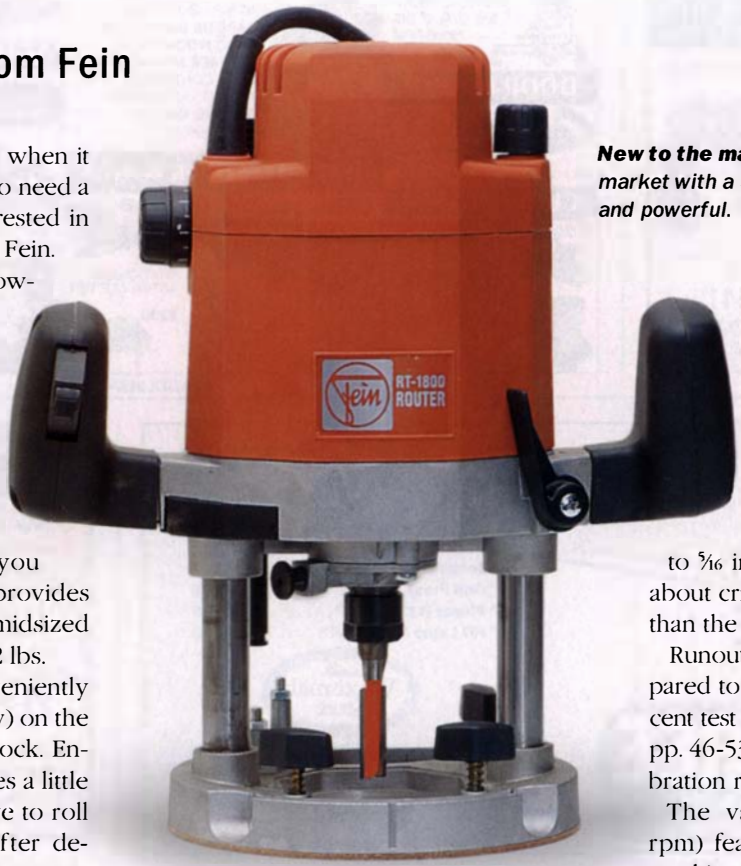
The right-angle head and 3-in. disc make the SXE400 a compact tool, roughly the size of a toy train engine. So it's easy to hold, enabling me to sand with one hand while steadying a workpiece with the other. Also, with the smaller disc, and because the right-angle shape puts my hand close to the workpiece, the SXE400 allows concentrated, aggressive sanding. And it can be handy for getting into inside corners or other hard-to-reach areas.

While it doesn't fully replace my need for a 5-in. or 6-in. random-orbit sander, I think the Metabo SXE400 can be a valuable companion. The tool sells for $125. For information, contact Metabo at (800) 638-2264.

—Rex Alexander

Cozying up to corners. *The smaller disc on the Metabo SXE400 lets you sand closer to corners.*

Heavy-duty router from Fein



New to the market. *Fein has entered the router market with a 3¼-hp plunger that's both smooth and powerful.*

Midsized routers are hard to beat when it comes to versatility, but those who need a little more oomph might be interested in a new heavyweight offering from Fein.

The RT-1800 is a well-finished power tool. And in this case, form reflects function—because its controls and plunge action are notably smooth.

As you might expect from a machine with 3¼ hp and a 3-in. stroke, it is somewhat bulkier than a typical midsized plunge router. On the other hand, when you consider that this machine provides roughly 50% more power than a midsized version, it's surprisingly light at 12 lbs.

The trigger-style switch is conveniently located (unless you're a southpaw) on the handle, with an auxiliary switch lock. Engaging this spring-loaded tab takes a little getting used to, because you have to roll your index finger downward after depressing the on/off switch. A light squeeze releases it, which is a nice safety feature.

Thanks to a spindle-locking button, it takes only one wrench to change a bit, although both hands are still required. The RT-1800 accepts only ½-in. shank bits.

Depressing the plunge-lock lever effectively locks the motor housing in place. For my hands, reaching the lever requires a bit of shifting, but it functions positively and predictably.

The router has a dial that adjusts to limit the upward travel of the motor. That's helpful when performing operations that don't require plunge cutting, such as moldings or rabbets.

In use, the Fein is smooth and powerful. The factory recommends restricting stock removal to 5/16 in. at a time, but that seems more about crisp, controlled cuts and cutter life than the limits of the router.

Runout measures only 0.0004 in., compared to an average of 0.00298 in. in a recent test of plunge routers (see *FWW* #149, pp. 46-53). And the Fein earns a "good" vibration rating.

The variable-speed (8,000 to 22,000 rpm) feature is a plus, especially when working with villainous grain or splintery species or when using a big bit that has to be run at a slow speed. And a soft-start feature cuts down on kickback at start-up.

The Fein RT-1800 sells for around $340. For more details, call (800) 441-9878.

—Michael Standish

High-angle frog tames unruly grain

Even the best, finely tuned standard-angle bench plane can produce tearout when called upon to work ornery grained woods. That's because the blade is bedded at 45°, an angle that's often too low for grain that's on the wild side. But now there's help. To minimize tearout when the grain is less than perfect, Lie-Nielsen has just introduced a unique high-angle (50°) frog for its No. 4½ smoothing plane.

Although the higher angle doesn't always prevent tearout when the grain gets nasty, those extra 5° do make a difference. While planing figured wood, the tearout I got with the 45° frog was routinely eliminated when I changed to the 50° version.

Switching from one frog to another is easy, so it makes sense to have both of them in the shop. That way you can use the 50° frog when faced with planing odd grain. But when working on straight-grained wood or softwood, the 45° frog produces equally smooth cuts with less effort. By the way, the high-angle frog fits only Lie-Nielsen planes.

The high-angle frog is available from Lie-Nielsen (800-327-2520). The current price is $75. *—William Tandy Young*

The lowdown on a high frog. *The high-angled (50°) frog (on the plane in back) cuts at a steeper angle than a typical 45° frog (front). A steep angle is less likely to cause tearout when planing uneven grain.*

Photos, except where noted: Erika Marks; this page (bottom): Michael Pekovich

Crackled finish in a kit

If a painted antique look appeals to you, or if you simply like shabby-chic or funky finishes, a crackled finish is a good one to consider. It imitates the look of an old, multilayered, painted finish, one that has long suffered from neglect as evidenced by a surface thoroughly covered with cracks.

On indoor furniture, it takes years for a painted finish to crack badly. Now, however, using a system developed by Franklin International, you can re-create the look of a crackled finish in just a weekend.

You'll need at least two items from Franklin; its base coat (in 16-oz., 1-qt. and 1-gal. containers) and ColorPak (in 0.72-oz. tubes in seven different colors). You'll also need water-based latex paint (not sold by Franklin) to serve as the outer coat. A clear topcoat is also a must. Franklin offers one (gloss only), but any oil-based polyurethane varnish will work. Don't use a water-based varnish because it's sure to create problems with the base coat.

Applying the finish is a three-step process. To color the base coat, mix in the ColorPak. Then brush on the mixture. It's pretty thick, so you may need to add a little water to make it easier to apply. A heavy coat produces larger cracks, while a thinner coat gives cracks that are finer and closer together. When the base coat dries, brush on a colored latex paint. Apply it quickly and uniformly. As the latex dries on the base coat, the cracks begin to develop, exposing the colored base coat underneath. After the latex has fully dried, the clear topcoat is added to complete the finish. This step isn't optional, because it protects the water-soluble base coat from the effects of moisture.

Instant old finish. *The Crackling Solution from Franklin lets you create an antiqued crackled finish in just a day or two.*

A 1-qt. container of base coat sells for $12.99, while a tube of ColorPak costs $4.99. Contact Franklin International at (800) 877-4583 for more information. *—Mark Ziobro*

Takes the edge off the toughest sanding jobs.

Contours. Edges. Inside curves. You name it. Only the RIDGID Oscillating Edge Belt/Spindle Sander lets you tackle all these sanding tasks with just one tool. The 4" x 24" belt sander quickly and efficiently sands end grain, faces, and edges. The range of spindles provided lets you accurately sand curves from as little as 1/2" to more than 3" in diameter. And conversion from belt to spindle mode is tool-less and takes just a few seconds. The durable cast aluminum worktable tilts from 0° to 47° for precise bevel sanding. The tough polypropylene base won't rust or dent, yet provides a large, stable footprint when mounted to sawhorses or on a shop bench. And the quiet Emerson induction motor powers a patented belt and pulley-free drive to provide years of trouble-free performance. It's the highest rated by WOOD magazine for performance and value–5 out of 5 stars. And just like all RIDGID tools, it's backed by a Lifetime Warranty.

Converts from a belt sander to a spindle sander in seconds.

RIDGID
TOOLS FOR A LIFETIME

THE HOME DEPOT

READER SERVICE NO. 148

DeWalt's cordless screwdriver is versatile and powerful

DeWalt has a new cordless screwdriver with a new angle on some old screwdriver features. Model No. DW920, powered by a 7.2-volt rechargeable battery, has a 15-position adjustable clutch that provides from 6 to 80 in.-lbs. of torque. And when the clutch isn't needed, it takes just an instant to switch to a purely driving mode.

A nicely placed large trigger and a comfortable grip make the tool easy to handle. The trigger also offers accurate control of the variable-speed feature (0 to 500 rpm). The forward-and-reverse control is located above the trigger, easily accessed with thumb or index finger.

A conveniently placed release button allows you to change the configuration of the driver quickly from straight to angled. With the screwdriver in angled mode, the grip provides a very comfortable, well-balanced handle that makes it easy to utilize the driver's power. In the straight mode the screwdriver offers a very narrow profile for getting into tight quarters.

The quick-release chuck accepts standard ¼-in. hex accessories and has an eject feature that pushes the screwdriver bit free of the chuck when the bit is released. The bit-eject feature makes changing bits easy, fast and, with a little coordination, one-handed.

I found the tool to be both powerful and handy. Also, its ability to accept a variety of different screwdriver bits, without the need for a separate chuck, makes the drill versatile without added bulk at the business end of the tool.

The DW920 comes with a Phillips and a straight bit, a battery charger and a plastic case. It generally sells for about $100. You can get additional information by contacting DeWalt (800-433-9258).

—Roland Johnson

A pair of positions. *The head of the screwdriver can be used either angled (shown) or straight.*

Strother Purdy works wood in Bridgewater, Conn.; Rex Alexander runs a one-man woodworking shop in Brethren, Mich.; Michael Standish is a woodworker and writer in West Roxbury, Mass.; William Tandy Young builds furniture in Stow, Mass.; Mark Ziobro builds reproduction furniture and restores antiques in Sheffield, Mass.; Roland Johnson lives in Sauk Rapids, Minn., where he has a woodworking business.


Power
Tools

Master the Miter




How to cut, trim, glue up and reinforce this multipurpose joint

BY GARY ROGOWSKI

The attraction of a miter joint is easy to see. It is an elegant and straightforward method for joining parts that meet at an angle without showing any end grain. Whether you are building the frame for a veneered panel (tabletops, case goods), applying wrap-around molding or constructing a simple picture frame, a miter joint will serve your needs. But as the saying goes, the devil is in the details. The very visibility of the miter joint means that errors in machining or assembly are hard to conceal. However, with a little patience and lots of practice cutting and assembling miters, you too can master the joint.

Generally used for right-angle corners between two boards of equal thickness and width, miters are made with matching cuts. These cuts are at 45° so no end grain shows. But the miter joint isn't reliable solely as a glue joint for most constructions. Where any real tenacity is required, strengthening with biscuits, splines or keys is always the prudent choice. In short, to get perfect miters requires perfectly mating joints, a slip-proof gluing system and at least one form of strengthening.

Cut miter joints with a chopsaw or tablesaw

No matter what type of saw you cut miters with, use a sharp, clean blade. Generally the more teeth to a blade, the smoother the cut, but no blade will cut well if it's dull or covered with pitch. Every cut is made in two directions: at 45° across the width of a board and at 90° across its face. For a miter to close up well, both angles need to be cut exactly. Make rough adjustments using a plastic 45° drafting triangle, then take several practice cuts, checking the results with a combination square.

A chopsaw works great at cutting miters. Just make sure the fence is flat and straight. If necessary, add an auxiliary fence and shim it to make it square to the table. Frame parts can lie flat on the chopsaw table. Angle the blade 45° to the fence to make the cuts. Clamp stops onto the auxiliary fence to index matching cuts.

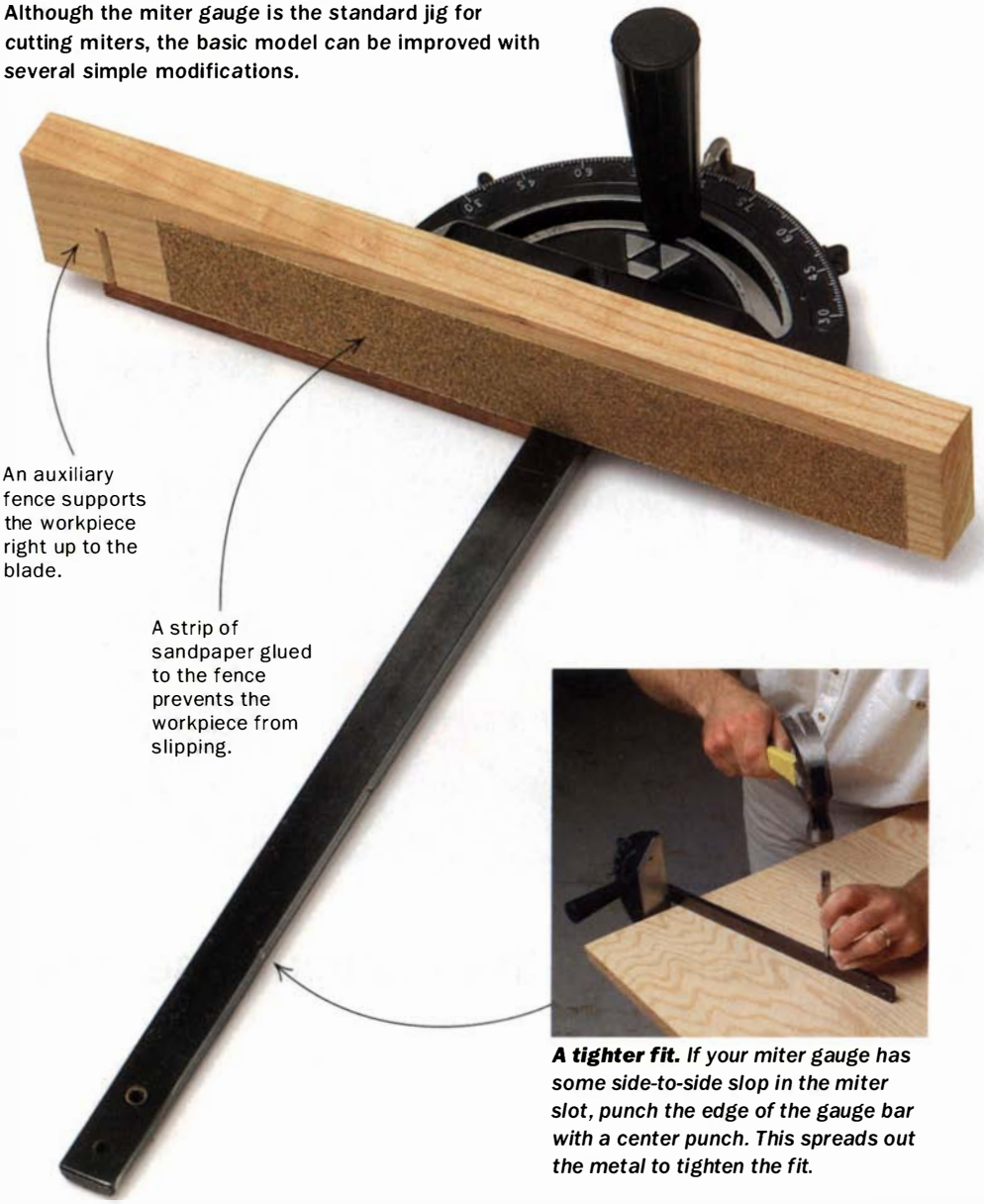
When cutting miters on a tablesaw, you'll get the best results using a jig that holds your work to move it past the blade.

The miter gauge is, of course, the stan-

Photos, except where noted: Mark Schofield

MITER-GAUGE TUNE-UP

Although the miter gauge is the standard jig for cutting miters, the basic model can be improved with several simple modifications.



A tighter fit. *If your miter gauge has some side-to-side slop in the miter slot, punch the edge of the gauge bar with a center punch. This spreads out the metal to tighten the fit.*

dard jig used for cutting miters. Be sure to check your settings for the angle of cut (see the photos below). Attach an auxiliary fence to the miter gauge to support the workpiece near the blade.

When cutting frame miters, angle the gauge down and away from the blade. This way, if the workpiece slips, it will slide away from the blade, not into it. A piece of sandpaper glued to the fence will help prevent slipping. Make certain that your gauge is cutting a true 45° angle, then cut one end of each matching part. Measure and mark off the required length and clamp a stop onto the auxiliary fence to index the cut so matching parts are the same length.

Picture-frame jig ensures accuracy

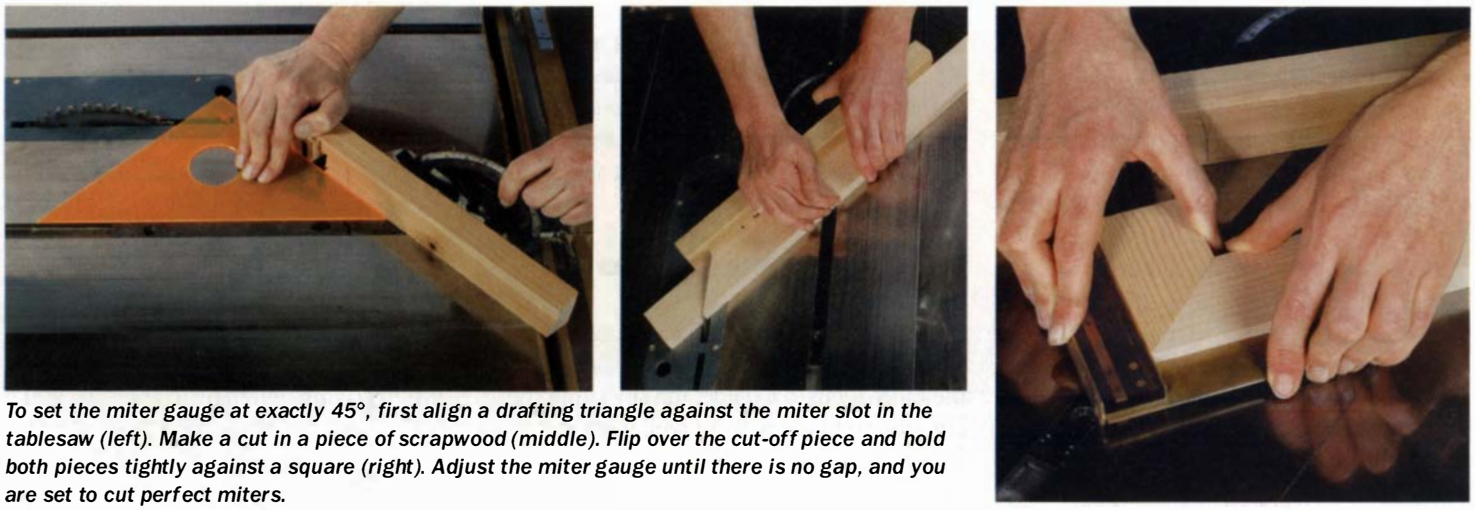
A picture-frame jig has four parts: a flat base, two runners, a fence and clamping blocks. The base can be made of any flat ½-in.-thick sheet stock. Make the runners, which attach to the bottom of the base, out of quartersawn hardwood, so seasonal movement won't affect their fit.

The fence of the jig is ¾-in.-thick plywood. Cut the corner of the fence at a right angle, then screw it to the base. It won't matter if it's mounted a little off a true 45° angle as long as you always cut one piece of the miter joint on the left side of the fence and the other on the right side. The cuts will always be complementary and mate perfectly. Put on the clamping blocks last. You can clamp a stop block to these blocks to make cuts of uniform length.

Fine-tune the fit before glue-up

After cutting the miters, do yourself a favor and take some time to prepare them for

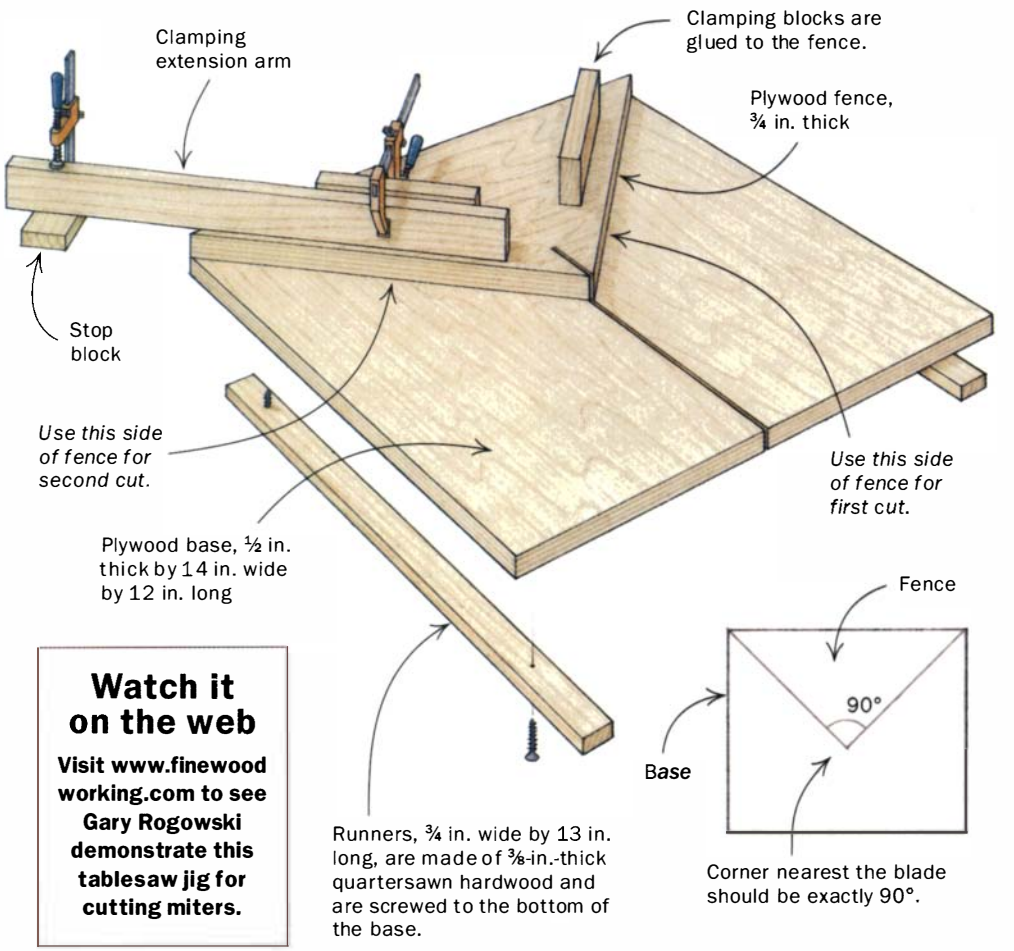
MAKE A TEST CUT AND CHECK FOR SQUARE



To set the miter gauge at exactly 45°, first align a drafting triangle against the miter slot in the tablesaw (left). Make a cut in a piece of scrapwood (middle). Flip over the cut-off piece and hold both pieces tightly against a square (right). Adjust the miter gauge until there is no gap, and you are set to cut perfect miters.

Photos, this page: Michael Pekovich

Cut adjoining parts on opposite sides of the jig to guarantee a 90° joint.



Watch it on the web

Visit www.finewoodworking.com to see Gary Rogowski demonstrate this tablesaw jig for cutting miters.

The first cut is made on the left-hand side of the jig. *If the work slips, it will do so away from the blade.*

Uniform length. *Mark the length on the workpiece and on the right-hand fence. Clamp a stop block against the mitered end.*

Make the second cut on the right-hand side of the jig. *With the stop block in place, you are assured of consistent cuts.*

gluing. First check your cuts to see how well your saw performed. There are several ways to remedy a cut that is less than smooth. Trim the miter with a low-angle block plane, tuned up with a freshly sharpened blade. Put the workpiece in a vise and take a few light passes off each mating face, but don't change the angle. Check your results with a combination square.

A disc sander outfitted with a miter-gauge jig can also be used to fine-tune miters. This jig rides in the slot in the sander table and has a plate on it cut at 90° but positioned 45° to the sanding disc. Work on both sides of this fence to ensure that mating pieces get complementary cuts, but always work on the left side of the moving disc. In this way your work will always get pushed down into the supporting table. Take only light passes, and try to move the work past the disc so you don't burn the wood or load up the disc in one spot. Before starting, double-check that the sander's table is exactly 90° to the disc.

A third method of trimming is to use a shooting board. A stop angled 45° on both sides is screwed to the base. When used with a square-sided plane, this jig will trim the miter at 45° across its width and at 90° to its face.

Even clamping pressure is critical

Wood is made up like a bundle of straws. Crosscut or miter the end of a board, and you expose the ends of those straws, which suck up glue and starve a joint, weakening it. The faces of a miter joint should be sized by precoating them with a light wash of glue to fill the pores. Scrape off any excess glue before it dries. Despite the normal warning not to apply glue to an already glued surface, in this case sizing will strengthen the glue joint.

Dry-fit and clamp everything before the final glue-up, and you'll thank yourself later for your calm demeanor and slow heart rate. Mind you, I am a yellow-glue devotee, so all of this advice comes from

Drawings, except where noted: Vince Babak

TRIMMING MITERS BY HAND AND MACHINE

A light plane. *A few passes with a well-tuned block plane clean up the surface and alter the angle, if necessary.*

Accurate shooting. *This shooting board, when used with a square-sided plane, trims the wood at 45° across its width and at 90° to its face.*

Sand to fit. *Another way to fine-tune a miter joint is to use a jig that holds the workpiece at 45° to a sanding disc.*

using quick-setting glue, not some expansive, messy polymer.

Band clamps fit around a box or a picture frame to apply even pressure to the miter joints. Practice locating and tightening the band clamp in place right over the joint. Use several clamps for wider glue-ups, and stagger the clamp heads so they're not in each other's way.

You can put clamping corners over the joint to help spread the pressure. Some band clamps come with self-adjusting corners suitable for any angle; you can also buy aftermarket versions. Again, practice with these systems before gluing.

When gluing up miters with splines or keys that would interfere with a band clamp, I use shopmade clamping blocks clamped right onto the frame side. These blocks have a notch cut right into them where you can place another clamp to apply pressure directly across the joint. If your clamping blocks slip too much, glue a piece of sandpaper to them on the side that rests against the workpiece.

How to strengthen miters

Reinforce miter joints by using splines or biscuits, which are inserted before the joint is glued up, or keys, which are added after glue-up. Which method you use is determined by several factors, the most important being aesthetic considerations. Do you want to conceal the strengthening for a seamless look, as with a gilded picture frame, or do you prefer to emphasize it, as with face-frame keys? The second factor is the difficulty and length of time involved.

Splined miters in frames—Through spline cuts are made along the length of the miter. They're most easily made on the tablesaw. Use a spline-cutting jig to support the workpiece at a 45° angle to the blade. Make this jig out of a straight piece of ¾-in.-thick plywood and a support piece glued and screwed on at a 45° angle. Make certain that your fasteners are higher than the tablesaw blade at its highest setting.

With your frame piece in the jig, set the fence so that the sawkerf is centered in the thickness of the stock. If it's not, the faces of your frame members will not be flush. One way to prevent this is by having a miter jig with two fences on it for each side of the miter (see the photos and drawings on p. 48). The jig is rotated 90° to cut the spline in the adjoining workpiece.

Sizing the joint. *The open grain on the face of a miter should be sealed with a thin layer of glue and allowed to nearly dry. The sealed end grain won't starve the joint when glue is applied to connect the miter.*

Set the blade height for a ¼-in.- to ⅜-in.-deep cut, but no deeper. Because the grain direction of a spline in a solid-wood frame has to run in the same direction as the frame members, too deep a spline cut makes for a wide and fragile spline. Hold or clamp the work firmly in the jig. Place your hands carefully out of harm's way and make a pass. Use a flat-grind blade to put a flat bottom on the cut.

Mill up the spline material out of a contrasting wood to set off the joint. Using a tenoning jig, hold the board vertically and run it past the blade to trim your spline to thickness. Then cut the spline to length. If your spline doesn't quite fit, use a block plane to trim it to thickness. Be careful not to snap the short grain of the spline as you plane. You're looking for a snug fit, not one that's overly tight.

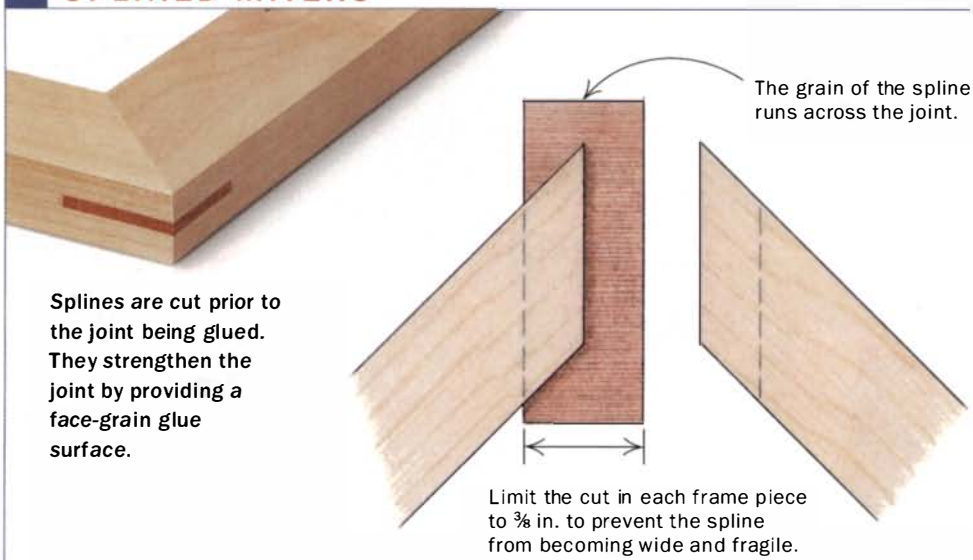
Fit one side of the spline and check to see that it will let the joint close up nicely. Trim its end grain with a block plane, if needed. Size the end grain of the miter, then put glue in one of the spline cuts with a thin piece of wood. Set the spline in place all the way down to the bottom of the groove. Then put glue on the rest of the joint and clamp it up. If the fit is a bit loose, clamp across the face of the joint as well. You can also pin this spline in place with dowels for extra strength and an additional design detail.

Biscuit splines—You can also strengthen a miter with a biscuit joint. Mark the frame

A better band clamp. *Plastic corner blocks added to a band clamp reduce the risk of crushing the corners of the workpiece.*

Bar-clamp techniques. *Shopmade clamping blocks distribute pressure across the joint and won't mar the workpiece.*

SPLINED MITERS



Splines are cut prior to the joint being glued. They strengthen the joint by providing a face-grain glue surface.

Cutting the spline. *Use a tenoning jig to trim the spline to thickness.*

No band clamps here. *Because the spline extends beyond the outside corner, it is necessary to use block clamps.*

members across their faces with a pencil at the center of the joint or closer toward the inside corner of the joint so that the cut won't show at the corners. Center the joiner in the thickness of the stock. Support or clamp the frame members securely, and hold the joiner tight to the miter as you cut.

Keys can reinforce miter joints

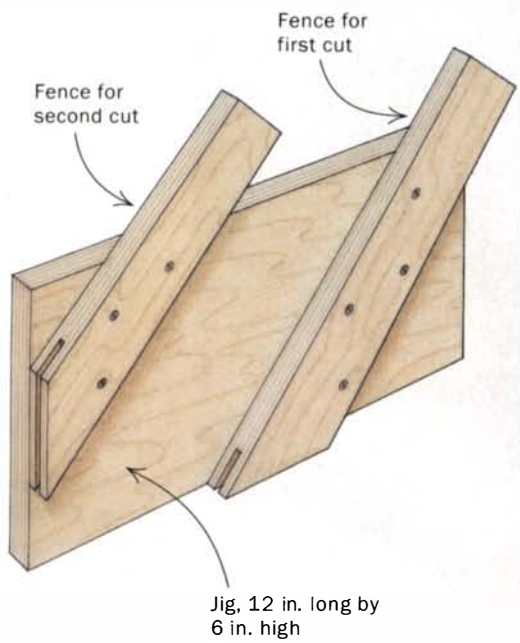
Mitered frames may also be reinforced after glue-up using exposed keys. These keys are inserted into mitered corners from the outside after cutting the appropriately sized slots. Slots may be cut on a tablesaw or on a router table.

Cutting straight keys on the tablesaw—A keyed miter jig works great for holding a glued-up frame in place while you pass it through the sawblade (see the photos and drawings on the facing page). Set the blade height for the full depth of cut, and use a flat-grind blade if you have one. Cut each corner, holding the same face of the frame to the jig.

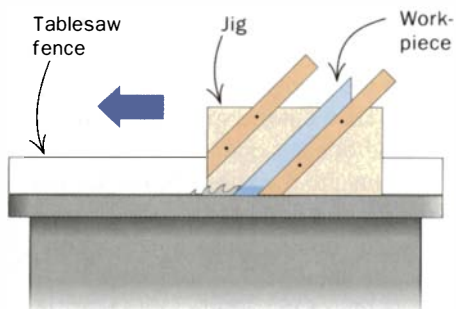
Mill up key stock wider than the depth of the key cut. Trim the stock to thickness on the tablesaw. You should use a thin

SPLINE-CUTTING JIG

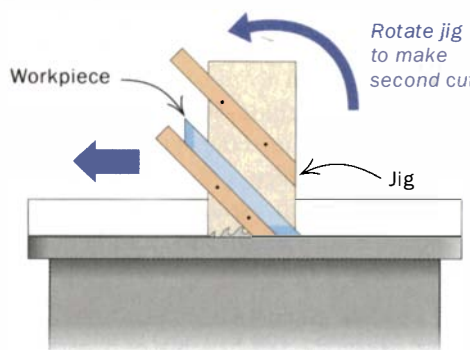
This jig has two 45° fences, which allow miters to be cut on both ends of the workpiece while keeping the same face registered against the jig. All parts are made of ¾-in.-thick plywood.



Cut one end. *Hold the workpiece firmly in place and register the jig against the tablesaw fence.*

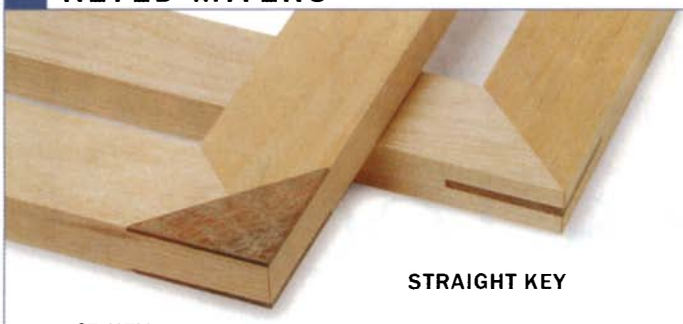


Then cut the opposite end. *Rotate the jig and register the workpiece against the other fence.*



Drawings, this page (bottom right): Michael Pekovich

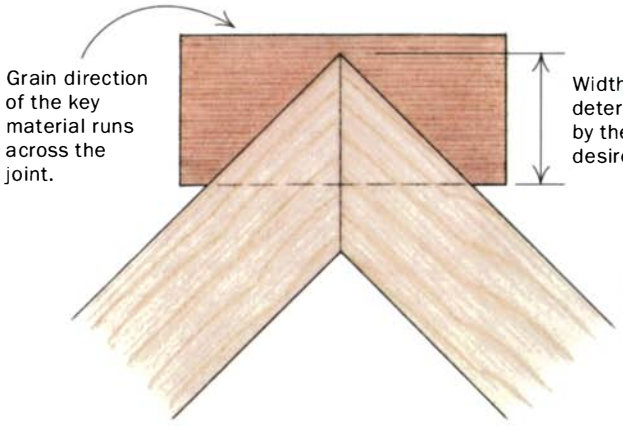
KEYED MITERS



FACE KEY

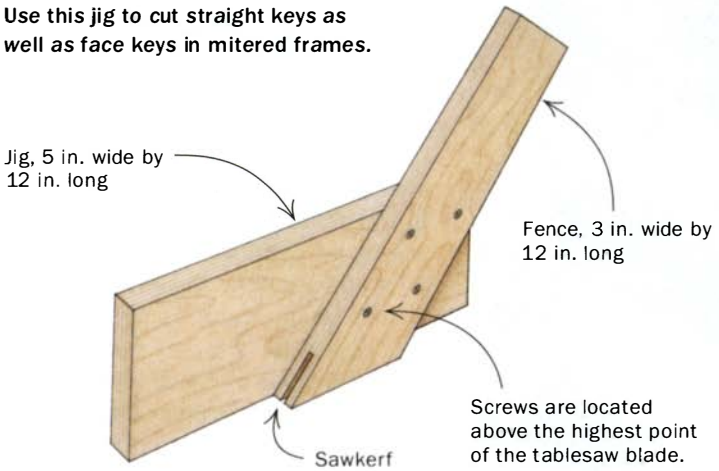
STRAIGHT KEY

Keys are added after the joint has been glued. Both face keys and straight keys add to the glue area of the joint.



KEY-CUTTING JIG

Use this jig to cut straight keys as well as face keys in mitered frames.



One jig cuts two keys. *Simply by adjusting the fence of the tablesaw, the key-cutting jig can cut either straight keys in the center of the frame (above), or face keys on the front of the frame (right).*

push stick to help you move the work safely past the blade. Use a handplane to trim the key exactly to thickness, then cut it longer than necessary.

Fit keys in their cuts so that they're snug and only require a light tap to position them. Make sure when gluing that they fit all the way down in the key cut at both its sides. Once the keys are dry, clean them up on the bandsaw. Sight along the edge of your frame as you make the cut so you don't cut into the piece. Then handplane away from the corner in each direction to trim the key flush. If you plane toward the corner, you will tear out the tip of the key.

Cutting face-keyed miters—Face-keyed miters for frames probably originated when someone made a straight key cut in the wrong spot. It was a pretty mistake. Make these cuts using the keyed miter jig on the tablesaw. Place the cut just on the outside edge of each corner on both faces of the frame. Make up key stock as before, but this time just make it conveniently thick. When gluing, make sure the keys fit down to the bottom of the cut on both sides of the joint. Put clamps across the keys to hold them in place. The final step is to plane the keys flush with the face of the frame, being careful of the contrasting grain directions. □

Gary Rogowski runs The Northwest Woodworking Studio in Portland, Ore., and is a contributing editor to Fine Woodworking.

Peak Power for Cordless Tools

Follow a few simple rules to get the best performance from your rechargeable batteries

BY FRED SOTCHER

Cordless power products have been one of the great growth industries of the last few years. By the middle of 2000, there were an estimated 431 million cordless products in the United States alone, according to the Rechargeable Battery Recycling Corp. Many woodworkers have embraced cordless tools, but the performance and life span of the rechargeable batteries has left many owners disappointed. With replacement batteries costing more than $100 for a 24-volt model, averaging a third of the power tool's original price, this is a serious handicap.

For 30 years I ran a company that specialized in electrical equipment designed to test portable tools. As part of our research, we performed extensive long-term tests on batteries and studied every new charger as it became available. I learned that the way we use cordless products has a major influence on their performance. If you are getting fewer than five years of use or 500 charges from your batteries, your recharging procedure may be at fault. A clear understanding of how the batteries and chargers work will help you maximize service from your cordless tools.

Battery packs are made up of individual 1.2-volt cells

Three types of batteries have been used in cordless tools. The lead acid variety, used in some early cordless tools, never caught on because of its bulk and the fact that the voltage declines over the discharge period.

The nickel-cadmium (Ni-Cd) battery, on

Photos, except where noted: Kelly Dunton; this page: Michael Pekovich

the other hand, stores a great deal of energy in a small, relatively light package. The voltage output remains constant, allowing the product to be used at full capacity until the charge has been depleted.

The nickel-metal-hydride (Ni-MH) battery is the newest. This battery has characteristics similar to the nickel cadmium but offers up to 30% more storage capacity, which translates to a longer run time between charges. Nickel-metal-hydride batteries require a special charger. While a nickel-cadmium battery can be charged in a nickel-metal-hydride charger, the reverse is not true. In mid-1999, a survey found that 85% of cordless tools used nickel-cadmium batteries, with the balance mostly nickel-metal-hydride and a few lead batteries. However, the proportion of nickel-metal-hydride powered tools is growing, with some manufacturers, including Makita, moving toward having only entry-level tools using nickel-cadmium batteries.

Most cordless tools, with either type of battery, use a battery made up of two or more sealed cells. Each cell produces 1.2 volts; the batteries come in multiples of that. Common sizes are 6, 9.6, 12, 14.4, 18, 19.2 or 24 volts. The higher the voltage, the more energy available but at greater cost and weight.

Chargers have experienced rapid growth in sophistication

There are three kinds of chargers: basic, standard and microprocessor. While basic chargers are very similar to each other, the other two are offered in a great variety of models. As manufacturers have learned more about batteries, better circuits have been developed and an ever-wider selection of chargers has become available.

Despite this profusion, some characteristics are common to all batteries and chargers. A battery loses some of its charge over a period of months. It holds each charge longer and will have a longer total life if it is stored in a cool place. As a battery is charged, its temperature abruptly rises as it becomes fully charged. Any effort to charge it further results in additional heating, drying out the cells, which vent to avoid excessive pressure buildup.

Universal tips include: Don't recharge a battery until a reduction in performance is noted; allow the battery to cool before charging; never place a short circuit across a battery; never fully discharge a battery

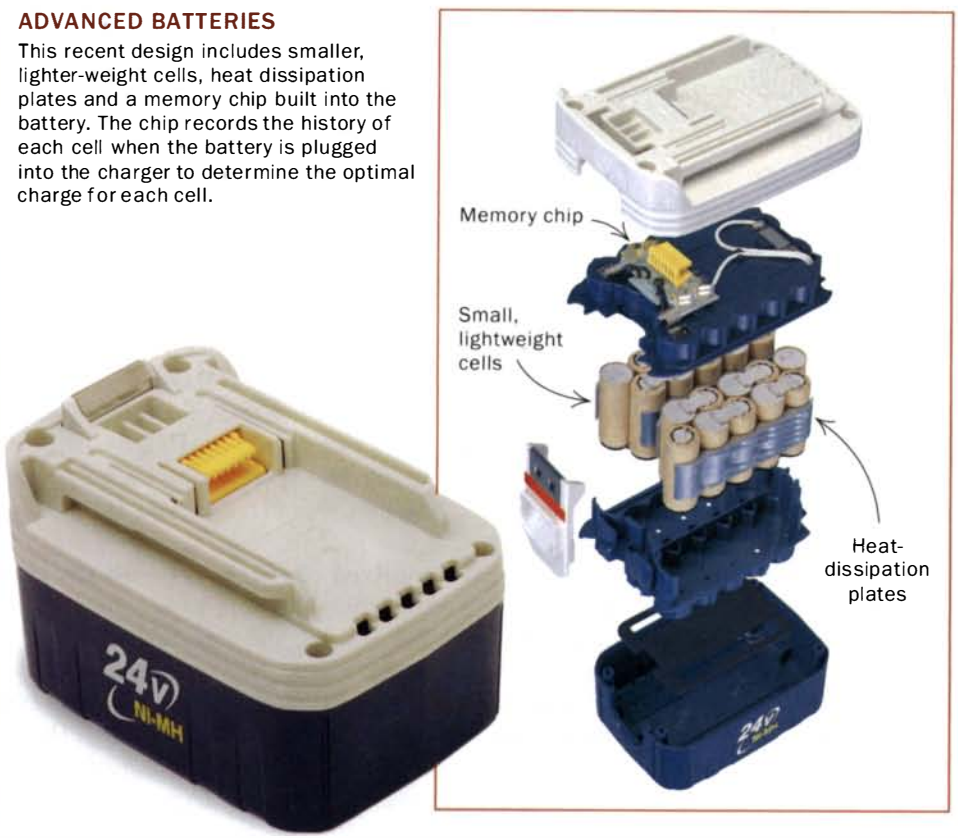
BATTERY BASICS

STANDARD BATTERIES

Both nickel-cadmium and nickel-metal-hydride batteries are made up of a collection of individual cells. Each cell provides 1.2 volts, and popular combinations include 9.6, 12, 14.4, 18 and 24 volts. The downside to more power is greater bulk and weight.

ADVANCED BATTERIES

This recent design includes smaller, lighter-weight cells, heat dissipation plates and a memory chip built into the battery. The chip records the history of each cell when the battery is plugged into the charger to determine the optimal charge for each cell.



Photo, this page (bottom right): courtesy of Makita Corp.

EXTENDING THE LIFE OF A BATTERY

A rechargeable battery ought to last for about five years or 500 charges. If you're not getting that kind of life from your batteries, improper use and recharging techniques may be at fault. Consider getting a third spare battery, which can actually save you money in the long haul because you won't have to rush the recharge cycle every time a battery drains.

because it can cause one or more of the cells to charge in reverse, permanently reducing the useful capacity of the battery; allow the battery to cool from the charge before using it in a power tool; all chargers work best if they are kept out of the direct sun and away from other heat sources.

Basic chargers have no frills—This unit is about 2 in. square, with a 120-volt plug on one side and a small cord that makes two electrical contacts with the battery. There are no indicator lights or start buttons. This type of charger provides a continuous small charge to the battery, requiring up to 10 hours for a full charge. Even after the battery has been fully charged, the charger keeps operating, overheating the cells and drying them out. This is the reason why a rechargeable flashlight that has been plugged in for months or years fails to work. With this type of charger, it is best to use the battery-operated device until it requires a charge, connect it to the charger for the time indicated in the instructions, then unplug it. This time should not exceed 24 hours.

Standard chargers are still the most common—The majority of cordless power tools rely on the standard charger. The charger is 4 in. to 8 in. in size and has a socket on top for the battery, which is removed from the tool for charging. The unit has one or two lights to indicate that the power is on and that a charge is being applied to the battery. Three electrical contacts are made with the battery, and charging normally takes 15 or 30 minutes.

This charger provides a high current during the charge period. When the battery has been charged, a thermal switch opens. In most cases this turns off the charger, so the battery can remain in the charger until it is needed. A few older chargers reduce the current to a very low level, but this will reduce the life span of the battery.

If you commonly use a nickel-cadmium battery for only a short time and then recharge it, the capacity of the battery will sometimes be reduced. The same problem can occur if you apply a slow charge to it for a prolonged period. You can typically restore the full capacity by using the bat-

tery until you note a significant reduction in output, then fully recharge the battery.

The error most people make is to recharge the battery when it is first removed, and still warm, from the power tool. Recharging a warm battery causes the charger to shut off early, reducing the charge and thus the energy available for its next use. The best charging procedure is to use the tool until there is a reduction in performance but before all power is exhausted. Allow the just-used battery to cool for at least 30 minutes before charging. Replace the battery with a second one from the charger. If you own a third battery, it can be charged while you are waiting for the just-used battery to cool. The battery can be left in the charger as the charging current drops to zero, and will not turn back on until either the charge button has been pressed or the battery has been removed and reinstalled in the charger. Some older chargers of this type do not have a button to start the charge cycle; they might switch back to a charge cycle following a power interruption, thus reheating the battery and reducing its life.

Microprocessor-based chargers are the way of the future— Offered with newer and more powerful cordless tools, a microprocessor-based charger has four electrical contacts with the battery. The fourth contact allows the charger to monitor the temperature of the battery. The charger waits for the battery to cool off before starting the charging cycle, allowing it to charge the battery fully. This type of charger often has lamps to indicate that the battery is too hot to start charging or that the battery is not accepting the charge and should be discarded.

The microprocessor-based chargers designed for nickel-metal-hydride batteries normally recharge at a fast rate until a 90% capacity has been achieved, then at a slower charge rate to complete the charge. The microprocessor in some chargers provides the charge current in pulses to reduce heating. Although a microprocessor-based charger is much more forgiving of the recharging procedure you use, it is still best to recharge the battery when you notice a reduction in the tool's performance—but before the battery is exhausted. □

Fred Sotcher is a retired electrical engineer who works wood in San Jose, Calif.

RULES FOR CHARGERS

THE BASIC CHARGER

Of limited use in the workshop, these chargers still have many applications around the house.

- Use the tool until a marked reduction in performance is noted but before the battery has been completely exhausted.
- If the battery is warm, allow it to cool before recharging.
- Recharge the battery for no more than 24 hours.
- Store the tool in a cool place.

THE STANDARD CHARGER

These chargers are most familiar to woodworkers but are far from idiot-proof.

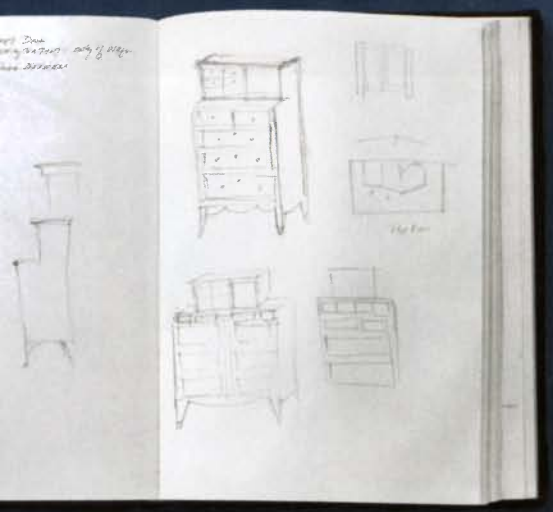
- Use the tool until a marked reduction in performance is noted but before the battery has been completely exhausted.
- If the battery is warm, allow it to cool before recharging.
- Never short out the battery.
- Batteries and charger should be stored away from sunlight and other heat sources.
- Do not charge a battery that has already been recharged.
- Remove the fully charged battery from the charger if it is not going to be used for several weeks.

THE MICROPROCESSOR-BASED CHARGER

A growing number of tools come with these new, sophisticated chargers.

- Most of the rules applying to basic and standard chargers are taken care of by the memory chip in the charger, but certain advice for their use still applies.
- Use the tool until the power is nearly exhausted.
- Keep the battery and the charger away from heat sources.
- Do not short out the battery.

Double-duty. *Microprocessor-based chargers are designed for Ni-MH batteries but will often handle Ni-Cd batteries as well.*

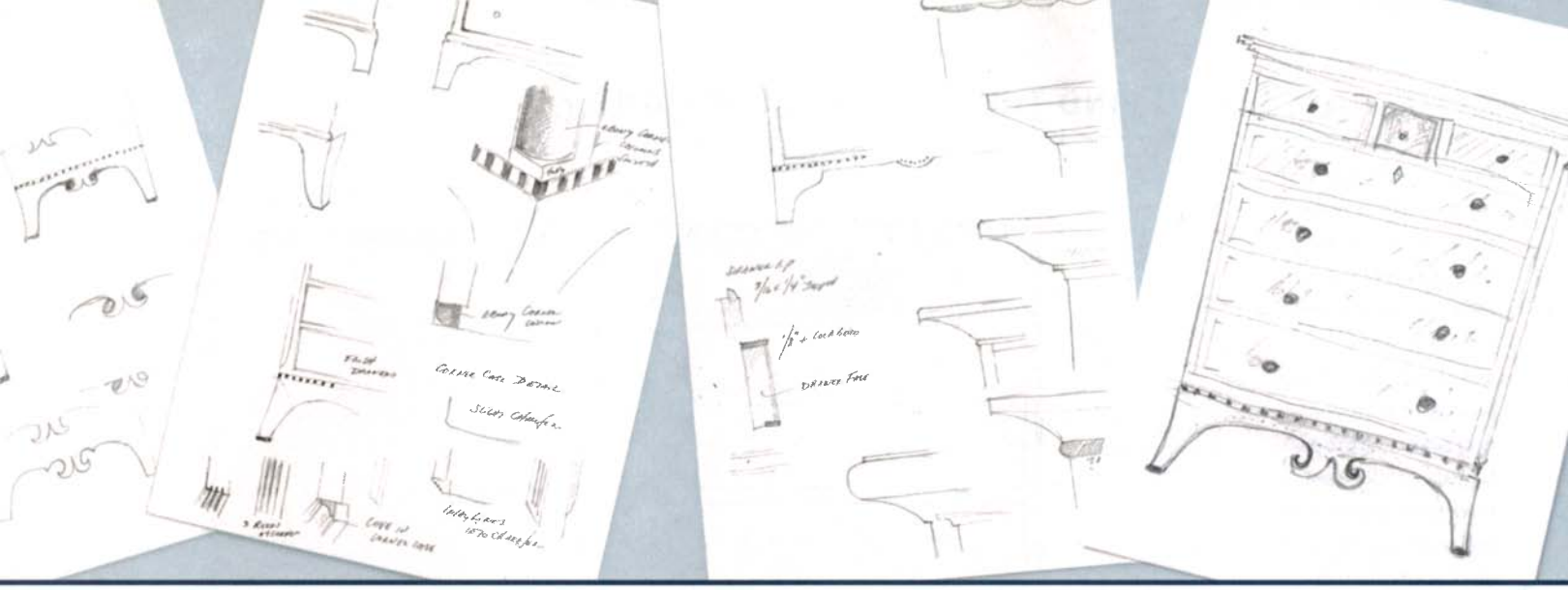


Designing a Chest of Drawers

Borrow form and detail from the past to help develop new ideas

BY GARRETT HACK

The chest form has been around at least 3,000 years, so it's hard to imagine designing something original today. I don't even pretend to. Instead, I freely borrow from this wealth of past ideas. Generations of craftsmen before me have played with chests in every way imaginable. They have refined everything from the sensuous sweep of certain curves to the basics of drawer joinery and case construction. Chests of drawers—from simple country chests to sophisticated highboys—are rich with ideas and lessons.



For me, originality comes not from trying to invent some new form or detail, but from some fresh and intriguing combination of ideas I've picked up along the way. I've been building and studying chests for years, and I've learned that knowledge builds on knowledge; you have to learn certain basics—about both design and construction—before you can understand more complex ideas. I can look at all sorts of furniture and absorb ideas, but only by actually building a piece that incorporates those ideas do they become part of my design vocabulary. And more importantly, I begin to understand new directions in which I can push those ideas next time. When thinking about a design problem, I often start by evaluating similar (and dissimilar) pieces I've built in the past.

The most exciting designs are those with the fewest restrictions. For example, a man recently gave me a commission for a chest of drawers. He didn't have any fixed ideas of what he wanted. He favored cherry, but he was open to other light-colored native woods. He also liked the dimensions of another chest he owned, about 4 ft. high and a little less than 3 ft. wide.

Find a starting point

Designing a chest of drawers shouldn't be all that complicated, considering that it's basically a series of boxes that slide into a larger box. Thinking about wood choices is often a good place to begin the design process. Dark woods can make a large chest seem heavier, just as light woods have the opposite effect. Chests have a lot of surfaces—the sides, top and drawers—that show off a wood differently than, say, the linear parts of a chair. Lots of heavy grain can dominate and distract from the quieter details. Fine-grained hardwoods take and hold small details that time would deface in a softer wood like white pine. With its quiet grain and rich color, cherry would have been a good choice for the client's chest of drawers, but I was a little tired of seeing it everywhere.

Butternut, another native species, soon came to mind. Commonly called white walnut, butternut has a warm amber color, subtle grain and works nicely with hand tools, although it's a little soft. I also had three exceptional wide boards stashed away—just enough to make single-board case sides and the top.

The widest case sides I could get out of the butternut boards were about 20 in., and the width of the top was limited to about 22 in. That size would allow drawers of a good usable depth. Defects in the boards limited the sides to 47 in. long. This would allow for a stack of five ample drawers. Four feet is also a nice height to stand at to see and use the top of the chest. Remembering that my client liked a chest of similar height, I used it as a starting point, drawing front and side views to proportion the drawers.

The smallest practical clothes drawer is about 4½ in. deep. Drawers deeper than 9 in. to 10 in. are prone to being overloaded and are not that efficient (imagine trying to find a particular shirt in a drawer with shirts stacked five high). I don't use any magic proportioning system for drawers; I just sketch out ideas. Sometimes it's as simple as increasing each successive drawer by an inch. Arranging larger drawers at the bottom and smaller drawers at the top is not only practical but also balances the composition. To give interest to the facade of this chest, I tried breaking up the top tier of drawers. First I tried two and then three smaller drawers. This

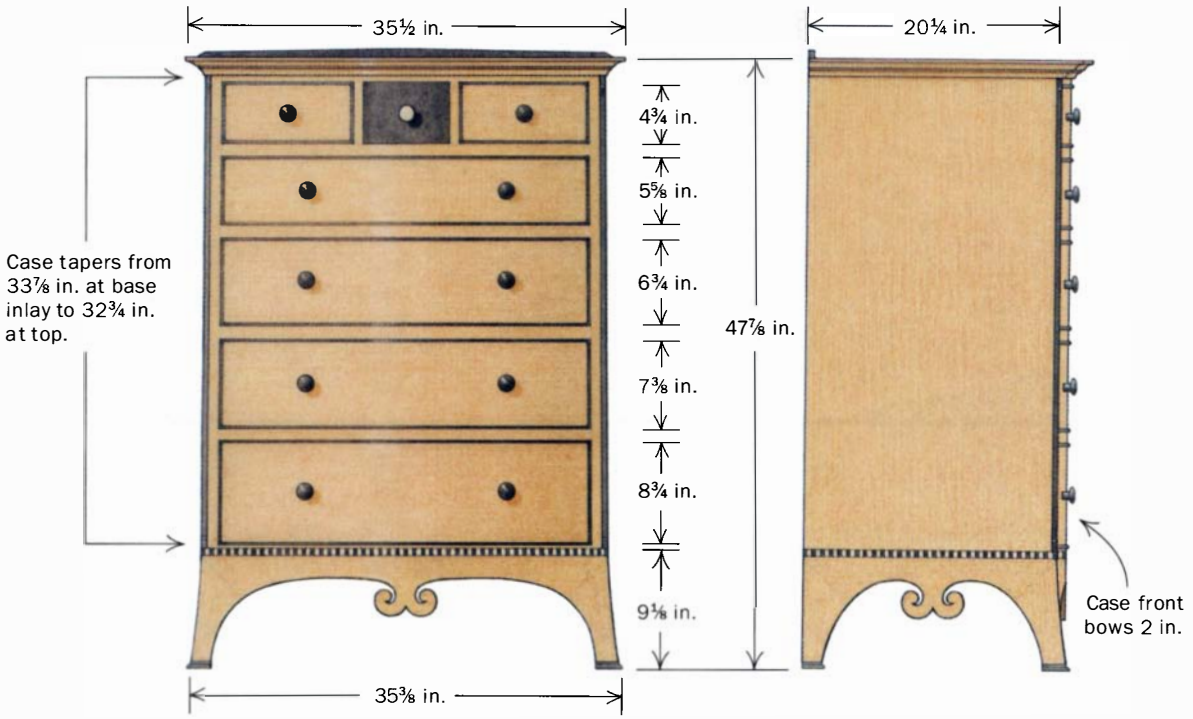
INSPIRATION IS EVERYWHERE

The richest source of inspiring forms and details is the furniture of the past, in museums, books, in *Antiques* magazine and in high-end auction catalogs. But design ideas can come from architecture, old farm implements, nature or even looking critically at your earlier work.

Photos: John Sheldon

TRAIN YOUR EYE TO FIND THE RIGHT PROPORTIONS

The visual balance of the parts can sometimes be so subtle—they just feel right. Awkward proportions are often more obvious. There are a few guides to help you find pleasing proportions, but it is best to train your eye by looking critically at good design of all kinds.



seemed more flexible in terms of storage and created a small drawer perfect for small treasures. Should the facade of drawers be flush, lipped, flat or shaped into a gentle bow front? As I developed other parts of the design, I would have a better idea about this.

The next problem was figuring out which base to use. I wanted a base that gave the massiveness of this chest a lift, maybe even to the point of exaggerating it a little. Too low a base would have given the chest a squat and heavy feel. Drawers close to the floor are also less comfortable to use. A high base cuts into the storage volume, but the visual lift it gives to the design more than makes up for this.

An idea that immediately appealed to me was four gently splayed feet known as French feet. Sometimes they splay to the side, and other times they splay forward as well. French feet create a sense of spring or tension, lifting the case. Flowing in an uninterrupted curve from the case, they would nicely complement the simplicity of the single-board sides. Quite foolishly (because I did not think about how much extra work this would be), I had the idea of emphasizing that upward curving energy by tapering the chest slightly, narrowing it at the top. In the drawings, I played with an inch or more taper, just on the edge of perception.

Why French feet rather than a more traditional design of a molded bottom edge of the case with bracket feet? Adding on the base in this way would have solved some of my problems with the defects at the ends of the case side boards and allowed me to build a higher chest. But such a base interrupts the smooth, upward sweep of the case, something my evolving design was emphasizing. I was also beginning to think about bowing out the drawers slightly, a curve echoing the out-swept feet.

Get down to specifics

At this point I had the beginnings of a design: a primary wood, rough dimensions of the case and drawers, curving French feet and possibly bow-front drawers. I had a good idea of how I might build the chest using single-board parts. Nothing was cast in stone. I could only imagine how differently a Shaker brother or an 18th-century Boston cabinetmaker would have worked within similar parameters and

APRON ACCENTS

Embellishing the apron with a whale's tail similar to ones used by the 18th-century Dunlap family of furniture makers connects this chest with its traditional roots. It adds interest to a part of the chest well below eye level, draws your eye up to the center and balances the ebony center drawer. The inlaid black-and-white banding helps extend the curved lines of the whale's tail around the base.

Drawings: Vince Babak

SUBTLE COVE

To balance the splayed base, the top needs some overhang and mass, but not necessarily the mass of a thick top. The top is thick; but by covering its underside and adding another small cove molding, its profile is more elegant and interesting. The main cove is subtle and far enough below eye level that the author hopes it might be discovered as much by feel as it would by sight.

the vastly different chests they might have created. While there may be obvious differences, such as the shape of the case, drawers and base, the most likely differences would be in the details.

While the larger elements of form and proportion might catch your attention, the details keep you interested. Edge shapes, moldings, inlays, touches of color and even the feel of surfaces can encourage your eyes and hands to play over a piece of furniture and come to know it more intimately. The details can often be a starting place for a design, or in this chest, a way to draw the various elements together. The challenge is to provide plenty of details to explore while maintaining a harmony among those details. Similar to a musical fugue, they should be variations of a theme.

The base illustrates the movement details can create. The drawback to the French feet was that your eye could follow the curve of the side and foot right to the floor and dead end there. Little ebony pads on the bottom of each foot catch your attention before this happens. The vibrant black and the tiny bead cut along the bottom edge of the toes relate them to the cockbeads around each drawer and the ebony corner columns. Moving your gaze back up, the inlay band at the bottom of the case draws your eye horizontally around the two sides and facade. To draw more attention to the base and to relate this chest to earlier chests built in the area where my client lived, I carved the whale's tail details. They express some of the same curving energy as the feet and bow fronts, and perhaps propel your eye upward.

Practical reasons behind details

The details that keep you exploring the forms can evolve for very practical reasons. Cockbeads, proud beads around drawer edges, originated as a way to protect the fragile veneered facade of the drawer. Using them meant flush, not lipped, drawers. Because I had only one other board from the same tree as the sides and top and I wanted good color and grain match, a solution was to laminate the drawer faces. I could then use any butternut for the backing laminates. Adding a cockbead allowed me to hide the lamination lines and nicely define the edges of each drawer. The cockbead also helps hide the necessary gap around the drawer in its opening and some of the slight variation of how the bow-front drawer aligns with the facade. Laminating the drawer faces into a bow front was only slightly more work and makes for a more interesting design.

By the time I had envisioned a pattern of ebony contrasted with holly and butternut, the rest of the details followed. Ebony corner columns give those edges definition and the case more verticality. The small ebony center drawer with a holly knob attracts your eye to the center of the facade and to the curved top. The top's modest overhang draws a minimum of attention; under-beveling the edge presents a thin and elegant profile. The coved under-bevel repeats the similar curves of the legs and bow fronts. The small cove molding under the top smooths the transition from top to case. Ebony knobs are practical and add interesting dots of color.

I like to add details so subtle that they will be discovered only by a casual sweep of your hand someday. The ebony backsplash has such details—it balances the ebony feet and echoes the overall color pattern with the noticeable holly dots at the ends. Almost hidden between the dots is a very fine groove and bead cut along the top edge. Whoever finds the bead might find the small tapering chamfer defining the back edge of the backsplash as well.

Every furniture design is an experiment of sorts. You have to define the problem and pursue solutions that give you hints at a direction to keep going. Trusting your decisions is part of maturing as a designer. But what keeps it all interesting is the serendipity of furniture making. You can't foresee everything. I didn't plan the slight cant of the knobs down the front, but I like them. □

Garrett Hack is a frequent contributor to Fine Woodworking.

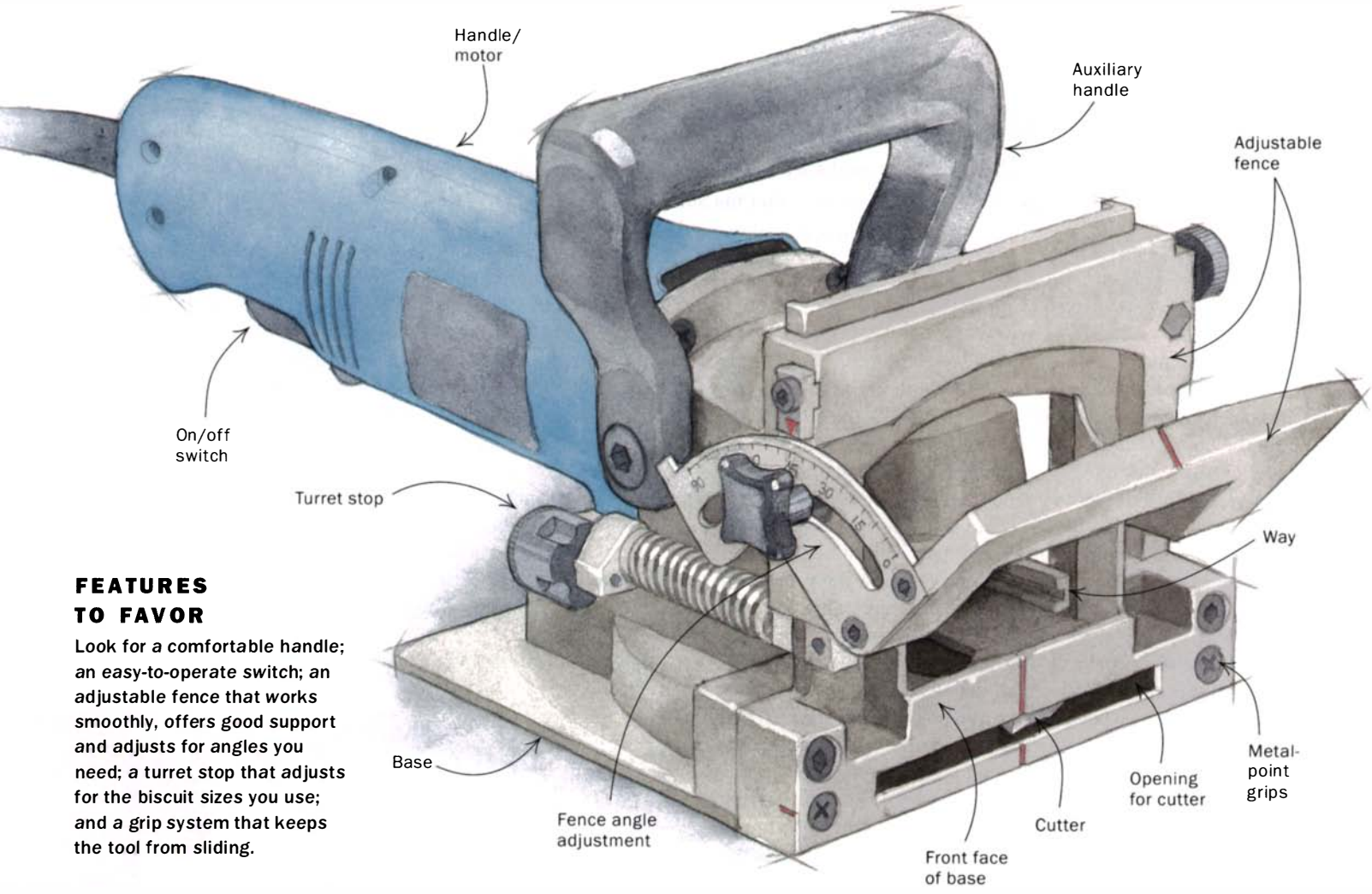
DETAILS UNIFY THE DESIGN

More exciting than chamfering or rounding the corners of the case, quarter-round ebony and holly columns boldly define these edges. They also help emphasize the verticality of the case and lead your eye to the upwardly sweeping French feet. Rounded columns echo the beads around the drawers and the ebony pads on the feet.

Biscuit Joiners

BY ROLAND JOHNSON

A hands-on review of what's on the market



FEATURES TO FAVOR

Look for a comfortable handle; an easy-to-operate switch; an adjustable fence that works smoothly, offers good support and adjusts for angles you need; a turret stop that adjusts for the biscuit sizes you use; and a grip system that keeps the tool from sliding.

The year was 1956. Dwight Eisenhower was re-elected president; Don Larson pitched a perfect game in the World Series; Elvis sang "Heartbreak Hotel." And in Switzerland, the first biscuit joiner was made by Lamello.

Lamello still makes biscuit joiners, also called plate joiners, but at least eight other manufacturers are cranking out biscuit joiners for sale in the United States. And woodworkers can now choose from more than a dozen models.

For anyone looking to buy a new biscuit joiner, that's a lot of options. In trying to sort them out, *Fine Woodworking* asked me to take a look at the most popular models. They included all of the commonly available corded versions: the Craftsman 277300 and 17501, DeWalt DW682, Freud JS100A and JS102, Jepson 7204, Lamello Classic C2 and Top 20, Makita 3901, Porter-Cable 557, Ryobi JM80 and Virutex AB11C.

How joiners work

A biscuit joiner is a relatively simple power tool. The motor spins a 4-in.-dia. cutter—a toothy disc that could easily be mistaken for a shrunken tablesaw blade.

Mounted to the front of the motor is a spring-loaded, sliding guide system made up of a base and a fence assembly. To cut a slot, simply butt the front face of the guide system against a workpiece, start the machine, then push the motor toward the

Drawing: Jim Richey

workpiece. As the motor is pushed, the cutter slips through an opening in the front face of the base and into the workpiece, cutting an arc-shaped slot that accepts a biscuit. Once you stop pushing, the cutter moves back behind the face of the base.

As the spinning cutter slices into a workpiece, it wants to push the biscuit joiner in the opposite direction. So manufacturers have added a variety of devices to the front face of the guide system to keep the tool from sliding during the cut. They include metal points, rubber dots and abrasive- or rubber-covered faces. I don't see any one of these gripping systems being better than the others. Just different.

The depth of the slot is adjusted by a plunger that butts against a stepped, indexed turret. Repositioning the turret index quickly changes the travel of the cutter, providing effective control of the slot depth. To make the adjustments easier, each of the indexes corresponds to one of the standard biscuit sizes.

The Lamello Top 20 even has a means to micro-adjust the height of the slot. Simply turn a dial on the top of the tool, and the cutter can be raised or lowered in ⅒mm steps, up to 2mm. That's a nice feature to have when switching to veneered stock in the middle of a job. The dial lets you raise or lower the cutter to compensate for the thickness of the veneer.

Fences make good friends

The fence assembly positions the tool so that the cutter is square to the edges of the workpiece in both the vertical and horizontal planes. The main part on the assembly is the adjustable fence. To account for various joints and thicknesses of stock, the adjustable fence has two adjustments: vertical and angular. The vertical adjustment raises or lowers the fence, effectively changing the elevation of the slot on the workpiece. The angular adjustment changes the angle of the fence, which is useful when making mitered joints.

But the adjustable fence isn't the only option you have for cutting a slot. On all of these tools, the cutter is centered approximately ⅜ in. above the base of the guide system. That way, if you put both the workpiece and base on a flat surface, you can register the cut off the base and end up with a slot pretty much centered in the edge of ¾-in.-thick stock. Don't worry if the slot isn't centered. The mating slot is going to align perfectly as long as you don't flip the parts at assembly time.

The skinny on adjustable fences—The adjustable fences on biscuit joiners are not all the same. Several of them have a fence with a removable, perpendicular angle guide. On the Freud JS100A and Jepson, this guide can be reversed for cutting slots at a 45° angle. Removing the guide on the Freud JS102 and the two Lamello joiners exposes an adjustable-angle fence that has a protractor and locking device to help cut accurate, angled slots. Among this subgroup, the fence on the Freud JS100A and the Jepson are difficult to keep parallel to the cutter during adjustment.

On the Lamello fence assemblies, the removable guide can be attached to the base of the machine. Once mounted, the guide adds support when cutting a slot close to the edge of a workpiece.

The Makita combines a perpendicular angle guide with a rack-and-pinion height adjustment that attaches to an adjustable-angle fence. The adjustable-angle fence includes a protractor—with detents at 0°, 45° and 90°—that simply locks in place with a lever. Its controls are easy to operate, and they hold the fence securely.

The DeWalt fence features a dual rack-and-pinion mechanism that's designed to keep the adjustable fence parallel to the blade. As a result, it's easier to adjust the height and angle of the cut. The Craftsman 277300, made by DeWalt for Sears, has the same fence.

Porter-Cable has a fence that's similar to that on the DeWalt. The primary difference is the amount the adjustable fence can pivot. A second protractor allows the fence to pivot to a full 135° and makes it easier to cut a slot in a mitered workpiece. The thumbscrew-type height-adjuster is slow and a bit tedious.

The two Freud biscuit joiners could benefit from a better fence-locking system. On both models, the fence slips with only moderate downward pressure.

Parallel is a plus—Viewed from the front of the tool, the adjustable fence should be parallel to the cutter. If it isn't, the slot won't be parallel to the workpiece surface, creating problems when the parts are assembled. When you cut the matching slot in the mating workpiece, the slot is going to be out of parallel in the opposite direc-

CRAFTSMAN 277300 (800) 697-3277

It has the same easy-to-control rack-and-pinion fence that's on the DeWalt DW682. And it has a paddle-style switch. DeWalt makes this biscuit joiner for Sears.

CRAFTSMAN 17501 (800) 697-3277

The handle is comfortable. It has a switch that's easy to use, but it can't be locked on. The fence is flimsy and challenging to lock parallel to the cutter. Wide teeth cut a wide slot, so biscuits fit a bit loosely.

DEWALT DW682 (800) 433-9258

This joiner has an easy-to-control rack-and-pinion fence. The trigger switch is a plus. Two cordless models (14.4 volts and 18 volts) are also available.

FREUD JS100A (800) 472-7307

It has good scores in the parallel test. But the small adjustable fence is hard to keep steady during a cut. And the fence slips under moderate downward pressure.

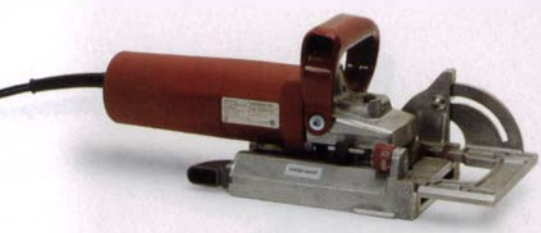
Photos, except where noted: Erika Marks; facing page: Tom Begnal

FREUD JS102 (800) 472-7307

It has decent numbers in the parallel test. The indent stop at 90° isn't quite square. The small adjustable fence is a challenge to keep steady during a cut, and it slips under moderate downward pressure.

JEPSON 7204 (800) 456-8665

When registering off the base, it has an excellent result in the parallel test. But when using the fence, results are poor. The small adjustable fence is difficult to keep steady during a cut. The fence slips when moderate downward pressure is applied.



LAMELLO CLASSIC C2 (800) 252-6355

Has a near-perfect score in the parallel test. The motor slides smoothly. Its large fence is easy to position. Also, the base easily disassembles for cleaning and blade changes. But the tool is expensive.

LAMELLO TOP 20 (800) 252-6355

This is the author's favorite machine. It cuts slots that are perfectly parallel. The motor slides smoothly. A micro-adjust dial allows the cutter to be raised or lowered in ⅒mm steps, up to 2mm. However, the price is above the clouds.

tion, effectively doubling the problem. And the same headache arises if the base of the carriage isn't parallel to the cutter.

To find out how parallel the slots ended up, we checked each model with a dial indicator and a flat, steel disc (for more on the test, see p. 62). The two Lamellos were as close to dead-on as can be expected. Check the chart for the other results.

Biscuits should fit snugly—To get maximum glue strength from a biscuit joint, you want the biscuit to fit snugly in the slot. If it's too loose, the glue bond might suffer. But too tight a fit, and it becomes a fight to put the parts together.

The Craftsman 17501 and Ryobi JM80 joiners cut slots that are a bit wide, so the biscuits fit somewhat loose. The remaining joiners cut slots in which the biscuit fit without problems.

Switches should be easy to use

The switches on these tools fall into three general categories: trigger, slide or paddle. There's no one switch style that's best. It's a matter of what feels good in your hands.

The Porter-Cable has a trigger switch at the bottom of the slightly angled barrel grip, placing the switch in a comfortable position. To lock on the switch, simply depress a button under your thumb.

The Lamello Top 20 has a similar trigger switch. It's located on the bottom of the barrel grip with a lock-on device built into the switch itself. The safety lock is easy to use and lessens the chance of accidentally starting the tool when it's lifted by the barrel grip.

The Dewalt has a nicely weighted trigger switch on the bottom of the barrel grip. The switch is a pleasure to use, but the lock-on button is at the end of the barrel, directly above the power cord. This location makes it awkward to lock the switch with one hand.

The Craftsman 17501 and Ryobi also have trigger switches, but neither has a lock-on device. A modified D-handle grip places the switch in an easy-to-use position.

BEYOND THE BASIC BISCUIT

DUPLEX HINGE

SIMPLEX CONNECTORS

PLASTIC BISCUITS

HARDWARE TO CONSIDER

The biscuit joiner can be used for more than just cutting slots for biscuits. By cutting the slot into the face of a workpiece, you get an instant mortise for a Duplex hinge. And you can get the hinges in solid brass, nickel-plated steel or burnished black.

Simplex connectors are marketed as knockdown hardware that can be installed quickly and easily. Just cut the slots, then use a two-part epoxy to glue the interlocking pieces of aluminum in place.

For applications where clamps can't be used, a serrated plastic biscuit can be used to keep two parts together. The serrations allow the workpieces to be pushed together but prevent the parts from pulling apart.

For more information about biscuit-joiner hardware, contact Colonial Saw (800-252-6355).

The Freud, Jepson, Lamello Classic C2, Makita and Virutex all have slide switches. The Lamello has a switch mounted on the left side of the barrel (as viewed when in the operating position) that locks on when it's pushed forward. Depressing the back of the switch unlocks it, allowing the switch to slide back and shut off the motor. Freud and Makita have similar switches in similar locations.

The switch on each of the two Freud models seems counterintuitive. It is pulled toward the operator to start the motor and pushed to shut it off. All of the other joiners use the reverse procedure.

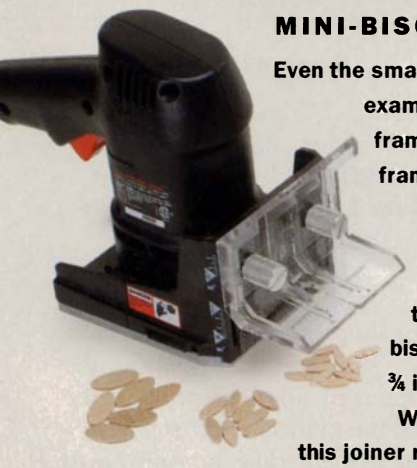
If you're left-handed, you probably won't like the feel of the switches on the Freud, Lamello C2 and Makita tools. With your thumb on the right side of the motor, and the switch on the left side, it's a nuisance to turn the tool on and off.

Virutex has a switch mounted on the top of the barrel. A lockout button in the switch must be depressed before the switch can be pushed forward to start the machine. Jepson also has the switch mounted on top of the barrel. It locks in the on position when pushed forward and down. Pressing on the back of the switch releases the lock, and the spring-loaded switch returns to the off position.

Craftsman's 277300 is the only model with a paddle switch. It's located toward the bottom of the barrel grip, near the back end. The lock-on device is located at the end of the barrel just beneath the power cord. It's supposed to be a one-handed operation, but it's a chore to operate.

Slides should glide

Except for the Makita, all of the biscuit joiners have ways cast into the base of the guide wings. Matching tabs cast into (or attached to) the motor housing allow the housing to slide back and forth in the ways. The Lamello joiners have a similar arrangement, except the ways are machined into the base. The Makita has parallel rods mounted on the base that slide in machined housings mounted on the motor.



MINI-BISCUITS

Even the smallest of standard-sized biscuits can be too big. As an example, when joining narrow face frames or picture frames, #0 biscuits can break through the edges of the frames, exposing the ends of the biscuits.

One answer can be found in the form of a diminutive biscuit joiner that cuts baby biscuits (left). A dead-ringer for the recently discontinued Ryobi DBJ50, the Craftsman 175500 cuts three sizes of mini-biscuits: R1 (7/32 in. by 5/8 in.), R2 (9/32 in. by 3/4 in.) and R3 (1/2 in. by 1 in.). With a 3.5-amp motor, this joiner runs a 1½-in.-dia. cutter at 19,000 rpm. A fence allows vertical adjustment and flips to provide a 45° surface for cutting miters. The 175500 is priced at $79.99. For more information, contact Craftsman at (800) 697-3277.

In addition, Porter-Cable makes a #FF biscuit that's smaller than standard, measuring ½ in. by 1 3/16 in. But before you can cut slots for a #FF biscuit, you first need to switch from the 4-in.-dia. cutter to a 2-in.-dia. cutter (right) that's a standard accessory for the Porter-Cable 557.

MAKITA 3901 (800) 462-5482

This machine has an excellent score in the parallel test. The rack-and-pinion fence is easy to adjust. But the fence on the model we tested slipped under moderate pressure until the fence-lock lever was repositioned.

PORTER-CABLE 557 (800) 368-1487

The tool scores well in the parallel test. It has a switch location that makes good sense. The fence pivots to 135°. A 2-in.-dia. blade is included for cutting smaller (#FF) biscuits.

RYOBI JM80 (800) 525-2579

It has an excellent result in the parallel test when registering off the base but not when using the fence. The handle is comfortable. It has a switch that's easy to use, but it can't be locked on.

VIRUTEX AB11C (800) 868-9663

It has excellent results in the parallel test. The fence tends to flex under moderate downward pressure.

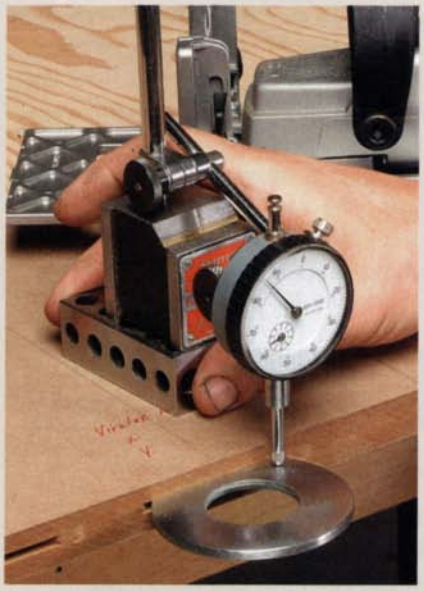
BISCUIT JOINERS BY THE NUMBERS

Testing for parallel. *For the first test, the adjustable fence supports the joiner (left). The base of the joiner serves as the fence for the second test (right).*

To check that the joiners cut slots parallel to the cutter, I ran a couple of tests. First I cut slots for a #20 biscuit with the adjustable fence supporting the joiner. After that, a flat steel testing disc was slipped into the slot. Then, with a dial indicator resting on the top of the workpiece, the elevation of each end of the slot was checked. The difference between the measurement represented the amount that the disc was out of parallel. As a second test, I cut a slot while using the base of the biscuit joiner as a fence. The results for both tests appear in the chart. ***—John White***

Watch it on the web

Visit www.finewoodworking.com to see how the biscuit joiners were tested.



Checking the results. *A dial indicator is used to see whether the slot is parallel to the face of the workpiece. A reading of 0.007 in. or less is considered good.*

MAKE AND MODEL		CRAFTSMAN 277300
AVERAGE STREET PRICE		$180
AMPERAGE		6.5
ADJUSTABLE-ANGLE FENCE		Yes
NO-LOAD NOISE LEVEL		100 dB
AMOUNT SLOT IS OUT OF PARALLEL	USING FENCE	0.007 in.
	USING BASE	0.006 in.
CUTTING-DEPTH INDEXES ON TURRET		0, 10, 20, M

Thanks to machined ways, the Lamello carriages enjoy silky smooth travel. The Makita carriage also slides smoothly. Plus it has lower spring pressure, making it easier on the muscles when making lots of cuts.

With one exception—the Craftsman 17501—all of the remaining tools have a sliding action that I'd consider acceptable. But the spring tension on the 17501 gets excessively high when the carriage reaches the end of its travel. Combine that with a handle that's located high on the motor housing, and it becomes a chore to make a full-depth cut for a big biscuit like a #20.

Setting slot depth is easy

As mentioned earlier, the depth of the slot is controlled by an adjustable plunger and a stepped, indexed turret. All of the turrets have positive stops at the different depths of cut. And all of them work well.

The settings 0, 10 and 20 correspond to the biscuit sizes most often used. The M (or Max) setting is used to cut a slot for an even bigger #6 biscuit. Some biscuit joiners include additional settings, such as S and D (or A and B), that stand for Simplex and Duplex, respectively. These settings are used for knockdown hardware and specialty hinges. The Porter-Cable has an additional FF setting for its unique face-frame biscuit (see p. 61).

Dust collection is a healthy option

The two Lamellos and the Virutex have adapters that hook up to an auxiliary dust collector or shop vacuum. The Craftsman 17501 has a screened dust box, but the dust port tends to clog. The ports on the DeWalt and the Craftsman 277300 have a small prong in the middle, presumably to prevent a user from sticking a finger into the port and accidentally making contact with the spinning cutter. But the prong tends to catch the shavings, which effectively plugs the dust port. The Ryobi JM80 also clogs easily because of a constricted exhaust port.

The biscuit joiners made by Porter-Cable, Makita and Freud have dust bags that are very effective. The two Freuds work especially well. The dust bag on the Jepson also does a good job collecting dust, but it gets in the way when using the base of the tool

CRAFTSMAN 17501	DEWALT DW682	FREUD JS100A	FREUD JS102	JEPSON 7204	LAMELLO CLASSIC C2	LAMELLO TOP 20	MAKITA 3901	PORTER-CABLE 557	RYOBI JM80	VIRUTEX AB11C
$100	$169	$99	$125	$136	$321	$629	$159	$202	$100	$265
6	6.5	5	5	6	6.4	6.2	5.6	7.5	6	6
Yes	Yes	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
96 dB	103 dB	95 dB	95 dB	98 dB	96 dB	96 dB	96 dB	96 dB	96 dB	95 dB
0.017 in.	0.017 in.	0.003 in.	0.007 in.	0.014 in.	0.000 in.	0.000 in.	0.001 in.	0.005 in.	0.015 in.	0.000 in.
0.007 in.	0.007 in.	0.004 in.	0.004 in.	0.001 in.	0.001 in.	0.000 in.	0.002 in.	0.001 in.	0.001 in.	0.003 in.
0, 10, 20	0, 10, 20, M	0, 10, 20, A, B, MAX,	0, 10, 20, A, B, MAX,	0, 10, 20	0, 10, 20, S, D, MAX	0, 10, 20, S, D, MAX	0, 10, 20, S, D, MAX	0, 10, 20, D, D, MAX, FF	0, 10, 20	0, 10, 20

to make a cut. The only solution, but not a good one, is to remove the bag.

Top choices

All things considered, and after poking, probing and "playing" with each of the tools, I'd say the Lamello Top 20 is my favorite. Top-quality construction, smooth operation and plenty of accuracy make this tool a pleasure to use. Plus, the turret has a wonderful action. And it has a trigger switch that should be the industry standard. Although the Top 20 is by far the most expensive of the bunch, it's built for the long haul. And as a full-time woodworker, that's an important plus for me.

But if the Lamello Top 20 looks to be a budget buster, I'd take a look at the Porter-Cable 557. For about a third the price of the Top 20, you get a 7.5-amp machine with comfortable handles, a convenient switch and a 2-in. accessory cutter. It also gets good marks in the parallel test. Plus it's the only machine I looked at that has the auxiliary handle mounted to the guide system rather than to the motor. The auxiliary handle stays fixed during a cut, making it a bit easier to hold the fence to the workpiece.

The Makita 3901 is nice machine that generally sells for about 20% less than the Porter-Cable, making it a good choice for those of us who count their pennies. Initially, the fence slipped under only moderate downward pressure, but a repositioning of the locking lever quickly corrected the problem. It's not quite as comfortable in the hands, but I like the rack-and-pinion fence. And it scores well in the parallel test.

I also like the DeWalt DW682. The fence adjusts easily, and the on/off switch is simple to use. And I like the price. But I was disappointed it tied for the worst score on the parallel test when using the fence. I expected it to do better, mostly because the Craftsman 27730, which has the exact same fence, did reasonably well in the test. Although I can live with 0.017 in. out of parallel, biscuit joints assemble with less fuss when the number is 0.007 in. or lower. □

Roland Johnson builds furniture in Sauk Rapids, Minn. Contributing Editor John White tested the joiners for noise and parallel in the FWW *shop.*

Colonial Cupboard

Freestanding cabinet offers a tutorial on hand-cut joinery

BY MIKE DUNBAR

This little cabinet is based on a late-18th-century original owned by a friend of mine. It's a rare piece, and antique dealers regularly pester him about selling it. The dealers want his cabinet for the same reason you will want to make it. There is always demand for an attractive and handy storage space.

The cabinet is interesting for woodworkers for two reasons: First, it's a tutorial on hand-cut joinery. Although a small piece, this cabinet requires nine types of joints. You will get some practice on dovetails, dadoes, rabbets, shiplaps, coping, miters, panel-in-groove and mortises and tenons (both blind and through-). While some of the work would be more straightforward if it were done on machines, there is value in sharpening your hand-tool skills (and certainly less dust and noise). The choice is yours, of course.

Second, this cabinet is a chameleon. It can be expressed in a host of ways. It's a good example of how a piece of furniture can be dressed up or down (see examples on p. 68).

Another plus is that you can drastically change this cabinet's dimensions to make it fit a particular space or application: My cabinet was designed to house my 8-year-old's videocassette collection. You can even substitute a base molding for the bracket base and hang this cupboard on a wall.

Most of the stock is either ¾-in.-thick or ½-in.-thick pine. The cornice is 5/4 stock. I went to a local home center and bought #2 common boards, 1x8x12. There are so many small parts to the cupboard that I was able to work around most of the large knots or place them in shelves or back boards. The dime-sized knots that appear in the carcase and door give me just the look I had want—not too perfect but not knotty pine, either.

As you build the piece, remember to use reference marks to keep track of parts and their positions.

The carcase comes first

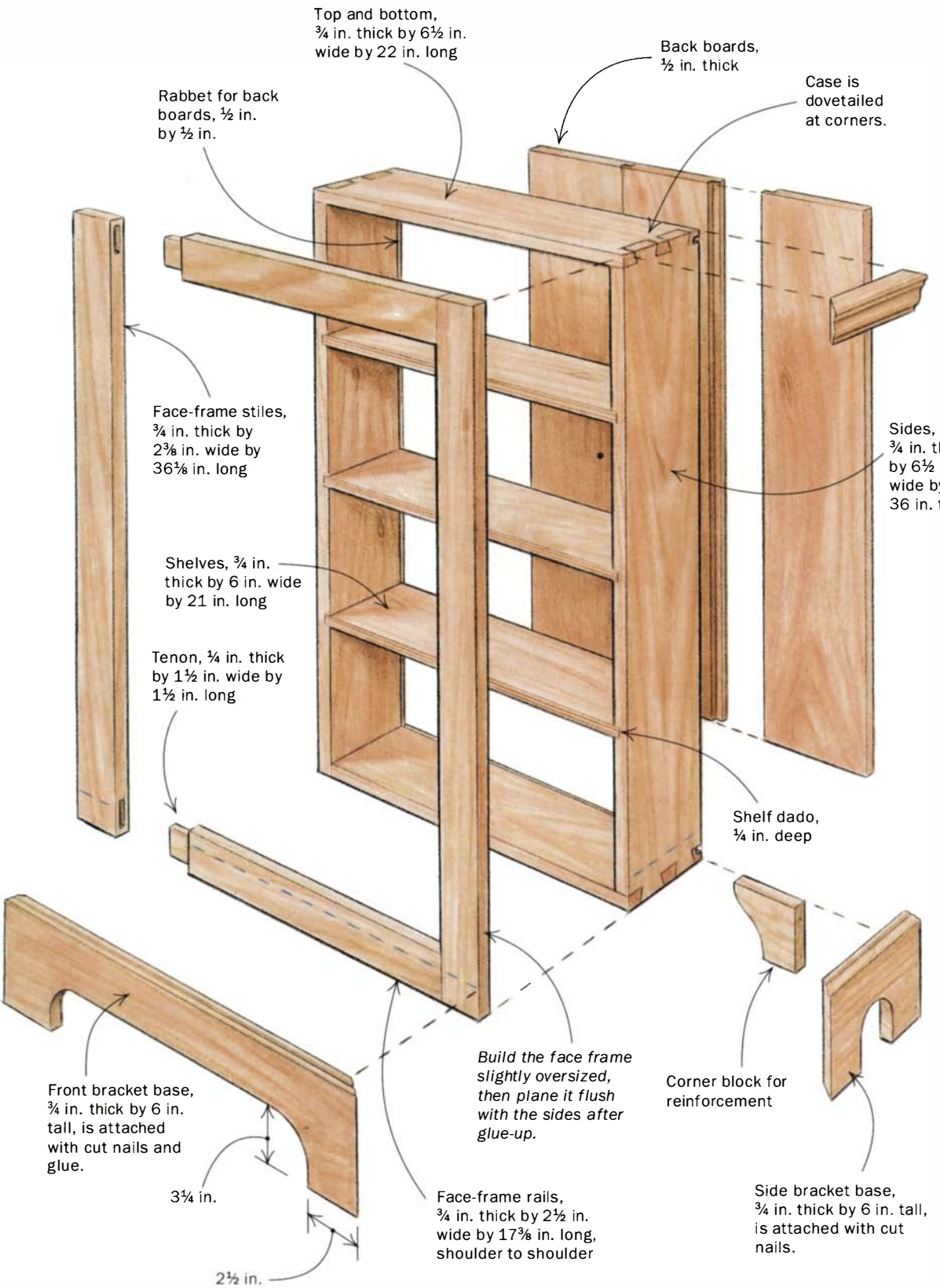
There are two large dovetails on each corner. Although it makes no real difference, my habit is to lay out the pins first. I sized the pins by eye, so each joint varies slightly. Because the dovetails are mostly covered by the cornice or the bracket base, uniformity does not matter.

Dry-assemble the dovetails to test their

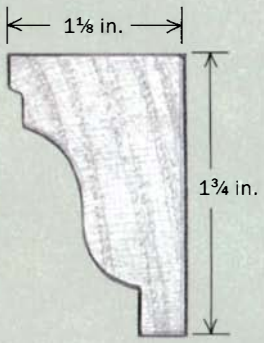
Photos, except where noted: Asa Christiana; this page: Michael Pekovich

A DOVETAILED BOX IS THE FOUNDATION

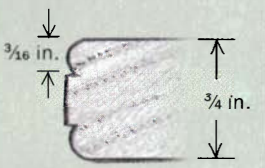
Shelves, back boards, face frame, cornice and bracket base all attach to the dovetailed case. Then, all that's left is the frame-and-panel door.



CORNICE DETAIL

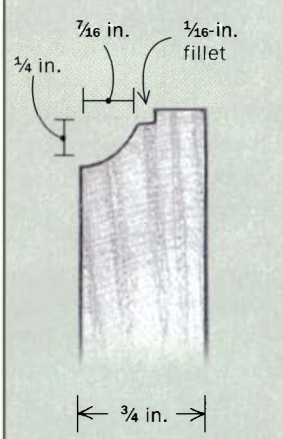


SHELF DETAIL



Bead the front edges of the shelves. *The author uses a flat-head screw driven into a dowel to cut a small groove in each edge.*

BRACKET-BASE DETAIL



Drawings: Bob La Pointe

Matching dadoes. *Butt the sides against each other and lay out the locations of shelf dadoes (1). Use a utility knife to scribe the edges as deeply as possible (2), then pare out the waste with a chisel (3). Scribe and pare until you reach final depth. If you have one, use a router plane to clean up the bottom of the dado.*

fit. Also, check the case for square by measuring the diagonals from one corner to the opposite corner. If the measurements are the same, the case is square.

Rabbets and dadoes—Once the carcase has been dovetailed, rabbet the back to accept the back boards. Cut the rabbets with an adjustable rabbet plane (called a fillister), and clean them up with a shoulder plane. For a neater joint, check your progress with a small square. The four rabbets will leave small, square openings where they meet on the carcase, but these are visible only from the back.

Arrange the shelf placement to accommodate your cabinet's intended purpose. Lay out the dadoes on one side. Instead of measuring for the dadoes on the other side, match up the sides so their inside faces are touching. Then transfer the layout marks from one side to the other. Direct layout techniques are always preferable to trusting a tape measure and your memory.

In the past, every woodworker owned a dado plane. But no one makes them any more, and the originals are expensive. You can use a multiplane like a Stanley No. 45 if you have one, but I find these all-in-one molding planes very difficult to use. You can make these dadoes with nothing more complicated than a utility knife and a chisel (for more on this technique, see *FWW* #134, p. 52). Score straight lines along each edge of the dado, and pare out the waste between them. Score and pare until you are at the desired depth. You can speed things up by using a router plane (also called a widow's tooth) to regulate the depth of the dado.

Once the carcase is finished, glue it up and clamp it, measuring diagonals to check for square.

The face frame

The door is hung inside a face frame joined with blind mortises and tenons. You don't want to risk this frame being slightly smaller than the cabinet, so leave the stiles and rails a little wide: about ⅛ in. per side is enough. After the face frame has been applied, you can handplane its edges flush with the carcase. Also, leave the stiles 4 in. longer than necessary. This will result in "horns" on both ends that can be trimmed when you are fitting the face frame to the carcase. These horns make it less likely that

you will split the mortises or break out their tops while chopping them.

Before laying out the joints, mark the front and outside edges as reference surfaces and number the corners. Use a marking or mortise gauge to lay out the mortises and tenons. For accuracy, use a single edge as a reference surface for the gauge's fence. Chop the mortises with a mortise chisel and cut the tenons with a backsaw (for more on these techniques, see *FWW* #142, pp. 50-52). Fit each joint and then test-fit the entire frame. Check for square. If you are satisfied, glue and clamp it. Afterward, trim the horns with a backsaw.

In keeping with the period, I glued and nailed the face fame to the cabinet with 4d cut nails, leaving the heads flush with the surface. The rectangular heads of cut nails are attractive and also less obvious than round heads. I purchase my cut nails from the Tremont Nail Co. (800-842-0560; www.tremontnail.com).

Finally, plane the face frame flush with the carcase.

Shelves and back boards

The shelf fronts are molded, and if you wish to include this feature, choose stock that is knot-free along one edge The molding profile—called an astragal—is a traditional way of decorating shelves. If you don't have a way of making this shape, you can run a small bead on each edge with a simple scratch stock.

Cut the shelves to length and fit them into their dadoes. There is no need to secure them with fasteners or glue because they will be held captive by the back boards and face frame.

The back boards are shiplapped, meaning the boards have two rabbets that overlap. Shiplapped boards allow for seasonal movement without gaps opening. Quick word of caution: If you are making this cabinet in the summer, you can fit the back boards tightly together; however, if you make the piece during the heating season, fit the back boards loosely, giving them room to expand.

The cornice

You have two considerations when choosing a profile for the crown molding. The most important is that the cornice be in scale with the cabinet. The type of profile is less important; it depends on how accurate you wish to be to a particular period. The ogee is typical of the 18th century, but other shapes came into vogue during the 1790s and early 1800s.

I used an appropriately sized ogee molding plane to make the cornice. This would be a great time to tune up that antique molding plane you own and learn to use it.

When you run moldings by hand, it is important to use straight-grained stock. Also, it's much easier to mold a single piece of wood long enough for the front and two sides at once.

Today, we usually cut miters with a tablesaw or a miter saw. The hand method is to use a miter box and backsaw. The miter box is simple to make. But be careful not to cut the miters going the wrong way. Draw an angled line showing which way each cut has to go.

If you need to trim a miter to fit, a low-angle block plane is ideal. Hold the tool against your chest and pull the miter over the cutting edge. This method lets you cut precisely and only where you want to.

The cornice is also nailed to the cabinet with cut nails. Add glue between the mitered ends of the molding to stop them from opening up later. The top of the cabinet is visible, so use a handplane to level off the cornice and dovetails.

Bracket base

The upper edge of the bracket base is molded with a stepped cove. Furniture

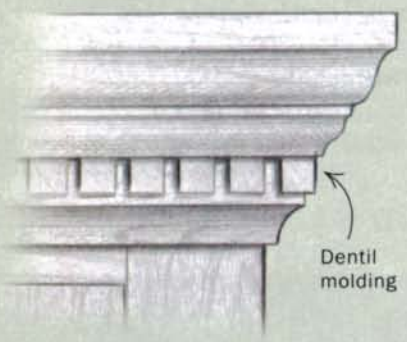
NAIL ON THE FACE FRAME AND BACK

Attach the face frame with glue and 4d cut nails. *These fasteners are appropriate to the period, and their thin, rectangular heads—aligned with the grain—are less obtrusive than round ones.*

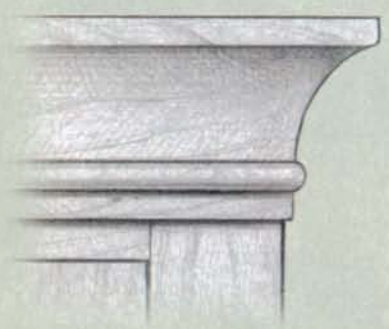
Shiplapped back boards. *The boards are rabbeted with the fillister to create the shiplap joints. When nailing on the boards, leave gaps between them to allow for seasonal movement.*

DETAILS MAKE THE DIFFERENCE

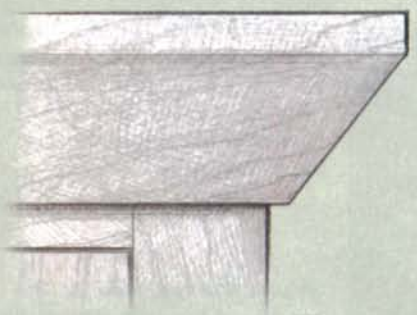
As built, this cabinet contains a fairly standard 18th-century vocabulary. By changing a few of these elements, you can shift the pedigree and overall appearance of the piece.



Make the cabinet more formal by building it of walnut or mahogany and adding complexity, including a dentil molding, to the cornice.

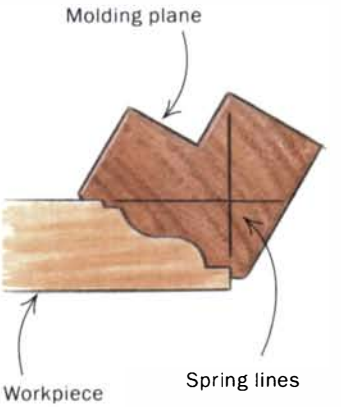


Bring the cabinet into the early 1800s by using a Federal-style molding for the cornice and a flat door panel with either an ovolo or an ogee on the stiles and rails. If you do so, use butt hinges and a later-style catch.



Finally, create a country look by trading the moldings for simple bevels.

Mold the cornice with an ogee molding plane. *Take all three pieces of the cornice from the same stock. Cut the stock wider than necessary, to handle the cutting pressure.*



Many molding planes are designed to be tilted in use. Spring lines offer the user a visual reference for maintaining the proper angle while planing.

Fit the miters to each other. *Cut the front piece to size and tack it on temporarily. Then trim the miters on each side piece to fit the front piece. A good way to do this is to hold a block plane against your chest and drag the miter across it.*

makers borrowed the cove from 18th-century architecture, but they added a small step at the top, called a fillet, to create another shadow line.

After cutting and testing the miters, make the scroll cuts along the bottom of each piece. I use either a small bowsaw or a coping saw. Here's a tip: It is easier to control a coping saw if you set it up to cut on the pull stroke.

Attach the base to the cabinet with cut nails. Then flip over the cabinet and glue in corner blocks, which will help strengthen the base.

Raised-panel door

The raised-panel door is your next lesson in hand-tool joinery. Making a simple door with unmolded stiles and rails and a flat panel is pretty straightforward. But add a couple of details, and the level of complexity increases by a surprising amount.

These stiles and rails have a typical 18th-century thumbnail molding, and the panel

is raised, or "fielded." Begin by numbering the ends of the mating stiles and rails and then marking the reference edges. As with the face frame, it will be a disaster if your door is too small, so make the stiles and rails oversized. And once again leave the stiles 2 in. longer on each end to support the mortises.

Cut the through-mortises first—Eighteenth-century passage and entryway doors were typically through-joined, with the joints pinned and wedged rather than glued. These are very effective techniques for preventing sagging. When you lay out the mortises and tenons, you can use the same setting on your marking gauge that you used for the face frame. Again, use a single reference surface. Lay out the ends of the through-mortise, and with a square, continue the lines over one side and onto the other edge.

Chop the mortise only about halfway through. Then flip over the stile and finish the mortise from the other side. If you are careful to hold your chisels in line with the workpiece, both cuts should meet in the middle. Wait to cut the tenons.

Plow the grooves—In the 18th century, grooving was done with a plane called a plow. These were and still are made in wood, like mine. They were also made in cast iron. A plow plane features a depth stop and an adjustable fence to control the placement of the groove. Plow planes come with sets of cutters of graduated widths. Be sure to fence the plow against a corresponding face on each rail or stile; otherwise, the grooves may not line up at the corners.

Cut your tenons as you did for the face frame and test their fit. Leave the tenons short of the stile's full width by exactly the depth of the groove. They will not fit all the way through until the molded edge has been cut and coped.

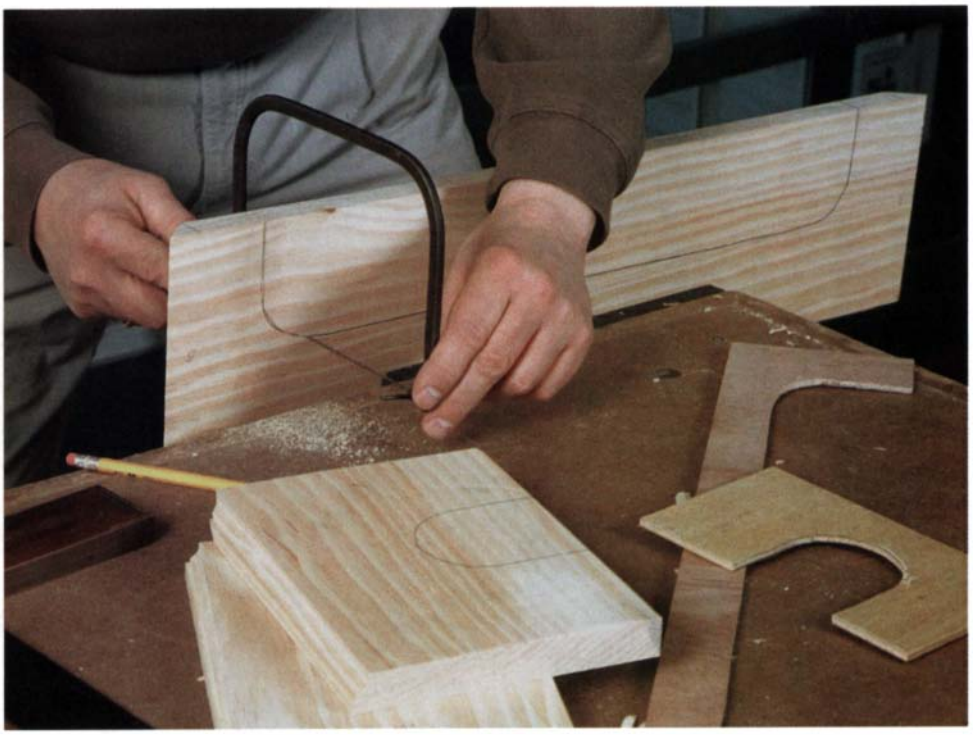
Cut and cope the molding—I have a molding plane that makes a thumbnail. However, you can also use a rabbet plane to create the fillet and a block plane to round the profile (see *FWW* #134, p. 53). Use a small profile template to ensure consistent results.

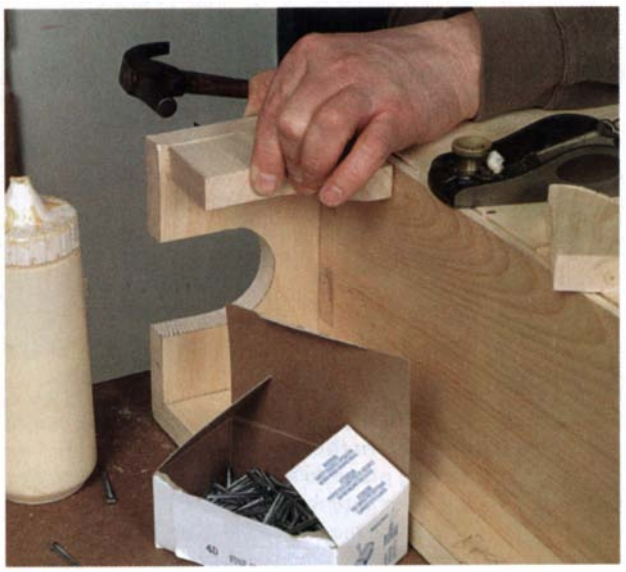
The thumbnail moldings will not come together unless you cope them and cut away the mortise's front edge to the depth of the groove. Coping is a way to make moldings come together at an apparent miter without the problem of the miter opening with seasonal movement. Cope-and-stick router bits undercut the entire tenon shoulder. However, in hand work, it is only necessary to undercut one corner.

To cope the joint you need a gouge close to the same radius as the thumbnail. If the gouge is ground along its inside curve, you can make a clean plunge cut. The thumbnail on the rails and stiles is ½ in., so measure back ½ in. from the shoulder along the molding to locate the top of the cope. The bottom will be at the intersection of the fillet and the shoulder. If your pine is at all crumbly, a straight plunge cut can crush some of the molding and leave a ragged miter. I avoid this by using a slight slicing motion toward the tenon (see "Coping the Corners" on p. 70). Assemble the joint. If your miter is ragged or uneven, you can clean up the coped edge with a sharp chisel. Cope the remaining joints and dry-fit the door. Test for square.

Raise the panel—Cut your panel to size. Remember, this wide panel is intend-

BUILD THE BRACKET BASE



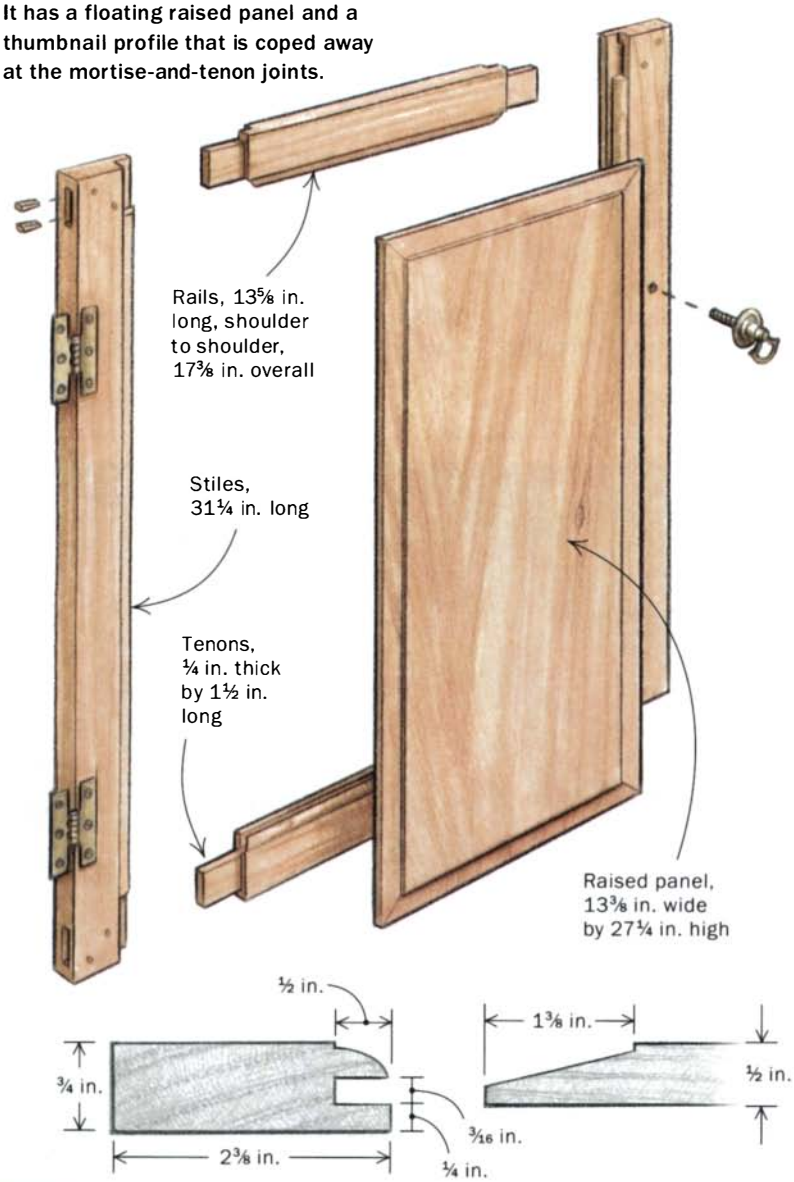


Make the scroll cuts in the bracket base. *Templates are used to lay out the simple cuts, and a coping saw makes short work of the job. The bracket base is molded, mitered and attached in much the same way as the cornice.*

Send in the reinforcements. *Corner blocks are nailed and glued on the back to strengthen the base.*

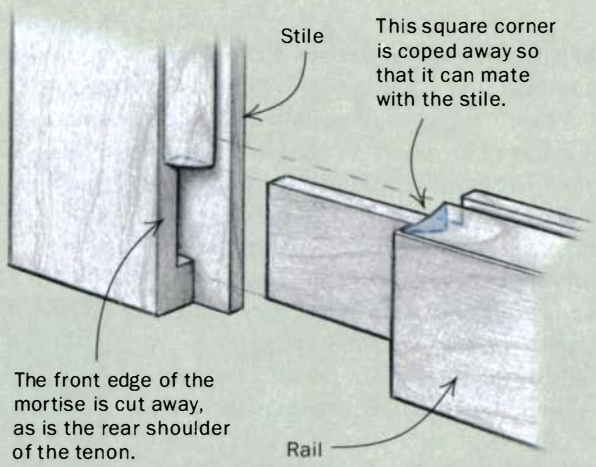
FRAME-AND-PANEL DOOR

The door is the most challenging part: It has a floating raised panel and a thumbnail profile that is coped away at the mortise-and-tenon joints.



COPING THE CORNERS

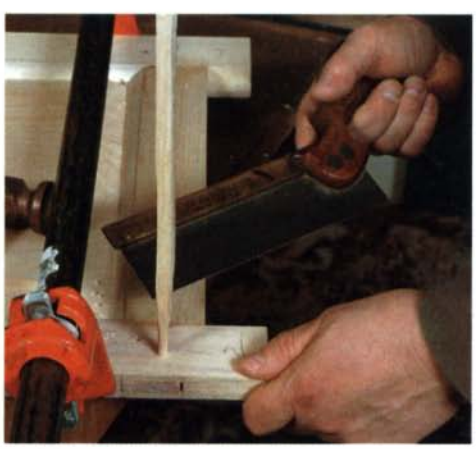
Two edges of the mortise-and-tenon joint are relieved. Then a small amount of the thumbnail edge is coped so that the joint can close.



Plunge down with a gouge to cope the joint. *Pick a gouge that is close to the radius of the thumbnail and ground along its inside edge.*

Cut the thumbnail profile. *Cut the small fillet with a rabbeting plane, and then round over the thumbnail profile with a block plane, working to a line.*

Sight down the spring lines of a panel-raising plane to maintain the proper angle. *Cut the cross-grain sides first. Place a waste strip along the back edge to avoid tearout.*



After glue-up, the joints are pinned and wedged. *Drive the pins all the way through the door frame before cutting them flush. Then wedge the tenon ends to lock the joint.*

ed to float in its frame, permitting seasonal movement. Place a rule in the groove in one stile and measure to the fillet of the opposite thumbnail. This is the maximum width of the panel. If you're building this piece in summer, make the panel about ⅛ in. narrower on each side. In the winter, I suggest ¼ in. per side. The height only needs to be left about ⅛ in. short at each end, regardless of the season.

It is difficult to raise a panel with a standard bench plane; a panel-raising plane makes the job much easier. Antique examples are expensive, but a number of modern makers still produce them (Harris, Crown Plane, Todd Hurley). I have four old models, and each raises a slightly different sized and shaped panel.

A panel raiser is simply a big molding plane that cuts a raised-panel profile, so it is used the same way as a molding plane. It has a fence and a stop. Keep cutting until the stop comes in contact with the panel. A panel raiser has skewed cutters, which allow the tool to cut cleanly across end grain with a minimum of tearout. Still, choose the best straight-grained pine you have for the panel.

Plane the end grain first, holding the panel between dogs. Place a backer strip at the far corner to prevent break-off. Raising the sides is easier, because you are cutting with the grain.

The trick here is to make each corner come out with a nearly perfect 45° angle. You can make this happen by trimming from one side or the other. You also can make small adjustments in the fit with a shoulder plane.

Place the panel in the frame, and pull the door together with clamps. The panel should not lift up any of the grooved edges. If it does, it is too tight and needs to be planed thinner. Do this by planing the back surface so as not to affect the front.

Assemble the door—Secure all of the joints. The mortises and tenons are pierced by two thin pins. Cut square lengths of pine and whittle them round with a wide, shallow gouge. The slight facets left help lock the pins in place.

The ends of the tenons are wedged at the top and bottom. Again, make squares and whittle the wedges with a gouge. Use a chisel to begin small splits in the tenon ends. Put a very small spot of glue on the wedges and tap them into place. Then saw and plane the wedges flush. These wedges close up the outside of the joint and are an attractive touch.

Trim the horns and plane the door to fit its opening. In the winter, remember to allow for the small amount of expansion that will occur across the stiles.

Two finish options

I wanted my cabinet to look as if it had some age. The color I had in mind was the pale tan that raw pine turns to after about five years. However, I did not want to use a stain. Stains darken the softer latewood and leave the harder earlywood lighter in color, which is the opposite of the way pine darkens with age.

I achieved the look I wanted in one afternoon by using nothing more complicated than tea. I made a really strong mixture by steeping three bags in a cup of hot water. When it had cooled, I brushed the strong tea onto the wood, darkening the surface very slightly. I allowed this application to dry and sanded any raised grain. Each subsequent coat of tea darkened the pine further. It took four coats to give me the look I wanted. You can follow with varnish, or if you want to tweak the color slightly—to make it a bit less yellow, for example—use a topcoat of shellac tinted with aniline dye.

Milk paint is another attractive option, and is probably the finish this cabinet would have received in the 1700s. The Old Fashioned Milk Paint Co. (978-448-6336, www.milkpaint.com) is an excellent source for powdered mixes and provides good instructions for their use (for more on milk paint, see *FWW* #136, pp. 64-67). A key is to finish the painted surface with linseed oil, which evens out the color.

Hardware

I hung the door with solid brass H-hinges, which are appropriate for an 18th-century design, and I secured the door with a brass pendant latch. Both of these items came from Ball and Ball Hardware Reproductions (800-257-3711; www.ballandball-us.com). While more expensive than the brasses sold at hardware stores and home centers, the prices were not prohibitive. I have always thought it a shame that a woodworker would invest so much in a piece but then install cheap hardware. □

Mike Dunbar is a contributing editor. This article is his third in a sequence of hand-tool-oriented projects (see FWW #134 and #142).

Options, options. *At far left is the cabinet finished with Lexington Green milk paint, with a linseed-oil overcoat. The other version is finished with four washcoats of concentrated tea followed by a tinted shellac.*

Air-Drying Lumber

It takes patience and a watchful eye, but the benefits go far beyond cost savings

BY LEE GRINDINGER

Cut and dry. *Contributor Garrett Hack stacks green lumber near his shop in Thetford Center, Vt.*

Whether you want to save a neighborhood walnut tree from becoming firewood or you're tired of paying $6 a board foot for cherry, there are plenty of reasons to dry your own lumber.

Of course, cost is the great motivator. Hiring a bandsaw mill and drying your own lumber can buy you many projects' worth of furniture-grade wood at less than $1 per board foot. These portable saws mean you don't have to truck your logs to a local sawmill. Also, the cheaper sawblades used by bandsaw mills make it practical to harvest urban and suburban trees, a great source of native and non-native species with the occasional nail lurking inside.

If you live in a wooded region of the country, a local sawmill is a good place to get green stock, sometimes from a single log. Generally, lumber sold directly from mills is not graded and is less than half the price of kiln-dried lumber. Getting and drying lumber from a single log allows you to match boards for furniture and cabinetry (see the photos on the facing page).

And finally, there's the satisfaction of building something from a tree you knew or a stack of lumber you seasoned.

Lumber has been dried without the use of kilns for centuries, in virtually every climate. All it takes is a well-built lumber stack, a watchful eye and patience.

Photos, except where noted: Asa Christiana

If you have called in a sawmill or are buying from one, remember that wood shrinks as it dries. Instruct the sawmill operator to cut the wood ⅛ in. over for each 1 in. of thickness. Be aware that it can take a year per inch of thickness to dry lumber, so thicker stock is truly an investment in the future.

Check also that the thickness is uniform. If it varies more than ⅛ in., the lumber will be difficult to stack, and warping is a very real problem if lumber is not in contact with all of the stickers.

During warm weather get the wood onto stickers within hours of having it sawn. This will prevent staining caused by the bacteria and fungi that invade wet, stacked boards in warm weather.

End-coat to prevent checking

Wood loses moisture 10 to 15 times faster through the ends as it does through the faces, so if you don't end-coat, you can expect some loss due to checking. Coat the ends of the log as soon as it is felled and cut to length. However, when handled properly, most individual boards won't check more than 4 in. to 8 in. into their ends, so the wood saved by end-coating a lumber stack sometimes isn't worth the time and effort.

The best end coatings, such as Anchorseal, are wax emulsions. Applied with either brush, roller or spray, these coatings must be applied as soon as possible, before any checking begins.

Choose the right stickers

The best stickers come from dry, straight-grained, clear wood. Hard maple, oak, beech, Douglas fir and hickory are good choices for sticker material. You should avoid cherry and walnut, which contain pigments that can bleed into the lumber. Resinous woods are best avoided as well.

Stickers must be of uniform thickness; ¾ in. is adequate to ensure good airflow. They should be at least 1 in. wide, but 1¼-in.-wide stickers are easier to handle because it's immediately clear which face goes against the lumber. The length of the stickers determines the width of the lumber pile. Unless you're stacking sawn logs exactly as they come out of the log (flitchsawn), sticker lengths of 3 ft. or more are better than shorter ones. Lumber in random widths and lengths is easier to stack when you have wide piles.

Some light-colored woods are prone to sticker stain, which is a discoloration beneath the stickers that can run all the way through the wood. To dry light-colored woods such as ash, maple, hickory and beech, restack the pile every week using dry stickers until the lumber's moisture content gets down to around 18%—about a month in most climates.

Build a solid stack

Choose the location of your lumber pile carefully. It should be out of direct sun and not in a windy location. Find an area free of vegetation and standing water. Gravel makes an excellent foundation.

Lay down 4x4 or 6x6 timbers every 20 in. to 24 in. It is very important that the tops of these beams be level and even. Unevenness will be transmitted to every board in the pile.

On top of these timbers, place the first course of stickers. When stacking boards and stickers, work from the outside of the stack, keeping the sides of the stack even and vertical. Make sure that at least every other board is flush with the end of the stack to support the sticker that will be placed above it. Place an additional sticker if you need to support the ends of short boards. Keep each row of stickers directly over the previous row. Woods prone to warping, such as hickory and elm, should be stickered more closely together—as much as 12 in. on center.

After all of the lumber has been stacked, add a layer of stickers and pile as much weight on top as you can. Throw on cinder blocks, logs or whatever you have. Restraining the wood during drying will make for much flatter and straighter stock.

You'll need to protect the pile from rain and direct sun. Drying sheds keep weather off the lumber without restricting airflow, but tarps or sunshades work, too. The idea is to keep the tarp away from direct contact with the lumber and to tent it slightly to allow

WHY BOTHER DRYING LUMBER?

Furniture from a flitch. *Kelly Mehler, a woodworker in Berea, Ky., made this chest of drawers from a single cherry log, achieving a beautiful continuity in the grain pattern. Mehler often has logs flitchsawn, air-dries them in his shop, then stores the planks in the order they came off the log.*

Photos, this page: Albert Mooney

ANATOMY OF A DRYING STACK

A successful lumber-drying stack needs a level, dry foundation; protection from direct rain and sun; and level support for each layer of boards.

Weight placed on top holds down roofing material and lumber below.

Denser layer of stickers to distribute weight

Rain/sun protection

Even sides and ends catch less water.

Slide in an extra sticker to support the free ends of boards that fall short of the next sticker.

Stickers, at least ¾ in. thick and no wider than 1¼ in.

Placing timbers (and stickers) 20 in. to 24 in. apart will provide plenty of support for most woods.

Support timbers

Support timbers can be laid directly on a bed of sand or gravel. Otherwise, cinder blocks offer an economical way to raise the foundation off the ground.

Place one set of stickers on the support timbers before putting on the first layer of boards.

A solid lumber stack starts with a dry and level foundation. *Sight down the timbers to see which cinder blocks must be dug in a bit deeper. The blocks keep the lumber away from the moist soil below.*

Drawing: Jim Richey

Add precision to the process. *Use a hygrometer (right) and an EMC chart to find the relative humidity and determine the EMC. Then a moisture meter (above) can tell you when your lumber reaches that EMC.*

EQUILIBRIUM MOISTURE CONTENT (EMC)

EMC is the final moisture content wood will achieve in a given environment, based on temperature and relative humidity.

TEMPERATURE (°F)	RELATIVE HUMIDITY 10%	20%	30%	40%	50%	60%	70%	80%	90%
30	2.6	4.6	6.3	7.9	9.5	11.3	13.5	16.5	21.0
40	2.6	4.6	6.3	7.9	9.5	11.3	13.5	16.5	21.0
50	2.6	4.6	6.3	7.9	9.5	11.3	13.4	16.4	20.9
60	2.5	4.6	6.2	7.8	9.4	11.1	13.3	16.2	20.7
70	2.5	4.5	6.2	7.7	9.2	11.0	13.1	16.0	20.5
80	2.4	4.4	6.1	7.6	9.1	10.8	12.9	15.7	20.2
90	2.3	4.3	5.9	7.4	8.9	10.5	12.6	15.4	19.8
100	2.3	4.2	5.8	7.2	8.7	10.3	12.3	15.1	19.5

Chart data from USDA Forest Products Laboratory

water to run off. Some woodworkers use roofing metal or plywood on top, tilted slightly to allow water to run off, with the weight placed on top to hold it down.

Keep an eye on the pile

Watch the stack closely for several weeks. You want to dry the wood as slowly as possible, to prevent both checking and case-hardening. However, mold is also a concern. Until the lumber gets down to 20% moisture content, any sign of mold indicates that the pile needs more air movement.

Checking is a sign that the pile is drying too quickly. Inspect the surface of the wood as well as the ends. If you find checks, slow down the air movement to prevent further degradation. Put a tarp on one, two or three sides of the pile to accomplish this.

Case-hardening occurs when the outer, drier shell of the board is stretched over a fatter and wetter interior and remains that way after the wood is dry, leaving severe internal stresses. Both case-hardening and checking occur when surface moisture evaporates faster than interior water can migrate to the surface. Each species has its own rate of diffusion, which determines how quickly the wood can be dried. A general rule of thumb is the lighter weight the wood, the faster it can be dried. Heavier woods, such as hickory, elm and oak, need more time.

When to stop

Moisture content is expressed as a percentage of the wood's oven-dry weight. A moisture content of 6% means that 6% of that board's weight is water. Moisture content is what you monitor during drying, but you should check it against the equilibrium moisture content. The equilibrium moisture content for wood is a function of the surrounding humidity and temperature. Basically, when the moisture in lumber reaches equilibrium with the air around it, the wood is not going to get any drier in that location.

You can use a few relatively inexpensive instruments for monitoring moisture content and equilibrium moisture content, or you can just guess at drying time. In the more-humid areas of the country, such as the Northeast and Gulf states, the rule of thumb for drying time is one year for every inch of wood, but things will go faster in other regions. Many folks simply use this general rule as a minimum; it doesn't hurt the wood to sit outside for a few extra months or even years, as long as the stack is maintained.

Once the wood has reached its outdoor equilibrium moisture content, it's time to move the stack inside, if you have the space. You could also bring in lumber as you need it.

Resticker the wood indoors

It's very important to finish drying your lumber in conditions similar to the furniture's final destination. Resticker the lumber in a heated space with adequate air movement and ventilation. Most basements are too humid. Generally, you can begin using the wood when it reaches 10% moisture content or so, depending on your region and the relative humidity of your home.

The best way to learn is to do it

Knowing the seasonal conditions of your location will make drying lumber much easier. Start with small quantities and monitor them closely. After a year you'll know the quirks, and daily or weekly monitoring will no longer be necessary. The USDA Forest Products Laboratory offers a number of free publications on drying lumber, which can be read on-line at www.fpl.fs.fed.us. Of course, the recently revised *Understanding Wood* (The Taunton Press, 2000), by R. Bruce Hoadley, is the bible on wood technology, including air-drying.

Now, about that neighbor's walnut tree. □

Lee Grindinger is a woodworker in Livingston, Mont.

Photos, this page: Michael Pekovich

Tackling Large Tabletops

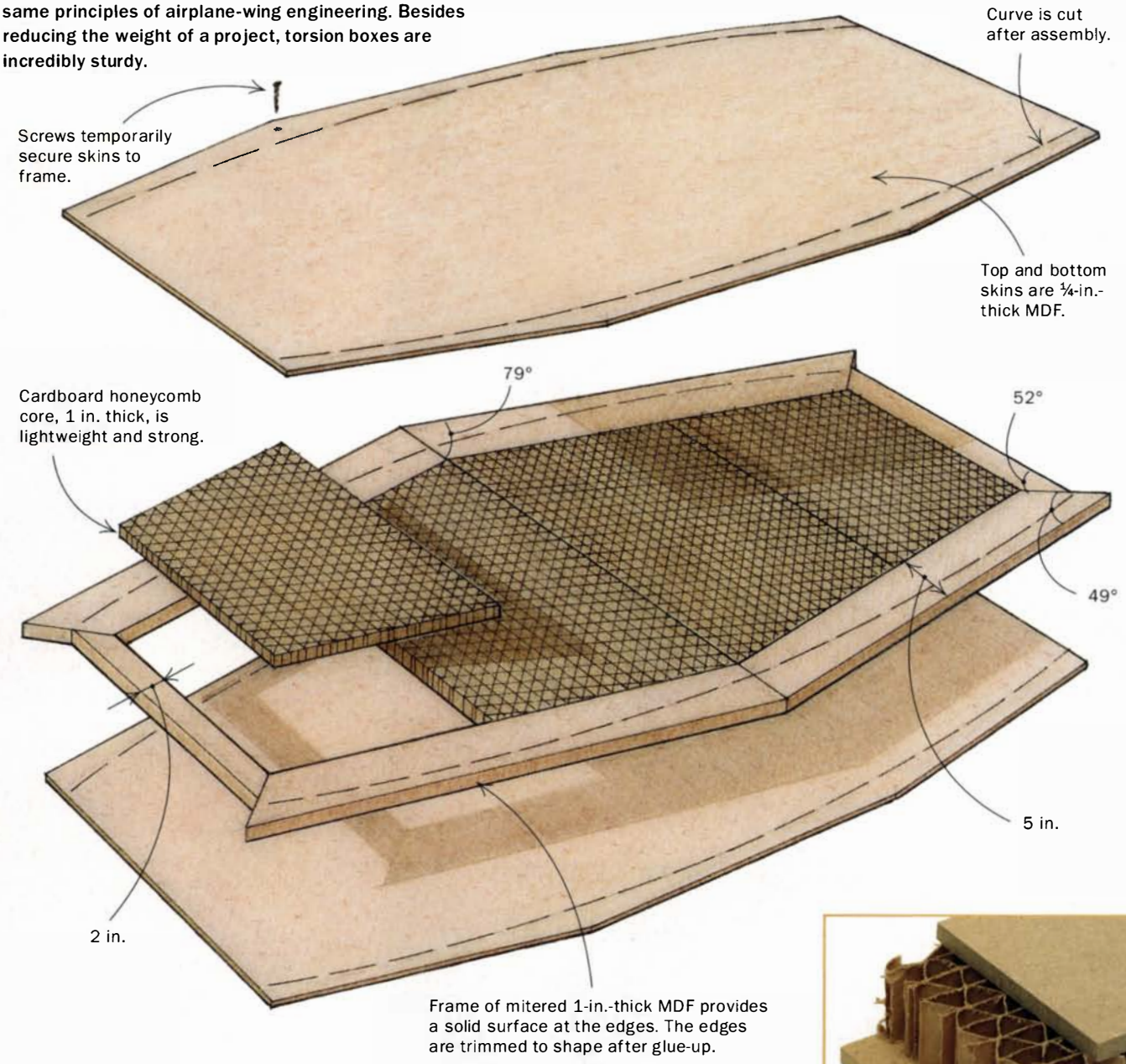
Make a tabletop that's as strong as an airplane wing using torsion-box construction

BY KIM CARLETON GRAVES

Photos: William Duckworth

TORSION-BOX CONSTRUCTION

Surprisingly few woodworkers ever consider this method of gluing up skins to a lightweight core, based on the same principles of airplane-wing engineering. Besides reducing the weight of a project, torsion boxes are incredibly sturdy.



Modern engineering has always seemed like magic to me. I find it amazing that skyscrapers don't collapse of their own weight and that bulky airplanes get off the ground and stay airborne. What makes these structures work, of course, are designs that distribute stresses over large areas.

I've wanted to use this principle in building furniture, and recently—after 11 years of making furniture with solid wood or ordinary plywood construction—I decided to build a torsion-box table. A torsion box is constructed much like an airplane wing, so it has a high strength-to-weight ratio. If I had built this tabletop from solid wood, it would be dimensionally unstable and too heavy to manage. The beauty of torsion-box construction is that it keeps the tabletop lightweight and flat, and it doesn't sag under its own weight.

Because I was making a large, formal dining table, I decided to build what's called a boat shape. The boat shape became popular for conference tables when researchers found that people seated at

SOURCE OF SUPPLY

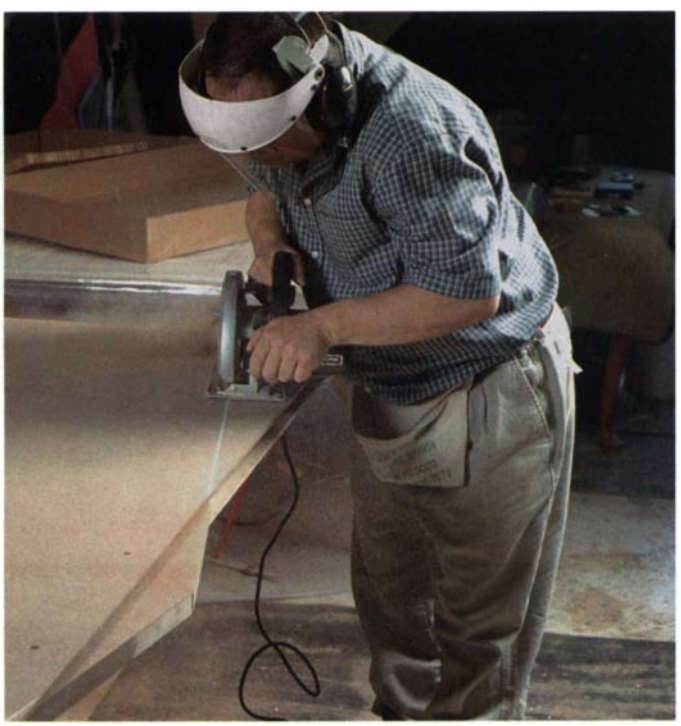
Resin-impregnated honeycomb is available in ½-, ¾- and 1-in. thicknesses from:

Vacuum Pressing Systems Inc.
553 River Road
Brunswick, ME 04011
(207) 725-0935

Drawings: Vince Babak

CUT THE CORE TO FIT THE FRAME

Dry-fit the core. *The cardboard honeycomb, purchased in 2-ft. by 4-ft. pieces, is cut on the tablesaw and fitted within the MDF frame.*



Cut the skins and frame to rough shape. *After snapping a chalkline to the outside miters, the author uses a circular saw to remove much of the waste.*

these curved tables could see and hear each other better than they could at long, straight tables. My feeling is that talking to your family and friends at dinner is just as important as talking to your colleagues or clients at meetings.

Anatomy of a torsion box

A torsion box consists of two thin skins glued to a core structure between them. The strength of the box comes from the gluelines, which are very thin individually but add up to a lot of glue surface overall. To make a core structure, you can staple together a simple lattice of wooden strips, which is the best alternative if you don't have a vacuum press. But making a lattice in this way is a lot of work, so I decided to use resin-impregnated cardboard honeycomb instead (see Sources on p. 77). Using this material for the core made the construction process cheaper and faster. Although the honeycomb is made of paper, it has enough glue surface to make a strong bond.

As you can see in the drawing on p. 77, I put an MDF frame around the honeycomb. This frame isn't needed for strength, but it protects the honeycomb from damage in the vacuum press. Also, it's used later to attach the veneer on the built-up edges around the table. Those edges hide the connection between pedestals and tabletop, and they make the tabletop look thicker than it really is.

Because of its shape and size, this table requires considerable care and attention to detail. The base assembly (see the drawing on p. 81) that I designed is quite difficult to make, because the pedestals taper in two directions and are constructed of veneered panels that must be cut with compound miters. For strength, I used plywood for the table subtop and the pedestal top that are screwed together to secure tabletop to base. But the torsion-box top is not difficult to make. Torsion boxes come in many sizes and shapes, and you can use them for parts other than tabletops, such as long unsupported shelves, beds or benches that must carry a lot of weight.

Build the core one layer at a time

Begin by milling strips of medium-density fiberboard (MDF) for the torsion-box frame and the built-up edges. The strips for the ends of the table are only 2 in. wide. For the curved sides, start with 5-in.-wide

strips to allow for the waste that will be cut off later.

Make enough strips to go around the table three times. One set—made of 1-in.-thick MDF—will become the torsion-box frame, and two sets—made of ¾-in.-thick MDF—are needed for the built-up edges on the underside. After all of the strips have been cut, miter their ends so they fit together into rough outlines of the tabletop, as shown in the drawing. First, make 52° cuts at both ends of the 2-in. strips, then make 49° cuts at one end of each 5-in. strip. Finally, make 79° cuts on the other ends of the 5-in. strips, adjusting the angles as necessary until the strips fit together tightly. Miter cuts leave sharp points on the outer ends of the 5-in. strips. If you trim off these ends, the pieces will be easier to work with.

The top and bottom skins of the tabletop are made of ¼-in.-thick MDF. You will also need to cut a tabletop-shaped caul made of ¼-in.-thick melamine, for vacuum pressing, because most glue won't stick to the melamine. To save time, stack two sheets of MDF and one sheet of melamine on your bench and screw them together at the corners. This way you can cut both tabletop skins and the caul at the same time.

On top of this stack, lay out one set of edging strips and trace around the inside and outside with a pencil. Then use a circular saw to cut the tabletop skins and caul to rough shape just outside the outside layout lines.

Assemble and glue up the top a little oversized

Unstack the MDF and melamine sheets, keeping only the sheet of MDF with the edging outlines on your bench. Assemble the 1-in.-thick frame onto it, using the outlines you traced. Hold the frame in place with two drywall screws per piece.

The hexagonal space inside the frame will be filled with honeycomb. Cut the honeycomb to shape using the tablesaw, and lay it into the space. The honeycomb should fit snugly, with no scrunching and no large gaps at the edges.

Put on the top skin of ¼-in.-thick MDF and then the melamine caul (melamine-side down), making sure all edges align within about ⅛ in. Trim them, if necessary. Round over the top edges and corners of the melamine sheet with a mill file, and disassemble the stack. Easing the edges pre-

GLUE UP THE SKINS

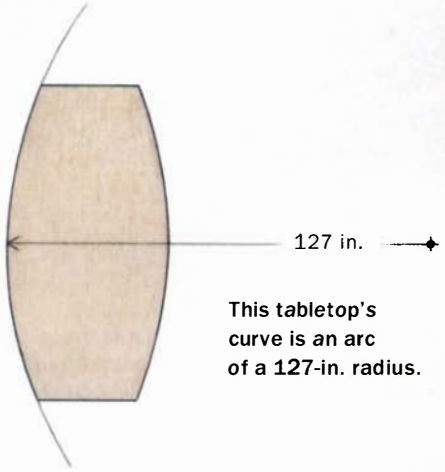
Don't spare the glue. *A liberal amount of urea resin glue applied with a squeegee and roller guarantees a rigid bond at the glueline.*

Work from the bottom up. *After applying glue to the bottom skin, place the MDF frame and the honeycomb material in place. Fasten the frame to the skin with screws.*

It doesn't take a lot of pressure. *The honeycomb core requires only about half of the clamping pressure as that used for gluing up veneer.*

CUT THE CURVED SHAPE WITH A SAME-SIZE TEMPLATE

Make a curved pattern. *To cut the curved edges, make a template with the exact radius required. Cut it with a router mounted on a compass.*



This tabletop's curve is an arc of a 127-in. radius.

Cut the final shape. *After glue-up, with the template clamped in place as a guide on the tabletop, the author trims off most of the waste with a jigsaw.*

Clean up the curved edge. *Without moving the template, he follows the jigsaw cut with a router fitted with a large flush-trimming bit that brings the table edges to their finished contour.*

vents puncturing the vacuum bag during the glue-up.

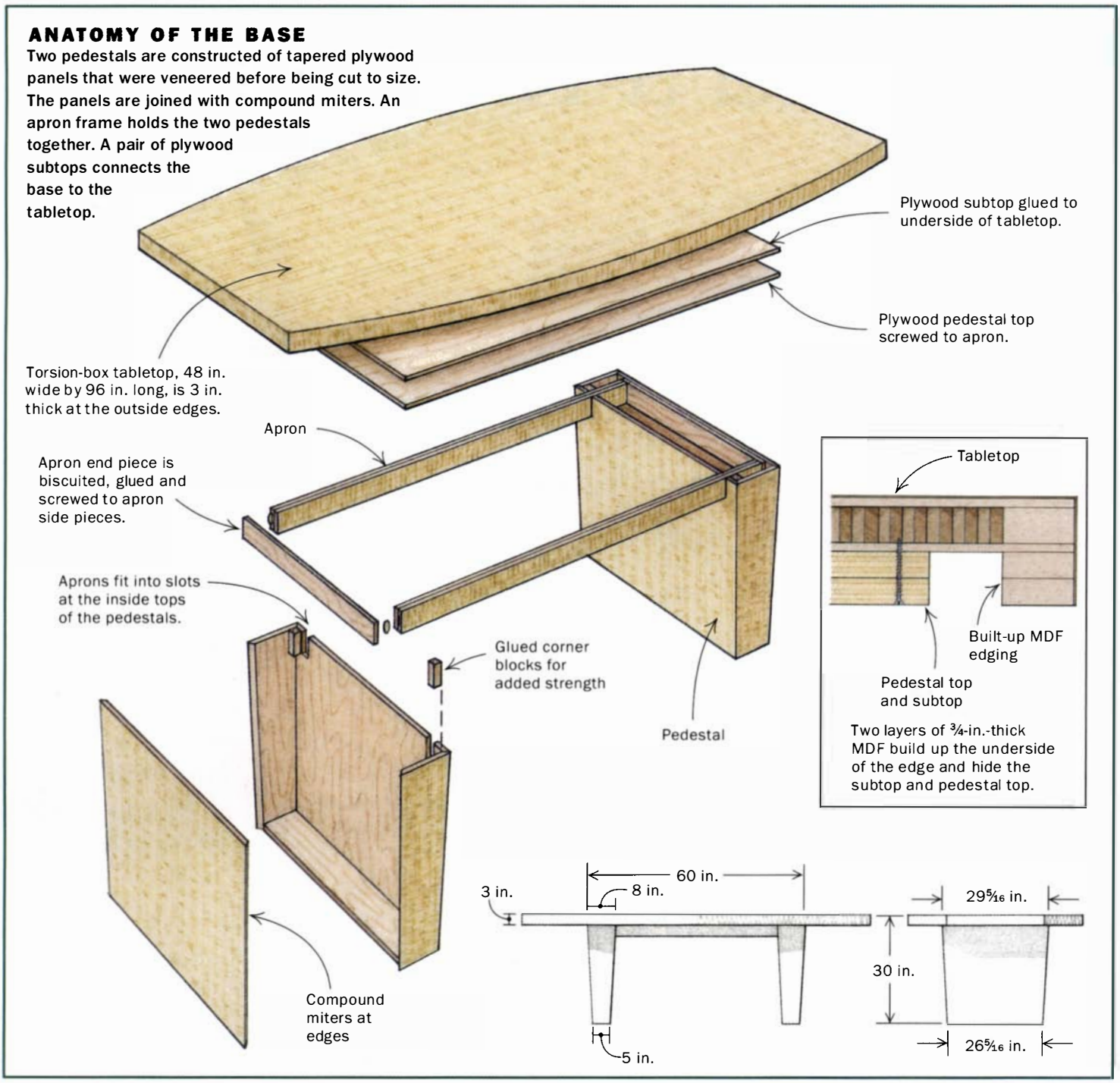
Set up the vacuum press, adjusting the vacuum pump to provide 10 Hg to 15 Hg of pressure, and arrange the torsion box components in an orderly fashion so that you can work quickly. Spread urea resin glue on the entire surface of the bottom skin. Don't skimp on the glue, and don't use regular yellow or white glue, because they have too short an open time and won't give you a rigid glueline.

Position the 1-in.-thick frame, holding it in place with a couple of 1-in. drywall screws through the skin into each frame piece. Make sure the heads of the screws are below the surface of the skin so that the skin sits flat on the platen. Put the honeycomb core inside the framework. Spread glue onto the bottom of the top skin and place it over the assembly. Screw the assembly together to keep it from slipping around in the vacuum press.

Place the top caul on the torsion box and put the assembly into the vacuum bag. Seal the bag and turn on the pump. Put some glue into a piece of plastic wrap and press the panel until the glue in the plastic wrap is hard. After pressing, stand up the tabletop so that air can circulate around it overnight and the glue can cure fully. Remove all screws, fill the screw holes, and sand the filled repairs flat to keep them from telegraphing through the veneer.

Cut the final shape to size and build up the edges

This tabletop's curve is an arc of a circle with a 127-in. radius. To cut the arc of a



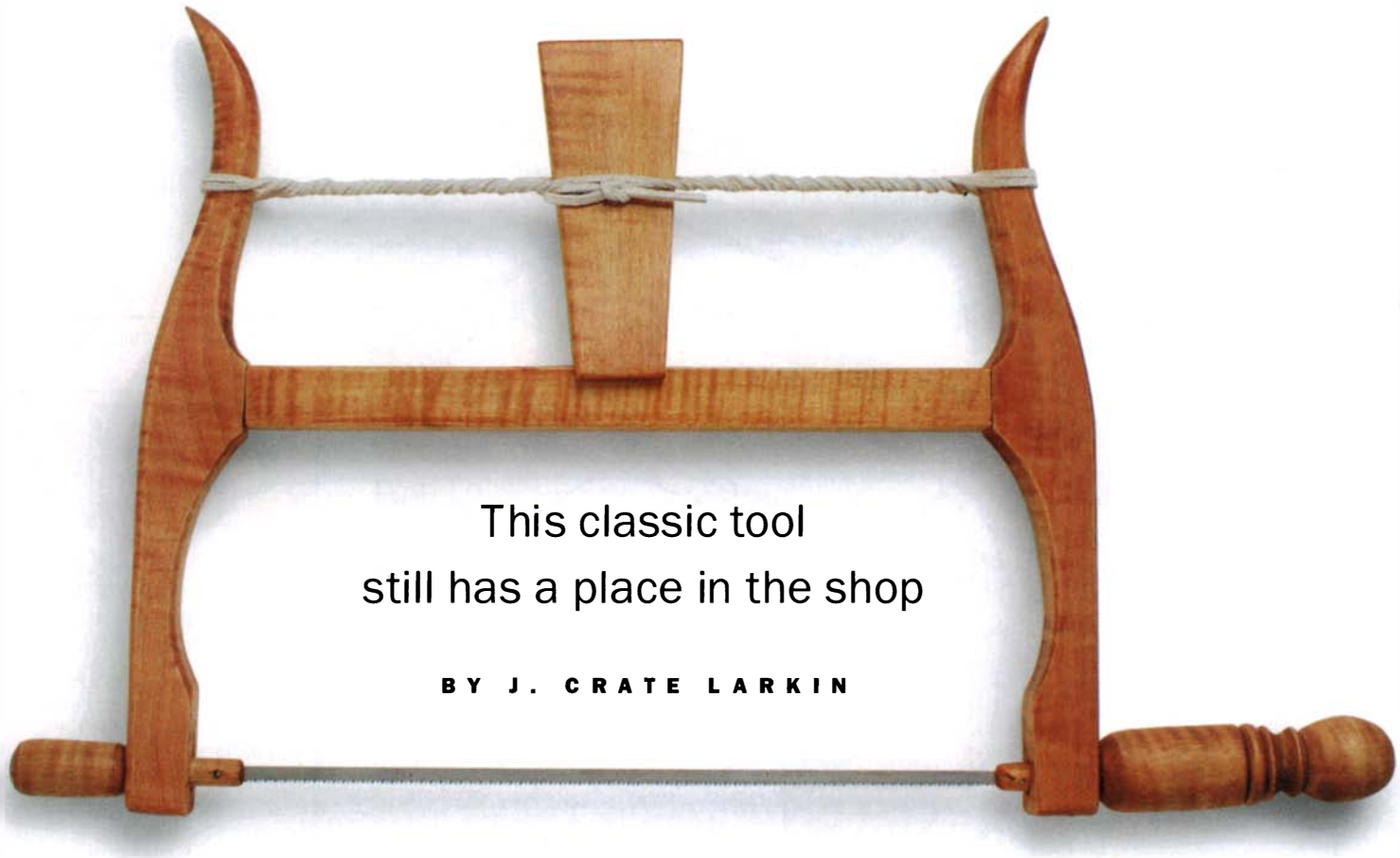
large circle, make a template from 1-in.-thick MDF, using a router on a compass, then pattern-rout the tabletop.

You can make the compass from scraps of plywood or MDF attached to a pivot that is screwed or hot-glued to the floor. The MDF sheet for the template should also be secured to the floor. Turn on the router and, making several passes, cut into the template until you're almost all the way through, being careful not to cut into the floor. Place the template on your workbench and cut through the router cut with a jigsaw, then use a flush-trimming bit to rout off the last bit of waste. Once you've made the template, position it on the tabletop and clamp the template in place. Use a jigsaw to cut out the arcs to within ⅛ in. of the line. Then rout the remainder of the edge, using a top-bearing flush-trimming bit with a ½-in. shank.

I book-matched African satinwood veneer for this tabletop, with the grain running the long way to accentuate the table's length. Cutting the veneer 10 in. to 12 in. longer than the tabletop let me save matching veneer to use on the edges of the table ends. The veneer was laid up with urea resin glue and pressed in the vacuum bag. I always use urea resin for gluing veneer to tops and bottoms of tabletops because the hard glueline holds veneers in place better, allowing less creep. □

Kim Carleton Graves is the owner of Carleton Woodworking in Brooklyn, N.Y. He wrote this article with the assistance of Masha Zager. Their book, "Dining Tables," will be published in February 2002 by The Taunton Press.

Build a Bowsaw



This classic tool still has a place in the shop

BY J. CRATE LARKIN

As a full-time woodworker, I have a lot of power-tool options in my shop. But there are occasions when it's simply faster and easier to use a hand tool to get the job done. And one I reach for all the time is the bowsaw, a tool that's been serving woodworkers for centuries. At first glance the saw might seem charmingly primitive. Yet the engineering is remarkably ingenious.

Over the years bowsaws have been made in various sizes. This one is an adaptation of several 18th-century English and Continental designs. With a 12-in.-long blade, it's both compact and light, so it gets used in all sorts of ways. For example, it's the tool I reach for when I need to crosscut a few parts quickly to rough length. I also use it like a scroll saw to cut curved shapes. The bowsaw also lends itself to cutting angles. And with the blade turned 90°, I sometimes even rip a board with the saw.

You can get the steel blade from a couple of mail-order outfits (see Sources on p. 84). The blade is available with either 8, 9, 12 or 16 teeth per inch (tpi). For most cuts, the 8-tpi or 9-tpi blade works just fine.

Tensioning the blade is easy. A thin, tapered piece of wood—called a key—twists a length of leather cord, which pulls together the top ends of the saw's two long arms, called brackets. That action forces apart the bottom ends of the brackets, putting the blade under tension.

Start by making the wood parts

The bowsaw is made up of just six wood parts: the two brackets and the key, plus a

Photos, except where noted: Tom Begnal; this page (top): Kelly Dunton

BRACKETS ADD STRENGTH AND STYLE

Scribe the curved profile on the brackets. *Using a paper pattern of the bracket profile, transfer the curved shape to ⅞-in.-thick stock.*

stretcher, handle and knob. You'll need about 2 bd. ft. of ⅞-in.-thick stock and an 8-in.-long piece of 1¾-in. square stock.

When the saw is assembled and tensioned, all of the parts end up under some stress, so it makes sense to use hardwood stock. Maple, birch or beech are good choices, but to make the saw look as nice as it works, I went one step further and used curly maple.

The brackets are first—Begin by cutting out two pieces of stock for the brackets. They'll be cut to final shape on the bandsaw, so make them a little wider and longer than necessary.

Now transfer the bracket pattern (right) to a piece of heavy paper or cardboard. Cut the pattern to shape with scissors, then place it on the bracket stock and trace the profile with a pencil.

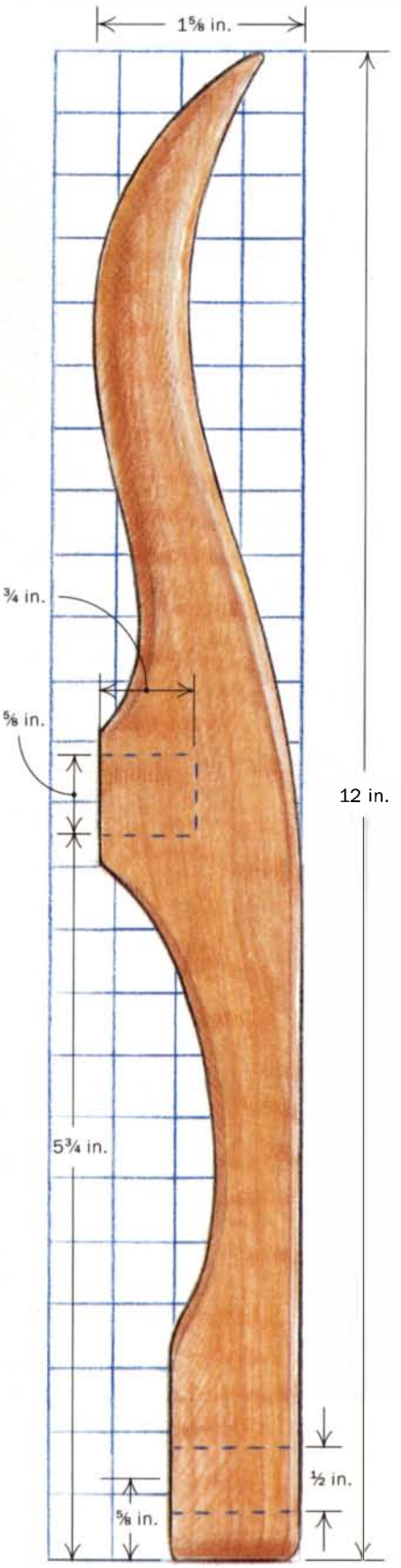
It takes just a few minutes to cut out the brackets on the bandsaw. Make the cut just outside the scribed line, then sand the parts to the line.

Give all sharp edges a good rounding over with a spokeshave, then follow with a file. Finish up by sanding each bracket up to 220 grit.

With the rounding and sanding completed, lay out the location of the single mortise in each bracket. Once the mortise

A spokeshave softens the edges. *The bracket is kinder on the hands if the edges are well-rounded.*

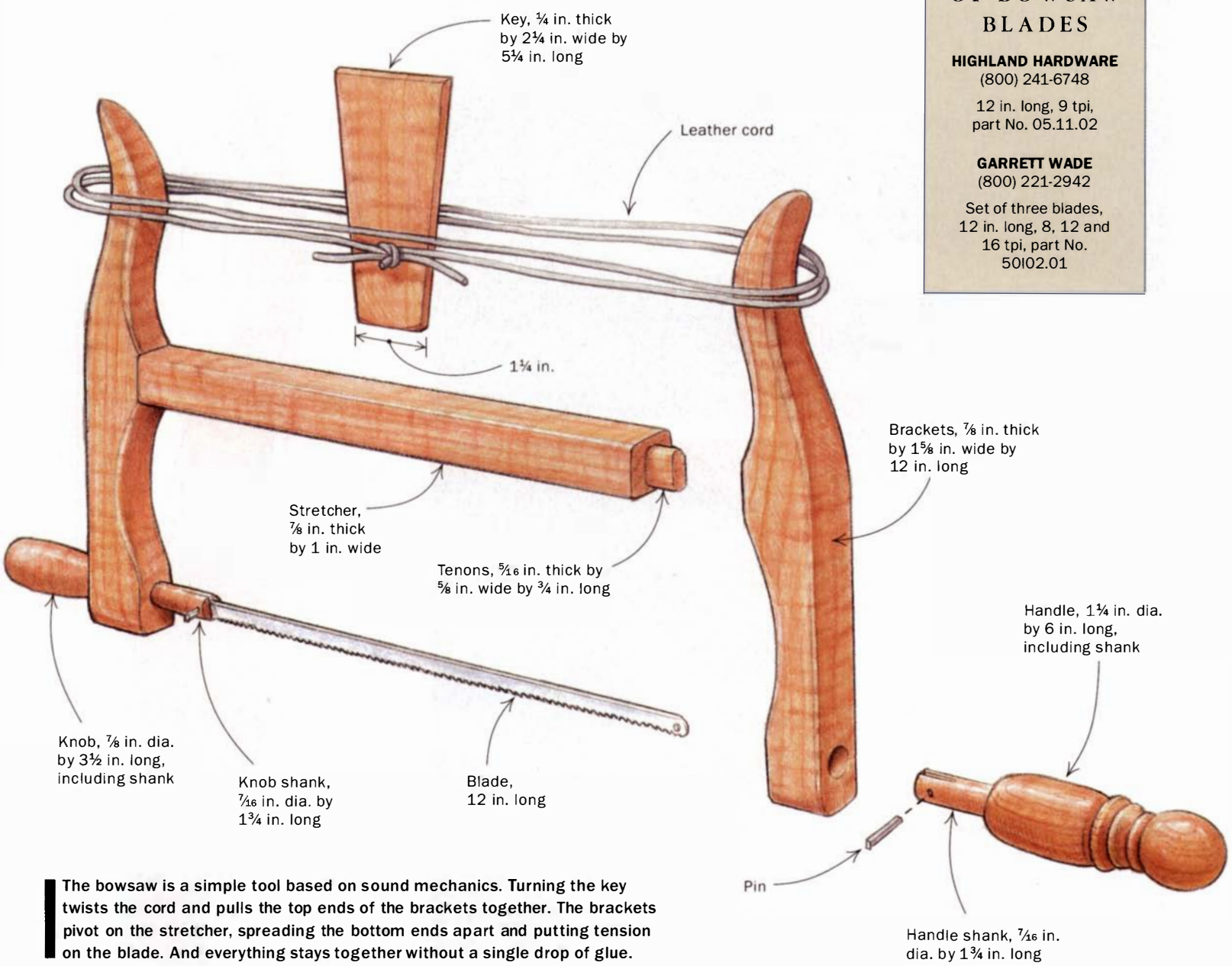
Each bracket has a single mortise. *Cutting the mortise is a two-step process. First drill a couple of holes to remove most of the waste material, then use a sharp mortising chisel to clean up what remains.*



1 square = ½ in.

Drawings: Bob La Pointe

THE PARTS OF A BOWSAW



The bowsaw is a simple tool based on sound mechanics. Turning the key twists the cord and pulls the top ends of the brackets together. The brackets pivot on the stretcher, spreading the bottom ends apart and putting tension on the blade. And everything stays together without a single drop of glue.

SOURCES OF BOWSAW BLADES

HIGHLAND HARDWARE
(800) 241-6748
12 in. long, 9 tpi, part No. 05.11.02

GARRETT WADE
(800) 221-2942
Set of three blades, 12 in. long, 8, 12 and 16 tpi, part No. 50102.01

locations have been marked, use a drill bit to remove most of the waste. A little work with a mortising chisel cleans up what remains.

At this point, the work on the brackets is just about completed. You just need to bore a ½-in.-dia. through-hole near the bottom of each one. Later, when the bowsaw is assembled, the shanks of the handle and knob are going to slip into these holes.

Stretcher connects the two brackets— The stretcher is simply a narrow length of stock with a tenon on each end that fits into a mortise in each bracket. I cut the tenons by establishing both the cheeks and shoulders on my bandsaw. The distance between the shoulders of the stretchers should be such that, when the stretcher is assembled, the ends of the blade will just meet the inside face of the lower end of the bracket.

One point to keep in mind here: Because the brackets must be free to pivot on the shoulders of the stretchers, the stretcher tenons are not glued into the bracket mortises. To allow the bracket to pivot just slightly, you need to make the tenons a little undersized.

The handle and knob anchor the blade—It takes only a few minutes to turn the handle and knob on the lathe. Make the shanks extralong, and keep a close eye on their diameters. You want them to slip smoothly into the holes that you drilled in the brackets.

Remove the handle and knob from the lathe, then trim the shanks to final length.

Simply slip the shanks into the bracket holes and mark the cutoff point. I generally like to have at least ¾ in. extending through the bracket.

Once the shanks have been trimmed, use the bandsaw to cut a kerf in each one so that they will accept the ends of the blade. Then test-fit the blade in the kerfs. If the fit is too tight, you'll have to do some sanding to open the kerfs a little.

The blade is held in place by two pins that slip through each shank and then through the corresponding factory-drilled holes in the blade. For pins I prefer to use old-fashioned, ½-in.-long cut nails, but 4d finish nails are an adequate substitute. By the way, it's not a bad idea to file down the pointed end of the pins. Sharp points always seem to attract soft skin.

Position the ends of the blade next to the shanks, and mark the hole locations on the shanks with a pencil. Then drill holes just big enough to accept the pins. Be sure to drill the holes at right angles to the kerfs in the shanks. After that, line up the holes in the shanks and blade and tap the pins through. There is no reason to worry about the pins falling out when you're using the saw. When the blade is under tension, the pins stay put.

The key is a crank—It's just a thin, tapered piece of wood, but the key is an important part of the bowsaw. It works like a simple crank, providing the leverage needed to twist the leather cord and apply tension to the blade. And after the blade has been tensioned, the narrow end of the key slips behind the stretcher, preventing the cord from unraveling.

Once the stock for the key has been cut to size, use a bevel gauge to scribe the two tapers along the edges. Then cut the tapers and plane the edges smooth. I also like to round all of the edges. That way, when I'm cranking the key, it feels a little more comfortable in my hand.

Apply the finish

After the key has been made, it's time to apply a finish to all of the wood parts. First, though, do some final smoothing with 0000 steel wool.

To make the figured grain really stand out, I applied a single coat of aniline dye (early American maple).

When the dye dries, I like to apply at least three coats of Minwax Antique Oil Finish. It builds to a smooth, lustrous finish that looks great on a tool like this.

MAKE THE HANDLE

Shape it on the lathe. *Once a blank for the handle has been mounted in the lathe, it takes just a few minutes to turn a profile that's both interesting and comfortable.*

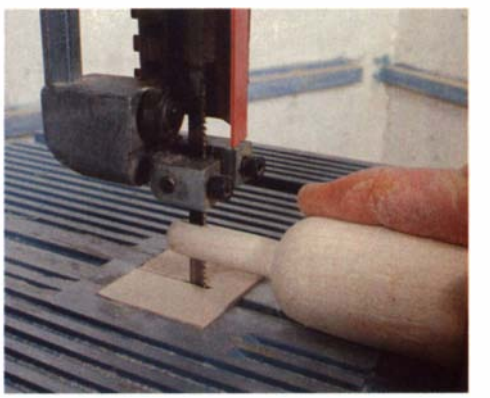
Assemble the saw

Slip the handle and knob into the holes in the brackets, then add the blade and pins. If you prefer to cut on the push stroke, the teeth of the blade should face away from the handle. If you like to cut on the pull stroke, as I do, face the teeth toward the handle. Once the blade has been installed, insert the stretcher tenons into the mortises in the brackets. Remember, though, there's no glue used here.

Now add the cord. I've used rawhide shoelaces in the past, but they don't hold up well. I've had better luck buying ¼-in. leather cord from a local fabric retailer.

Wrap the cord twice around the tops of the brackets. Pull the cord slightly taut, and tie the ends in a square knot. Next, slip the key between the rawhide, and turn (the direction it's turned doesn't matter) until the tension on the blade is enough to prevent it from bowing when making a cut. Slide the narrow end of the key behind the stretcher to keep the cord from unwinding, and you're ready to work. □

J. Crate Larkin builds furniture and hand tools in Woodsboro, Md.



The shank gets a narrow slot. *Feeding the end of the shank into the bandsaw creates a near-perfect kerf for the bowsaw blade.*

Mark the holes for the blade pins. *Use the blade to determine the exact locations of the holes on the shanks.*

All About Thinning Finishes

You don't need a chemistry degree to understand which solvents work with each kind of finish

BY JEFF JEWITT

How much time do you need?

The slow and the fast. *Mineral spirits and naphtha were simultaneously brushed onto a board. Three minutes later, the naphtha had almost evaporated, while the mineral spirits was still wet.*

One of the reasons for adding solvents is to control the rate at which the finish dries. This control is desirable for any method of application. When spraying a vertical surface, too slow a drying time may cause the finish to run, while a finish that evaporates too fast may leave an orange-peel appearance. When brushing, the right solvent can maintain a wet edge yet not attract dust by taking forever to dry. In the charts, the drying time of a solvent is rated as slow if it acts as a retarder (slows down the drying time). A rating of medium means that the solvent doesn't significantly change the drying properties of a finish, although the drying time of any thinned finish will speed up somewhat. And fast solvents do just that: speed up the drying time. The actual speed will vary based on application methods and environmental conditions.

Photo, this page (background): Scott Phillips

It's a rare woodworker who is not intimidated by the cans of solvents lining the shelves in a hardware store. The multisyllabic names are reminders of less-than-productive school chemistry classes, while the dire health warnings are equally off-putting. The temptation is to grab something vaguely familiar, hope that it is compatible with the finish you are using, and leave as fast as possible.

But it need not be like this. I will guide you through the world of solvents—the good, the bad and the unpronounceable. I will show you which solvents are appropriate for water- or oil-based finishes, shellacs or solvent lacquers, whether you are spraying, brushing or wiping on the finish.

A very quick word about chemistry

Almost all finishing materials contain liquids that are volatile, meaning they evaporate during the drying and curing of the finish. These liquids, called solvents and thinners, make the finishing material less viscous for easier application.

Chemists distinguish between solvents and thinners: Solvents dissolve or break up finishing resins and reduce viscosity, while thinners merely reduce the viscosity. Dissolving shellac flakes with denatured alcohol is the only occasion a woodworker is likely to use a solvent as such. For this article I use the terms solvent and thinner interchangeably, as many woodworkers do.

I have divided finishes into four families, roughly in order of the toxicity of their solvents: water-based, shellac, oil-based and solvent-based lacquer. For each family I cover the range of compatible thinners and the points to consider when choosing one.

Thinning water-based finishes takes more than water

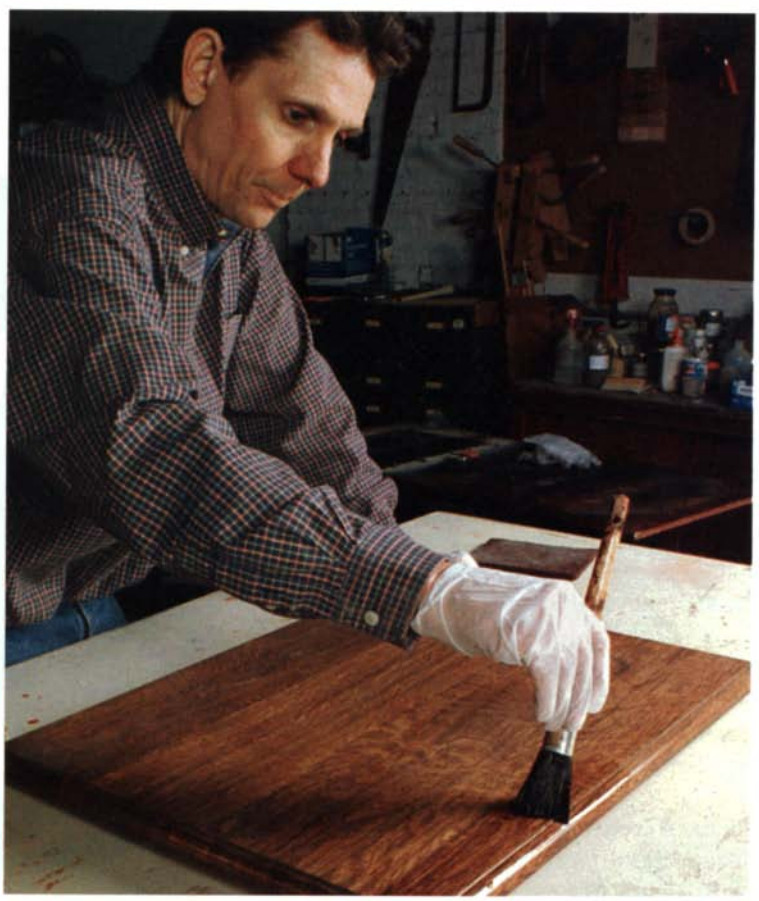
The widespread use of water-based finishes is rather new, and in many cases the chemistry behind it is still being fine-tuned. Many woodworkers are aware of water-based versions of lacquer and polyurethane, but water-based varieties of varnish, gel stain and Danish-oil finishes are also available. While the novice might assume they would be the easiest finishes to thin because they are made up mostly of water, their chemical complexity makes them the least-forgiving finishes to tamper with.

You can get into serious problems if you add too much water. Usually 5% to 10% is fine for viscosity adjustments (to make it

WATER-BASED FINISHES

Among the finishing families, the evaporation rate of water-based finishes is the most difficult to adjust. They typically require a specific retarder, while plain water should only be added sparingly.

THINNER	DRYING TIME	COMMENTS
Retarder (water, glycol ether and additives)	Medium	Used to combat lap marks when brushing or orange peel when spraying. Follow the advice of the finish manufacturer carefully and use only the recommended retarder; otherwise, the chemical balance may be upset, rendering the product useless.
Water	Fast	To avoid upsetting the chemical balance, never add more than 10% water. If the product is too thick to atomize properly for spraying or if it streaks when brushing or wiping, thinning may be required. If the humidity is 90% or more, don't add water because it will act as a retarder and lead to excessive drying time.



A brushed finish should go down without leaving lap marks. *If you have trouble keeping a wet edge because the finish dries too quickly, which may happen in warm, dry weather, add a small amount of retarder to a water-based finish.*

Photos, except where noted: Mark Schofield; this page (top): Erika Marks

SHELLAC

Most woodworkers use only denatured alcohol to thin shellac, but several other solvents offer slower evaporation rates for brushing shellac or spraying it on a hot and dry day.

THINNER	DRYING TIME	COMMENTS
Pure gum spirit turpentine	Slow	For an effective retarder, add a teaspoon to about 4 oz. of liquid shellac.
Isobutanol	Medium/slow	Acts as a retarder but is difficult to find and has a very strong odor.
Isopropanol	Medium/slow	A suitable retarder when brushing shellac. Auto-parts stores sell it as gas-line antifreeze. Check the label to make sure that isopropanol is the only component. An alternative source for 99% pure isopropanol is www.chemistrystore.com.
Denatured alcohol	Medium/fast	Will slightly speed up drying time and improve the flow and atomization of heavy (3-lb. cut) shellac. It is the main solvent and thinner for shellac. Specific-brand formulas with different additives are available.
Methanol	Very fast	Although no longer available to the consumer market, professional finishers can still obtain the product. Speeds up drying times considerably.

spray or brush better), but more than that can disrupt the chemical makeup of the finish, which will have a negative effect on how the finish forms a film.

For a finish that dries too fast, a better alternative is to use a retarder. A retarder is typically used in hot, dry conditions. It helps you avoid orange peel by giving the finish more time to flow out and achieve a level surface. Be sure to use a retarder recommended by the finish manufacturer. The wrong retarder can upset the chemical balance of the finish.

When spraying a water-based finish, before adding water or a retarder, try to compensate for viscosity by changing to a larger needle/nozzle and making adjustments to your finishing environment or technique. Spray thinner coats when it's hot and humid, and arrange fans so that air blows gently across the finish as it dries.

Shellac is compatible with more than alcohol

Shellac is one of the oldest finishes in woodworking. No other finish can match the depth and clarity it brings to wood, but its lack of durability makes it unsuitable for surfaces subject to heavy use.

Shellac is available in dried flakes that are dissolved in alcohol or in ready-to-use liquid form. For both premixed shellac and shellac flakes, the best all-around thinner is denatured alcohol.

As shellac is sprayed, the solvents evaporate, cooling the surface of the workpiece. If the temperature falls below the dew

More brushing, less rushing. *The addition of turpentine slows the drying time of shellac, allowing you to keep a wet edge while brushing a large surface. You can even go back and tip off the surface.*

Photos, this page (top) and facing page: Erika Marks

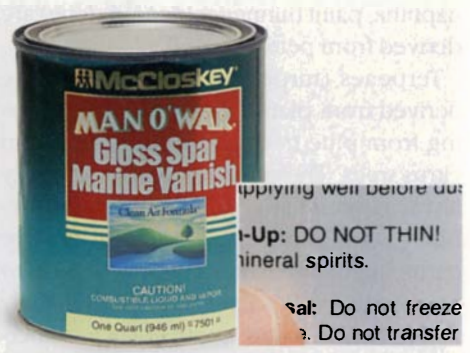
THINNER	DRYING TIME	COMMENTS
Kerosene	Slow	Used in small amounts, kerosene is very effective as a retarder when brushing on an oil finish in dry weather.
Odorless mineral spirits	Slow	Mineral spirits becomes odorless mineral spirits by removing the aromatics. This product is commonly available at art-supply stores as well as hardware stores. Acts as a retarder.
Mineral spirits/ paint thinner	Medium	Use to change the viscosity without impacting the drying time significantly. Good for adding to a finish that will be brushed. Can also be used to thin gel varnishes that dry too fast and streak.
Pure gum spirit turpentine	Medium	No longer used much in commercial finishing due to the variable quality. The rosin content is not reported on the can, but a batch with high rosin may leave a soft finish. The high price relative to paint thinner is another drawback.
Xylene	Medium/fast	Best used for thinning conversion varnishes.
VM&P naphtha	Fast	Varnish maker's and painter's naphtha is the best solvent for fast evaporation. Use it when spraying in cold weather, on vertical surfaces or when using varnish or polyurethane as a wipe-on finish.
Toluene	Fast	Dries slightly faster than VM&P naphtha but has a very strong odor. For consumers, naphtha is a better choice.
Acetone (ketone)	Fast	Add to a thick varnish when spraying a single, heavy coat, to avoid runs and sags. When applied over a previous coat, may cause wrinkling of the finish.

OIL-BASED FINISHES

The petroleum industry has produced a large range of solvents compatible with oil-based finishes. These range from slow-evaporating kerosene to fast-evaporating ketone.

point, moisture condenses on the surface, causing a cloudy appearance in the finish known as blushing. If you are spraying shellac in hot, humid weather, you need to slow down the drying rate to avoid blushing. Suitable retarders include butanol or isopropanol, the latter being found at auto-parts stores as a gas-line antifreeze. Do not use rubbing alcohol; even though the active ingredient is isopropanol, the other 30% to 50% is water, which will not improve your finish. Glycol ether such as lacquer retarder also slows the drying time of shellac, but the finish may remain soft and be more easily damaged.

A retarder is also useful when you are brushing shellac on a large surface, such as a tabletop. If the shellac dries too quickly, you risk applying the finish to an area adja-



To thin or not to thin. *Some finishes, particularly oil-based ones, come with a warning not to thin the contents. In finishes advertised as having a "clean-air formula," any addition of solvent would place the finish above the emissions limit agreed with the government.*

LACQUER

Besides the generic medium-speed lacquer thinner, slow and fast formulations are also available. The evaporation of lacquer can be slowed by adding a retarder or accelerated by adding acetone.

THINNER	DRYING TIME	COMMENTS
Lacquer retarder	Slow	It's best not to mix retarder directly with a brushing lacquer. Instead, add 1 oz. to 2 oz. of retarder to 1 qt. standard (medium) lacquer thinner; then add small amounts of the mix to a finish.
Slow lacquer thinner	Medium/slow	Most lacquer thinner available in hardware or woodworking stores has a medium-speed evaporation rate. The best place to find slow- or fast-evaporating lacquer thinner is at an auto-finishing supply store. If in doubt about their suitability, an alternative is to add lacquer retarder to a medium-speed thinner. This will produce a slow-evaporating thinner needed on hot days to avoid blushing and when spraying a horizontal surface to improve flow-out. Fast-evaporating thinner is recommended for cool weather and when spraying vertical surfaces. This can be made by adding acetone to a medium-speed lacquer thinner.
Medium lacquer thinner	Medium	
Fast lacquer thinner	Fast	
Acetone	Very fast	Acetone evaporates so fast that it is prone to leave a finish blushed unless the humidity is very low. Woodworkers in Arizona spraying during the summer may get away with using it.

cent to one where the finish has already started to set up, preventing the edges of the brush strokes from blending together. Adding a teaspoon of pure gum spirit turpentine to approximately 4 oz. of liquid shellac acts as a retarder. With a retarder added, the first line of finish will remain wet until the second line can be brushed on and the two can blend together.

Hydrocarbon solvents and oil-based finishes offer the most choices

Linseed, tung and Danish oils, oil-based varnishes and polyurethanes, oil paint and waxes make up the largest family of finishes and are the products most woodworkers think of when it comes to finishing. These finishes are thinned with two groups of solvents: hydrocarbons and terpenes.

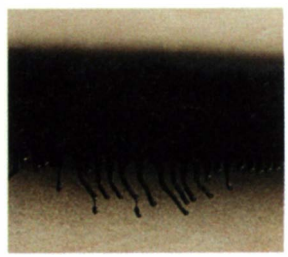
Hydrocarbons (kerosene, mineral spirits, naphtha, paint thinner, toluene, xylene) are derived from petroleum oil.

Terpenes (turpentine, d-limonene) are derived from plants, with turpentine coming from pine trees and d-limonene from citrus trees. These two solvents are nearly always interchangeable with hydrocarbons. D-limonene has a pretty distinctive citrus smell that makes it more pleasant to work with, but it's hard to find. Its toxicity and flammability are about equal to mineral spirits, but the evaporation rate is slower.

Because of the high cost of extracting turpentine, this classic thinner has all but been replaced with mineral spirits. A drawback to using turpentine is the rosin content, which can vary depending on what

Adjust your lacquer for every occasion. *When spraying a vertical surface, it is important that the finish dries before it has a chance to sag and run.*

See how it runs. *The top bar of black lacquer had fast-evaporating acetone added. The lower bar was thinned with slow-evaporating lacquer thinner, giving the finish time to run before it could dry.*



Photos, this page (top) and facing page: Erika Marks

trees were processed in each particular batch. If the rosin content is high in the can you are using, the finish will remain soft; however, you will not find a measurement on the side of the can.

The two best thinners to use are mineral spirits and naphtha. Mineral spirits is best for maintaining a wet edge when brushing, while naphtha is better for spraying or wiping. Kerosene can be added in very small amounts (6 to 12 drops per pint) to oil-based stains to slow them down for easier application on large surfaces.

The right retarder makes lacquers easier to use

Solvent-based lacquer finishes have traditionally been the mainstays of commercial furniture makers and professional finishers. They are not as popular with hobbyists because of their reputation for needing expensive spraying facilities.

Solvent-based lacquer is thinned with lacquer thinner, a blend of ketones, alcohol and hydrocarbons. By adjusting the ratio of these components, manufacturers can tailor a thinner to be fast, medium or slow evaporating. Most woodworking finish suppliers stock only medium-speed thinner. The best place to find fast- and slow-evaporating lacquer thinners is an auto-finishing store. Fast-evaporating thinner prevents sagging on vertical surfaces, but if you can't find it, use acetone. Unless you are spraying in very low humidity, however, an acetone-thinned finish is susceptible to blushing because of its very fast evaporation rate.

Slow-evaporating thinners allow the finish to flow out and level better on horizontal surfaces. For this reason, slow-evaporating thinner is sometimes called "warm-weather" thinner. An alternative to slow-evaporating thinner is to add lacquer retarder (glycol ether) to a standard lacquer thinner, then add the mix to a finish.

For more information on the dangers of a particular solvent, and to find out what type of respirator to use, check its material safety data sheet (MSDS) available on line at siri.uvm.edu/msds. Another useful source of information is National Institute for Occupational Safety and Health (NIOSH): www.cdc.gov/niosh. □

Jeff Jewitt is the owner of Homestead Finishing Products in Cleveland, Ohio, and a frequent contributor to Fine Woodworking.

The right glove for each solvent

When using solvents, many woodworkers protect their hands with disposable latex or vinyl gloves. Inevitably a particular solvent seems to eat through the glove as if it wasn't there, resulting in chapped skin or even chemical burns.

Shown here are disposable and reusable gloves made of latex, nitrile, vinyl and neoprene. Less important than what the glove is made of is to remember that disposable gloves should be used only for splash protection, such as when blending a finish or brushing one on. For more sustained contact, such as when using a solvent to clean a spray gun or wiping on a finish, use heavy-duty gloves. Unfortunately, no one glove is suitable for all solvents.

Specific information on how different glove materials stand up to various solvents can be found at Mapa Glove's web site (www.mapaglove.com) as well as other manufacturers' sites.

LATEX

Used primarily for mixing dye powders and applying water-based dyes. The main advantage of disposable latex gloves is their flexibility and feel, which make them good for doing detailed work. Neither type of glove shown will stand up to oils or hydrocarbon derivatives (mineral spirits, naphtha, paint thinner or kerosene).

NITRILE

Nitrile gloves offer protection from almost any solvent a woodworker is likely to use. The only exception is a solvent that contains a ketone such as acetone. The disposable version offers more protection than the other two types of disposable gloves, but they are harder to find and are more expensive.

VINYL

Okay for powdered dyes and dyes in a water solution. Disposable vinyl gloves are the cheapest protection available, but they tear more easily than disposable latex ones. Avoid contact with ketones and aromatic solvents. The thicker gloves offer good protection but at the expense of a clumsy feel.

NEOPRENE

This is another excellent choice for regular contact with most solvents, except lacquer thinner, where nitrile is a better choice.

Current Work

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

BEST OF SHOW

James Betts

This reproduction Goddard-Townsend block-front secretary (24 in. deep by 40 in. wide by 96 in. tall) won Best of Show from *Fine Woodworking* at this year's Design in Wood competition at San Diego's Del Mar Fair. The piece, made of Honduras mahogany and maple with a shellac and wax finish, took Betts approximately three years to complete. See the back cover and www.finewoodworking.com for more winning entries. Photo: Lynn Rybarczyk and Ed Suszynski, courtesy of San Diego Fine Woodworkers Association

Michael Seward ▲

Seward was commissioned to build this cradle (22 in deep by 42 in. wide by 48 in. tall) for a couple in Norwalk, Ohio, before the birth of their son in January 2001. Made of hard curly maple and cherry heartwood, it is constructed with hand-cut dovetails and through mortise-and-tenon joints with maple wedges. The cradle can be lifted from the trestle base and rocked on the floor or locked on the uprights to offer a secure place for the infant. It has an oil and wax finish. Photo by Karen Holway

◀ Jeff Grainger

Grainger built this Honduras mahogany floor lamp (22 in. deep by 22 in. wide by 60 in. tall) in what he calls the "West Coast Arts and Crafts style." The shade design incorporates a carved California oak tree with a stained-glass backing set over undulating lines that symbolize the mountains and seas. The lamp was finished with dye stain, glaze, shellac and wax.

Charles E. Roberts ▲

This unusual jewelry chest (9½ in. deep by 16 in. wide by 9⅝ in. tall) is made of Brazilian zebrawood and Paraguayan lapacho and is accented with a 14-karat gold inlay down the front of the door cap strip. "Perhaps the most remarkable element of the design is the coopered, hyperbolic doors," said Roberts. The chest affords much storage space, with four drawers, a top tray and necklace pegs and shelves inside each door. The finish is sprayed polyurethane.

A. Scott MacFarlane ▶

MacFarlane was commissioned to build this cabinet for a couple whose daughter passed away. It is used to house artifacts, found objects and gifts that were collected both before and during her illness. Made of pommele sapele, quilted maple, ebony and ebonized mahogany, the cabinet (18 in. deep by 18 in. wide by 96 in. tall) has a slight curve to the sides as well as to the doors. The finish is hand-rubbed gel varnish and wax.

◀ Doug Chamblin

While assisting Jere Osgood last summer at the Penland School, Chamblin built this bent-laminated desk. Made of ash and narra, the desk (29 in. deep by 44 in. wide by 35 in. tall) is finished with shellac and wax. The chair, made of the same materials, features a woven Danish cord seat. The chair's design was copied from a metal folding chair that Chamblin saw on a porch. Photo by Seth Tice-Lewis

Seth Rolland

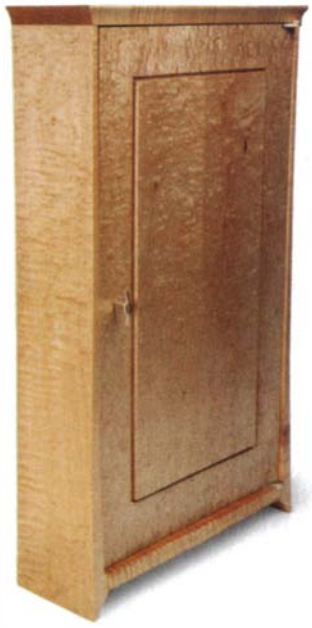
Rolland, a professional woodworker from El Prado, N.M., enjoys working with contrasting woods and tapered laminations. He decided to combine the two interests and make a huge taper-laminated top for this console table. The table (21 in. deep by 60 in. wide by 36 in. tall) is made of walnut, cherry, maple and curly maple. Rolland finished it with hand-rubbed lacquer.

Ashton Waters

This pencil-post bed (65 in. wide by 85 in. deep by 82 in. tall), dubbed by Waters as "Full Moon Rising," is constructed mostly of curly cherry. Its origins are Shaker in design, but a few added touches give the piece a cosmic feel. The 18-in.-dia. disc on the headboard is made of curly ambrosia maple, and each of the four maple finials is ringed with blue glass like the rings of Saturn. The bed's finish is natural-colored Watco oil.

Roger Heitzman

This Art Nouveau buffet (28 in. deep by 91 in. wide by 87 in. tall) was built from two pieces of highly figured mahogany. Heitzman used mostly solid-wood construction to allow for the heavily carved and sculpted curves—done with the help of a carving machine he designed and built. The lower doors and drawer fronts are veneered bent panels, and all of the bronze hardware was cast by hand. The unit was finished with hand-rubbed polyurethane.



Trevor Corp

"Furniture should not only speak about its function," said Corp, "but should also provide the audience with a desire to feel and explore its surfaces." Corp builds one-of-a-kind furniture using traditional hand tools out of his partially converted barn in Jefferson, Maine. This cabinet (5¼ in. deep by 16½ in. wide by 28¾ in. tall) is made of bird's-eye maple and has an oil finish.

Peter Buentello

Buentello got the idea for this drum table—his table project while a student at North Bennet Street School—after seeing one of Lance Patterson's original drawings of a similar table in the Sheraton style. The table (24 in. dia. by 25¾ in. tall) is made of mahogany with a crotch mahogany veneer, poplar apron bricking and rosewood feet. The finish is French-polished shellac. Photo by Lance Patterson

Tips for photographing your furniture

1. *Use 35mm color print (negative) film of moderate speed (ISO 200-400).*
2. *Clean and dust the furniture.*
3. *The furniture will appear more three-dimensional if it is lit so that each plane has a different brightness. Take care, however, to avoid excessively bright highlights or dark shadows.*
4. *To be sure the photos will be free of distortion, avoid the use of wide-angle lenses, and photograph with the camera positioned even with the center of the furniture both vertically and horizontally.*
5. *Photograph the furniture from several angles. Include some head-on shots, as well as some shots that show both the front and side of a piece.*
6. *Keep the background simple. A cluttered or otherwise distracting background may draw the viewer's attention away from the subject.*

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Rules of Thumb

BY LON SCHLEINING

Metalworking skills make you a better woodworker

Like it or not, a good woodworker has to be something of a metalworker, too. The majority of woodworking tools are, after all, made of metal. The more understanding a woodworker has about working with metal, the easier it will be to tune, adapt and even make tools, all practices common to generations of woodworkers.

As a kid my first job was working in Ole Olson's automotive machine shop, in Seal Beach, Calif. One thing I learned was to use the right tool for the job. But he also taught me that if you didn't have the right tool, you could just make or modify one.

Recently, I showed a class how to slim down a chisel on a bench grinder so that we could cut some very small dovetails—so small that even a ⅛-in. chisel was too wide. In a jiffy, being careful to keep the chisel cool, we were able to modify the tool to fit this special application.

My metalworking capability advances my woodworking by opening new ways to use, adapt and make the tooling I need for woodworking. Instead of being stuck with what is available in catalogs, it has become natural to modify hardware, tools and machines, use metal in jigs, even make tools from scratch. When I look at my collection of woodworking machines and tools, I see wrenches with one end cut off to fit into a confined space, saw tables with holes drilled and tapped for accessories, scrapers cut to fit molding contours and an assortment of odd-looking but invaluable jigs and gizmos.

The key to grinding metal is to keep it from overheating. *Use a light touch and pause often to dunk the tool in water. Aluminum-oxide wheels, usually white or pink, produce less heat than standard-grit gray Carborundum wheels. Slow-speed motors also help.*

Many woodworkers steer clear of metalworking, remembering when they turned an expensive chisel blue with a bench grinder. But there's nothing to fear about cutting, grinding, filing, drilling and tapping metal once you understand a few rules of thumb and invest in a few tools. If you are truly ambitious, you might even try making your own hardware, to make your furniture unique.

Grinding and shaping

As most of us have found out the hard way, it isn't difficult to ruin a chisel on a bench grinder. But it isn't hard to *avoid* ruining it, either. The important thing to remember when grinding any sort of metal is to keep it cool.

If the metal ever gets hot enough to change color, it will change the temper of the tool. If, however, you keep the tool cool enough to hold in your bare hand, you can grind all you like, modify the shape to suit the task or simply renew the bevel.

Here's how it works: First, use very little pressure on the grinding wheel. The abrasive will remove metal very quickly with even a light touch. Olson used to say, "Just tickle the wheel." Grind patiently, and the tool will never get too hot. Just to be on the safe side, however, I frequently swish the tool in cold water.

There are also a couple of equipment changes you can make to minimize the chance of overheating the tool. The gray Carborundum wheels that come with new grinders are too hard for fine

MAKING A CUSTOM SCRAPER FOR A COMPLEX MOLDING

Lay out the profile. *Paint the scraper stock with a permanent marker, then scribe around a cutoff of the molding. An awl will leave a sharp, precise line.*

Grind close to the line. *Set the tool rest perpendicular to the grinding wheel, and use the corner of the wheel to reach into concave areas of the profile.*

Fine-tune the profile with round and flat files. *Finish by honing the edge with stones and burnishing it (for photos of these steps, see Q&A, p. 108).*

A custom scraper makes short work of tool marks. *It would be very difficult to sand this profile, but the scraper smooths the surface and leaves crisp edges.*

Photos, except where noted: Erika Marks; this page (top): Asa Christiana

DRILLING AND TAPPING CAST IRON

Use a center punch, the right drill size and some light oil. *The hardened tip of the punch leaves a small indentation to guide the drill. Apply a lot of pressure when drilling metal, but take breaks to let the bit cool. When cutting threads, in this case to bolt a power feeder onto a tablesaw, back out the tap frequently to clear the chips.*

work, such as shaping a chisel or a contour on a scraper. A better bet is a softer aluminum-oxide wheel, usually white or pink in color. Remember, the finer the grit, the greater the friction. I run an 80-grit wheel for most grinding. A typical bench grinder turns at about 3,600 rpm. But you can get one that turns at half that speed, around 1,800 rpm. The slower speed will work almost as quickly and generate less heat.

A word to the wise: I made the mistake of using only my eyeglasses to protect my eyes from grindings, and I ruined an expensive pair of lenses in one day. Now I wear sacrificial safety glasses over my regular glasses when working metal. Obviously, wearing no eye protection at all would be a recipe for disaster.

Invest in a few metal files

With metal files you can shape, sharpen and true scraper edges. A scraper can be made to just about any contour (see the photos on p. 100). A custom scraper like this will remove tool marks from a molding without dubbing over the edges the way sandpaper does.

A single-cut metalworking file, called a mill file, is perfect to have around. Chances are the old file you have rattling around in your tool box is dull. Get a new one. Keep the new one in a place where it won't bang against other metal tools. While you're at it, either make or buy a handle for the file. It's all too common to hear about someone sticking the bare tang of the file into their hand.

Smaller files come in handy for removing rough edges, such as when tuning up a handplane. You can smooth the frog and flatten the edge of the chipbreaker and file the throat opening smooth.

Use firm pressure when drilling metal

Twist drills, which are made for metalworking, also work fine in wood, but brad-point drills don't work in metal. All you need to remember with twist drills is first to indent the center point of your intended hole with a center punch. Give the punch a solid rap with a ball-peen hammer to make an indentation in the metal. This makes a small crater so the drill won't wander as it starts.

Drilling holes in steel requires a fair amount of pressure; a drill press is your best bet. If the bit spins without cutting, heat will build up quickly and dull the bit. When in doubt, apply more pressure rather than less. Just as with wood, the larger the drill bit, the slower the speed. As the drill breaks through the other side, the bit will grab the metal part and try to spin it out of your hands. Clamp the piece before you begin, to avoid this hazard.

Drilling cast iron—Cast iron is the typical material used in tabletops for woodworking machines. If you're ever faced with mounting an aftermarket fence system on a tablesaw, you'll probably have to drill into cast iron. And there are other reasons for doing so. I must have 25 or 30 extra holes in my shaper's tabletop and at least a dozen in the top of my tablesaw for mounting accessories, such as a power feeder, in a variety of locations and bolting down jigs and guards securely.

There is no harm in drilling holes in the cast-iron tops, as long as you avoid the webbing braces cast underneath. Look at the underside to see what areas to avoid.

A drill press works well for drilling small pieces but won't work for a large cast-iron tabletop. Use a hand drill, keeping it as square as possible to the tabletop, and apply as much pressure as you can.

Some tips on tapping threads

If you have a fixture that must come on and off the table frequently, tapped holes will save you from having to reach under the table to access nuts. Threads also can be tapped in hardwoods, too, when building jigs, for example.

It's very easy to tap threads in the holes you just drilled in the tabletop. But it's important to use the correct drill size. There are charts for these sizes. Some are in-between sizes denoted by letters, not fractions. I recommend using individually packaged drill and tap sets. Three thread sizes will handle almost every situation: ¼-20, 5⁄16-13 and ⅜-13.

Use some kind of light oil to lubricate the hole and the tap; the threads will cut much more smoothly. Also, use a tap wrench. It will hold the tap securely, give you just the right amount of leverage and help you keep the tap square. To get the tap started, it takes a bit of downward force as you twist, about as much force as it took to drill the hole. Once it's started, the tap will thread itself.

As you rotate the tap, chips will build up inside the hole, and the tap will get harder and harder to turn. Back out the tap enough to clear the chips, then continue. □

Photos, this page: Asa Christiana (top); Anatole Burkin (bottom)

Q&A

Clamping around curves

I recently had to glue up several curved sections of a custom stair rail with dowels. I could not come up with an easy way to clamp the pieces together without using pocket screws. Is there a better way? ***—John C. Hare, Corner Brook, Newfoundland, Canada***

Gary Rogowski replies: For starters, dowel construction is always a bear to glue up. The little buggers can get very tight, making assembly difficult. You need strong clamps or a very large hammer. You can solve that part of your problem by cooking the dowels in a simple homemade kiln—a coffee can suspended under a light bulb will work—to shrink them just a bit so they enter their holes easier. They will swell up when the glue hits them, so move fast during assembly.

You'll still need positive clamping pressure, though, and you have several alternatives. Eyeball the mating faces and the curves and figure out exactly where the pressure should occur. Then leave a flat on your curved pieces large enough for a clamping head to fit on. Yes, you will have to remove that flat later on and do your shaping by hand, but you'll get good clamping pressure. Incorporate the flat into the piece when you are bandsawing the curve.

Another alternative is to glue blocks onto the pieces to act as your clamping spots. I use pine blocks and yellow glue. Hot-melt glue would be ideal for this application because it sets quickly and can be peeled off a surface when heat is applied. But I haven't found a hot-melt glue that holds up under clamping pressure. (The blocks need really good shear strength to survive.) Put the glue blocks on top and bottom or on both sides of your pieces. Once the glue has set on the finished piece, knock off the blocks with a chisel and clean up the surfaces with a handplane or belt sander.

Another option is to glue clamping blocks onto pieces of plywood and then clamp these jigs onto the handrail sections. Simply clamp across the blocks.

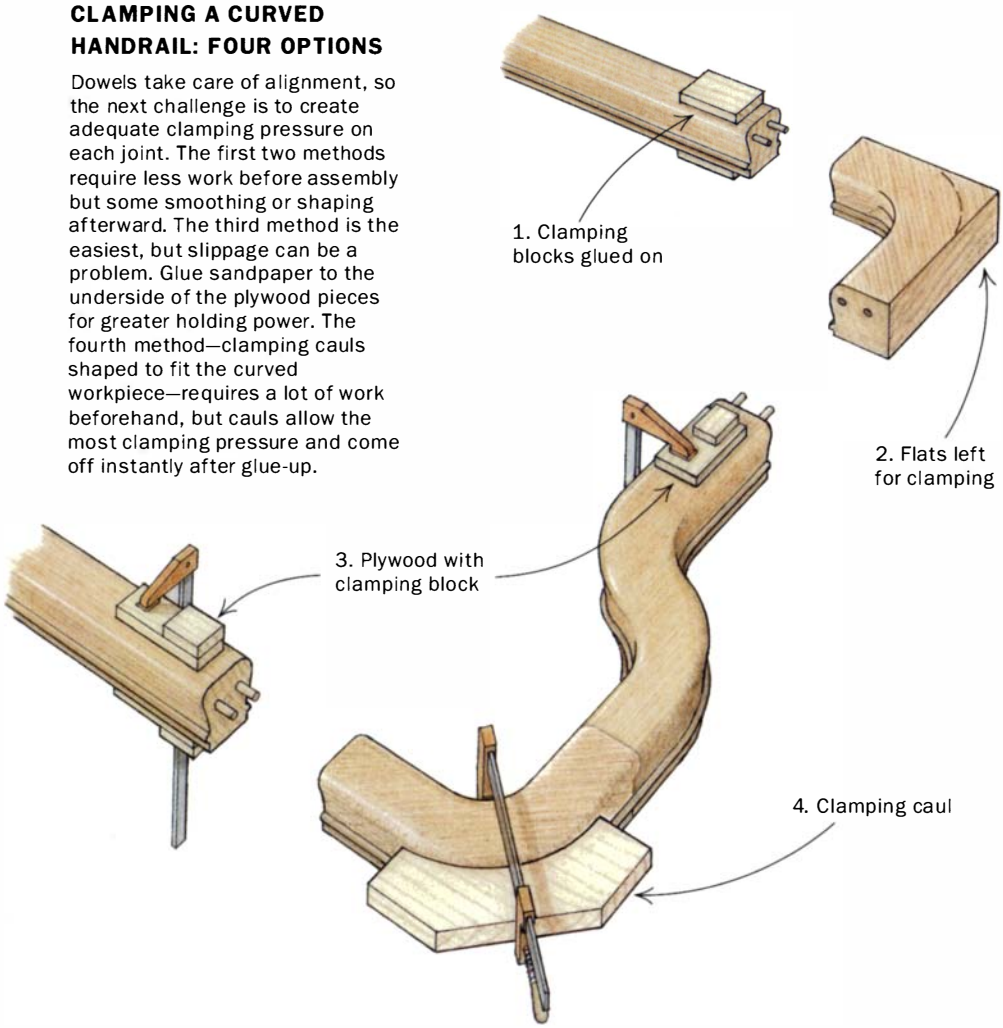
My last alternative is to make clamping cauls that fit over whatever rail shape you're stuck with. This is difficult and time-consuming but would be worthwhile if you're making more than one of the same handrail. Cut in clamping spots along the cauls for applying pressure. You can line the cauls with cardboard to prevent marring your workpieces.

Most importantly, do all of this work before you even think about putting glue on your boards. Dry-clamping will help you work out these problems before you're stuck in the middle of a glue-up with the clock ticking.

[Gary Rogowski is a contributing editor.]

CLAMPING A CURVED HANDRAIL: FOUR OPTIONS

Dowels take care of alignment, so the next challenge is to create adequate clamping pressure on each joint. The first two methods require less work before assembly but some smoothing or shaping afterward. The third method is the easiest, but slippage can be a problem. Glue sandpaper to the underside of the plywood pieces for greater holding power. The fourth method—clamping cauls shaped to fit the curved workpiece—requires a lot of work beforehand, but cauls allow the most clamping pressure and come off instantly after glue-up.



Can PVA glue fill gaps?

In "A Working Guide to Glues" (FWW #134, pp. 60-67), William Tandy Young puts "gap-filling" glues, such as Lee Valley's 202GF, in the polyvinyl acetate (PVA) glue category. But Lee Valley's catalog says this glue does not soak into the wood like normal PVA. What makes it different? Is its bond as strong as that of normal PVA glue? ***—R. Camp, via e-mail***

William Tandy Young replies: The LV202GF glue is technically a filled PVA glue. This filler is an inert additive, not an adhesive additive, meaning it doesn't make the glue stronger but just adds bulk so there will be more solids in the bond line when the glue hardens. That's why it's sold as a gap-filling glue.

However, as far as the strength of a LV202GF bond goes, if anything it might be weaker than a regular PVA glue bond. The reason why is that the more inert solids you add to a PVA glue, the lower the percentage of adhesive solids (PVA resins) you end up with in the cured bond line.

In general, LV202GF is a good-quality glue, but I wouldn't use it (or any PVA for

Drawings: Vince Babak

that matter) to fill serious gaps in joints. PVAs contain between 40% and 55% water, which evacuates as the glue dries. With the loss of the water, the glue shrinks in volume as it cures. To fill gaps with true structural strength, use an epoxy, which experiences little or no volume loss as it cures.

The claim in the Lee Valley catalog that the glue doesn't soak into the wood surface is also confusing to some woodworkers, so I'm glad to have a chance to elaborate on it here. The glue certainly does enter the wood pores, wetting the wood like any PVA glue does. What I think the Lee Valley people are trying to say is that the LV202GF squeeze-out doesn't soak into the wood surrounding a joint as deeply as regular PVA, because the LV202GF glue is thicker and has a higher surface tension. [William Tandy Young is a woodworker and adhesive consultant in Stow, Mass.]

Sharpening curved scrapers

Phil Lowe describes the process of sharpening straight-edged scrapers in great detail (FWW #147, pp. 94, 96) but fails to mention how he sharpens curved-edge scrapers. Could he explain it?

—John Kriegshauser, Chicago, Ill.

Phil Lowe replies: A curved scraper is sharpened in much the same way as a flat scraper is (see the photos at right). It takes a couple of tools to handle the concave areas: a round or a half-round mill file and a cone-shaped slip stone.

The convex edges are filed and honed with a flat file and stone, just like a straight-edged scraper. Use the same draw-filing technique, with the file square to the edge but skewed at an angle to the direction of the stroke. The trick is to make your stroke follow the curve. To hone the convex areas, hold the scraper upright and drag it across the stone while rolling it to follow the curve.

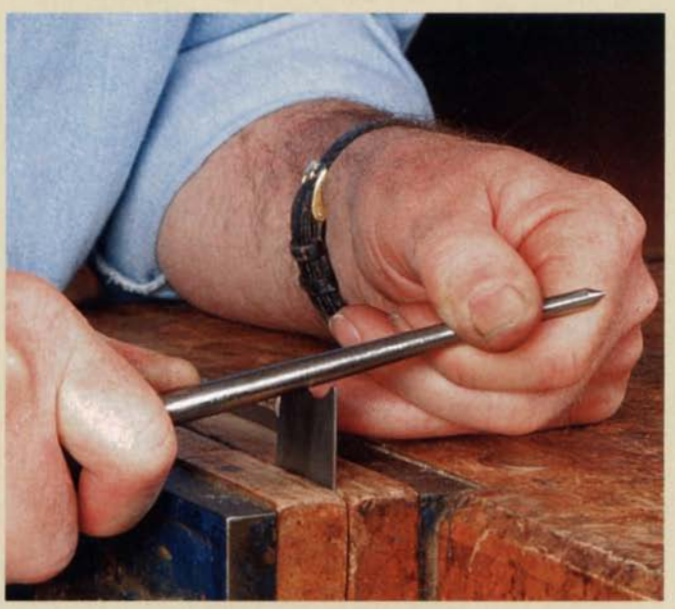
To joint the concave areas, I use a round or half-round file, but the draw-filing technique is the same. Then I use the cone-shaped slip stone to hone these areas. The goal is the same with all scrapers: to get a square edge, free of file marks, before burnishing.

There's nothing different about the burnishing of a curved scraper. A

DIFFERENT PROFILE, SAME PRINCIPLES

1. JOINT THE EDGE *Keep the file level and follow the curve. Use a round file for the concave areas (left), and a flat mill file for the convex areas (right). Make your strokes diagonal—moving across the edge and along it at the same time.*

2. HONE THE EDGE *Again, keep the stone square to the scraper. A rounded stone is necessary for the concave areas (left). Use a standard waterstone for the other curves, holding the scraper instead of the stone (right).*



3. CREATE A FINE BURR *Concave, convex or straight, burnishing is the same. Use a standard burnishing rod and follow the scraper profile. Just as with straight edges, start the burnishing rod level, then tilt it a bit for each subsequent stroke, ending at about 10° off level.*

Photos: Asa Christiana

standard round or triangular burnishing rod will follow almost any contour, and the idea of turning over the edge to create a fine burr is the same. Start the burnisher nearly level for the first stroke, then bring it down to about 10° off level in subsequent strokes. If the burr, or hook, gets bent over too far, it can be straightened with the point of the burnisher, as described in the article. [Phil Lowe makes and restores period furniture in Beverly, Mass.]

Is 19th-century old-growth lumber better than today's?

I was at a gun shop and heard a guy talking about how a fancy walnut stock he was selling was 160 years old. He said there is no wood like that anymore. I just don't buy that argument. The same genetic code is in our trees today. Who is right? ***—Tony Harkin, Omaha, Neb.***

Jon Arno replies: You are. Anatomically speaking, there is no difference between timber harvested in the 19th century and old-growth timber harvested today, if you can find it.

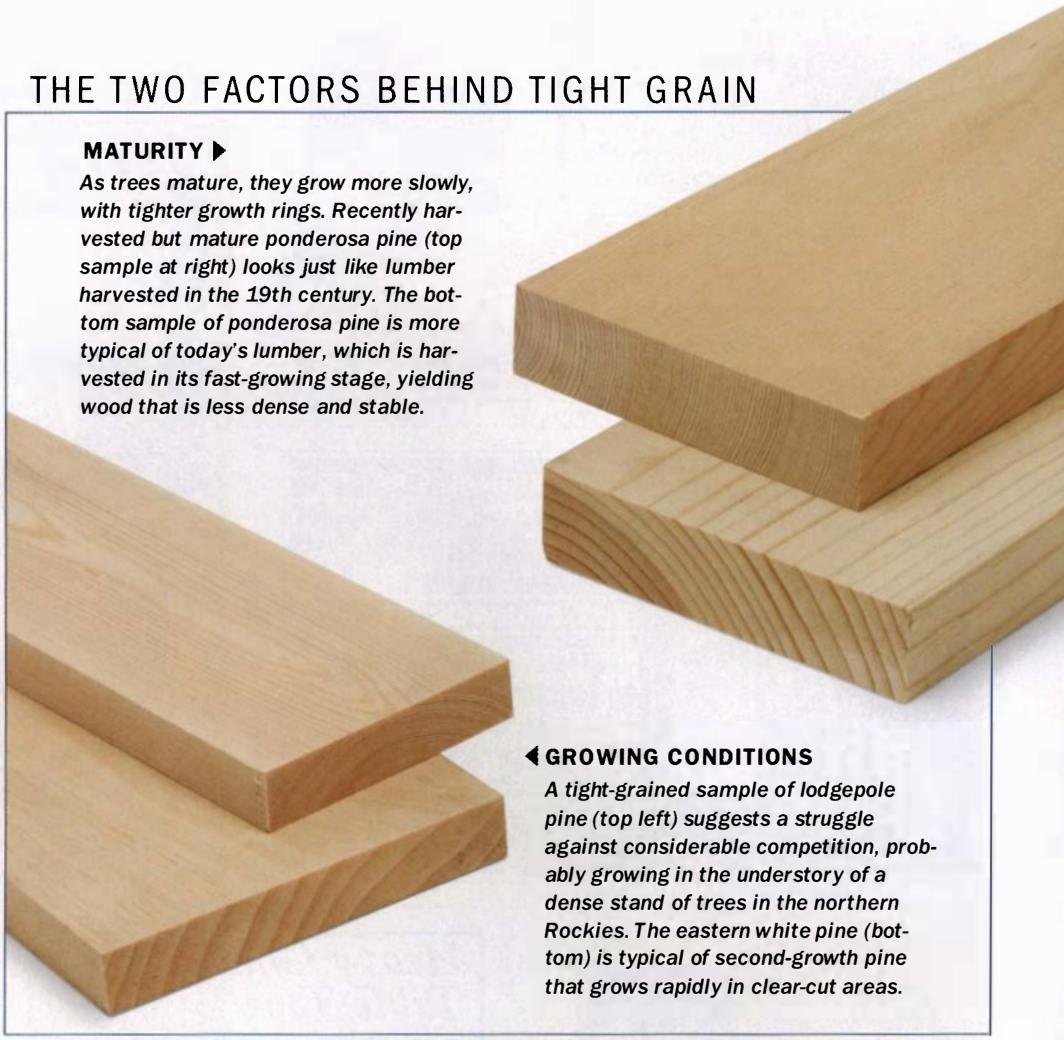
Provided that the trees experienced comparable growing conditions, their virtually identical genetic programming would produce the same results. Of course, a tree that grew slowly in a dense, mature 19th-century forest will be much different than a second-growth tree that shot up in a modern clear-cut tract with much less competition for sunlight. Most lumber today has wider-spaced annual rings, and depending upon the species, this affects both the wood's average density and its strength properties.

The other primary reason for the wider-spaced growth rings in most of today's lumber is that our current supply is coming primarily from trees that haven't been allowed to attain full maturity. As trees mature, their rate of growth slows and the annual rings become closer.

For most cabinetmaking purposes, old-growth stock has darker color, more consistent and predictable working characteristics and a more subtle, complicated figure. On the other hand, second-growth stock is superior in some applications. For example, second-growth ash makes stronger and more resilient baseball bats and tool handles. Also, fast-growing trees are desirable in some species when the softer or lighter colored sapwood represents the preferred material. This is typically the case with basswood and even some cabinet woods selected for their blond color, such as maple and birch.

It is true that as lumber ages it undergoes subtle changes in surface character. Also, over time, seasonal cycles of humidity tend to relax internal stresses. But given comparable aging, recently harvested old-growth timber will eventually become identical to old-growth lumber harvested 160 years ago. [Jon Arno is a wood technologist and wood consultant in Troy, Mich.]

THE TWO FACTORS BEHIND TIGHT GRAIN



MATURITY ▶

As trees mature, they grow more slowly, with tighter growth rings. Recently harvested but mature ponderosa pine (top sample at right) looks just like lumber harvested in the 19th century. The bottom sample of ponderosa pine is more typical of today's lumber, which is harvested in its fast-growing stage, yielding wood that is less dense and stable.

◀ GROWING CONDITIONS

A tight-grained sample of lodgepole pine (top left) suggests a struggle against considerable competition, probably growing in the understory of a dense stand of trees in the northern Rockies. The eastern white pine (bottom) is typical of second-growth pine that grows rapidly in clear-cut areas.

"Just-planed look" with thicker topcoat?

I really enjoyed Jeff Jewitt's article on a minimal finish for maple to get that "just-planed look" (FWW #147, pp. 125, 126). Jewitt burnishes the wood with Abralon buffing pads and then applies two thin coats of shellac or lacquer. Would it be possible to use the same burnishing techniques that sharpen the grain and figure image, but then put on a thicker topcoat? I'm afraid that with a thicker finish, such as on an instrument, there may be adhesion problems because of the burnishing. Also, can I add an aniline dye to the process?

—Joe Monti, Berwyn, Ill.

Jeff Jewitt replies: As long as you wipe on the first coat, I don't see any adhesion issues. However, by laying on a thicker film of finish, you may lose some of the surface quality that you get with the technique described in the article.

Dyes are fine, but pigment-based stains would definitely be a no-no with regard to adhesion. Put the dye on twice, meaning: use the first dyeing to raise the grain before your second-to-last sanding grit, then sand, dye again and sand at the final grit before the first finish coat.

You'll have to make some side-by-side

samples to see if the extra effort for burnish-buffing the bare wood is worth it beneath a thicker topcoat. However, I will say that meticulous sanding is very important to a quality finish.
[Jeff Jewitt is the author of *Great Wood Finishes* (The Taunton Press, 2000).]

Maintaining fine finishes

What's the best way to care for fine furniture?

—Rob Walker, Nottingham, England

Chris A. Minick replies: There are as many recommended furniture-care procedures as there are manufacturers of furniture-care products. Actually, it doesn't matter which product you choose or which procedure you follow, as long as you understand what you are trying to accomplish.

Think of it in the following way. When you touch a piece of fine furniture, you are not touching the wood; you are touching the finish. And the function of any finish is to enhance the beauty of the underlying wood and to protect the piece of furniture from the ravages of everyday life. So the object of furniture care is to maintain the finish. The finish will take care of the furniture.

Furniture finishes can be divided into two broad classes: film-forming finishes and non-film-forming finishes. This distinction is important, because different care procedures are required by each.

Film-forming finishes, as the name implies, form a film much like kitchen plastic wrap over the entire piece of furniture. Most furniture-care products will remove the accumulated dirt and grime, but, more importantly, leave behind a low-friction coating on the film finish. This slick coating preserves the integrity of the film by deflecting direct blows that would abrade the finish. As long as the finish film is completely intact, with no cracks or deep scratches, it matters little whether you choose an aerosol product containing silicone or a traditional paste wax for furniture. Both work equally well, and neither harms the finish or furniture. However, if the finish surface is scratched, cracked or chipped, use only paste wax. Aerosol silicone products may seep through the finish cracks and cause future refinishing problems.

By the way, lemon oil is really mineral oil with an added lemon scent. It's okay for cutting boards but probably not the best choice for furniture.

Non-film-forming finishes, such as linseed oil, have no film to protect the wood, so both aerosol silicone products and paste wax should be avoided. Simply remove surface dust and smudges with a dry or slightly water-dampened rag. Periodic oiling, once a year or so, will maintain the appearance of the piece.
[Chris A. Minick is a consulting editor.]

Do you have a question you'd like us to consider for the column? Send it to Q&A, Fine Woodworking, P.O. Box 5506, Newtown, CT 06470-5506 or e-mail it to fwqa@taunton.com.

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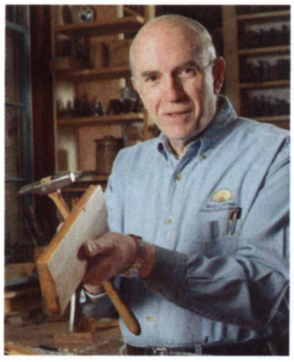


BY EUGENE LANDON

Gadrooning, carved embellishment along the edges of aprons and rails of chairs and tables, was not widely used by American furniture makers until the so-called rococo style developed in the mid-18th century. Prior to that time, furniture makers decorated edges with scrollwork (often in a scalloped shape), applied molding, cutouts and various bowsaw expressions.

By the third quarter of the 18th century, gadrooning flourished, adorning sofas, chairs—such as those Thomas Affleck made for John Penn, now in the Department of State Collection—as well as desks, bureaus, tables and other pieces, from Boston to Charleston.

Examples of gadrooning may be found in a lot of places, especially books such as Thomas Chippendale's *The Gentleman and Cabinet Maker's Director* (Dover, 1966). Another good research tool is *Antiques* magazine. And you can also find examples of gadrooning at major museums, such as the Philadelphia Museum of Art; the Metropolitan Museum of Art; Colonial Williamsburg; the Henry Francis DuPont Winterthur Museum in Winterthur, Del.; the Department of State Collection in Washington, D.C.; the Charleston Museum; the Chipstone Foundation; and the Boston Museum of Fine Arts. I'm sure that I've missed some great examples, but I haven't stopped looking.

Begin with a pattern

Whether you use drawings, photographs or experiment with your own design, the first step in gadrooning is to lay out the pattern. The shapes may vary from stiff and boxlike to sensuous and flowing.

The parts can be broken up into distinct elements. The size of each element is more or less dependent on the piece of furniture. For example, a chair skirt would have a more diminutive carving than, say, a New York chest-on-chest. I have seen the width of each carved element ranging from ⅜ in. to ¾ in. In general, though, if you make each element about ½ in. wide, give or take 1/16 in., you will be happy with the results.

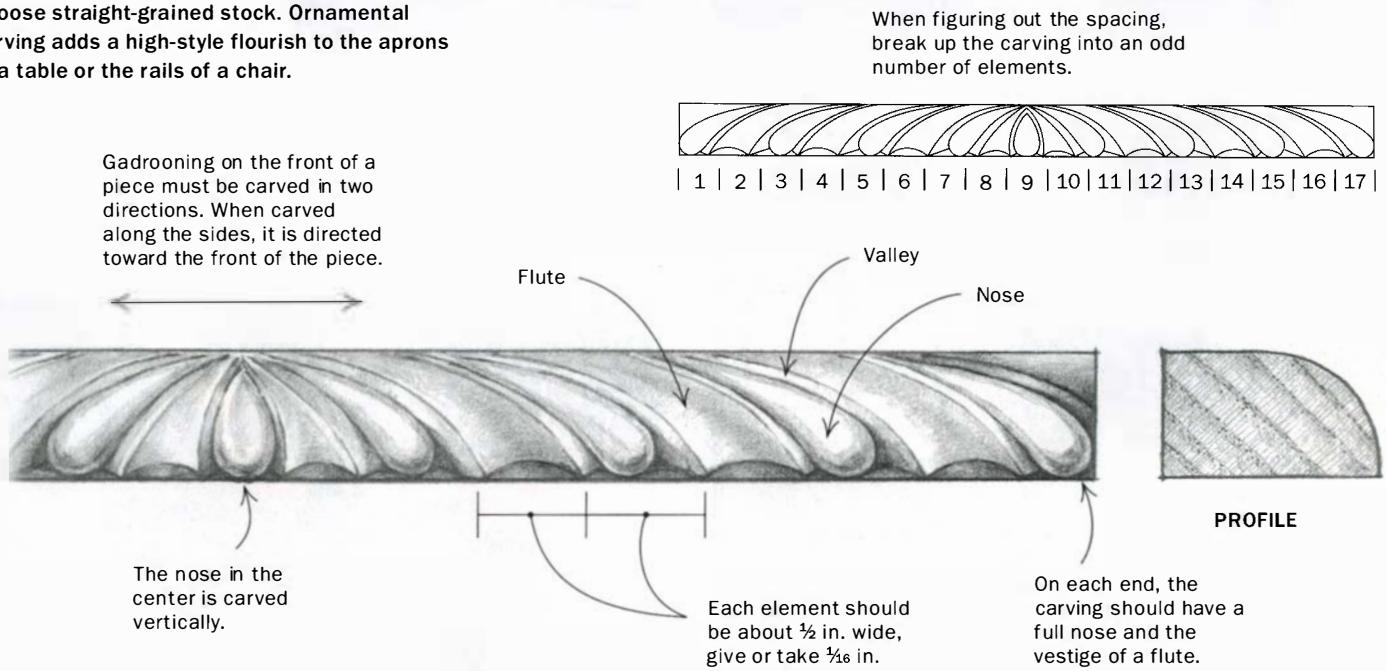
Begin by dividing the length required for the gadrooning elements into an odd

A typical example of gadrooning. *The pattern, which is carved separately and then applied to the apron, reverses direction in the center.*

Photo, this page (bottom): Michael Pekovich

A SIMPLE PATTERN CREATES AN ELEGANT EFFECT

Choose straight-grained stock. Ornamental carving adds a high-style flourish to the aprons of a table or the rails of a chair.



number of parts (see the drawings above). For example, a nose and the valleys to each side of it may be considered a single unit; the flute is another unit or element. I use a set of dividers to figure out the sizing, adjusting them as necessary until I end up with an odd number of elements with the correct proportions. You don't have to get overly fussy here, because you can fudge at the carving stage and make everything come out right.

On the front corners of a square apron, the flute may blend with another from the side, or it may flow into a separate carving of a full nose on the turret leg (see the bottom photo on p. 120).

Once you have the approximate width of the divisions, draw the basic shape onto a piece of mylar, then cut out sections to create a tracing template.

The carving shown in the photos is modeled after a piece owned by the Philadelphia Museum, and the shapes are a series of hollows and rounds. The edges are rounded over to form noses, and the carving continues around the edge and just into the back side.

Gadrooning often has a shape or flow that is directional. For example, on the table shown, the carvings on the side aprons flow out toward the front edges. The front apron, however, is divided in half (with a vertical nose at center) to cre-

ROUND OVER THE EDGE AND LAY OUT THE PATTERN

Scribe the carving stock ½ in. from the edge. *Use straight-grained wood about ½ in. thick.*

Radius the edge of the stock to the scribe line. *Most of the carving is done along this radiused edge.*

A template made of thin plastic or cardboard simplifies layout. *The carving along each apron should begin and end with the same element.*

Drawings: Erika Marks

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NS150A
18 Gauge
1/4" Crown Stapler
Length: 1/2" – 1 1/2"
Bottom Fire

READER SERVICE NO. 222

THE CARVING PROCESS

1. Establish the base of the nose. *Press a gouge firmly into the stock, and complete this step along the entire carving before continuing to the next phase.*

2. Cut the valleys of the nose with a gouge whose radius conforms to the arc. *Make a long sweeping motion with the tool, which will give you a clean cut.*

3. Pare away at the valley with a chisel. *Note how the left hand is kept close to the cutting edge for a controlled cut.*

4. Round the nose with a gouge. *Work this section to completion.*

5. Relieve the nose at its base. *This is a very distinct detail. Take your time to make it right.*

6. Work the fluted section at the top. *Approach the base carefully, but don't plunge through.*

7. Notch the wall of the flute at its base. *This will prevent blowout for the next step.*

8. Work the flutes from both directions to completion. *Files and brass brushes may be used to touch up the carving.*

ate a nice visual balance. At the center section, the carving is more or less vertical. The carving to the right of center flows down and toward the right; the carving to the left of center flows toward the left. Be sure to take these considerations into account when laying out the design.

Choose straight-grained stock

Gadrooning is typically carved first, then attached. Begin by selecting a piece of straight-grained stock, wide enough to clamp easily in a vise for carving. Plane it to thickness, then round over one edge. Use the template to lay out the carving.

As one carves, it is possible to get slightly off the pattern. It's fair game to increase or decrease the size of the divisions slightly to get back on track. Slight variations are fine and won't even be noticed. But I have seen such adjustments carried to the extreme on older pieces.

Turret-top table with gadrooning. *The author modeled this piece after an original at the Philadelphia Museum.*

One thing I find helpful when carving is to proceed in logical steps. Do one element throughout the entire length before moving on to another. Make adjustments as necessary to keep the divisions close to equal. And when making adjustments, spread them out to help disguise variations. Owning a good selection of carving tools will make it easier to pick the right size tool to fit the pattern.

Once the carving is complete, rip off the gadrooned section and fasten it in place. The 18th-century furniture maker used rose-head nails. □

Photos, except where noted: Anatole Burkin

WOODWORKER'S MART

See ad index on page **128** for reader service number.

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BY ANDY CHARRON

Rubbing out water-based finishes

I'm a fan of water-based finishes, but I know many fellow woodworkers who are a good deal less enthusiastic about them. We all appreciate the safety factors associated with water-based finishes, including a low level of volatile compounds, the minimal risk of an explosion when spraying them and the easy cleanup with soap and water. However, many woodworkers find these virtues outweighed by the difficulty in obtaining an appearance that matches that of solvent-based finishes.

Many problems with water-based finishes stem from the final rubbing-out process. If you use the same methods as you do for a solvent-based finish, you may run into a few problems. If you follow the methods I describe here, you will achieve a satin or a gloss finish you can be proud of.

Applying and drying the last coat

How you apply the final coat will determine your workload when rubbing out the finish. I like to apply a slightly thicker last coat to lessen the chances of rubbing through and creating witness rings. If I am spraying a vertical surface, I apply a relatively thin coat, wait a few minutes and then spray another thin coat. The two coats bond together to form one thick film that will dry properly.

Before rubbing out the final coat, you must be sure the finish is not only dry to the touch but also fully cured. The longer you wait, the better: I wait a minimum of two to three days before doing any rubbing out, but when I want a highly polished gloss finish, I wait at least a week and sometimes even longer.

A fully cured finish should be easy to sand and will create a fine white powder almost immediately. On a finish that has not fully cured, the surface will begin to streak and may become gummy. If the paper clogs up with little bits of finish or the surface appears to be streaking, let the finish cure for a few more days, then rub out the areas that are streaked. If you've damaged the final coat, you have to scuff the entire surface and apply another topcoat.

Achieving a satin finish

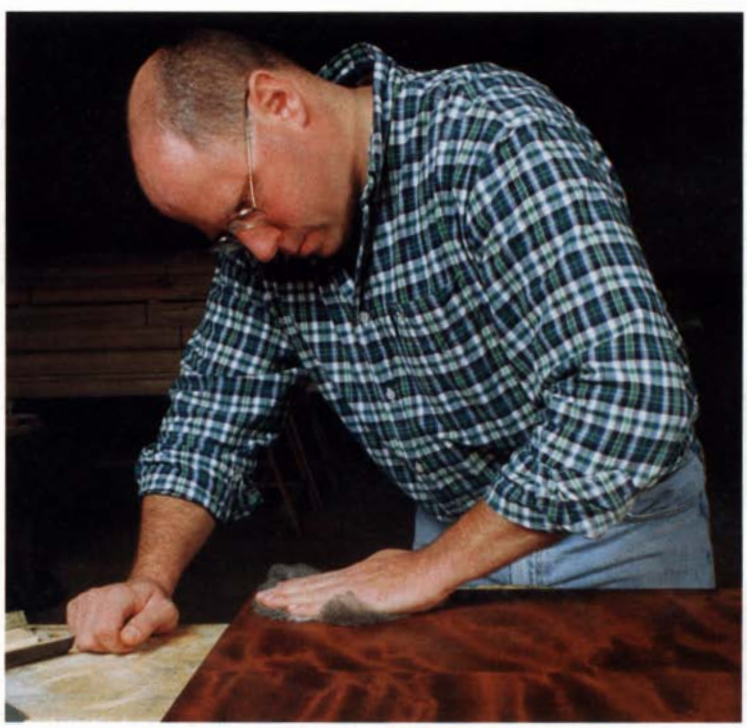
If you have a reasonably blemish-free topcoat, you can achieve a satin finish just by using steel wool (see the photos and drawings below). If there are irregularities that steel wool cannot remove, try progressively coarser-grit paper, starting with 1,000-grit wet-or-dry paper. If you have to go below 600 grit, you will create scratches that steel wool cannot remove, necessitating going back up the grit ladder prior to using the steel wool.

You may have read that you should not use steel wool when working with water-based finishes, because small particles can become lodged in the finish and eventually turn black. This is true if you use the steel wool *between* coats of finish. As long as the final coat is fully cured, the steel wool won't cause any problems. Although you don't have to use any liquids or pastes when rubbing with steel wool, on large surfaces a lubricant makes the work easier. I use water with a small drop of soap added.

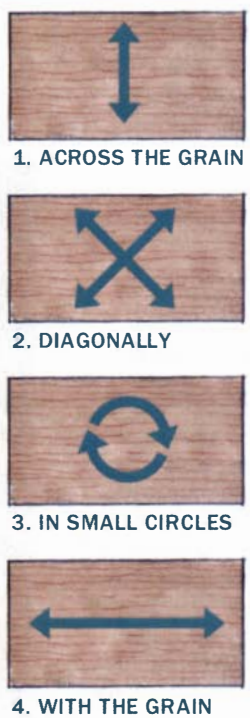
After unrolling and refolding the pad of steel wool, start by working perpendicular to the grain; don't be afraid to use a bit of

STEEL WOOL FOR A SATIN LUSTER

Make a steel-wool pad. *When rubbing out large surfaces, steel wool is more effective if you unroll the pad, then fold it into a larger and looser pad to fit under your whole hand.*



Rub in all directions. *Work perpendicular to the grain, then at a 45° angle in both directions, then in small circles and, finally, with the grain. The surface will change from a dull, matte appearance to one of a uniform low luster.*



Drawings: Michael Pekovich

THREE STEPS TO A GLOSS SHEEN

Leveling the surface. *A mirror finish requires a dead-flat surface. Using wet-or-dry paper, follow the same directions as when using the steel wool in the satin finish.*

Rubbing powder. *Next, sprinkle pumice on the surface, splash on some water, then bear down and rub it in a circular motion with a damp cloth. Repeat the procedure using rottenstone.*

The third step. *The secret to a wet-look gloss is to sprinkle some rottenstone on a previously cleaned surface, then with a pad very slightly dampened, power-buff the surface. Keep the pad moving lightly over the surface at all times.*

muscle. Next, work at a 45° angle across the piece in both directions. Then make another pass over the piece using small circular motions. Finally, finish off the surface by taking long strokes with the grain. Steel wool will at first dull the finish, and the first set of scratches should be very visible. As you progress through the various stages of buffing in each direction, the scratches will become less visible. When you make the final pass in the direction of the grain, the scratches should virtually disappear, leaving a finish that's very smooth to the touch and with a deep, warm glow.

Achieving a gloss finish

Compared to solvent-based lacquers, rubbing out a water-based product to a gloss sheen takes more work (see the photos at left). A lot of water-based finishes, prior to being rubbed out, are slightly duller than comparable solvent-based products. Most of the better-quality water-based products today are very tough and scratch resistant, which makes creating a fine, even scratch pattern more laborious.

To achieve a mirror finish, the surface must first be perfectly flat. Sand the surface until it is smooth and contains no large scratches. What grit you start with will depend on how smooth the final coat is. On a sprayed surface I usually start with either 400- or 600-grit paper and, using a backing block, progress through 800, 1,000, 1,200 and 1,500 grit. In comparison, on a solvent-based finish, I stop at 800-grit paper. On a surface brushed with water-based finish, I may start with 320-grit paper, and in extreme cases, I have even resorted to using 240-grit paper. Just be careful not to cut through the finish, especially on sharp corners and edges.

With the first grit, sand using the same patterns for rubbing out with steel wool. Once the high and low spots have been evened out (the surface should be uniformly dull with no shiny spots), move to the next grit. At this point you should only need to sand with the grain, with each grit removing the scratches left by the previous sandpaper. By the time you reach the 1,500-grit paper, the scratch pattern should be very fine and uniform, and the surface will begin to take on a noticeable shine.

Now you are ready to finish the polishing process with pumice and then rottenstone. Using water as a lubricant and a clean, damp cloth, work first in a circular pattern, then finish by making long strokes with the grain. If you did a good job of sanding, you may be able to skip the pumice and go right to the rottenstone. But if you want a really shiny, wet look to the finish, I find it quicker and easier to use the pumice first.

Although you could use premixed rubbing pastes, I generally try to avoid them when working with water-based finishes. Some of the premixed pastes contain solvents (i.e., mineral spirits) that can soften certain water-based products, making them extremely difficult to rub to a gloss finish. However, there are a few new brands that will work with water-based finishes. If you are not sure about the paste you want to use, try it on a sample piece or in an inconspicuous area first.

Finally, I often polish the finish with dry rottenstone and a slightly damp, soft pad. On larger surfaces use a power buffer to make the work easier. You must use a light touch and keep the pad moving across the surface evenly and quickly. If you press too hard or linger in one spot, the buffer will generate enough heat to soften and dull the finish. □

Photos: Mark Schofield

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A Good Showing

For woodworkers, looking at beautiful examples of hand-crafted furniture is the next-best thing to spending time in the shop, working on projects. The Design in Wood competition in San Diego is a feast for the woodworker's eye. It is arguably the single best annual display of the craft. More than 350 amateurs and professionals compete side-by-side for ribbons and prizes in about 20 categories, but few entries would be out of place on the back cover of *Fine Woodworking*. Among the 2001 winners, clockwise from upper left: Paul Schurch's "Spinning Cabinet"; Sean Palmer's jewelry box; James Bowie's "Oyster Chest"; James Leary's "Pierced Bottle"; and Randall Miller's hall table. For a look at the Best of Show winner, James Betts' reproduction of a Goddard-Townsend secretary, see Current Work (p. 92). To see more of the winners, visit www.finewoodworking.com.

Photos: Lynn Rybarczyk and Ed Suszynski, courtesy of San Diego Fine Woodworkers Association