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Fine WoodWorking

Three smart ways to store clamps

August 2003
No. 164

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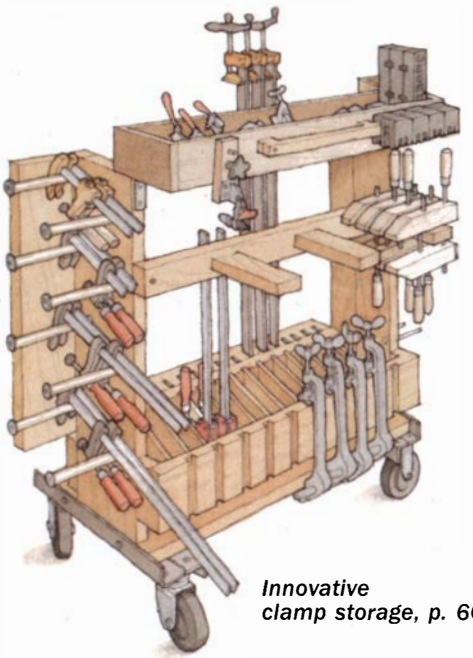
Departments

Desk designed for today's home office, p. 42



Innovative clamp storage, p. 60

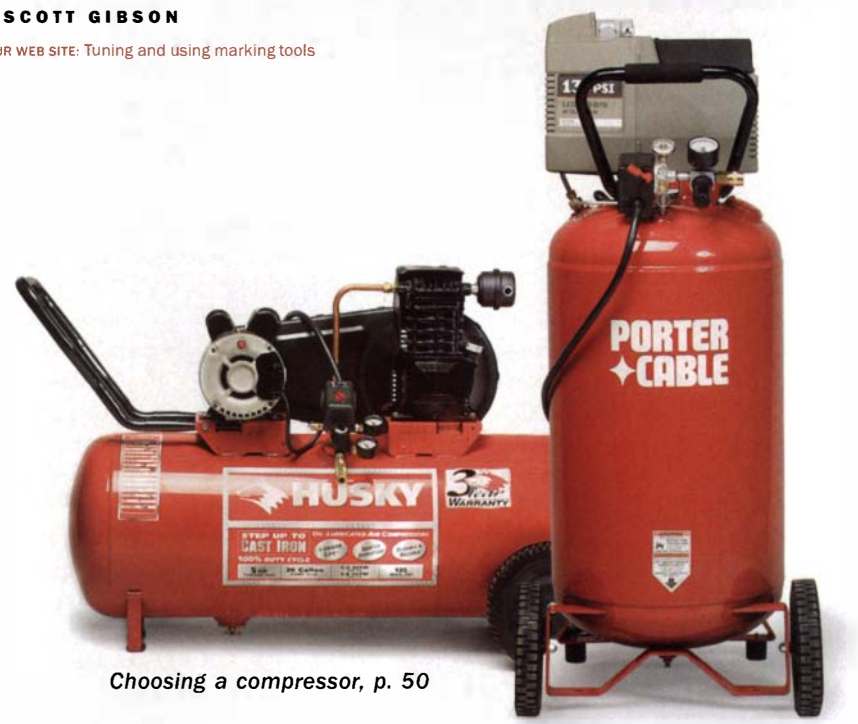
User's guide to block planes, p. 68

On the Cover:
Marking gauges are a woodworker's best friend when it comes to laying out joinery. We take a close look at a variety of marking tools.
See p. 80
Photo: Rodney Diaz

JULY/AUGUST 2003 NO.164

Articles

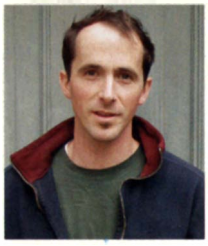
Antique finish for mahogany, p. 36



Choosing a compressor, p. 50

Contributors

Paul Schürch ("Decorative Veneering") operates a custom-woodworking shop specializing in marquetry in Santa Barbara, Calif. When he was 15, he went to Switzerland, apprenticing to become a church-organ builder. With this knowledge, Schürch went on to learn about boat-building in the United Kingdom and marquetry in Italy, ending up back in California as a furniture maker and teacher. Until 1995, he traveled once a year to northern Italy to work in a small shop doing production marquetry for the furniture trade, working side by side with some of the finest craftsmen in the world. These days, Schürch, a father of three, also finds the time to teach classes at Marc Adams School of Woodworking and The Woodworking Shows. To see pictures of his work and to get information on his books, videos and classes, go to www.schurchwoodwork.com.



Leonard Bechler ("Breaking with Convention") was first exposed to woodworking while attending the Rochester Institute of Technology, where he earned a degree in photography. After six years working in California as a carpenter, Bechler needed a break from the long hours of the trade, so he and his wife hiked the Appalachian Trail. He returned with a rejuvenated spirit and signed up to attend the College of the Redwoods in 2001. These days, he spends most of his time "dancing in his living room, waiting for his newborn daughter to burp."

As much as **Charles Durfee** ("Build a Computer Desk") uses and appreciates computers, he generally has his head firmly stuck in the past. Hand tools, hand methods and a traditional workbench form the heart of his shop. Designs grounded in tradition form the body of his work. Thirty years ago, he says, his romanticized visions of woodworking consisted of a cozy shop with a rocking chair and a few hand tools. Now a good deal of his Maine shop is taken up with machinery, though he often thinks of them as "apprentices," because they do what helpers would have done in earlier times. And after many years of heating the shop with wood, Durfee now backs up the woodstove with a gas heater. The romantic past has merged with the realistic present.

Jeff Jewitt ("Finishing Mahogany") sells finishing supplies and restores furniture from his shop in Cleveland, Ohio. He contributes finishing articles regularly to *Fine Woodworking* and other magazines, and he also teaches courses and gives seminars on finishing-related topics. Jewitt is the author of two Taunton Press books on finishing—*Great Wood Finishes* and *Hand-Applied Finishes*—and is working on a third.

Chris Gochnour ("User's Guide to Block Planes") discovered the pleasure of building things by hand when he made his own skateboards and snowboards as a teenager. His zeal for carving turns on a board eventually was replaced by a passion for woodworking. He has spent the last 15 years building custom furniture in his shop in Salt Lake City and teaching woodworking around the country. Along the way, Gochnour developed a fascination for traditional woodworking techniques and tools and now spends early mornings and weekends in his "unplugged workshop" rediscovering old ways of working wood. When he's not in the woodshop or searching for old tools, Gochnour enjoys throwing baseballs, shooting hoops and kicking soccer balls with his children, Rosie and Theo.

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Letters

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

Dust and finishing—I would like to offer a few comments pertaining to Jerry Terhark's Finish Line "Removing surface dust" (*FWW* #159, pp. 129-130).

I used to paint cars in an environment that, from a dust standpoint, was similar to many subscribers' woodworking shops. Since I frequently used enamels that could not be buffed out, I had to learn to control the dust so I could put out a quality product. I have used these same techniques quite successfully to minimize dust on wood finishes.

A clean work area is a must. Clean the shop and vacuum the floor before you finish a piece, ideally one day before. I usually put a dust-free drop cloth or a piece of clean newspaper under my workpiece to keep down the dust around the piece.

Terhark's description of the proper use of a tack cloth was very good. One point that I would like to add is to wipe down your project twice with the tack cloth. I usually do it once before getting my finishes ready and then once just before I am ready to apply the finishes. To reduce the likelihood of the tack-cloth resin sticking to the workpiece, I rub a little fine dust onto the cloth before I use it.

If you're going to use compressed air to clean the workpiece, here are a few cautions. Air compressors have a potential problem of moisture in the compressed air. In humid and damp environments, this can become a significant problem. As a rule of thumb, I try to avoid doing anything to introduce moisture to the wood before putting on a finish.

I always wait a while after blowing off the workpiece to allow the dust to settle. Remember to dust yourself, too. I usually walk outside and use the blowgun to blow the dust off my clothes and off myself before finishing the piece.

A good-quality shop vacuum with a stiff bristled upholstery brush works great to clean out the grain; just don't use that brush for anything other than prefinish preparation—you don't want any type of dirt on it at all. Also, I suggest upgrading your shop-vacuum filter. The coarse filters that come with many machines will expel fine dust out the exhaust port and back into the shop air.

Terhark also makes a good point about not letting the oils on your hands contact the workpiece. I have found that it is easier to feel areas that might be rough and need attention than it is to see them. I simply wash my hands thoroughly with a good grease-cutting dish detergent and dry them thoroughly before running my hands over the wood. Don't use bar soaps; they tend to leave residue. If your hands are callused, you can use the backs of your hands to feel for problem areas.

—Dan Payne, Canyon Country, Calif.

Shop-vacuum shock and awe—I was amazed and disappointed with Roland Johnson's "Shop Vacuums" article (*FWW* #163, pp. 80-85). It dwelled on the superficial while intentionally ignoring the two items that matter: negative pressure developed (vacuum) and cubic feet per minute (cfm).

When selecting this device, these measurements are the required comparison and are rarely supplied by the manufacturers. Initially, in seeing that you had published this article, I believed that *FWW* would have bridged the gap and delineated this data.

—Bruce B. Bonner Jr., Westford, Mass.

In regard to Roland Johnson's article "Shop Vacuums," it was refreshing to see a focus on something other than raw horsepower or how many inches of water a vac could suck up. I expect any vac I might buy would be able to suck up wood. Johnson's article mentioned the most important thing about any vac: It won't work with a clogged filter!

His focus on filter placement, tank capacity, hose diameter and variable-speed motors hit all the high points for a

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Fine WoodWorking .... around the country

July 31-Aug. 3: If you plan on attending the Association of Woodworking and Furnishings Suppliers (AWFS) Fair at the Anaheim, Calif., Convention Center this summer, come by and see us at booth No. 520. The *Fine Woodworking* crew will be on hand for the duration of the show. Our special guest this year will be author Will Neptune, who will discuss the construction techniques involved in making a chest of drawers (*FWW* #163, pp. 36-43). Also, we'll have a daily raffle to win a rare Tool Chest Legacy poster featuring the H.O. Studley tool chest. For those of you who can't make the show, log on to our web site, www.finewoodworking.com, in late July for a chance to win a poster.

woodworker with an engineering background buying a shop vac.

The chart was helpful, too, as seeing all the info comparatively saves time and effort on my part when making the decision to invest in a new, quieter shop vacuum.

–Richard M. Santina, San Jose, Calif.

More than a push block—Thank you for the tool review on the GRR-Ripper System (*FWW* #163, p. 31). However, the title "Grr-andiose push block" and Dennis Preston's opinion seem to indicate that he did not carefully peruse the accompanying instruction manual. The vast capabilities of the GRR-Ripper System were never mentioned; moreover, the GRR-Ripper was erroneously configured for the review, and the observations put forth are based on an incorrect assumption that the GRR-Ripper System is just another push block.

The GRR-Ripper System is a totally different approach to tablesaw and router accuracy and safety. It requires a paradigm shift in one's thinking in order to take full advantage of what it has to offer.

Based on Preston's opinion and the accompanying photos, I question even his basic understanding of this tool: its concept, setup, configurations and functionality. And most important, I question if Preston understands how to use it correctly. The GRR-Ripper also serves as a blade guard that the user holds rather than a blade guard that is affixed to the back of the tablesaw, or one that hovers above it.

There are a few hundred posts among many woodworking forums on the Internet where owners of the GRR-Ripper System expressed their comments after extensive use. Also, many woodworking instructors and school systems now use the GRR-Ripper System in their classrooms.

The right part for the job. *When the outside edge of the GRR-Ripper overhangs a workpiece, an L-shaped piece, called a balance support, prevents the tool from tipping. In the last issue, we mistakenly showed the tool supported by an adjustable spacer.*

I encourage you to take a closer look at the GRR-Ripper System to witness that it is, indeed, more than just a "grr-andiose push block."

–Henry Wang, president, Micro Jig Inc.

EDITOR REPLIES: The suggested assembly, shown in the photo (above), shows the GRR-Ripper System with the balance support on the outside edge of the device. The text of our review does mention the balance support (we described it as an "L-shaped plate") and its function. The photo that ran with the review, however, shows the tool in an atypical configuration. In that photo, the tool is supported by the the adjustable spacer, which has a smaller footprint than the balance support. The adjustable spacer also is available only on the higher-priced version of the tool.

Dueling professionals—On p. 40 of Will Neptune's article "Anatomy of a Chest of Drawers" (*FWW* #163, pp. 36-43), there is a photo caption that reads "Elongated screw holes are the answer."

I've never quite understood the concept of elongating a screw hole on one side of a board and simply countersinking on the other. It seems that when the wood in which the screw is imbedded moves, you are asking either for the screw to bend or for the screw to rack in its pilot hole.

By keeping the head of the screw stationary, one or both of these things has to happen. In the second instance, repeated racking will in time surely enlarge the pilot hole and weaken the screw's grip.

To make connections with screws that allow wood movement, I'll elongate both the slip hole and the countersinking system, sometimes using pan-head screws with slightly oversize washers.

–Ted Blachly, Warner, N.H.

WILL NEPTUNE REPLIES: My use of the sloppy screw method dates back to my training at North Bennet Street School, where I also taught for many years. I've seen a wide variety of furniture built using this method and never heard of any reports of failure. I understand the theoretical issues of rigidity, angles and length, but apparently there is enough give to allow for movement over each year. One advantage this method offers is that the head of the screw is fully supported. A second one is the efficiency it offers over the milling of slots.

Not-so-disgruntled readers—Having read Duane Yoder's letter "A disgruntled reader" (*FWW* #163, pp. 8-10), I am aghast

Writing an article

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

Photo: Tom Begnal

by his comments. I always look forward to my *Fine Woodworking*. Some issues I scan and then read in depth later, while others are read immediately from cover to cover. All eventually end up dog-eared.

Woodworking is a passion of innovation. If you humbly and constantly enjoy seeking to improve, you have a passion.

–Larry Dison, Louisville, Ky.

I'm almost finished reading *FWW* #163 from cover to cover. I'd like to suggest to Mr. Yoder that perhaps he should find another publication.

If this isn't good enough for him, he should look elsewhere. Please don't change anything about this fine magazine. Of all the woodworking publications I read, and have read, this one is by far the best, without a doubt. It's too bad it cannot be a monthly.

–Joe Gass, Rohnert Park, Calif.

I usually don't send in a letter to the editor, but the egregious and, may I say, arrogant letter in the June 2003 issue of your fine magazine forces me to respond.

The pompous complaint of the esteemed Mr. Yoder about the content of your recent *Tools & Shops* issue (*FWW* #160) reminds all of us that there are a few in our ranks who obviously place themselves far above us mere wood butchers or tool monkeys! I found that issue a wealth of good information; but then again, I have only been woodworking for the past 30-some years. As ignorant and unenlightened as I obviously am in Mr. Yoder's view, I enjoy the learning and relearning of this craft.

I suggest that Mr. Yoder subscribe to a more esoteric publication—perhaps by *The New York Times*, Smithsonian Institution or some other high-brow venue where his ego can be stroked—and leave the rest of us mere mortals to enjoy this magazine.

–John Downing, Amherst, N.H.

Learning the hard way—I am a novice woodworker and recently became injured while pushing a piece of rock maple through my tablesaw. I was in the process of making 45° kerf cuts using a scrap piece of hardwood as a push stick. Unfortunately, the push stick was grabbed by the blade and shot into my forearm. The laceration required a total of 70 internal and external stitches. I wanted to share my experience of a careless practice that resulted in a needless injury.

Just a reminder to you all: Focus on the project and the process with safety as your primary concern, which most definitely will keep you safe from serious injury or even death.

Fine Woodworking is a great resource with a wealth of information. I would like you to consider a section in each issue dedicated to safety in the workshop.

I know you mention safety frequently; I just believe a stronger safety emphasis with more detailed instruction by experts should be a bigger part of your information forum.

–Sal Morelli, Leicester, Mass.

Contest idea rebuffed—I'm always surprised when someone writes in to say that the quality of *Fine Woodworking* has somehow deteriorated. The underlying assumption seems to be that the magazine ought to cater to their particular requirements or viewpoints and no one else's. There is a fundamental flaw in this assumption that needs no further explanation from me.

In contrast, I have nothing but praise for the magazine, which has served as my primary tutor for the past five years in my efforts to learn and apply the many skills needed to successfully work wood. I may find the odd article on building tablesaw extensions bigger than the total floor area of my house a bit redundant; but these are exceptions. The vast majority of articles are informative, relevant and extremely well produced.

I also would like to offer my opinion on the matter of making the Current Work department the basis of some sort of competition. I agree wholeheartedly with Bob Gilda's letter "Judged or be judged" (*FWW* #163, pp. 10-12) that comparisons are odious.

All of the works showcased in the department have merit of some kind and serve as inspiration to us mere mortals. Why make what would be entirely subjective, divisive and perhaps merely fashionable judgments about these labors of love? Better to simply appreciate them all, in their variety and generally excellent craftsmanship.

The world is full of competition and worse kinds of strife. The cooperative and open spirit that exists in the world of woodworking is inspiring and encouraging. It should be cherished and preserved, as it is this cooperative spirit that promotes good work, rather than seeking some glittering prize.

–David Trusty, Galgate, Lancaster, England

The Letters section of your June issue (*FWW* #163, p. 12) asked for comments regarding judging the entries of the Current Work department.

What objective method could you possibly use to pick a winner? This isn't a 100-meter race where choosing a winner is a clear-cut decision. If you pick a winner each month, that means the rest of the entries are losers.

Please don't turn this into a contest. Just present these amazing pieces as they are without someone's label of winner or loser attached to them.

For me, *Fine Woodworking* has always been about education and camaraderie among woodworkers, not about competition.

–Dave McGeehan, Palmerton, Pa.

If you are taking votes on the best of the Current Work department, my vote is NO.

My life dream is to have my work published in *Fine Woodworking*. While basking in the glory of my success, I would be asked how I finished on the best of the best yearly poll. If I didn't

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

–Anatole Burkin, executive editor

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Carl Stude–Burbank, CA

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READER SERVICE NO. 139

finish in the top 5 or 10, then I must not be very good. There goes my lifelong dream shattered like a cheap glass.

I figure if you get your work published in *Fine Woodworking*, you are the best. And I'm sure having your work published in the magazine has got to help your career. Besides that, who has the right to decide who is really the best?

–Mark Walden, Hoquiam, Wash.

EDITOR REPLIES: The three previous responses are representative of the flood of mail we received regarding the Current Work contest idea. It seems that this is an area where we best leave well enough alone. No contest needed. Thank you for your letters and e-mails.

Screwy info—As a Canadian, I feel compelled to respond to Aimé Fraser's article "A Guide to Modern Wood Screws" (*FWW* #162, pp. 46-49).

I am sure that I am not the only reader to remind you that square drive (American) is not the same thing as Robertson (Canadian).

When Mr. Robertson first developed his screw, he somehow managed in the patent and licensing agreement to prevent his screw from being used in the United States. I'm not sure of the exact reasoning or his motivation behind the move, but it still seems to be in place.

As I'm sure you know, square-drive screws are just that—all angles are at 90°—whereas Robertson screws have a slight taper to the recess and the driver. This taper helps prevent the driver bit from slipping out of the hole. I can't say that I necessarily understand the physics behind this; but having used both, I believe it to be true.

–John R. Guy, Milford Station, N.S., Canada

Paradigm drift and shift—In anticipation of turning my hobby into a more serious preoccupation, I decided that I needed to upgrade my bandsaw. I agree with the advice I have gleaned from magazine articles; the bandsaw is a tool that you can least afford to compromise on quality.

Despite the wealth of information I have acquired lately, I had even more questions, so I made a pilgrimage to the Toronto Woodworking Show. Contrary to everything I learned from reading and discussions with users, I realized that drift is an artifact of poor blades and/or defective saws. Drift is an unacceptable misbehavior that robs horsepower.

A blade manufacturer demonstrated this on a Delta 14-in. saw. The company representative cut with the fence parallel to the blade, i.e., no drift. The lack of drift was attributed to the perfect symmetry of the tooth set of a bimetal, silicon-steel blade run at low tension.

The second demonstration was by a bandsaw manufacturer who was cutting wood paper-thin. This feat was achieved by having high blade tension, a saw and blade that can handle this tension, heavy wheels that run true, a narrow-kerf blade and innovative saw guides.

Last, I spoke with *The American Woodshop* host, Scott Phillips, who broke into a spontaneous, impassioned lecture on the subject of bandsaws, drift and why it shouldn't happen.

These events created the impression that bandsaws are underachievers on the threshold of significant improvement caused by a shift in thinking. So my question is, who is going to take the lead in debunking the old wives' tales and assemble a state-of-the-art understanding of bandsaw technology while providing a comparison of saws and blade performance?

–M.J. Lavigne, Thunder Bay, Ont., Canada

Corrections—Due to an editing error in the article "Shop Vacuums" (*FWW* #163, pp. 80-85), the Craftsman shop vacuum model 17924 was inaccurately characterized. The article should have said: "Because of the canister's stainless-steel design, it is not prone to rusting."

Also, the price given for the Fein 9.77.25 was the manufacturer's suggested retail price. The machine can be purchased at many vendors for about $290.

In the article "Tilt-Top Shop Cart" (*FWW* #160, pp. 82-83) the dimension of the cart's sides was labeled incorrectly. The correct dimension is 20 in. wide.

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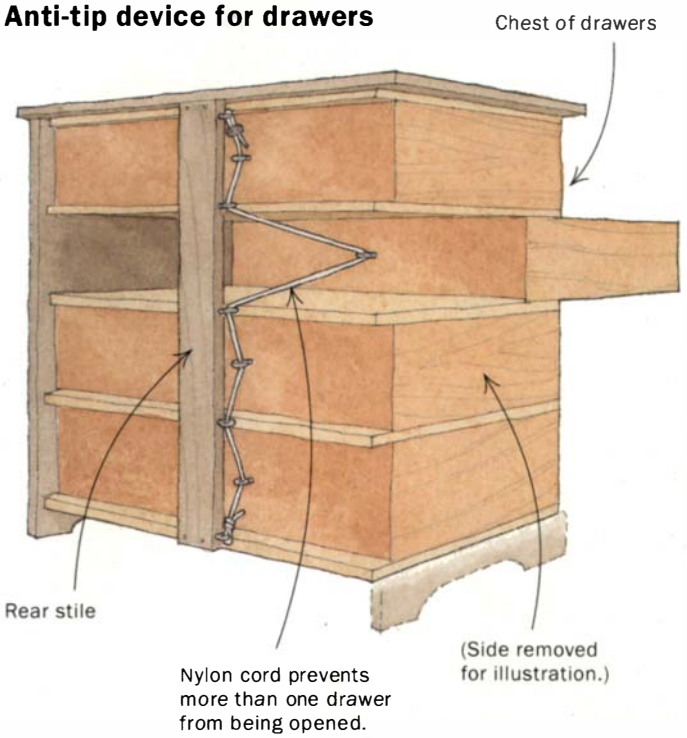
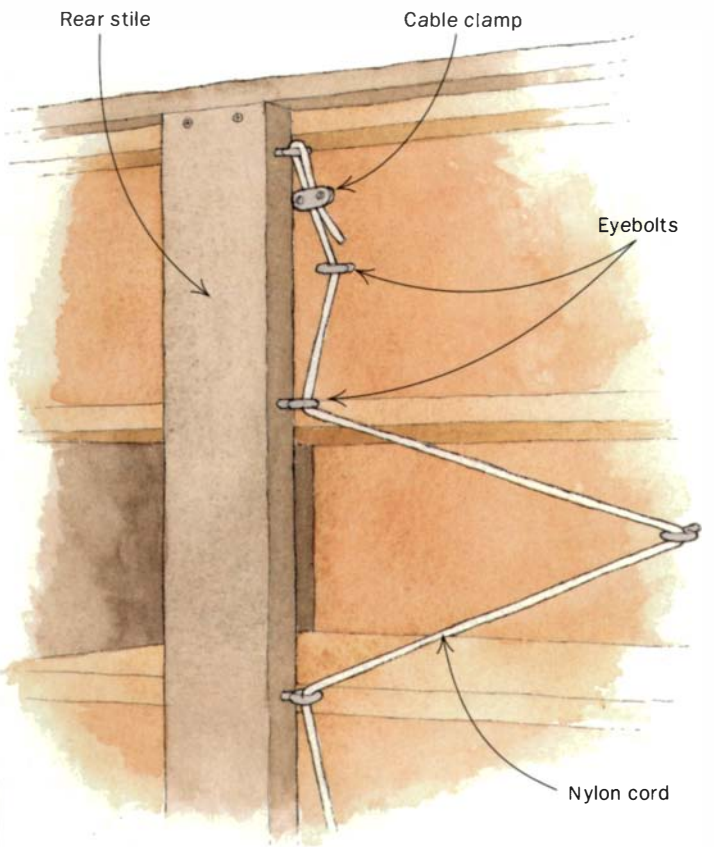
READER SERVICE NO. 164

Methods of Work

EDITED AND DRAWN BY JIM RICHEY

Anti-tip device for drawers

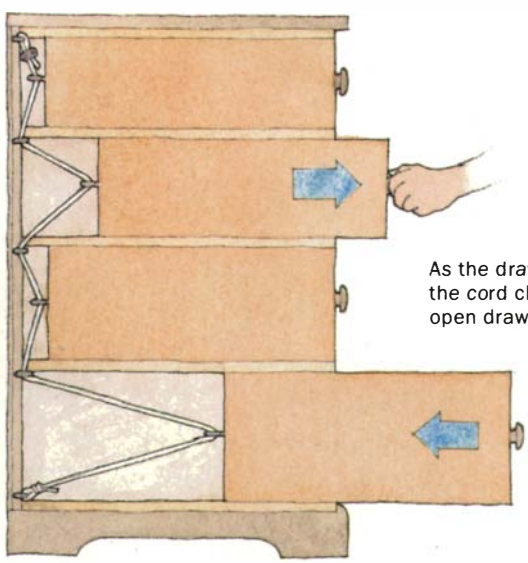




After I decided to build my grandchild a chest of drawers, I remembered an incident from my son's childhood. He once opened all of the drawers at the same time, causing the chest to topple over. So I designed this new chest so that only one drawer at a time could be opened (the design also could work with file cabinets).

To accomplish this, I installed a stile behind the drawers into which I screwed eyebolts at the height of each drawer. Then I screwed an eyebolt into the center of each drawer back and threaded heavy-duty braided nylon cord through each eye. With one drawer fully opened, I pulled the cord taut and secured it at the top with a cable clamp. The cord will pull any open drawer closed if another drawer is opened. Finally, I cut a hole at the top of the back so that I can adjust the length of the cord later, if necessary.

—Jack Wigginton Jr., Otisco, Ind.



As the drawer is opened, the cord closes any other open drawer.

Fixed-angle honing jig

Traditionally, a blade for a scraper plane such as the Stanley No. 80 is prepared by filing a 45° bevel followed by stoning, burnishing and, finally, turning a hook. I've found it difficult to maintain the 45° bevel through all of those steps freehand, so I made a jig to help. Construction of the jig is fairly straightforward (see the drawing on p. 18). You want a platform that places the blade at the

A reward for the best tip

Jack Wigginton Jr. retired from a military career and took an apprentice-level position at a local cabinet shop near his home in Indiana in order to learn more about woodworking. Now he does custom work on his own, mostly to keep active and to have fun. His winning tip is a safety measure he came up with when building a chest of drawers for his grandchild. 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.*

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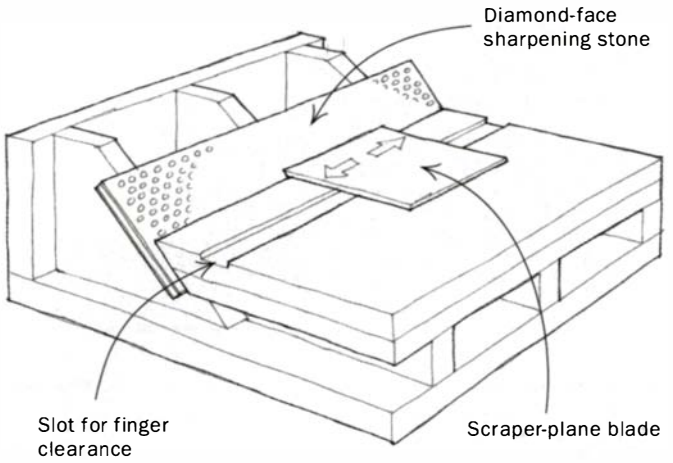
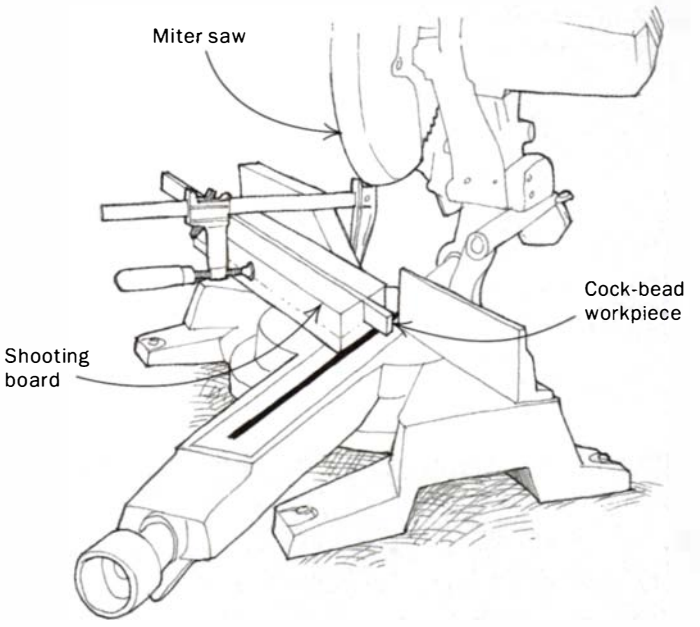


desired angle to the stone. My jig uses 10-in. by 4-in. DMT brand diamond stones, but with slight changes, the jig could accommodate any sharpening stone. To use this jig, rub the bevel against the coarse diamond stone until you raise an even burr; then work up through the grits and remove the wire edge. Don't forget to polish the back of the blade, too. Finally, burnish the edge, turn the hook and prepare to be amazed at your scraper plane's performance.

This concept could be adapted for sharpening plane irons, chisels or any other straight blade that has a flat back. You will, of course, need a separate jig for each sharpening angle.

—Ed Mulligan, S. Yarmouth, Mass.

Miter-saw shooting board



I like to add cock-bead trim to the drawers and doors of my furniture. In the past, I have mitered the cock bead using a 45° shooting board and a chisel. To speed things up, I decided to make a shooting board for my miter saw.

Here's how to make it: Laminate a piece of solid-wood scrap to a plywood bottom to make a block about 1½ in. thick by 4 in. wide by 16 in. long. Then, on the tablesaw, cut a groove lengthwise in the solid-wood part of the jig to hold the cock bead. The plywood on the bottom provides stiffness once this groove has been cut. The groove needs to provide a snug fit for the cock bead and be cut deep enough to support the entire width of the stock to prevent splintering when it's cut.

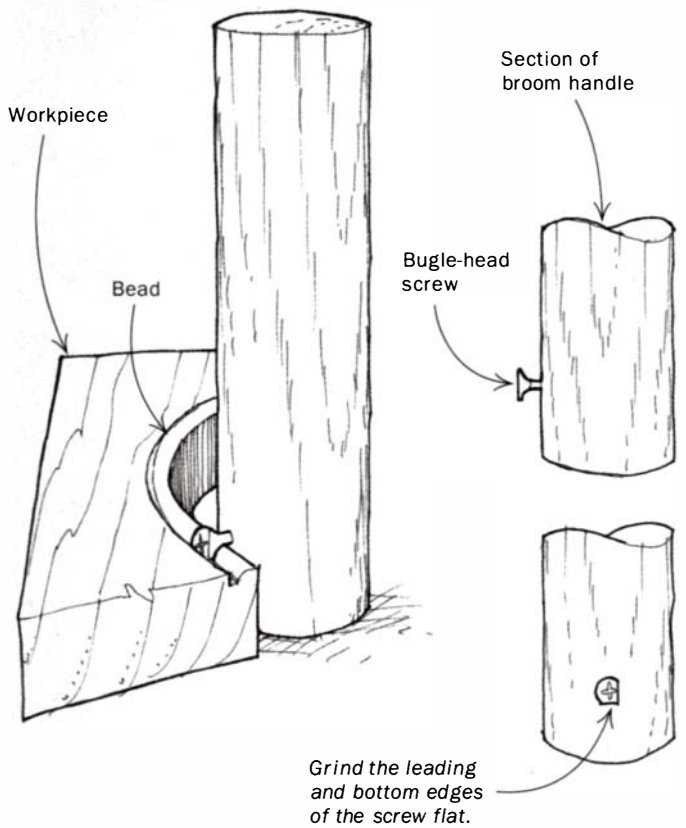
Next, clamp the shooting board to the miter saw and make a 45° cut. Without moving the shooting board, place the cock bead into the groove, adjust its length and make the miter cut. The jig will allow you to set the length perfectly and cut a miter that is as smooth as glass.

—Jon C. Uithol, Madison, Ind.

Quick tip: When cutting rails and stiles, I cut all of the pieces to length first. Then I cope the ends on all of the full-width boards and rip a pair of stiles or rails from each board as a last step, marking each pair to make sure they stay together. This has several advantages: It ensures all pairs are the same length, provides wider stock for fewer and safer coping cuts and reduces tearout, which is usually limited to the waste that is cut away.

—Charles Townsend, Longview, Texas

Broom-handle scratch stock



While making tombstone-pattern frame-and-panel doors with a ¼-in. bead around the panel, I used a router with a beading bit for the sides and bottoms, but the router would not work on the arched tops. I tried a scratch stock of standard design, but it was difficult to use. My solution was a low-cost, easy-to-use scratch stock made from a piece of broom handle and a bugle-head drywall screw.

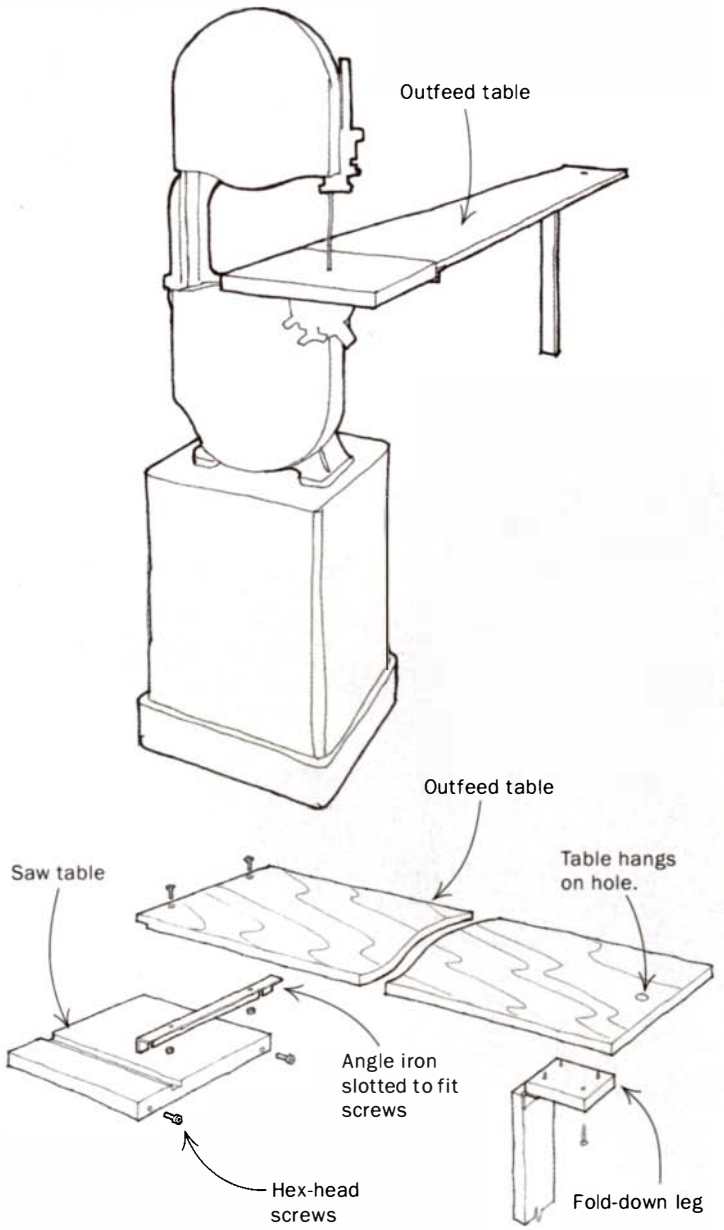
To make this simple tool, cut a piece of broom handle about 6 in. long and drive a bugle-head screw about ⅝ in. up from the

bottom of the stick. Drive it until the distance from the head to the stick is the desired width of the bead. Then grind the leading edge of the screw flat until its shape matches the desired bead contour. Also, slightly grind the bottom edge flat until the width of the quirk is correct.

To use this tool, simply place the stick against the arch and pull it around, keeping the screw perpendicular to the curve of the arch, until you reach the desired depth. Finish the inside edge of the bead with a small concave scraper or sandpaper.

—Robert Bell, Bell Buckle, Tenn.

Outfeed table for the bandsaw



When cutting long boards on a bandsaw, an outfeed table is a big help. This one folds up to hang on the wall when it's not in use.

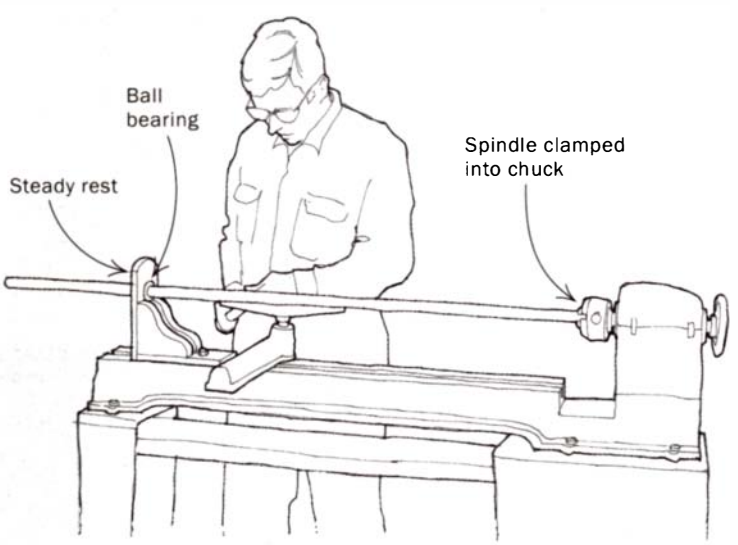
To make this table, cut a ¾-in.-thick pine or plywood platform as wide as your saw table and about 6 ft. long. Bolt a notched 1-in. by 1-in. length of angle iron to the front of the outfeed table. Cut slots in the angle iron so that it fits over hex-head machine screws installed in the fence-attachment holes on the back of your saw table. When cutting the slots, start shallow and then slowly file the slots deeper to bring the top of the outfeed table flush with the bandsaw table. Finally, attach a hinged fold-down leg underneath. The weight of the outfeed table will be enough to hold the fold-down leg in place.

—Willie Lochhead, E. Falmouth, Mass.

Quick tip: I use a digital camera whenever I think I might want to make a copy of a woodworking project. I shoot a series of photos—front, back, sides—including close-ups of details. Then I print the pictures and add measurements. The resulting pictures are better than a measured drawing if I want to reproduce the object.

—Charles E. Kolb, LaVale, Md.

Affordable steady rest



Prompted by a question at one of my wood-turning workshops, I began searching for a spindle steady rest that was efficient and inexpensive. After much searching, I came up with the idea of making one with ball bearings, which are readily available at a reasonable cost. This design also has the added bonus of extending the capacity of the lathe.

Ball bearings come in many different types and sizes. You can buy them housed in a flange, which makes them easier to mount, or you can just use regular radial-style ball bearings. One good source is www.mscdirect.com, or call (800) 645-7270. To make the steady rest, select a bearing with an inside diameter that will match the outside diameter of the spindle. To mount the bearing, saw a snug-fitting hole in the upright at the height of the spur center and jam-fit the bearing in place. Add a couple of braces and a base to the fixture that you can slide back and forth on the lathe ways, and lock it in place.

To use, fasten the live end of the spindle into a chuck and slide the other end into the steady rest right next to the area you wish to turn. If the spindle is really long, you may have to reverse it after turning one end so that you can turn the other end. Also, this operation may require leaving a short section to be finished by hand.

—Eddy Noel, Ste-Genevieve, Que., Canada

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Notes & Comment

Career change places woodworker in the prize money

This year's *Fine Woodworking* prize for the Best New Artist in Wood at the Philadelphia Furnishings Show went to Brian Bortz, a Durham, N.C., woodworker.

Bortz became a professional woodworker two years ago, when at the age of 38, after having worked steadily in the telecommunications business, he found himself with a severance check and time on his hands. With a cautiously supportive wife, he decided to turn his love of woodworking into a second career. To help improve his skills, the mostly self-taught woodworker signed up for additional classes with nationally renowned craftsmen such as Garrett Hack, Frank Pollaro and Michael Fortune.

A few friends provided him with commissions, and he was off to a steady start. Landing a spot at the juried Philadelphia show this year was quite an accomplishment, as it is a premier furniture show featuring top-notch craftsmen.

Bortz's work reflects a contemporary sensibility but has deep roots in the past. "My design influences have started to take some distinct shape," said Bortz. "I am definitely influenced by the past—the inlay work of the 18th century, the more dramatic details of the Arts and Crafts era and the softer side of Art Deco furniture and its use of beautiful veneers.

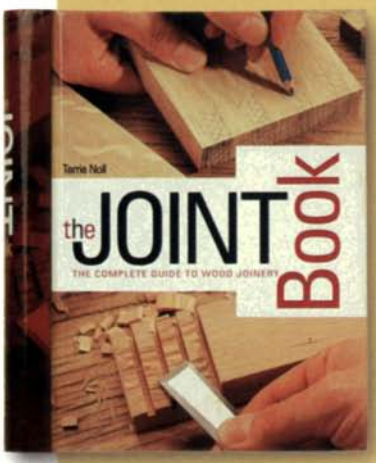
"I prefer to work in domestic hardwoods as a primary wood and accent these with some of the exotic hardwoods and veneers," he added.

More of Bortz's work can be seen on his web site, www.lostartwoodworks.com.

—Anatole Burkin, executive editor

Brian Bortz, winner of the Best New Artist in Wood award at the 2003 Philadelphia Furnishings Show. Fine Woodworking *awarded the prize to Bortz, who has been woodworking professionally for only two years. Among the items he displayed at the show were a matching bedroom set and room screen (below) made of solid cherry with veneered makore panels accented with holly and redwood burl inlays and cocobolo accents.*

Book review



The Joint Book: The Complete Guide to Wood Joinery ***by Terrie Noll. Popular Woodworking Books; 2002. $26 hardcover; 192 pp. (800) 448-0915; www.popularwoodworking.com.***

This far-reaching yet compact book offers both hand and power techniques for most woodworking joints, as well as some of the pros and cons of each joint. However, the book ultimately is hamstrung by its 6-in. by 7½-in. page format. While the spiral binding and compact size have some appeal, the author's wealth of wisdom and experience is shortchanged. I for one would like to see a full-sized revised edition someday.

This edition is appropriate for intermediate- and higher-level woodworkers, who will get the gist with a minimum of explanation. It is comprehensive in scope, if not scale, with only a few missteps (only thick dovetail pins are shown, for one) and occasional British terms and techniques that differ from American-style woodworking.

—Asa Christiana, senior editor

Photos, except where noted: Asa Christiana; this page: Mark Schofield (top); Brian Bortz (center)

IT WILL DRILL THROUGH WOOD, CONCRETE AND TIME.

Scared to go into the basement? Is it only fit for habitation by cardboard boxes, cobwebs and the outdated washer and dryer? Obviously, you need to do something about it. If only there were time, right? Well, here's a way to find some. First off, you'll need materials: wood, drywall or wood paneling and hardware—screws and bolts. And then, you'll need a drill with the power to turn your dungeon of despair back into a living space. Volt for volt and feature for feature, no line of cordless drills offers more torque than our new Craftsman® EX™ drills. With a bigger motor, these drills will carve right into stone or concrete. (The built-in level will make sure your pilot holes stay on the straight and narrow, too.) But anyone who has worked with concrete or stone foundations will tell you, it doesn't give up easy. No, far from it. But that's okay. The cushioned pistol grip dampens the vibration caused by drilling into harder substances. In other words, the walls will surrender long before your hand will. Speaking of giving up, you'll be a long way into screwing the drywall or wood paneling into the studs before the EX wears out. Every EX drill has the longest battery life of any drill in its class. Longer life means longer time working and less time changing batteries. And when you think that for every sheet of drywall, you'll be driving four rows of five screws, the EX can save you a lot of time. Which brings us to the final point: What are you going to do with all this time you just saved? Perhaps spend it in your now newly renovated basement, excuse us, family room, watching the game? The new line of Craftsman EX drills. Find them at Sears, Sears Hardware Stores, online at craftsman.com or call 800-437-9686. You'll find it well worth your time.

Introducing our new line of EX cordless drills. EXtra torque. EXtended run time. EXtra performance.

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Australian furniture-making school is world class

Master class. *David Livermore (left) teaches steam-bending to Ross Annels (center) and James Curtis.*

During the past year and a half, I often wondered why I came to Australia. I usually said something like, "To take advantage of the exchange rate" or "for the beautiful Tasmanian timbers." But the truth is that I decided on a whim to leave Pennsylvania to attend the Australian School of Fine Furniture, a woodworking school in Tasmania.

While students at the school have every opportunity to master both hand and machine skills, the school's focus is on creating professional furniture designers and makers. Graduates receive a diploma of arts in furniture design and a certificate in small-business management. Classes include drawing, technical drawing, 3D design, art theory, furniture history, materials and technology, upholstery, business, health and safety, digital photography, wood turning and chainsaw use. Also, students organize a number of outside exhibitions to generate sales and contacts.

Academic director David Upfill-Brown (his work was featured in *FWW* #146) teaches the first-year students, while second-year students are taught by seven master furniture makers, each a self-employed designer/maker with his or her own style and skills.

Tuition at the school is $15,000 AU per year (around $9,000 U.S.). For more information, go to www.asff.com.au.

—Evan Gist, Launceston, Tasmania, Australia

Australian School of Fine Furniture. *The school is located in a restored brewery in Tasmania, a large island with plentiful timber and beautiful beaches.*

A homage to American ideals

More than money. *Although he usually works on commission, Bikowski carved this large plaque on spec, inspired by timeless American ideals and the artwork on classic U.S. currency.*

As many readers may have recognized by now, our national currency has been undergoing a redesign. As a fan of the Neoclassic artwork found on U.S. currency of the 1800s, I am greatly disappointed by the awkward disunity of the new versions.

I was inspired to do a carving in the style of classic American currency, particularly four bills from around 1896 that were created as part an educational series to honor significant events and inventions of the past, such as electricity. However, I wanted to communicate something about American life in the 21st century, about the privilege of being an American citizen today, about the original ideals that are still worthy of admiration. I carefully thought out every component, striving for balance, harmony and, okay, happy excess. It is the first major piece I've carved without a commission.

After the events of Sept. 11, 2001, I set out to modify the central text on the carving with the intent of encouraging any who might see it. Although I had been waiting for someone else to speak words that would comfort me, I realized I already had all I needed within to pick myself up.

Around portraits of the Founding Fathers, I inscribed:

"The future.
O, Divine Providence,
guide our paths of heart
and mind.
What destinies await,
near, though still unimagined,
yet undreamt?"

Made from alder, the plaque is 32 in. high and 20 in. wide. I am shopping it to local galleries.

—Leon William Bikowski, Salt Lake City

Photos, this page: Evan Gist (top left and right); Grant Heaton (bottom); p. 28: courtesy of Wood Contour Inc.

Teen offers advice on getting started in woodworking

With woodshops disappearing from middle and high schools across the country, at least one teenager has taken matters into his own hands. Peter Olechiw, 14, convinced his parents (neither one a woodworker) to let him set up a basement shop in their Pennsylvania home, and he has advice for other young people who want to do the same.

Steady flow of projects. *So far, Olechiw has focused mainly on the lathe and scroll saw, though he has made boxes on the bandsaw and uses the planer to mill stock.*

To get started, Olechiw says kids will need the help and support of their parents as well as an adult woodworker. This can be one of their parents, a friend, a relative or a local woodshop teacher. To sort out the safety issues and to help decide which tools should come first, the Olechiws read woodworking magazines and got advice from an uncle who builds furniture. Then Olechiw and his father attended a Grizzly tent sale and bought a lathe, bandsaw, bench grinder and portable planer. For safety reasons, a tablesaw probably will have to wait a few years.

Obviously, safety is a primary concern, especially for a 14-year-old, and Olechiw recommends a dust collector, air filter, good lighting and safety switches on all machines (all of which he and his father have installed in the shop). Also, he and his dad read about and discussed the safe use of each piece of equipment before Olechiw was allowed to fly solo. Olechiw also wears safety glasses and uses a dust mask and a face shield as necessary.

After working on more than a dozen small projects, Olechiw said he has had no injuries so far. "Treat tools like they can hurt you in an instant and respect their power, and you will be okay," he said.

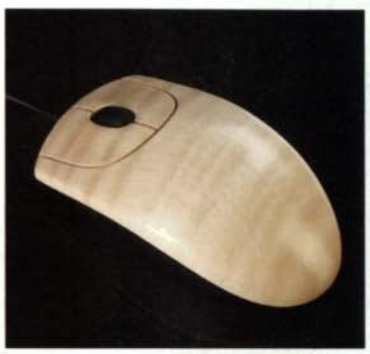
—A.C.

Young and determined. *Though just 14, Peter Olechiw has his own woodshop and has advice for other teens interested in the craft.*

Computer hardware in hardwood

For those looking to bring the warmth and character of polished hardwood to their computer workstations, Wood Contour Inc. offers peripheral components made of solid oak, beech, walnut, maple, cherry, alder, ash and pear, as well as many exotics. Starting with high-end optical mice, flat-screen monitors (15 in. and 17 in.) and keyboards with gold-plated contacts, the company creates custom housings and covers, each one hollowed and shaped from a single piece of FSC-certified wood and finished with lacquer.

While the keyboards and monitors go for $1,000 and up, mice are $99 each, making them a nice gift for the tech-savvy woodworker (or yourself). For more information and prices, go to www.woodcontour.com or call (805) 267-7220. —*A.C.*



Wood technology. *Wood Contour makes custom covers for computer monitors, mice and keyboards from solid hardwoods.*

Tools & Materials

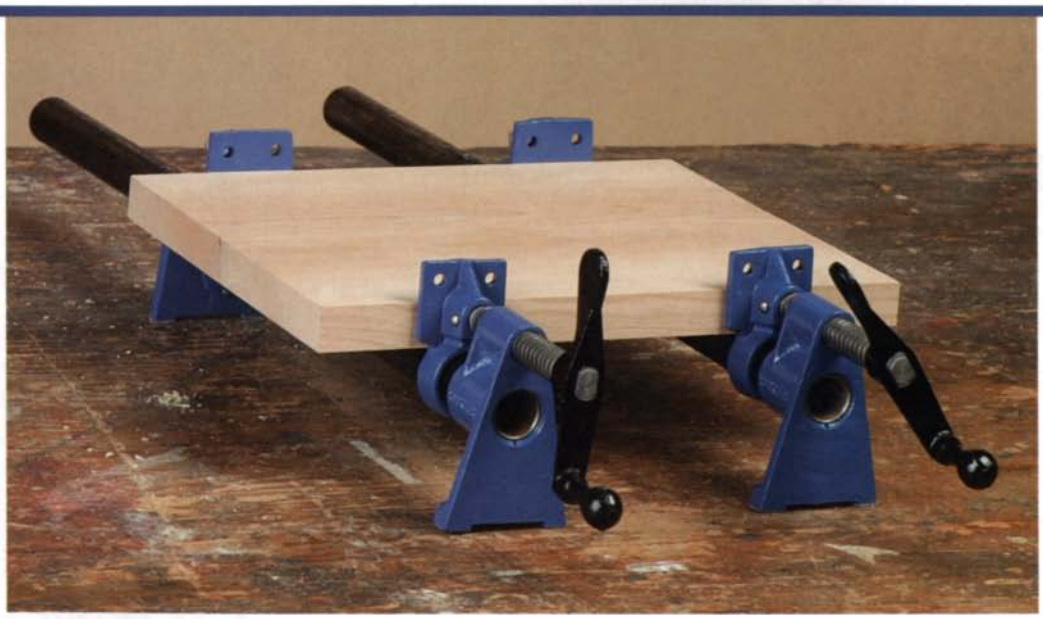
Jet's canister-style dust collector

To collect the most dangerous dust particles—those that are 5 microns in size or smaller—you need adequate airflow and a fine filter. These two important qualities are hard to find in a relatively low-cost dust collector.

However, the new Jet cartridge-based dust collector (model DC-1100CK) promises 2-micron filtration without significantly restricting airflow. The key to this performance is the pleated cartridge, which offers six times the filtering area of a standard bag, according to Jet. This allowed Jet to install a clear plastic bag in the bottom of the unit without worrying about affecting airflow. It is easy to tell when the bag needs emptying. Plus, compared with a dust-caked cloth bag, it empties cleanly and easily. A snap-in ring is an improvement over the standard strap clamps that usually hold lower bags in place.

The other slick feature of the cartridge is two internal, flexible paddles, which can

Finer filter traps finer dust. *Thanks to a pleated filter inside the canister, the DC-1100CK dust collector from Jet maintains a strong airflow while trapping dust particles as small as 2 microns.*



New pipe-clamp design makes glue-ups less stressful. *Sure-Foot clamps not only are wide, which ensures that they won't tip, but they're also tall, which makes the clamps easier to crank.*

High-rise pipe clamps

Pipe clamps haven't changed noticeably in the almost 30 years since I bought my first pair. I still have those Watergate-era Pony-brand clamps, and they work just as well as on the day I bought them.

Recently, however, Rockier introduced a version of this clamping standard in the ¾-in. size. Called the Sure-Foot, it's a dead ringer for a Pony clamp (paint color excepted) but with one obvious difference. On the Sure-Foot, the head and foot are taller and wider than those of a typical pipe clamp. The height positions the crank handle so that it clears the benchtop with more than an inch to spare, allowing you to turn the crank with ease. And the additional width

Photos, except where noted: Tom Begnal

be rotated to rattle the filter's pleats and dislodge caked dust. These are connected to exterior handles above the cartridge, making it easy to shake and clean the cartridge without removing it, keeping the airflow free and powerful.

My informal tests over nearly three months of heavy use were very positive. Rated at 1,100 cfm of airflow, 1½-hp dust collectors are appropriate for short runs connected to one or two machines, three at the most. I connected the unit to my tablesaw and planer, and both operate almost dust-free when the collector is running. My tablesaw, which has a port at the base to collect dust, is as clean as a whistle.

I also cannot perceive any dust in the air when the unit is running, not a scientific test but different from my experience with bag-style dust collectors, which leave a perceptible cloud in the air when running nearby. Also, the DC-1100CK is relatively quiet.

According to John Otto, Jet product manager, the paper cartridge filter should last at least five years, with proper use, and longer in many cases. He warned against blowing out the filter with compressed air, which could cause damage.

The DC-1100CK sells for about $440 (2-hp and 3-hp models are available). The cartridges also can be purchased separately for retrofitting to existing dust collectors. For more information, contact Jet (800-274-6848; www.jettools.com).

—Asa Christiana is senior editor.

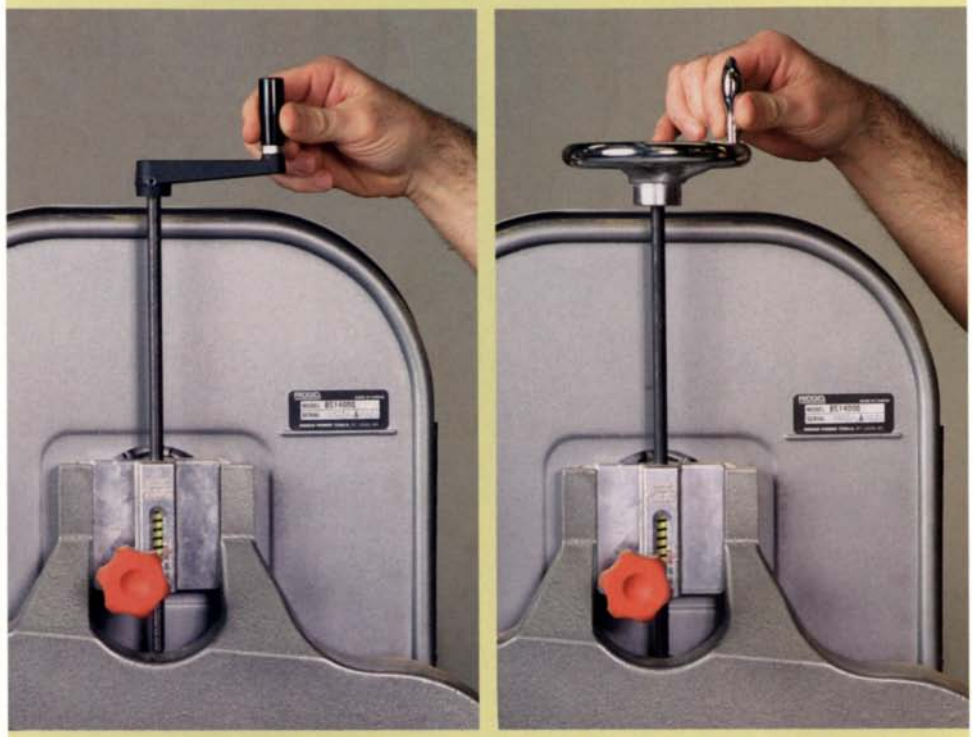
adds stability, so the clamp is pretty much tip-proof.

The extra width and height did indeed simplify the clamping procedure. I had just one complaint. Compared with other pipe clamps I've used, the Sure-Foot clamps required a bit of extra effort to squeeze the clutch plates. I'd prefer for the clutch to respond to a little lighter touch.

Everything considered, though, the Sure-Foot clamp looks to be a simple, effective improvement to the venerable pipe clamp, and I plan to add a few more to my collection. They sell for about $12 each (pipes are sold separately). For more information, contact Rockler (800-279-4441; www.rockler.com). ***—T.B.***

SIDE BY SIDE

Aftermarket blade-tension cranks for bandsaws



Cranks add convenience. *Two companies, INI (left) and Iturra Design (right), now offer cranks that make it easier to adjust bandsaw-blade tension.*

Any bandsaw that gets a lot of use is likely to have a tension knob that also gets regular attention. That's because, before the blade can be changed, the tension must be removed by turning the tension knob. Also, to reduce stress on the wheels, tires and bearings, many bandsaw owners like to remove the tension from the blade at the end of the day and retension it before the next use.

But bandsaw manufacturers, especially makers of the popular 14-in. size, don't always make this an easy step. Many of these bandsaws have the blade-tensioning knob tucked alongside the upper wheel cover, a location that is awkward and inconvenient for most users because it makes it difficult to fully grip the knob.

Other manufacturers make an effort to improve convenience by using a longer threaded rod, one that extends above the wheel. That's a big help, but the rod usually is topped off with a small knob that's a chore to turn.

Recognizing a need here, two companies now sell aftermarket tension cranks designed to make things easier. INI of Eden Prairie, Minn., sells the Quik-Crank, and Iturra Design of Jacksonville, Fla., markets the Spinner. Both models use a longer rod that extends above the upper wheel, where there is plenty of room for a hand. Instead of a knob, the Quik-Crank has a crank handle and the Spinner has a crank wheel.

Each model installed in just minutes. And although each one offered a slightly different feel, they both made it considerably easier to add or remove tension. If you use the tension knob a lot, I think you'll find these products to your liking.

The Quik-Crank sells for $25; the Spinner goes for $39. For more information, contact INI (877-641-5252; www.i-n-i.net) or Iturra (888-722-7078). Before ordering from either company, ask whether the product will fit your saw.

—Tom Begnal is an associate editor.

Music to your ear protectors

Toe-tapping ear protection. *With a built-in FM receiver, the Elvex muffs let you enjoy music while protecting your ears.*

With the information we have today about the cumulative, irreversible nature of hearing loss, ear protection is a must, not an option, around noisy shop machinery. Further, as reported in *FWW* #152 (pp. 62-65), earmuff-type protection offers relatively foolproof and consistent decibel reduction.

When it comes to earmuffs, woodworkers have a variety of choices, ranging from inexpensive, basic muffs to high-tech models that mask loud sounds but allow voice-level noise to filter through. Falling somewhere in the middle is the Elvex QuieTunes Com-260R, earmuffs made with the music lover in mind. The muffs combine comfort and efficiency with a high-quality FM radio receiver.

I found them comfortable to wear, even when used for a long period of time, so much so that I often left the shop without realizing I still had them on—until I was outdoors wondering why the hills were alive with the sound of music.

Rated at a solid 25 decibels of noise reduction, the Elvex muffs lower the roar of a chopsaw to a dull whine. And for anyone tempted to crank up the music to a level that would make a router seem quiet, the sound inside the muffs is limited to 85 decibels, a number considered safe.

The muffs work for 40 hours before the rechargeable batteries need attention. A charger is included.

The only drawback I could find was the lack of an AM receiver; my favorite baseball team's games are not broadcast on FM. Of course, FM does offer high-quality stereo sound when a station is locked in. However, you can expect static when tuned to a station with a weak signal.

The Elvex QuieTunes Com-260R sells for about $90. For more information, contact Elvex at (800) 888-6582 (www.elvex.com).

—A.C.

Tool Recalls

Sears router

Sears is recalling about 5,200 Craftsman routers with the model No. 315.17510 and date codes of A0304 and lower. The on/off switch could stick in the "on" position and pose a "serious risk of serious lacerations to the operator and bystanders." To date, Sears has not received any reports of injuries or incidents. The routers were sold in the United States between November 2002 and January 2003. Owners should return the router to the nearest Sears store for a product exchange. For more information, call (800) 932-3188.

Makita sanders

Makita has recalled about 350,000 5-in. random-orbit sanders with model Nos. BO5000 and BO5001. (Excepted from the recall, however, are models BO5000 and BO5001 that have the letters P-U-R on the pad.) According to Makita, the sander pads can "break apart during use and strike the operator, posing an injury hazard." Makita has learned of 13 pads coming apart and, in three of those incidents, the operator was injured when struck by pieces of the pad. The sanders were sold nationwide between April 1992 and February 2003. Owners should return the sander to the nearest Makita service center for a free repair. More information is available by calling (800) 462-5482.

Skil battery charger

About two million Skil Warrior drill battery chargers have been recalled by Bosch. The chargers were sold with, or as accessories for, Skil Warrior drills. The charger transformer could overheat and, if this occurs, according to Bosch, "the charger housing can melt and deform, possibly igniting flammable materials near or on the charger." Bosch has 160 reports of overheating; one resulted in a fire that caused property damage. The chargers were sold between July 1994 and February 2003. Owners should immediately unplug the chargers. Replacement drills and chargers will be provided at no cost. Call (800) 661-5398 for more details.

Makita circular saw

Makita has recalled about 180,000 7¼-in. circular saws with model No. 5740NB. (Excepted from the recall, however, are any model number 5740NB saws with an "N" preceding the serial number on the nameplate and a blue dot on the shipping carton.) The lower blade guard of the saw "can become jammed, which can result in the consumer coming in contact with the blade and suffering a serious injury." The saws were sold between April 1998 and November 2002. Owners should bring the saw to the nearest Makita service center for a free repair. Call (800) 462-5482 for details.

Black & Decker tablesaw

Black & Decker has recalled about 6,100 model BT2500 tablesaws with date codes of 200128-CT through 200148-CT, sold between August 2001 and April 2002. The motor housing can crack, posing a risk of electric shock. Contact Black & Decker at (866) 357-0324 to learn how to get a free repair. *—T.B.*

Photo, p. 34: Rodney Diaz

Veritas cabinet scraper

As an avid hand-tool user, I always keep a cabinet scraper in the tool cabinet right next to my handplanes. A scraper won't remove material as quickly as a handplane, but for certain tasks a less-aggressive cutting tool is exactly what I need.

The cabinet scraper stands out when it comes to cutting through tricky grain; it generally produces a smoother surface, mainly because it's less likely than a plane to tear out wood fibers. Also, when set to make an extra-fine cut, it's useful for smoothing the surface of veneer because it minimizes the danger of accidentally cutting through the thin material. And, to add to its versatility, the cabinet scraper often is used to remove glue from a board, or sometimes even paint. So, with all that in mind, when the latest cabinet scraper from Veritas arrived at my shop, I was anxious to give it a good workout.

Right out of the box, the scraper was ready to go. All I needed to do was burnish a small hook on the bevel of the blade.

Good tool gets better. *By making a few subtle design changes, Veritas has produced a better scraper.*

Weighing just under 2 lbs., the Veritas is heavier than other cabinet scrapers, a characteristic that contributes to its solid, well-built feel. The overall width of the ductile-cast-iron body is about 11½ in., with the blade measuring 2¾ in. wide.

As a test, I used the scraper on three figured hardwoods: white oak, mahogany and cherry. Each time I was able to produce a blemish-free surface along with a heap of fine shavings.

In short, I was more than pleased with this new scraper, and it has earned a place in my tool cabinet. The scraper sells for about $34. Veritas can be reached at 800-871-8158 (www.leevalley.com).

–Chris Gochnour builds furniture in Murray, Utah.

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READER SERVICE NO. 157

Finishing Mahogany

Transform the light-pink color of freshly milled mahogany into the deep, rich shades of old-world furniture

BY JEFF JEWITT

When the cabinetmakers in England and America who built early 18th-century furniture fell in love with mahogany, most of the wood was of a color and quality that few woodworkers will have the chance to work with ever again. Those old-growth trees of Cuban and Santo Domingan mahogany (*Swietenia mahagoni*) yielded lumber with a much darker color and a finer texture than what's commonly available now. I first saw that wood up close many years ago, when I toured the collection of American furniture at a museum in Williamsburg, Virginia. The first thing that struck me was the color of those pieces: It wasn't just the patina—it was simply awe-inspiring wood. So when I recently had the chance to put a finish on a piecrust table made with a single-plank top, I knew I had to come up with a way to coax that rich, dark finish from the lighter color of the Central and South American (also called Honduras) mahogany (*S. macrophylla*) available today.

Lay on the first layer of color

It is not uncommon to find worm holes in otherwise perfectly sound mahogany lumber. To avoid wasting a lot of wood, you can fill and color them easily (see the story on p. 38). After that, you can lay on the first level of color. I use an amber-colored water-soluble dye as a base coat to mimic an old finish. The amber undertone evens out color variations in the wood and adds depth to the final finish. I prefer water-soluble dyes because they're easier to control. Also, they tend to absorb more evenly into the wood than alcohol-based dye stains, which dry faster and leave behind unsightly lap marks.

Before applying the stain, sand the piece with 220-grit paper, then raise the grain by wiping the surface with distilled water to minimize any further grain-raising. (Tap water can contain mineral impurities

STEP ONE

START WITH A WATER-BASED DYE STAIN

An amber-colored stain as the first coat of color does two things: It gives the lumber an aged look, and it evens out different shades inherent in the wood.

Raise the grain before the first coat. *Before applying a water-based dye stain, wet the surface thoroughly to raise the grain, then let it dry. Sand down the raised fibers before applying the dye stain. The result is a smoother finish than you'd get without taking this preliminary step.*

Spray it on for even coverage. *An inexpensive plastic spray bottle is a great tool for applying water-based dye stain quickly and evenly.*

that may discolor the wood.) Wait several hours for the water to dry, then resand with the 220-grit paper.

Use a plant mister to spray on the amber dye, saturating the surface quickly and thoroughly. Water-based dyes are very forgiving compared with alcohol-based dyes, but make sure you soak up any excess with clean rags. After the amber dye has dried, scuff the dry surface using a gray synthetic abrasive pad such as Scotch-Brite brand; go lightly so that you don't cut through the dye.

Mix the second color into an oil-sealer coat

Now it's time to add the second, primary overtone of color. With this table, I used a technique that I first heard about from Rob Millard, who builds reproductions of 18th-century furniture. To get an aged effect and a rich color, use boiled linseed oil colored with dye. You can use an oil-soluble dry powder or a liquid concentrate like I used on this table (see Sources of Supply on p. 41). Practice on some scraps first to get the effect you want. To enrich the yellow undertone of the first color, I used equal amounts of TransTint

Abrasive pads conform to tight spaces. *To smooth out intricate shapes after staining, abrasive pads work better than sandpaper, and they last longer.*

Photos: William Duckworth

STEP TWO

SEAL THE WOOD WITH A COAT OF TINTED OIL

Powdered or liquid dyes mixed with oil will stain and seal the wood in one step. Jewitt uses boiled linseed oil. Be precise and keep track of the amounts that you mix so that you can duplicate the same concentration if you run out.

Elbow grease appreciated here. *Saturate a wiping rag with the dyed-oil mixture and apply it quickly and efficiently, wiping in a circular motion.*

Use a brush to do what the rag couldn't. *The dampened rag may not effectively stain detailed areas, such as the carved edge of this table.*

brown mahogany and reddish-brown liquid dyes, mixing 5 ml of each into 100 ml of boiled linseed oil.

Mix the color into the oil in precise amounts and keep a record so that you can duplicate the mixture if you run out. Apply the oil by vigorously wiping it on with a rag in a circular motion; you can use a small brush for intricate shapes. Don't add thinners to the oil because it causes dark circles to form around the pores where the color becomes too concentrated. If the piece becomes too dark, just wipe the colored oil with a new coat of clear oil or a rag dampened with alcohol to remove some of the color.

Fill the grain with a rottenstone slurry

As an option, you can fill the grain in the tabletop at this stage, rather than waiting for the oil to dry and using a paste wood filler. Filled grain results in a smoother surface after the topcoats have been applied. Or you can leave it unfilled. My preference for tabletops is for a filled surface, so I added some more clear oil, sprinkled some rottenstone on the surface and padded the slurry mixture into the grain of the wood with a circular motion. The rottenstone isn't as abrasive as pumice, which might cut through the dye and the undertone color. Also, the gray rottenstone adds a bit of darker color when it's mixed with the oil. After the rottenstone filler has set up for several hours, use a wadded clean cloth to wipe off any excess slurry remaining on the surface. Let that last coat of oil dry for at least three days. If it's cool (65°F or less) and damp in your shop, let the coat dry for a week.

Build up the topcoats in thin layers

You can choose from a wide range of topcoats—a solvent-based wiping varnish, spray lacquer or even water-based finishes if you

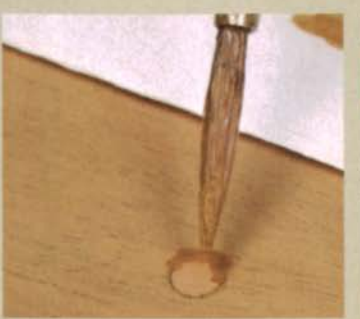
Filling the inevitable worm holes

In most extrawide mahogany boards, you'll often find large worm holes near the edges. You can cut them out, but then you risk losing your chance to make a one-piece top, and you waste a lot of lumber. I've used all sorts of putties and fillers, and I've come to the conclusion that the best solution is to use a nonshrinking auto-body filler, such as Bondo brand. I've used Bondo for 20 years now in repair work, and while I suspect that some purists may despise it, the product has several things going for it.

First, it's absolutely nonshrinking, so after two or three years, you won't notice any depression where the hole was. Second, the color of the mixed putty is a pinkish red that matches the natural color of the mahogany, and it's easy to tweak to get the final color of the finish. When you apply Bondo to an open-grain wood such as mahogany, it's important to apply masking tape around the hole so that you don't get any Bondo in the grain, which will show up later in the finishing process. Let the Bondo dry several hours, then remove the tape and sand the surface level. After the subsequent staining and first coat of shellac finish, you can further refine the putty with some dry pigment colors mixed with shellac, if necessary (see the bottom photos on the facing page).

Even out the color. *After applying the first coat of tinted oil, a rag dampened with alcohol or a new coat of clear oil will help even out the color. The alcohol will dilute the dye without affecting the oil sealer.*

Mix dry pigments into a little shellac. *After doing this a few times, you really can develop an artist's eye for color.*



Paint around the rim of the filled hole. *The distinct black line left around the rim needs to be covered with a nearly opaque coating of color.*

Add some faux grain. *Small, darker-tinted lines will look like grain texture after a finish goes on over the repair.*

Tweak the color after the stain has been applied. *After the sealer coat of oil goes on but before the topcoat, tweak the final color of the repaired area.*

STEP THREE

BUILD UP THE FINISH WITH THIN COATS

Jewitt chose seedlac shellac for the finish on this table because it adds more color to the surface and dries quickly, so he can apply three thin coats in a day. Shellac also bonds well to a surface that was sealed with linseed oil.

Small brushes are better for tight spaces. *Slap on several thin coats with a small brush to avoid muddling up carving details.*

Dewax your own shellac. *Mix shellac several days ahead of time to allow impurities to settle out of the mixture. Skim the clear shellac off the top with a syringe.*

apply dewaxed shellac first—as a barrier coat over the oil. For this job, I opted for the classic and traditional shellac finish. For brushing shellac, I prefer a 1½-lb. cut. Because a gallon of shellac was much more than I needed, I just factored the ratio down to 3 oz. of shellac flakes mixed into a pint of alcohol.

I really like the subtleties of texture you get with a brushed-on shellac finish. I use a technique I learned from Don Williams at the Smithsonian Institution many years ago. The trick is to apply the fast-drying shellac in whisper-thin strokes with a very finely bristled synthetic brush, such as the Taklon brushes sold in specialty catalogs and art-supply stores.

For this table I used two widths—a 2-in. brush for the flat top and a 1-in. brush for the intricately carved base. A single 1½-in. brush would suffice if you don't want to buy both sizes (these brushes are rather pricey).

To apply, dip the brush about halfway into the shellac solution. With shellac, bubbles aren't a problem like they are with brushing varnish, so you can scrape off the excess shellac by dragging the bristles across the lip of the jar. The raised, molded edge of this table can be a challenge for laying on a finish, but this brush excels at the task. Because it doesn't hold a great deal of finish (like a larger brush with an internal reser-

Fill the grain for a smooth top

Fill only the top surface of the tabletop. A second, fresh coat of oil mixed with some rottenstone sprinkled over the surface forms a slurry of paste that fills the open grain, leaving a smoother finish after topcoats are applied over it. This step is not recommended for intricately carved details, like those on the table legs.

Sprinkle it on and rub it in. *Swabbed in a circular motion, the rottenstone and oil form a gray-colored slurry that fills the open grain on the tabletop.*

Work toward the center. *Lay down each brush stroke of thin shellac quickly. Brush from the outside edge toward the center of the table to keep the finish from pooling at the shaped edge.*

voir would), this small brush doesn't deposit a pool of shellac when it first touches the surface. And because it has a finely chiseled edge, you can place the brush down lightly right where the edge of the raised molding meets the flat surface of the tabletop and drag it gently toward the center. Use minimal pressure and leave just a whisper-thin film of shellac. When you start to run out, dunk the brush into the shellac again and feather each new stroke into where you left off with the last one. Brushing shellac this way takes a bit of practice, so start on the undersides of a project to get the feel for it. For the intricately carved parts, I use a slapping or flicking motion to apply the shellac. The fast-drying nature of shellac keeps dust pimples from forming in the finish, and you can keep building up new coats very quickly.

SOURCES OF SUPPLY

J.E. Moser's powdered dyes, Wizard Tints liquid dyes and rottenstone: Woodworker's Supply (800-645-9292; www.woodworker.com)

TransTint liquid dyes and rottenstone: Woodcraft (800-225-1153; www.woodcraft.com)

I usually build up at least three coats in a day, let it dry overnight and then lightly sand the surface with 600-grit wet-or-dry sandpaper for the flat areas and gray synthetic pads for the complex shapes. Once the shellac has dried for at least three days, you can dull the surface with 0000 steel wool if you want more of a matte sheen. Because all of the layers of shellac melt into one another as the last one dries, there's little danger of rubbing through the finish. If you have to remove some brush marks, use 600-grit sandpaper first, and then follow that with the 0000 steel wool. A light coat of paste wax will bring up a dull surface to a satiny sheen. □

Jeff Jewitt is a frequent contributor of finishing articles to Fine Woodworking.

FILE AND MEDIA STORAGE

HIDDEN KEYBOARD TRAY

PULL-OUT WORK SURFACE

Build a Computer Desk

With plenty of work surface and efficient storage, this desk is not only functional but also enhances the home office

BY CHARLES DURFEE

In my study at home stands a lovely, tall secretary desk with bookcase, glowing beautifully in its 20-year-old patina. For the past several years it's been piled high with papers, notes, photos, stuff and more stuff. I make periodic assaults on the piles, but the fact of the matter is that I don't work at the desk anymore. I now work—doing letters, bills, e-mail—about 8 ft. away at a small table that holds the computer, with storage in a cabinet below. On some K-Mart-bought shelves lie a printer, scanner, files and books.

Whether you have made the plunge into working from a home office or just find yourself using the computer more often, maybe it's time to give the computer a real place in your home on a piece of furniture that works well, is built to last and is a pleasure to live with.

My original plan was for a cabinet similar to an entertainment center that could house the whole system and be closed up when not in use. But I suspect that many people work with their computer in short bursts throughout the day and week and want it out and accessible. Also, today's computers look much more stylish than the gray boxes of a few years ago.

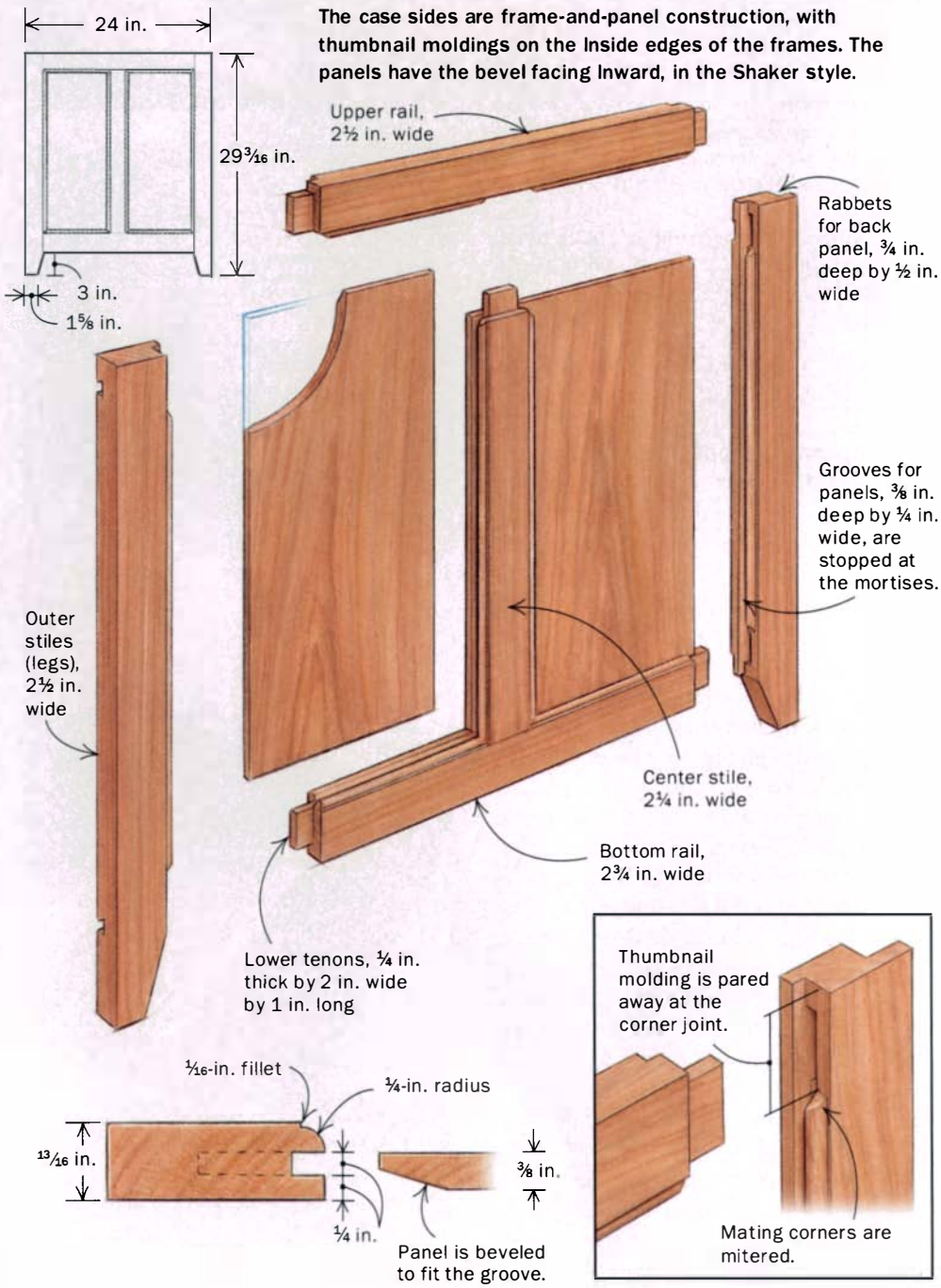
Another problem with a cabinet design that closes everything away is that by necessity it becomes quite large and rather awkward-looking, especially if your computer has a large monitor.

That's how I arrived at an unobstructed tabletop, with enough room for equipment and workspace. An additional pull-out work surface is handy. Add an adaptable storage cabinet below and a keyboard tray behind a traditional drawer front, and presto, I had my solution.

Major components—monitor, processor and printer—go on top. The processor could also go on the floor, either in the

CASE-SIDE ASSEMBLY

The case sides are frame-and-panel construction, with thumbnail moldings on the inside edges of the frames. The panels have the bevel facing inward, in the Shaker style.



Drawings: Bob La Pointe; photos, facing page: Michael Pekovich

Dovetails and dadoes with one jig. *A router outfitted with a guide collar rides in a long jig placed squarely across the cabinet side.*

First, rout in from the front and back to cut the dovetail sockets. *Clamp a square of plywood to the jig to act as a stop.*

footwell or up on brackets. Wires are bundled and routed out of the way.

When it comes to computer desks, think function first

This is a classic case of inside-out design: Begin with the function and work from there. The height is 30 in., though tall people may want to add an inch or two. The keyboard pulls out at approximately 26 in., a comfortable height. The length of the desk is 60 in. but could be extended. Stretchers support the legs at the open end and tie the design together by continuing the lower line of the cabinet.

In keeping with a Shaker aesthetic, the cabinet and doors are of frame-and-panel construction with thumbnail molding (also called sticking) on the inside edge of the frame. Classic Shaker style almost always left door panels flat (with the beveled side facing inward). The desktop edge gets a slight bullnose profile. In a departure from the Shaker style, I used brass knobs.

An additional work surface pulls out to the right, closer at hand than the desktop when you are using the keyboard (lefties might want to reverse the entire desk). The pencil drawer, not covered by the doors, is easily accessible.

I chose bifold doors over single or double doors. A single door would stick out too far when open, which it often will be when you are working at the desk. And double doors would block access to the cabinet from a sitting position.

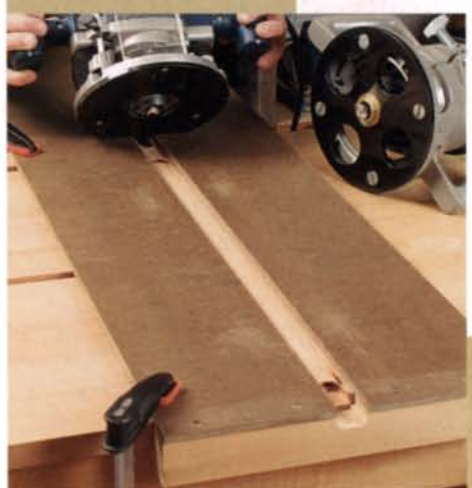
Behind the doors are two small drawers above a file drawer. The top drawer holds paper, print cartridges and the like, or even a flatbed scanner. The middle drawer can hold CDs and other supplies. The file drawer is the lateral type, easier to access while seated at the desk. Closing the doors covers up all of this neatly. The drawers are hung on full-extension slides. These screw-mounted commercial slides allow the components to be moved easily in the future. I used finger joints in the drawers, which are easier to make than dovetails and are in keeping with the utilitarian nature of this desk.

A wood keyboard tray is mounted on special pull-out hardware that's attached to the underside of the desktop. The tray is hidden behind a drawer front that folds down.

Construction starts with the cabinet

The basic structure is a table, with a cabinet for one end instead of legs. Because the cabinet is the most complex part, it is a good place to begin construction.

The two side assemblies are joined together by internal frames, top and bottom. The bottom one has dust panels, while the



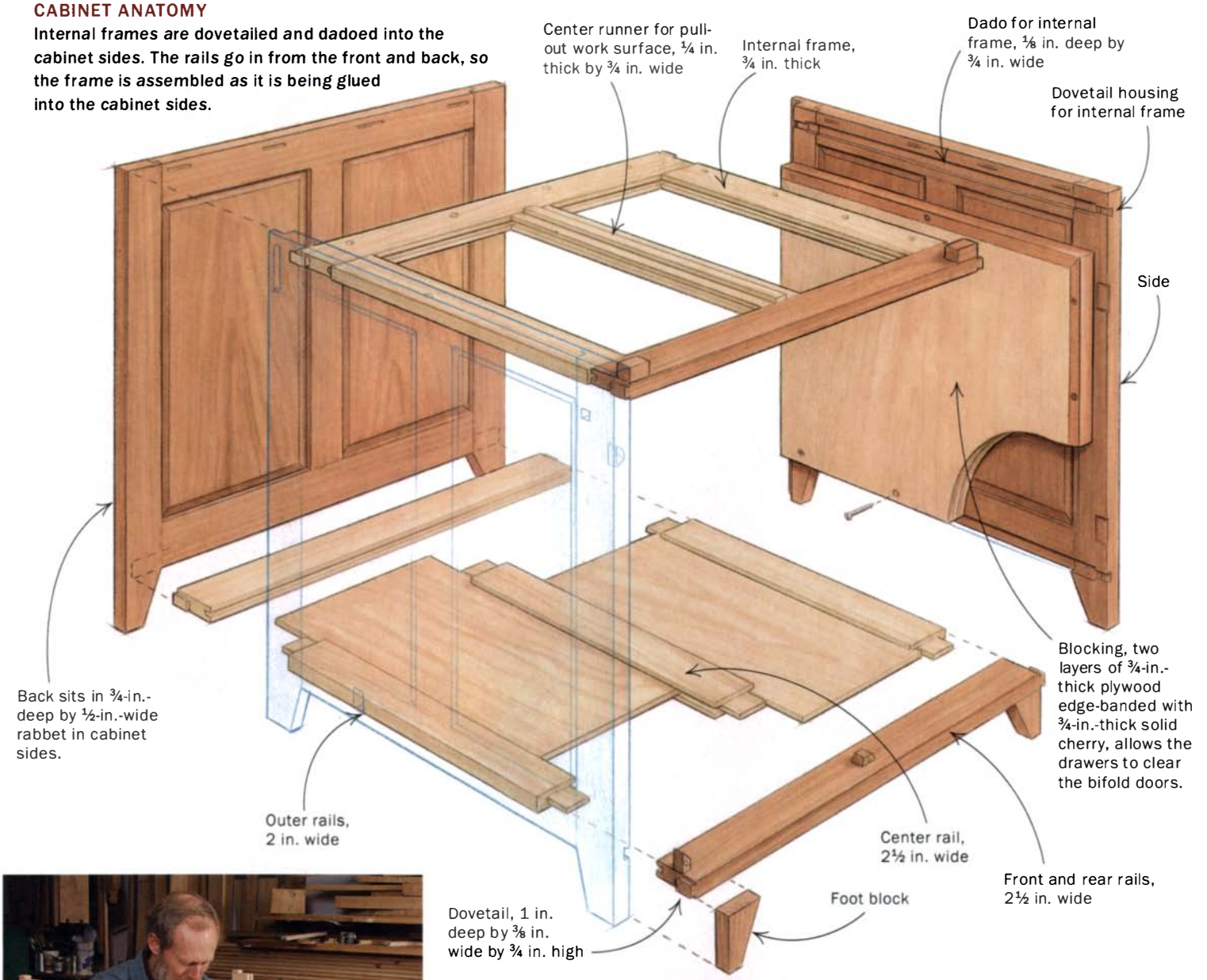
Rout the long dado next. *Use a straight bit to rout a shallow dado that stops at each dovetail socket.*

Dovetail the front and rear rails on the router table. *Set the depth first, then move the fence gradually to creep up on a perfect fit.*

Photos, except where noted: Asa Christiana

CABINET ANATOMY

Internal frames are dovetailed and dadoed into the cabinet sides. The rails go in from the front and back, so the frame is assembled as it is being glued into the cabinet sides.



Order of assembly. *Insert the front rails into one side (left), then the other (center). Press the front-to-back members into their dadoes, add the dust panels to the lower internal frame, and tap in the rear rails (right). Make sure the cabinet is square, then glue in the back.*

upper one serves as support for the pull-out work surface.

While you are making the frame-and-panel sides, make one for the back as well. I left the back frame unmolded to keep the joinery simple. As an alternative, you can use high-quality plywood for the back.

All of the drawers are side hung, as previously mentioned, using full-extension, ball-bearing slides. The finger joints are neat, strong and can be cut quickly. Of course, you can dovetail the drawer boxes if you want. The pencil drawer has an applied front, which covers the slides and is easier to align in the opening.

The pull-out surface is sandwiched between the desktop and the upper internal frame and is guided by a groove on its underside, which rides on a runner applied to the internal frame. The surface is less than full width (with small filler blocks at the front edge) to allow access to the fasteners that will attach the desktop to the case.

Order of construction—First assemble the two frame-and-panel sides. The panel grooves in the stiles are stopped at the mortises so they don't show when you cut the leg taper. The thumbnail molding is mitered where the rail and stile join, and the tenon shoulders are offset as shown.

Next, cut the dovetail sockets and dadoes in the cabinet sides to receive the internal frames (see the photos on p. 44). For this I set up two routers with guide collars—one with a straight bit for the dado and the other with a dovetail bit—both guided by the same jig. This job can be handled with one router, though; just leave the jig in place and go back and forth between bits.

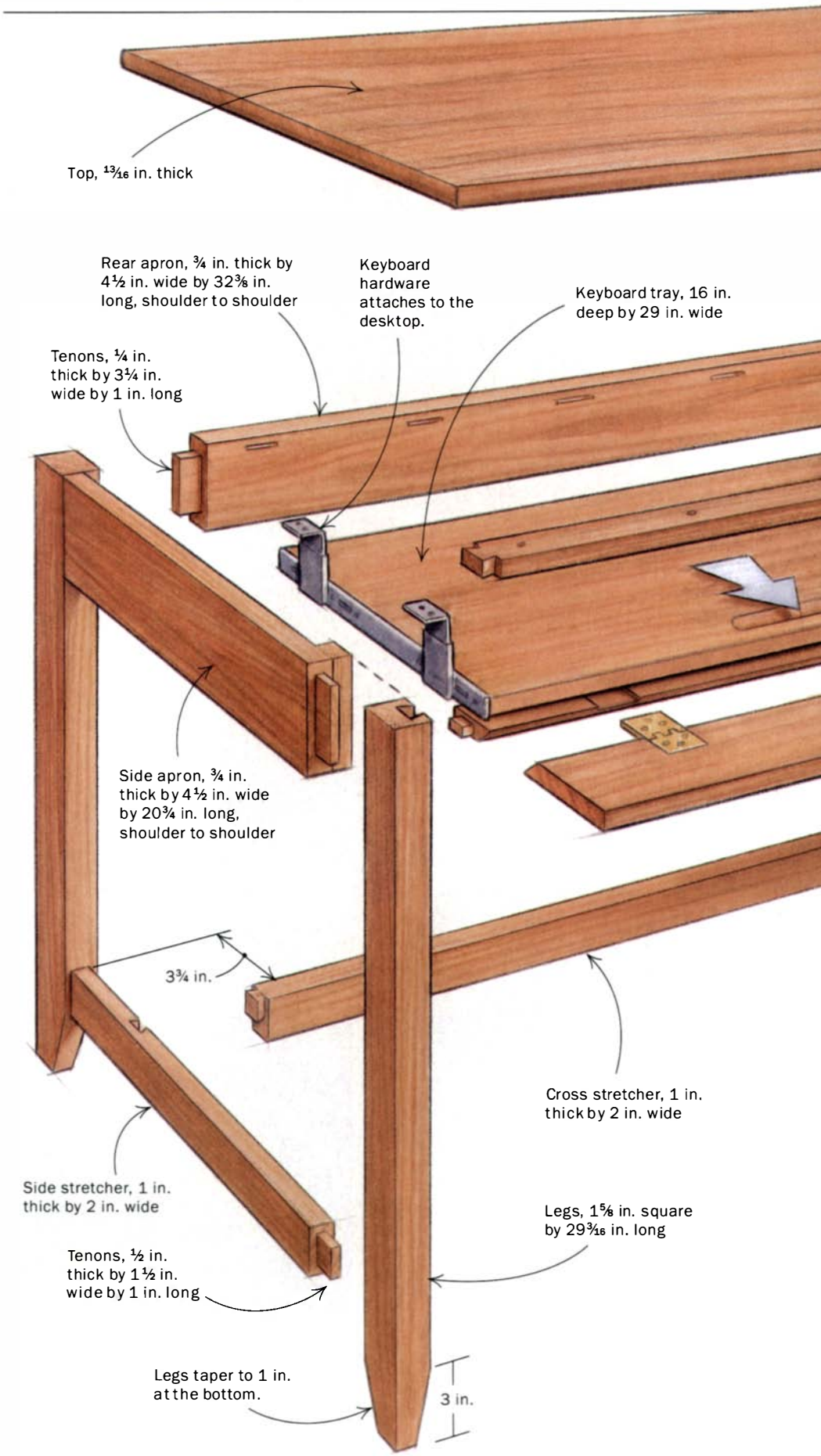
Next, make the internal frames the same thickness as the dadoes—try for a press fit.

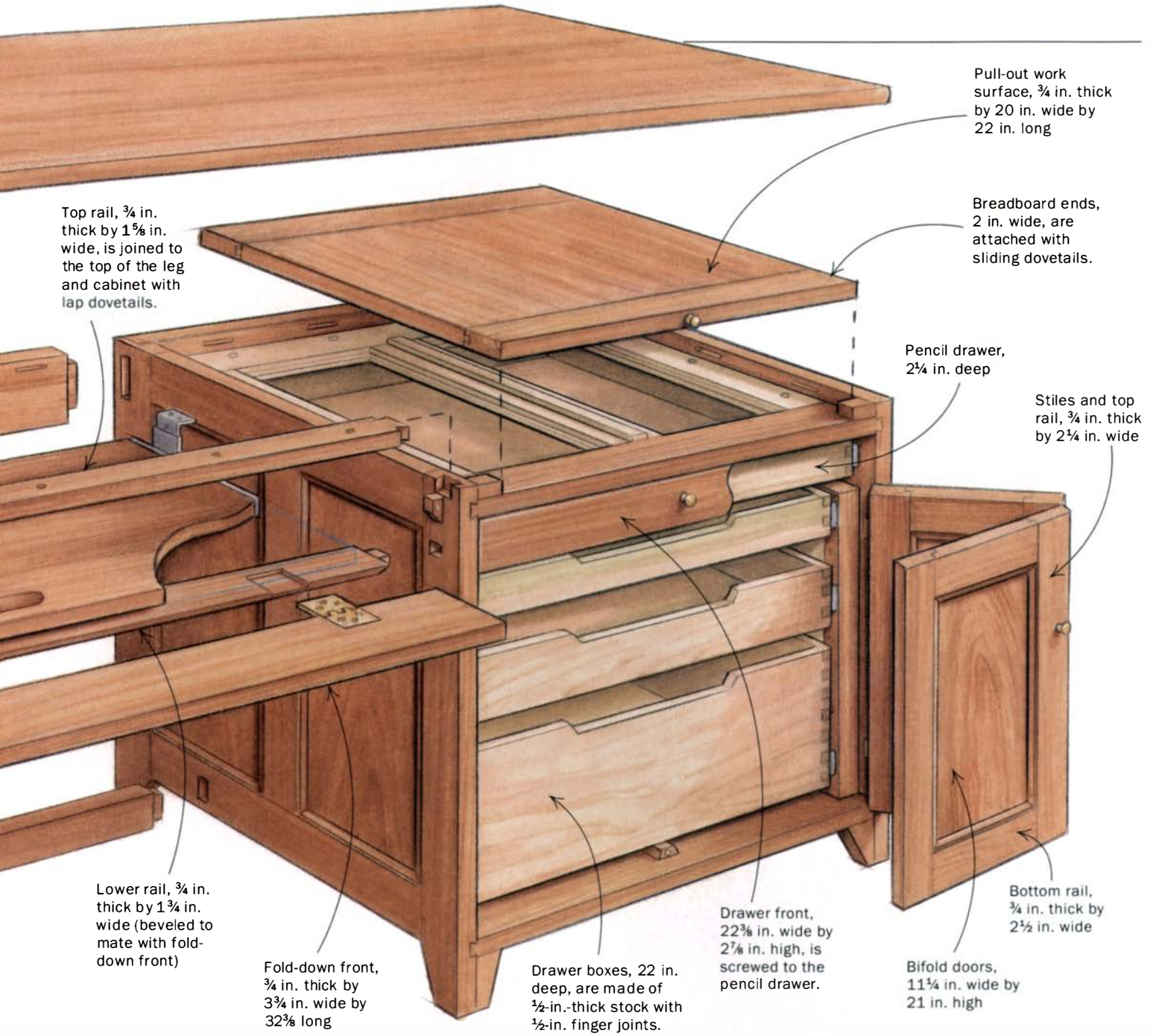
Before assembly, cut slots in the cabinet sides to accept the desktop fasteners (buttons or clips), and drill access holes in the upper internal frame so that you can get at the fasteners with a screwdriver.

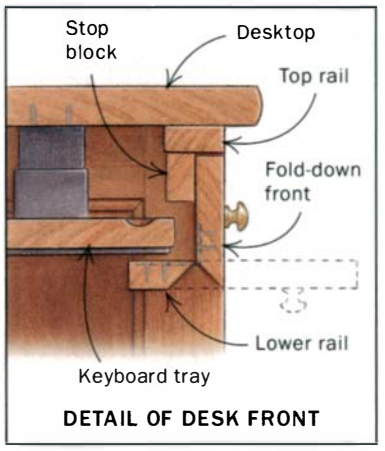
Build the rest of the base

With the back installed, you are ready to begin building and attaching the open side of the base. Cut the mortises in the cabinet for the cross stretcher and rear apron. The stretcher tenon will be wedged inside the cabinet, so the bottom rail of the cabinet side needs a through-mortise. Moving to the far left side of the base, make up the legs with the necessary joinery. Glue up

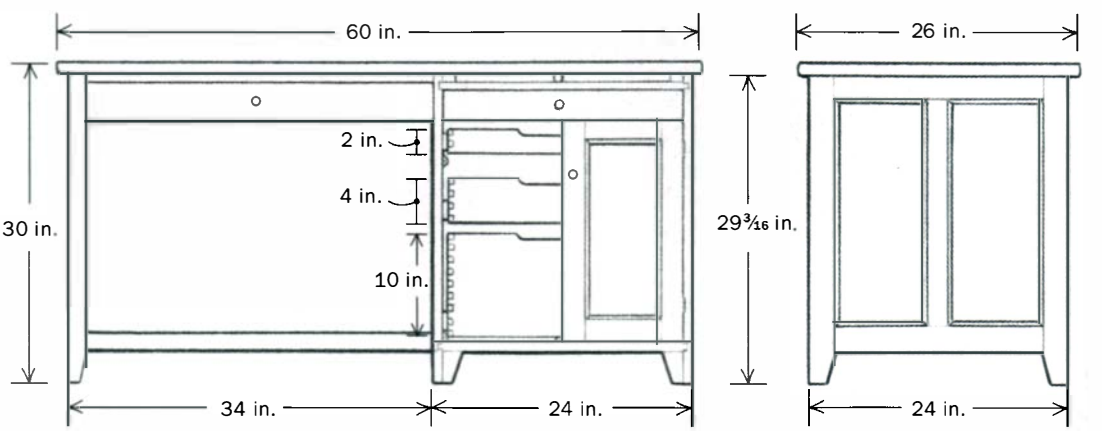
OPEN BASE AND CABINET INTERIOR







DETAIL OF DESK FRONT



OPEN-BASE ASSEMBLY

Before assembly, install the drop-leaf hinges in the lower rail. *Extra clearance is needed for the hinge barrel. Detach the fold-down front before installing the rail.*

the two legs with their shared stretcher and apron.

Cut the joinery in the open-base assembly for the various cross members. Because the lower rail—the one that will hold the keyboard front—must be set back and beveled, you will need to glue a block to the front of the side apron to accommodate its mortise. This rail is through-tenoned and wedged into the cabinet, like the cross stretcher.

Before assembling the base, mortise and fit the drop-leaf hinges on the fold-down drawer front and the lower rail. Now you are ready to put this whole piece together. You should work on a surface that is large enough yet flat. I sometimes put a sheet of medium-density fiberboard (MDF) on the bench or floor for such a task. Before beginning, I also recommend unplugging the phone, turning off the radio and invoking the appropriate spirits.

Lay the cabinet on its side. Insert the rear apron, the cross stretcher and the lower front rail into their mortises in the open-base assembly and then into their mortises in the cabinet. Flip the entire base onto its feet, draw the joints home with clamps and square it all up. Use a straightedge to check that the cabinet front and the front rail are in the same plane. Wedge the two through-tenons from inside the cabinet.

Attach the lower rail, stretcher and rear apron to the leg assembly first. *The top rail goes in afterward.*

Now attach the open-base assembly to the cabinet. *This is easiest to do with the cabinet on its side.*

Last, scribe the joinery for the top rail. *It has lap dovetails on both ends, which are let into the top of the cabinet and the front leg.*

There still is one rail to be attached. The top rail is joined to the legs and cabinet with lap dovetails. Make the rail, and then use it to scribe its dovetail sockets in the cabinet and legs. Chop out these sockets. Before gluing in the top rail, drill and countersink holes in it for attaching the desktop.

I chose two methods to attach the top. I used screws through the top rail, as just mentioned. I also used wood buttons or metal S-clips inside the cabinet and the back and side table aprons. These are accessed in the cabinet area through holes in the upper internal frame.

Apply a finish and add final touches

Handplane surfaces, if possible, to clean them up. That, combined with a cabinet scraper, removes the machine marks. As the project progresses and parts are ready for assembly, knock off edges with a block plane, though not where that would leave a gap at a flush joint. After assembly, finish knocking off edges and do a final sanding with 220-grit paper.

For this cherry piece, I chose an oil finish, which is excellent for bringing out cherry's rich, mellow tone. I prefer an oil-varnish mix, which gives a bit more surface durability and is easy to wipe on and repair. You can mix your own, though for years I have used Minwax Antique Oil with satisfaction. If you want a more durable work surface, use varnish. I have read that lacquer and plastic will stick together over time, making lacquer a poor choice for a computer desk.

Wire management deserves attention. The wires that come out the back of components can go through a hole in the desktop, or you can route them over the back. There are many gizmos on the market today to accomplish this: pop-up outlets, grommets and the like (Rockler Woodworking and Hardware is a good source for this stuff). Then you can mount a power strip/surge protector in the footwell, high on the cabinet wall. Harness clips or wire channels can keep the wires bundled and out of the way. If you keep a scanner or other component inside the cabinet, drill a hole in the cabinet side or bottom to run wires. Leave enough slack so that the tray can be pulled out easily. Bear in mind that the age of wireless connections is coming quickly, and we may soon outgrow these bundles of wires.

I encourage you to think through this design for yourself and adapt it to your ideas and needs. The aim here is to build a piece of furniture that will serve your work habits and adapt to changing technology while being a pleasure to live with. □

Charles Durfee is a furniture maker in Woolwich, Maine.

SOURCES FOR HARDWARE

DRAWER SLIDES
Full extension, 22 in., ebony color, Model KV 8400
Woodworker's Supply (800-645-9292; www.woodworker.com)

KEYBOARD SLIDE
Variable height, 16 in., black color, Model KV 8150
Woodworker's Supply

BUTT HINGES
2 in. by 1½ in., "standard" finish, Part No. 142H5
Whitechapel Ltd. (800-468-5534; www.whitechapel-ltd.com)

DROP-LEAF TABLE HINGES
3 in. by 1½ in., "standard" finish, Part No. 166H17
Whitechapel Ltd.

KNOBS
Sold as desk interior knobs, ¾ in. (except ⅝-in. size on pull-out surface), semibright
Horton Brasses (800-754-9127; www.horton-brasses.com)

HOME-OFFICE HARDWARE
File-drawer fittings, wrist rest, media storage, wire managers, grommets
Rockler Woodworking and Hardware (800-279-4441; www.rockler.com)

TABLETOP FASTENERS
Rockler Woodworking and Hardware

Install the drawer-slide hardware. *Rest a piece of plywood or MDF inside the cabinet to locate each pair of slides. Start with the highest slides and then trim the plywood to locate each set below.*

Attach the desktop and the keyboard tray. *It is easiest to do this with everything turned upside down. Mount the hardware on the keyboard tray before attaching it to the underside of the desktop.*

Choosing a Compressor

The way you work and the tools you use determine your air-supply needs

BY ROLAND JOHNSON

In my custom woodworking shop, the first tool that gets powered up in the morning is the air compressor. It is also the last to be switched off after I have blown the day's dust off me with an air gun. In between I use air power for nailing, sanding, spraying, grinding and even vacuum-pressing.

Many woodworkers are skeptical about air-powered tools and the accompanying compressor. Their only encounter may have been at the local service station, where the mechanic uses a screaming air-powered wrench to put the nuts back on a wheel of a car with gorilla-strength torque, while a huge compressor clatters away in the corner.

This experience may have led to the belief that to use any air tool other than a brad nailer requires a compressor with at least a 6-hp pump and a 60-gal. or 80-gal. tank. If you are a full-time woodworker planning to do a lot of air-powered sanding or to finish large projects with a high-pressure spray gun, then you will need one of these larger compressors. But if you are a weekend hobbyist, and you select your air tools carefully, a small or medium-size compressor may fit the bill.

The parts of a compressor

Before deciding how big and how powerful a compressor to buy, it is helpful to understand how a compressor works and what variations are on the market. Most compressors have an

HOW MUCH AIR DO YOU NEED?

Different tools require different volumes of air. Decide what kinds of tools you'll use, research the air consumption of individual models and then select a compressor that can supply that demand.

SMALL COMPRESSORS

Designed to be carried around construction sites, these machines supply enough air to power two framing nailers simultaneously. Some small compressors can supply almost the same volume of air (cfm) as midsize machines. However, their small tank size makes them unsuitable for high-consumption air tools, and running small compressors constantly may wear them out prematurely.

MIDSIZE COMPRESSORS

Typically set on wheels but too heavy to lift, these machines can be moved around the shop and connected to tools with a flexible hose. The tanks are mounted horizontally, for stability, or vertically, which is increasingly popular because the machines occupy less floor space. These machines can supply enough air to satisfy the needs of most amateur one-man shops that use low-air consumption sanders, nailers and sprayers.

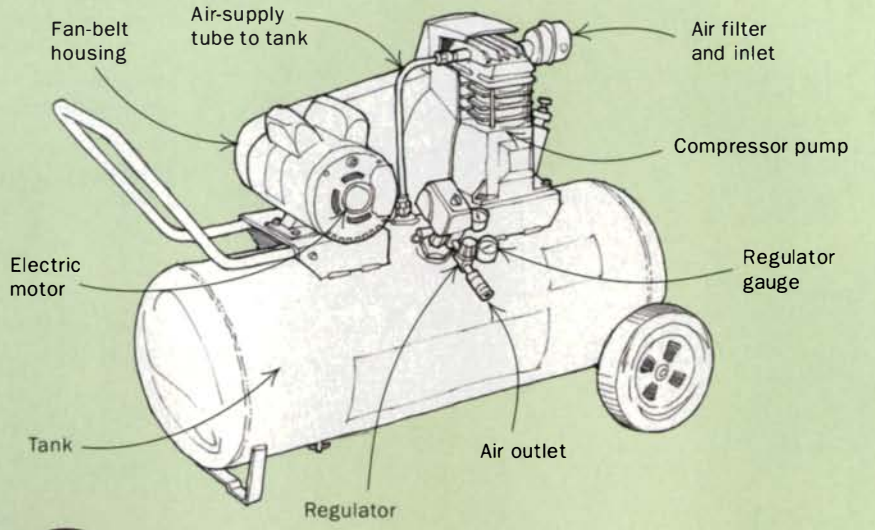
Photos: Mark Schofield

electric motor that powers a pump. Air is compressed by the pump to its maximum output pressure and is stored in a tank. Some compressors have rotary-screw pumps or rotary-vane pumps, but most machines have piston pumps, and I'll focus on these.

Single-stage and double-stage pumps— A single-stage pump compresses air with a single stroke of the piston. A two-stage pump compresses air partway with one piston; the air then is delivered to another cylinder where it is fully compressed.

A two-stage pump offers a number of advantages over a single-stage pump: Higher pressures can be achieved with less horsepower than with a single-stage pump. The same-size storage tank can hold 30% more air when compressed to 175 psi than it does at 125 psi. This means that the pump will not have to run as often to replenish the tank, prolonging the life of the pump. Because a two-

Compressor parts and terminology



CFM (cubic feet per minute) The unit of measure representing the volume of air.

CFM delivered The actual volume a compressor produces.

Duty cycle The amount of time a compressor can run in relation to the time that it needs to rest, usually measured over a 30-minute time span. For example, a compressor rated at 30% duty cycle can operate for nine minutes at full load, then rest for 21 minutes without creating excessive wear.

PSI (pounds per square inch) The unit of measure for air pressure.

Single-stage pump Air is compressed by a single stroke of the pump's piston before going into the storage tank.

Two-stage pump Air is compressed from initial intake pressure to final maximum-output pressure in two stages. A large piston compresses the volume of air, and a second piston, half the size of the first piston, compresses the air a second time before it is sent to the storage tank.

LARGE COMPRESSORS

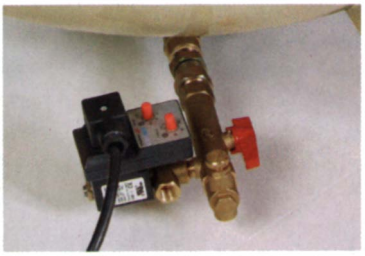
The advantage of large compressors is that they can run continuously, known as a 100% duty cycle (see the glossary at right). They can power high-pressure spray guns, high-consumption sanders or several less power-hungry tools at once. Most machines in this category require a 240-volt power supply, and because they are stationary, they probably will need permanent plumbing to supply air in all but the smallest shop.

Drawing: Jim Richey

WHAT YOU GET FOR YOUR MONEY

For about $500, you can buy a 60-gal. compressor, which provides an air supply that will satisfy most tools an amateur woodworker would use. For four times the money, an industrial-quality, 80-gal. machine provides a 100% duty cycle (see the glossary on p. 51) to run high air-consumption tools all day.

Blowing hot and cold. *The Ingersoll-Rand cools the hot air from the pump before it enters the tank. This reduces condensation inside the tank.*



One less chore. *Tanks should be drained after each day's use to avoid rusting. Some high-end machines drain automatically.*

stage pump runs slower, it is considerably quieter than a single-stage pump of a similar size and lubrication. A two-stage pump also runs cooler, resulting in less condensation when the warm air reaches the cold steel of the storage tank.

Oil-lubed vs. oilless pumps—In many ways compressor pumps are similar to internal combustion engines: Both require some means to reduce friction among the moving parts. An oil-lubed pump has a crankcase containing oil to lubricate the crankshaft and the rod bearings. An oilless pump has sealed bearings on all of the reciprocating parts and Teflon-impregnated piston rings to reduce friction against the cylinder walls.

The oilless model has the advantage of eliminating the possibility of contaminating the compressed air with oil. It also requires less maintenance, usually costs less and doesn't require a level surface to lubricate correctly. According to one manufacturer, oilless compressors now account for more than 75% of the compressors sold in the United States. Manufacturers now claim that the life expectancy is similar to that of oil-lubed models, and that the pumps can be rebuilt just as easily. About the only drawback of oilless models is that they're louder than oil-lubed pumps.

Tank sizes and configuration—Storage tanks are oriented either horizontally or vertically. Vertical tanks have small footprints: I replaced my 40-gal. horizontal-tank compressor with an 80-gal. vertical model and gained floor space in the shop.

Another advantage of a vertical tank is that the condensation in the tank accumulates at the bottom, farther from the air outlet than it would be in a horizontal tank. That means there's less chance of water getting into the delivery system. It also is easier to drain the water completely from a vertical tank. A horizontal tank can be placed on a shelf or stashed under a workbench, but leave enough space around the pump for adequate cooling airflow.

The bigger the tank, the less condensation you are likely to have. Hot air from the compressor entering a large tank has more room to mix with the existing cool air before it encounters the cold walls of the tank. Another advantage of a larger tank is that the compressor will not have to run as often, keeping the pump cooler.

Same size, different appetites. *These are all 6-in. random-orbit sanders, but their rated air consumption ranges from 8 cfm to 24 cfm. Unless you are buying a large-capacity compressor, pick your tools carefully to make sure you have enough air to power them.*

Compressors fall into three ranges

For this article I obtained a variety of compressors ranging from 2 hp to 6.5 hp, with tanks ranging in size from 4 gal. to 80 gal. The pumps included oil-lubed and oilless versions, one- and two-cylinder pumps, and single- and two-stage pumps. The idea was not to perform a traditional tool-comparison test but to understand the capabilities of each group of compressors,

whether design differences affected performance, and what tools would work with each size of compressor.

Small compressors: portability comes at a price—In some ways the only thing small about these compressors is their tank capacity. The small and midsize Craftsman compressors illustrate this point: The midsize unit has a 3.5-hp pump, a 25-gal. tank and yields 5.1 cfm of air at 90 psi; the small unit has a 3-hp pump, a 4-gal. tank and yields 5.7 cfm of air at 90 psi.

However, small compressors are not meant for use with sanders or spray equipment. These machines are not designed to run constantly, and doing so will heat them excessively, shortening their lifespan.

Midsize compressors: all you need for occasional use—Like their smaller brethren, these compressors would have to run constantly to supply a sander, so I asked an engineer who works for one of the manufacturers whether this would damage the machines. He said that the workload demanded by most amateur woodworkers would not cause the pump to run more than 50% of the time. Large machines can run 100% of the time, known as the duty cycle (see the glossary on p. 51), but small and midsize machines should not exceed 50% duty cycle.

If you are going to push these compressors, you may want to purchase a two-stage pump or a slower-running single-stage machine, which are considerably quieter and should last longer.

Large compressors have air to spare—The two large-capacity machines I looked at represent both ends of the spectrum. The headline horsepower of both machines demonstrates that a better measure of their true power is the amp rating. The Campbell Hausfeld's 6.5-hp motor is rated at 15 amps, while the 5-hp Ingersoll-Rand's motor is rated at 28 amps. The former can produce 10.2 cfm of air at 90 psi, while the latter pumps 17.1 cfm of air at 90 psi.

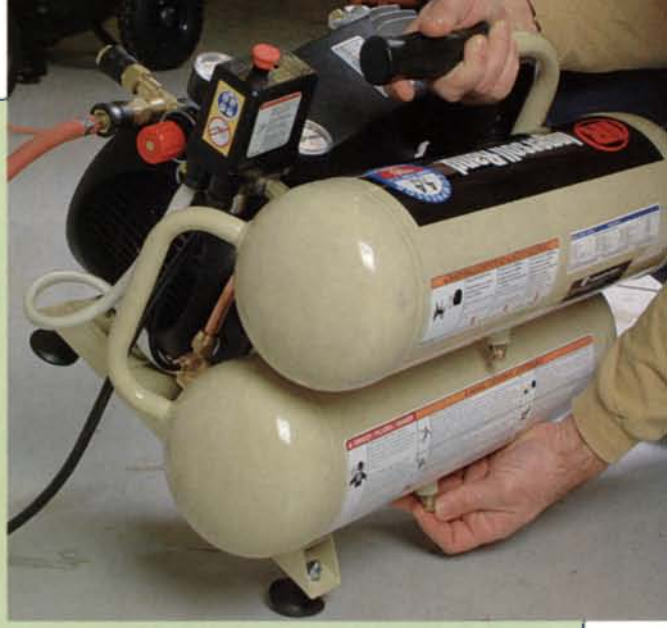
As with most tools, you get what you pay for. But before you decide which compressor to buy in any size category, it pays to think about what air tools you'll need and how intensively you'll use them. □

Roland Johnson is a professional woodworker in Minnesota.

Maintaining a compressor

Compressors tend to be pretty forgiving machines, but a little basic maintenance will keep a compressor running trouble free for years.

Water is a real killer of compressors: Left standing in a compressor tank, water can rust the tank to the point that the walls become dangerously thin or develop pinhole leaks. Excess water in the tank also is more apt to find its way into the delivery system, contaminating spray equipment and finishes and causing problems with pneumatic tools. Water never should be left in a tank that is exposed to freezing conditions.



Drain the water. *Heated compressed air condenses moisture on the cool tank walls. To avoid rust inside the tank, water should be drained by releasing the valve until only air comes out. Vertical tanks are easier to empty because the drain is on the bottom.*

REGULAR OIL CHANGES

Under normal conditions, change the oil at least twice a year on oil-lubed compressors. There are two conditions that demand more frequent oil changes: If the compressor sees severe duty, excessive heat can cause the oil to break down, inhibiting its lubricating ability. The by-products of this breakdown are acids that can cause premature wear of reciprocating parts. The second condition for more frequent oil changes is if the compressor is used in damp areas or in places where the temperatures fluctuate drastically, like in an occasionally heated shop in northern climes. Condensation can occur in the crankcase, inhibiting the oil's lubricating ability and even causing rust in the crankcase if the unit sits idle for long periods of time.

Check the oil. *Although they don't burn oil, oil-lubed compressors gradually transfer some oil into the air tank. Check the oil level regularly.*

COMPRESSORS NEED TO BREATHE

Change or clean the intake-air filter regularly. The often dusty conditions in a shop can quickly plug intake filters, resulting in a loss of efficiency and increased pump heat. Some companies offer retrofit kits with larger air filters that help a lot in dusty conditions.

Check the air filter. *Most compressors have an air filter made from pleated paper that is easily accessible for checking and changing. Some models have foam filters.*

Lamination Bending

Produce strong, tightly bent parts with minimal springback

BY LON SCHLEINING

Classic curve. *The graceful aprons on this maple table were curved using lamination-bending techniques.*

When it comes to making curved furniture parts, woodworkers have several options: They can cut or shape the curve from a single, thick piece of wood, or they can steam the part to make it pliable enough for bending. Some woodworkers cut a series of thin sawkerfs into the back of a piece of wood to make it bendable. And finally, there is lamination bending.

For many applications, I find that lamination bending—in which thin plies of wood are glued up on a curved form—is often the best method. It uses material efficiently and produces tight curves with little springback.

Lamination bending is very economical

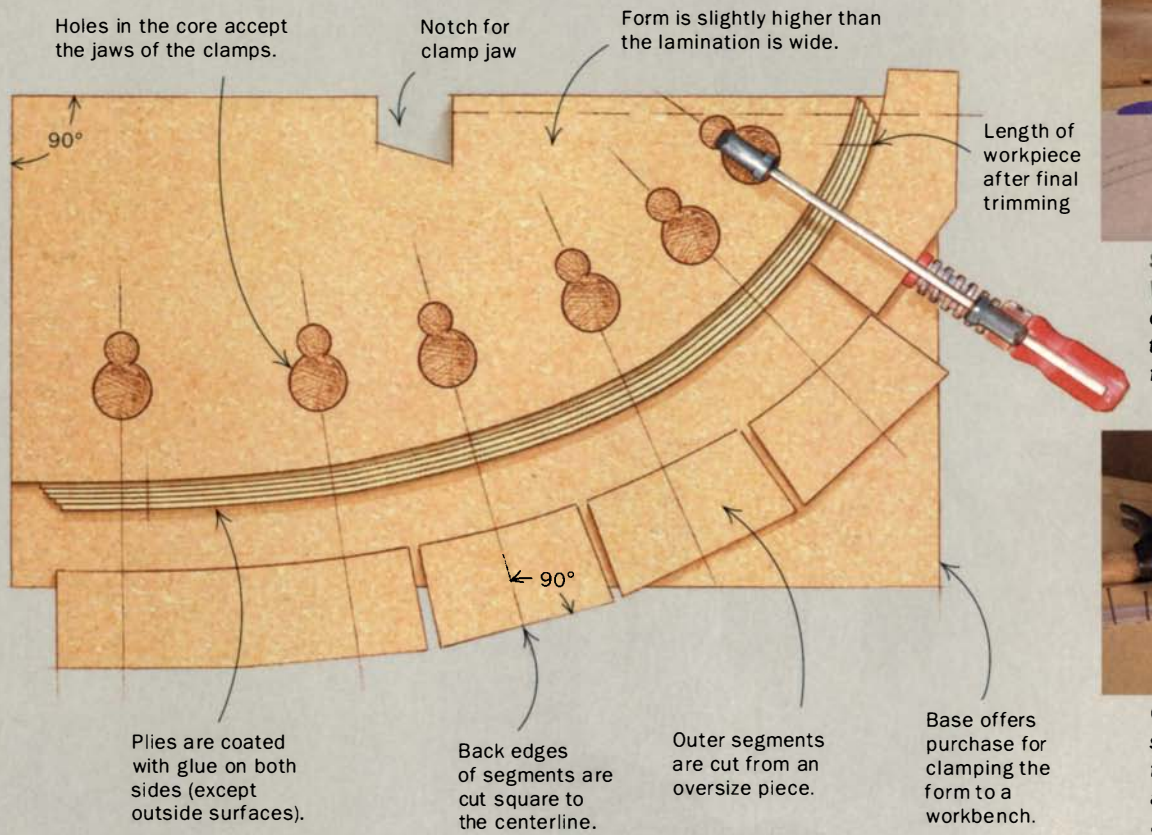
The procedure is simple. Glue is applied to all of the plies, then they are stacked and clamped around a curved form. The piece ends up with the same curve as the form.

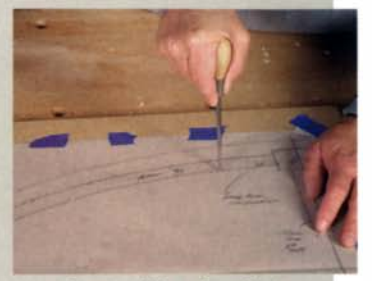
This technique is a good way to bend woods that feature interesting grain patterns, like curly or bird's-eye figure. You pay a premium for such wood, so cutting the curved piece from a single

Photos, except where noted: Tom Begnal

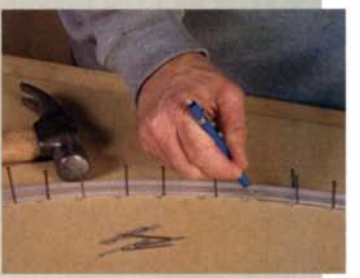
A FORM PRODUCES IDENTICAL CURVED PARTS

Mimicking the shape of the curve, the bending form consists of a core made from several layers of MDF, plus several outer segments that work like big clamp pads.





Start with a drawing. *With the full-size curve on paper, use an awl to transfer the curve to the first layer of the form.*



Connect the dots. *A series of nails holds a flexible ruler in place along the awl marks as Schleining scribes the curves.*

thick board can get rather expensive. And that fancy grain doesn't hold up well to the stresses of steam-bending. But by gluing up a stack of plies to make a curved piece, you need only use the figured wood for the show side of the workpiece. The inner plies can be any straight-grain wood. You end up with a strong part that looks like a solid piece of expensive wood.

A form supports the bend

To control the shape of a bend until the glue dries, you'll need a bending form. A typical form consists of a solid core with several outer segments. The core, often called the male form, matches the inside shape of the bend, while the outer segments, the female forms, match the outside shape of the bend. Particleboard, plywood and medium-density fiberboard (MDF) all are acceptable materials for making a form.

When clamped to the plies placed on the core, the outer segments serve as clamp pads, distributing the pressure evenly along the full length of the workpiece. With this method, all of the laminations end up squeezed tightly together, ensuring a good glue bond.

The height of the form should equal the width of the laminations, plus a bit extra. Generally, that means you'll need to face-glue several pieces of MDF.

But before making the form, two curves must be drawn full size on paper: One line represents the inside curve of the lamination; a second line parallel to the first represents the outside curve.

Once the curves have been drawn, tape the paper to a single piece of MDF that's a few inches wider and longer than the curve. Transfer the inside curve to the MDF using an awl. Punch a hole through the line on the paper and into the MDF every inch or so along the full length of both the inside and outside curves. Remove the paper and connect all of the holes to create a smooth curve.

A piece of thin plastic or wood batten comes in handy here as a flexible ruler. To make the process easier, use a few small nails to position the ruler exactly on the curve. Once everything looks okay, use a pencil to scribe a line along the full length of the curve. Then repeat the process for the outside curve.

Next, use the bandsaw to cut just slightly on the waste side of the two lines. You end up with three pieces: one for the core of the form, one for the segments and a waste piece from the middle.

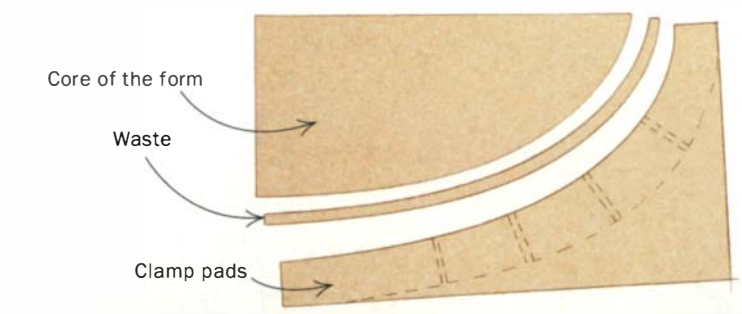
Now sand the curved edge of the core exactly to the line (I use a belt sander on edge). The inside curves on the segment piece are shaped to the line with a half-round file and then smoothed with sandpaper.

Use the first layer as a template to scribe the two curves on all of the remaining layers, then cut them out a bit on the waste side, just as you did on the first one. Now you're ready to trim the edge flush using a router and a flush-trimming bit. For applications like this, I like a bit with a shank-mounted bearing because it's easier to see

Drawings: Melanie Powell

THE FORM TAKES SHAPE

After cutting on the bandsaw, three parts are left. The large section is the core of the form, and the bottom piece is used for clamp pads. The middle section is discarded.



Smooth the curve. *With a belt sander on its side and secured in place, Schleining smooths the curve of the core of the form.*

Trim subsequent layers of the form flush to the first. *With the first layer of the core serving as a template, use a router and flush-trimming bit to bring the additional layers flush to the first.*

that the bearing is staying in contact with the template. Also, it vibrates less than a typical end-mounted flush-trimming bit.

Fasten the template to the first layer with a couple of screws. Then trim it flush using a router. Repeat the process for each layer, using the original template to guide the router.

Once all of the layers of the form have been cut out, glue and screw the pieces together, taking care to make sure the edges remain perfectly flush. When completed, you'll have two parts: the core and the segment piece.

Now use the bandsaw to cut the segment piece into several parts. On each segmented part, the edge opposite the curve is cut square to the centerline for better clamp alignment. Cut out about ¼ in. between each of the segments to provide adequate clearance.

Next, drill holes for the clamps in the core. Then add a base piece to the core, which will make it easier to clamp the form to a workbench. To complete work on the core, use wide cellophane tape to cover all of the surfaces that might see glue squeeze-out. Without the cellophane, the lamination would likely end up glued to the form.

For tight bends, use thinner plies

With the form completed, you need to determine the thickness of each ply. A general rule of thumb applies here: As the desired bend gets tighter, the plies must get thinner. When the plies are the correct thickness, springback becomes inconsequential, and failure due to splits or cracks is rare.

Fortunately, there's a foolproof test that can provide the correct ply thickness in short order. First, though, you need to cut a piece of stock to the same length and width as the lamination. Any thickness will do. Then plane one face flat.

As a starting point for determining the thickness, I usually set the bandsaw to make a resawing cut just slightly more than ⅛ in. thick. Then, with the planed face against the bandsaw fence, I cut a test piece.

The bandsaw leaves one side of the test piece with a rough surface. The test piece is too thin and flexible to run through the thickness planer without additional support. So I use double-sided tape to secure it temporarily, smooth side down, to a piece of melamine. Then, with the test piece attached and the planer set to make the lightest of cuts, run the melamine through the thickness planer to smooth the remaining side of the test piece to about ⅛ in. thick.

Next, place the test piece against the face of the core and try to bend the piece around the form using only a few fingers to apply moderate pressure. If the test piece bends, it is thin enough. However, if the test piece is hard to bend and feels like it might crack, it's too thick. In that case, remount it to the melamine and plane a little more off the thickness. Continue testing and planing until the test piece makes the bend.

At this point you'll need to determine how many plies you need to make the lamination. The process requires only a dial caliper and a little math. First measure the thickness of the test piece in decimals. Then divide the desired thickness of the lamination by the thickness of the test piece. For those like me who are numerically challenged, here's a numberless technique that also

THE PLIES TAKE SHAPE

HOW THICK? HOW MANY?

First, determine the proper thickness of the individual plies by bending a test piece around the core of the form. Plane the test piece until it can bend easily to the shape of the curve with only light finger pressure.

Second, determine how many plies you need. Measure the thickness of the test piece in decimals with a dial caliper. Then divide the desired thickness of the lamination (in decimals) by the thickness of the test piece. For example, a ¾-in.-thick lamination (0.750 in. in decimals) using a test piece 0.075 in. thick, divide 0.750 in. by 0.075 in. to get 10. The result: 10 plies to make a ¾-in.-thick lamination.

works. Simply bundle sample pieces together until you get the desired lamination thickness.

Milling the plies—Once the ply thickness is known, you can go ahead and cut all of the plies. First, rip stock to a little wider than the workpiece to allow for trimming after the part has been bent.

Next, crosscut the stock to length, keeping in mind that it's generally best to cut the plies several inches longer than the finished part. The lamination will be trimmed to final length after bending.

With all of the stock cut to rough length and width, it's ready to be resawn. Set the bandsaw fence to cut the stock just slightly thicker than the thickness of the test piece. Before starting, make sure the stock has both faces planed flat and parallel. Place the face of the stock against the bandsaw fence to cut the first piece. Before cutting the next ply, run the stock through the thickness planer to smooth the bandsawn face. Repeat the process until all of the plies have been resawn, each with one smooth face and one rough face.

To complete work on the plies, mount each one smooth side down to the melamine with double-sided tape. If the plies are narrow enough, two or more can be aligned side by side. Then, taking very light passes, plane each piece to the same thickness as the test piece. A drum sander also may be used to thickness stock.

You need to work quickly during glue-up

It's best to glue all of the plies in one operation. Apply glue to both sides of each one except, of course, for the two outside surfaces. The goal is to coat all of the surfaces completely. A pair of lightweight rubber gloves will help keep glue off your hands.

You'll want to work quickly because the glue has a very limited open time. To help speed up the process, I lay all of the plies on plastic wrap before spreading glue on one side of all of the layers at once. Then, except for the two outside pieces, I turn them over, glued side down on the plastic, and coat the other side. It's tempt-

Resaw thick stock for the plies. *With the ply stock cut to rough width and length, use a bandsaw to resaw each ply to a thickness that's slightly oversize.*

Plane the plies to thickness. *Use double-sided tape to secure several resawn surfaces, face up, to a piece of melamine. After a few light passes through a portable thickness planer, the resawn surface ends up smooth, and the plies are reduced to the correct thickness.*

Photo, this page (bottom left): Rodney Diaz

GLUE UP THE PLIES

Spread the glue. *Use a notched piece of credit-card size plastic or wood.*

Stack the plies. *With the glue applied, the plies are stacked with all of the edges flush.*

Add the first clamp. *After placing the stack of plies in the form, install the first clamp while making sure all edges of the plies stay reasonably flush.*

ing to glue the layers just a few at a time, but I always glue the entire oozing bundle at one time no matter how many pieces.

Once the surfaces have been coated with glue, the plies are placed one on top of the other to form a single stack. Make sure the two uncoated surfaces are facing the outside of the stack. Also, you want all of the edges of the stack to be reasonably flush.

Clamp the plies in the form—Now comes the part that's most exciting—bending the plies. First, though, place the stacked plies, on edge, on the core of the form. Then start adding the clamps and the segments.

You have a couple of options when determining the clamping sequence. You can apply the first clamp at the lengthwise midpoint of the lamination and then add clamps as you work toward each end. Or you can start at one end and work toward the opposite end (as shown above). The point is to avoid adding a clamp between two clamps already tightened. Doing so might encourage a bump in the curve.

Either way, get the first clamp secured. And as you do, keep the edges of the plies reasonably well aligned. Then add the remaining clamps in sequence. As I work my

Easy applicator. *Teaming up a gun, glue cartridge and mixing nozzle, R.S. Hughes offers an easier way to apply epoxy.*

The right glue is everything

When lamination bending, I don't use either white or yellow woodworking glues because both of these glues remain slightly flexible, even when fully cured. That means, in time, they can allow the plies to slip a bit. Manufacturers call this "creep." The solution is to use glues that cure rock hard, so creep isn't a problem. Plastic resin glue is my first choice—although it takes longer to cure, it's less expensive than other creep-free glues. Vacuum Pressing Systems (800-382-4109) sells a two-part urea resin designed specifically for lamination bending. When pressed for time, I use an epoxy from West Systems (989-684-7286) that dries relatively quickly. And when convenience is a must, I use an epoxy system (left) from R.S. Hughes (877-774-8443) that includes an application gun and a long nozzle that mixes the glue as it travels to the tip.

Photos, this page (bottom left and right): Rodney Diaz

Once the first clamp is on, add the remaining clamps in sequence. *Schleining always leads with a loosely tightened temporary clamp to get the bend started.*

Tighten the clamps. *After adding the final clamp, give them all a final check for tightness.*

way along, adding and tightening clamps, I often keep an extra clamp on the plies. This loosely applied clamp, which is about a foot or so from the clamp being tightened, helps encourage the lamination to conform to the bend.

Once all of the clamps have been added, take a minute to make sure all of them are tight. When you're satisfied everything is snugged up properly, it's just a matter of letting the glue cure.

One last point. Big glue-ups like this always come with a certain amount of anxiety. But you can minimize the anxiety level by doing a dry run of the entire clamping process.

CLEAN UP THE EDGES

Smooth the edges—After the glue has dried, remove the workpiece from the form. Expect a fair amount of glue squeeze-out along the edges. Because the plies tend to shift a little during glue-up, the edges are going to be less than smooth. So the next step is to flatten, smooth and trim both edges to final width.

A handplane or belt sander makes short work of cleaning the glue, but they aren't the best tools for getting the two long edges of the workpiece straight and parallel. I get one surface as straight as possible and then send the workpiece on edge through my portable thickness planer. Depending on how much the workpiece is curved, it might have to be steered through the machine.

Take light cuts with the planer until the edge is clean, then turn over the piece and clean the other edge. Now keep taking cuts until you reach the final width. □

Lon Schleining (www.woodbender.com) is a contributing editor and author of The Complete Manual of Wood Bending *(Linden Publishing, 2002).*

One edge is handplaned. *When removed from the form, the edges of the workpiece are uneven and covered with glue.*

The other edge is smoothed by the thickness planer. *After the first edge has been handplaned reasonably smooth and flat, the opposite edge is planed using a thickness planer.*

Clamp Storage Solutions

Three woodworkers offer clever ways to keep clamps organized

Clamps are to woodshops what closets are to houses: You can't have too many of them. Band clamps, bar clamps, C-clamps, corner clamps, edge clamps, hand clamps, miter clamps, pipe clamps, quick clamps, spring clamps—you can pile them all in a corner or throw them into a drawer. Or you can organize them on a wall or a movable cart that will make them easy to get at when you need them and will keep them out of the way when you don't. What follows are examples of how some of our readers solved their clamp-storage problems.

Wall Rack

The wall of a lumber rack doubles as a place to store clamps

BY JOHN WEST

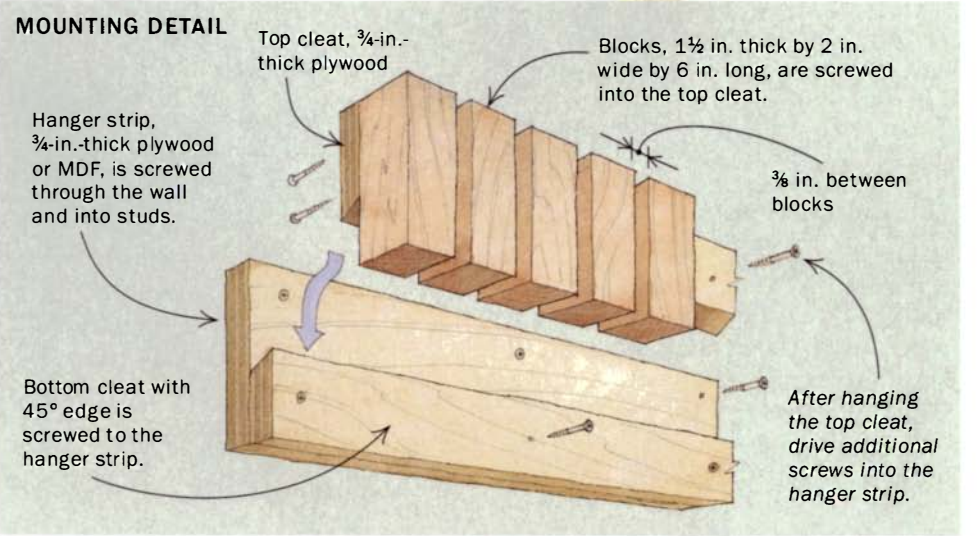
Having recently moved to a smaller shop, I had to find somewhere to store my fairly large collection of bar clamps and hand clamps. When considering where to put them, I decided against a fancy rack that rolls around the shop on casters because the floor space it would require is too dear. I wanted my clamps near the area where large glue-up projects will be done, but I also wanted to keep them out of the way when they're not needed. The solution was to hang the clamps on the outside wall of a lumber-storage rack. (In the business world, they call this "multitasking.")

The racks I designed are quite simple, and they can be used to store a variety of different-size clamps. First, securely fasten a ¾-in.-thick hanger strip (plywood or medium-density fiberboard) to the wall, using two screws at every stud location. This hanger strip serves two purposes: It's a sturdy anchor, and it adds depth for building out the rack enough to make a good ledge on which to hang the bar clamps. Along the bottom of the hanger strip goes another ¾-in. plywood cleat (what some people call a French cleat) with a 45° cut along the top edge. That bottom cleat gets screwed to the hanger cleat. Another matching plywood cleat with a 45° cut along the bottom edge has blocks of lumber screwed into the front face from behind; these blocks are spaced apart so there's room to hang the clamps on them. Nothing fancy—most of the racks I used were salvaged from my previous shop, where they've given 20 years of faithful service so far. Depending on the type of clamps, they will hang better facing in or out, because of how the weight is balanced. On the 12-ft. wall shown on the facing page, I currently store 108 clamps, and there's room for more.

John West owns and operates Cope and Mould Millwork in Ridgefield, Conn.

BAR-CLAMP RACK

By hanging all of his clamps on one wall, West can space the hanging racks apart as necessary to fit different sizes of clamps. The deep-throat bar clamps face outward; the more traditional, older-style bar clamps face the wall. This rack was made longer to allow room for a growing collection of clamps.



Photo, facing page: William Duckworth

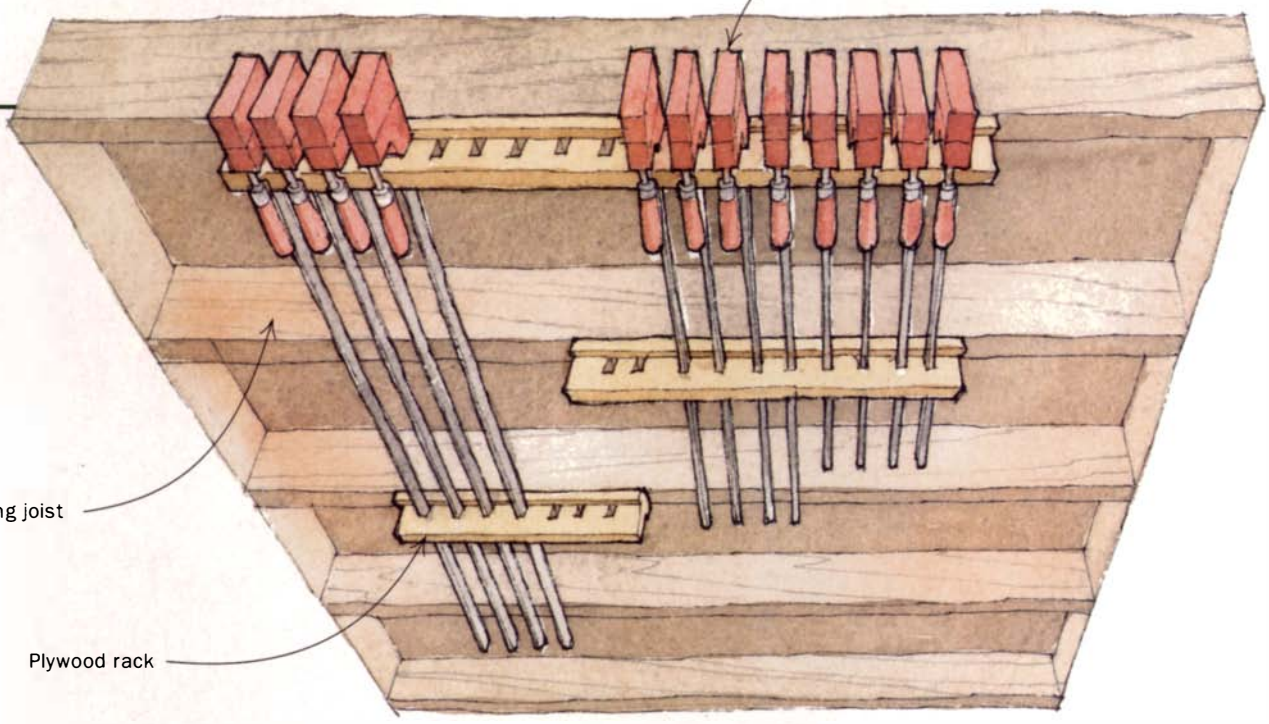
Ceiling and Wall Racks

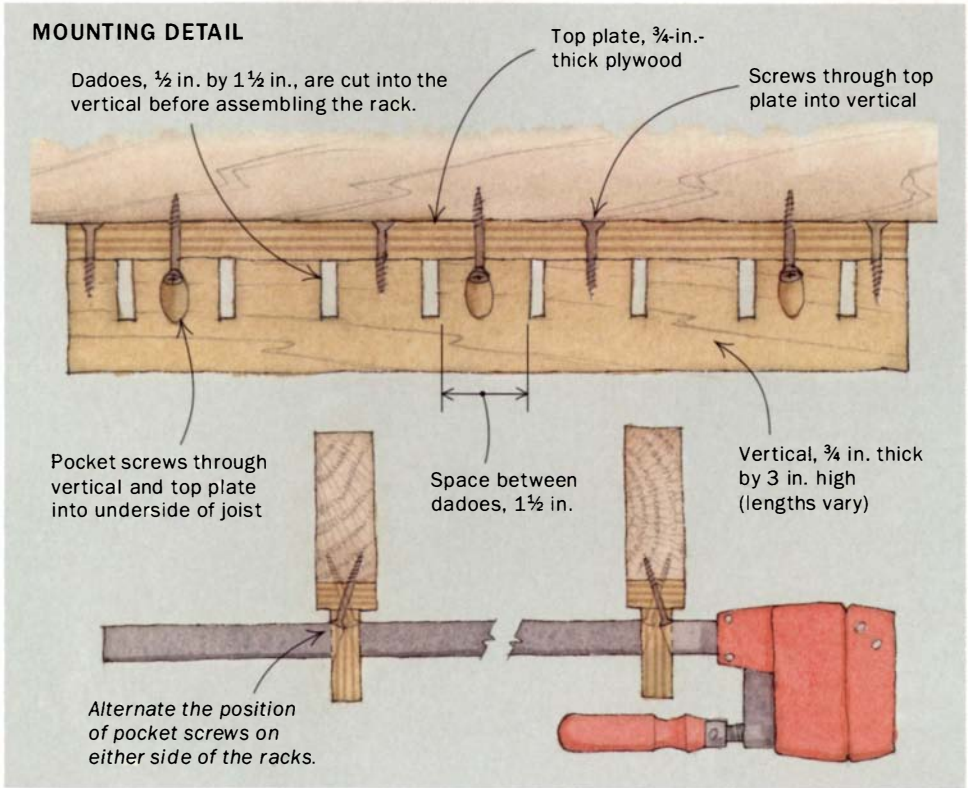
BY BROOK DUERR

In a shop lacking storage space, look for ceilings and wall alcoves to fill the need

BAR-CLAMP CEILING RACK

To hold bar clamps, Duerr fastened plywood racks directly to the underside of the ceiling joists. He staggered the position of the racks to accommodate various lengths of bar clamps.





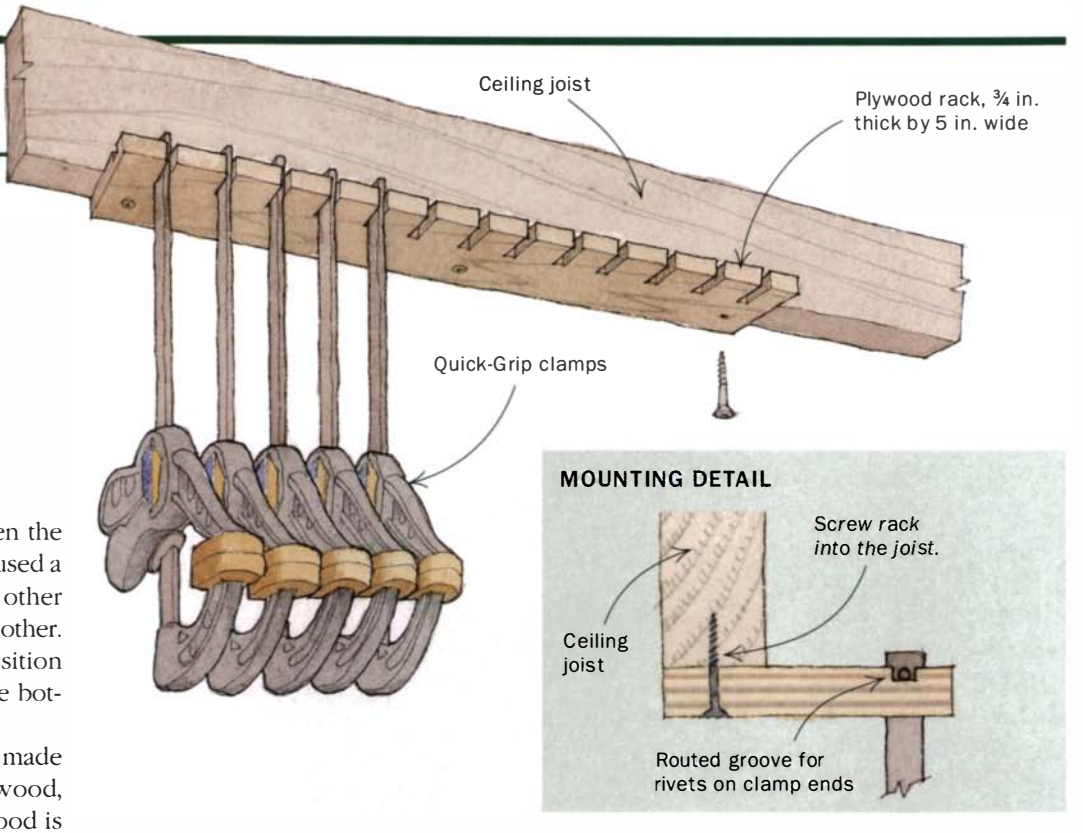
In my basement shop, wall space and open floor space are scarce. Faced with a growing collection of all kinds of clamps, I didn't know where to store them. One day it dawned on me that I could make use of the unfinished ceiling, with its exposed joists, and one wall alcove to store clamps out of the way. I designed and built several different racks, basing the design on the dimensions of each type of clamp.

For my bar clamps, I constructed each rack with two strips of ¾-in.-thick Baltic birch plywood, fastened together into a T shape with screws driven through the top plate. The top plate is 1½ in. wide, and the vertical piece is 3 in. wide; the lengths will vary according to the number of clamps of each size you need to store. Before assembling the two pieces, I used a dado blade to cut a series of ½-in. by 1½-in. dadoes to serve as slots for slipping the clamps into the racks. You could use a finger-joint jig on the tablesaw if you have a lot of dadoes to cut, but I simply marked

Drawings: Jim Richey

QUICK-CLAMP CEILING RACK

After running out of room on a wall rack, Duerr added this ceiling rack. He routed a groove into the top to stabilize the hanging clamps and keep them from falling out.



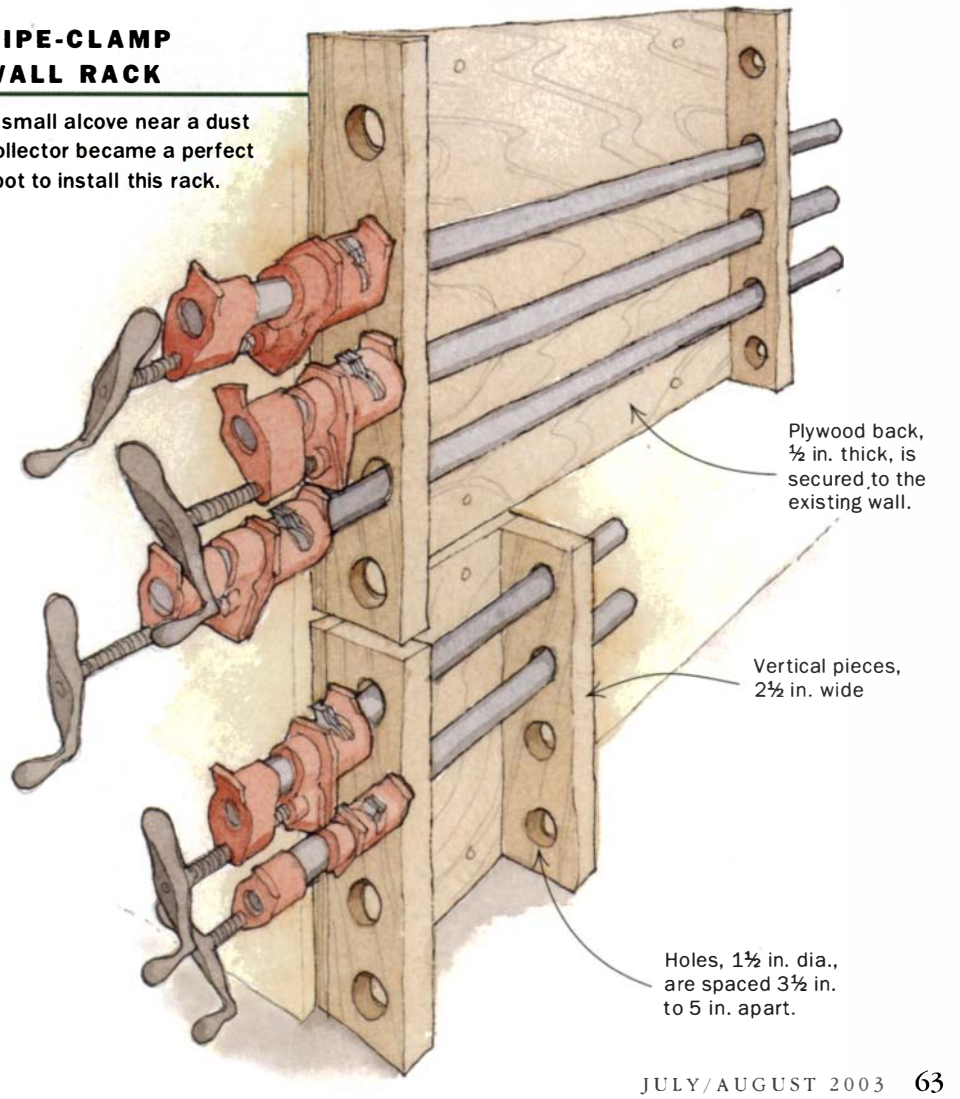
each one with a pencil line. To fasten the racks to the underside of the joists, I used a pocket-screw jig, alternating every other screw from one side of the rack to the other. I put the clamps into the closed position and slip them into the racks with the bottom end first.

For all of my Quick-Grip clamps, I made a rack out of a single piece of plywood, ¾ in. thick by 5 in. wide. The plywood is screwed into a joist from below. I cut a series of dadoes on one side only for hanging each clamp. I also used the dado blade to cut a groove in the top surface that runs the length of that edge. The rivets on the bottoms of the clamps sit in that groove and keep the clamps from falling out.

For my pipe clamps I arrived at a solution similar to the ceiling racks for my bar clamps. I drilled a series of 1½-in.-dia. holes in matching pairs of ¾-in.-thick material and mounted them onto a plywood back, which in turn was screwed to studs against a wall where I store my dust collector. I drilled the holes 3½ in. apart, but if I had to do it again, I'd make the spacing about 5 in. apart for more clearance of the clamp heads. With this design, it's important that one end is on the outside corner of the wall so that the clamp handles don't bind against the wall as you place the pipe clamps into the rack; then you'll have easy access to them when you need them.

PIPE-CLAMP WALL RACK

A small alcove near a dust collector became a perfect spot to install this rack.



Brook Duerr is a research scientist for a medical-device manufacturer. He does woodworking in his basement shop in a suburb of St. Paul, Minn.

Photo, this page: Barbara Duerr

Clamp Cart

BY DAVID DIRANNA

When floor space is plentiful, rolling storage racks bring the clamps to where you need them

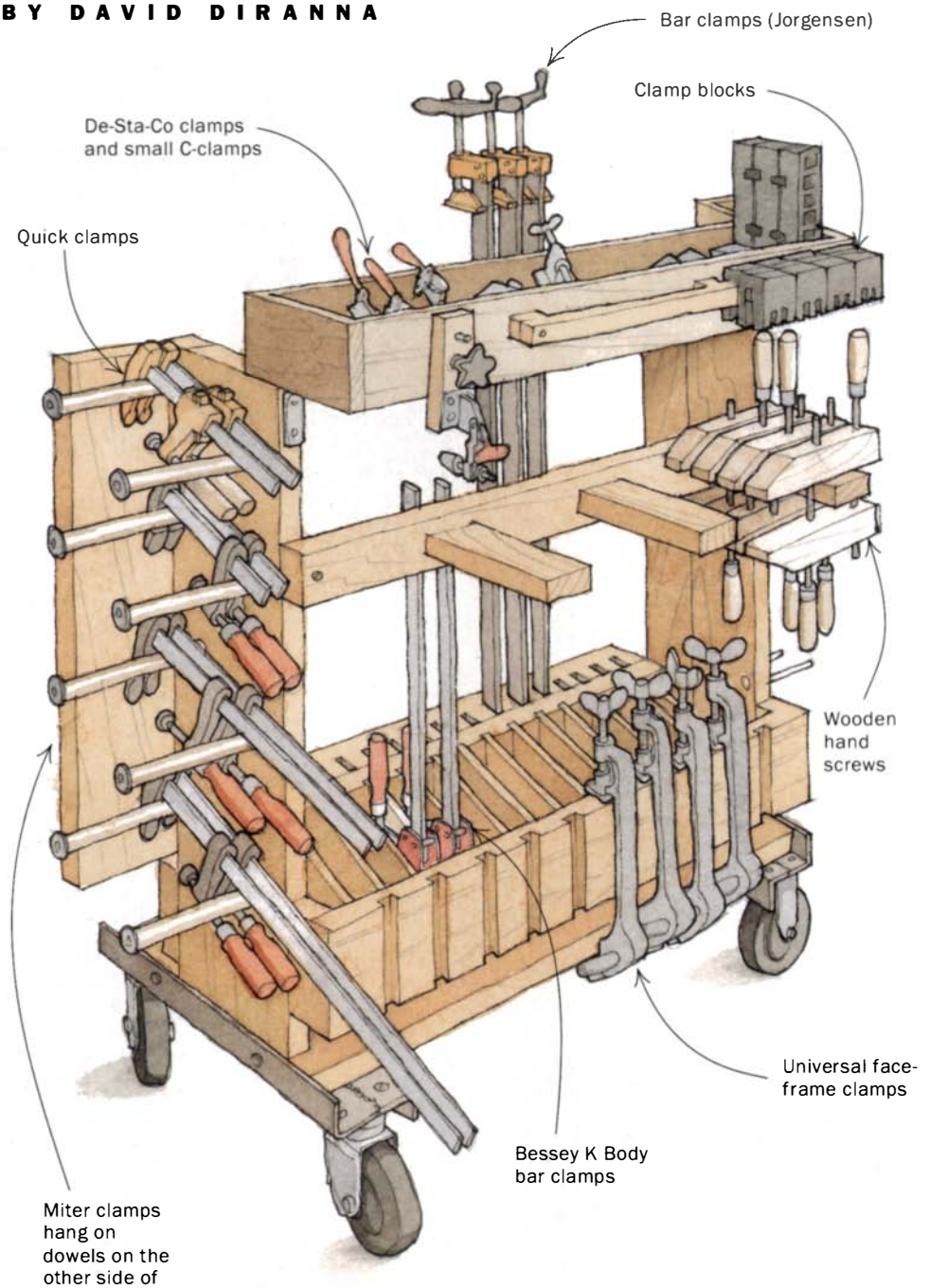
I took up woodworking 22 years ago when I received a radial-arm saw as a present. For most of that time, I had to share shop space with two cars in a three-car garage. But about five years ago, I kicked out the cars, reorganized the layout of the shop and built storage cabinets along many of the walls.

The end result gave me a lot more floor space to work in, and so when the time came to figure out how to store my small clamp collection, I decided a mobile cart was the best solution for me. I put most of the machinery on casters for the same reason—I like the freedom of being able to move things around. On one end, two casters are fixed, while the other two are swivel—that combination works best.

My main problem with clamps is that I keep buying more. When I first started building this clamp-storage cart, I didn't have a master design for it as it now looks, because I had many fewer clamps than I do now. The design of the cart has undergone a sort of organic evolutionary process.

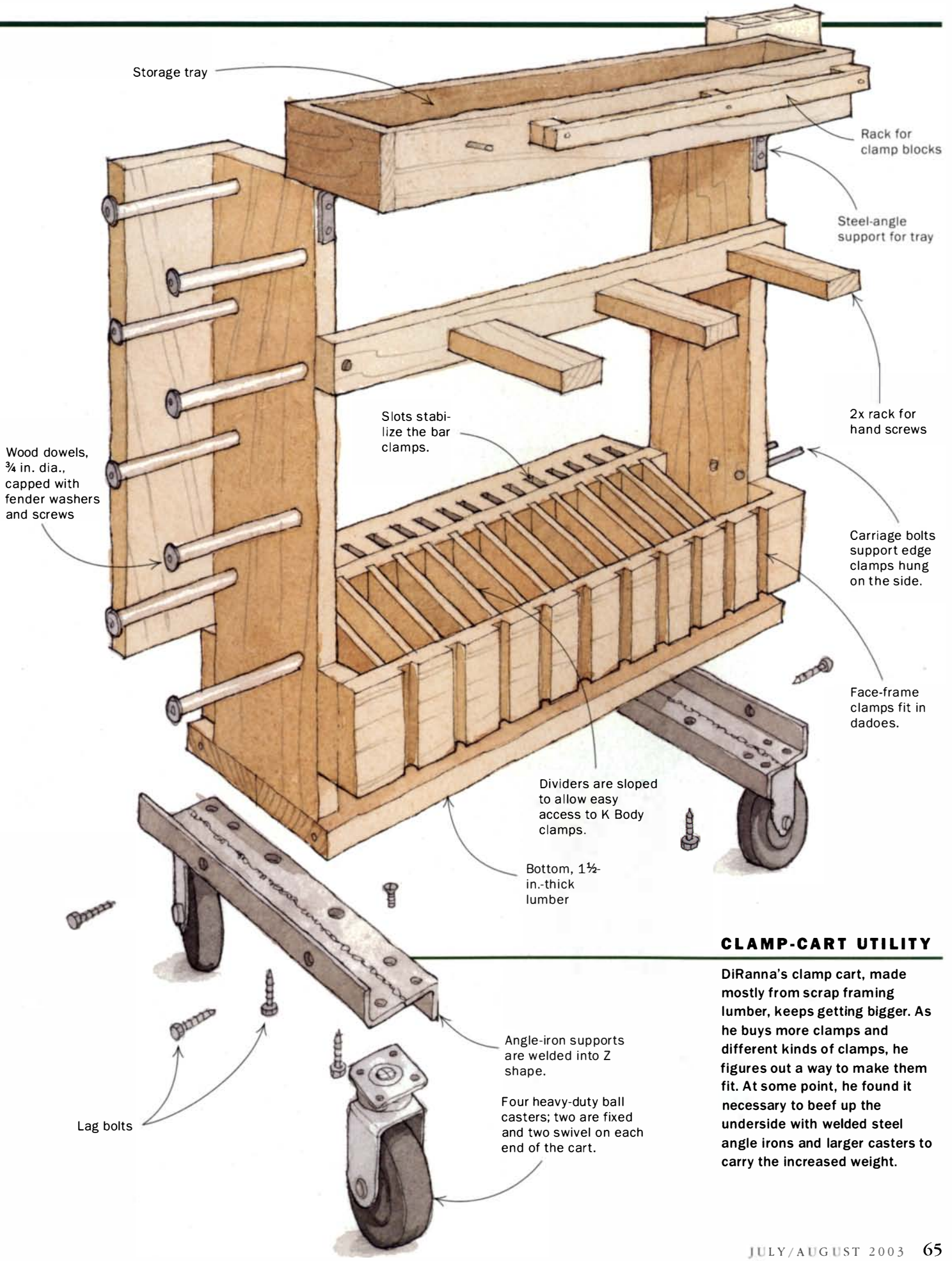
The purchase of every new batch of clamps has turned this into a modular construction project. I just keep finding ways to add onto the cart to accommodate my most recent clamp purchases. The cart got so heavy at one point that I found it necessary to replace the original 3-in. casters with a heavier-duty 5-in. ball-bearing style. I figured out recently that I'm storing more than $2,000 worth of clamps on the cart. I just hope I don't find it necessary to buy any more. □

David DiRanna taught college-level business courses for many years before switching careers to a business-management position.



Have clamps, will travel. *Blessed with plenty of floor space, DiRanna chose to put all of his many clamps on a rolling cart.*

Photo, this page: Dean Della Ventura



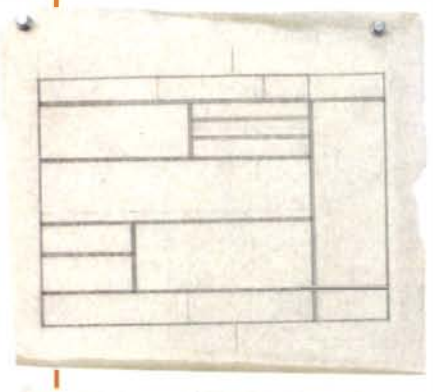
CLAMP-CART UTILITY

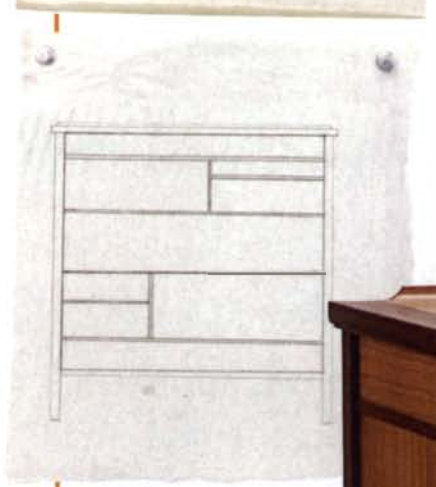
DiRanna's clamp cart, made mostly from scrap framing lumber, keeps getting bigger. As he buys more clamps and different kinds of clamps, he figures out a way to make them fit. At some point, he found it necessary to beef up the underside with welded steel angle irons and larger casters to carry the increased weight.

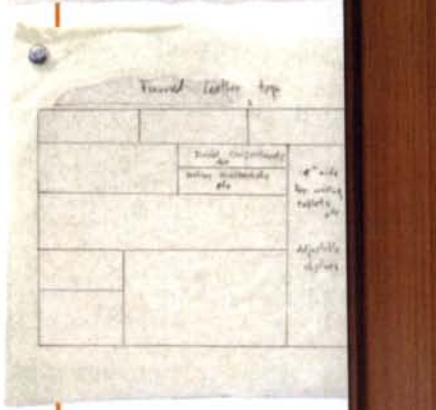
Breaking with Convention

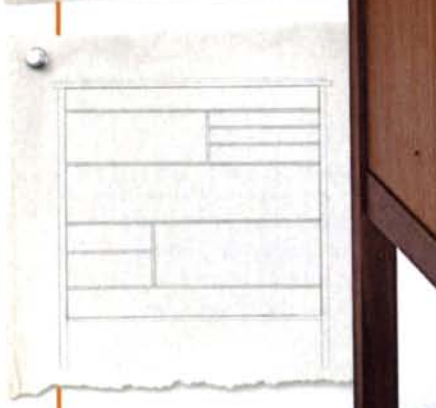
For a cutting-edge design, you sometimes have to bend the rules

BY LEONARD C. BECHLER









THE DESIGN EVOLUTION

Bechler sketched a multitude of different drawer configurations until he came upon an asymmetrical but balanced grouping of drawers and a door.

CONSTRUCTION TIP

DRAWER-FRAME ANATOMY

Three horizontal dividers and one vertical divider compose the internal structure of this bureau. Each divider was veneered on both sides with 3/32-in.-thick white oak to achieve the desired thickness. With the dividers in place, all of the drawer frames were constructed with slip joints (open mortise and tenons). The frames use two different size stocks, depending on the overall drawer size.

SPECIFICATIONS

DIMENSIONS
15⅞ in. deep by 37⅜ in. wide by 35 in. high

MATERIALS
Ash, black walnut, white oak, kwila

FINISH
Liberon finishing oil

While studying under James Krenov at the College of the Redwoods, I gained an appreciation for his flirtation with weights and balances. There are always four or five things going on with one of his cabinets that tend to keep the eyes moving and the mind involved. Thinking of this, I spent a day sifting through back issues of *Home Furniture* magazine and found the perfect starting point for my second project at the school: an apothecary's chest.

Having grown up with a traditional chest of drawers, I had come to detest the symmetry of it. I find the active jumble of drawers inherent in the tansu style appealing and decided to blend that into my design. Tansu chests are similar to apothecary chests in their organization of small compartments but also exhibit a playful form of proportion. Borrowing what I needed from both chest styles, I created a bureau design that was both active and calm.

Once I had worked out the drawer configuration on paper, it was time to make a full-size mock-up. I used large sheets of cardboard for the body and top of the piece and some scrap lumber for the legs. I chose dimensions by referring to other furniture but ultimately scaled them to what looked and felt right.

Next, I used some black-walnut scraps to mock up the drawer configuration on the face of the cardboard carcase. Double-faced tape allowed me to reposition the scraps until I was satisfied with the proportions and balance of the drawers. Realizing that the dark tone of the walnut would drive the activity of the piece, I decided to use it as the face-frame material.

I wanted the drawer fronts to function as a calming field of color and grain. So my main concern in the wood choice was aesthetic. After laying many samples of wood next to the walnut for consideration, I chose a piece of white oak.

The tone of the pulls also would be a significant and playful element. I settled on kwila because it matched the walnut and had gorgeous end grain. Kwila also is easily shaped by machine.

The carcase was doweled at all four junctures, while the frames were joined with slip joints (open mortise and tenons). All of the frames were attached to the carcase with splines. The top was splined all around its frame, including its miters and pencil-roll edge. I chose traditional dovetail drawer construction with loose bottoms. The top, sides, back, door and any vertical element within the drawer/door configuration all were veneered with shop-sliced 3/32-in.-thick veneer. I finished the piece with Liberon oil.

I often heard Krenov emphasize that "furniture should be true and honest and yet catch one's attention." I hope that my bureau lives up to these Krenovian ideals. □

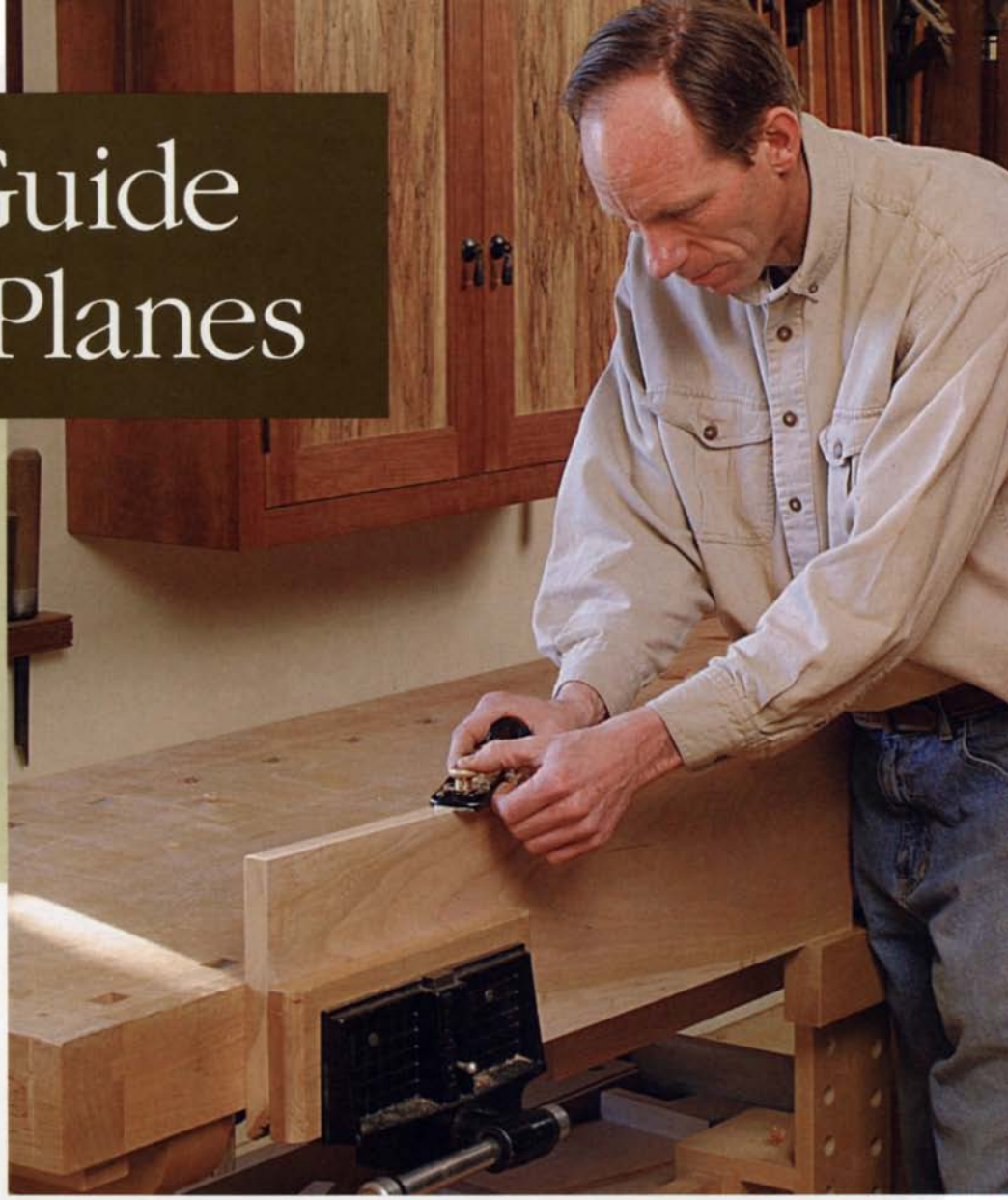
Leonard C. Bechler is a finish carpenter and cabinetmaker in Oakland, Calif.

Photos: Leonard C. Bechler; drawing: Vince Babak

User's Guide to Block Planes

Five common tasks for the handiest plane in the shop

BY CHRIS GOCHNOUR



One of the tools I reach for most often is a block plane. With its compact size and comfortable palm grip, it is an extension of my hand. I almost always have a block plane within reach as I navigate through the diverse tasks of custom-furniture building.

A finely tuned block plane is a pleasure to use. Quiet, efficient and precise, it can slice tissue-thin shavings off end grain, leaving a crisp, clean surface that no method can rival. I use a block plane for many tasks, such as eliminating mill marks from board edges and ends, shaping a radius or a chamfer on a board's edge, and fine-tuning and cleaning up joinery. Over the years, I've refined the way I tune and use this plane, based on the tool's unique geometry and features.

Typically made of metal and varying in length from 4 in. to 7 in., block planes are ideal for planing small parts and reaching into tight areas. They can be used one- or two-handed, either pushed or pulled. The blade is bedded at a low angle—between 12° and 20°—but the bevel faces upward, creating an actual cutting angle of 37° to 45° (if the blade is sharpened at 25°). The low blade angle allows for a palm-and-finger grasp and a low center of gravity, creating a more sensitive feel and greater stability. It also puts the blade in more di-

Low-angle vs. standard block plane

Years ago, when I first tried my hand at planing, I used a low-angle block plane to level the front edges of a figured mahogany dresser. I was puzzled by the torn grain that resulted, because I knew my plane was well tuned and razor sharp. After further experimentation, it became clear that I had not chosen the right plane for the situation.

Understanding cutting angles will help you select and tune a block plane that will handle the task at hand effectively. The cutting angle is the angle formed by the workpiece and the top of the blade. A low cutting angle requires less energy, reduces friction (enabling the blade to stay sharp longer) and minimizes blade deflection and chatter, allowing the blade to slice through long grain or end grain with less effort. However, a low-angle blade has more trouble on figured or changing grain because the low angle produces a knifelike cut that tends to lift and pry, tearing the grain.

Conversely, a standard block plane with a steeper cutting angle requires more energy to use, generates more friction and dulls more rapidly. It also is more susceptible to chatter. However, these qualities make a standard block plane more valuable on long grain, where its wedgelike cut will not lift, pry and tear the grain.

Photos: Asa Christiana

1 REMOVING MILL MARKS

With its low center of gravity, the block plane excels at slicing machine marks off the edges and ends of boards.

Edge vs. end grain. *To plane edge grain (left), check the grain direction and use a standard-angle plane. For end grain, use a low-angle plane, if possible, and chamfer the far edge (above) beforehand to avoid splintering. Skew the plane to create a shearing action (right), and wet the wood with paint thinner or water if you encounter stiff resistance.*

rect alignment with the thrust of the cut, reducing blade deflection and chatter.

Another nice feature of a block plane is that the upward-facing bevel is supported by the bed all the way to its cutting edge. This further stabilizes the blade, so it gives rock-solid performance even in harsh end-grain planing. A final attribute of many block planes is an adjustable throat. This enables you to fine-tune the plane's throat from a wide opening that accommodates a free flow of coarse shavings to a narrow slit that's capable of supporting the finest cut, leaving a smooth, tearout-free surface.

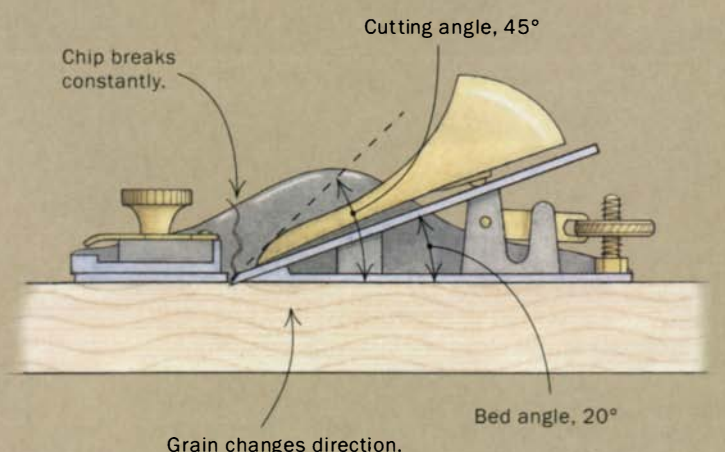
With a sharp, well-seated blade in your plane (for more on tuning up a block plane, see the story on p. 72), you are ready to tackle many tasks. There are five crucial woodworking operations that a block plane handles easily. A standard-angle plane works better for some of these tasks; for others, a low-angle plane is preferable (below).

Clean up saw and mill marks

Due to their compact size and stable footing, block planes are ideal tools for elimi-

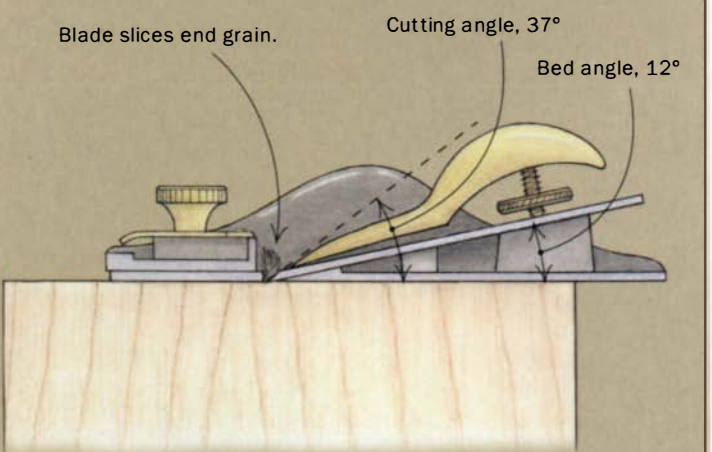
STANDARD ANGLE FOR LONG GRAIN

A 45° cutting angle is harder to push through the wood and causes the blade to dull more quickly, but it breaks the chip aggressively for a cleaner cut in long grain.



LOW ANGLE FOR END GRAIN

A low cutting angle requires less force to slice through tough end grain, and the blade doesn't dull as quickly.



Drawings: Vince Babak

2 CHAMFERING AND ROUNDING EDGES

The block plane excels at working the edges of a workpiece, from roundovers to wide bevels to just lightly breaking an edge.

Chamfers and roundovers. *Draw reference lines on the edges and ends of the workpiece. For roundovers (above), stop short of the lines with the first bevel and then bevel the new corners. Finish with fine sandpaper.*

Large bevels can start on a machine. *The wide bevels on this drawer bottom were roughed out on the tablesaw, but they were finished and fitted to the drawer with a few passes of a block plane.*

nating mill marks from edge and end grain (see the top photos on p. 69). Secure the board and use a light cut. Generally, you should push the plane, but if the grain direction changes, it's easy to turn around the plane and pull it toward you.

It is important to keep the edge square. If your machinery is set up squarely, you can use the mill marks as a reference, planing until the marks disappear evenly. Pencil marks across the board edge also will serve as a reference. In time you will develop a feel for the job, enabling you to maintain a square cut without using any reference marks.

Removing mill marks from the ends of a board can be a bit more challenging because of the tough nature of end grain and its tendency to splinter at the unsupported edge of the cut. For this job, a low-angle plane is better than a standard block plane. Set the plane for a very light cut and make sure the blade is sharp. I have found that skewing the plane is a very effective technique here, producing a shearing action that contributes to a smoother, cleaner cut on end grain. Skewing the blade also lowers the effective cutting angle. For example, if the plane has a 37° cutting angle and is skewed 45°, the effective cutting angle becomes a low 28°.

Generally, I plane board ends with one continuous stroke from edge to edge. To

3 CLEANING UP JOINERY

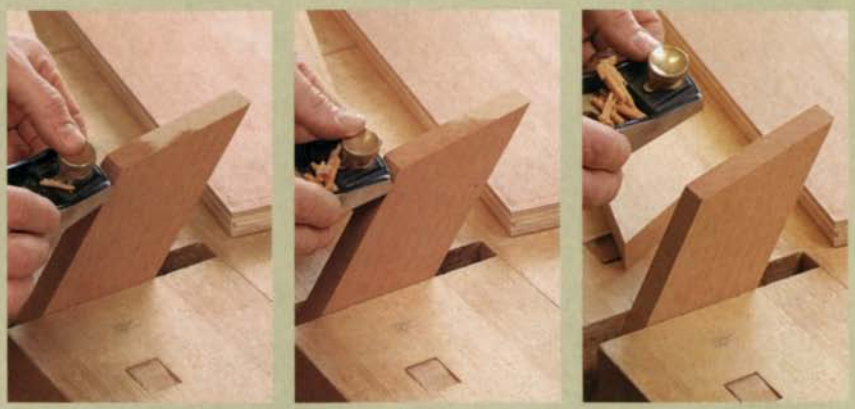
For perfect-fitting joinery, make joints proud and then plane them flush with a block plane.

Plane dovetails in two directions. *First remove the bulk of the excess stock by planing along the row of pins or tails (left) with the nose skewed inward to avoid splintering the end grain. Then work inward from the edge (above) for the last few passes.*

Plane pegs flush. *Plane in a tight circular motion to work toward the center of the peg.*

4 FINE-TUNING MITER JOINTS

Angled cuts from a machine tool aren't always perfect, but a block plane can adjust the fit of miters quickly.



Closing the gap. *This solid-wood edging for a plywood panel has loose-fitting miter joints (left). A series of cuts makes the adjustment. The first cut (above left) changes the miter angle, and successive cuts carry that new angle across the entire joint.*

prevent a chipped edge at the far end of the cut, there are a few things you can try: Plane a small bevel on the far edge to reinforce the fibers, or clamp a piece of scrap to the back edge to support it. Also, you can plane toward the center of the board from both edges.

Certain woods have harsh end grain that will dull the blade of a block plane rapidly. Unless you enjoy sharpening, dampen the end grain with water or paint thinner to make the wood more supple, preserving the blade's edge.

Round and chamfer edges

Block planes excel at lightly softening a hard edge, milling a crisp chamfer or fully rounding an edge.

To chamfer an edge, make several light passes, rolling the plane slightly with each pass. To make roundovers from 1/32-in. radius to 1/4-in. radius, just keep rolling the plane with each pass. After planing, slight facets will remain, but these can be smoothed quickly with fine sandpaper.

To make a rounded edge, lay out the profile on the board edge and end. Because the shaping is freehand, a diverse range of contours can be shaped simply by working to your layout lines. Begin the radius with a few bevel cuts. Then bevel the bevels, gradually shaping the intended profile. Finish with a very light cut and multiple passes,

5 FITTING A DOOR

After installing the hinges, use a block plane to adjust the fit of a door. Start by putting a back bevel on the door stile.

A back bevel (left) will make the next step easier. *It leaves good clearance for closing and only a small amount of wood to be removed during final fitting. Next, install the door and fine-tune the fit (above left). Check your progress frequently, creeping up on a fine, even gap (right).*

rolling the plane continuously. Final touch-ups can be made with a contoured card scraper or sandpaper.

To chamfer or bevel an edge, begin by laying out the cut with pencil lines on the board's edge and ends. Then plane to the layout lines, making sure the cut stays in the center of the two lines. If you stray off course, make corrections now rather than waiting until you've reached the pencil lines.

When chamfering end grain, skew the plane's nose off the edge of the board so that the blade is cutting the grain downward. This will give a smoother finish.

Clean up joinery

I frequently use a block plane to clean up joinery after gluing. I'll trim tenon pegs flush, moving the plane in a tight swirl and working until the blade skims the surface surrounding the peg. Through-tenons, dovetails and bridle joints also can be trimmed flush with a block plane.

When making a dovetail joint, for example, leave the pins and tails a bit long. After the glue dries, remove most of the extra material by planing in line with the edge, skewing the plane nose inward, which supports the cut and prevents chipped edges. When the joint is nearly flush, start planing in from the end, cutting lightly until the joint is flush and clean.

Fine-tune miters

Frequently, miter joints require slight adjustments after being cut. A block plane is

Tune up the plane for best results

Whether you choose a low-angle or standard plane, an initial tune-up makes all the difference. Each time I tune up a plane, I follow a sensible order of refinements, beginning with the sole of the plane and then progressing to the bed, the lever cap and finally the blade.

1. FLATTEN THE SOLE

A convex or concave sole will leave the cut unsupported, causing unpredictable results, so I always check to see whether the sole is flat. Before lapping the sole flat, I also check that the adjustable throat seats well in the plane body. Remove the throat plate and check for any burrs or debris and then use a file to eliminate any trouble spots. Reassemble the plane, making certain the throat plate seats properly and moves freely.

I flatten planes by putting abrasive paper on a flat surface (plate glass, a slab of granite or a jointer bed) and lapping the bottom of the plane. I always keep the blade in the tool, properly tensioned but raised above the sole. Begin with 80 grit and then follow with 150 and 220. You can stop there and let actual use further polish the sole, or go one step further to 320 grit.

Lap the sole. *Attach coarse- and medium-grit sandpaper to a flat substrate and flatten the bottom of the plane until the sandpaper hits the entire sole. The area around the blade is the most critical to get flat. The scratch pattern will tell you how much more steel to remove.*

Watch it on the web

For more on tuning up a block plane, go to www.finewoodworking.com.

the perfect tool to accomplish this task. For example, if I'm mitering a solid-wood border around a center panel, and a corner has a slight bird's mouth, I first assess where the material needs trimming. Then, using a series of overlapping cuts followed by one continuous pass, I make the adjustment with a block plane and check the fit.

Even if the joint has been cut accurately, one light cut on each miter will quickly eliminate any irregularities that sawblade deflection may cause, ensuring an invisible glueline.

Fine-tune gaps on doors and drawers

Nothing works better for evening out the gaps on cabinet doors and drawers than a block plane. I appreciate how its compact size allows a one-handed grip, freeing the other hand to steady the work. Depending on the location of the door or drawer being fit, sometimes I push the plane; other times I pull.

To ensure that a door stile has enough clearance and doesn't hit when opened or closed, I recommend a slight bevel from the door's front to back. This bevel is shaped easily with a block plane, even with the door in place. Another reason for this back bevel is that only a small amount of wood needs to be removed during the subsequent final fitting. □

Chris Gochnour is a custom-furniture maker in Salt Lake City and teaches around the country.

2. TUNE THE LEVER CAP AND BED

The blade must have a snug fit with the lever cap and the bed of the plane. First remove any rough burrs or sizable drips of japanning (black paint) that prevent a stable fit between the cap and blade. Then check that the bed of the plane is free from rust, paint globs, grime or coarse machining. The blade must have a solid footing to remain still under pressure.

Eliminate any imperfections with careful filing, being cautious not to make matters worse by being reckless with the file.

Tune the lever cap. *While protecting the back of the cap assembly with a piece of paper, sand the paint off the front edge for a snug fit with the blade.*

Level the bed. *Insert a small wood block into the back of the plane body as shown (right), to raise the file to the blade angle. Don't over-file.*

3. LUBRICATE THE PARTS AND HONE THE BLADE

The plane's vertical adjuster and adjustable throat will work more smoothly with a light drop of machine oil on each part. A little paste wax on the sole of the plane will keep it gliding freely and prevent rust.

Sharpen the blade as you would any other, remembering that the sharpening angle of a block plane impacts performance. Because a block plane has its bevel up, its cutting angle is the sum of the bed and the sharpening angle. I sharpen my standard (20° bed) and low-angle (12° bed) planes with a 25° bevel, producing 45° and 37° cutting angles, respectively.

I use a honing guide because it helps maintain the desired bevel angle. There are two sides to a sharp edge: the bevel and the blade's back. I take both surfaces to 6,000 grit on my waterstones.

Adjust the throat. *A small gap in front of the blade supports the finest cuts; a larger gap is required for heavier cuts.*

Wax the sole. *This protects the plane from rust and makes for smooth sliding action.*

Step 1 Build the background.

Step 2 Apply the banding.

Step 3 Attach the border.

WORK FROM THE CENTER OUT

Working from the middle outward allows you to perfect each section before moving on to the next.

Decorative Veneering

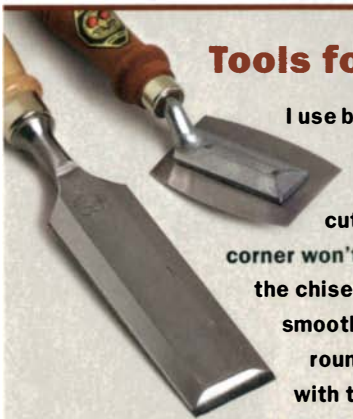
Assembling a complex pattern requires only basic tools and a logical approach

BY PAUL SCHÜRCH

In the many years I've been teaching, I've found that many students initially are afraid of veneer—a thin, fragile material. But that fear disappears once they've learned a few basic cutting and assembly techniques. By using a common chisel in uncommon ways and learning to tune up and use a standard veneer saw, assembling a complex panel becomes as easy as cutting and taping together paper.

Decorative veneering is the process of assembling the pieces of a design like a jigsaw puzzle, forming a single sheet. The design then can be glued onto a substrate in one piece. This eliminates the need to rout out a recess for inlay after gluing the main veneer to a core, and it offers a world of complex design possibilities.

Wood veneer offers a wonderful and varied palette of color and grain found in the burl, trunk and crotch areas of a tree. Burl veneer is my favorite because of its swirling patterns of reflecting light and color. I often use it as a background for marquetry. In the panel assembled for this article, a four-way book-match draws the



Tools for success

I use both a chisel and veneer saw to cut veneer. The secret to tuning a chisel is to round the cutting corner slightly. A rounded corner won't dive into the grain, which pulls the chisel off line. It also cuts more smoothly. The corner you want to round is the one that's in contact with the work when you are dragging the chisel toward you with the bevel side against the straightedge.

After grinding an even bevel, hone the edge on a 1,000-grit waterstone, pausing periodically to knock off the burr from the back of the edge with one lapping stroke on the back.

Next, cut through the back of cloth-backed, 100-grit sandpaper two or three times to round the corner slightly (roughly a 0.020-in. radius). Scraping the corner over medium-density fiberboard (MDF) also works. Switch to a 1,200-grit waterstone to continue honing the edge and to knock off the burr from the blunted corner.

A veneer-cutting chisel must be sharp, with a rounded corner. *Run the corner over the back of cloth sandpaper a few times to break it slightly. Then rehone it.*

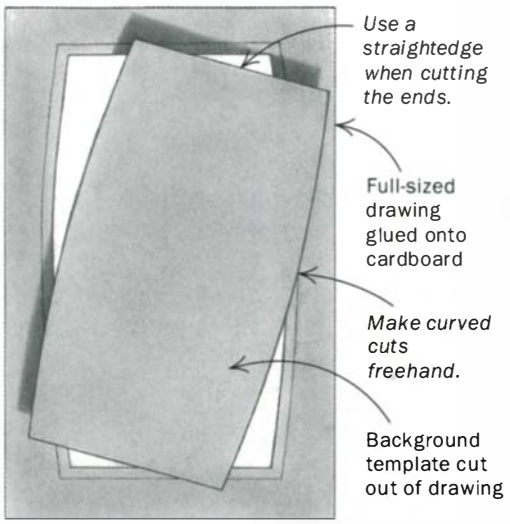
For veneer work, I don't stop at the waterstones. To finish honing the edge and to sharpen the rounded corner, buff the edge on a felt wheel with buffing compound. Hair should actually leap off your arm trying to escape this edge.

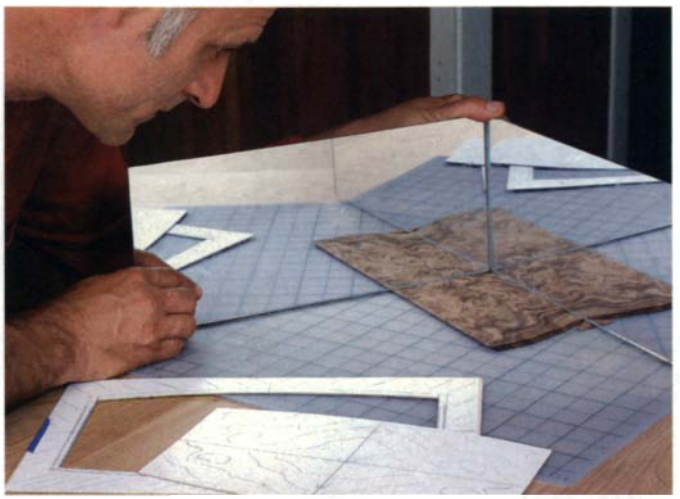
The chisel excels at cutting one layer of veneer at a time, but

Photos: Asa Christiana

STEP 1 CREATE A BOOK-MATCHED BACKGROUND

MAKE A TEMPLATE





Use a pair of mirrors to find the best book-match seams. *Refer to a template (foreground) to make sure you leave enough veneer to cover the pattern.*

Stack all four layers and then cut them using a veneer saw and a thick straightedge. *Assemble two halves of the book-match, retrim the center seams and join the halves.*

Put down gum tape on the outside edges of the pattern. *This will prevent the burl from crumbling when cut. Use a brush to burnish all gum tape onto the surface.*

Cut the burl background section to its final shape. *Use the cardboard template as a fence to guide the chisel. Always use the chisel on the glue face, which will keep its V-shaped kerf on the back of the pattern.*

eye toward the center of the panel and offers a rich contrast to the border. I used walnut burl for the center, or background, mahogany as a medium-colored border and a thin border banding (traditionally called a *filleti*) of padauk and sycamore to frame the background and separate it from the border.

The same cutting and assembly techniques you will learn making this panel can be used to make an endless variety of designs, in a variety of sizes and shapes, with different combinations of border, background and banding. The scale and style of the panel in this article are well suited for the top of a jewelry box. However, larger decorative panels made with these same techniques also are used in furniture, such as case pieces and beds.

Start with a full-sized drawing

In my shop every panel starts as a full-sized drawing. I even paint in approximate colors to get a better idea of the final result. This drawing is your chance to work out shapes, proportions and

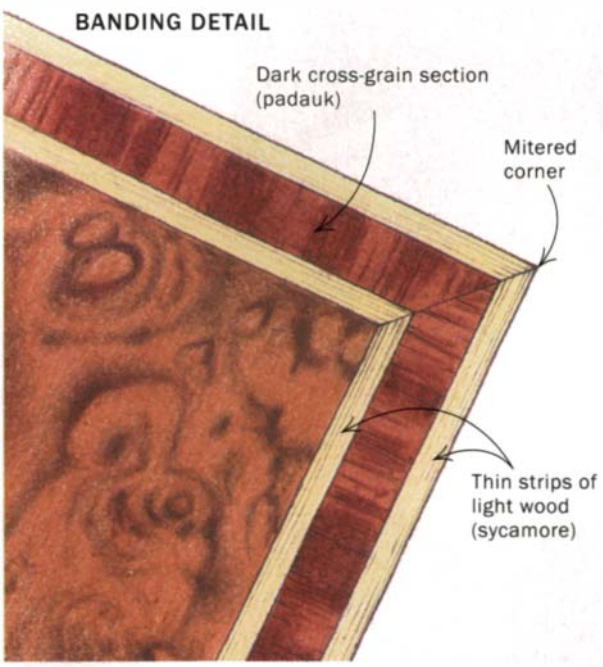
Veneer saws are not ready out of the box. *First, sharpen the teeth with a fine file, following the angles already established. Then file a bevel onto the outside edge to bring each tooth to a sharp point. Knock off the burr from the back, and you're ready to make perfect cuts.*

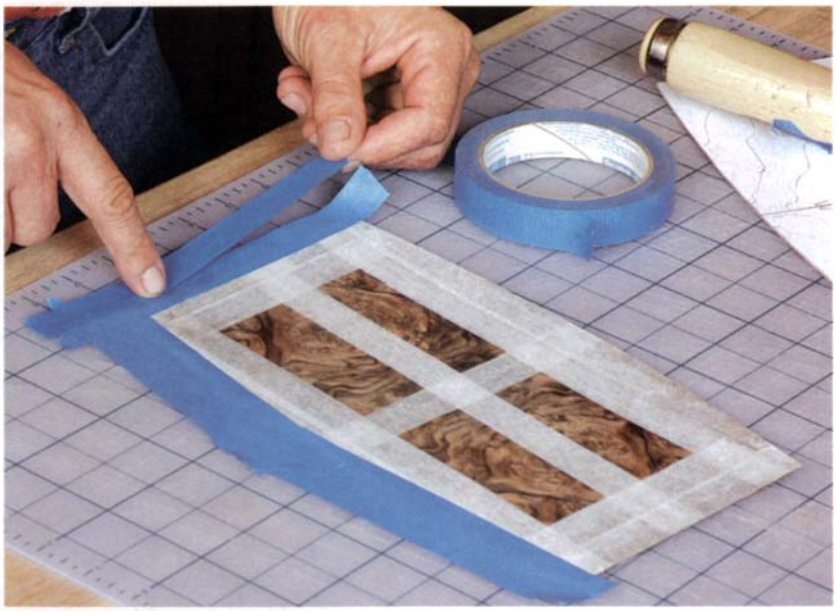
the veneer saw is necessary for cutting straight lines through multiple layers.

To sharpen this saw, file the teeth, bevel one edge of the blade so that each tooth comes to a sharp point and then hone off the burr on the back of the saw.

Drawings: Michael Gellatly

STEP 2 ATTACH THE BANDING ONE PIECE AT A TIME





Assemble the banding. *First, edge the pattern with blue tape, sticky-side up, to hold the individual pieces in place.*

veneer species. You only have to color one-quarter of the pattern; you can use two mirrors to mock up the rest. The same mirror technique is used to preview the burl book-match (see the top photo on p. 75). Draw the final lines on this pattern accurately; later you will use this drawing as a cutting template.

Along with the full-sized drawing, you must arm yourself with cutting techniques. During my apprenticeship in Italy, I learned to use a wide chisel to make a number of different veneer cuts easily and accurately. I use a 40mm Double Cherry-brand chisel. The extra mass of the tool adds momentum to the cut, making it smoother, and the long wooden handle fits comfortably into my shoulder when I press straight down on the tool to make chopping, or parceling, cuts.

For the other chiseling cuts, I use the corner of the blade as a knife, drawing it across the veneer in subsequent passes. I can make freehand, curving cuts, use a straightedge to guide the chisel or use a partially assembled veneer pattern as a fence to cut a mating piece.

Assemble the pattern from the center out

Upon receiving your veneer order, carefully inspect and number the leaves of veneer using blue tape to keep them in sequence. Do not mark directly on the veneer. Store the leaves between two flat surfaces in an area that is cool and at about 70% humidity.

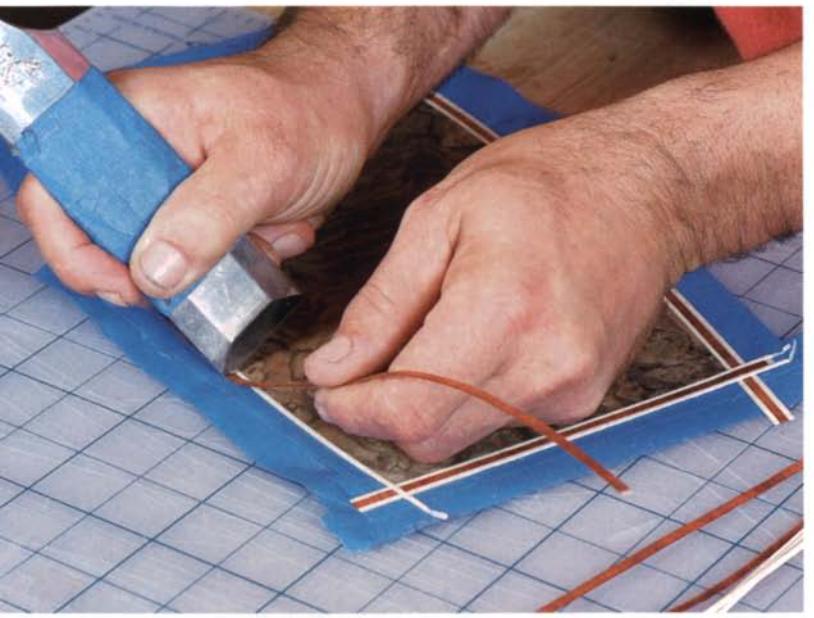
By working from the middle out, you can perfect the center joints before trimming the perimeter and adding the next element. Determine the most attractive grain pattern for the double book-match and mark the two seams. Line up, or index, the four leaves

Spacer jig makes perfect stringing

Slide the veneer against the simple jig. *The thickness of the stringing will be determined by how much the screw heads protrude from the edge of the jig. Again, place gum tape on the back of the veneer to prevent splintering.*

Set a thick straightedge onto the veneer against the screw heads. *Sandpaper under the straightedge keeps the veneer in place.*

Cut away each strip with a sharp veneer saw. *Pulling the saw straight back, make a light pass to start, then make firm passes until the strip is severed cleanly.*



Handle with care. *Gently kerf the outside edges of the cross-grain strips, which will allow them to bend without breaking.*

A perfect miter. *Overlap the ends and make a parceling (chopping) cut. Then align the chisel blade with the two corners and press straight down.*

in a stack by aligning two or three natural grain markings or knots on the surface. Tape the leaves together, and use the veneer saw and a ¾-in.-thick straightedge to cut only one seam. Be sure to use a long sanding block to clean up the edges.

Align the grain, and join the first two leaves of veneer with blue tape on their glue faces, pulling them tightly together as you tape. Then cover the entire seam with a strip. Flip the panel and apply gum tape over the seam. Repeat this on the other two leaves, then align and stack the two halves and cut the last seam. Flip one half to finish the four-way match, and then join the halves.

The blue tape holds the leaves together until the water-activated gum tape dries on the other side. The 25-gram gum tape should be moistened enough to feel slimy. Apply the tape over a joint, then use a fine brass- or plastic-bristle brush to burnish the gum tape onto the veneer. Wet gum tape will warp the veneer, so put the sheet between two pieces of plywood or melamine to dry.

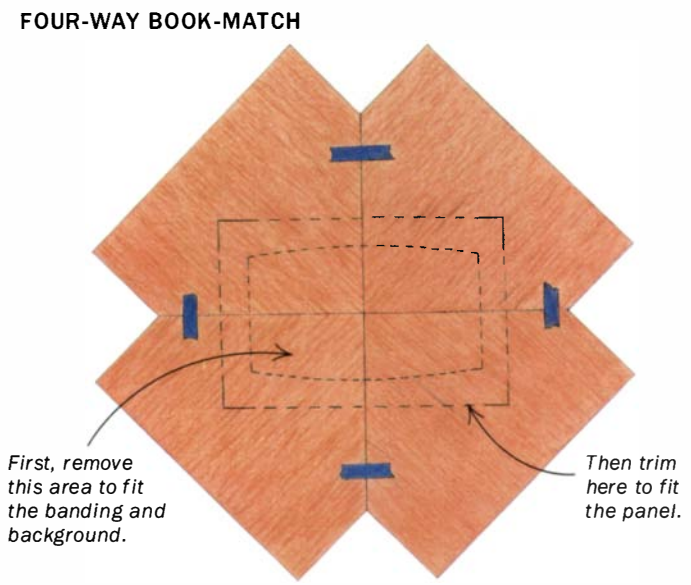
With spray adhesive, glue a photocopy of your original drawing of the panel onto a piece of thin cardboard to make a cutting template for the outside edge of the background. Using this template as a fence, cut the curving, outside edge of the background and the straight ends. The proper technique is to hold the chisel at an angle with its bevel riding vertically against the guiding edge so that you can see the cut clearly. It takes at least three passes to cut through a piece of veneer. The first cut, a light scoring pass, is the most important one. Use a bit more pressure for each subsequent cut. If the veneer is tearing a lot, you may have to reinforce it with blue tape on the opposite side. Cutting the veneer creates a V-shaped groove in the wood, so you must do your cutting on the glue face to keep the V-kerf hidden in the final pattern.

Make and attach the banding

In this case the banding is made up of two thin strips of light wood surrounding a darker cross-grain section. Use a spacer jig (see the

Trim away the overhanging tape. *The chisel technique makes it possible to cut right to the banding without damaging it.*

STEP 3 INSET THE BACKGROUND AND BANDING INTO THE BORDER



Assemble a four-way book-match with the veneer aligned diagonally. *Then place the center pattern onto it, aligning the center seams, and use the pattern as a fence to cut the border to fit.*

bottom photos on p. 76) to cut thin, even strips. The veneer saw is the tool of choice here.

Reinforcing the veneer, especially the cross-grain sections, with gum tape prior to cutting keeps the sheets intact while cutting and assembling them. Don't worry about excess gum tape; it will all come off later after the panel has been glued up.

To attach the banding, first attach blue tape to the edges of the background, putting it on the show face and leaving tape hanging over the edge. Assemble the strips piece by piece on the blue tape, placing them snugly along the edge. Overlap the banding at the corners.

Then, using the chisel, miter the overlapped pieces with a single plunging, parceling cut. The joint should come out perfect.

Finally, assemble the entire banding with blue tape on the glue face. Then remove the blue tape from the show face and replace it with gum tape.

Book-match and attach the border

The grain in the border is aligned diagonally so that it appears to emanate from the center of the pattern. I lay out these seams using a 45° drafting triangle.

Again, index and cut the four leaves in a single stack, using the straightedge and the veneer saw, and joint the edges lightly with a long sanding block. Assemble the four-way book-match.

Overlay the background and banding onto the border sheet and align the center seams of the two layers. Apply a few strips of tape and use the over-laid center section as a cutting fence for the chisel. If everything remains in place during cutting, the border will fit the center section exactly. Attach the border as usual, with blue tape on the glue face and gum tape on the other.

Trim the veneer panel to size—Last, lay the substrate onto the glue side of the veneer sheet. For the substrate I used Medex, a water-resistant type of medium-density fiberboard (MDF). Align the center seams of the sheet with center marks on the edges of the substrate. Before cutting, attach gum tape to the show face where the cuts will be, to avoid splintering. Use the substrate as a fence to trim the veneer sheet to size.

Remove all tape from the glue face, make sure all of the seams and edges on the show face have gum tape and check that there is no overlapping veneer.

A simple setup for veneering small panels. *To lay up veneer without using a vacuum bag, use ¾-in.-thick cauls and deep-reach clamps.*

Lay up and finish the panel

Vacuum presses are wonderful for flat or curved work, and affordable small-shop models are available. But a panel this size is laid up easily using just clamps and melamine cauls.

For an adhesive, I prefer Unibond 800, a urea formaldehyde resin liquid, because the powdered catalyst comes in three colors to match various colors of the wood, and it has a rigid glueline, unlike yellow or white glue. Color-matching the adhesive makes squeeze-through much less obvious and problematic. A disposable foam roller applies the right amount of glue onto the substrate, about as much as a

Lay the center section into the border and tape it. *Again, use blue tape first on the glue face, then gum tape on the show face.*

Lay down the substrate and trim around it. *Use center marks to align the MDF substrate with the pattern's center seams.*

good coat of paint. Minimize warping by gluing a layer of veneer to the back of the panel at the same time to balance out the panel.

After a day or so, carefully scuff-sand the gum tape (and the high points of any thicker veneer) with a sanding block and 80-grit paper, continuing until the tape is almost gone. Stay away from the corners and edges to avoid sanding through the veneer. Next, use a paintbrush to wet the remaining gum tape. The water will soften the tape and show any loose veneer that needs regluing prior to sanding. After a minute, the tape can be removed easily with a sharp putty knife.

After the panel is completely dry, remove the 80-grit scratches with finer grits. Sand lightly and carefully to avoid sanding through the veneer.

With the burl veneers and multiple joints in this panel, it may be necessary to fill small gaps that remain after glue-up. Once you finish sanding, apply a light coat of shellac over the panel and fill any remaining gaps with Famowood #1 professional tinted filler, which is a creamy acetone-based putty. The putty can be tinted with universal tinting colors to match the surrounding veneer.

To remove the excess filler after it has dried, use a few drops of acetone on absorbent cloth or paper over a wood block. The acetone will not penetrate the alcohol-based shellac. Sand the panel to 400 grit, apply a topcoat, and the panel is done. □

Paul Schürch demonstrates this veneering process and other techniques in his book and video Decorative Veneering, Vol. 1, *available at www.schurchwoodwork.com. The web site also features his furniture, teaching schedule and other tools and tips for veneering.*

Finishing touches

After the glue sets, sand away most of the gum tape. *Use a sanding block and stay away from the edges to avoid sanding through them.*

Wet the surface to scrape away the last bits of tape. *The moisture also serves to reveal any air pockets beneath that must be repaired.*

Wipe on a thin coat of shellac before filling and finishing. *Schürch uses colored, acetone-based wood filler to fill the small voids in the burl or elsewhere. The acetone won't dissolve the shellac, which protects the workpiece.*

Choosing Marking Tools

Marking, mortise and combination gauges come in myriad styles and prices

BY SCOTT GIBSON

Marking, mortise and combination gauges are simple layout tools designed to cut shallow reference lines into wood, parallel to an edge. While a pencil line might be too thick or easily smudged, an incised line is clean and precise.

Look through a woodworking catalog for a marking, mortise or combination gauge, and you'll likely find that choices abound, from basic all-wood tools to elegantly crafted versions complete with inlaid brass wear strips. To get a better idea of what's out there, I surveyed a few of the most commonly available gauges, from makers such as Bridge City Tool Works, Colen Clenton, Crown Tools, Glen-Drake Toolworks, Marples, Starrett, Veritas and Woodjoy. I also looked at a couple of Japanese-style gauges.

Gauges are simple tools

A typical gauge has two main parts: a beam and a fence. Depending on the type of gauge, the beam may have one, two or three steel cutters. The fence slides along the beam to adjust the dis-

CROWN TOOLS
Beech marking gauge with single hardened-steel cutter; brass wear strips inlaid on fence; plastic thumbscrew; about $12.

MARKING GAUGES: PIN STYLE

All marking gauges have a single cutter for scribing one line at a time. Pin-style gauges have a cylindrical cutter with the end tapered to a point much like a pencil. This tapered point works well when cutting end grain or parallel to the grain but not so well across the grain.

Photos, except where noted: Rodney Diaz; this page (top and bottom right): Tom Begnal

A knife-style gauge cuts a clean line parallel to the grain, across the grain or on end grain.

tance from the cutter to the fence. The gauge is held in one hand with the fence bearing against the edge of a workpiece; then the cutter is drawn across the surface of the wood to scribe a line.

What differentiates marking, mortise and combination gauges from one another is the number and type of cutters each employs. Marking gauges have a single cutter for scribing one line at a time. Mortise gauges have two cutters and are used mostly for marking parallel lines to establish the width of a mortise. Combination gauges typically have three cutters: a single cutter on one side of the beam for use as a marking gauge and an additional pair on the other side of the beam for laying out mortises.

Many of the gauges with wood fences have inlaid wear strips made from brass. The strips make the tools look nicer, but as a practical matter, they aren't necessary. My Marples, more than 25 years old, has no brass in the fence and shows only negligible wear.

Marking gauges come in three styles

Marking gauges can be found in a variety of shapes and sizes. They include pin-cutter marking gauges, knife-cutter marking gauges (also called cutting gauges) and wheeled-cutter marking gauges.

Pin cutters—A marking gauge with a round, pinlike cutter sharpened to a pencil point at one end is best suited for making a line parallel to the grain or across end grain. Cross-grain cuts tend to be ragged. If a pin-cutter gauge is going to be used to scribe a line across the grain—for a dovetail baseline, for example, or to scribe the shoulder of a tenon—the cutter should be filed to a knife edge so that it cuts a deep, crisp line (see the story on p. 82).

I looked at a beech model made by Crown Tools of Sheffield, England (Crown gauges are available in most woodworking catalogs), with brass wear strips and a plastic thumbscrew. Although it was not the fanciest of the tools here, it appeared to be a very serviceable gauge. And at $12, it won't break the bank.

Knife cutters—Traditionally called a cutting gauge, this tool is a close relative of the pin-cutter marking gauge. But instead of using a pinlike cutter, a knife-cutter marking gauge uses a cutter that resembles a knife blade. Thanks to the knife edge, it can mark a line parallel to the grain, across the grain or on end grain.

Colen Clenton of Australia makes a beautiful knife-cutter marking gauge (available through The Tool Shop; www.uktoolshop.com) or the Museum of Woodworking Tools (800-426-4613;

COLEN CLENTON
Rose she-oak cutting gauge with inlaid brass wear strips; brass thumbscrew; reversible crescent-shaped cutter with flat and beveled sides; about $175.

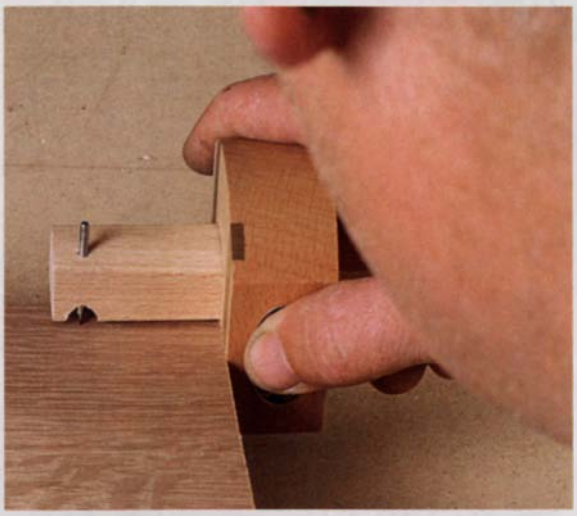
CROWN TOOLS
Rosewood cutting gauge with a single hardened-steel cutter; brass wear strips inlaid on fence; brass thumbscrew; about $22.

STARRETT NO. 29B
Has a hardened-steel fence; tempered-steel square blade; steel beam graduated in 64ths of an inch; about $65.

WOODJOY
Brazilian cherry cutting gauge with reversible brass fence for both straight and curved work; hardened-steel blade; brass thumbscrew; about $48.

Photo, this page (top left): Tom Begnal

Two modifications to improve your mark



Seeing is believing. *When it's important to start or stop a line at an exact spot, you need to be able to see the cutter. Thanks to the angled hole and shaped recess, the pin-cutter on this marking gauge is considerably easier to see.*

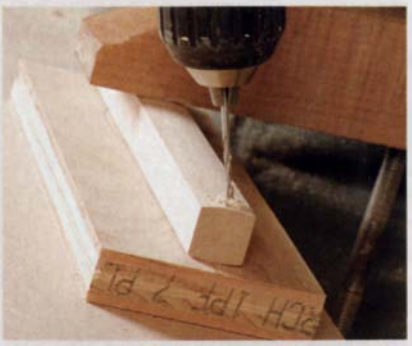
EXPOSE THE CUTTER

When using a pin-style marking gauge, it's just about impossible to see the cutter because the beam of the tool blocks the line of sight. That can be a nuisance, especially when it's important for the line to start or stop at a precise point. But English furniture maker David Charlesworth doesn't have that problem. He has made a quick modification to all of his pin-style gauges to open the field of vision.

Charlesworth favors the Stanley No. 5061 (now discontinued) because the thumbscrew locks the beam on the diagonal. But his method can be adapted to any gauge with a wood beam.

Charlesworth starts by drilling a new hole in the beam to change the angle of the cutter. The hole, drilled about 20° off vertical, is 0.004 in. to 0.006 in. smaller than the diameter of the cutter to ensure a snug friction fit.

Then he removes the part of the beam where the cutter emerges, using a chisel, a round file and sandpaper. The result is a tear-shaped recess that exposes the end of the cutter, making it easier to see where a gauged line starts and stops.



Change the angle of the cutter. *The first step to an easier-to-see cutter is drilling a new hole for the cutter, angled about 20° off vertical.*

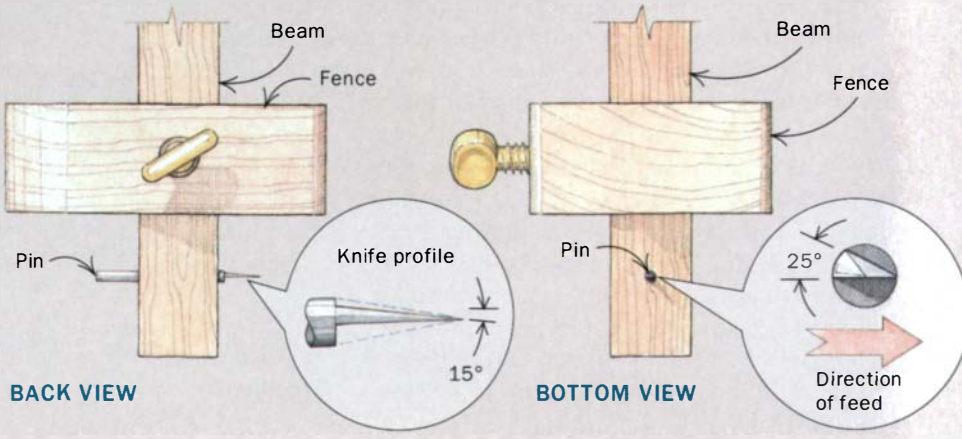
Cut a simple, tear-shaped recess. *Open up some daylight on the beam using a chisel and round file. Clean up rough edges with sandpaper.*

SHARPEN THE CUTTER

Pin-style marking gauges typically have a cylindrical steel cutter with the end tapered to a point. A tapered point works well when cutting a line parallel to the grain or on end grain, but when a line is scribed across the grain, the point tears a ragged line in the wood. The solution is to file the cutter to a knife point. With the cutter between the file and the fence, file a flat surface on the cutter in approximately the same plane as the fence. Then, working on the area of the cutter opposite the flat, use the file to apply the knife edge. Viewed from below, the file should cut about a 25° taper, an angle that steers the fence toward the wood. At the same time, hold the file to 15° and taper the cutter toward the end.

Sharp as a knife. *When filed to a knife edge, the cutter scribes clean lines not only parallel to the grain but also across it.*

Cylindrical cutter makes a ragged cross-grain line. *The tapered point in a pin-cutter marking gauge tears the wood when scribed across the grain.*



Watch it on the web

For more on tuning and using marking tools, go to www.finewoodworking.com.

Photos, this page: Tom Begnal; drawings: Heather Lambert

MARKING GAUGES: WHEEL STYLE

A wheel-style marking gauge has several advantages over pin- and knife-style marking gauges. In particular, the disc-shaped cutter is fully visible as it incises a line, and it creates a clean cut no matter the grain direction.

VERITAS
Steel beam graduated in 16ths of an inch; brass fence and thumbscrew; about $27.

BRIDGE CITY TOOL WORKS
Brass beam with inlaid steel rule; thumbscrew and fence are brass and Juara wood; about $130.

GLEN-DRAKE TOOLWORKS (TITE-MARK)
Steel beam (7 in. long) and thumbscrews with brass fence; $79.
Steel beam (9 in. long) and thumbscrews with brass fence; $89.

www.toolsforworkingwood.com). The hardwood beam and fence are softly polished, and the machining on the brass wear strip is flawless. A nearly 4-in.-long fence offers plenty of bearing surface.

Crown Tools makes one from rosewood with brass wear strips, a brass thumbscrew and a brass wedge that secures the cutter.

Starrett's version, the 29B scratch gauge available from Grainger (888-361-8649; www.grainger.com), is an elegant tool. Graduations on the beam are crisply inscribed, and the thumbscrew clamps down on a split bushing inside the fence instead of bearing directly on the beam. On the downside, the fence is the smallest of all the tools I tested. As a result, when the fence approaches the edge of the board, it can inadvertently pivot, creating a wobble at the end of the incised line. Also, out of the box, the square cutter was too dull for woodworking, so I had to hone it to an edge before use. Given its size, the job wasn't easy. A better solution is to replace it with a cutter made for a Tite-Mark.

The Woodjoy (508-669-5245; www.woodjoytools.com) version is a handsome tool made of Brazilian cherry with a brass fence. Unlike any of the other gauges, the Woodjoy's fence is reversible. One side of the fence is flat for straight cuts, and the other side has two bearing surfaces for cutting a line parallel to a curved surface (as long as the curve radius is greater than about 1½ in.).

Wheeled cutters—The so-called wheeled-cutter marking gauges have several advantages over pin- and knife-cutter marking gauges—and a couple of shortcomings.

***Wheel sharpener.** With the beam on end, the cutter on a Tite-Mark gauge is sharpened easily on a fine-grit stone.*

On the plus side, the disc-shaped cutter is fully visible as it incises a line in a workpiece. The hardened-steel cutter is very sharp, easy to hone and can be adjusted quickly to expose a new cutting edge. And because the wheel is beveled, it draws the fence tightly against the workpiece. Unlike any of the gauges with knife edges, a wheeled-cutter marking gauge can be used in either direction, thereby keeping both right-handers and left-handers happy. Also, it effectively cuts across the grain, with the grain and on end grain.

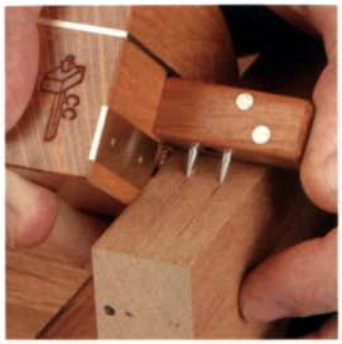
On the downside, the fence of a wheeled-cutter marking gauge is relatively small. Also, with the exception of the Tite-Mark from Glen-Drake Toolworks (707-961-1569; www.glen-drake.com), these gauges have only a single cutter, not a pair. Without the two-cutter option, they cannot mark both sides of a mortise at the same time.

Among the various wheeled-cutter marking gauges I looked at, I especially liked the Tite-Mark gauge. It has a cutting wheel that can be honed easily without removing it from the tool, and a micro-adjust feature.

Veritas makes a wheeled-cutter gauge, too. Unlike the beam on the Tite-Mark, the beam on the Veritas is graduated. The fence slides on the beam with a smooth friction fit, a feature I liked. But there is no micro-adjust feature, and because the wheel cutter is held in place with a round-headed screw, the cutter must be removed from the tool for sharpening. The Veritas is available through Lee Valley Tools (800-871-8158; www.leevalley.com). The wheeled-cutter

Photo, this page (top left): Tom Begnal

MORTISE AND COMBINATION GAUGES



A mortise gauge (left) has two cutters for scribing parallel lines. Similar in design to a pin-style marking gauge, a mortise gauge employs a second cutter that can be adjusted to scribe mortises of various widths. A combination gauge (right) has two cutters on one side of the beam for scribing parallel lines and a single cutter on the other side for use as a marking gauge. The Japanese combos take a slightly different approach by allowing the removal of one of the cutters for marking single lines.

OAKYBO MORTISE GAUGE
Japanese gauge with red oak fence and beam; brass thumbscrew; beveled steel cutting blades; about $24.

OAKYBO COMBINATION GAUGE
Japanese combination gauge with white oak fence and reversible beams; beveled steel cutting blades; brass thumbscrew; about $25.

COLEN CLENTON
Rose she-oak mortise gauge with two hardened-steel pins; inlaid brass wear strips; brass thumbscrew; adjustable cutter can be recessed in fence for scribing single lines; about $245.

gauge from Bridge City Tool Works (model MG-3; 800-253-3332; www.bridgecitytools.com) is a sweet tool. The semicircular fence is longer than that on other wheeled-cutter gauges, about 2⅛ in., and it features Juara wood sandwiched between brass facings.

Mortise gauges

A traditional mortise gauge has two cutters that can be adjusted independently so that both edges of a mortise can be marked at the same time. They have become harder to find because most retailers prefer to offer combination gauges.

Like the Clenton marking gauge, the company's mortise gauge is gorgeous. The finish is silky smooth, and the adjustment mechanism worked perfectly.

The Tite-Mark gauge can be outfitted with two adjustable cutters that slide onto the beam, allowing the gauge to scribe a pair of lines. It's also available in a slightly longer version (9 in. vs. 7 in.), making it better suited for two-handed use. Add four cutters to the Tite-Mark, and you can scribe double tenons. As a mortise gauge, though, it's not the most convenient to use because each cutter is secured by tightening a setscrew with an Allen wrench.

Combination gauges

A combination gauge blends the features of both the marking gauge and the mortise gauge, so you get two tools for not much more than the price of one. Most combination gauges are made in the style of the traditional gauges. But some Japanese-style gauges also work effectively as combination tools.

Traditional combination gauges—Traditional combination gauges have three pin-style cutters—one on one side of the beam and a pair on the other. The single cutter and the outermost cutter on the other side are both fixed. A second cutter for marking mortises is attached to a brass strip that slides in a groove in the beam.

The paired cutters, used to mark mortises, don't have to be sharpened to a knife edge because they are drawn either with the grain or across end grain.

I looked at two traditional combination gauges from Crown Tools, one with an adjustment knob at the end of the beam and

Photos, this page (top left): Tom Begnal

CROWN TOOLS
Rosewood combination gauge with mechanical adjustment knob; brass wear strips inlaid on fence; about $38.

MARPLES
Beech combination gauge with standard sliding adjustment; plastic thumbscrew; about $12 (also available in rosewood and brass).

one with a standard sliding adjustment (not shown). The knobbed version makes it easier to get an accurate cutter adjustment for a mortise. But because the machining was poor on both gauges, the brass bar that adjusts the position of one of the mortising cutters was tight and difficult to move smoothly.

Marples makes a variety of combination gauges available through the Museum of Woodworking Tools (for contact information, see p. 81). Prices range from about $12 for the beech model (shown above) up to $55 for a fancy rosewood version.

Japanese combination gauges—I looked at two gauges made by Oakybo and available from Japan Woodworker (800-537-7820; www.japanwoodworker.com). One, made of white oak, is sold as a combination gauge. The other, made of red oak, is called a mortise gauge. But each one can make either single or double cuts.

Although not as stylish as the Clenton gauges, these tools have some advantages over traditional combination gauges. For one thing, they both have long fences—5¼ in. for the combination gauge; 4⅛ in. for the mortise gauge.

The combination gauge uses twin beams, each with a knife-edged cutter driven through a slot and held in place by friction. Hardware appears to be zinc-coated steel, and the tips of the cutters are roughly 1 in. apart. Once the setscrew in the side of the fence had been loosened, there was a lot of play in the beams, which made it awkward for me to set up the tool for laying out a mortise. There is no recess in the fence for one of the cutters, so to use the tool as a marking gauge, one beam must be reversed so that the cutter is out of the way. But because the beams are reversible, the gauge can scribe a line on either side of the fence.

The mortise gauge has two beveled knife-edged cutters that share a slot on the beam and can be adjusted independently of one another. This tool was simple, light in the hand and appealing. One of the cutters can be withdrawn into the face of the fence so that the tool can be used as a marking gauge. Because the cutters are exposed, it's easy to start and stop a line where you want.

A few of my favorite gauges

If I were in the market, I'd probably buy two of these tools. One would be the Tite-Mark marking gauge or the Starrett gauge. The other would be either the Clenton mortise gauge (if I could raise the cash) or the red-oak Oakybo.

GLEN-DRAKE TOOLWORKS (TITE-MARK)
Can be outfitted with a pair of mortise blades that are independently adjustable and are locked with setscrews; about $113 as shown with two blades and a 9-in. beam. Add an additional set of blades to scribe double mortises. Blades are about $24 a pair.

The Tite-Mark has an easy-to-see cutter that sliced cleanly, regardless of the grain direction. The Starrett simply felt comfortable to use, while the quality of the Clenton was unmatched. And I liked the red-oak Japanese mortise gauge for its simplicity and sharp cutters.

If finish and appearance as well as performance are important considerations, I'd recommend buying a Clenton or a Bridge City tool. The Clenton mortise gauge was superb, with the look and feel of a tool made to the highest standards. The only disadvantage with the Clenton gauge other than price is that the cutter is harder to see than the cutter on a wheel gauge. □

Scott Gibson lives in Maine, where he works as a writer, editor and furniture maker.

Current Work

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Carl Zytowski Moab, Utah

Zytowski combined elements of two 1950s Edward Barnsley originals to build this bubinga-veneered reproduction. The dresser (17 in. deep by 33 in. wide by 30 in. tall) features hard-maple string inlay and a pull-out tray with a leather insert. The brown-oak and Spanish-cedar drawers are of NK construction with hand-cut dovetails and feature sterling-silver drop pulls. The finish is three coats of hand-rubbed Liberon oil. Photos by Jay Odee

Robbi Staples North Dartmouth, Mass.

Staples' goal behind the construction of this wine and spirits cabinet (17 in. deep by 42 in. wide by 36 in. tall) was to provide a place to display a few nice bottles of wine and wineglasses for people who don't have the space or can't afford a wine cellar. "My main influence for this design is the work of Hank Gilpin," said Staples. Made of quartersawn English brown oak, the piece features ebony door handles and has a lacquer finish.

Alan Reams Wimberley, Texas ▶

Working with interior designers and architects as his primary source of commissions, Reams collaborated with local architect John Gutzler to design and build this folding screen. Made of cherry, the screen (80 in. wide by 80 in. tall) was constructed in four equal segments with wooden hinges—an idea he got from an old issue of *Fine Woodworking*—which allow the panels to fold into a stack. The ¾₄-in.-thick laths that were used in the formation of the screens took three people to weave. The folding screen is finished with an oil stain and precatalyzed lacquer.

Omar A. Perez Houston, Texas ▲

Perez made this jewelry box (8½ in. deep by 16 in. wide by 6½ in. tall) to enter into the Texas juried exhibition Craft Houston: 2002. To give the cherry box an appearance of floating within its stand, he attached it to the cocobolo base at just four points. The front and back cylindrical connection points are capped with rose mother-of-pearl. The curves of the box were achieved by using a metal grinder, a carving tool and then hand carving. Both the box and stand have a lacquer finish.

Marie Kline Oakland, Calif. ▶

After signing up to participate in a local Artists' Open Studios event, Kline needed something to show: This curved trunk (22¼ in. deep by 47 in. wide by 22¼ in. tall) is what she chose to build for the exhibit. The piece, constructed out of maple and walnut, took approximately 540 hours to complete. "The trunk became a canvas for my freehand doodle designs," Kline said. It has a water-based satin-polyurethane finish with a black-acrylic enamel design.

Steven Chase Midland, Texas

Chase built this reading chair (23 in. deep by 24 in. wide by 47 in. tall) for a tall client who needed an oversize chair. The client also wanted the chair to have excellent lower-back support and arms that would support his elbows. Using the Sam Maloof style as a base and then working from the client's requests, Chase made the chair out of cherry with ebony plugs. It has an oil and spar-varnish finish. Photo by Samuel Johnson

Bernard Resh Lancaster, Pa.

Resh made this country sideboard (19¼ in. deep by 36 in. wide by 36 in. tall) for storage space in his small kitchen. It is made of cherry, flame cherry, curly maple, maple and black walnut and is finished with hand-rubbed oil and varnish.

Allan Smith Hopewell, N.J.

The design for this coffee table (23 in. deep by 56 in. wide by 17 in. high) was taken from an illustration in Gustav Ecke's *Chinese Domestic Furniture* (Dover Publications, 1990). Smith chose to build the table out of Philippine narra, the wood used for high-class household furniture during the classic era of Chinese furniture making in the Ming and Ch'ing dynasties. The piece is finished with an aniline stain, an oil-and-polyurethane mixture and wax.

Douglas Harris and David Hall Saline, Mich. ▲

Harris and Hall made this pulpit (20½ in. deep by 32½ in. wide by 47¾ in. tall) for the First Unitarian Church of Ann Arbor. The design is a synthesis of the prior pulpit and the sweeping, curving walls of the church. The pulpit is constructed from 20 slats laminated with quartersawn white oak over an inner core of three layers of ⅛-in.-thick plywood; each slat was shaped to its final size with a shopmade router jig. Walnut inlays on the top and back edges cover the plywood core. The finish is Danish oil.

John Percifield West Lafayette, Ind. ▲

This buffet (24 in. deep by 65 in. wide by 36 in. tall) is made of highly figured curly cherry, cherry and cherry veneer. To form the curved and veneered side panels, doors and drawer fronts with a vacuum press, Percifield had to construct three forms and 12 curved templates. The finish is two coats of linseed oil topped with several coats of varnish.

Keith P. Tompkins Tivoli, N.Y. ▲

"I like to create wood turnings that reflect my experience as a furniture maker as well as a turner," Tompkins said. In making this turned vase (9 in. dia. by 9 in. tall), he chose to use stave construction instead of the usual stack method to create patterns from the top to the bottom. Made of yellowheart, wenge, padauk, maple and ebony veneer, all of the joints in the piece involve compound angles cut on the tablesaw. The turning is finished with lacquer. Photo by Rick Becker Studio

Tips for photographing your furniture

1. *Clean and dust the furniture.*
2. *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.*
3. *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.*
4. *Use 35mm color print (negative) film of moderate speed (ISO 200-400). If you're using a digital camera, shoot at the highest resolution and place the image on a CD.*
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.*

Rules of Thumb

BY ERNIE CONOVER

Mortise-and-tenon basics

I often tell students that the best way to learn how to make mortise-and-tenon joints is to cut them by hand. Once they have mastered laying out and hand-cutting mortise and tenons, these skills can be transferred into fast and painless setups for machine-cut joints. My method employs simple tools and a logical approach.

An orderly layout sequence

An accurate layout begins with the right tools. The best tools for the job are a marking knife or scribe (for more on these tools, see *FWW* #155, pp. 88-90), a sharp pencil, a marking gauge and a mortising gauge (see "Choosing Marking Tools," pp. 80-85).

Before layout can begin, however, you need accurately milled stock that is straight, flat and square. Once the stock has been milled, the first step is to draw carpenter's triangles on the pieces (see the right photo below). Carpenter's triangles drawn across each rail and stile of a frame let you quickly see the relationship of the parts and help maintain proper orientation during layout.

When hand-cutting a mortise, allow an extra inch of wood at the end of each stile. Known as a horn, this area of wood, which is removed later, prevents the end of the stile from splitting while the mortise is being chopped. When cutting mortise-and-tenons by machine, a horn is not necessary.

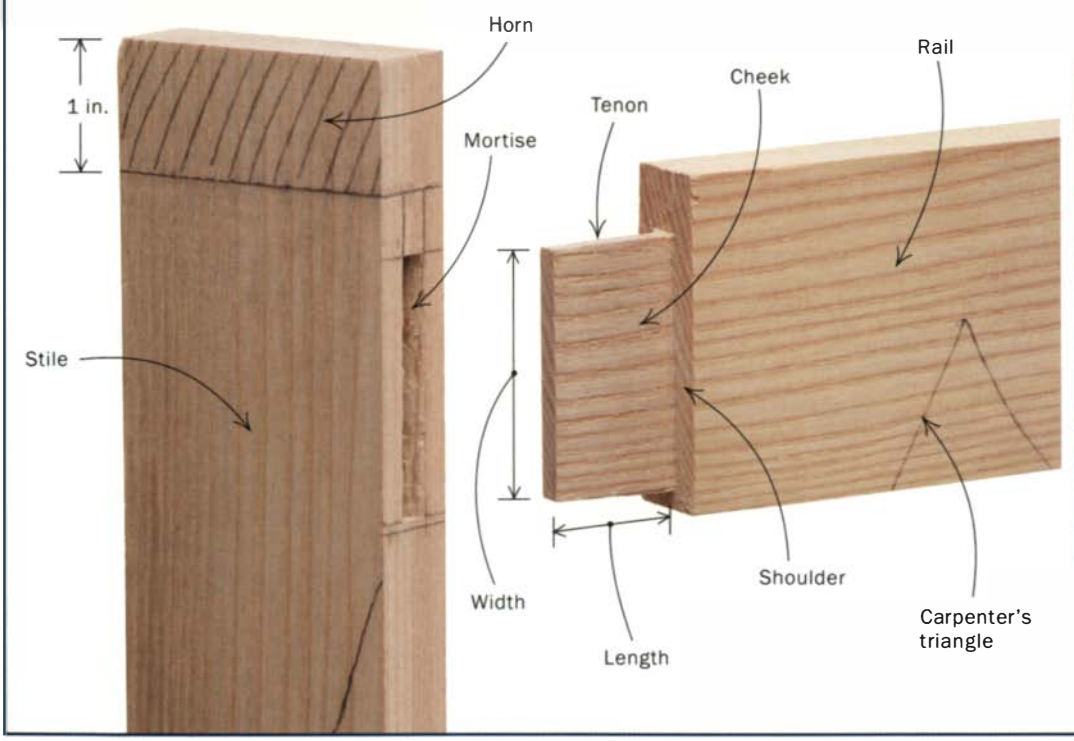
Mark the inside edges of the stiles where they intersect with the rails. Direct transfer, using a square to support the rail for marking, easily accomplishes this (see photo 2 on the facing page). Cut deeply with the marking knife so that planing or sanding doesn't remove the resulting marks, which are helpful in square assembly. If you are marking dark wood like walnut, rubbing the area to be scribed with chalk will help you see the layout lines.

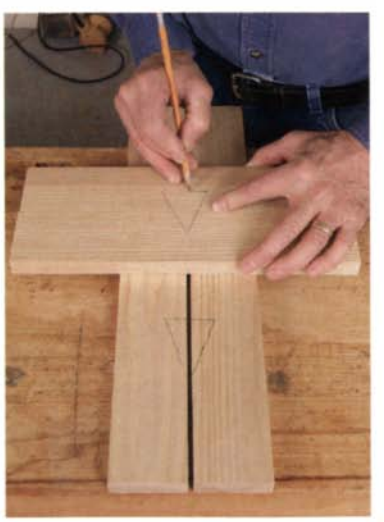
To establish the length of the tenon from the shoulder, use a marking gauge. The tenon length is typically two-thirds to three-quarters of the width of the stile. For typical face frames, the length generally works out to be between ¾ in. and 1 in.

When joining pieces of equal thickness

MORTISE-AND-TENON ANATOMY

This is a typical mortise and tenon for a frame-and-panel assembly. The mortise is one-third the thickness of the stile and centered.



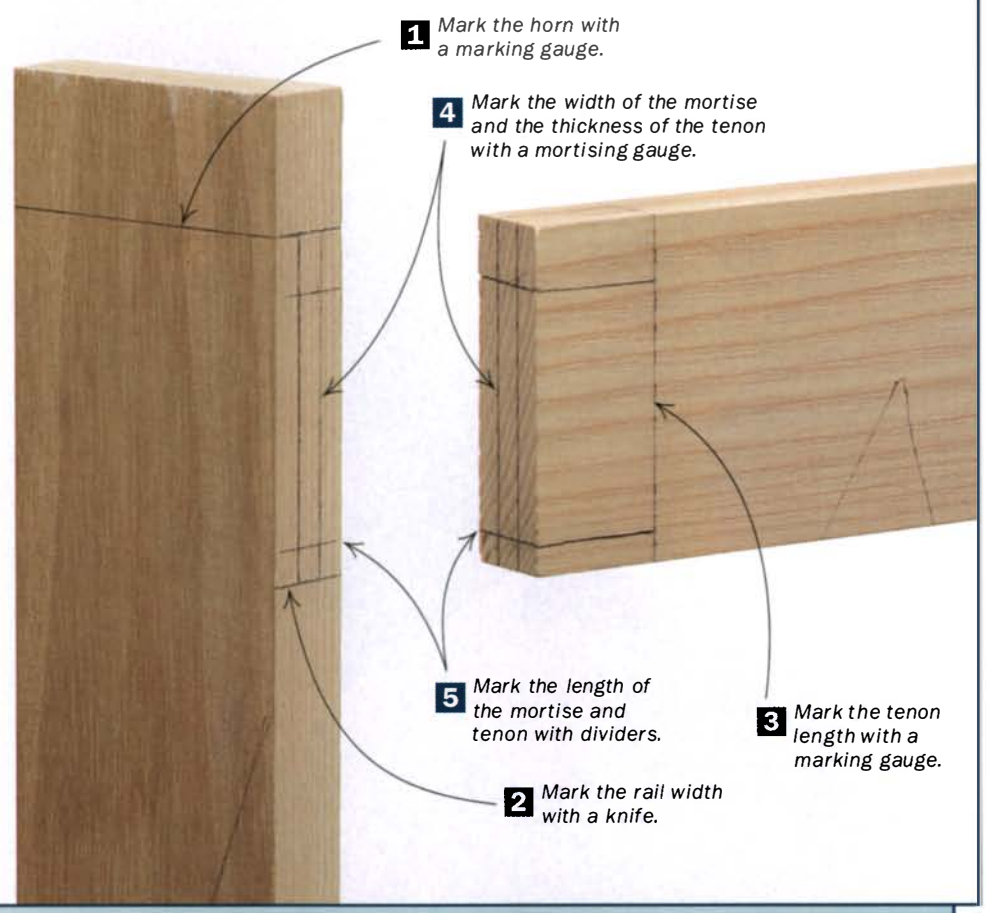


Triangles keep you organized. *Mark the rails and stiles with carpenter's triangles. The triangles will help you keep track of the relationship of one piece to another.*

Photos, except where noted: Mark Schofield; facing page: Kelly J. Dunton

SPECIALIZED LAYOUT TOOLS ENSURE ACCURACY

Always work off the face that has the carpenter's triangle marked on it (see the bottom right photo on the facing page). If necessary, darken the scored lines with a pencil.



1 *Lay out the horn on both stiles.* *If you plan to chisel a mortise by hand, leave an extra inch at each end of the stile. This prevents the end of the stile from splitting when the mortise is chiseled out.*

2 *Mark the width of the rails.* *While both stiles are still together, place one edge of the rail on the edge of the horn, and then place a square against the bottom edge of the rail. Remove the rail and use a knife against the square to mark the inside edge of the rail.*

3 *Score the tenon's length.* *Scribe the length of the tenon on the end of each rail. The tenon is usually two-thirds to three-quarters of the width of the stile.*

4 *Mark the mortise.* *Set the pins of the mortising gauge to match the width of the chisel (inset). Center the pins on the stile to define the edges of the mortise.*

5 *Mark the shoulders.* *Use a pair of dividers to mark the narrow shoulders of the tenon.*

CHOP THE MORTISE FIRST

Because the width of the mortise is determined by the chisel, cut this part first.

The right depth. *The mortise should be slightly deeper than the length of the tenon. Wrap some masking tape around the mortising chisel to mark that depth.*

Define the ends. *With the point of the chisel resting in the knife mark, establish the ends of the mortise with a light tap.*

such as in face frames, the mortise width should be one-third the thickness of the stock. Because face frames typically are made from ¾-in.-thick material, a ¼-in. chisel is a necessity. Set the mortising gauge to match the width of whatever hand chisel you select.

In an unobtrusive area, make your best guess at centering this spacing by using the mortising gauge to mark from both faces. If your guess was a bit off, the result will be a pair of double lines. Placing each point in the center of its respective set of lines (from either face) will result in perfect centering of the pins.

Once the mortising gauge has been centered, use it to lay out the mortises between the scribed lines on the stiles. This establishes the cheeks of the mortise. Without setting down the gauge, lay out the tenons on the end of each rail by marking the end and edges up to the previously gauged shoulder line.

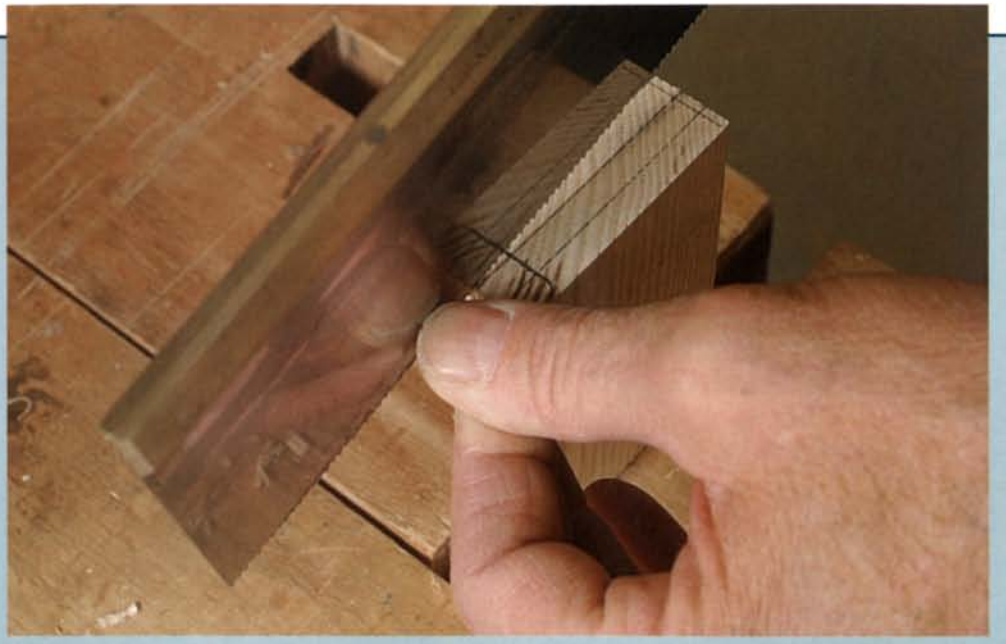
Even though the mortising-gauge points are centered, it is good practice to mark from only one face. I always mark from the primary face that has the carpenter's triangles on it. This means that if there is some variation in stock thickness, the primary face will be flush.

Now lay out the inside and outside shoulders for each mortise and on the end of each rail. On inside corners you need only enough shoulder to conceal the joint, usually 1/16 in. On outside corners you need

Small cuts first. *Using hand power alone, raise a series of small chips.*

Clear the chips. *Slide the side of the chisel over the mortise to remove the small chips. The small cuts and this removal method give a clean and precise start to the mortise.*

Make deep cuts. *Establish the full depth of the mortise in the center first, working back toward each end and chiseling the waste into the center.*



Split your line. *Using your thumb as a guide, take light cuts on a corner of the line until the kerf is deep enough to guide the saw. Then make the remainder of the cut. After cutting the long shoulders, cut the narrow shoulders.*

SAW THE TENON

Err on the side of making the tenon oversize; then fit it to the mortise.

Remove the waste. *When sawing off the waste to expose the shoulders, a bench hook is an invaluable tool.*

Straighten your shoulders. *You probably will need to clean up the shoulders to ensure a perfect fit with the stile. A shoulder plane is designed for that purpose.*

Fine-tuning. *The first few times, play it safe and cut the tenon slightly thick. The surplus wood can be removed with either a bench chisel or a shoulder plane.*

something on the order of ¼ in. to ⅜ in. of shoulder to leave sufficient cross-grain strength on the outside of the mortise.

Cut the mortise, then the tenon

Whether cutting by hand or machine, it is best to chop the mortises before cutting the tenons, because tools usually determine the width of the mortise. The tenon then may be adjusted to fit the mortise.

The mortise should be about 1/16 in. deeper than the tenon length to ensure the joint fits at the shoulder. Place the mortising chisel over the tenon layout and wrap masking tape around the chisel at the desired depth.

To ensure that the cut follows the layout lines and leaves clean shoulders, start with a light tap at both ends. Then, using only hand power, make a series of angular cuts about 1/16 in. deep to raise a line of chips.

The cleanest way to remove the chips is to push the shaft of the chisel across the mortise. With the area of the mortise defined, begin to excavate the mortise to its full depth in the middle. Excavate the waste by pulling back on the chisel, using the uncut area of the mortise as a fulcrum. Now you'll appreciate the value of the horn. Once you have reached the full depth, work back from the center to both ends, chopping the waste into the center hole.

Once you have finished the mortise, evaluate how well your marking matched what the chisel actually cut. You will want to take this into account when cutting the tenon.

To cut good tenons you will need a fine-toothed saw. Some people swear by thin-kerfed Japanese saws, but I always have found it hard to correct the direction of a cut with them. I prefer a traditional brass-backed tenon saw with 12 to 15 tpi.

Start the cut on either the front or rear corner of the line with the saw angled about 30°. Using your thumb as a guide, make very light cuts until the kerf is deep enough to guide the saw on its own. Then bring the saw down until the cut is parallel to the end of the tenon. Make the cuts for the long shoulders first, followed by the inside and outside shoulders. Finally, using a bench hook to hold the rail, saw away the waste to define the shoulders.

Fitting the mortise and tenon

The odds are that you will have left the tenon slightly fat and that a small amount of wood must be pared from one or more cheeks for a good fit. Even if the tenon fits the mortise right off the bat, it is still a good idea to clean the shoulders of any saw marks. A shoulder plane is designed for both jobs, but a sharp bench chisel with a perfectly flat back will do the same job more slowly. When you do the final assembly, the layout lines are a great help in keeping the frame square. □

Q&A

Yellow pine for period furniture?

I'm interested in reproducing an 18th-century corner cupboard using yellow pine. Was yellow pine used in the southern colonies around that time? If so, was it used for fine furniture or merely as utility-grade wood? I want wood that is good to work with and that paints well. Does yellow pine or another type of wood meet this criteria?

—Richard Divine, Dunnellon, Fla.

Mike Dunbar replies: Southern yellow pine appears in 18th-century furniture made in New Jersey on south. Cabinetmakers used the material primarily as a secondary wood (unseen parts such as drawer bottoms and sides and back boards). Furniture made entirely of this wood tended to be utilitarian, although some formal pieces of furniture were made with southern yellow pine as the primary wood.

In the book *Furniture of Williamsburg and Eastern Virginia* (Virginia Museum of Arts, 1979), Wallace B. Gusler illustrates a desk-and-bookcase with ball-and-claw feet made entirely of yellow pine. Of particular interest to you would be the formal corner cupboard illustrated in this book. It, too, is made entirely of southern yellow pine.

Southern yellow pine encompasses a group of different species with the same properties. The group includes: long-leaf pine, short-leaf pine, slash pine and loblolly pine. All of these species are resinous and have relatively hard summer growth. This hard summer wood gives southern yellow pine a pronounced figure. The wood is much harder and heavier than northern white pine, and it yields crisp details. Working it with handplanes requires sharp edges, and you should sharpen more frequently than with other woods. Yellow pine takes paint well.

Not a single species. *Long-leaf, short-leaf, slash and loblolly all fall under the category of southern yellow pine.*

As far as other suitable species, I would recommend yellow poplar or northern white pine. These woods also are very workable and historically accurate. [Mike Dunbar is a contributing editor.]

BORING MORTISES IN THE PROPER ORDER

First, bore holes at each end of the mortise area. Then, continue to make as many clean holes as the length of the mortise allows.

Drill the ends of the mortise first to give the tip of the bit solid footing. *Square ends are critical to a strong joint, so it's important to eliminate bit deflection at the ends.*

Do not overlap the holes. *The drill bit needs the surrounding wood as support so that it can bore straight.*

Clean up with a chisel. *Pare the walls of the mortise smooth.*

How to drill out better mortises

I use a drill press with a brad-point bit to drill out mortises, and then I clean up the sides with a sharp chisel. When I drill, I always begin in the middle and work my way out to the ends. I have a lot of trouble keeping the bit on track as I make my outer holes, and by the time I come to the outer edge, I can barely shave the end with the outer part of the bit because it deflects so much. Do I have to invest in a square (hollow) mortise cutter?

—Will Carroll, Madison, Wis.

David Margonelli replies: Whether or not you invest in a hollow chisel for cutting mortises, you need to change your order of operations in cutting them. Instead of starting in the middle and working your way out to the ends, drill the ends first. Then, forget about trying to make one, continuous, clean hole; instead, focus on making clean holes that are slightly separated from one another. They must be cut close to one another but should not overlap.

A drill bit needs footing on the full diameter of the bit's face at the point of entry. If the bit doesn't get solid footing, it will deflect, giving you canted or an otherwise out-of-square hole. Flexing a

Photos, except where noted: Karen Wales

bit to an extreme presents a danger to you and should be avoided. If your drill holes are straight, you can clean up the walls of the mortise easily by paring them with a chisel. Having a bit of wood left over between holes will not get in your way. [David Margonelli builds custom furniture in Edgecomb, Maine.]

Preventing rust in a toolbox

I've just started layout of a wall-mounted toolbox along the lines of the one made by Christian Becksvoort in* Tools & Shops *(FWW #153, pp. 84-89). This and other references point to using a "rust-inhibiting" liner in any toolbox or case, but I have not seen any specific material named. Can you name a few?

—Clark Champion, Bodega Bay, Calif.

Warm it with a lamp. *A lamp will warm an open toolbox and lower humidity in the immediate area.*

Christian Becksvoort replies: There are several ways of inhibiting rust in a toolbox. The first is heat. A lamp will keep the temperature above the ambient shop temperature, thereby keeping it above the dew point. You can even go to the extreme of buying a small dehumidifier made for scientific and museum use. However, these "oxygen eaters" are expensive and work well only in an inert environment. Putting each tool in a polyethylene (plastic) bag with a zip seal will give nearly the same result for a lot less money.

You also can go the route of rust inhibitors, such as treated kraft paper to line toolbox compartments and drawers. This material gives off slight fumes that prevent the formation of rust. One company that makes this type of product is Cromwell-Phoenix of Alsip, Ill. (708-293-7750). Lie-Nielsen Toolworks wraps tools in it for shipment. I save the paper and stuff it in my toolbox.

Wrap against rust. *Treated kraft paper gives off rust-inhibiting fumes. Silver cloth inhibits tarnish and protects tools from other tools.*

Try a desiccant pack. *From disposable packets to reusable cartridges, desiccants provide long-lasting protection against rust.*

Other good rust inhibitors are desiccants, which absorb moisture. Some types of desiccants can be put in a microwave or conventional oven to get rid of absorbed moisture and can be reused indefinitely. A good source for these supplies is www.gaylord.com (go to the archival section of the web site).

Finally, to protect brass and bronze tools from tarnish, you can go to jewelry-supply outlets for a treated flannel called silver cloth. If there are no listings in your yellow pages, go to www.thomasregister.com. This is the complete Thomas Register of companies and manufacturers online. [Christian Becksvoort is a contributing editor.]

Preparing a tabletop for finishing

I have a slab of walnut crotch that I've labored over for several months to make a coffee-table top. However, in an attempt to remove a few very small scratches, I'm afraid that I may have ruined it.

Initially, I scraped and sanded the surface to 600 grit, followed by 2F and 4F pumice and then rottenstone. I blew out the grain with my air compressor between each abrasive process. When I finished with the rottenstone, it looked and felt as if it were oiled. The surface was like a mirror! I applied boiled linseed oil for the finish.

After working the edges, I noticed that I had made a few slight scratches on the top and decided to repair them. I laid on small pieces of slightly moistened paper towel, hoping to raise the grain and smooth out these blemishes. This seemed to help some but did not eliminate the scratches, probably because the rottenstone process did not leave much grain to raise. I assumed the water would leave dull spots, and it did, but I figured those would disappear when I refinished the surface with another coat of oil.

Next, I resanded these areas with 600-grit paper followed again by 2F and 4F pumice and the rottenstone, blowing the surface with compressed air after each step. I recoated the surface with the linseed oil but ended up with dull spots in all of my repaired areas. How do I get back my mirror finish?

—Phillip Anthony Briles, Mesilla, N.M.

Chris Minick replies: You've wasted your time and energy, and I'll explain why. Sanding bare wood with sandpaper any finer than 220 grit before applying a finish is rarely necessary and may even be detrimental because it effectively burnishes the wood surface, which severely limits the penetration of any finish into the wood. By carrying the sanding sequence that far, you did more harm than good to that beautiful piece of walnut. The mirror-smooth surface you produced on the bare slab had about the same finish-absorption characteristics as the mirror in your bathroom—virtually none. No finish equals no protection.

It is not surprising that your scratch-repair areas looked different than the surrounding wood. It is difficult enough to spot-sand a small area of a high-gloss

finish without having it show. I suspect it is impossible to do so with burnished bare wood, because you can't see the difference with the naked eye. I'm afraid the only recourse you have now is to re-sand the entire surface and start over. This time, though, stop sanding at 220 grit and build up a film finish, such as shellac, lacquer or varnish, applied over the oil sealer coat. You can rub out film finishes using pumice and rottenstone after they've dried to get as much of a gloss as you want. I think you'll be happy with the results.

Better yet, use automotive rubbing and polishing compounds: They will take less time, and the finished product will look better.

[Chris Minick is a consulting editor.]

Yellow glue and stain

I work with pine often and have never been able to solve this problem. Stain will not penetrate any spot that has been wiped clean from yellow-glue squeeze-out. What do you suggest?

—John Freda, Huntington Bay, N.Y.

Teri Masaschi replies: This is a common problem among woodworkers. There are several options. The first one is to use less glue. Most woodworkers feel as though they must have bountiful squeeze-out to have a good glue bond. Not so! Apply just enough to have tiny beads barely squeezing out.

Then, there's option two: Don't touch it. Don't wipe it. And absolutely do not use a wet rag to remove the excess glue. The water rag is full of dissolved glue, which, when wiped on the wood, ultimately seals the pores. This causes uneven stain absorption. Allow those tiny pearls of squeezed-out glue to harden a little. When they're skinned over, a sharp chisel pops them off perfectly. A little sanding, and then—voilà!—no glue spots. If the joint is a tabletop or some type of flat surface, sanding is in order anyway. If it is a table apron mortised into the leg, there is no need to put glue on the shoulder of the tenon area—it is edge grain and won't add strength anyway. Skip the glue on the outside shoulder entirely.

Or, as a third consideration, you might try switching from yellow glue to hide glue. It accepts stain just a little better than yellow glue does. Last, if you just love squeeze-out, stain your pieces (other than surfaces) before final assembly. Then a damp rag won't cause the wood to take glue unevenly.

[Teri Masaschi is a regular contributor to *Fine Woodworking*.]

GLUE AND STAIN DON'T MIX

DON'T WIPE WET GLUE

Wiping causes blotches. *Wiping along the glueline seals the pores of the wood, making it impossible for stain to penetrate evenly.*

LET IT DRY AND PARE AWAY

Chisel slightly hardened glue. *Allow beads of glue to skin over but not completely harden. Then, use a sharp chisel to slice them off. The stain absorbs evenly for an imperceptible glueline.*

Lacquer finish on musical instruments

I enjoyed your article on hand-rubbed lacquers in FWW #161, pp. 121-122. As an amateur luthier, I sometimes use at least 15 coats of finish on my instruments. Would nitrocellulose lacquer as described in the article be appropriate for guitars and violins?

—James Redmond, Syracuse, N.Y.

Steve Rowles replies: Nitrocellulose lacquer has been used on guitars for a long time. Its main advantage is that it dries fast, allowing many coats to be built up in a short time. The result is a crystal-clear, glasslike appearance. But the finish is too hard and inflexible for violins. Spirit varnish (shellac based) and oil varnish (linseed oil based) are appropriate materials for bowed instruments.

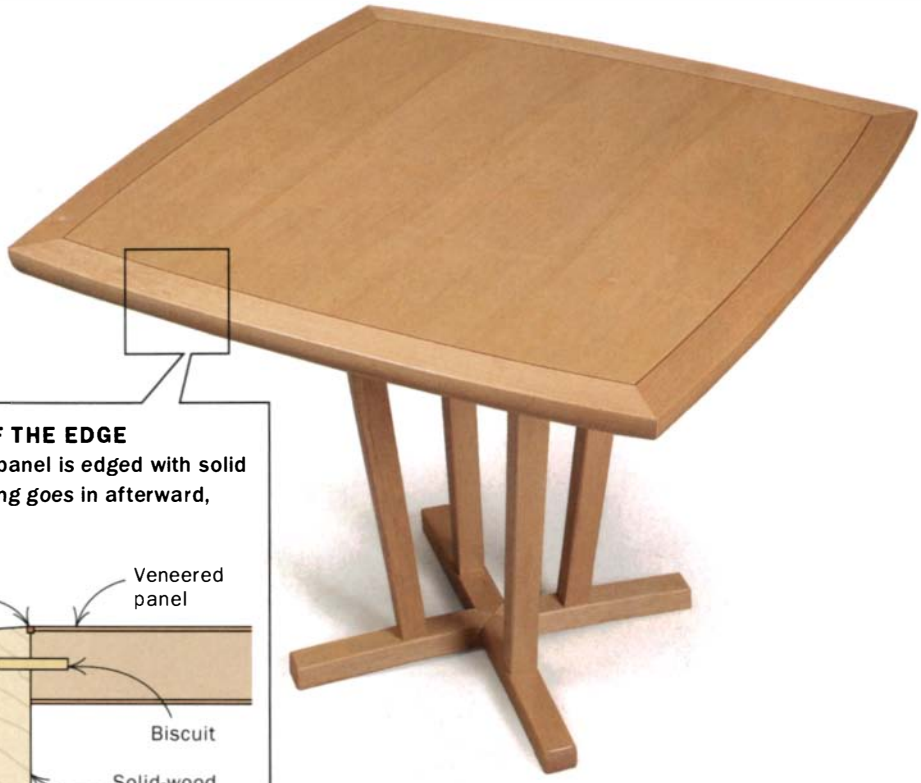
[Steve Rowles builds violins in Maine.]

Photos, this page: Kelly J. Dunton

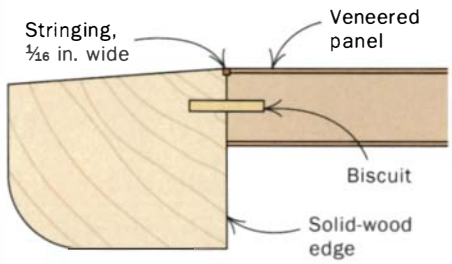
Master Class

Curved, solid edge for a veneered tabletop

BY MARK EDMUNDSON



CROSS SECTION OF THE EDGE
The veneered central panel is edged with solid hardwood. The stringing goes in afterward, hiding the glue joint.



A small table can transform a nook into an informal place for the morning coffee and paper. These tight spots are even more inviting if the edges of the table have a slight curve to them, making it easy to slide in on either side. This was my thinking when I took a commission to build a 36-in.-square table for just such a nook.

After a series of conversations with a trusted woodworking friend, I began to see how to build this tabletop, and I have continued to refine the process while building several more. The process works for any square or rectangular table, producing mildly curved, or "pillowed," sides and elevating the appearance.

Originally, when the design was a square table, I had planned to use string inlay between the veneered panel and the solid edge. Now that I was going to curve the edges, the inlay over the joint would provide flexibility when fitting the long, curved edge-band pieces.

One master template rules the rest

The first step is to make a master template for one of the curved sides, and use it to make the four-sided template for the veneered panel as well as the edge-band template. Later, that same panel template is used again to cut the inlay groove.

Before walking through the steps, it's important to understand how the panel template is used both for trimming the outside edge of the veneered panel and for routing the inlay groove. To trim the panel edge with a router, use a ½-in. bit with a 1-in.-O.D. (outside diameter) template guide. You'll get a cut that is ¼ in. from the template edge. Later, after the solid edges have been applied, use a 1/16-in. bit with a ½-in.-O.D. guide in the router to cut the inlay groove. You'll get a 1/16-in.-wide cut that is 7/32 in. from the template edge, splitting the glue seam.

Start the master template by making a half template for the curve. This will ensure symmetry and a good fit for all of the curved pieces. First, draw perpendicular, diagonal lines on a piece of template stock the size of your intended panel. Use those diagonals and a flexible batten to find an attractive curve that ends in the same place on each corner. Then trace a little more than half of the curve onto paper. Cut out the paper curve and transfer it to the

MAKE A MASTER TEMPLATE

Start by finding a pleasing curve. *Mark diagonals to locate the corners and use a batten to trace the desired curve.*

Transfer half of the curve to paper and make a half template. *Using a half pattern will ensure symmetry. Cut out the template on the bandsaw. Then sand with a flexible batten to maintain a fair curve.*

Use the half template to rout a full-length master template. *Use a flush-trimming bit. This master will be the reference for both the panel and the edge-band templates.*

Photos: Asa Christiana

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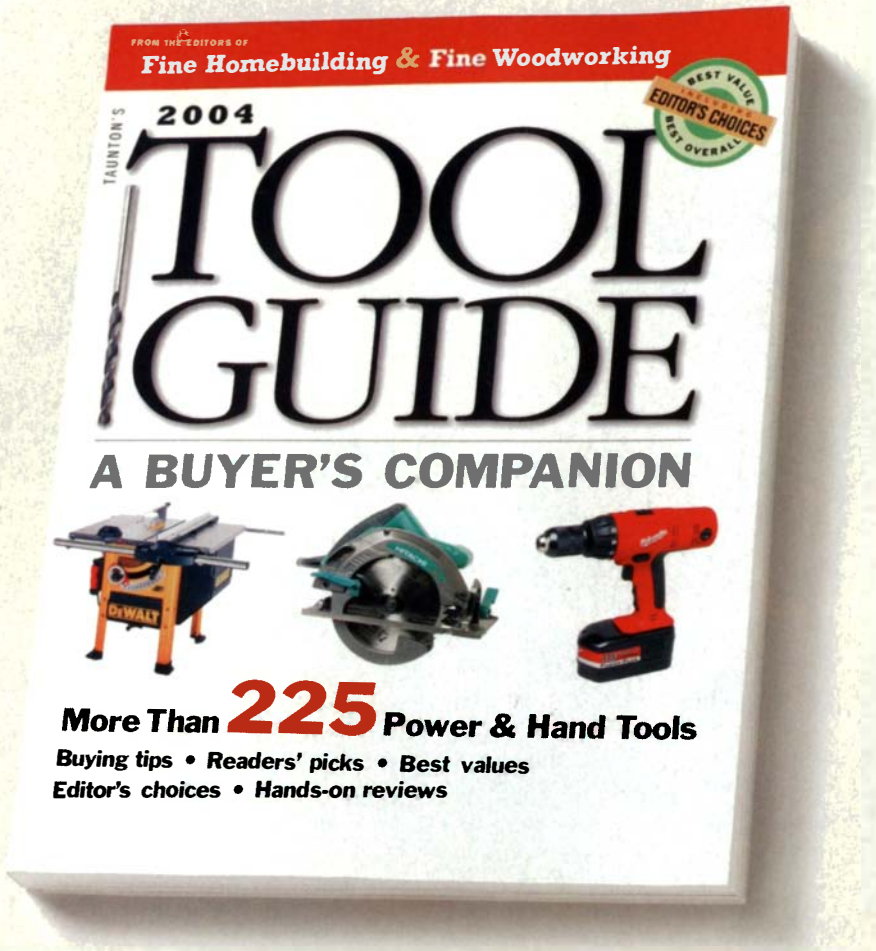

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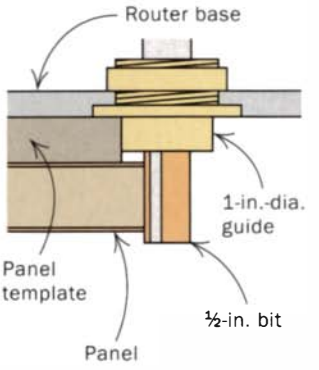
SHAPE THE PANEL

Use the master template to rout the panel template. *Shift the edge of the template inward to allow for the offset of the router template guide.*

Now use the panel template to lay out the panel. *Draw the actual finished edge of the panel by using a thin stick to simulate the offset of the template guide.*

Use the panel template to rout the panel. *An inside template like this will leave round corners, so stop ⅜ in. short and finish them by hand.*



template stock. Cut this half curve and smooth it with a sanding block until there are no flat spots. Feel for flats by rolling the edge on your benchtop.

Use this half template to draw the full curve on another piece of sheet stock by scribing one side and then flipping it over on its centerline to lay out the other. This full curve will be the master template. Cut close to the line on the bandsaw, then use the half template and a flush-trimming bit to rout each side of the master.

From master to panel template to finished panel

To lay out the panel template, position the master template evenly between the diagonals and ¼ in. shy of your intended finished edge, to account for the offset of the template guide.

On the bandsaw, cut the panel template slightly proud of the line on all four sides. Then clamp the master template back in place, this time even with the actual edge, and use a flush-trimming bit to rout each edge of the template.

When your veneered panel has been laid up, lay out and trim the finished edges. First, draw diagonals across the panel as you did on its template. Then clamp the template on the panel. Trace lines at the corners to record the template location. These marks will help locate the template when you cut the inlay.

Next, use a ¼-in.-thick piece of wood as a guide for drawing the location of the finished edge (see the bottom left photo above). Remove the clamps and cut slightly proud of the line on the bandsaw. Reclamp the template and set up the router with the ½-in. bit and ¾-in. template guide for cutting the finished edge. Finish the corners by hand with a rasp and a block plane.

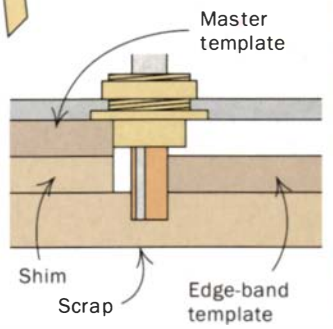
Edge-band also needs a template

With the master template as a reference, I made an edge-band template the exact size of the finished pieces and used a ½-in. flush-trimming bit on the router table. While the master template is useful for laying out and routing the inside and outside edges of the edge-band, the inside curve requires a different setup than the ones used earlier (see the photos below). Making the template extralong allows screws to be placed at the ends past the finished cut.

Attach the template with screws and trim the pieces on the router table. While you're at it, make a few extra edge-band pieces to allow for mistakes. The fit against the panel won't be perfect, but a file and/or a block plane can clean up any high spots. Remember

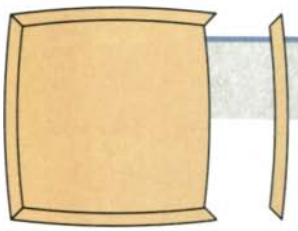
SHAPE THE EDGE-BAND

Use the master template to make an edge-band template. *Place a shim under the master template to allow clearance for the guide.*



Switch to a flush-trimming bit and rout both edges of the edge-band. *Attach the template by driving screws into the waste areas of the edge-band stock.*

Drawings: Michael Pekovich



ATTACH THE EDGE-BAND

A jig for cutting accurate miters on curved pieces. *Use the edge-band template to lay out each side of the jig, making the miter line on the template meet the sawblade exactly when it is in the 45° position.*

Glue on the first edge. *Use biscuits to align the edge-band, with two biscuits joining the mitered ends.*

Work your way around the table. *Fit one end of the next piece, then mark and miter its free end.*

that there will be a 1/16-in.-wide inlay over the seam. Just try to make it a strong joint with good contact.

This is a good time to cut the edge profile on these pieces. It's easier to work with smaller pieces than a whole glued-up table. Just make sure you leave a flat bottom or top (depending on the edge profile you choose) for reference on the chopsaw.

My edge pieces are 2¼ in. wide and 1¾ in. thick, with a slight bevel on the top surface, sloping away from the inside edge. I cut that bevel on the tablesaw, running the pieces curved-side-up past an angled sawblade. Sounds scary, but it works fine. Then I rout a large roundover on the outside bottom edge.

Jig helps cut accurate miters on curved stock

Determining the angle to be cut on the chopsaw is next. Recently, I devised a curved jig for locating the edge-band on the chopsaw (see the left photo above). The jig is based on the curve template and allows the saw to be set at 45° on each side. This jig gets the miter cuts very close. If any adjustment is needed, place a thin shim behind the workpiece and cut again.

It's better to glue on these edge pieces one at a time so that you will have a fixed piece from which to reference. Get a good fit in the miter joint between the loose piece and the glued-on piece, then cut the free end to length. I used biscuits to locate the edge-band during glue-up; they also held the next piece of edge-band in place when I was marking the location of the miter joint. Also, I used biscuits on the end grain of the miter joint for alignment and strength.

Use the offcuts from the curves as clamp cauls. Also, place blocks under the panel to raise it so that the edge-band can sit flat on the bench during glue-up. I used polyurethane glue on the miters to allow them to be shifted easily but applied yellow glue on the edges so that I could remove the clamps a bit more quickly from each successive piece.

Rout for the inlay

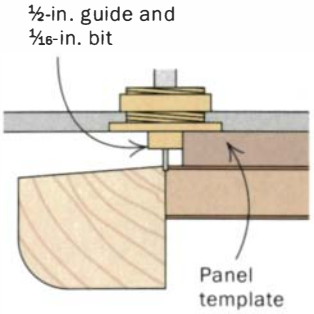
After the edge-bands have been attached, rout the inlay groove. Reposition your panel template using the pencil marks that you drew on the veneered panel. Switch to the 1/16-in. bit and 1/2-in. template guide on the router. You won't be able to rout the corners; the last inch or so must be done by hand. Use the panel template as a chisel guide by moving it to the edge of the routed groove.

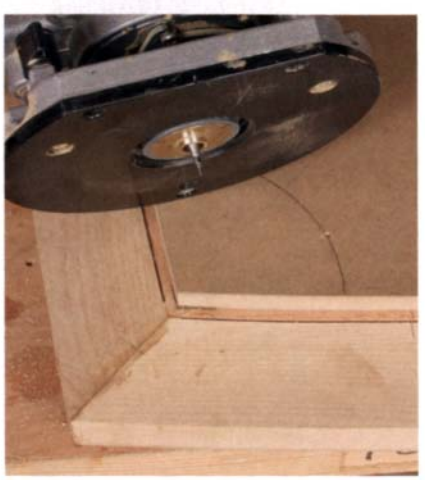
Cutting and installing the inlay are next. Make string inlay by ripping a 1/16-in.-wide strip from the edge of a 4/4 board. Then, using the bandsaw and a fence, rip the strip into pieces 1/16 in. wider than the inlay groove is deep. Cut the miter on one end, then place the inlay on top of the groove in the table and mark and cut the other end. Now it's ready to be installed.

After you have worked your way around the table, wait for the glue to dry before planing, scraping and sanding the inlay flush. □

STRING INLAY HIDES ANY GAPS

Use the panel template to rout the inlay groove. *Stop the cut just short of the corner and finish with a narrow chisel.*





Install one piece of stringing at a time. *Put a fine line of glue in the groove and push each mitered end in place. Then work toward the middle.*

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INDEX TO ADVERTISERS

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Reader Service No.	ADVERTISER, *page #*
	Abacus Chair Parts, *p. 17*
128	Accuride International, *p. 7*
79	Adams Wood Products, Inc., *p. 109*
63	Airware America, *p. 113*
171	Allred & Associates, Inc., *p. 108*
182	Amazon.com/ToolCrib, *p. 109*
21	American School of French Marquetry, *p. 110*
168	American Fabric Filter Co., *p. 19*
62	American Furniture Design, *p. 114*
138	American Sycamore Woodworkers' Retreat, *p. 9*
28	Ashman Technical, Ltd., *p. 107*
165	The Astragal Press, *p. 111*
119	Australian School of Fine Furniture, *p. 109*
66	Bailey's, Inc., *p. 11*
	Barr Specialty Tools, *p. 114*
124	Bauhaus Apprenticeship Institute, *p. 112*
195	The Beall Tool Co., *p. 112*
8	Belcher Veneer Co., *p. 110*
104	Bench Dog, *p. 27*
44	Berea Hardwoods, *p. 11*
45	Berea Hardwoods, *p. 97*
98	Bradley Woodworks, *p. 113*
	BrandNew Industries, *p. 112*
149	Brookside Veneers, Ltd., *p. 27*
122	CMT-USA, *p. 3*
148	CS Woods, *p. 93*
179	CT Valley School of Woodworking, *p. 25*
130	CT Valley School of Woodworking, *p. 112*
	Cabinetparts.com, *p. 110*
91	CabParts, *p. 101*
	Canvas Goods, *p. 114*
19	Carter Products, *p. 3*
	Center for Essential Education, *p. 113*
71	Certainly Wood, *p. 113*
103	Chips Fly, *p. 114*
117	Classic Designs by Matthew Burak, *p. 9*
95	Clayton Machine Corp., *p. 93*
108	Colonial Saw Company, *p. 107*
134	Conover Workshops, *p. 113*
74	Cook Woods, *p. 112*
65	Cormark International, *p. 110*
47	Crown Plane, *p. 111*
	Center for Furniture Craftsmanship, *p. 3*
175	Custom Leathercraft Mfg. Co., *p. 3*
18	The Cutting Edge, Inc., *p. 110*
31	Dakota County Technical College, *p. 33*
81	Dana Robes Wood Craftsmen, *p. 113*
82	Delmhorst Instrument Co., *p. 19*
35	Delta Machinery, *p. 2*
157	Delta Machinery, *p. 35*
158	Dewalt, *p. 119*
141	Diamond Machining Technology, *p. 28*
5	Diefenbach Benches, *p. 113*
	Diefenbacher Tools, *p. 112*
	Dimestore Cowboys, *p. 110*
	Dovetail Restoration, *p. 113*
126	Downdrafter, *p. 112*
144	Dura Jig, *p. 111*
100	Dust Boy, Inc., *p. 112*
193	Eagle Tools, *p. 9*
107	Eagle Woodworking, *p. 112*
	Engraving Arts, *p. 110*
192	Felder USA, *p. 27*
51	Flamingo Specialty Veneer, *p. 107*
139	Forrest Manufacturing, *p. 13*
60	Fuji Industrial Sprayers, *p. 108*
132	The Furniture Institute of Massachusetts, *p. 111*
52	General Manufacturing Co., Ltd., *p. 11*
120	Gilmer Wood Company, *p. 110*
190	Gizmo Lab, *p. 111*
154	Goby's Walnut Wood Products, *p. 113*
32	Good Hope Hardwoods, *p. 113*
118	Gorilla Glue, *p. 99*
61	Gougeon Brothers, *p. 110*
58	Groff & Groff Lumber, *p. 111*
96	HTC Products, Inc., *p. 105*
180	Harris Woodworking, *p. 111*
99	Hearne Hardwoods, Inc., *p. 99*
94	Hida Tool & Hardware, *p. 95*
76	Highland Hardware, *p. 25*
194	Hoffmann Machine Co., Inc., *p. 7*
64	Iturra Design, *p. 99*
6	J.B. Dawn, *p. 112*
174	JDS Company, *p. 17*
	Jack Rabbit Tool, *p. 99*
33	The Japan Woodworker, *p. 33*
80	JessEm Tool Co., *p. 101*
151	Jet Equipment, *p. 21*
93	Jointech, *p. 108*
173	Kay Industries, Inc., *p. 17*
59	Keller & Company, *p. 95*
196	Klingspor Corporation, *p. 3*
145	Kreg Tool Company, *p. 34*
2	Kremer Pigments, *p. 113*
150	Kuffel Creek Press, *p. 95*
55	Laguna Tools, *p. 25*
	Leigh Industries, *p. 26*
	Leigh Industries, *p. 97*
29	Lie-Nielsen Toolworks, *p. 17*
70	Lignomat Moisture Meters, *p. 97*
184	Logosol, Inc., *p. 113*
87	Luthiers Mercantile, Intl., *p. 93*
101	M.L. Condon Lumber, *p. 107*
	M-Power Tools, Ltd., *p. 113*
155	MEG Products, *p. 112*
	Marc Blanchette Windsor Chair, *p. 113*
67	Mass Bay Wood Products, Inc., *p. 112*
92	McFeely's Square Drive, *p. 25*
160	Microplane, *p. 3*
27	Micro-Rip 2000, *p. 112*
75	Mikron Woodworking Machinery, *p. 110*
143	Miller Dowel Company, *p. 29*
147	Mini Max, *p. 7*
146	Mini Max, *p. 95*
163	Misugi Designs, *p. 114*
189	Molding Knives.com, *p. 17*
34	Noah's, *p. 110*
	Nora Hall, *p. 112*
22	Northwest Timber, *p. 109*
77	Northwest Woodworking Studio, *p. 110*
	Oakwood Veneer, *p. 111*
23	Omer Direct, *p. 29*
177	Oneida Air Systems, *p. 7*
178	Oneida Air Systems, *p. 101*
68	Originalfurnitureplans.com, *p. 113*
121	Osborne Wood Products, *p. 111*
115	Outwater Plastics Industries, *p. 29*
38	Packard WoodWorks, *p. 112*
97	Peck Tool, *p. 110*
111	Philadelphia Windsor Chair, *p. 114*
49	PlansNow.com, *p. 110*
161	Pootatuck Corporation, *p. 110*
	Porta-Vise, *p. 111*
159	Pygmy Boats, Inc., *p. 112*
37	Rare Earth Hardwoods, *p. 114*
78	Ridge Carbide Tool Company, *p. 111*
88	Robert Larson Company, Inc., *p. 110*
73	Rockingham Community College, *p. 110*
43	Ronk Electrical Industries, Inc, *p. 27*
56	Rosewood Studio, *p. 107*
106	Rousseau Company, *p. 26*
140	Router Bits on the Web, *p. 109*
127	Routerbitsonline.com, *p. 113*
185	SR Woods, *p. 111*
83	Sauers & Co. Processed Veneers, *p. 112*
172	Scherr's Cabinet & Doors, Inc., *p. 17*
114	Sears Craftsman, *p. 23*
50	Sharp Tools USA, *p. 110*
169	Simp'l Products, Inc., *p. 9*
170	Simp'l Products, Inc., *p. 93*
102	Space Balls, *p. 105*
12	Specialty Tools, *p. 111*
112	The St. James Bay Tool Co., *p. 113*
156	Stubai Direct/Whillock Woodcarving, *p. 111*
16	Suffolk Machinery, *p. 111*
85	Super Shop by Smithy, *p. 25*
197	Sutherland Tool, *p. 112*
	System Three Resins, *p. 9*
166	Talarico Hardwoods, *p. 111*
9	Target Enterprises, *p. 93*
191	Tech Mark, Inc., *p. 29*
17	Tech-Wood, Inc., *p. 111*
142	Ten Fingers Corporation, *p. 33*
84	Tenryu America, Inc., *p. 34*
113	Thewindsorinstitute.com, *p. 111*
	Taunton's Tool Guide , *p. 103*
7	The Tool Chest, *p. 111*
131	Tools for Working Wood, *p. 112*
	Trend, *p. 11*
137	Turbinaire, *p. 11*
136	Turbinaire, *p. 95*
125	Vac-U-Clamp, *p. 95*
183	Vacuum Pressing Systems, *p. 105*
188	Veto Pro Pac, LLC, *p. 26*
41	Viel Tools, Inc., *p. 93*
109	Virutex.com, Inc., *p. 93*
11	W. Moore Profiles, *p. 107*
39	WGB Glass, *p. 99*
1	Waterlox Coatings Corp., *p. 17*
4	West Penn Hardwoods, *p. 113*
105	Whitechapel, Ltd., *p. 107*
176	Whiteside Machine Company, *p. 105*
123	Wilke Machinery Co./ Bridgewood, *p. 19*
40	Williams & Hussey, *p. 25*
86	Wood River Veneer, *p. 114*
164	Woodcraft Supply, *p. 14-15*
	Woodfinder by Woodrose, *p. 110*
153	WoodFinishingSupplies.com, *p. 33*
10	WoodjoyTools, *p. 114*
90	Woodline USA, *p. 27*
186	Woodmaster Power Tools, *p. 28*
187	Woodmaster Power Tools, *p. 97*
129	Wood-Ply Lumber Corp., *p. 112*
69	WoodRat, *p. 105*
3	Woodsmith Store, *p. 99*
48	WoodsmithStore.com, *p. 114*
54	Woodworker's Depot, *p. 101*
13	Woodworker's Supply, *p. 95*
46	Worcester Center for Crafts, *p. 101*

Finish Line

A quicker and better rubbed-out finish

BY TERI MASASCHI

No matter how skillful your spray technique or how flawless your brushing, to achieve the perfect film finish you still must rub it out. This process kills the just-been-finished look and takes care of sags, stroke marks, dust nibs and heavy spots. A rubbed-out surface has an even sheen, with no abrasion marks, swirls or inconsistencies.

The traditional way of rubbing out a finish using rubbing oil with pumice and rottenstone is tedious and messy. But by employing different abrasives and liquids, many borrowed from automotive finishing, broad surfaces no longer take hours to rub out. You can obtain a high-gloss or satin sheen with no discernible scratch pattern.

Start with a gloss finish

Whatever the desired final look, use a gloss finish and rub it out to the desired sheen. Gloss finishes have greater clarity than matte or semigloss finishes, which are chemically dulled by the manufacturer.

A good rubbed-out finish starts with a properly applied coating: If the finish is brushed on, each coat must be scuffed and leveled. If you're using a spray gun, no tremendous sags or orange peel can be left to the end. Problems must be dealt with after each application.

Both methods of application must leave a final film thickness of at least four to six mils. This equates to six to nine coats, depending on the percentage of solids in the finish. The risk of rubbing through a thinner finish is very high.

You must let a finish fully cure before rubbing it out; otherwise, you can create a haze that will not go away. According to manufacturers, most finishes are only fully cured after 200 hours. Most production shops can't survive that kind of delay, but four to five days is a bare minimum, and remember, it's impossible to let a finish cure too long.

LEVEL THE FINISH

Not finished yet. *All film finishes, even this sprayed one, have an uneven, plastic look before being rubbed out. Use 1,000-grit followed by 1,500-grit wet-or-dry paper wrapped around a felt block to level the surface. Lubricate the paper with a mixture of mineral spirits and either paraffin or mineral oil.*

Now flatten the surface

Before you can rub out a finish, you must first level it. Start by wet-sanding using 1,000-grit silicon-carbide paper wrapped around either a felt block or a cork pad. My favorite lubricant is two parts mineral spirits to one part paraffin or mineral oil. Adding more oil decreases the cutting action. Some finishers use water with a few drops of dish soap, but this mixture is more aggressive than the oil and mineral spirits combination. Put the lubricant in a spray bottle to provide an easy method of application.

Wet-sand until the surface is evenly dull. Check your progress frequently and use caution near the edges. Proceed to 1,500-grit paper and wet-sand again. The surface will begin to shine.

As a general rule, the finer the grit, the shinier the surface. Each scratch pattern is replaced by increasingly finer scratches until the eye cannot

Photos: Mark Schofield

RUB OUT THE FINISH WITH ABRASIVE PADS

A low luster. *When the surface is level, use a 2,000-grit Abralon abrasive pad lubricated with the oil and mineral spirits mixture to achieve a low-luster finish.*

Raise the grit and raise the shine. *Switch to a 4,000-grit Abralon abrasive pad to achieve a moderate-gloss finish.*

discern them. However, if you skip a grit or skimp on its use, any bigger scratches left from a prior grit do not go away, no matter how much time is spent with finer grits.

Grit level equals luster level—At this point, swap the 1,500-grit paper for a 6-in.-dia., 2,000-grit foam-backed Abralon pad (866-348-1677; www.woodfinishingsupplies.com). Attach the pad to a hook-and-loop-backed hand-sanding block, and rub the surface both in a circular motion and with the grain, using the oil and mineral spirits mixture as a lubricant. Stopping at 2,000 grit achieves a satin sheen superior to that produced with traditional materials.

For a pleasing higher-gloss finish, switch to a 4,000-grit Abralon pad. The Abralon scratch pattern is more random and softer than that left by 0000 steel wool. These pads also can be scrunched up to rub out tight cove moldings and details.

The more you rub, the higher the gloss—If a real wet-look gloss is desired, automotive finishing compounds are the answer. You can find various brands of swirl remover and final finish, such as those made by 3M or Meguiars, at automotive stores, but the versions made by Transtar seem particularly effective at rubbing out a wood finish. Apply the compounds as directed by the manufacturer, using fine-polishing cloths, or microfiber cloths, which also are available at automotive stores.

These compounds are applied usually only once, or at most twice, and further applications will not increase the shine. No compound can cover up poor sanding or a poorly applied finish.

For speed, use an orbital sander

Each of the previous steps can be done much faster using an air-powered orbital sander. Air sanders are preferred because of the very slight risk of fumes from the mineral spirits being ignited by a spark from an electric sander.

Begin with a 1,000-grit hook-and-loop micro-disc, and then switch to 1,500 grit. When using the Abralon pads, an optional 6-in. interface pad can be used between the sander and the pad, which makes the sander feel as if it were floating across the surface on a cushion of air. With or without the interface pad, never bear down on the sander during the wet-sanding process.

Use a buffer to apply the swirl remover and the final finish. If you're trying this for the first time, be warned that buffing machines and polishers sling the material everywhere. So work in a dedicated space in your shop and wear an apron; otherwise, you will end up wearing a table-high stripe of polishing liquid across your middle. □

POWER POLISHING IS QUICKER

An air-powered sander speeds up the process. Electric sanders should be avoided because of the slight risk of igniting fumes.

AUTO POLISH PRODUCES HIGH GLOSS

Smooth away the swirls. *Apply swirl-remover auto polish with a fine-polishing cloth. Then buff the surface with a final-finish polish to leave a mirror-like gloss.*

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READER SERVICE NO. 158

Graduation Time

George Webster wanted to do something special to commemorate his granddaughter's graduation from Princeton University—his alma mater of 65 years ago—so he commissioned Tim O'Brien to build this tall case clock from the best walnut boards in his private inventory. Webster, a passionate woodworker and metalworker, crafted the movement. O'Brien made a full-scale drawing of John Goddard's 1760s original pictured in Wallace Nutting's *Furniture Treasury* and then downsized the proportions by 25% to create a shorter, more slender grandmother-style version, which Webster had requested. "I referenced Robert Effinger's article 'Newport-Style Tall Clock' (*FWW* #55, pp. 75-81) extensively in the construction," said O'Brien, "but I took liberties as well." Unfortunately, Webster died before the clock was finished and presented to his granddaughter; but through this heirloom, his love for her will live on timelessly.

Photos: Lindbloom Photography