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Build an Adirondack chair, p. 54

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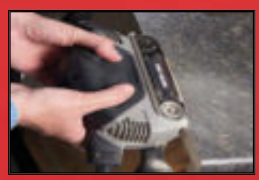

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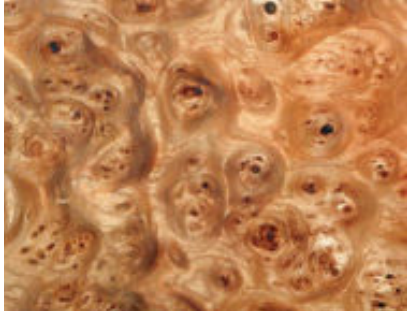

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VIDEOS

Assembling an Adirondack

Tom Begnal ("Adirondack Chair") walks through the assembly of this backyard classic and demonstrates beginner's techniques for cutting the parts.

Glue Testing

Go behind the scenes with Mark Schofield ("How Strong is Your Glue?") to see how we performed our methodical joint-breaking test.

Radial-Arm Drill Presses

Charlie Reina ("Benchtop Drill Presses") reviews two more drill presses that offer extra reach and a tilting head, and talks about why you might want one.

PROJECT PLAN

Dead-Flat Assembly Table

Build a torsion-box assembly table with plenty of storage below in the first of our exclusive Web-only project series hosted by FineWoodworking.com's new contributing editor, Marc Spagnuolo.

Step Tansu
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JUNE 18: Avant-garde furniture maker Garry Knox Bennett details his favorite methods for incorporating steel, aluminum, glass, and other non-wood materials in furniture.

Turn a Windsor Chair Leg

JUNE 25: Learn spindle-turning techniques with chair maker Jim Rendi as he demonstrates the step-by-step process of making a classic Windsor leg.

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Seth Janofsky *("Elegant Veneered Boxes"* and Master Class) learned photography at The Cooper Union in New York City. But after a few years of photographing documents in the city's archives, he decided to study woodworking at the College of the Redwoods in California. He now does his woodworking at the old Alameda Naval Air Station near Oakland. His shop space is a bunkerlike room once used for testing aircraft engines, with foot-thick reinforced-concrete walls and an explosion-proof steel door.

Mark Edmundson *("Center Guides for Drawers")* **has a passion for more than woodworking. When not making furniture or spending time with his family, Edmundson can be seen in the wild, shredding powder on the ski slopes or tearing up the mountain-bike trails he's carved through his property in Sandpoint, Idaho. Most recently, he's been making snow skates, a snowboard/skateboard hybrid.**

Lonnie Bird *("Mitered Molding Simplifies Traditional Doors")* **teaches woodworking at his school near Knoxville, Tenn. Bird and his family also enjoy the outdoors and their small horse farm in the foothills of the Great Smoky Mountains National Park. You can view his class schedule at www.lonniebird.com.**

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For more information on our contributors, go to www.finewoodworking.com/authors.

Associate editor Tom Begnal *("Adirondack Chair")* **began his woodworking career as a hobbyist in the mid-1970s. Eventually, his interest in the craft evolved into a full-time furniture-making business in northwestern Connecticut. After spending time at two other woodworking magazines, he joined our staff in 2000.**

Teri Masaschi *("10 Best Fixes for Finishing Mistakes")*, **a frequent contributor, operates a thriving finishing and furniture-restoration business from her home near Albuquerque, N.M. She also teaches her finishing techniques at woodworking schools and shows across the country. Between classes, she searches for old furniture that she can take home to New Mexico to rejuvenate and sell.**

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letters

Spotlight

ISSUE NO. 191
June 2007
p. 74

HEAVY-DUTY LATHES?

In "Tool Test: Heavy-Duty Lathes," author Andy Barnum says that his review is limited to machines in the $1,200 to $3,200 price range because higher-priced lathes are "sized and priced strictly for the pros." Because of this, he has neglected to include a number of machines a buyer might consider: Stubby, VB36, Oneway, Robust, Vega, Vicmarc, to name a few.

Spending more than $3,200 on a lathe does not require one to sell work nor to hang out a shingle any more than spending $10,000 on a bass boat makes one a professional bass fisherman. It is clear that Mr. Barnum's idea of "heavy-duty" and mine are not the same.

—BILL RUBENSTEIN, Stubby Lathe USA, St. Charles, Mo.

Editor Asa Christiana replies: Your point is well-taken. We've received a number of similar letters from dedicated wood turners. The editors deserve the heat for the headline, not the author. We chose this specific group of lathes, and called them "heavy-duty," because the majority of our readers are furniture makers who will see these lathes as a major upgrade. Every machine review is a massive undertaking. We try to define a manageable group that will be relevant to our readers. In this case, we stopped short of the highest tier: massive, very pricey, zero-compromise lathes—meat and potatoes to some, agreed, but caviar to others. A ceiling of $3,000 made sense. At the last minute, the street price of the Powermatic 3520B we reviewed went to $3,200.

Octagonal peg in a round hole

Matthew Teague's "The Pegged Joint, Exposed" (*FWW* #191) was well done. One thing that should be added to the repertoire of pegged joints is cutting them to more-or-less octagons and then driving them into the hole. The odd dimensions will cut their own channel and lock the peg into place. As a furniture conservator, I have disassembled many 18th- and 19th-century mortise-and-tenon joints where the pegs were not glued in, thus allowing the piece of furniture to be taken apart for needed repairs. I seldom, if ever, glue pegs into place and have never suffered a joint failure or loosening because of it.

—RICHARD O. BYRNE, Staunton, Va.

Park machines like cars

Regarding your illustrations of casters ("Choosing and Using Casters," *FWW* #190), a cart handles better with the swivel wheels on the back, below the push bar.

Years ago, I learned from valet parking attendants that backing cars into spaces makes parking and retrieving much faster and easier (and safer from scratches).

—RICHARD ELLERS, Warren, Ohio

Jointer/planer combo machines

The newest machine in my 50-year-old workshop is a Hammer A3 31, named "Best Value" in your recent test of 12-in. jointer-planer combo machines (*FWW* #190). It is worth every cent I paid. Equally valuable are the accessories I bought: The handwheel with digital readout and two jointer extension tables. The tables go on quickly and double the length of the bed to 118 in. (jointer-table length was cited as a reason the Hammer was not "Best Overall"). The extension also can be used on the planer bed.

—DENIS LOCK, Bedfordview, South Africa

Watch your math

In *FWW* #187, Christian Becksvoort's article on moisture content contained an elementary math error. Repeatedly, it says a change from 6% MC to 16% MC is a 10% increase. It's not. It's a 167% increase, or an increase of 10 percentage points.

—VAUGHN J. MANTOR, Tucson, Ariz.

Review missed a Woodcraft router bit

I was disappointed that the recent article "Tool Test: Router Bits" (*FWW* #191) did not include a selection from the Woodcraft router-bit line. Woodcraft's Classic Roman Ogee Bit (#144125) has the same profile as the bits tested. While the #144125 is not listed in the Woodcraft catalog, readers can find it at www.woodcraft.com, where there is an expanded offering of both Woodcraft and Whiteside router bits.

—JODY GARRETT, vice president, Woodcraft Supply

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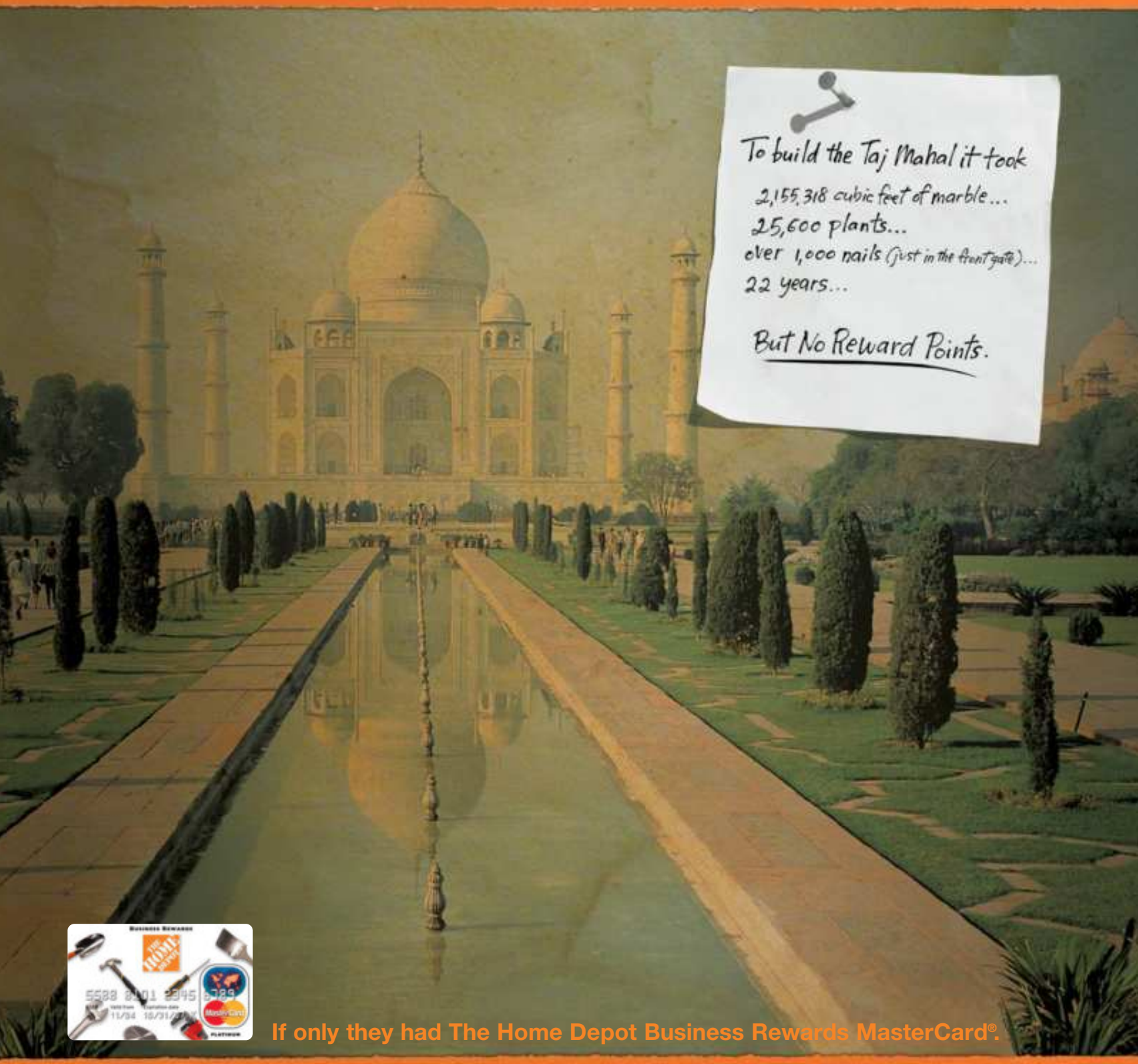
Meet the contest winners

Six months ago, we asked readers to tell us "Why I Deserve a New Shop." The reader with the best story would win a complete set of machines, power tools, and hand tools, plus a daylong visit by our tool expert to get set up. After reading 9,000 essays, we chose a worthy winner, Tim Carroll, the woodworking instructor at Harrisburg (Pa.) Career and Technology Academy. Four runners-up won router packages. Go to www.finewoodworking.com/extras to read the winning essays and watch a video about this special teacher, his students, and his new shop.



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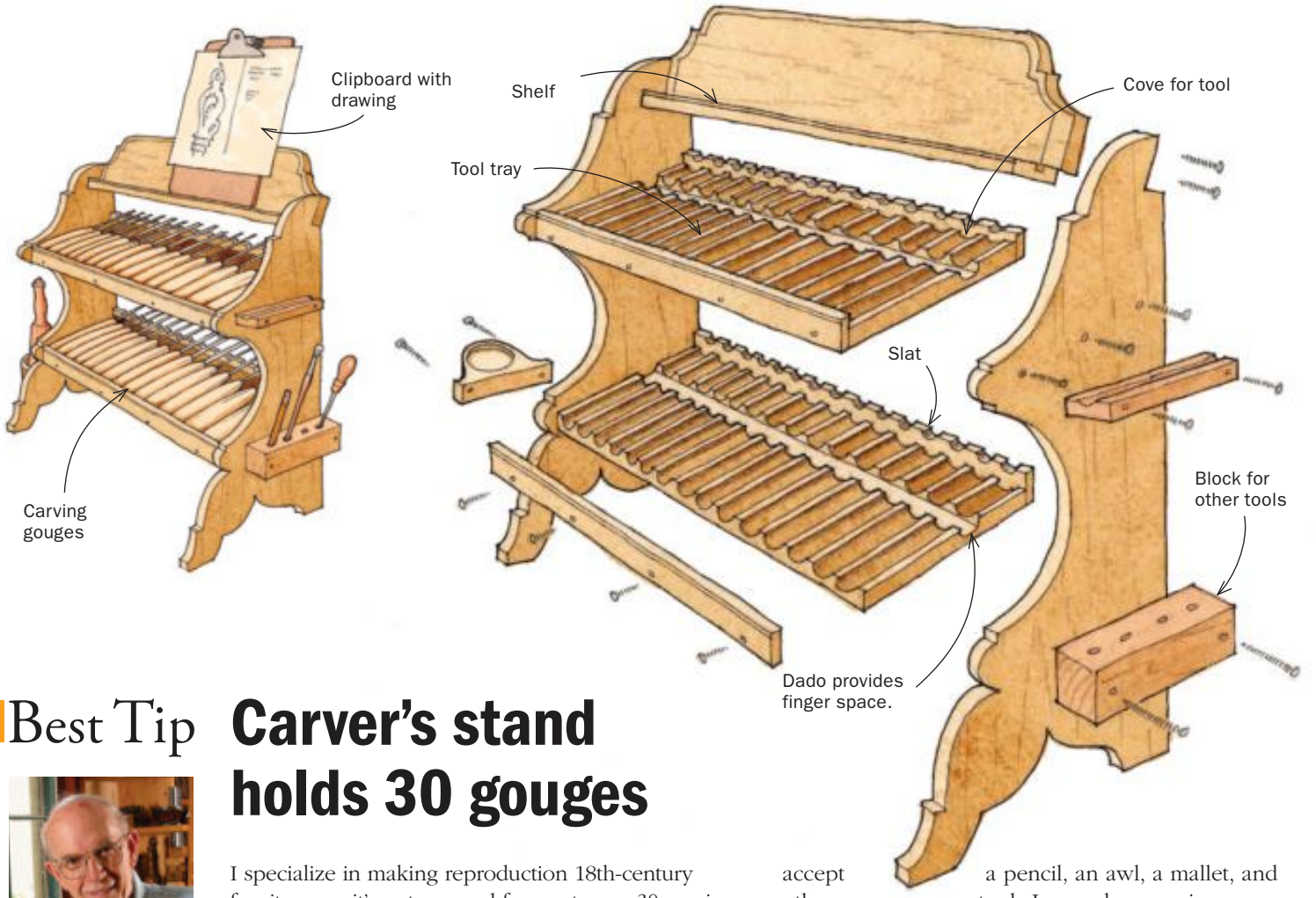

Best Tip

Carver's stand holds 30 gouges

An award-winning builder of reproduction furniture, Eugene Landon frequently teaches at the Olde Mill Cabinet Shoppe in York, Pa.

I specialize in making reproduction 18th-century furniture, so it's not unusual for me to use 30 carving gouges on one piece. With that many tools in play, an efficient storage system is a must; otherwise, I'd spend more time looking for tools than using them. This double-decker stand lets me grab the right tool almost from memory.

The design is my impression of what an 18th-century furniture maker might have built. The stand has two sides, two tool trays, and a rack on top to display a sketch of the carving. All the parts are pine. Screws hold everything together.

The tool trays are the heart of the stand. They feature multiple coves, one for each tool. I plowed them with an antique round-bottom plane, but you could either drill 1-in. holes into 2-in.-thick stock and then rip it on the bandsaw, or use a dado blade to cut recesses in 1-in. stock. I also cut a dado the length of the tray about where the tool handles meet the blades. This allows me to grab the neck of each tool easily with my fingers. Each tray also features a slat at the back to elevate each tool slightly. Finally I added blocks, hooks, and holders to the sides to accept a pencil, an awl, a mallet, and other tools I use when carving.

So that I can efficiently pull and replace gouges, I use a logical tool marking and placement system. First I mark each handle with the radius number and blade width in millimeters. Then I place them in ascending order by radius and width. After using this system for a time, I can locate the tool I need with just a glance.

—EUGENE LANDON, Montoursville, Pa.

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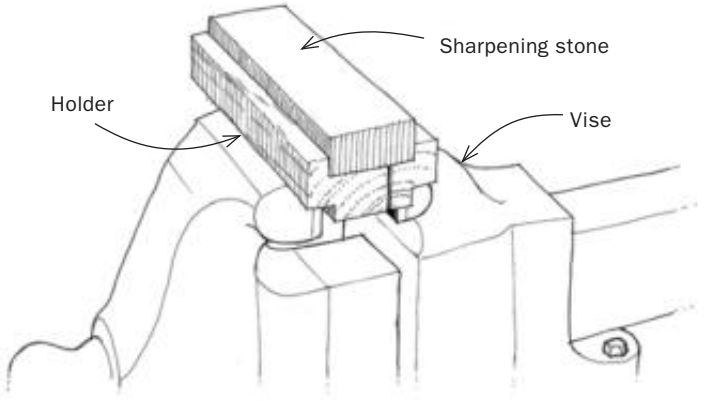
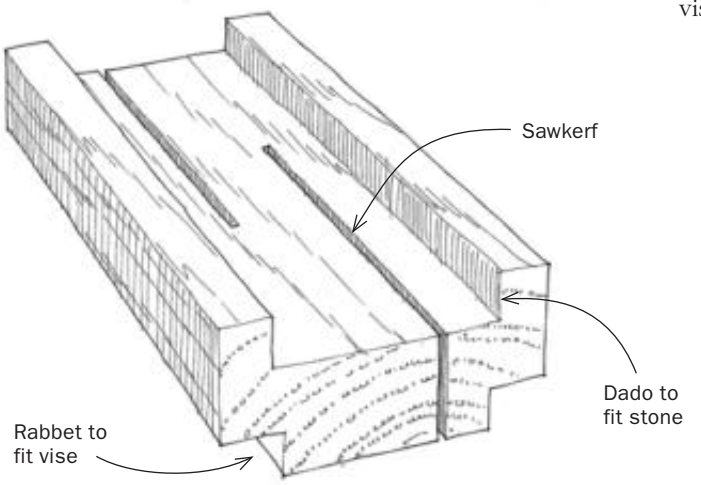




For years I have been securing my honing stones in a metalworking bench vise, protecting the stone from the metal jaws with a towel. This required careful adjustment of the vise—too much clamping pressure would crush the stone, too little would allow it to fall to the floor. I was never happy with the arrangement. Today, I hit upon this better solution.

To make the holder, start with a scrap block of wood as long as the stone. Cut a dado in the top of the block just wide enough to accept the stone. Also, cut rabbets on the bottom, so the block can be clamped in the vise. Now, from opposite ends, cut two sawkerfs, each about two-thirds the length of the block. Just make sure the kerfs have enough width so that you get an adequate amount of squeeze when the block is tightened in the vise. The fixture is easy on the stone yet holds it securely.

—JOSEPH SCANNELL, Novato, Calif.

Quick Tip

To prevent safety glasses from fogging, use a bar of soap like a crayon to rub soap on each lens. Polish the lenses with a cloth. No more fog.

Eventually, the soap loses its effectiveness. Keep a bar of soap handy in the shop, in a plastic bag, so you can quickly recoat the lenses.

—JAMES ARTHURS, Gibsons, B.C.

Car jack simplifies cabinet installation

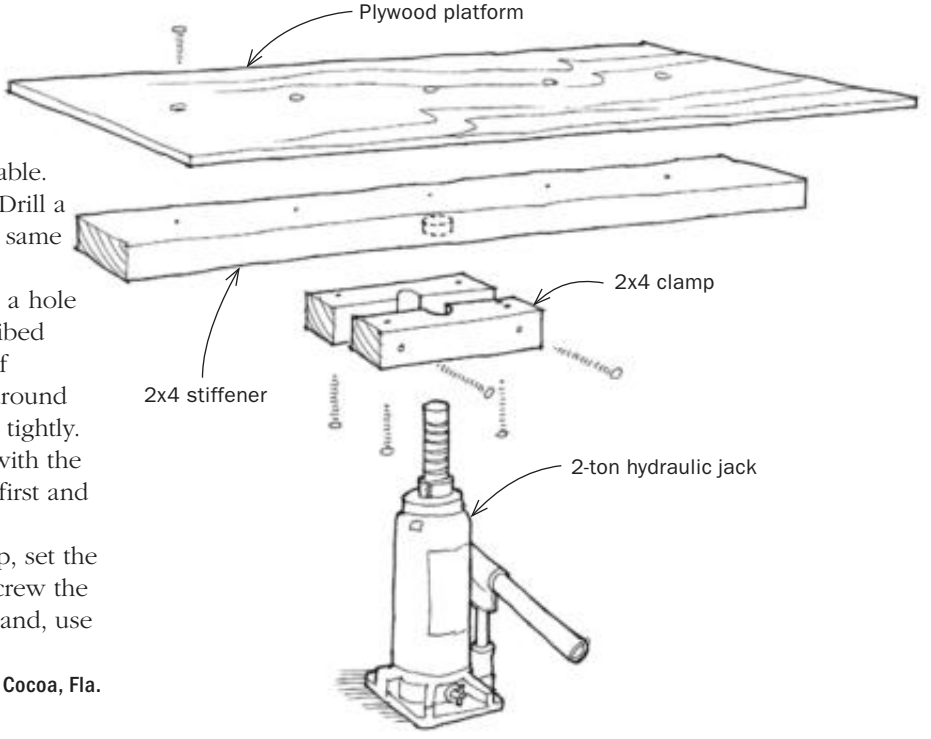
When installing the upper sections of kitchen cabinets, you need to hold the cabinets at just the right elevation until they are attached. The setup shown here is both effective and simple. Plus, the height is variable.

Screw the ½-in. plywood platform to a 2x4 stiffener. Drill a hole halfway through the underside of the stiffener the same diameter as the threaded shaft on the jack.

Cut another 2x4, about 5 in. long, for the clamp. Drill a hole through the center of the clamp the same size as described earlier. Cut the clamp in half (to remove one sawkerf of material) and verify that the two pieces, when placed around the shaft and screwed back together, will grip the shaft tightly. Screw one half of the clamp to the stiffener and then, with the clamp on the jack's shaft, screw the second half to the first and then to the stiffener.

To use, simply set the fixture on the lower cabinet top, set the cabinet on the fixture, jack to the correct height, and screw the cabinet to the wall. As you operate the jack with one hand, use your other hand to keep the cabinet from tipping.

—LYLE BRISTOL, Cocoa, Fla.

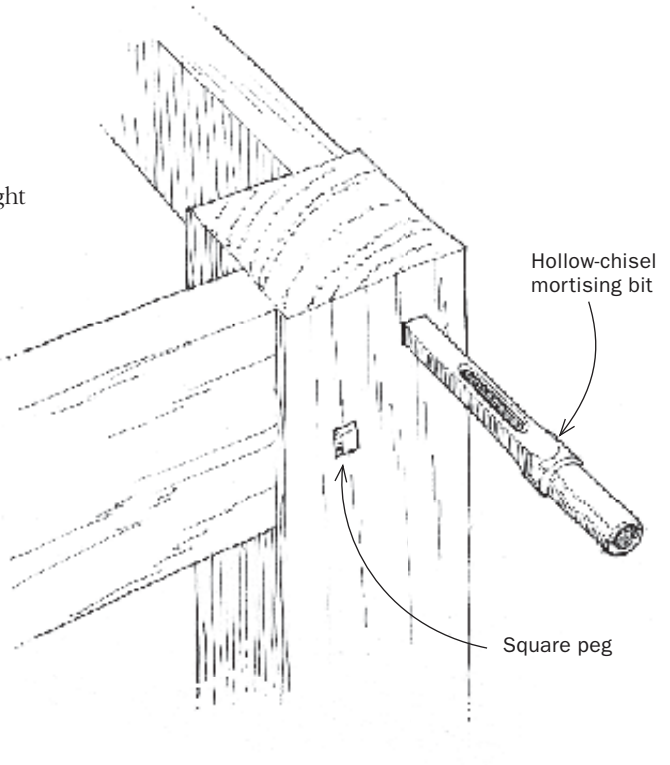


Square holes for square pegs

I like to build Craftsman-era furniture and my pieces usually include square pegs. To cut square holes for these pegs, I bought extra ¼-in. and ⅜-in. hollow-chisel mortising bits and I honed them razor sharp.

To cut a square hole, I place the bit where the peg will be inserted and give it a few whacks with a mallet. I then remove the waste with a chisel and glue the square peg in place. Then I bevel the edges of the peg with a chisel.

—JACK HINKEL, Apex, N.C.

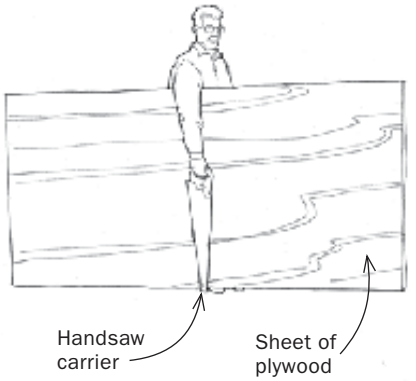


Quick Tip

Unwaxed dental floss often comes in handy when I want to work glue into a crack. First, I coat the floss with glue. Then I use the floss to work the glue deep into the crack.

—ANNETTE DUBE, Ipswich, Mass.

Handsaw doubles as sheet-goods carrier

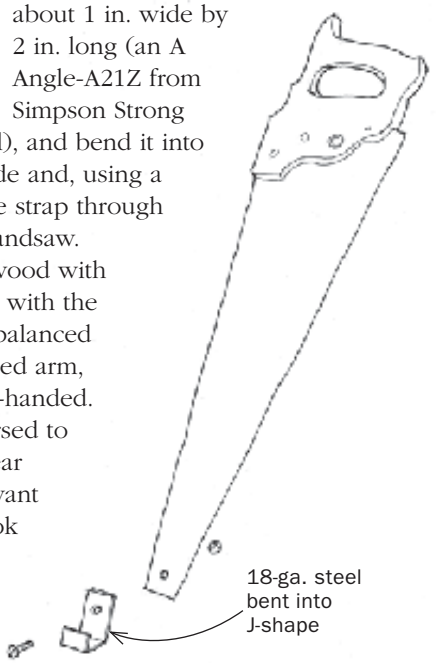


Plywood sheets often are too large to carry comfortably. There are plywood handling devices available from tool suppliers, but I found a way to transport 4x8 sheet goods using items found in my shop.

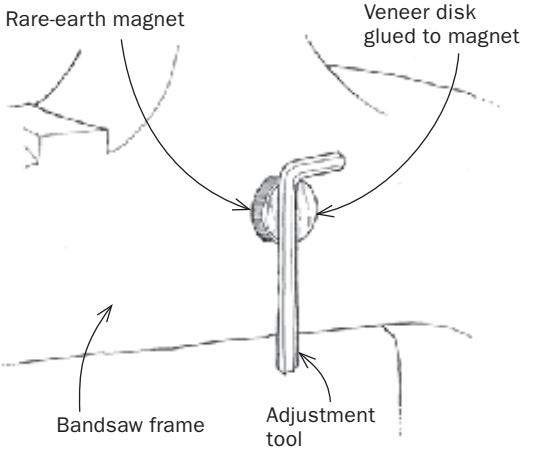
Simply take a piece of 18 ga. or thicker steel strap, about 1 in. wide by 2 in. long (an A Angle-A21Z from Simpson Strong Tie, www.strongtie.com, works well), and bend it into a J-hook. Drill a hole in the long side and, using a machine screw and a nut, attach the strap through the hole at the end of a standard handsaw.

To use, reach over a sheet of plywood with the handsaw, grab the bottom edge with the J-hook, and lift. With the plywood balanced and tucked under your fully extended arm, you can almost carry the piece one-handed. Alternatively, the hook can be reversed to allow lifting with the saw on the near side of the panel. And, when you want to use the saw for cutting, the J-hook isn't in the way.

—ROB DAVES, Brookline, Mass.



Keep rare-earth magnets in place



Rare-earth magnets are great for holding frequently used accessories near my power tools. For instance, I attach an Allen wrench to the frame of my bandsaw with one of these handy magnets.

Unfortunately, the magnet isn't always sure if it wants to stay home on the bandsaw or travel with the wrench. I considered permanently gluing the magnet to the tool, but came up with a better idea.

I cut a circle from a scrap of veneer and glued this circle to the magnet with cyanoacrylate glue. This makes the magnetic pull stronger on the back side of the magnet, opposite the veneer. I put that side against the bandsaw. Now, the magnet always sticks to the bandsaw and not to the wrench.

—BRAD KNABEL, Rosslyn Farms, Pa.

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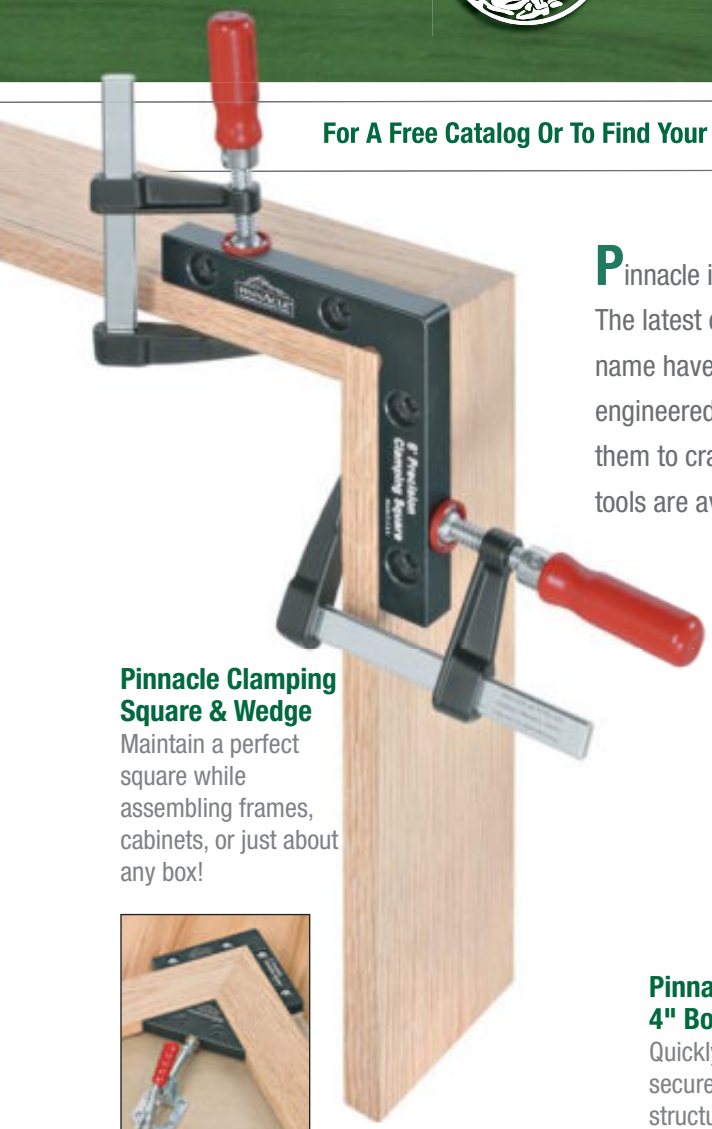

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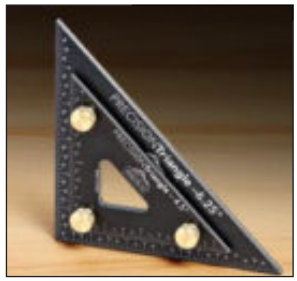

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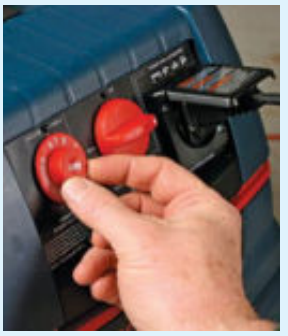
SHOP CLEANUP

New vacuum from Bosch tames dust and debris—quietly

Plug in, turn on. *Plug a tool into the onboard socket, switch to auto start, then turn on the tool. The vacuum will start and shut down when the tool does.*



Variable power and suction. *The Power Broker feature lets you adjust the operating amperage so you can control electrical draw as well as suction power.*

BOSCH 3931A

Source/Street price: Amazon.com/$400
Amps: 5 to 11
Capacity: 11.35 gal.
Auto start: Yes
Variable-speed motor: Yes
Noise level: 62 db. at 5 amps; 74 db. at 11 amps
Weight: 45.7 lb.
Cord length: 25 ft.
Exhaust: Lower rear of motor housing, above collection canister

Bosch's new 3931A shop vacuum is easy on the ears and has several dynamic features that make it a great shop helper.

The vacuum's auto-start feature fires up the vacuum and a tool plugged into it simultaneously (top left) and shuts down seven seconds after you turn off the tool, enough time to clear the dust-collection hose. The Power Broker feature (top right) lets you dial in the operating amperage (and thus the suction rate) so you don't trip a breaker when both tools are activated—an especially handy feature when plugging in larger-amperage tools to the socket.

Dual filters located above the holding tank can catch 99.93% of particles 3 microns or larger. The filters can be shaken clean using the electromagnetic pulse-clean mode or they can be removed for more thorough cleaning. The hose inlet port accommodates standard 2¼-in. fittings and the vacuum includes a 1½-in.-dia. hose with a 1-in. end adapter.

With all of its worthy features, the Bosch 3931A has become a much appreciated addition to the clean-air campaign in my shop. It sells for $400 at Amazon.com.

—Roland Johnson is a contributing editor.

HAND TOOLS

Fine chisels for finest work

A new set of dovetail chisels from Blue Spruce Toolworks includes four standard-size chisels (⅛ in., ¼ in., ⅜ in., and ½ in.), but there's nothing standard about these tools.

After a quick honing on a fine stone, the tools were ready to go. The A2 steel blades are thin, with concave edges that allow you to reach into the tightest of places. And being made from A2 steel, they hold their edges exceedingly well. The cocobolo handles are not only attractive, they're also comfortable.

These chisels aren't made for removing a lot of waste. Rather, they are best-suited for fine, precise joinery work. While I can't recommend these chisels as a first set, they make perfect supplements to a veteran's tool collection—a Stradivarius within reach. The set sells for $220, but you can purchase the chisels individually. For information, go to www.bluesprucetoolworks.com.

—Rich Macrae is a hand-tool junkie and an active member of the Long Island Woodworkers Club.

The right chisel for tight corners. *Blue Spruce dovetail chisels have concave edges, giving them access to tight places.*

Photos, except where noted: Thomas McKenna; facing page: Matt Berger

WORKBENCHES

Adjustable bench raises work to a comfortable height

Liftoff and landing. *To raise the benchtop (left), lift one end until the locking bar catches, then go around to the other end and do the same. To lower the bench (above), step on a release pedal, lift the top to disengage the stop bar, then drop to the desired height.*

I'm a big advocate of working at the proper height for specific tasks. So I was intrigued by the concept of the Noden Adjust-a Bench, a workbench system that can be adjusted to a variety of heights.

The Adjust-a Bench is available as either a set of adjustable legs (you'll have to supply the top and vises) for $430 or as a complete bench, which includes the legs, a wood stretcher, and a top, for $800. We added a few accessories—benchdog holes ($50) in the top, Jorgensen vises ($300), and locking casters ($160). Initial assembly was straightforward and relatively easy.

The ratcheting adjustment mechanism lifts the benchtop in 1½-in. increments from roughly 28 in. to 45 in. high. This adjustable height feature proved very useful for tasks ranging from assembly work to planing to close detail work. Noden suggests using the bench as an outfeed table, but setting it to the correct height could be a very fussy operation because of the 1½-in. increments.

Suitable for planing. *The Adjust-A-Bench was rigid and stationary on solid ground. On its locking casters, it moved quite a bit.*

With the legs on the floor, the bench was rigid enough for planing tasks, even at its maximum height. Not surprisingly, though, when fitted with the casters, the bench moved quite a bit.

The top supplied by the manufacturer is essentially a 1¾-in.-thick wooden kitchen countertop, which worked well enough. It was not perfectly flat, but it was within 1⁄16 in., an acceptable tolerance. The Jorgensen quick-release vises are mounted on the side and end of the bench (not flush with the edge, but sticking out). They are good-quality heavy-duty vises, although small for my taste.

The adjustability of this system makes it a versatile addition to a shop. If I were buying it, I'd be inclined to purchase the base system (legs only) and add a better top and larger vises.

For more information about pricing, go to www.adjustabench.com.

—Jeff Miller is a woodworker and a teacher in Chicago.

Safety where you need it. *A featherboard helps keep the board snug to the fence at the start of the cut, where you have the least amount of control.*

SAFETY

Magnetic featherboard mounts easily on saw table

Magnetic attraction. *The magnets in the Magswitch featherboard are activated by turning two knobs.*

For certain tablesaw cuts, such as ripping narrow stock, a featherboard can go a long way toward improving safety and accuracy. Unlike other commercial featherboards, which lock in the miter slot, the Magswitch Pro Magnet Featherboard mounts in an instant anywhere on the saw table. Adjusting or removing it is just as easy.

The secret is a pair of magnets that are activated or deactivated simply by turning a knob. Butt the Magswitch against the edge of the stock (the featherboard must be in front of the blade), apply sideways pressure to bend the thin fingers slightly, then turn on the two magnets to lock it in place.

The Magswitch worked well and is a convenient safety accessory for any shop. The pro model sells for $50 at www.woodcraft.com (a standard version with smaller magnets sells for $38). Magswitch will soon offer a model for those who cut with the rip fence on the left side of the tablesaw blade.

—Tom Begnal is an associate editor.

SHARPENING

Honing guide has limitations

The Pinnacle honing guide is designed to assist in sharpening chisels and plane irons to a razor-sharp edge that is correctly shaped and at the proper angle.

In use, the blade is held in a sled that rides on two rails. The frame of the rails holds a sharpening stone (water, oil, or diamond) or the Pinnacle honing plate. The plate can be used with sandpaper or honing films. The sled can be set at precise angles in 5° increments from 15° to 40°. Microbevels also are possible.

It's fairly easy to mount a blade in the sled, and it automatically squares the blade to the stone. But switching from one stone to the next (progressing through grits) is tedious because each stone has to be mounted to the frame in succession. Using the plate is more convenient because you don't have to remove it to change out honing films, but it's still time consuming. Also, the frame hinders access to the stone's face, so flattening the back of a blade while it's in the sled is next to impossible. The guide cannot produce a cambered edge, and won't register correctly if the blade's sides are tapered.

I'd rate the Pinnacle 5 on a scale of 1 to 10 for convenience, ease of use, and versatility. It costs $100 ($115 for kit with guide, plate, and film) at www.woodcraft.com.

—Chris Gochnour is a woodworker and a teacher in Salt Lake City.

The good and the bad. *The sled of the Pinnacle honing guide glides smoothly and keeps the blade square to the stone (above). But you can't flatten the back of a blade while it's in the sled (below). You have to remove the blade from the sled to perform that task.*

■ ROUTER ACCESSORIES

Practical jig for routing circles and ellipses

Simple setup. *Attach the polycarbonate base to the subbase of the router, then slide the aluminum trammel into the dovetailed way. Set it to the desired diameter, then tighten it in place with an Allen wrench.*

Many commercial jigs for routing circles and ellipses are expensive and complex. But the Router Buddy System from Practical Technologies takes a simple approach, and the system is stout and accurate. The basic system allows you to rout circles from 2 in. dia. to 18⅜ in. dia. For larger work, you can buy the large circle jig accessory to rout circles from 8 in. dia. to 60 in. dia. Another handy accessory is the ellipse jig, which cuts ellipses with up to a 12-in. differential between minor and major diameters.

The basic kit and the accessories were easy to set up and performed quite well, putting this jig on my short list of must-have router accessories. The basic Router Buddy retails for $70. The large circle jig and ellipse axis plate accessories cost $70 and $60, respectively. For information or to order, visit www.practical-technologies.com.

—*R.J.*

Pin centers the bit in a circle. *With the pin on the trammel engaged in a hole, you can rout a perfect circle.*

what's the difference?

Natural vs. synthetic brushes

BY JEFF JEWITT

Match bristle to base. *Natural bristles, as on the China-bristle brush (far left), are best for oil-based products. Use synthetic bristles (left) for water-based finishes.*

About the only finishing tool less complicated than a brush is a rag. However, there are some essential things you should know about brushes before you start on your finishing journeys.

Basically, brushes fall into two categories, natural and synthetic. Nowadays, natural-bristle brushes are made primarily from Chinese hog bristle (China bristle). Some premium brushes using skunk, ox, and badger are available, but I doubt you'll find them at your local hardware or paint store. Natural-bristle brushes excel with solvent-based products such as oil-based varnishes and polyurethanes, shellac, and lacquer. But because they absorb water, they become limp and lose their stiffness and shape with water-based finishes.

Synthetic-bristle brushes use manmade fibers like nylon and polyester. They can handle either type of finish but are used primarily for the application of water-based products.

Profiles and shapes

The key features in a brush other than the bristle type are the profile and the amount of finish it will hold. Round, fat brushes hold more finish, while sharp, chiseled-edge brushes cut into corners and crevices better. The profile is built in during the brush-making process. The most expensive brushes usually are made by hand, and different bristle lengths, amounts, and thicknesses can be used to create brushes that have different shapes for different uses. □

Use a big brush for a large, flat surface. *Jewitt applies shellac to a tabletop with a 2-in. rectangular-cut brush.*

A fine tip does detail work. *Use an artist's brush, preferably with synthetic bristles, for staining such things as fine inlay and dovetails.*

Basic inventory

For clear finishes, choose good quality, rectangular, chisel-cut brushes—natural bristle for solvent-based products, synthetic for water-based. A 2–2½-in. brush is best for large areas, while a 1-in. model is good for detail work. Expect to pay $15 to $30 for the larger sizes.

For stains and glazes, use less-expensive round and square brushes—natural or synthetic, depending on the finish. The price should be $10 or less.

For detail work, artists' brushes, including a #1 and a #4, are the best choice. Good-quality synthetic-bristle models run $4 to $6 each.

You might also consider a 1-in., art-quality synthetic brush (known generically as Taklon-bristle) which costs $15 to $20. However, it can lay down a very thin topcoat of any finish with minimal brush marks.

A set of brushes to handle most jobs. *From left: 2-in. and 1-in. chisel-cut brushes for clear finishes, a round and a square brush for stains, artist's brushes for detail work, and a 1-in. Taklon-bristle brush.*

Photos: Charlie Reina (brushes); Bill Duckworth (top inset); Mark Schofield (bottom inset):

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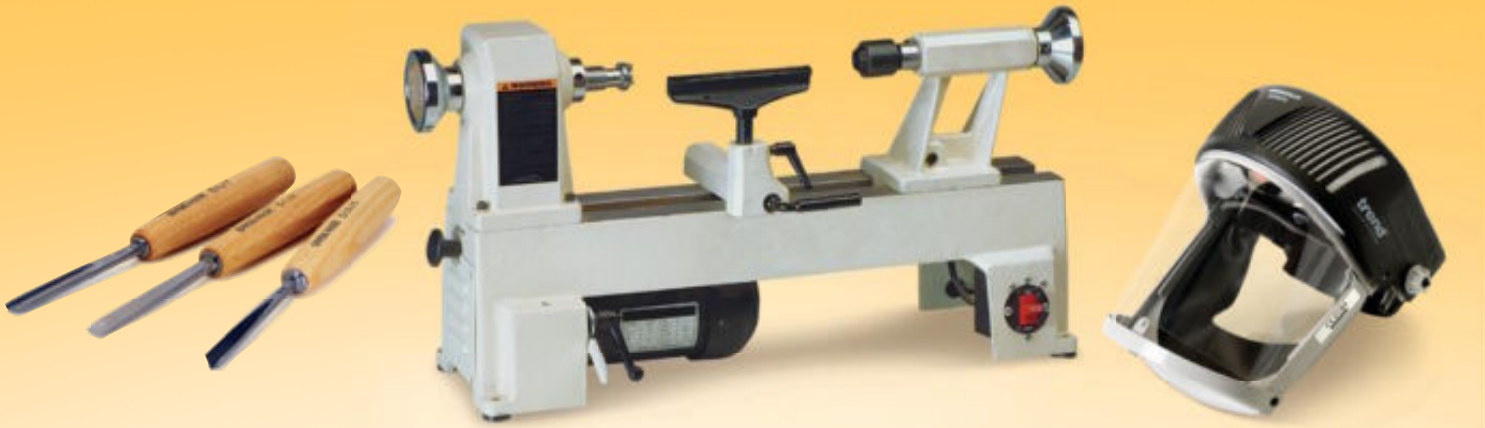

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Get the most from your bench chisels

BY CHRIS GOCHNOUR

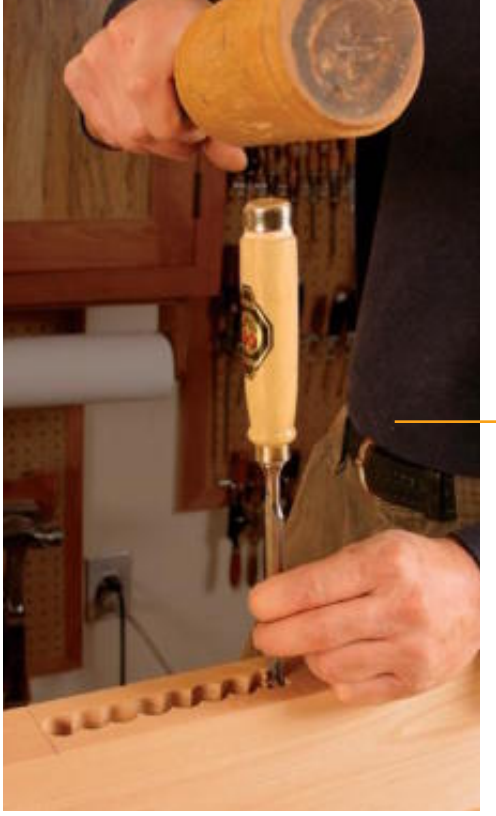
Among the longest-used and most rudimentary of tools, chisels are just as useful in today's woodshop. They are extremely versatile—capable of coarse, moderate, or refined work—and come in a dizzying array of shapes and sizes (for more on chisel styles and their intended uses, see *FWW* #181, pp. 46-53).

To help you understand where and how to use a chisel effectively, I'll demonstrate a variety of chisel techniques, from heavy stock removal to fine paring techniques on joinery, using a set of standard, bevel-edge cabinetmaker's chisels.

Clean out a drilled mortise

One way to create a mortise is to drill out the waste and refine the joint with a bevel-edged chisel.

First, bore out the bulk of the waste with a bit that is 1/16 in. smaller than the mortise width. Next, square up the ends of the mortise using a chisel that is slightly narrower than the mortise width. Holding the chisel 90° to the workpiece and aligned just ahead of the layout mark, use a mallet to drive the chisel blade perpendicular to the grain. Take light chopping cuts, sneaking up to the line until you have a square, perpendicular mortise wall. Once the ends of the mortise have been established, use



Clean up a mortise

Square up the ends first. *Hold the chisel 90° to the workpiece and align its tip with the layout mark, with the bevel facing in. While driving the chisel, be sure to keep the blade square to the end of the mortise. Now clean up the side walls. Use a wider chisel to sneak up on the layout lines. Work your way along the mortise with overlapping passes, keeping the chisel vertical.*

Square a corner

Define the corner. *Use a marking knife and a square to scribe well-defined layout lines in the corner for the chisel to follow.*

Chop down. *Hold the chisel 90° to the workpiece, bevel facing in. Make a series of light chops, working up to the line.*

Pare in. *With the bevel facedown, push the chisel into the corner, levering up as you near the wall. Work from both directions.*

Photos: Thomas McKenna

Chop a hinge mortise

Chop vertically. *After scribing the layout, make a series of shallow chops nearly as deep as the mortise. Start and end about 1/16 in. shy of the layout lines.*

Pare away the waste across the grain. *Take light passes, keeping the chisel level, until you reach the full mortise depth. Because of the chopping cuts (left), the waste will pop out easily.*

Check the fit. *Chop carefully to the layout lines and then put the hinge in place to check the fit, including the mortise depth.*

a wider chisel and the same technique on the sides. Last, use a chisel slightly narrower than the mortise width, with its bevel down, to clean out the loosened waste and to level the mortise bottom.

Square a routed corner

Using a router is an effective way to cut a rabbet on the back of a case or a frame, but it leaves rounded corners that must be squared. A chisel is the ideal tool for this task.

First, define the corners using a square and a marking knife. Next, chop out the corner, first from above, with the bevel facing in, then from the side, with the bevel facedown. In no time, you'll have a clean, square corner.

Cut hinge mortises

Bevel-edge chisels are great for the delicate work of cutting hinge mortises. First, lay the hinge in place and mark its ends with a knife. Then set a marking gauge to mark its width and depth.

Next, using a chisel that's as wide as the mortise, make a series of shallow chops, perpendicular to the grain, from one end of the mortise to the other. Clear out the waste by paring in across the grain from the mortise edge. Pare to the full depth of the mortise, being careful to keep the chisel level. The waste will pop out easily because it has been severed by the cross-grain cuts.

After cleaning out the bulk of the waste, pare vertically to the layout lines, then clean out any remaining debris by paring in from the mortise side.

Fine-tune tenons

Chisels are handy for cleaning up the shoulders and cheeks of a tenon. In this case, try to use as wide a chisel as you can, preferably one that's as wide as the tenon is long.

For this technique to be effective, you should have clearly defined scribe lines marked on the stock. To trim the shoulders,

Trim tenons

Shoulders and cheeks. *When fitting shoulders, it helps to work up to a scribe line. Take light, overlapping chops until the chisel is registered in the scribe line for the final pass. When paring cheeks, push with your dominant hand and use the fingertips of your other hand to guide the blade. Take light passes across the grain.*

Chamfer the tenon end to make assembly easier. *Push the chisel with one hand and guide the blade with the other, taking a series of light, controlled passes. Skewing the chisel produces a smooth finish and makes cutting easier.*

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first steady the workpiece with clamps or against a stop. Register the chisel blade in the scribe lines, with the bevel facing out. Holding the chisel perpendicular to the workpiece, drive it with a mallet or by using your hands and body, taking overlapping cuts from one side of the tenon to the other.

To trim the cheeks, grasp the chisel in the palm of your hand and use the fingertips of your other hand to guide the blade and help keep it engaged in the cut. Make a series of light and controlled paring cuts, working across the grain until you reach the layout lines. A final pass along the base of the shoulder will clean up any remaining debris and make a nice, clean corner.

Finally, when you have the tenon trimmed and fitted, chamfering the end with a chisel helps to ease assembly and to give excess glue a place to run to.

Clear waste between dovetails and pins

Effective chisel work is essential to successful dovetail joinery. With practice, you'll be cutting dovetails with machine-like precision and the look of handcrafted workmanship.

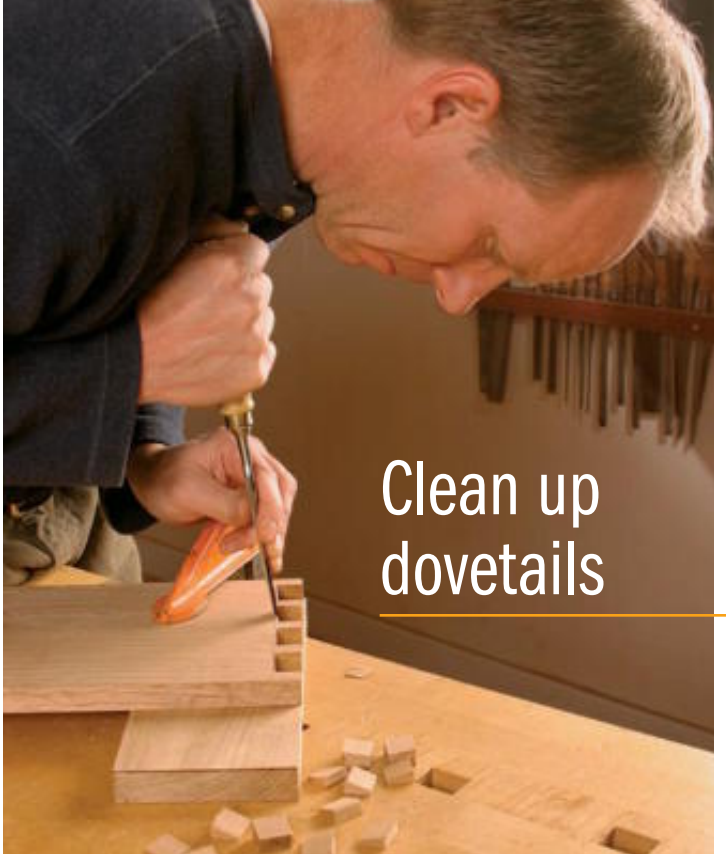
Once you've defined the joint with a backsaw, use a coping saw to remove the bulk of the waste, leaving about 1/32 in. to 1/16 in. of material in front of the baseline. For the chisel work, you can either pare away the waste by hand or use a mallet to assist. Depending on the width of the waste, I use a 1/4-in. to 1/2-in. chisel.

With the inside of the board facing up, place the bevel of the chisel into the baseline. Using the weight of your body to assist, drive the chisel with your dominant hand and guide it with your other hand. Make a series of light, overlapping cuts along the baseline from one side of the board to the other. The key here is to make the first series of cuts from the inside, with the chisel angled slightly toward the board end so that you do not cut through the baseline on the other side.

After your work on the inside baseline is done, repeat the process from the outside while holding the chisel at 90°. The areas you pare now will have a different sheen than the ones pared from the opposite side. The color difference will help you avoid overshooting the baseline on the other side.

Paring pins—When trimming dovetail pins to fit their sockets, it is best to pare across the grain. Secure the work in a vise with its business end up and its face out. Select a chisel that is slightly wider than the pins are long. Align the chisel so that it splits the layout lines, which should still be visible. Hold the handle with the palm of your hand and guide the blade with the fingertips of your other hand. Take a full-width shaving across the grain, following the layout line on the board end. Before finishing the cut (with roughly 1/8 in. remaining), raise the chisel handle upward. This causes the blade to cut in a more vertical direction, preventing chipped corners. With the upper edge of the pin cleanly severed, you can drop the chisel to the horizontal position and complete the cut.

Once the dovetail joint is fitted, chamfer the inside of the pin sockets with a chisel to ease the assembly. □

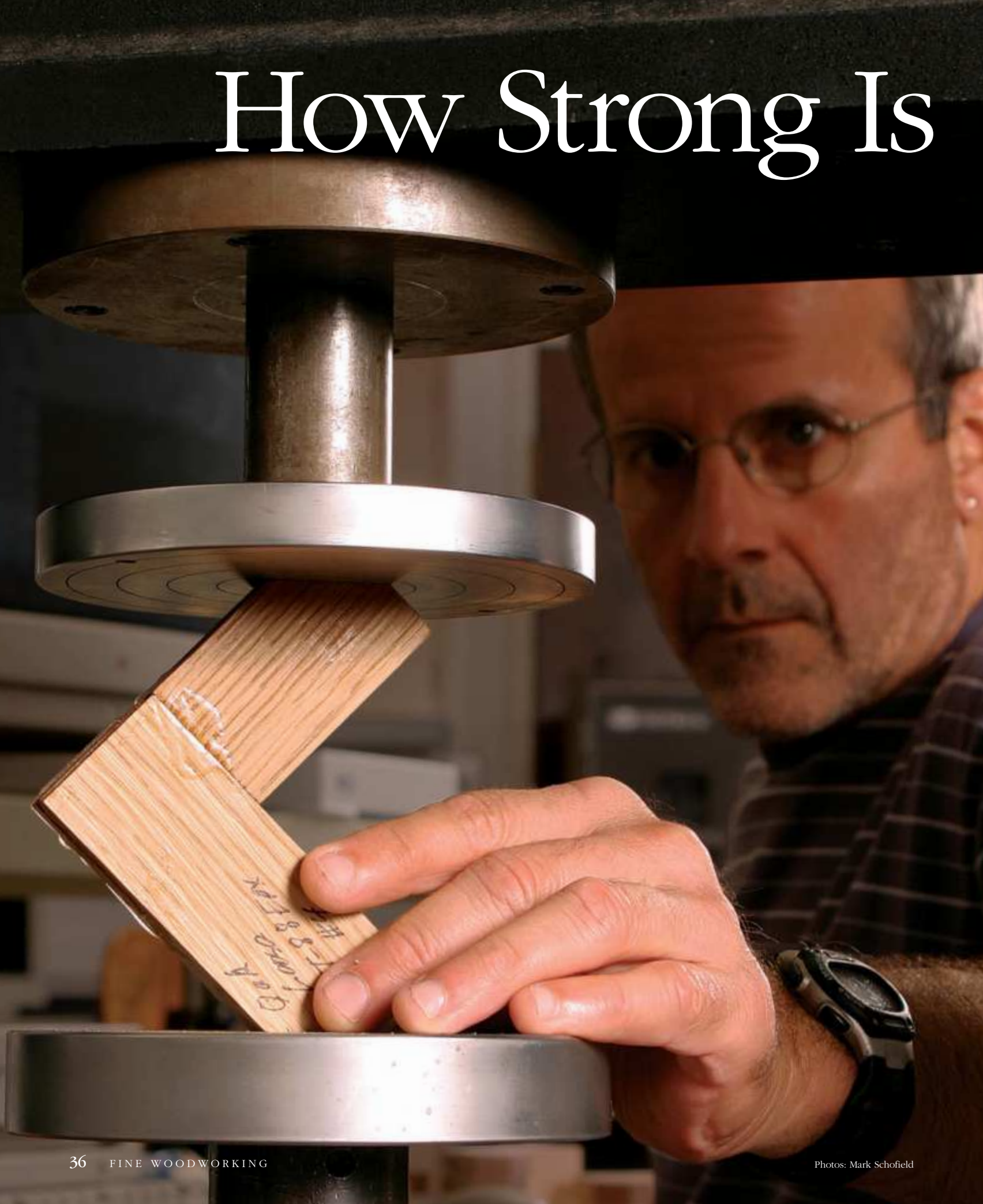


Pare to the baseline one side at a time. *On the first side, angle the chisel slightly toward the end of the board (above). With your dominant hand on the handle, drive the chisel using your upper body. Repeat on the opposite side, but hold the chisel at 90°. A scrap piece under the workpiece will protect the benchtop.*

Getting clean edges on pins. *When paring pins, hold the chisel handle with the palm of your dominant hand and guide the blade with your other hand. As you near the end of the cut, lever the chisel up to make a clean cut at the corner.*

Chamfered pin sockets ease assembly. *Choke up on the chisel and use the edge as you would a knife. Chamfer the inside edges and start the cuts 1/8 in. from the tail end so they will not be visible.*

How Strong Is



Photos: Mark Schofield

Your Glue?

We take six types to the breaking point, shattering some common wisdom in the process

BY MARK SCHOFIELD

Unless they confine their woodworking to knockdown furniture, all woodworkers rely on glue. As a result, there are dozens of types of glue and masses of competing brands all proclaiming their superiority.

To help make sense of it all, *Fine Woodworking* ran a test with three main objectives. The first was to compare six common types of woodworking glue; the second was to see if the type of wood might affect the bonding strength of the different glues; the third was to determine how tolerant the glues are to poorly cut joints.

The results were revealing. Some older glues performed superbly, while a newer glue was less than impressive. The wood type does make a difference, but don't believe the stories that say all dense tropical woods are hard to glue. And, while glue starvation seems to be a myth, so does the gap-filling ability of certain glues.

Selecting glues, woods, and gaps

To see whether an open-grained wood bonds differently from a tight-grained one, we chose white oak and hard maple. Dense tropical woods have a reputation as being difficult to glue. We intended to use teak, but the lumberyard owner suggested ipé, as he had heard many complaints about glue failure with this wood.

We chose a traditional interior polyvinyl acetate (PVA) yellow glue represented by Elmer's carpenter's glue; a newer PVA glue with a Type I waterproof rating in the form of Titebond III; two types of hide glue, a room-temperature version by Old Brown Glue and traditional granules that must be mixed with water and heated; a two-part, slow-set epoxy from System Three; and Gorilla Glue's polyurethane.

If a joint is sloppy, will the glue fill the gaps? Conversely, if the joint is so tight it has to be hammered home, will it be starved of glue? Does a perfectly fitting joint produce the strongest glue bond? To answer these questions, we tested bridle joints with three types of fit: tight, snug, and loose.

Bridle joints: First make 'em, then break 'em

We settled on a bridle joint, also known as an open mortise-and-tenon joint, because it has no mechanical strength and instead relies entirely on the glue bond. It also was easy to adjust the width of the tenon to change the fit of the joint to test each glue's gap-filling ability.

Precise milling—To lessen the impact of a rogue result, John White, *Fine Woodworking's* shop manager, made three samples of each joint for a total of 162 samples.

To keep wood variables to a minimum, he cut

THE TYPES WE TESTED

We picked six brands to represent the spectrum of common woodworking glues, including two types of PVA glue, a polyurethane glue, an epoxy, and two types of hide glue.

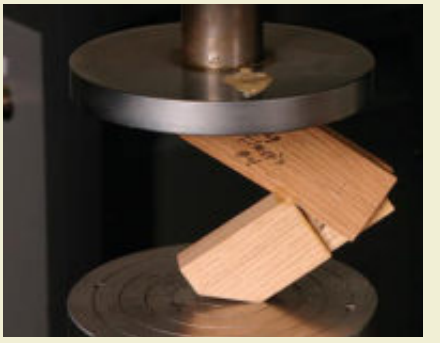
PVA glue | Type I PVA glue | Polyurethane glue | Slow-set epoxy | Hot hide glue granules | Liquid hide glue

MAKING THE JOINTS

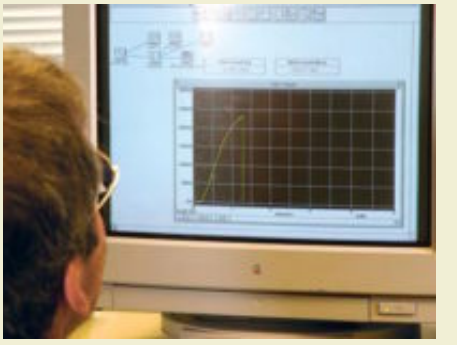
All 162 joints for the test were cut on a tablesaw using a tenoning jig. To maintain even spacing on either side of the tenon in the loose joints, White machined each joint carefully and clamped both pieces to a piece of dead-flat glass while the glue dried.

BREAKING THE JOINTS

Under pressure. *Under the direction of David Matthiesen (left), Chris Tuma placed each joint in the machine at Case Western and applied force gradually.*



Breaking point. *Eventually, the force became great enough for the joint to break within the wood or, as in this case, along the glueline.*



Monitoring the test. *The computer displays the force applied and the amount the joint was compressed. The line's peak marks the point where the joint failed.*

the joints from a single, straight-grained board of each species.

The joints were cut using a Freud box-joint blade set in the ¼-in.-wide configuration, as these blades give a very clean cut with a flat bottom. White cut all the tight joints first, spacing them so that they needed a light tap to bring them together. Using a dial indicator to adjust the tenoning jig, he cut the snug-fitting joints so that they required only hand pressure to bring them together and would represent a perfect fit to most woodworkers. Last, he cut the loose joints with a 1/64-in. gap, split evenly on each side of the tenon. We chose this spacing because there was no wood contact on the tenon, but the joint was still tight enough that most woodworkers would take a chance and hope that glue would fill the gap.

Applying the glue—Each glue was prepared and applied according to the manufacturer's instructions. We used ample glue because squeeze-out was not a consideration.

FineWoodworking.com

Watch a video to see how we prepared the joints for testing, and to see the Instron machine in action.

The final step was to make a 45° cut at the end of each arm to prepare the joints for the joint-breaking machine. To give the glues time to develop maximum strength, we allowed the joints to rest for three weeks.

Off to the lab—We shipped the joints to the Department of Materials Science and Engineering at Case Western Reserve University in Cleveland, Ohio. Under the direction of associate professor David Matthiesen, the samples were placed in an Instron testing machine. The force it took to break each joint was recorded on a computer, and then the values for the three joints were averaged and a standard deviation calculated. See what we learned, p. 40.

Mark Schofield is the managing editor.

WHICH GLUE IS THE STRONGEST?

The chart shows the glues ranked by the average force it took to break their joints. To give a guide to each glue's relative performance, its average joint strength is shown as a percentage of that of the strongest glue. We rated Type I PVA as the best overall, with interior yellow glue (PVA) as the best value.

GLUE	JOINT FIT	MAPLE	OAK	IPÉ	AVG. JOINT STRENGTH (LB.)	JOINT STRENGTH AS % OF TYPE I PVA GLUE	COMMENTS
AUTHOR'S BEST OVERALL CHOICE **Type I PVA glue (waterproof)**	Tight	1842	1843	2554	2024	100%	This proved to be a good all-around glue with no weakness in any of the woods or joint fits. Combined with its ease of use and moderate cost, this glue wins the best overall label.
	Snug	1700	1822	2733			
	Loose	1593	1603	2525			
Slow-set epoxy	Tight	1690	1908	2425	1994	99%	The betting before the test was that this glue would be the strongest. It came in a close second, but given its high cost and longer preparation time, this was disappointing. In particular, it didn't prove to be the clear choice for gap-filling.
	Snug	1680	1832	2712			
	Loose	1635	1557	2503			
AUTHOR'S BEST VALUE CHOICE **PVA glue**	Tight	1737	1769	2696	1924	95%	Many woodworkers will be relieved to see that their first-choice glue performed so well. Amazingly, it produced the strongest bonds on tight and snug ipé joints. This glue is the best value.
	Snug	1543	1684	2842			
	Loose	1474	1537	2036			
Liquid hide glue	Tight	1468	1850	1716	1595	79%	Not as strong as epoxy or the PVAs, this glue still gave a very credible performance. It performed particularly well on oak, but was relatively less strong on ipé.
	Snug	1516	1699	1779			
	Loose	1436	1521	1374			
Hot hide glue	Tight	1488	1847	1769	1531	76%	Proponents of hide glue have never claimed that it is as strong as PVA, but instead promote its reversibility and compatibility with stains and finish. From this test, it appears that hot hide glue is only a little weaker than yellow glue and is stronger on oak.
	Snug	1412	1765	1459			
	Loose	1485	1618	936			
Polyurethane	Tight	1414	1491	1875	1164	58%	The surprise of the test was this glue's poor showing. The snug joints were poor, and the loose joints were unacceptable. Polyurethane may be a tough finish, but it isn't a tough glue.
	Snug	1336	1055	1455			
	Loose	564	571	716			

THE WEAKEST LINK

The joints failed in three different ways: With the strongest glues, particularly in maple and oak, the failure was usually 100% in the wood. With the weakest glues, particularly in the strongest wood, ipé, the failure was 100% along the glueline, with the wood fibers remaining intact. But the majority of the joints showed some combination of both types of failure.

GLUE FAILURE | WOOD FAILURE | COMBINATION

What we learned about glue

The first lesson is that most (but not all) of these joints are incredibly strong. As Matthiesen joked, "You could park a car on these joints!" Given that the majority of the joints showed either complete or partial wood failure (with the exception of hide-glued ipé and all three woods glued with polyurethane), we concluded that most woodworkers can rely on their glue. That said, there are significant variations between the different glues, between the three woods, and according to the fit of the joint. Many of the results directly contradict conventional wisdom.

Ordinary yellow glue is as strong as the expensive stuff

If you are confident in your joint-making ability, then stick with good old-fashioned interior yellow glue. It was only a little weaker than Type I PVA (Titebond III) on tight and snug maple and oak joints, and it was stronger on ipé. If your joint-making skills still need a little help, go with the more expensive Type I PVA.

Epoxy isn't necessary on a dense tropical wood

The strongest joint in the whole test was yellow glue on ipé—a real surprise. Indeed, both yellow glue and Type I PVA were stronger than epoxy in tight and snug ipé joints. On loose ipé joints, epoxy showed no great advantage, so I would stick with either interior PVA or Type I PVA on this tropical wood. At all costs, don't hope that polyurethane will fill a loose ipé joint—it won't.

Liquid hide glue is as good as hot hide glue

Based on the average strength of all the joints, liquid hide glue beat out hot hide glue. However, if you look at specific joints and woods, hot hide glue was strongest in five of the nine categories. I had expected liquid hide glue to be weaker due to the addition of urea to keep it workable at room temperature, but in this test the two glue types were about equal. Where hot hide glue was comparatively weakest was on snug and loose ipé joints.

Tightness didn't starve these joints

With oak, all six glues created stronger bonds on tight joints than on snug ones, and the same was true with five out of six glues on maple. If oak and maple are representative of domestic woods, you don't need to worry about a tight fit causing glue starvation. Of course, these "tight" joints are far less tight than a clamped joint. On ipé, and perhaps other dense tropical woods, leaving a little extra room for the glue seems like a good idea. That said, both PVA glues and epoxy create incredibly strong joints whether the joints are tight or snug.

Open-pored wood produces stronger joints

In only two of 18 categories did maple produce a stronger joint than oak. Hide glues in particular seem to get a better bond on open-pored woods. This may explain why period furniture makers have great success using hide glue on mahogany, another relatively open-pored wood.

Polyurethane glue fails in loose joints

With the exception of hot hide glue on maple, all glues were slightly weaker on loose joints compared to tight and snug ones. All but polyurethane, however, were strong enough. If you want the best adhesive for a sloppy joint, use epoxy for maple, hot hide on oak, and Type I PVA on ipé. Polyurethane gluelines failed on loose joints in all three woods.

10 Best Fixes for Finishing Mistakes

Cures for common problems, and how to prevent them in the first place

BY TERI MASASCHI

Hobbyists and professionals alike make mistakes in the shop. When you're building a piece, fixing an error is fairly straightforward: Back up and start again by milling a new piece, recutting a joint, or fitting in a patch. But finishing mistakes can be harder to overcome—hence the dread many woodworkers feel.

Problems can pop up at any one of three points in the finishing process—surface preparation (and assembly), staining and coloring, and applying the topcoat. I'll show you some of the methods I use as a professional to back out of a mistake and to try to keep it from happening in the first place.

The best way to avoid mistakes altogether is to practice on a sample board. Testing the colors and materials you want to use will alert you to problems before you risk ruining an expensive project. Also, resist the urge to rush through the finishing process. You can nearly always tell when someone has taken a shortcut.

And finally, even if you make mistakes you can't fix, after suffering through them you probably won't repeat the same ones again.

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

Surface flaws

The most common pitfalls are sanding swirls and tearout, sanding through the veneer of hardwood plywood, and glue squeeze-out. Many of these maladies can occur even if you're trying to be meticulous. And you might not see the problem until it glares at you through a freshly applied coat of oil or stain.

1 SCRATCHES AND TEAROUT

Problem: A random-orbit sander left its signature pigtail marks, or you didn't use the right paper to eliminate scratches left by coarser grits. Or, cutting or planing tore out some wood fibers, leaving a divot in the surface. If the first swipe of stain shows vivid swirls or scratches all over the work, stop.

Solution: Sand the piece again, this time changing paper frequently and working your way systematically through the grits. If you've oiled or stained the piece and find that swirls show up in only one or two spots, sand those areas by hand with P220-grit wet-or-dry paper, wetting it with some of the same finish you used. This method works well with most oil finishes or oil-based pigment stains. If you used stain, reapply it carefully to match the surrounding stained areas.

If you used a dye, resand a stand-alone area, such as an entire stile. If it is a large surface, sand the damaged area, feathering the edge between sanded and unsanded parts. Then apply more dye.

To eliminate tearout, sand, plane, or scrape the surface. Wipe the surface with mineral spirits to check the smoothness. If the imperfections are small enough (generally no larger than a pinhead), you can fill them after you've stained and sealed the piece, using fill sticks, the wax crayons sold for touching up scratches.

If you aren't coloring the wood, small amounts of tearout can be OK in some places (legs, frames, etc.). But stain makes them pop.

Not smooth enough. *Swirl marks tell you that you haven't done enough sanding to eliminate scratches.*

Smoothing slurry. *Wet-sanding with the oil or stain you used helps eliminate swirls more rapidly without ruining the color.*

2 GLUE RESIDUE

Problem: You used too much glue, leaving squeeze-out around the joint. Or you got sloppy and left a gluey fingerprint on the workpiece. Oil or stain won't penetrate the glue residue, leaving an unsightly light spot.

Uneven oiling. *Glue residue on this mortise-and-tenon joint prevents the wood from absorbing oil evenly.*

Solution: You can get rid of some fingerprints by wet-sanding with the stain you used, or by lightly sanding and reapplying the stain.

Use a sharp chisel to eliminate dried glue from around a joint. Use sandpaper to clear up areas where you didn't completely wipe away squeeze-out. Wrap P220-grit paper around a hard block and sand with the grain, using firm pressure. To avoid scratching adjacent surfaces, use a 6-in. flexible drywall knife as a shield.

Touch-up. *When removing glue squeeze-out, sand with the grain using P220-grit sandpaper. Keep the block flat against the work to avoid rounding over an edge. Shield adjacent surfaces with a wide drywall knife.*

Photos, except where noted: David Heim; this page (top left): Kelly J. Dunton

3 SAND-THROUGH

Overdone. *It doesn't take much to sand through the face veneer on hardwood plywood.*

Problem: You sanded away some face veneer on a large, expensive piece of plywood after you had glued up everything.

Solution: Use a scrap of the same plywood to duplicate the mistake and serve as a sample board for the remedy. Apply the same finish you plan to use on the piece, then sand through a portion of the face veneer to give yourself a place to experiment with a repair.

Mix thin shellac with a touch-up powder such as Behlen Master Furniture Powder (www.woodworker.com) or Mohawk Blendal Powder Stain (www.mohawk-finishing.com). Put a piece of glass next to the sand-through on the practice board and begin developing your color. Quickly dip the brush into the shellac, then into one of the touch-up powders. Swirl the brush around on the glass to incorporate the powder and shellac. Dab on more shellac and a different powder to blend the color you need. Work in thin layers, sneaking up on the color rather than painting it in. If you aren't happy with the results, wipe away the color and start over.

When you've done a reasonable job of covering the sand-through on the scrap, take a deep breath and do the same thing on the real project. A glaze—a type of stain used on a semisealed surface—brushed on and then lightly wiped off will help blend in the patch.

Practice patch. *Make a similar burn-through on a scrap of the same plywood. Mix touch-up powders with thinned shellac to match the color of the face veneer and hide the sanded-through spot.*

Faux finish. *Carefully paint the tinted shellac over the sand-through. Apply a glaze to help blend the patch into the surrounding wood.*

How to prevent surface flaws

Sand with progressively finer grits, ending with P220. Finish by hand-sanding with the grain with P180- or P220-grit paper. Vacuum or blow off the dust. Wet the surface with mineral spirits or shine a bright light across it to reveal flaws. If you're working with hardwood-veneer plywood, sand with a very light touch and check your progress often. Use glue sparingly and remove squeeze-out carefully.

Sand by hand. *To eliminate cross-grain scratches, finish sanding by hand, always moving with the grain.*

Check your work. *Wipe on mineral spirits before applying the finish. This will reveal any lingering scratches or patches of tearout.*

Color mistakes

By far the biggest finishing problems can occur when you apply dye or stain. A color you thought would look great comes up garish. Or the first coat of color takes unevenly, leaving blotches or streaks. Here's how to get around drawbacks like these.

4 UNEVEN DYE STAIN

Problem: A dye-based stain looks stronger or more intense in some areas than in others. Consequently, you have an unevenly colored surface or lap marks where you wanted uniformity.

Solution: Pull a damp rag over the surface. That will lift the dye, so you can "move" or remove it to make the color even. Work the rag around to blend the color evenly. Then apply a washcoat of shellac and the stain you want to use.

Easy fix. *This maple door didn't take dye well, leaving lap marks on the frame. A wet rag rubbed over the dye will even out the color, minimizing blotchiness.*

5 WRONG STAIN COLOR

Problem: The stain you applied threw the wood color way off. Generally, a stain will appear either too red or not red enough. Either way, it spoils the appearance of the piece.

Tone it down. *A contrasting glaze usually will correct a color that's wrong. Here, black glaze will tame a too-red stain on this oak door. Wipe off the excess glaze almost immediately, revealing a better color.*

Solution: Correct the color with a glaze. I've had good results with Behlen or Mohawk glazing stains. Apply a washcoat of shellac over the stain, then gently scuff-sand with P320-grit paper when it's dry. Use a glaze that contrasts with the stain to bring the color back into line.

For example, if the stain looks too red, tone it down with a raw umber glaze, which is greenish in tone. Alternatively, you can use a black glaze to change the color's tone.

If the stain doesn't have enough red, warm up the color with burnt umber or burnt sienna, which is predominantly reddish.

Brush on the glaze liberally, let it sit for a minute or so, then lightly remove most of it with a clean rag, leaving a thin film of color. Once you've corrected the color to your liking, protect the glaze with another washcoat of shellac before you apply the topcoat.

Photos, facing page (top left and bottom right): Kelly J. Dunton

6 BLOTCHY STAIN

Problem: You chose a pigmented stain that didn't take evenly on the wood. Pine, cherry, maple, birch, and alder are the most likely to blotch.

Solution: If the surface is very blotchy, you'll have to remove the stain by stripping, sanding, or both, and start over. This time, apply a washcoat of shellac and then the stain.

If the blotching isn't too severe, try using a glaze to soften the contrast between the deeply colored and lighter areas. Once the initial stain is dry, apply a washcoat of shellac. Let it dry, then gently scuff with P320-grit paper. Brush on a burnt umber or other brownish glaze; wipe gently to remove most of the excess.

Sand lightly. *Pine is one of several woods that blotch easily. To even things out, begin by scuff-sanding.*

Apply a glaze and wipe it off. *Brush on a glaze to help cover up the blotches. Once the excess glaze has been wiped away, the door's color is much more uniform.*

How to prevent color mistakes

To avoid problems with stain or water-based dye in the first place, use a sample board to test the finish you want to use. You'll greatly increase the odds of having the color go on evenly if you apply a washcoat of thinned shellac beforehand. That will help ensure that subsequent coats of color take uniformly. A good washcoat is a 1-lb. cut: Combine premixed shellac (which is a 3-lb. cut) and denatured alcohol in a 3:2 ratio.

Control penetration. *A light coat of shellac thinned to a 1-lb. cut creates a good foundation before coloring the wood.*

No blotching. *Stain over a shellac washcoat has much less tendency to blotch.*

Sample board. *Test the finish you want to use on a scrap of the same wood used in the workpiece.*

Topcoat trouble

Problems can occur in laying down the final coats, whether you brush, wipe, or spray. Apply multiple light layers of the topcoat rather than one or two thick ones. Sand carefully, wiping away the sanding dust to check surfaces frequently. Rubbing out, the last step, is incredibly important because it "finishes" the finish. However, the idea of abrading a carefully applied topcoat scares many people, and rightly so. You don't want to have problems so close to the finale. Use a light touch.

7 DRIPS AND SAGS

Problem: You used too heavy a hand in applying the topcoat, so the coating drools down the side of your beautiful project.

Solution: Wait until the sag is totally dried. It should feel hard, not resilient, when you push on it. Wrap a cork or hardwood sanding block with P320-grit paper and lightly sand to level the mess. If you start sanding while the sag is still gummy, you'll just make the mess worse. Check your work frequently and change the paper often. You want to flatten the lumps without going through the stain color or down to the bare wood.

Or, if you only have one or two drips, you can use a fresh single-edge razor blade to scrape them off. Be sure to scrape carefully to avoid cutting through the finish.

Scrape or sand. *Once a drip has dried completely, scrape it off with a razor blade (above) or sand it flush (right).*

8 CONTAMINATED FINISH

Problem: Flat surfaces are pockmarked with small craters. Often from the first brushful, the coating literally "crawls" into an odd formation that resembles a crater or fisheye. You can't do anything ahead of time to prevent this contamination. It may come from lubricants used on a tablesaw or jointer bed. It can also occur if you put a water-based finish over an oil-based stain.

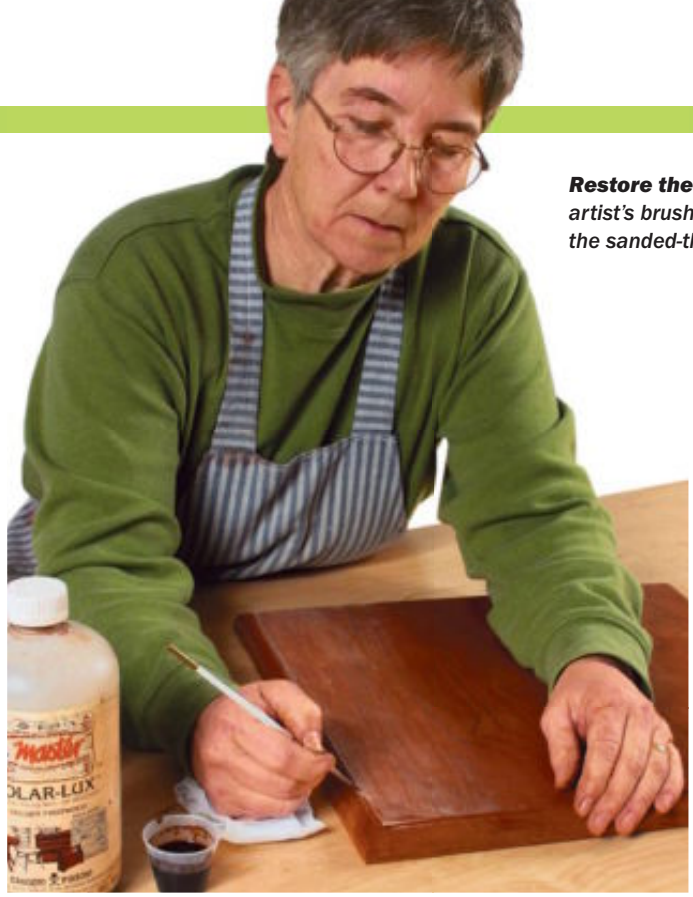
Solution: Stop. Don't even begin to think you can keep brushing to eliminate the problem. Wipe off all the coating, then brush or spray on a light coat of shellac. If spraying, use a very fine, almost dry spray. The shellac forms a barrier to keep the contaminant from coming up through subsequent layers of finish. When the shellac dries, continue applying the topcoat you want.

Attack immediately. *Wipe off all the contaminated topcoat as soon as you see it crawl. A light spray of shellac will isolate the contamination, so you can reapply the topcoat.*

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

9 BURN-THROUGH

Burned up. *If you sand the topcoat too aggressively or don't keep the sanding block level, you risk removing some of the finish.*



Restore the color. *Use a small artist's brush to reapply stain to the sanded-through area (left).*

Seal the color. *Brush a light coat of shellac over the stain touch-up.*

Problem: You have either sanded through the finish (a frequent occurrence on edges, moldings, and carvings) or burned through the color (removing both the topcoats and the stain).

Solution: If you've burned through the color, carefully apply more stain, protect it with a light coat of shellac, and then replace the topcoats. If you've only burned through the finish, delicately reapply it. When the repairs are thoroughly dry, rub out those areas to blend them in with the rest of the surface.

10 WITNESS LINES

Problem: When rubbing out a film finish like varnish, you cut through the layers of finish. Witness lines are shadowy craters of this cut-through. Witness lines seldom occur with shellac or lacquer because new coats of those finishes dissolve into the old ones.

Solution: Keep leveling the finish, then apply at least two more fresh coats of finish.

Witnesses. *Sanding too much can produce witness lines, whitish areas exposing earlier coats of finish.*

Keep sanding. *Using fine sandpaper and a light touch, sand the surface to level it as much as possible before applying more topcoat.*

Add another topcoat. *Apply more of the topcoat to the entire surface, not just where the witness lines had been.*

A Back for Every Cabinet

The right choices balance strength, appearance, and efficiency

BY STEVE LATTA

Like many avid readers and collectors, I have a lot of bookcases. Over the years, I've jammed some of them so full that paperbacks are wedged into any usable opening. The shelves are so crowded, in fact, that it's almost impossible to see the back of the case. For strictly functional cabinets like these, a sturdy back can be as simple as a plain sheet of plywood.

But there are other types of cases that need a good-looking back, and some instances in which an attractive back also must be rock solid.

I have display cases, for example, that house ceramics, antique tools, and other prized possessions. For cases like these, the back needs to look good. The case that holds my collection of first-edition books needs a different kind of back. It has a pair of inset glass doors, so the back must look good and also be quite rigid. That helps hold the case square and keep the doors from racking and binding, regardless of the substantial weight of the books.

Fortunately, there are several ways to make an attractive back; some combine

Photos: Steve Scott

TWO STYLISH OPTIONS

A bookcase stuffed to the gills with paperbacks doesn't need a fancy-looking back. On the other hand, a case for displaying collectibles probably needs something dressier than a plain sheet of plywood. Slat backs (far left) made of solid wood are attractive enough to set off fine collectibles or rare books, and provide sufficient strength for an open-front cabinet. Frame-and-panel backs (left) are even more handsome. With glued-in plywood panels, this back is also exceptionally rigid, making it the best choice for a cabinet with inset doors.

great looks with construction rigid enough for the most demanding applications.

Apart from that bare sheet of plywood, most cabinet backs fall into two basic designs: slats or frame-and-panel. Slats offer a wide variety of looks—from rustic to refined—and their joinery allows for wood movement. They work well with open-front cases but aren't rigid enough for cabinets with inset doors. A frame-and-panel back, whether it's made with floating panels or glued-in plywood, is sturdier.

Slat-back options

The basic aesthetic goal for any slatted back is a pleasing, consistent pattern that doesn't involve very narrow or wide slats on the edges. I stagger the width of the slats, using pieces around 4 in. and 5 in. wide. Wider boards look better on larger backs.

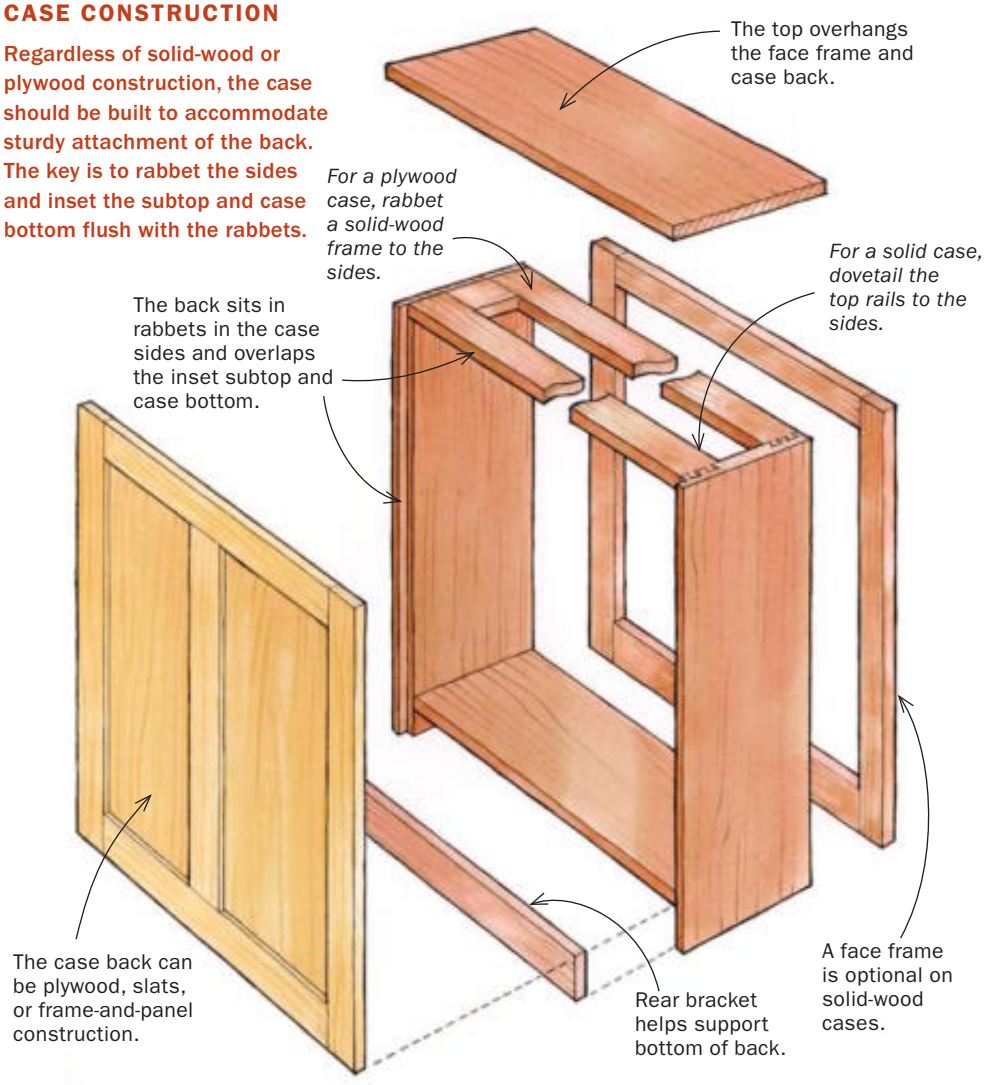
For slatted backs, three basic forms of joinery come into play. In order of simplicity, these are shiplapping, splining, and tongue-and-groove.

Shiplapping—Shiplapping involves rabbetting opposite sides of the same board so that the edges of adjoining slats overlap. Use a router table, a tablesaw with dado head, or a shaper; make the rabbets about ¼ in. wide and half as thick as the stock.

For small cases like the one shown here, (the back is 28½ in. wide and 42¾ in. tall), slats as thin as 5/16 in. would work. But

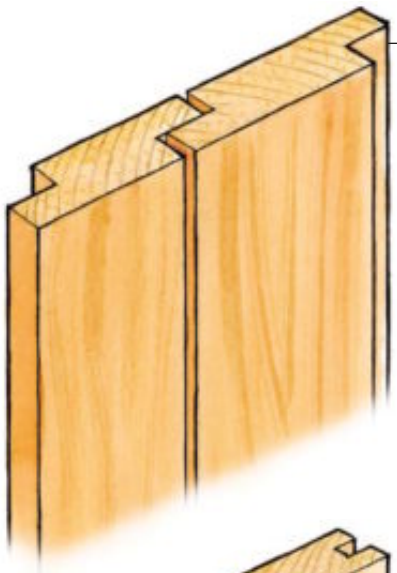
CASE CONSTRUCTION

Regardless of solid-wood or plywood construction, the case should be built to accommodate sturdy attachment of the back. The key is to rabbet the sides and inset the subtop and case bottom flush with the rabbets.



Options for slat backs

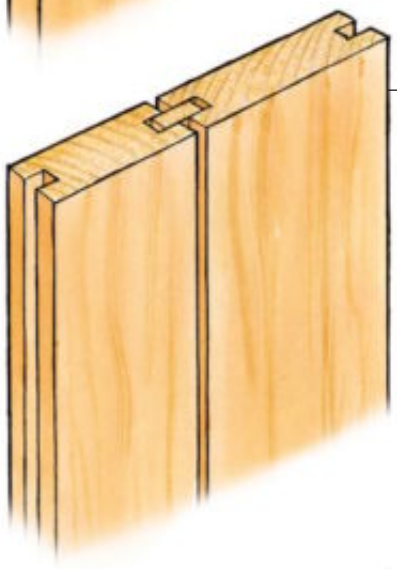
A slat back is relatively simple solid-wood construction. Each of these joinery choices is designed to allow for its own wood movement, so don't glue the slats to each other. Each slat should expand and contract as an individual unit.



SHIPLAP

This is a practical choice for thinner slat stock because rabbetting divides the narrow edge of each slat into just two elements. In contrast, a groove plowed in the edge of a too-narrow slat will have skinny, fragile walls that could snap off.

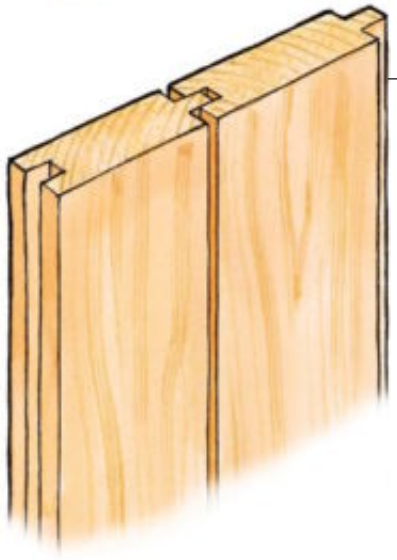
Matched rabbets form a joint. *With the bit height set at half the thickness of the stock, all of the cuts can be made with one router-table setup.*



SPLINES

Cutting a simple groove along the edges of each slat allows the boards to be held together with splines. Stronger than shiplap, but not as strong as tongue and groove, a splined back is much quicker to make than the latter.

Cut a groove. *A tablesaw kerf is wide enough to house a spline. The spline should be slightly narrower than the combined depth of the grooves to allow for movement.*



TONGUE AND GROOVE

Tongue-and-groove joinery makes a sturdier back. The joints interlock more securely than splined slats, reducing the likelihood of a piece cupping or twisting.

A slot cutter plows a groove. *Tongue-and-groove joinery requires a wider groove. Make one pass in each direction to ensure that the groove is perfectly centered.*

A straight bit cuts the tongue. *Set the bit height to match the bottom of the groove.*

because shiplapped joints are not truly interlocking, large cases require thicker slats to avoid having edges twist out and pull away from the case. Another strategy for this is to use a splined or tongue-and-groove back, both of which join the slats more securely.

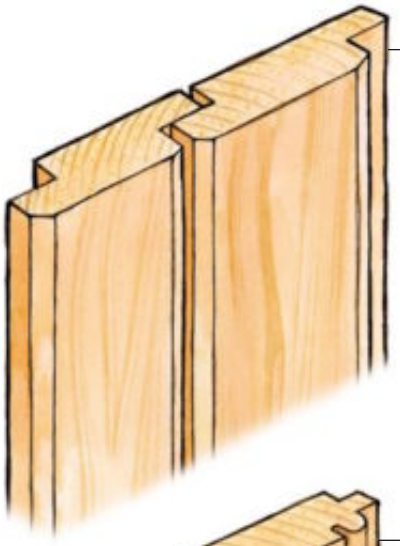
Splining—For boards of this size and length, cut a groove ⅛ in. to 3⁄16 in. wide. Keep the groove no deeper than 3⁄16 in. to ¼ in. or you risk breaking off one of the sides. It's simplest to center the groove on the slat's edge unless you plan to add a bead or chamfer on the front of the board. In that case, cut the groove closer to the back of the board, but not so close that it compromises the strength of the groove's back lip.

On the tablesaw, use a featherboard and a tall auxiliary fence for safety and consistency of cut. A zero-clearance insert adds safety and prevents tearout.

You also can cut the grooves with a slot cutter mounted on a shaper or router table. Most slot-cutter sets are designed to cut a

Drawings: Stephen Hutchings

Edge details

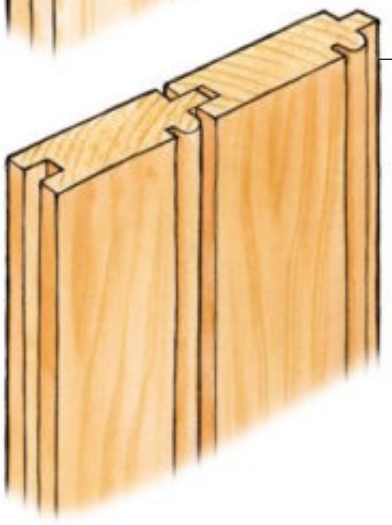


CHAMFERS

Chamfers work well on all three styles of slat backs, and they're easily cut using a block plane or a chamfering or V-groove bit chucked into a router table.

A shiplap fence simplifies the work. *Allowing the stock to overlap the fence means both edges can be chamfered with one router-table setup.*

Cut a chamfer on each edge. *Make sure that the profile doesn't compromise the integrity of the rabbet at either edge.*



BEADS

Beading works best on a shiplapped or tongue-and-groove back. On a splined slat, however, the bead can weaken one of the groove walls.

Cut the decorative element after cutting the joinery. *Cutting the tongue first yields a cleaner cut because the beading bit isn't forced to hog away large amounts of waste material.*

groove about ½ in. deep, so I bury the cutter in the fence to get a shallower cut and to reduce tearout. A fence-mounted featherboard adds both safety and accuracy.

After cutting the grooves, I create splines by thickness-planing a board of slat stock to a little less than the combined depth of the two grooves and using the tablesaw to rip off strips that fit snugly in the grooves. When mounting the slats in the case, leave a slight gap, no more than 1/16 in., between the pieces to allow for movement.

Tongue and groove—Positioning and cutting the grooves for tongue-and-groove slats is the same as for splining. Because these boards aren't very wide, there will be minimal movement, so the groove does not need to be very deep.

Amana sells a two-wing, slot-cutting assembly marketed under the name of Quadraset that can be adjusted to cut both halves of the joint with a slot width as

INSTALLING SLATS

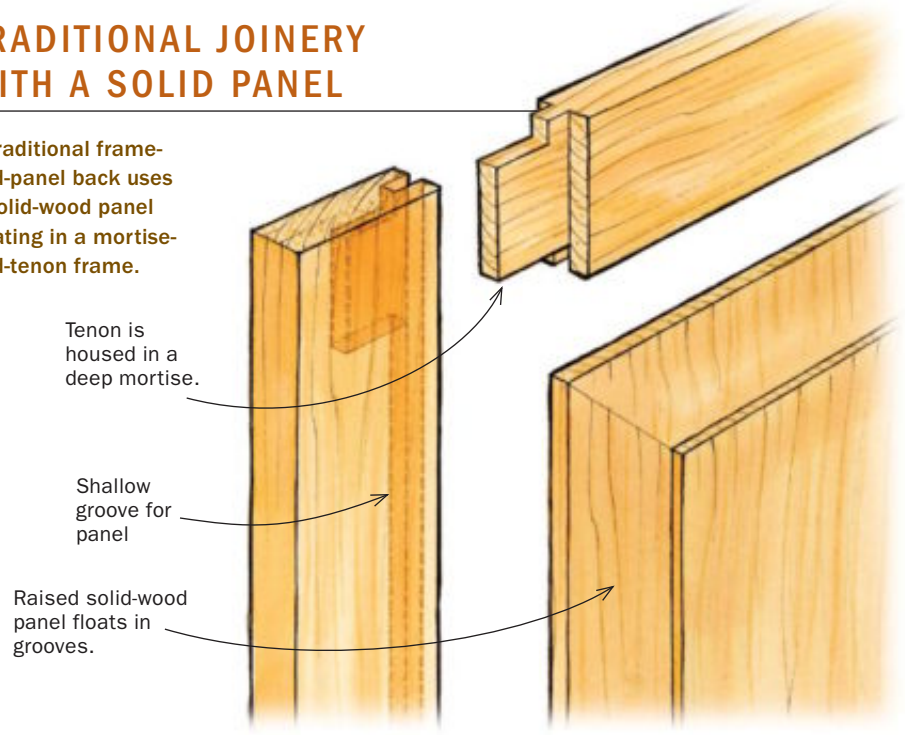
Start in the middle. *Space the slats about 1/16 in. apart. Rip the outer boards to fit. Nail or screw the outer slats along the edge. Use two nails in each middle slat, about ¾ in. from each edge.*

Frame-and-panel backs

Frame-and-panel backs are much more rigid than slat backs and as a result they're much more effective at keeping a case from racking. They are also quite attractive, and the use of contrasting panels adds a contemporary feel.

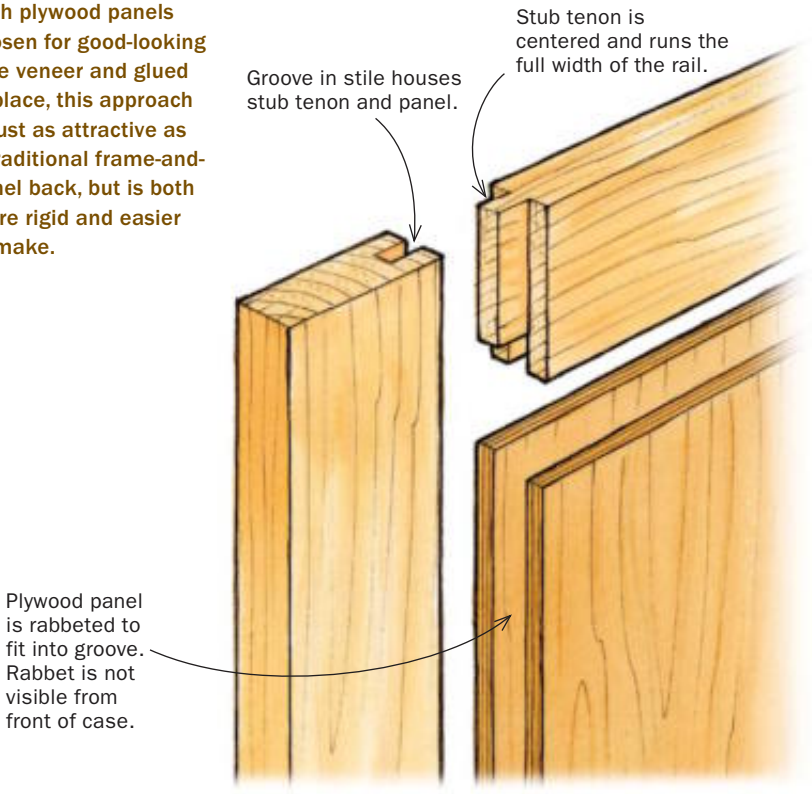
TRADITIONAL JOINERY WITH A SOLID PANEL

A traditional frame-and-panel back uses a solid-wood panel floating in a mortise-and-tenon frame.



STUB TENONS WITH A PLYWOOD PANEL

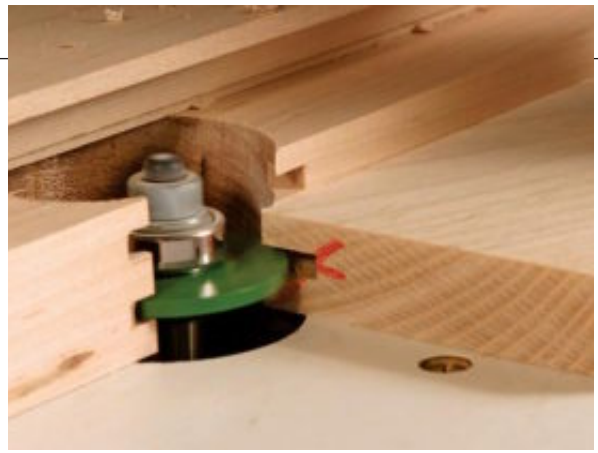
With plywood panels chosen for good-looking face veneer and glued in place, this approach is just as attractive as a traditional frame-and-panel back, but is both more rigid and easier to make.



narrow as ⅛ in. and expandable in 1/32-in. increments. There is a distinct advantage in cutting both the top and bottom rabbets at the same time, because the tongue is guaranteed to be consistent and fit the groove. In my experience, cutting one side at a time, regardless of setup efforts, leads to variations in the tongue thickness that may require touch-up with a rabbet plane.

Embellishments—Chamfers and beads are the two most common forms of edge detail on slat backs. For chamfers on splined or shiplapped slats, bury the bit into an auxiliary fence to ensure that the chamfer doesn't take up the entire edge. For tongue-and-groove slats, I make a special fence that allows me to chamfer both the tongued and the grooved slats with one router-table setup. I cut one of the lips off an extra piece of grooved stock, then bury the V-groove bit into the lower lip. (Don't use a chamfering bit here. The tongue on your slats will ride the bit's bearing and push the work away from the cutter.) The small flat that was left below the chamfer rides the edge of the rabbet.

I typically bead only tongue-and-groove slats, using a high fence and a beading bit in a table-mounted router. I cut the



Cut a continuous groove in the frame members. *On the stiles, the groove that houses the panel also serves as a mortise for the stub tenons on the rails. Because the cutter is buried into the fence, tearout is radically reduced. Make one pass in each direction to center the groove.*

bead on the tongued section. When using thin stock, I don't bead the grooved edge because it will weaken the lip. This isn't an issue for larger cases with thicker back boards. If possible, set the top of the bead a little below the surface of the board so that it is not flattened during subsequent planing, scraping, and sanding stages.

Easy frame and panel

Frame-and-panel backs are much more rigid than slat backs and, as a result, are more effective at keeping a case from racking. Frame-and-panel backs are also quite attractive, and the use of contrasting panels adds a contemporary feel.

A very traditional back can be made with full tenons and a solid, raised panel, but I prefer another method, using plywood panels. This is just as attractive yet easier and more rigid. Plywood frame-and-panel backs can be made with a simple, quick method. For a case of this size, use ⅝-in. to ¾-in. frame stock with panels made from ⅜-in. or ½-in. plywood. Plywood is available rotary cut in common species such as walnut, mahogany, cherry, and red or white oak. Since the panels aren't large, it is not difficult to cut a sheet for optimum appearance. Plain-sliced plywood has a more uniform look, but may not be as readily available in most species.

Size the back about ⅛ in. taller and wider than the rabbeted case opening. Design the back so that interior stiles and rails are proportional to each other. In my bookcase (see photo, below), the back is divided into two panels for a balanced look. The center stile is about ½ in. narrower to compensate for the edges of the side, which rest in a rabbet in the case.

Making the frame—I use stub-tenon joinery, which is a wonderful way to make frames quickly for a variety of applications such as cabinet backs and dust panels. By itself, this frame isn't as strong as one made with traditional mortise-and-tenon joinery. But with plywood panels glued in place, you wind up with a lightweight back that is more rigid than its traditional cousin.

The joinery is easy to cut. Start by plowing a full-length groove, ½ in. deep and ¼ in. wide, along the inner edges of the frame members. You can do this with a slot cutter or dado head. Lay out the tenons so they are centered on the stock. You can cut them quickly using any tenoning jig.

With all the joints cut, fit the frame together and size the panels. Measure the panel openings and add ⅞ in. to the length and width to account for the panel's rabbeted edges. Cut the rabbets about ½ in. to 9⁄16 in. wide. There is no need to make the reveal precisely even, as the rabbets are not visible from the front of the case.

Glue up in stages—It's best to approach the glue-up very systematically, starting with the top and bottom rails and the center stile. Next, apply a bead of glue along the back edges of the grooves only. In this way, any squeeze-out will be on the back of the plywood panel. Slide the panels in, mount the side stiles dry, and clamp the whole assembly, making sure everything is flat and square. After about half an hour, unclamp the assembly, glue on the side stiles, and reclamp.

Fit the panel to the case—Taking special care to keep the panel square, size it for a snug fit in the case back. Racking is devastating if you plan to use inset doors. Rather than nails, use screws to hold paneled backs in place. This facilitates easy removal for finishing or any other reason that might arise. □

Steve Latta, an instructor at Thaddeus Stevens College in Lancaster, Pa., is a contributing editor.

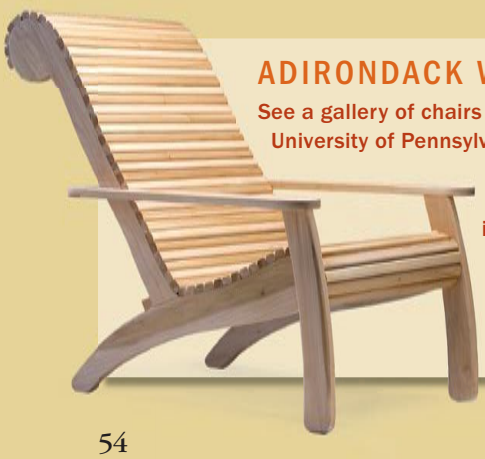
Cut the stub tenons. *Raise the tablesaw blade enough to barely nick the bottom corner of the groove (top). This ensures a clean, snug-fitting corner at the base of the tenon. Raise the blade to trim the tenon cheeks (bottom).*

Assemble the back. *The ½-in.- thick plywood is rabbeted on the back side, ensuring a good fit in the grooves. Check carefully once the clamps are on to make sure the assembly is flat, tapping the components into place with a deadblow hammer, if needed, as you tighten the clamps.*

Adirondack Chair

Build this comfortable, lightweight version of an American classic

BY TOM BEGNAL



ADIRONDACK WITH A TWIST

See a gallery of chairs (pp. 60-61) from Indiana University of Pennsylvania's design competition. Chair makers were invited to develop their own interpretations, using the basic concept of this classic chair as a point of departure.

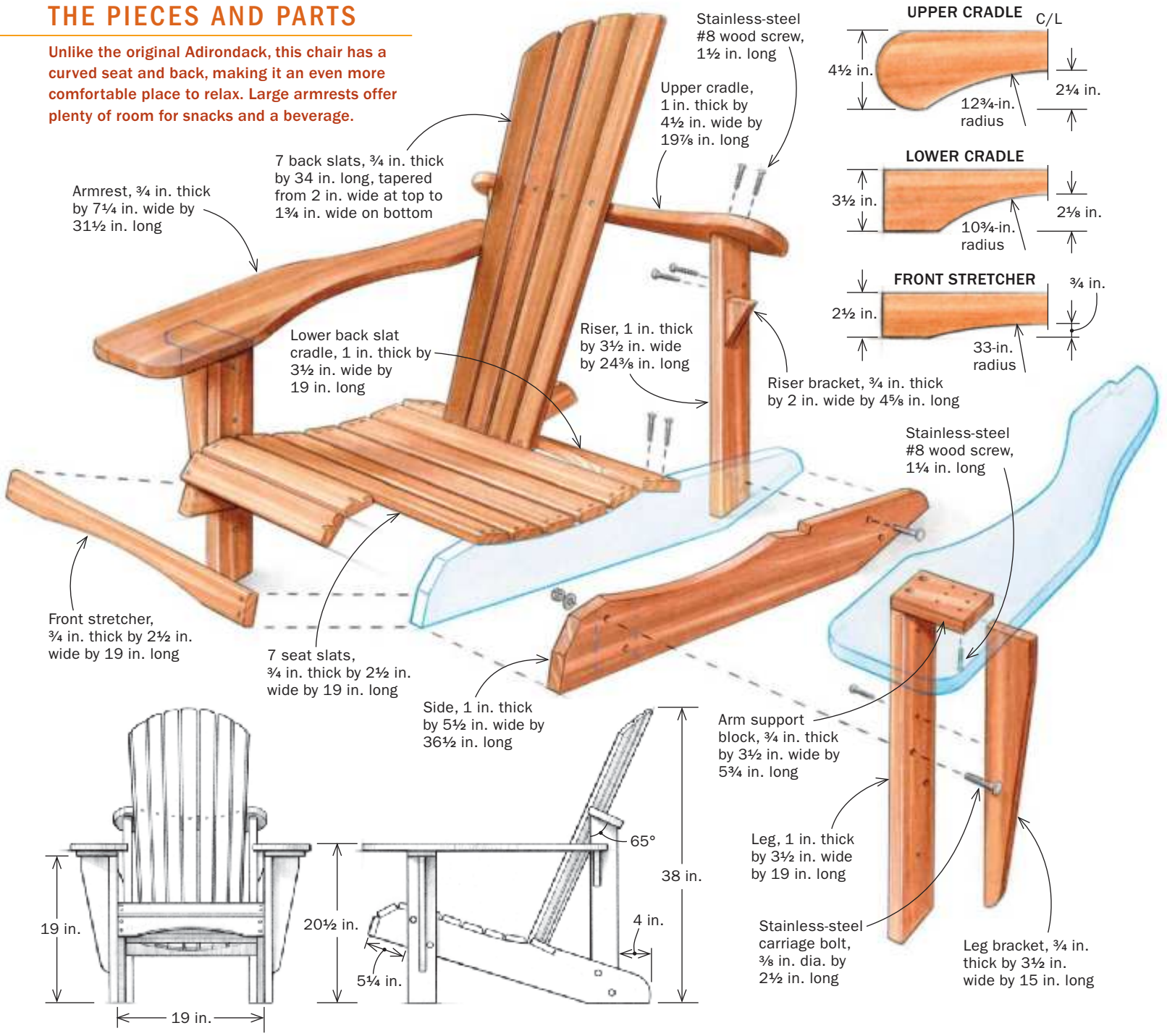
This quintessentially American outdoor chair was born in the early 1900s in the Adirondack mountain region of New York state. The generous slant of the seat and back make it an inviting place to relax outdoors. And for those who like to graze while relaxing, armrests the size of small tables offer plenty of room for a plate of snacks and a favorite beverage.

Unlike the original, our chair has a curved seat and back, making it a place where you won't mind spending a lot of downtime. It is made from western red cedar, a weather-resistant, lightweight wood available at most lumberyards. Cypress, mahogany, and redwood also are lightweight and enjoy the outdoors. Ipé and

Photos, this page: Michael Pekovich (top); Roy Engelbrecht (bottom left)

THE PIECES AND PARTS

Unlike the original Adirondack, this chair has a curved seat and back, making it an even more comfortable place to relax. Large armrests offer plenty of room for snacks and a beverage.



teak are at home outdoors, too, but expect a chair made from either to be a muscle-strainer.

Most of the parts are made from presurfaced "1-by" stock, but for the parts that carry extra load—sides, legs, risers, and cradles—I used 5/4 presurfaced stock. Much like a 2x4, the actual dimensions end up slightly less. That said, if you use teak, ipé, or any other hardwood, you can build the entire chair from 1-by boards.

Begin with the sides

The sides are the foundation of the framework. Cut a full-size pattern, then transfer it to the stock, and cut out the shape on the

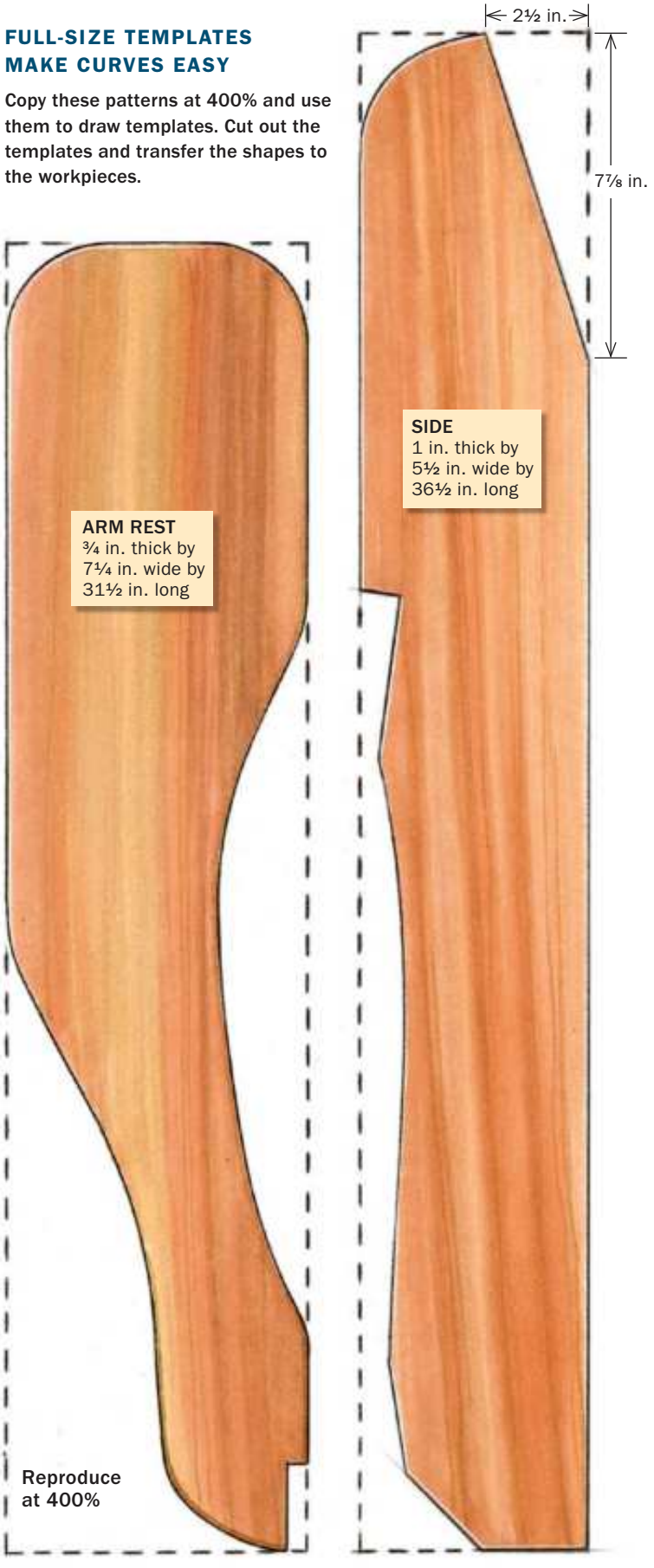
TIP

Make a jumbo compass. *The compass is a thin strip of wood about 36 in. long. Measure 1 in. from the end, and drill a hole to accept a nail. Create a pivot point by driving the nail through the strip and into a square block of ¾-in.-thick stock. The location of the pencil hole will vary depending on the radius of the arc.*

BEGIN WITH THE SIDE PIECES

FULL-SIZE TEMPLATES MAKE CURVES EASY

Copy these patterns at 400% and use them to draw templates. Cut out the templates and transfer the shapes to the workpieces.



Trace the shape. *Use a thick-paper template to outline the side shape on stock.*

Tape sides together. *Begnal uses double-sided tape to hold the boards together as he cuts them.*

Keep the parts taped together. *A file, followed with sandpaper, is a good way to smooth the edges of inside or outside curves. Start sanding with coarse paper, say P80-grit, working up to P150-grit.*

bandsaw. Smooth the sawblade marks on the edges of the sides with a plane, scraper, or sanding block.

Cut seat slats, stretcher, and lower back-slat cradle

Cut the seat slats to size before moving on to the front stretcher. To lay out the curve along the bottom edge of the stretcher, make a jumbo compass (see tip, p. 55) Measure 33 in. from the compass pivot point and drill a ⅛-in.-dia. hole to accept a pencil point.

Before scribing the curve, add reference points to the stretcher. At a point ¾ in. from the front edge, draw a line across the length of the piece. On that line, mark the center point. Now, place the stretcher on a workbench. Align the pivot point of the compass with the center mark on the stretcher, positioning the pencil on the center point. Use the compass to scribe the arc across the stretcher, use a bandsaw to cut it out, then smooth the sawn edges.

Again, turn to the jumbo compass to scribe the curved front edge of the lower cradle. Relocate the pencil hole to create a 10¾-in. radius. At a point 2⅛ in. from the front edge of the cradle, draw a reference line across the length of the piece. Then, mark the end-

Photos, except where noted: Anissa Kapsales; drawings: Bob La Pointe

TAPER AND SHAPE THE BACK SLATS

Easy tapering on the jointer. *With the infeed table set to make a ⅛-in.-deep cut, add a piece of tape to the fence 1 in. from the front edge of the outfeed table. Also, wedge the guard open 1 in. or so. Now, with the machine running, lower the top end of a slat onto the outfeed table, using the tape as a guide and keeping your hands a safe distance from the cutterhead.*

One pass per side. *Use a push block to feed the back slat through the cutterhead. Flip the slat over and repeat. The short untapered portion at the top end won't be visible after sanding.*

to-end center point on the line and cut the curve on the bandsaw. After that, smooth, sand, and round over the edges.

Move on to the leg assemblies, then the back

Each of the two leg assemblies is made up of a leg, a leg bracket, and an arm-support block. With the parts disassembled, drill all the shank holes in the legs and support block. Use a bandsaw to cut the taper on the bracket, and then smooth with a smoothing plane. Now, sand all the leg parts and round over the edges. But do not round edges where parts meet. Screw one block to the top of each leg. For each leg assembly, screw a bracket to the underside of a block and outside of a leg.

The back assembly is made up of two parts: a pair of vertical risers and a pair of riser brackets. Once the parts are cut, rounded, and smoothed, screw them together. To locate the proper position for the riser brackets, place a leg assembly on the riser with both bottom ends flush, then use the arm-support block as a straight-edge to scribe a line across the riser. Position the bracket so that its face is flush with the front edge of the riser and its top edge is at the marked line. Secure each bracket in place by driving three screws through the inside face of the riser and into the bracket.

Make the upper cradle

To create the curved front edge, use the jumbo compass again. This time, though, locate the pencil hole 12¾ in. from the nail hole. Again, add a reference point to the cradle. Draw a line 2¼ in. from the front edge of the cradle, and then mark the end-to-end center point on the line. Use the compass to scribe the arc.

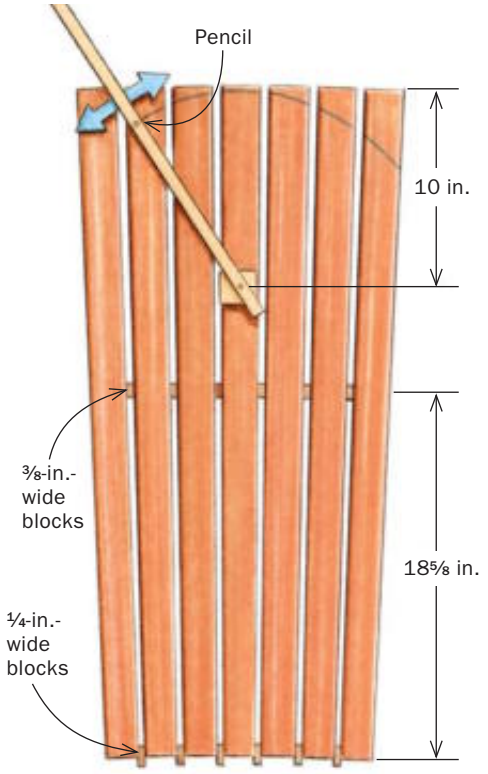
The end curves are next. I experimented with several shapes on the end of a 4½-in.-wide piece of cardboard. When I hit on one that looked good, I cut out the curve and used the cardboard to trace the shape on each end of the cradle. Use a bandsaw to cut them out, and then smooth the sawn edges.

Cut out the arms

The arms are the focal point of the chair. Enlarge the drawing on p. 56 to trace a full-size pattern on stiff paper or cardboard. Cut

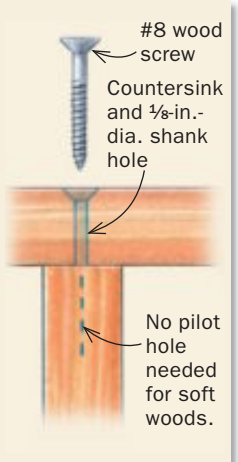
SCRIBE AN ARC ON THE BACK SLATS

Use the tip on p. 55 to create a jumbo compass. After that, measure 10 in. from the nail hole and drill a ⅛-in.-dia. hole—a size just big enough to accept a pencil point.



Mark the arc. *A clamp and some light pressure keep the back slats and spacers from shifting while Begnal uses the jumbo compass.*

ASSEMBLE THE BASE



SCREW DETAIL

Make a subassembly. *Screw the stretcher to the front and follow with the lower cradle.*

Add one leg assembly at a time. *Use a spring clamp to temporarily clamp each one to a side piece, then square it to the worksurface.*

Secure the leg assemblies. *Once the leg assemblies are in place, drill ⅜-in.-dia. holes through the sides and legs and add bolts, nuts, and washers.*

FineWoodworking.com

Tom Begnal walks through the complete assembly process.

out the pattern and use it as a template to trace the shape on each length of stock. Then use a bandsaw to cut out both arms at the same time. Smooth the edges, round them over, and sand through P150-grit.

Taper the back slats

To taper the seven back slats, I use an old jointer trick that makes the process quick and easy. First, apply a piece of tape to the jointer fence to establish a point about 1 in. from the front edge of the outfeed table. Lower the infeed table ⅛ in. (the amount of taper you want on each edge). Then wedge the guard open so that you can lower a slat onto the cutterhead.

Next, with the machine turned on, rest the bottom end of the slat on the infeed table (or, if the infeed table is short, overhanging the end), and align the top end of the slat with the tape. Holding the slat against the fence with your hands well behind the cutterhead, lower the end onto the outfeed table. Use a push block to feed the slat through the cutterhead. Repeat on the opposite edge.

Now you're ready to trace the top curve on the back slats. Start by placing all the back slats edge to edge with a pair of spacers between each. Redrill the pencil hole on the jumbo compass

Attach the upper cradle. *Use a temporary spacer board to ensure that the risers stay parallel when the upper cradle is attached.*

ADD THE ARMS AND SLATS

Add the arms. *Drive the riser screws (at the back) first to be sure the arm notch fits snugly around the riser. Begnal conceals the screws by driving them in from the inside of the riser and the underside of the support block.*

Position the back slats. *Start with the center slat, then the two end slats, and work your way in. The slats must be aligned at the bottom of the lower cradle, with even spacing between them.*

Layout trick. *Place the chair on its back and use spring clamps to level it. This will allow you to rest the slats on the cradles and adjust positioning without slippage.*

10 in. from the nail. Position the pivot point 10 in. from the top end of the slats and centered on the middle slat. Scribe the arc across all the slats.

Cut out the curved ends with a bandsaw. Sand or scrape each sawn edge and sand the faces through P150-grit before rounding the edges.

Assemble all the parts

You are ready to start putting the chair together. Stainless-steel screws (countersunk) and carriage bolts eliminate the need for glue. Start the assembly by screwing the stretcher to the front end of each side piece. With the stretcher mounted, add the lower back-slat cradle to give some rigidity to the subassembly.

Now, on each side piece, mark a line 5¼ in. from the front face of the stretcher. Elevate the stretcher until the back ends are flat on the worksurface. Then place a leg against the side piece, and use a square to make sure it is square to the worksurface and on your mark. Add a clamp to make sure it won't inadvertently shift out of position as you drill a pair of ⅜-in.-dia. holes through the legs and sides. Bolt the leg in place, then attach the other leg.

With the legs safely at first base, the back assembly is now at bat. At a point 4 in. from the back end of the side, clamp a riser to a side piece. Check for square with the worksurface, then drill the holes and add the bolts. Follow the same procedure for the second riser.

The upper cradle is next. Position the cradle so that its back edge is set back ¼ in. from the back edges of the risers. Measure and drill for a pair of shank holes at each end of the upper cradle.

After you attach the upper cradle, add the arms, as it becomes a chore to attach them once the back slats are in place. Position each arm so that the notch fits around the riser, and screw through the riser and arm-support block.

The back slats are attached to the lower and upper cradles. I attach the center slat first, then move to the two outside slats and work inward. Before drilling the shank holes, it is important to align them from left to right, up and down, and keep the spacing even to maintain a nice curve on the bottom and the top.

Seat slats are the final step. *The seven slats are attached at each end. The ⅜-in. spacers between each slat make placement a snap.*

Give the entire project a quick once-over with P150-grit sandpaper, and break any sharp edges. You can leave the chair unfinished and let it weather naturally. Or, three coats of spar varnish provide a finish that will hold up well in an outdoor environment. A fresh coat every couple of years should keep the chair happy and fit for decades to come.

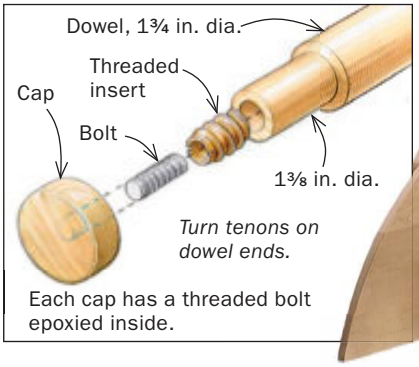
Tom Begnal is an associate editor.

A gallery of inventive designs

These chairs are a sampling from Indiana University of Pennsylvania's second exhibition on the Adirondack theme. Professor Christopher Weiland and director Steve Loar invited students and alumni from recognized furniture and design programs, challenging them to explore and redesign the century-old Adirondack chair. These are design exercises, so feel free to vary materials or joinery for outdoor use.

NICOLE TARTONI *Indiana University of Pennsylvania (IUP)*

This version borrows its inspiration from a sundial. To allow the chair to recline and break down, Tartoni incorporated hand-turned, threaded dowels into the design, construction, and function. Upright, the chair stands nearly 41 in. tall. Fully reclined, it is 47 in. deep and 30 in. wide.



ANTHONY McCARTY, IAN ELDRIDGE, AND SAMANTHA SARHADI *Purchase College, State University of New York*

While the construction of this chair is traditional, the design is not. Adirondacks can be hard to exit, and the backs aren't always comfortable. So the makers removed an arm, allowing for easy exit and a wider variety of body positions. This left the chair visually asymmetrical, so they varied the angle and size of the back slats. The chair is 33 in. deep by 30 in. wide by 40 in. tall.

RON MORETTI *IUP*

Moretti likes the traditional version, but felt it could be streamlined and softened. His chair has more curves and is tapered nearly 6 in. to the back. The seat slats must follow the taper. Unlike the typical Adirondack chair, which has the seat slats resting directly across the side supports, Moretti used a bracket to recess the slats slightly. The chair (40 in. deep by 24 in. wide by 41 in. tall) breaks down to four pieces.

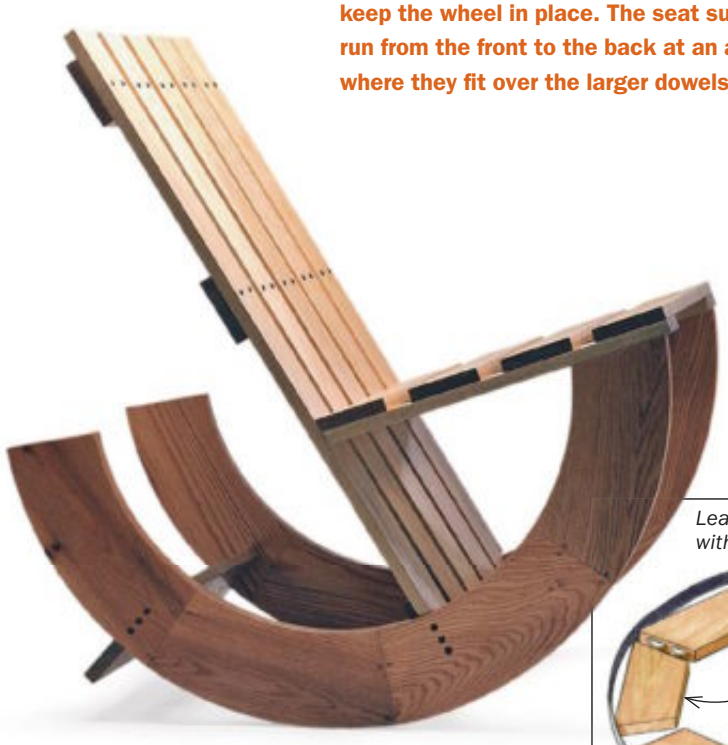
Photos, this spread: Roy Engelbrecht

MARK WEABER ***Lehigh University***

At the time the call for entries was announced, Weaber was studying ergonomics in design. The thin slats allowed a more ergonomic profile than the traditional chair. He curved the front slats down and around to avoid sharp edges. For a smoother front surface, he glued the back and seat slats to the framework and reinforced them with a cleat and screws from the back. The joint between the back post and back legs is a half-lap, pared by hand for a gap-free shoulder. The chair is 40 in. deep by 25 in. wide by 41 in. tall.

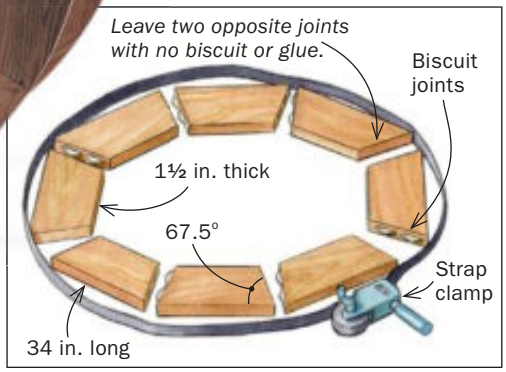
ISAAC HILLSON ***IUP***

Hillson's chair (29 in. deep by 22 in. wide by 32 in. tall) merges two typical outdoor images, the wheelbarrow and the Adirondack chair. The wheel turns on a dowel, which is glued into larger dowels at both ends to keep the wheel in place. The seat supports run from the front to the back at an angle, where they fit over the larger dowels.



MATHEW NAUMAN ***IUP***

Nauman's chair merges the Adirondack with a rocker. Nauman created the rockers as one large circle, then broke the circle into halves. He began with eight biscuited segments. The resulting octagon was glued and clamped, and the two halves were rough cut to a circle on the bandsaw and then finish-routed using a template. For strength, Nauman inserted ¼-in. dowels to support the biscuit joint. The chair is 32 in. deep by 24 in. wide by 36 in. tall.



Mitered Molding Simplifies Traditional Doors

Power-tool technique works for any molding profile

BY LONNIE BIRD

The term "sticking" refers to the decorative molding along the inside edges of traditional door frames. The sticking is commonly a simple molding profile such as an ovolo or a thumbnail. The challenge is joining this molding cleanly at the inside corners.

I use a miter joint that is quick and easy, requires almost no hand tools, works on any molding profile, and allows a full mortise and tenon.

If you are constructing a dozen or more doors for kitchen or shop cabinets, cope-and-stick router bit sets can be an efficient way to produce a large number of doors quickly. These matched bits will "cope" the joint cleanly, sculpting one side to match the other. But these bit sets are expensive, and they deliver only a short stub tenon.

When making a pair of doors for a piece of fine casework, you'll want the greater strength of a full tenon and mortise. And where the sticking intersects in the corners, you'll have two choices, a cope or a miter.

A coped, or sculpted, joint is executed by hand and requires a certain amount of hand-tool proficiency. It also requires a gouge with a sweep that matches the profile of the sticking.

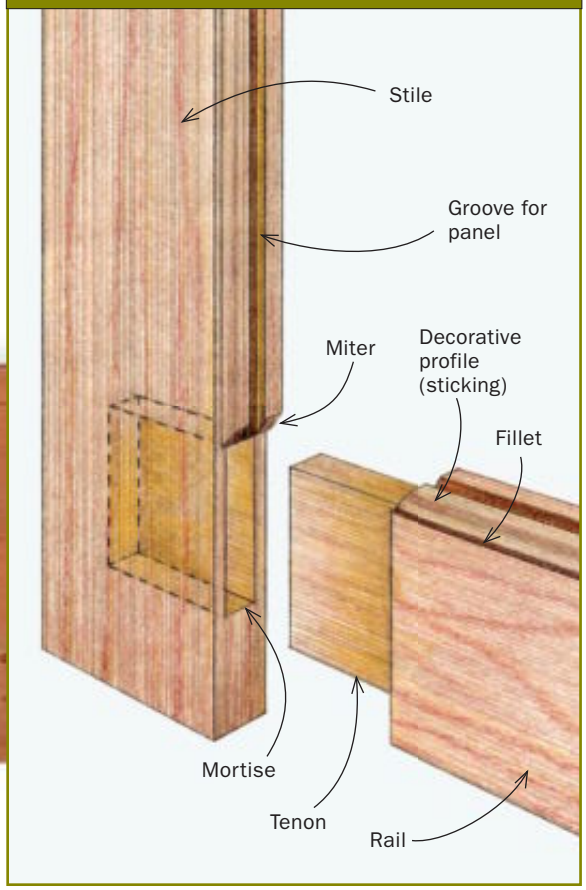
Photos: Anissa Kapsales; drawings: Kelly J. Dunton

The miter is the easier method, bringing any profile together at a clean 45° line. Mitered sticking is a traditional technique that has been used by furniture craftsmen for several hundred years; it is time-tested. You don't need special tools or costly bits. Also, mitering allows the use of profiles that cannot be coped, such as a quirk bead or an ogee.

There may be a concern that seasonal wood movement could cause a gap to appear at the miter and show light. I haven't had this problem because the rails on furniture are typically narrow and the movement is minimal in such narrow pieces.

Traditionally, sticking is mitered using a chisel guided by a block. My method is far less time-consuming: The miters are cut efficiently and accurately with a tablesaw and a

ANATOMY OF A MORTISE-AND-TENON JOINT WITH MITERED STICKING



Design the sticking

The term "sticking" refers to the decorative profile around the inside edges of doors. Sticking profiles are usually simple, such as the ovolo and thumbnail, and are sized in proportion to the door. For example, large doors for a secretary may have a thumbnail profile of ⅜ in. or a ½-in. radius, while a ¼-in. or 5⁄16-in. radius looks more appropriate on the small door of a spice cabinet.

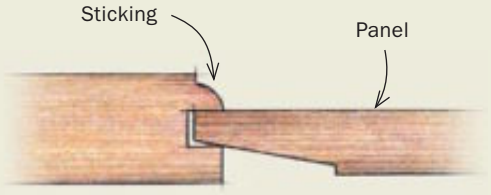
THE RIGHT PROPORTIONS

SMALL DOOR

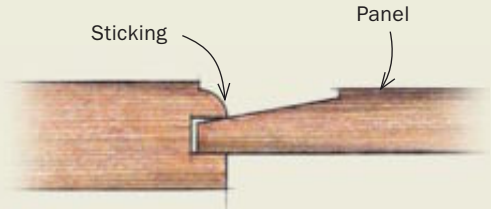
LARGE DOOR

PANEL OPTIONS

Panels can be flat (above) or beveled along the edges with a raised field (right). When compared to a raised panel, a flat panel appears somewhat plain, which looks appropriate on a simple piece of furniture. Although flat on the outside, flat panels in solid wood are typically beveled on the inside. This allows for a thicker, stronger panel. Either way, panels are a great place to show off beautiful, wide, figured stock or veneer.



FLAT PANEL

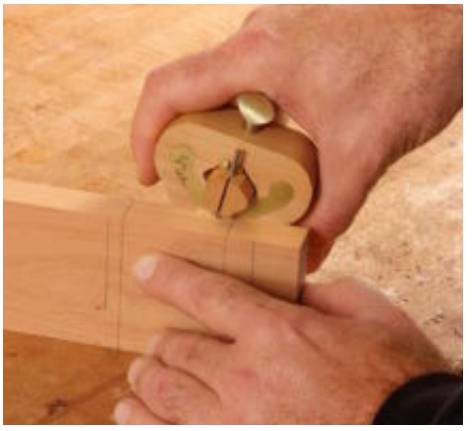


BEVELED PANEL

LAY OUT THE STILES

Clamp the pieces together for accuracy. *Mark the length of the finished door on the stiles. Then mark the rail width, the sticking width, and the end of the mortise.*

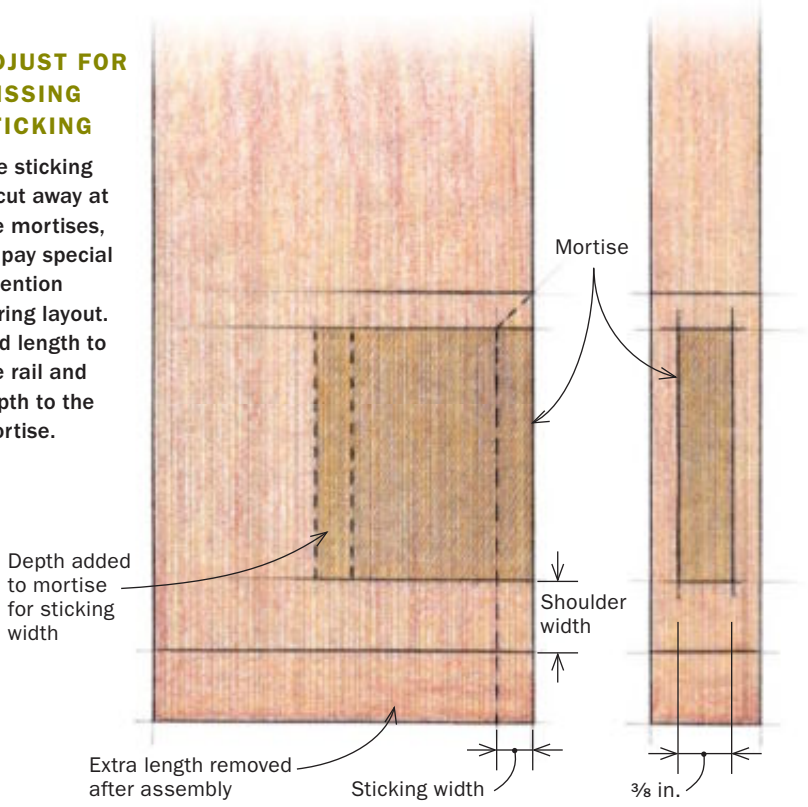
Transfer the lines to the edges. *Use a square to bring the layout marks to the edges of the stiles.*



Scribe the mortise. *A marking gauge makes it easy to score the sides of the mortise.*

ADJUST FOR MISSING STICKING

The sticking is cut away at the mortises, so pay special attention during layout. Add length to the rail and depth to the mortise.



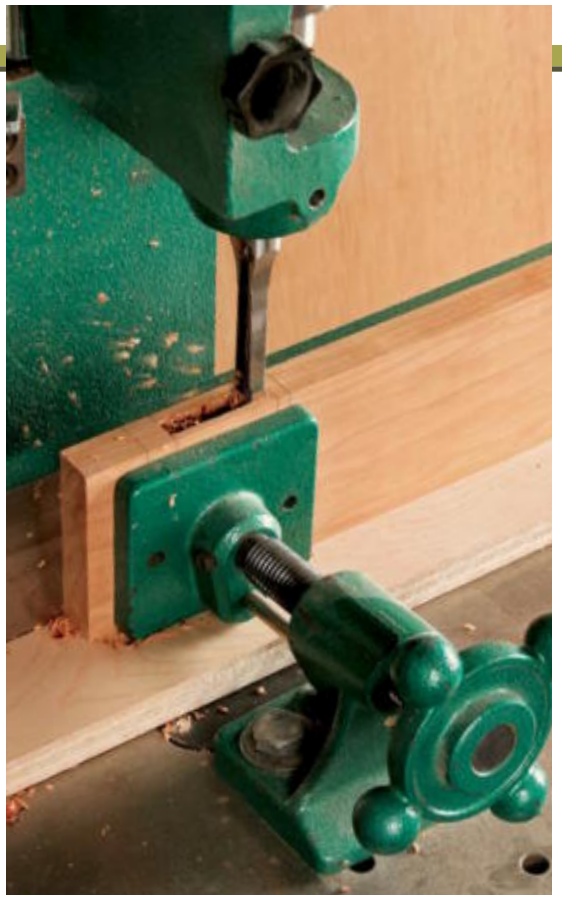
combination blade. Once you've mastered this technique, you're sure to find other uses for it. For example, I use it to apply a quirk bead to the inside edges of cabinet face frames and to join the complex parts of a seat board for a desk gallery. This is a versatile technique that offers a lot of flexibility.

Lay out the door height, the molding profile, and the mortises

The first step to producing a door with mitered sticking is to mill the stock so that all the frame members are the same thickness. Differences can make it difficult to align the sticking where it joins in each corner. I always mill a couple of extra pieces of stock for use when setting up the tablesaw and router table.

Once you've milled the frame stock, you're ready to lay out the joinery. Although the layout process is pretty straightforward, there are a couple of things to keep in mind. First, because the sticking at the mortise is removed after mitering, the rail length between the shoulders of the tenons must be increased to compensate for the dimensional change. The increase in length is equal to the size of the sticking times two. Also, the mortise depth must be increased by the stick-

CUT THE JOINERY



Chop the mortises. *A hollow-chisel mortiser is a quick and efficient way to tackle mortises.*

Use a dado set to cut the tenons. *The miter gauge, in conjunction with a few graduated crosscuts ending at the rip fence, allows you to cut the cheek and establish the shoulder at the same time.*

Complete the shoulder. *Keeping the tablesaw fence in the same position, raise the blade and flip the stile on edge to cut the remainder of the shoulder.*

ing width to compensate for the loss of depth after mitering (see drawing, facing page).

I begin layout with the stiles left too long. In fact, I leave the stiles long until I have finished the frame and I actually am ready to fit the door to an opening. This ensures that the ends of the mortises don't blow out while I am cutting them and assembling the joints. First, I mark the overall height of the door. This is the most critical dimension if the door is going to fit. Next, I mark the width of the top and bottom rails. Finally, I mark lines for the haunch and the width of the rail sticking where it intersects the stile.

As a general rule, I don't lay out the rails. Instead, I use the stiles themselves and some simple math to calculate the overall length of the rails. Then I can set up the tablesaw to cut the tenons with no layout needed.

Cut the mortises first, then move on to the tenons

My mortise-and-tenon methods are fairly routine. A hollow-chisel mortiser makes easy work of the mortises, but a drill press or router and chisels are good alternatives. I use a dado set on the tablesaw to cut the tenons. Once the mortise-and-tenon joinery is complete, you are ready to shape the sticking profile on the stiles and rails.

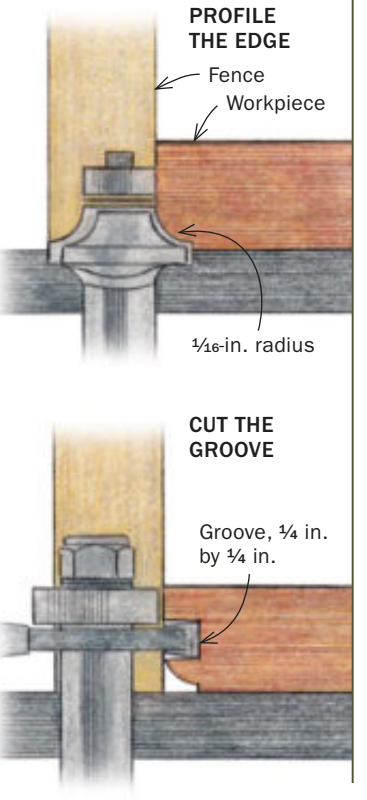
Shape the molding profile and cut the grooves

I cut both the sticking profile and the grooves on the router table. With the sticking, to ensure the correct

Create the decorative profile. *Leaving the fence in place but adjusting the bit height, Bird makes two passes. The first scores the profile so the final cut can be made without tearout.*

Groove the rails and stiles. *Using a slot-cutter, run the groove all the way through on the rails. But on the stiles, be sure to stop and start the groove in the mortise.*

ROUT THE PROFILE AND GROOVES FOR THE PANEL



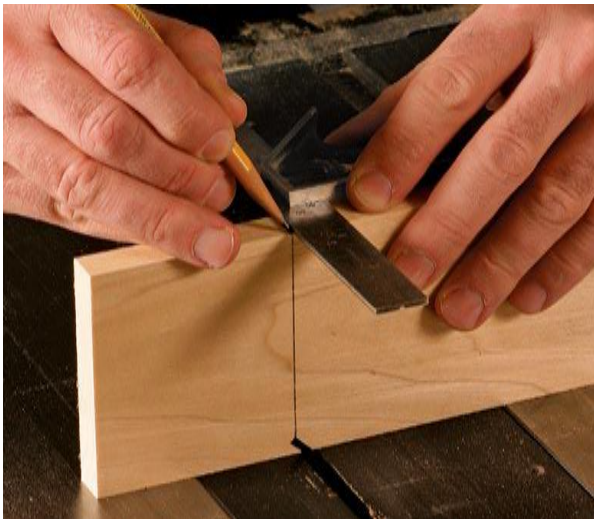
CUT MITERS ON THE TABLESAW

1 SET THE BLADE HEIGHT

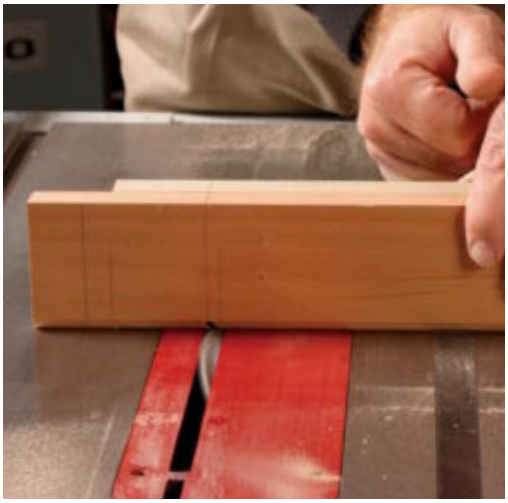
Make test cuts on a setup piece that has been shaped with the sticking profile. The tip of the sawkerf must be set precisely to the width of the sticking.

2 DRAW A REFERENCE LINE

Once the blade height is set, attach a fresh fence on the miter gauge and run a cut through it. Draw a reference line from the tip of the kerf straight up and over the top edge of the fence.



3 MAKE THE MITER CUTS



Use the reference line to make cuts. When mitering the stiles, match the reference mark on the backing board to the inside sticking line on the stile. To miter the rail stock, align the shoulder with the reference mark on the backing board.

cutting depth, I align the fence with the guide bearing on the bit for the final pass.

Once I have cut the profile on all the rails and stiles, I cut the grooves for the panel. For most work, I cut a ¼-in.-wide groove at a depth of ¼ in. These measurements provide a snug fit for the edge of a solid-wood panel while allowing 1/16 in. on each side for seasonal expansion.

Miter the sticking

The next step is to miter the sticking on the tablesaw using the miter gauge. To cut the miter, I tilt the blade to 45° and position the stiles and rails on edge. But first, to ensure that the miters will be precise, I take a few minutes to set up the saw carefully.

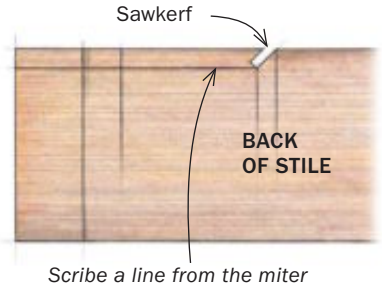
First I check the angle of the blade by mitering two pieces of stock at 45° and placing them within the legs of a square. If the blade is set precisely at 45°, the miter will close and create a 90° assembly.

Next, I adjust the blade height so that it exactly matches the profile width. Several test cuts may be necessary to get the correct height.

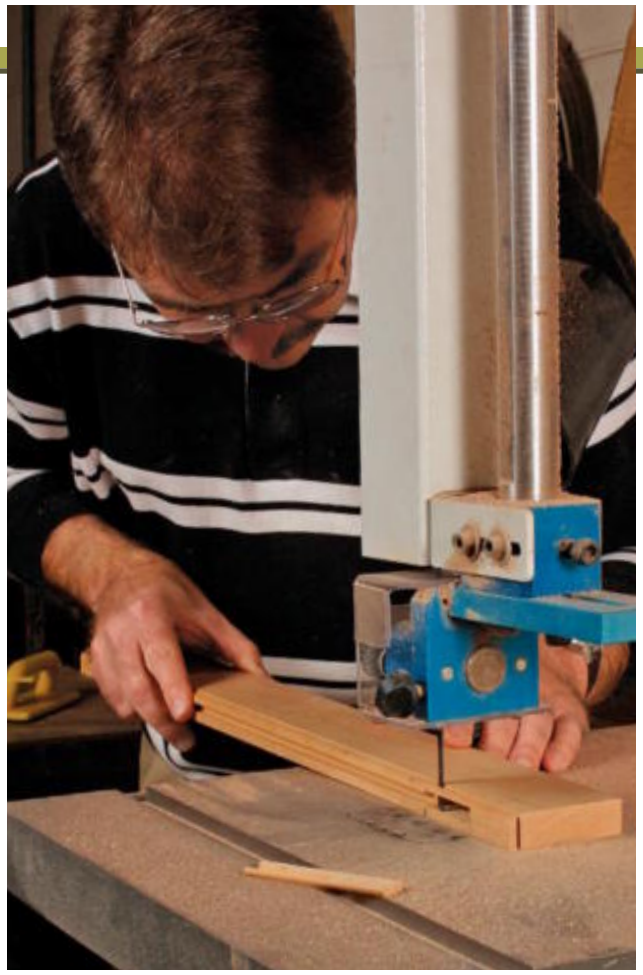
The last step to completing the tablesaw setup for the miters is to fasten a backup board to the miter gauge. Make a cut in the backup board and mark a fine line from the tip of the sawkerf up and over the top edge of the backup board. This mark serves as a reference when aligning the workpieces to cut each miter, so it is very important that the cut is the correct height and that the mark is made accurately.

REMOVE THE STICKING AT THE JOINT

Transfer the sticking line. *On the front of the stock, the profile is the reference, but you can use a marking gauge to scribe that line on the back of the stock.*



Scribe a line from the miter cut to the end of the stock.



Cut close to the sticking line. *Cutting freehand on a bandsaw, you can eliminate almost all of the sticking.*

Finish by hand. *Use a chisel to pare the rest of the sticking away.*

With the setup complete, you can make the miter cuts on both the rails and the stiles. When mitering the stiles, align the sticking layout mark with the line on the backing board. For the rails, line up the shoulder with the line on the fence. When making multiple doors, I clamp a thin stick to the backing board to serve as a stop.

Eliminate sticking at the joint

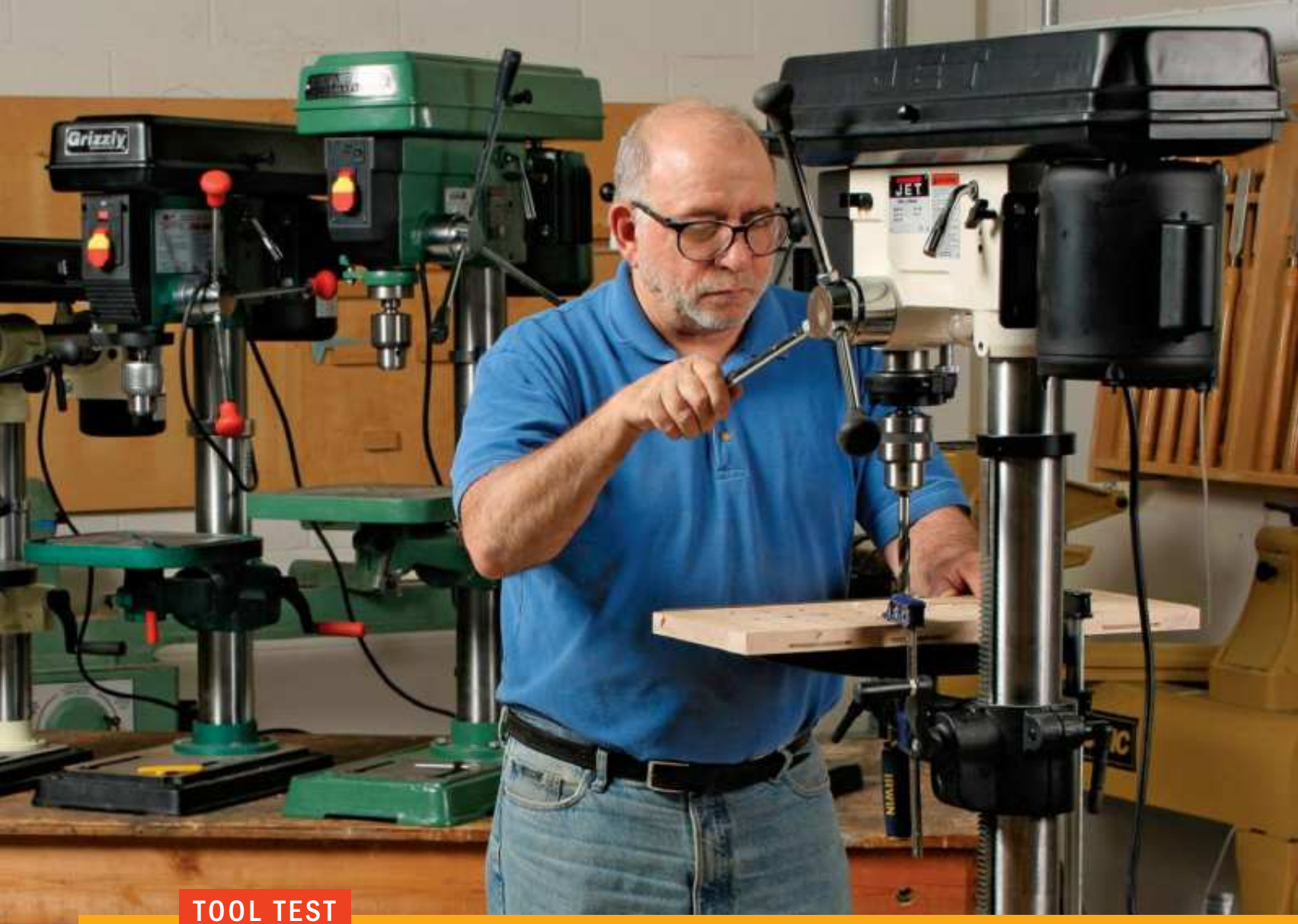
Before assembling the door, you'll have to remove the sticking where the joint comes together. I scribe a line with a marking gauge on the back of the stock to serve as a reference mark.

On the face of the stock, the inside edge of the sticking serves as a reference point. You can cut away most of the sticking with a bandsaw and finish the cut by carefully paring to the line with a chisel.

At this point, if you have completed your cuts and layout carefully and accurately, the stiles and rails should come together perfectly. Once you have glued up the door, you can trim it to fit the carcase opening. □

Lonnie Bird teaches woodworking in Dandridge, Tenn. You can view his class schedule at www.lonniebird.com.

Slide the rails and stiles together. *A beautiful fit depends on accurate layout, precise tablesaw setup, and careful chisel work.*



TOOL TEST

Benchtop Drill Presses

The best do everything a furniture maker needs

BY CHARLIE REINA

It's a good bet that most woodshops have at least one cordless drill, and possibly a corded model as well. Between them, they can take care of most drilling jobs. But these handheld drills have a weak link: the hand that holds them. Humans are inconsistent. We don't always drill straight and true, or on the mark. That's why so many of us are willing to spend hundreds of dollars on a drill press. Properly set up, a drill press gives you clean, straight holes, right where you want them, at whatever angle you choose, time after time. It also has more power than a handheld drill, and it won't wrench your wrist with a big bit.

In our last drill-press review (*FWW* #162), we tested floor-standing models. But a lot of woodworkers opt for benchtop models. They take up less floor space and, on average, cost less than floor-standers. The question is: Do they have the power and precision a furniture maker needs?

For this review, we looked at nine medium- to large-size models, based on power and plunge depth. Each has at least ⅓ hp and can drill at least 3 in. deep. All but one cost less than most floor-standers. The results told us two encouraging things about benchtop drill presses: You do get what you pay for; but you don't have to pay a lot to get what you need.

One thing you should know about all benchtop drill presses: Like most of the floor-standing models, they're designed for metalworking, with small tables that are hard to clamp onto. So you'll

Photos: John Tetreault

have to buy or make a larger auxiliary table that can support large workpieces and accept a fence easily.

All drill accurate holes, but power varies widely

In order to get the consistently straight, perfectly placed holes necessary for making furniture, the important parts of the machine must line up. All of the models come with tables preset at zero (90° to the spindle) for left-to-right tilt, that can be adjusted by loosening a bolt beneath the table. None needed adjusting.

Front-to-back tilt is another matter, since there is no adjustment for this on any of these drill presses. Five of the models were off-level, front to back. Although none was off by more than half a degree, even that slight deviance gives you another reason to attach an auxiliary table, which you can shim level.

Accuracy also requires that the drill bit spin without significant runout, or you'll get oversize holes and, possibly, tearout at the rim. We tested each model using a straight rod held in the chuck and found that every machine had at least a small amount of runout. But when we drilled holes with ½-in. brad-point and twist bits, each model made clean, accurately sized holes.

If you're shelling out good money for a drill press, you should expect a significant power upgrade over a handheld drill. It should be able to drive the largest of bits easily through hardwood. We set each drill press at an appropriate speed (500–600 rpm) and recorded how long it took to drive a 2-in. Forstner bit ¾ in. deep into maple without slowing down obviously or vibrating. The results varied pretty much according to motor power, from 10 to 12 seconds for two of the most powerful (¾ hp) models, all the way up to 23 seconds for one of the least powerful (⅓ hp) models.

Ease of use is important, too

If power and precision were all it took to decide on a drill press, I could stop right here. But there's more to it. You want a machine that treats you well, one that lets you work efficiently without fuss, back strain, or scraped knuckles. Money aside, this might well be the deciding factor in your choice.

We looked at two key ease-of-use factors. We rated each model for how easy it is to set the plunge depth and to change drilling speeds (according to the bit size and hardness of the wood.)

Setting the plunge—All but two of the models employ threaded stop rods (long, grooved, threaded rods with a scale in the groove) and stop nuts for setting plunge depth. You turn the stop nuts to the right point on the scale, bring down the bit, and the plunge stops when the nuts hit a stationary bracket. Sounds efficient, but ease goes out the window when the manufacturer takes shortcuts, like using thin, hard-to-turn hex nuts or an extrathin (3⁄32-in.) stop bracket, so bendable that you can get an unwanted extra 1⁄64 in. to 1⁄16 in. of depth when you bring down the bit. The

GENERAL INT'L 75-100

The General International 75-100 stands out for performance and ease of use. It tested best for drilling power, and it had the least runout (0.002 in.). One drawback: its $450 price tag.

JET JDP-15M

The Jet JDP-15M shares top honors with the General for its own stand-out performance in our tests. Its table is also the biggest of the bunch. All that for $100 less than the General.

GRIZZLY G7943

The Grizzly G7943 earned high all-around marks, matching the Jet for drilling power. Yet it's one of the least expensive benchtops, at $225.

Benchtop drill-press test

MAKE & MODEL	STREET PRICE	MOTOR	CHUCK	CHUCK-POST DISTANCE	STROKE	QUILL-TABLE DISTANCE	SPEEDS (RANGE)	RUNOUT	2-IN. HOLE TEST	SPEED CHANGE EASE
Craftsman 21914 www.craftsman.com	$200	⅔ hp	½ in.	6 in.	3 in.	15⅛ in.	5 (500-3000 rpm)	0.004 in.	18 sec.	Poor
Delta DP350 www.deltamachinery.com	$220	⅓ hp	½ in.	6 in.	3¼ in.	13⅝ in.	V/S (500-3100 rpm)	0.004 in.	23 sec.	Excellent
BEST OVERALL CHOICE General Int'l. 75-100 www.general.ca	$450	¾ hp	⅝ in.	8½ in.	3¼ in.	14 in.	12 (340-2800 rpm)	0.002 in.	10 sec.	Very good
Grizzly G7943 www.grizzly.com	$225	¾ hp	⅝ in.	7 in.	3¼ in.	12 in.	12 (140-3050 rpm)	0.004 in.	12 sec.	Very good
BEST VALUE CHOICE Grizzly G0485	$200	½ hp	⅝ in.	6½ in.	3 3/16 in.	13⅞ in.	16 (230-3270 rpm)	0.002 in.	14 sec.	Good
BEST OVERALL CHOICE Jet JDP-15M www.wmhtoolgroup.com	$350	¾ hp	⅝ in.	7½ in.	3⅛ in.	13⅜ in.	16 (200-3630 rpm)	0.004 in.	12 sec.	Very good
Ryobi DP121L www.ryobitools.com	$180	⅓ hp	½ in.	6 in.	3 in.	12¼ in.	V/S (500-3000 rpm)	0.008 in.	17 sec.	Excellent
Shop Fox W1668 www.woodstockint.com	$270	¾ hp	⅝ in.	6⅝ in.	3¼ in.	14¼ in.	12 (250-3050 rpm)	0.003 in.	15 sec.	Poor
Shop Fox M1102	$275	½ hp	⅝ in.	6½ in.	3 3/16 in.	14⅜ in.	16 (230-3270 rpm)	0.002 in.	18 sec.	Good

Delta DP350, Shop Fox W1668, and Grizzly G7943 fell short in this area, making depth setting difficult and/or inaccurate.

Two of the less-powerful models made strong showings with different kinds of depth-setting systems. The Craftsman has its depth stop on the shaft of the pull-down arm mechanism, so there are no thin brackets or hex nuts to worry about, and its electronic, digital readout is pinpoint accurate. The Ryobi DP121L has a scale ring on the pull-down arm shaft, and a depth-set mechanism in the form of a large winglike handle that turns and locks in smoothly. This makes it especially easy to zero the bit out on the workpiece surface and set the drilling depth precisely.

Changing speeds—Belts and pulleys are this tool's transmission. Seven of the models require manual speed changes. You pull the motor forward to loosen the belt (on five-speed models) or belts (on 12- or 16-speed models); then you move the belts to smaller or larger pulleys and, finally, push the motor back to tighten them.

At its worst, this can be a chore, such as with the Craftsman and the Shop Fox W1668. Both came with belts so tight that the motors were held fast in their forward positions. We had to loosen the motor mounts in order to change belt positions.

Fortunately, the rest of the models worked as advertised. The General International 75-100, Jet JDP-15M, and Grizzly G7943 come with levers that allow you to move the motors forward and back for belt changing with ease. The Ryobi and the Delta come with variable-speed mechanisms. Both let you change speeds effortlessly, by turning an arm while the motor is running.

FineWoodworking.com

We review two radial drill presses, which combine very deep throat capacity with the ability to angle the head.

Lights, lasers, and other features may help you decide

Most models come with special features that improve performance or ease of use. All but one (Shop Fox W1668) are equipped for or with work lights. The Craftsman and Ryobi have crosshair lasers to pinpoint where bit meets board.

Oscillating quill—The Shop Fox W1668 has an oscillating quill for spindle sanding. It works off an easily installed belt in the pulley housing, and it gives the sanding drum ¾ in. of up-and-down movement for even wear.

DEPTH SET EASE	COMMENTS
Excellent	Laser, swivel knob, offset table crank, work light, digital depth readout, difficult speed change
Fair	Best work light, offset table crank, variable speed
Excellent	Least runout, belt-change handle, work light, deepest chuck-to-post distance
Fair	Medium-size base, work light, belt-change handle
Good	Medium-size base, work light, solid performance across the board
Excellent	Largest table, large base, work light, belt-change handle
Excellent	Laser, variable speed, digital speed readout, easy depth set on pull-arm axle, work light
Fair	Oscillating spindle sanding, difficult speed change
Good	Largest base, work light

DEPTH SETTING

Solid depth setting. *Seven models use stop rods for depth setting. Four of them, including the General (left) and Jet, are solidly made, with easy-to-turn, knurled depth-stop nuts. The Ryobi (above) and Craftsman have easy-to-use depth sets on their pull-arm axles.*

SPEED CHANGING

Love that lever. *All three "best" models have a lever (left) that lets you move the motor back and forth for easy manual belt changing. The variable-speed Ryobi (above) has a digital speed display.*

Swivel handle—One of the Craftsman's pull-down arms has a swivel-grip knob that allows a full-depth plunge without having to change to a second arm. That leaves your left hand free to hold the workpiece.

And the winners are ...

All in all, our tests showed that a solid benchtop drill press gives you the performance you need to make the finest furniture.

The General International 75-100 tested best for drilling power and all-around performance. If you can afford the $450 price, it's the best you can buy. Or, the Jet JDP-15M might be the drill press for you. It rated second for power, among the best for speed-change and depth-set ease, has the largest table, and at $350, is more affordable. We rated both models best overall.

We gave the best-value award to the Grizzly G7943. It scored among the highest for drilling power and speed-change ease. Its range of 12 speeds offers the lowest setting of all the test models, 140 rpm, ideal for driving circle cutters and the largest of bits. And its $225 price is among the lowest of the pack. □

Charlie Reina is an associate editor.

OTHER FEATURES

Extras. *The Craftsman (above) is one of two models equipped with laser crosshairs. The Shop Fox W1668 (left) comes with a quill that can oscillate for spindle sanding.*

Center

Shopmade guides ensure smooth action for wide drawers

BY MARK EDMUNDSON

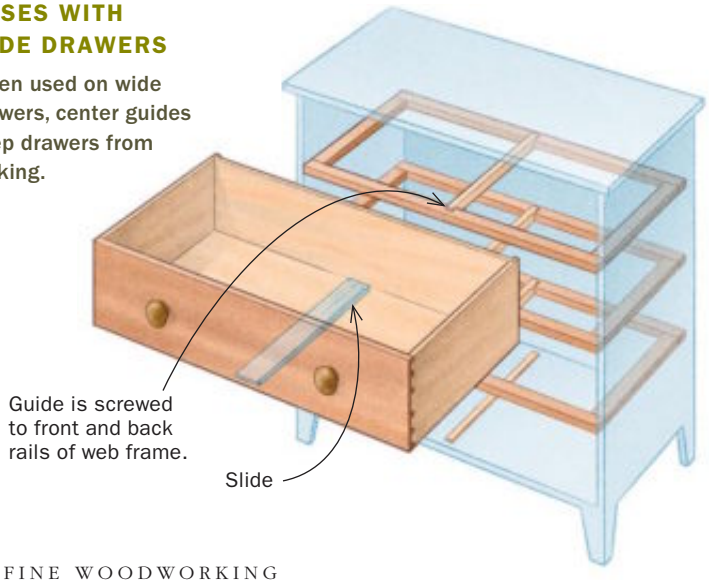
Let's be honest. An occasional binding drawer is an ugly fact of life in woodworking. We've all knocked our heads against the wall trying to get a drawer to run straight and smooth. But center guides can relieve a lot of the pain, while solving the binding problem.

To steer a drawer in the center, you need to build two parts: the guide and the slide (see drawing, facing page). Make both parts of quartersawn hardwood to minimize seasonal wood movement. The guide is secured to the rails of the drawer pocket and mates with the slide, which is mounted underneath the drawer. The guide also serves as the stop for an inset drawer, allowing you to fine-tune the desired reveal at the front, and it works as the

A range of uses

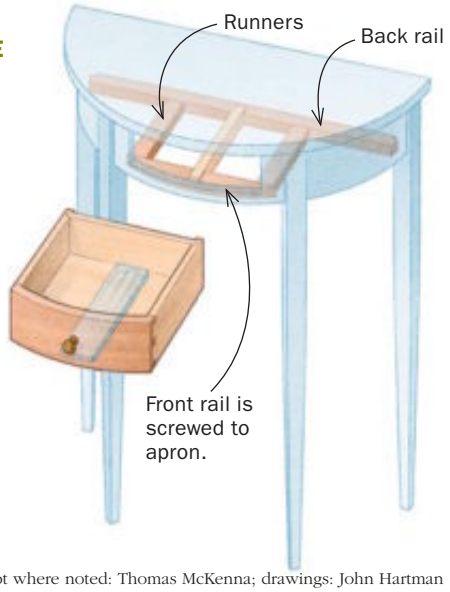
CASES WITH WIDE DRAWERS

When used on wide drawers, center guides keep drawers from racking.



DRAWER IN A DEMILUNE TABLE

Center guides are a great solution for steering drawers in irregularly shaped pieces, like this demilune table.



Photos, except where noted: Thomas McKenna; drawings: John Hartman

Guides for Drawers

kicker for a drawer below. The system is dirt-simple but very effective. With it, you can make any drawer run straight and true, with no binding—ever.

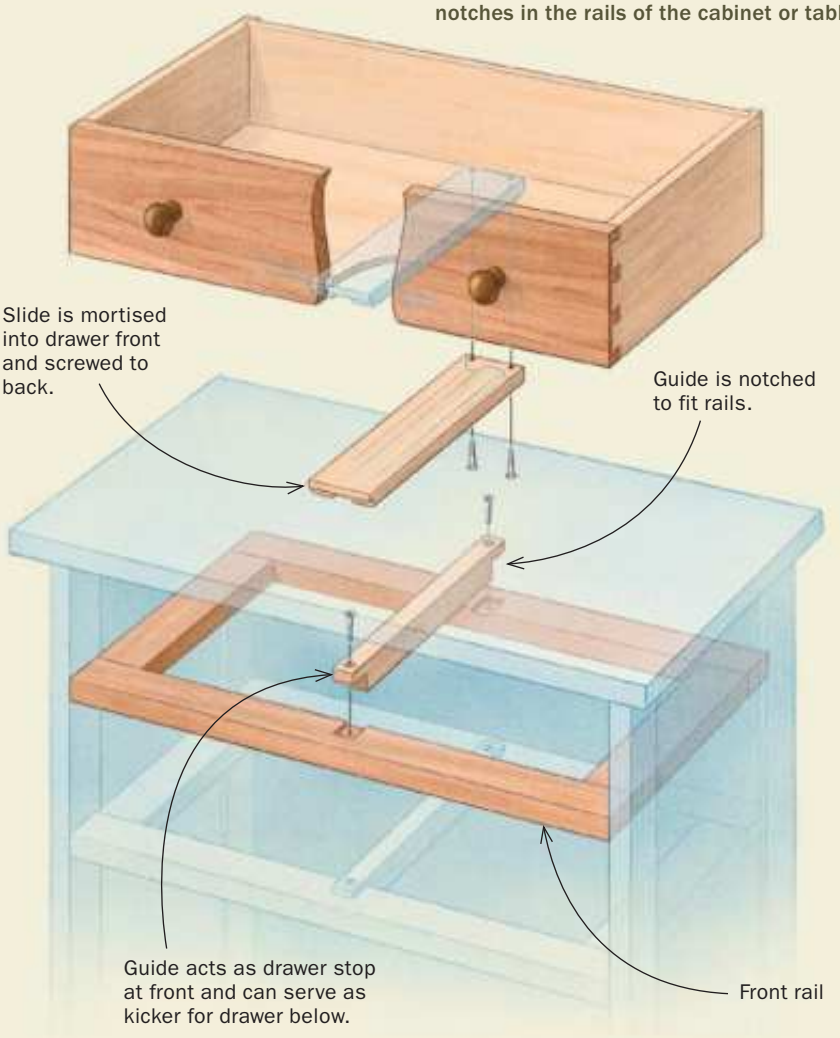
Although center guides work with almost any type of furniture—tables and both solid-wood and frame-and-panel cases—they are especially effective at guiding wide drawers. Installed correctly, center guides will allow you to open a drawer from either corner without fear of binding. Center guides also work well on small drawers, where they can take the place of side runners. What's more, they are a great solution for guiding irregularly shaped drawers, or normal drawers in an irregularly shaped cabinet or table—basically anywhere the sides of the case can't guide the drawers. The system even works with overlay drawers.

Notch rails to hold the guide

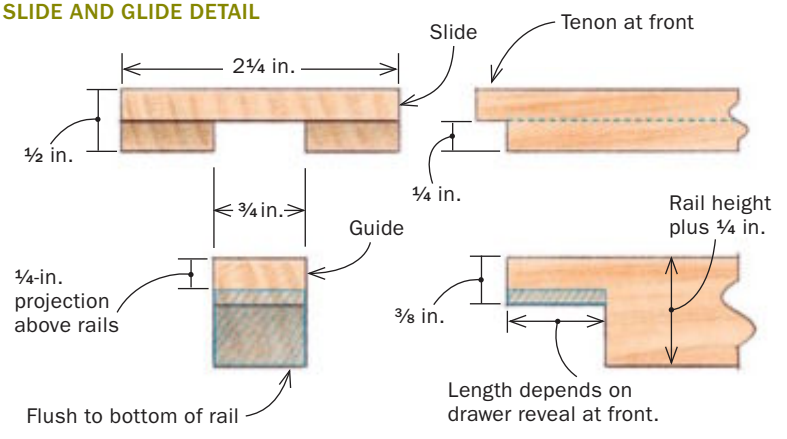
The construction sequence for center-guided drawers differs a bit from traditional methods, in that the web frame that supports the drawer (two rails, two runners) will need to be notched for the guide before it is glued into the cabinet. But the drawer bottom should be the type that can be slid out the back. Once you

ANATOMY: THE SLIDE AND THE GUIDE

The slide is grooved and mounted underneath the drawer bottom; one end sits in a shallow mortise in the drawer front and the other is screwed to the drawer back. The guide mates with the groove in the slide and sits in notches in the rails of the cabinet or table.

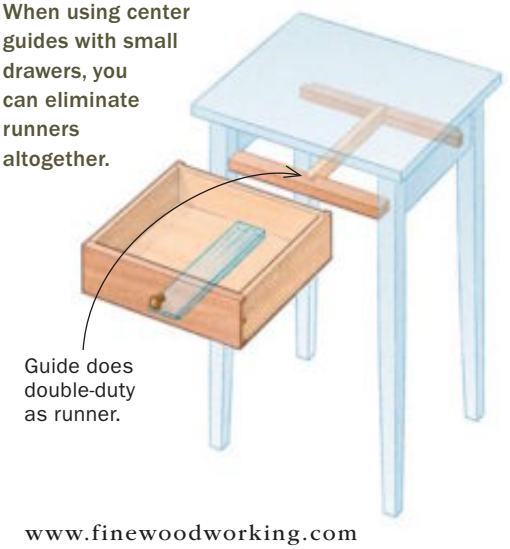


SLIDE AND GLIDE DETAIL



SMALL DRAWERS

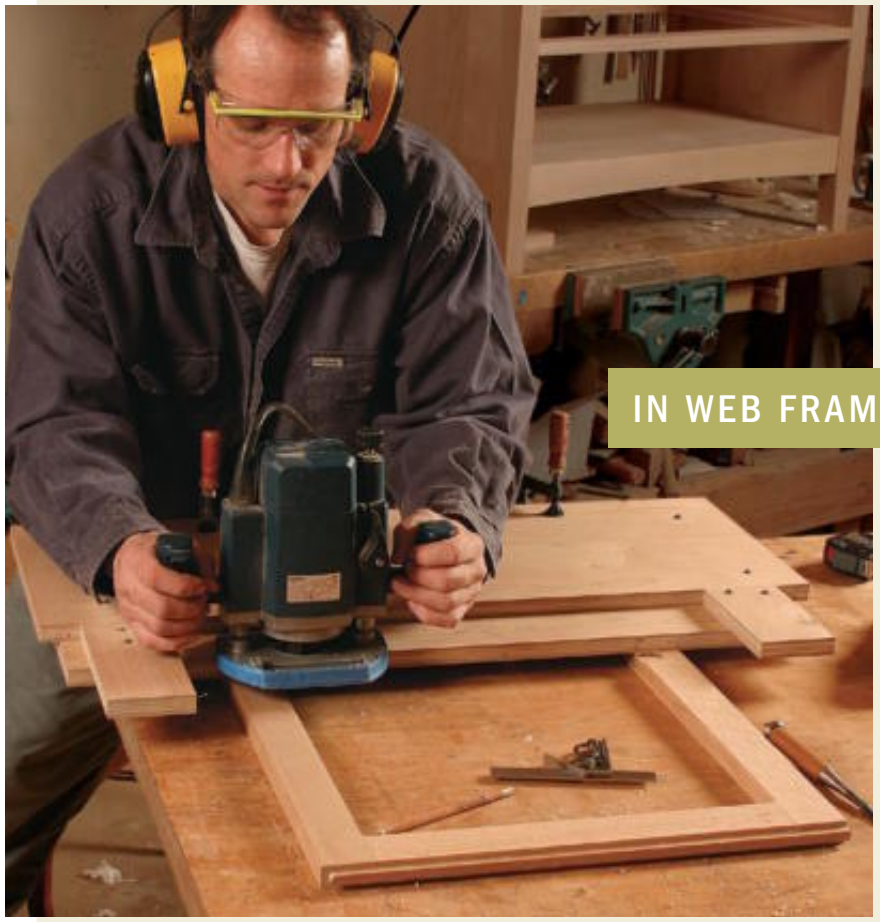
When using center guides with small drawers, you can eliminate runners altogether.



Rout notches for the guides

Frame-and-panel cases usually use web frames to support drawers, while solid-wood cases often use separate back and front rails to allow for wood movement. Either way, the notches for the center guides must be perfectly aligned, side to side and front to back.

IN WEB FRAMES



Router-cut notches are quick and precise. *If you have a few web frames to notch, use a jig like this, clamped flush with the edge of the frame. The fence on top aligns the notches front to back, and stops keep all notches the same length.*

IN SEPARATE RAILS

T-shaped jig aligns notches. *Clamp the two rails together and make a T-shaped fence from plywood scraps. First, rout a test slot into the "T" of the fence to help align the path of the bit with the marks for the notch.*

The router-bit flaw. *The ¾-in.-dia. straight bit leaves a rounded notch that needs to be squared up with a chisel.*

Make the guide,

Mill the guide. *After planing the width to fit tightly in the notches, cut the half-lap joint using a dado set.*

have completed this and glued up the carcase, you can build the drawer box and put the bottom in place. Once the drawer has been fitted into the opening, the guide and slide can be milled and installed.

The guide is typically ¾ in. wide and sits in ⅛-in.-deep notches centered in the front and back rails of the web frame. The length of the notches in the rails depends on whether the drawer is an overlay or inset type. If you're using overlay drawers, which don't need a drawer stop, simply end the notches ¾ in. from the outside edges of the rails.

An inset drawer requires a little more finesse. The guide will act as the drawer stop. So if the drawer front is flush with the front of the case, mark the end of the notch based on the thickness of the drawer front (for a ¾-in.-thick drawer front, the notch stops ¾ in. from the front of the rail). If the drawer front is set into the case to create a reveal, add that inset to the equation. In either case, make the notch on the rear rail the same length to avoid complication when notching the guides.

You can chop out the notches using a chisel and a scrap of hardwood as a guide, but this can be slow going and inconsistent. For this guide system to work well, it's critical that the guide run parallel to the case side (or side of the web frame). That's why I prefer to cut the notches using

Photo, bottom left: John Tetreault

then the slide

Get a groove in your slide. *Cut the groove in the drawer slide using a ½-in. dado set. To ensure a centered groove, make two passes, rotating the slide 180° after the first pass (left). When the groove is almost the right size, stop shifting the fence to adjust the groove width. Instead, put masking tape along the fence to dial in the width (right).*

Cut the stub tenon on the front of the slide. *Use the same dado-blade height as you did to cut the center groove.*

a router and a plywood jig (see photos, facing page). The jig ensures that the cuts are parallel to the edges and makes it easy to bang out all of the notches for a chest of drawers in minutes.

Fit the guide to the rails and the slide to the guide

Once you have the web frame notched, mill the guide so that it fits tight in the notches. Then lay out and cut the half-lap joints on both ends so that the guide is flush with the bottom of the rails and projects ¼ in. above them. If you're doing more than one drawer, cut all the guides at the same time. You are now ready to mill the slide, or slides if you have more than one drawer.

In most situations, a ½-in.-thick by 2¼-in.-wide slide is sufficient. To cut the groove down the center for the guide, use a ½-in.-wide dado setup on the tablesaw. Make the cut in two passes, rotating the piece 180° after the first pass. Check the fit of guide to slide often. Shift the fence to make heavy adjustments, but when you're close, attach masking tape to the fence to shim out the cut in small increments.

You don't want a loose fit, so once you have a tight fit, it may be better to fine-tune it with a handplane along the edge of the guide. Take light passes. This step also cleans up any rough areas that could

Fine-tune the fit

A slide that glides. *You want the slide to move without sticking and without noticeable side-to-side play. If necessary, take a couple of light plane strokes off the guide to fine-tune the fit, but don't go overboard.*

Kiss the edges with a file. *Ease the blunt edges of the guide and slide to make it easier for the two parts to engage.*

Final assembly requires careful layout

ATTACH SLIDE TO DRAWER

Install the guide and wedge the slide. *Put masking tape over the guide to wedge the slide on top, with the tip of the slide sticking out about 3 in.*

Center the drawer in the opening. *Place the drawer on top of the slide and push it in until the underside of the drawer front touches the front of the slide. Add paper shims on both sides to keep the drawer centered as you work.*

Mark, mortise, and check the fit. *Knife in the edges of the mortise for the stub tenon (right). Remove the drawer, and chisel out the mortise for the slide. When checking the fit, insert a scrap piece of the drawer bottom to ensure alignment (far right).*

interfere with the drawer run. Once the pieces fit nicely, cut the stub tenon on the front of the slide.

To make the parts engage more easily, ease the edges on the front of the guide and the rear of the slide using files or sandpaper. If you are making more than one pair of slides and guides, be sure to mark mating pairs that have been fitted to each other. Now screw the guide to the web frame and install the frame in the case.

Mount the slide underneath the drawer

With the web frames installed, glue up the drawer box and add the bottom. Be sure that the drawer is square; if it's not perfectly square and the slide is centered, the drawer front will not be parallel in the opening.

To fit the slide to the drawer, begin by placing a couple of pieces of blue tape over the guide inside the case. Now place the slide on the guide, with the slide protruding about 3 in. out front; the tape will wedge the slide in place for marking.

Push in the drawer until the underside of the drawer front touches the front of the slide. You want the drawer face centered in the opening. To center it, add paper shims between the drawer and cabinet sides. Now mark the mortise for the slide on the back of the drawer front. Remove the drawer from the opening, take out the drawer bottom, and then chisel out the mortise for the slide.

ADJUST FOR A PERFECT RUN

Almost there. *With the slide fitted into its mortise in front and cut to length, place the drawer back into its opening. Push it all the way in and pencil in the outline of the slide on the bottom (top). Next, remove the drawer and attach the slide to the bottom using double-sided tape, aligning the slide at the rear with the layout marks (bottom).*

Does it work? *Push in the drawer and pull it out to test the run. If there's any binding, adjust the slide to the left or right, depending on where the bind occurs.*

Fine-tune the fit—Once the slide fits snug in the mortise, cut it to length and screw in the drawer bottom. Place the slide into its mortise, then put the drawer and slide over the guide. Push the drawer all the way in, and then scribe the outline of the slide at the back of the drawer. Now remove the drawer, and temporarily attach the slide to the drawer bottom with double-sided tape, aligning the back of the slide with the scribe marks. Slide in the drawer to test the run.

If the drawer binds on one side, shift the slide at the back of the drawer closer to the side that is binding. If the drawer binds at the front, you may need to lengthen the slide mortise a bit away from the side that binds, then glue in a shim later to fix it in place. When the drawer runs smoothly and the drawer front is parallel to the cabinet, screw the slide to the drawer back on each side of the groove. If the drawer runs smoothly but the drawer front is a bit out of alignment with the cabinet, you'll have to plane a bit of the drawer front to correct the reveal. Countersink the screws so they don't rub the front rail. Add a bit of wax, and you'll have a drawer that will run smooth and straight for its lifetime. □

Mark Edmundson is a furniture maker and teacher based in Sandpoint, Idaho.

Screw the slide to the drawer back. *Once the drawer is running straight and smooth, permanently attach the slide. Use an offcut from the guide as a clamping caul.*

Elegant Veneered Boxes

Veneer creates striking patterns, yet construction is straightforward

BY SETH JANOFSKY

When I have a bit of time to work on a special project, I like to make a beautiful box. It's manageably small yet involves a fair amount of interesting detail work. One of my favorite designs is covered in a parquet of figured-maple squares.

I originally made boxes like these for collectors of netsuke (small carved objects of stone, wood, or ivory), but of course they can be used for just about any collection of small things.

The box itself is built much like a drawer, with tongue-and-groove joints for the corners and the bottom held in a groove. You can make everything, including the veneers, on the tablesaw.

Although conceptually simple, a parquet pattern can be difficult to execute precisely. In theory, you could cut many squares of veneer and piece them together into a sheet. But I find advantages to cutting blocks of maple, gluing them together, and then cutting that piece into strips of parquet that are glued into sheets.

This method keeps the veneer squares in an orderly sequence relative to the piece of wood from which they came. It creates a surface made more interesting by its display of multiple grain, figure, and color patterns. This box has three patterns at work even though it uses only one type of wood. The first pattern comes from the primary grain lines at right angles to each other in the parquet squares, the second from the maple's fiddleback figure, the third from the difference in color between the sap and heartwood areas.

Of course, parquet isn't the only covering for an elegant box. You also can use plain book-matched or slip-matched veneers, or you can create a unique scrollsawn marquetry design (see photo, right).

There are a number of ways to configure a box. The one described here has a top rabbeted to mate with the bottom, with the joint about two-thirds of the way up the side. I use binding—a narrow strip of white

Thinking outside the box. *Leaves cut from different woods make a striking design. Master Class (p. 104) explains Janofsky's methods for assembling the leaves and fitting them into the background.*

Photos, except where noted: David Heim; this page and facing page (top left): John Tetreault

oak glued along all the edges—which harmonizes nicely with the maple veneer.

Make the sheets of veneer first

This box starts with the parquet veneer. The parquet began as a piece of figured maple about 1¾ in. thick by 3½ in. wide by 20 in. long. The quartersawn side had the most consistent figure, so it was the face that yielded the parquet pattern.

A piece this size will produce enough veneer to cover a box approximately 10½ in. wide by 15 in. long by 4½ in. tall in a pattern of 1½-in. by 1½-in. squares. The exact size will be determined by the actual dimensions of the parquet sheets and the width of the oak edging.

After milling the maple board perfectly flat, straight, and square, mark the working face with a long triangle that will help keep the pieces in order. Then crosscut it into two equal lengths.

Plane one piece to exactly 1½ in. thick and cut it into six blocks exactly 1¾ in. long. Set them aside, in order. Crosscut the other length (still 1¾ in. thick) into five blocks exactly 1½ in. long and set them aside, in order.

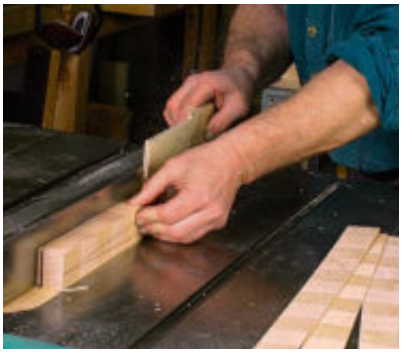
Next, intersperse the blocks into one line, one from the first set, one from the second, and so on. Rotate the blocks from the first set 90° so that all 1½-in. faces abut. You'll have a strip of 11 blocks, 1¾ in. thick, that when viewed from the edge is made from 1½-in. blocks of alternating grain.

Glue the blocks together, in order. I push them against a piece of scrap screwed to a piece of plywood or medium-density fiberboard (MDF), which helps keep them aligned while I clamp them together. Coat all the mating surfaces with glue to ensure that the pieces will hold together.

Next day, when the strip is thoroughly dry, carefully square up two faces, then

Start with the veneer

If you use a parquet pattern made up of squares, the veneer sheets you make will determine the final dimensions of the box. With plain veneer, on the other hand, you can make the box carcase first, and cut the veneer sheets to fit.

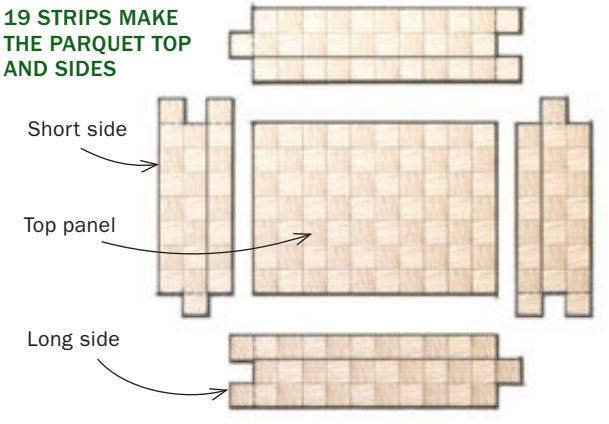


Block becomes veneer strips. *Maple blocks are stacked so that the edge grain is alternately horizontal and vertical. Then they're glued and clamped in a simple fixture (left). Once completely dry, the glued-up block is ripped into strips 1/16 in. thick (right).*

The second glue-up. *Veneer strips are edge-glued a few at a time (left). Old newspaper keeps veneers from sticking to the gluing jig. The strips are staggered to create the checkerboard pattern.*

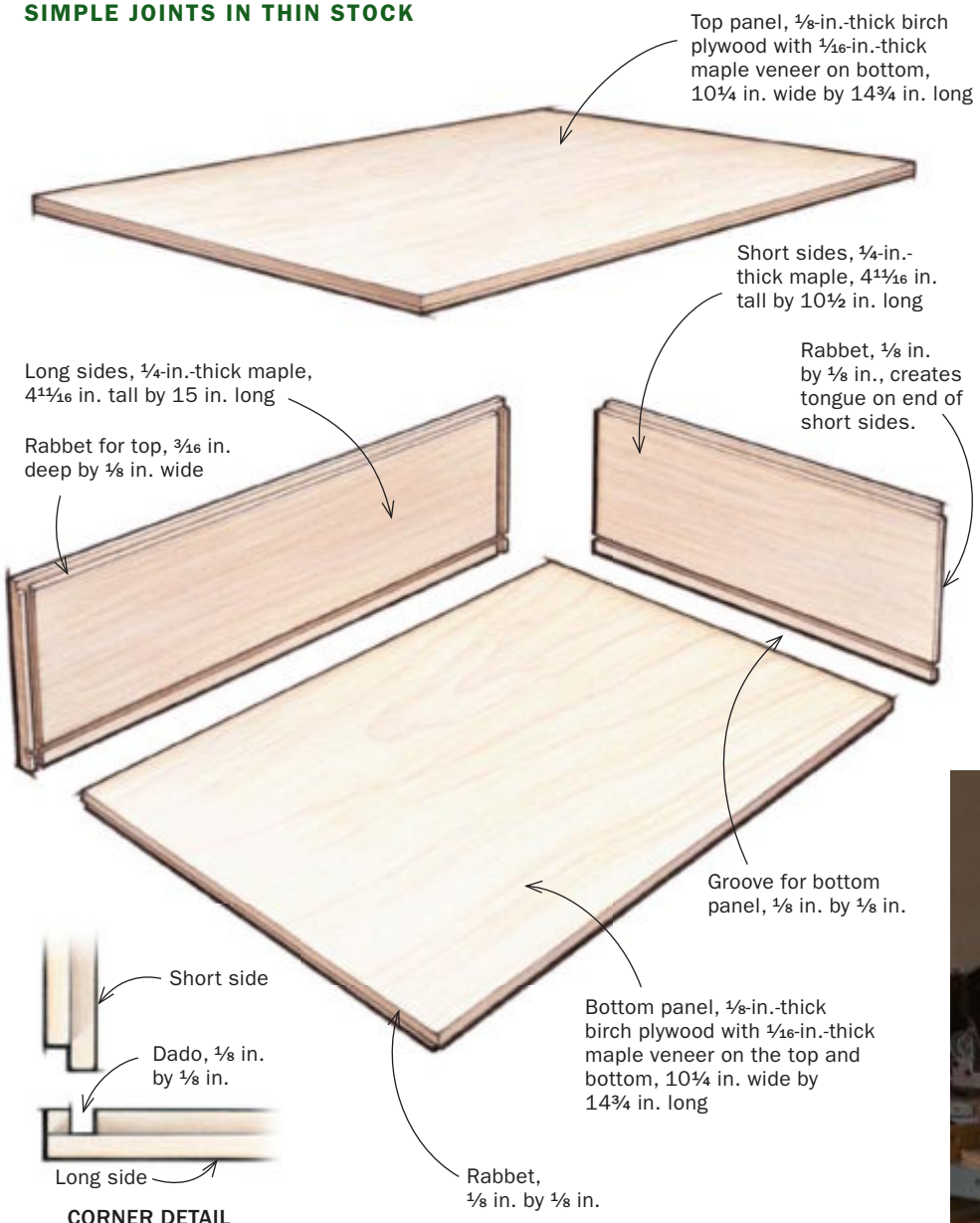
An ingenious clamp. *Scrap blocks and weights keep veneer sheets from buckling (above). Wedges tapped in place between the veneer and fence provide clamping pressure.*

Spreading the sheets. *Once the parquet panels have dried, lay them out and arrange side panels to match the grain pattern with the top panel.*



Construct the box carcase

SIMPLE JOINTS IN THIN STOCK

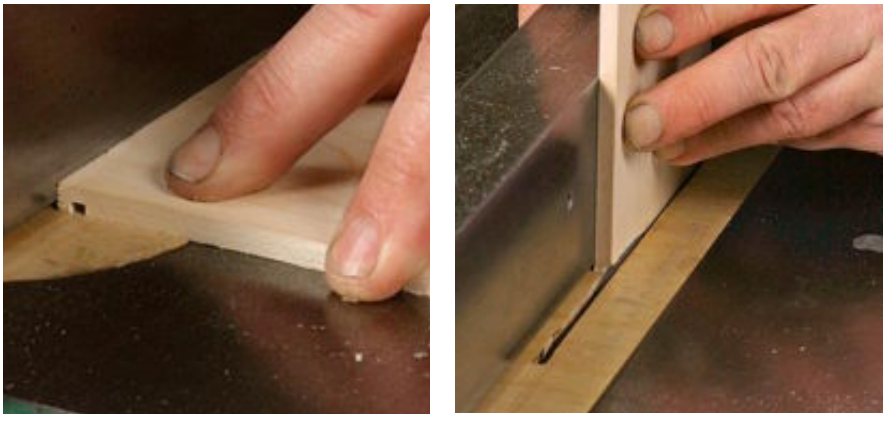


CORNER DETAIL

rip and plane the piece to exactly 1½ in. thick. Now it's ready to be sawn into veneer strips 1/16 in. thick. This box uses 19 strips of veneer: seven for the top and three for each side and end. I prefer to use a well-tuned tablesaw with a clean, sharp, thin-kerf blade because it makes a cleaner cut than a bandsaw.

With the strips of parquet stacked in the order they came off the saw, glue them together edge to edge several at a time. I use a fixture consisting of an MDF base and two fences. To keep the strips from buckling, I hold them down with exercise weights. And to apply clamping pressure, I tap opposing wedges in place between the last strip and one fence. As I glue up the strips, I offset every other one by one square to produce the checkerboard parquet surface. The extra squares will get trimmed away later. To assemble large sheets of veneer, you'll have to move one of the fences.

If you've done your work neatly, the veneer sheets will need just a little light



Small, simple joints. *Use the tablesaw to cut the joints for the box carcase. Begin by making a ⅛-in.-deep dado in the long side pieces (left). With the same fence and blade-height settings, cut the mating rabbets in the short sides (right).*

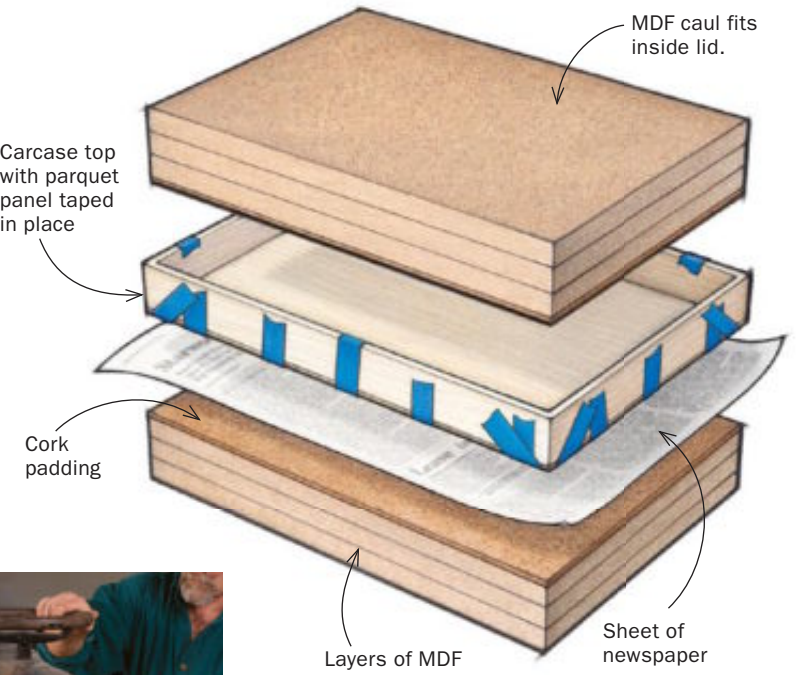
Open the box. *This is the final step in assembling the box carcase. Progressively deeper cuts on the tablesaw separate the bottom section from the top.*

Drawings: Christopher Mills

Apply the veneer

Begin veneering at the top. *Liberal amounts of blue tape hold a veneer sheet securely in place on the top of the carcase.*

CAULS PROVIDE EVEN PRESSURE WHEN CLAMPING



sanding or scraping to make sure there's no dried glue on the surfaces.

The parquet determines the box size

The box carcase is very straightforward—¼-in.-thick solid maple with tongue-and-groove joints for the corners, a groove to hold the bottom panel, and a rabbet to house the top panel. For a box of this size, both the top and bottom panels should be veneered with a core of ⅛-in.-thick birch plywood for dimensional stability.

Figure the exact dimensions based on a top 10 squares long and 7 squares wide, with sides that are 3 squares tall. The oak binding is approximately ⅛ in. thick. So the carcase should be the same width and length as the top veneer sheet; make the carcase 3⁄16 in. taller than the side veneer panels, mainly to account for material sawn away when the box is cut open.

Because the finished sheets may be slightly larger or smaller than their nominal size, measure the sheets before cutting the pieces for the carcase. Don't assume the sheets will be an exact multiple of 1½ in.

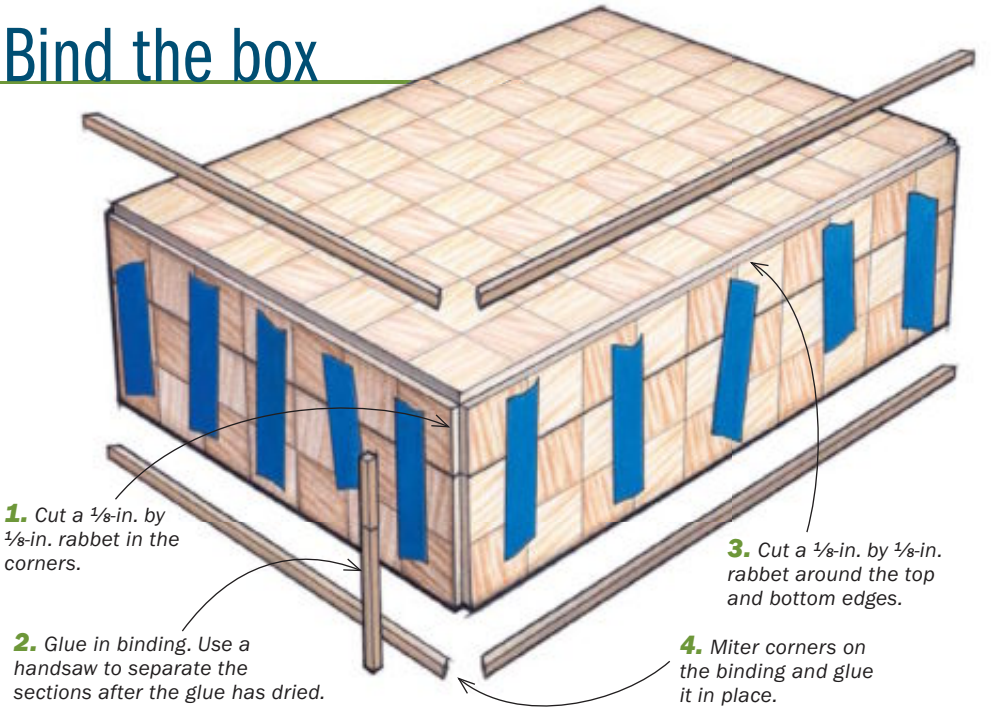
Glue plain 1⁄16-in.-thick maple veneer to both faces of the bottom panel, but only to the inside face of the top panel. Once the veneers have dried, rabbet the bottom panel to create a ⅛-in. tongue around the edge, which will fit in the groove cut in the sides. Cut all the grooves and rabbets on the

A box-sized caul. *The top is clamped in an antique book press while the glue dries. A caul, made of layers of medium-density fiberboard (MDF) with cork padding on one face, provides even pressure. If you don't happen to own an antique book press, a pair of cauls and lots of clamps will do nicely.*

Veneer the sides. *The sides of the top and bottom sections are veneered separately. The T-shaped jig, clamped into a bench vise, supports the workpiece and also serves as a clamping caul.*

Grooves for binding. *With top and bottom sections taped together temporarily, Janofsky cuts a shallow rabbet into each corner to hold the binding—thin strips of white oak.*

Bind the box



Corners first. *Binding strips are glued into the corner rabbets and held with tape. Janofsky uses a Japanese handsaw to separate the sections after the glue has dried.*

Top and bottom next. *Rabbets are cut in the top and bottom for mitered pieces of binding. These pieces are cut slightly oversize, then planed flush.*

tablesaw. After all the pieces are cut, sand and finish inside surfaces with shellac and wax.

Glue the box sides together as neatly as possible with the bottom installed; I use a simple jig of scrapwood to hold it square while it dries. When it's dry, plane or sand the corners perfectly flush and clean. Finally, glue the top panel in place.

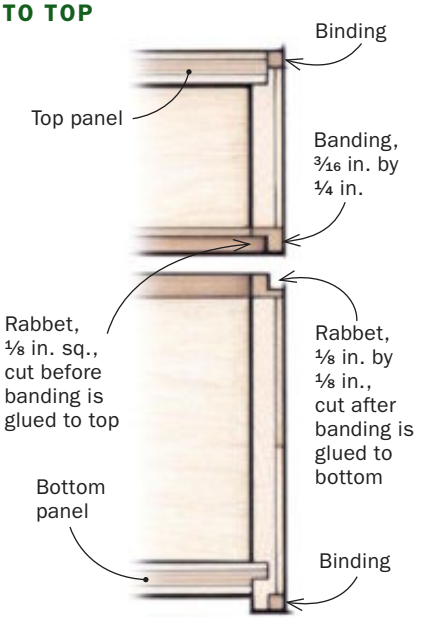
Applying the veneer

With a smaller box, I sometimes apply the veneer to the surfaces before cutting the top from the sealed box. But this box is too large for that because the sides and top will bow under the clamping pressure if not supported on the inside. So, after identifying exactly where you want the top to separate from the bottom, stand the box on edge on the tablesaw and cut through all four sides, making several light cuts until the pieces separate. It's a good idea to mark the parts to keep their orientation.

Then begin applying the veneer. I start with the top of the box. Spread the top with glue and tape the veneer in place securely. Hold the assembly in a press with a cork-faced caul on the inside of the top, or with cauls and clamps on both sides.

OPPOSING RABBETS LOCK BOTTOM TO TOP

A rabbet meets its mate. *Banding, mitered and glued to the lip of the bottom section, will mate with similarly rabbeted banding on the top section. Make a series of light cuts to sneak up on a tight fit.*



Photos, facing page: Courtesy of Seth Janofsky

When the top has dried, glue the veneer to the sides, first on the top and then on the bottom. Try to keep the parquet squares aligned as perfectly as you can where the top meets the sides and ends. For this part of the work, I use a sort of upside-down caul that clamps into my bench vise and another caul clamped on the inside of the sides.

Binding the box

The last major job entails applying the binding strips to all of the corners and edges, and also the edges where the top joins the bottom. The latter will incorporate two small rabbets that key the halves of the box to each other.

Cut the rabbets on the tablesaw. At the same time, rip the small pieces of binding. (In case you were wondering, "binding" means a trim piece that fits in the corner where two veneer sheets meet; "banding" means trim along the edge of veneer.) To allow for any small variations, make the bindings slightly oversize. Once they're glued in, they can be planed flush.

When the corner bindings are in place, cut a rabbet all around the top and bottom for the binding there. These cuts also will trim the ends of the corner bindings. I like to cut and fit the pieces for the opposing sides of the box, mitering the joints with a small handsaw and shooting the miters with a block plane. Once I've glued these in place, I fit the binding in the remaining sides.

The bandings at the junction of the top and bottom are a bit more complicated. First, make a rabbeted banding about 3/16 in. thick by 5/16 in. wide and glue it to the underside of the top so that the rabbet faces the inside of the box. Miter the ends.

Then glue more 3/16-in. by 5/16-in. banding onto the top of the lower part of the box. These pieces are rabbeted after they've been mitered and glued in place. I make the rabbet on the tablesaw, using a flat-toothed blade. Make a series of shallow cuts until the banding just mates with the rabbet in the top. If possible, leave it a bit tight to allow for final sanding and fitting.

The hard part is over. On a box like this, it's a pleasure to sand the surfaces and edges to a fine polish that invites the touch of a finger and brings out the patterns created by the wood's figure and colors. The final finish can be as simple as a couple of coats of Danish oil and a coat of wax buffed to a high luster. □

Seth Janofsky is a woodworker in Alameda, Calif.

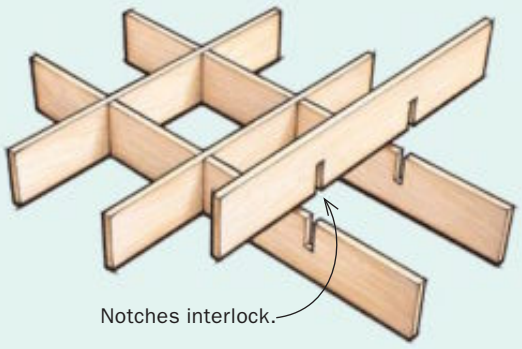
Two ways to fill a box

The interior of a box can range from a simple grid to complex, partitioned trays. Here's how I make two common interior fillers:

THE SIMPLE PARTITION

To make a grid, mill stock to slightly more than ⅛ in. thick. Using a crosscut sled and a stop block, cut several pieces to fit snugly across the length and width of the box. Then, still using the sled and a stop, cut several notches halfway up each piece. Finally, slide the pieces together.

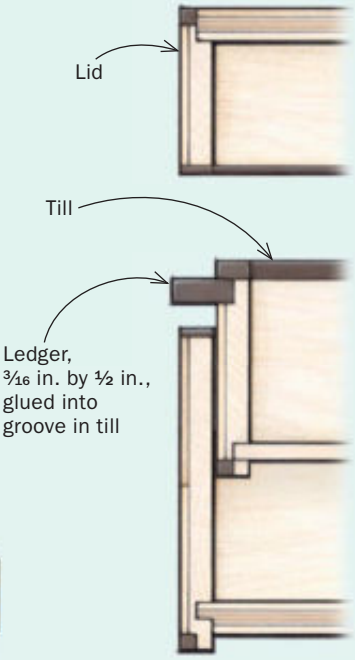
INTERLOCKING PIECES MAKE A GRID

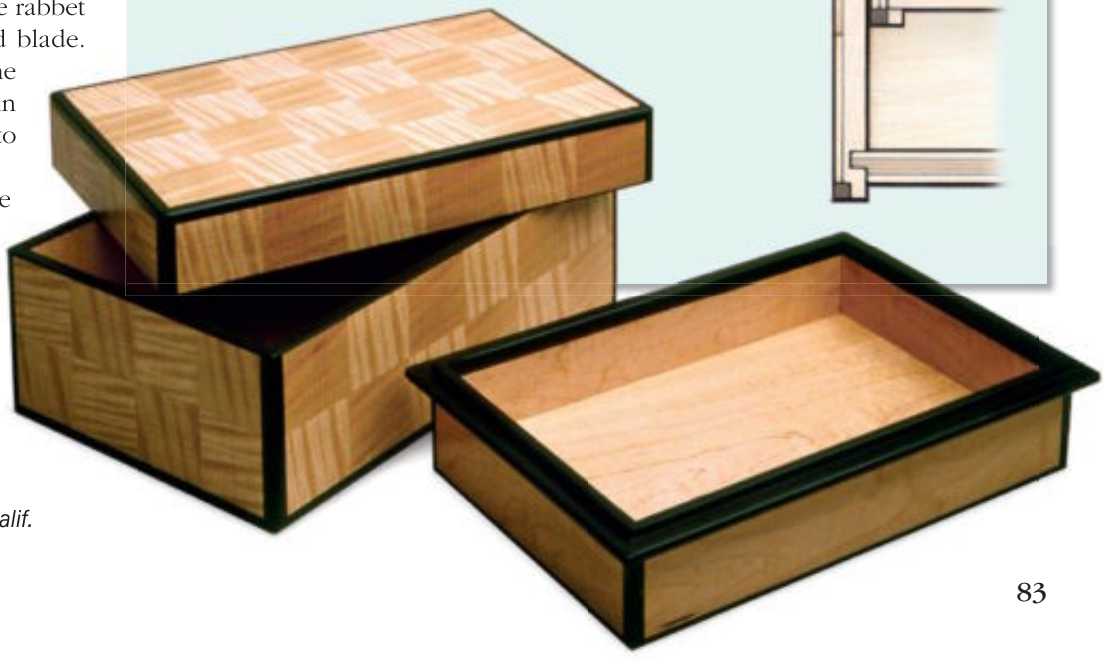


THE TILL

A simple tray, or till, serves as the registration between the two halves of the box. Put mitered edge-banding about 1/16 in. thick on the top and bottom sections where they meet. Then, using ¼-in. stock, make a tray that fits inside the lower section; use edge-banding, as on the box itself. Cut a groove about 3/16 in. wide and 1/16 to ⅛ in. deep around the perimeter of the tray, aligned so that the edge of the groove just meets the edge-banding around the top of the tray. Into the groove miter a ledger, made from 3/16-in. by ½-in. strips of the same wood as the bindings.

TRAY ALIGNS THE TOP AND BOTTOM





readers gallery

Because we've included a gallery of Adirondack chair designs in this issue (pp. 60-61), we are running two pages of Reader's Gallery instead of the usual four.

RICHARD CHILL COTT
Ruskin, Fla.

This quartersawn walnut and zebrawood table (14 in. deep by 48 in. wide by 35 in. tall) was inspired by the architectural framework of a beach house Chill Cott designed. The center shelf represents a glass-enclosed deck on the beach house. The most challenging part of the construction was the glue-up. Since everything interlocks, Chill Cott couldn't glue in stages, and had to assemble the mortise-and-tenon joints, the lap joints, and the veneered panel all at once. The finish is lacquer.

BRIAN McEVOY
Edmonton, Alta., Canada

McEvoy, a full-time professional turner since 1995, started out as a hobbyist in the mid '80s. Now he creates general-use items as well as one-of-a-kind pieces for collectors. "Golden Lace" (12 in. dia. by 5 in. tall) is a natural-edged box elder bowl with a lacy border. McEvoy achieved the lace effect by piercing the wood with a pneumatic dental tool. He filled a bark inclusion with melted gold and finished the piece with lacquer.

PHOTOS: LINDA FINSTAD

RON GRESHAM
Larkspur, Calif.

Gresham created this veneered cabinet (17 in. deep by 50 in. wide by 28 in. tall) from narra, a Southeast Asian wood. The veneered basketweave pattern in the drawer bottoms was inspired by the hand-woven baskets of the area. For a three-dimensional effect, he used hot sand to brown the ends of tiny pieces of cypress, and the black gaps are slivers of ebony. The pulls are patinated brass and tiger's eye stone. The finish is shellac and polyurethane.

STEVEN KESSLER
West Caldwell, N.J.

To make this desk (20 in. deep by 36 in. wide by 45 in. tall), Kessler modified plans for a Roycroft lady's writing desk. He finished the quartersawn white oak with Jeff Jewitt's Arts and Crafts finishing technique (*FWW* #157). Each silver panel took over 100 hours to complete. Kessler employed the metalworking techniques of chasing and repousseé to repeatedly hammer the heated metal into shape. PHOTO: TOM VERNIERO

JEFFREY HILLS
El Prado, N.M.

Hills designed and built this coffee table for clients who wanted a table with "lightness of presence." Made of quilted maple and cocobolo, it is 24 in. deep by 48 in. wide by 20 in. tall and is finished with tung oil and wax.

DENNIS MULLEN
West Richland, Wash.

Mullen made this white oak and juniper box (11 in. deep by 16 in. wide by 11 in. tall) for his goddaughter. The carved lid reflects her love of the ocean. To make the twisted dovetail carcase, Mullen cut flat 8/4 stock to size, created the twist with a handsaw, then cut and fit the dovetails. The finish is satin urethane varnish.

BOB STEVE
Lakewood, Ohio

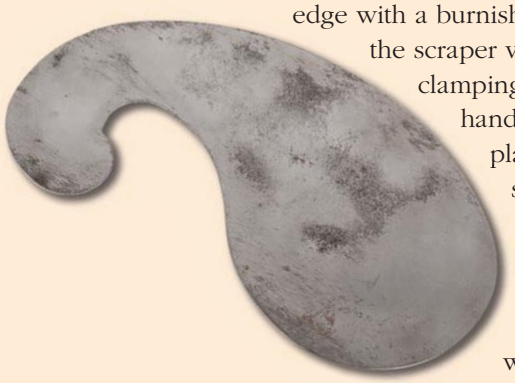
Steve built this secretary from Lonnie Bird's "18th-century Pennsylvania Secretary" plans (*FWW* #154-156). He finished the cherry piece (21 in. deep by 38 in. wide by 85 in. tall) with cherry stain and water-based polyurethane.

Q&A

Sharpening a curved scraper

Q: How do you tune a curved scraper without leaving flat spots when filing?

—JEFF STEIFEL, Pittstown, N.J.



A: FIRST, FLATTEN THE OLD BURR on the edge by laying the scraper flat on a bench and flattening the edge with a burnisher. Then hold the scraper vertically by clamping it in a wooden hand screw and placing the hand screw in a bench vise. This allows you to file a longer section of the curved edge without stopping. It's important to file the edge at 90°, but don't file straight across the edge as this will leave flat spots.

Next, hone the filed edge and the two faces to remove the ragged edges left by the file and remnants of the old burrs. To prevent honing facets on the curve, hold the scraper between your thumbs, index fingers, and middle fingers. As you hone the edge, roll the scraper between these fingers while keeping it perpendicular to the surface of the stone. Then hone the scraper's faces on 800- and 1,200-grit waterstones.

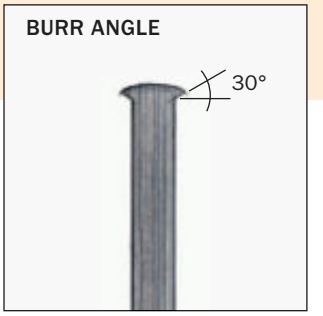
Once the honing is complete, return the scraper to the hand screw and bench vise. Use a burnisher to roll a burr along both corners. Finally, with the scraper flat on the bench, straighten the burrs by drawing the point of the burnisher along the inside of each burr to achieve the correct 30° cutting angle. (If your burnisher is not pointed, grind a 60° point on the end of it.)

—Philip C. Lowe is a frequent contributor.

File without stopping. *With the scraper clamped vertically, file along the curved surface; longer strokes are less likely to file flat spots. (Note the starting and stopping positions above and left.)*

Hone on stone. *Again using long strokes, hone the scraper's curved edge at 90° over 800- and 1,200-grit waterstones, then hone the flat surfaces on the stones.*

Burnish a burr. *With the scraper clamped vertically again, burnish a burr along both corners of the curved edge. Then, with the scraper flat on the benchtop, use the point of the burnisher to adjust the angle of the burrs.*



Photos, this page: Thomas McKenna

Ask a question

Do you have a question you'd like us to consider for the column? Send it to Q&A, *Fine Woodworking*, 63 S. Main St., Newtown, CT 06470, or email fwqa@taunton.com.

Mixing small amounts of finish

Q: I'm new to woodworking and to mixing dyes and finishes. When instructions say to add a very small quantity of a desired color to a finish—say, in "2% or 3% increments"—how do I calculate those small percentages when I'm mixing just a cup of stain? Do I use a teaspoon, an eye-dropper, or what?

—TREVOR ANDERSON, New York, N.Y.

A: WHEN MIXING A CUSTOM COLOR, the measuring device is not as significant as the process. By using test samples, you can "sneak up" on the desired color by adding colorant "to taste." Transport the colorant into whatever stain you are tinting in small increments—say, ¼ tsp. or ⅛ tsp. at a time. Then mix and test. When you finally arrive at the correct color, write down how you got there (added two quantities of black, etc.) and then expand this formula to the final quantity and make enough for the job. Don't forget to test that final quantity as well, just to be sure.

—Teri Masaschi is a professional finisher.

Sneak up on color. *Add small amounts of dye—for example, ⅛ tsp. or ¼ tsp. at a time—to the finish to approach the desired color.*

Use a test board. *Wipe each successive mixture on the board until the desired color is reached. Keep a log of how you got there (colors and quantities) for future use.*

Cut a lengthwise groove in a dowel

Q: For a frame to hold glass shelves, I need to cut grooves ¼ in. wide by ½ in. deep along lengths of 1-in. dowel. What's the best way to do this?

—KHODADAD BETAHARON, Rockville, Md.

Holders are the key. *The dowel slides into a matching pair of holders. It's locked in place by two setscrews.*

A: ROUTING A GROOVE LENGTHWISE IN A DOWEL requires that you keep the dowel from rolling as you make the cut. This can be done with a table-mounted router, a pair of holders, and two screws.

Cut the sections of dowel 2 in. to 3 in. longer than you will need. Make two holders out of 1-in.-thick scrapwood. On a drill press, use a 1-in. bit to drill a hole in each holder. Use the fence to ensure that each hole is an equal distance from two adjacent sides of the holders, and check to make sure that the holes are lined up perfectly. Then drill a pilot hole into each holder. Run the dowel through the holders, and drive the screws through the pilot holes to lock the dowel in place.

With the dowel held firmly, set up the router table with a fence. The edges of the holders that lined up on the drill-press fence should run against the router fence while you make a stopped groove cut. Make the cut in a series of passes. Keep your hands out of harm's way, up on the holders. After removing the dowel from the holders, you can cut it to length and discard the sections with the screw holes.

—Gary Rogowski is a contributing editor.

Lower carefully to start. *Begin the cut by lowering the dowel into the rotating router bit at the desired starting point, with the holders flat against the fence.*

Photos, this page: Charlie Reina; drawings (p. 86, 90): Kelly J. Dunton

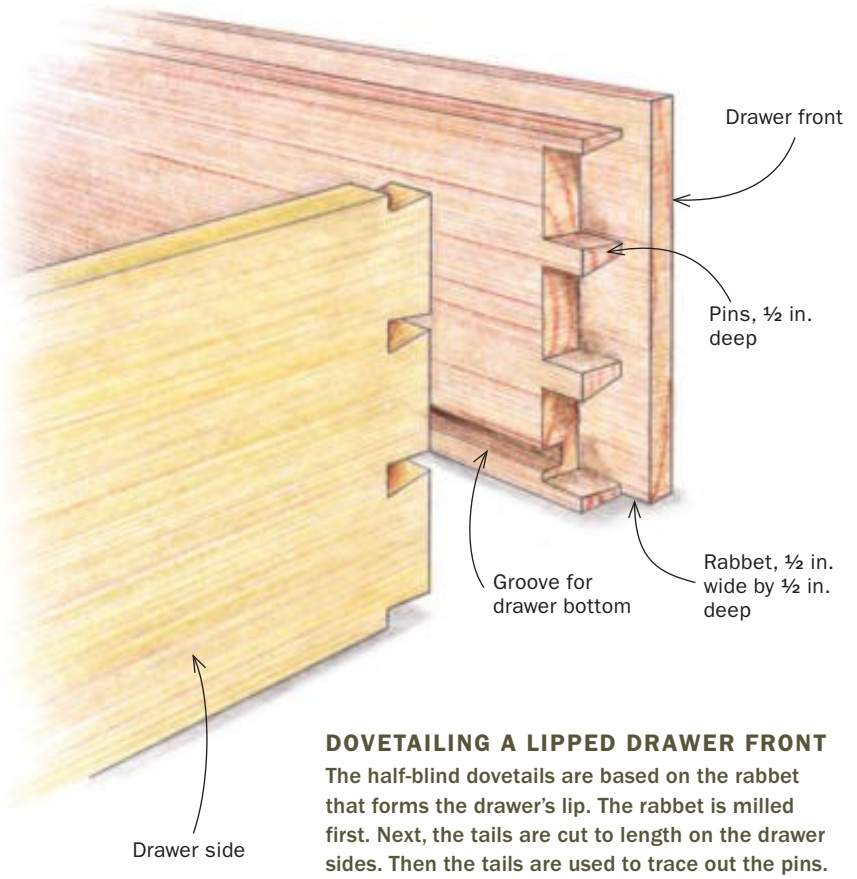
Cutting half-blind dovetails

Q: I am trying to create a new drawer for an old dresser, and I'm concerned about cutting the half-blind dovetails in the lipped drawer front. When I make through-dovetails, I always cut the tails first. Is there any reason to change for these half-blinds? (The drawer front is ¾ in. thick with a ½-in. by ½-in. rabbet around the inside edges. It will attach to ½-in. sides.)

—THOMAS DELIA,
Mt. Pleasant, Mich.

A: YOU CAN STAY WITH YOUR CUTTING ORDER: tails first, then pins. But both cuts should come after you mill the rabbet around the inside of the drawer front. Measure the depth of the rabbet (it might turn out to be 15/32 in. instead of ½ in.) and cut the tails on the front ends of the drawer sides; their length should be equal to the rabbet depth. Once the tails are cut, use them to mark out the pins with a long, sharp pencil or knife on the inside face of the drawer-front side rabbets. Chisel out the pins, then fit and glue.

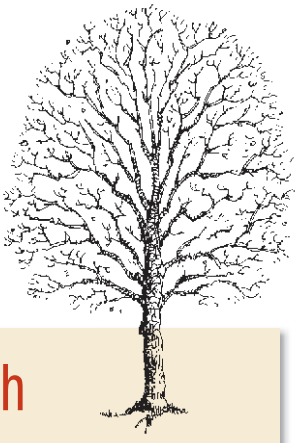
—Charlie Reina is an associate editor.



DOVETAILING A LIPPED DRAWER FRONT
The half-blind dovetails are based on the rabbet that forms the drawer's lip. The rabbet is milled first. Next, the tails are cut to length on the drawer sides. Then the tails are used to trace out the pins.

a closer look

Understanding figure in wood



HOW IT HAPPENS, WHAT TO CALL IT, AND HOW TO WORK IT

BY THOMAS R. SCHRUNK

Imagine woodworking without any figured woods: no bird's-eye maple, no crotch mahogany, no walnut burl, no curly cherry—just foot after board foot of straight-grained, uniform wood. Sure, life would be easier: Straight-grained wood dries predictably, works easily, and can be used to make solid-wood furniture. On the other hand, burl or crotch wood can crack or warp on drying; solid pieces may be impossible to work with; and just try planing that board of bird's-eye maple. But like moths to the flame, woodworkers are drawn to highly figured wood by its unique beauty and even the challenges it presents.

We all know figure when we see it, but how is it defined scientifically? What causes one maple tree to have uniform grain and its neighbor to have the wildest fiddleback pattern? Not all the causes of exotic figure are known, but I'll describe some theories, give a glossary of the many names for wood figure, and offer a few tips for working these difficult but beautiful woods.

The greater the stress, the better the figure

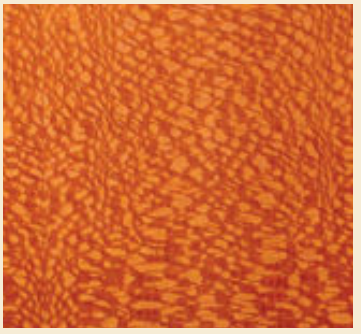
"Figure" is a deviation from normal straight-cell orientation. This deviation can be quite organized, as in fiddleback or blister, or it can be random, as in bird's eye or burl. While the individual cells are too small to see, we read the figure by a change in luster, and sometimes in cell color.

The causes of figure are much debated, but stress seems to be a factor, whether it comes from climate, insect or fungus attack,

Figure found in normal growth

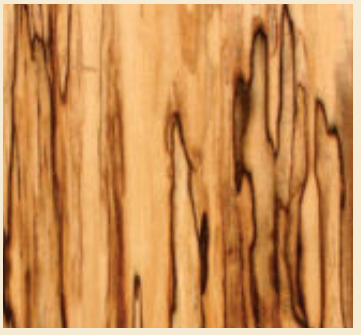
CROTCH WOOD

The juncture between two major limbs produces this distinctive figure. As each branch adds its annual cylinder of growth, the cylinders impinge on each other in the crotch, creating chaotic growth patterns. However, too sharp an angle entraps the bark and compromises the appearance and workability (old-time lumber men said that for optimal figure a person must be able to sit in the crotch like a saddle). Crotch wood is available as both veneer and solid wood.



RAY FLECK

Also known as flake, this figure is not actually a deviation from normal growth, but is the result of cutting wood on the radial plane to expose the medullary rays that run horizontally from the center to the outer edge. Normally too small to be noticed, in some species the rays are so pronounced they become a visual feature. Quartersawn white oak is the most well-known example. Sycamore also has abundant rays, but lacewood (left) is the exotic champion.



SPALTING

The distinctive dark brown and black lines of spalted wood are unlike any other figure type. Representing the boundaries of different colonies of fungi, spalting shows up best in light-colored woods such as maple and birch. Because this is a decay process, spalted wood may be compromised in strength, and for this reason is rarely available as veneer. But when the decay is stopped soon enough, the solid wood is quite usable.

STUMP OR BUTT

As the base of a tree transitions from typical vertical wood cells to root cells, it widens and abruptly branches in all directions, causing pressure ridges and convoluted growth. Angel Step is a stump-wood figure type that looks like lustrous stairs, and is found most frequently in walnut, ash, and maple. Because of its location, stump wood comes in limited sizes. This is not a problem for gun stocks, where stump figure and luster are much prized.

Photos, except where noted: Mark Schofield; this page (ray fleck): Thomas R. Schrunk

or physical damage. Bigleaf maple trees that lean tend to produce both blister and quilt figure; the northern range of the sugar maple produces far more bird's eye than warmer regions; burl is likely started by a dormant bud that divides and subdivides profusely.

Some types of figure begin more easily than others. Development of a corrugated or washboard pattern is common in large trees. It is normally found in the radial or quartersawn plane and produces the pattern known as fiddleback. When this undulant growth occurs on the tangential or flatsawn plane, the result is a trunk that looks like a corrugated drainage pipe. This curly figure, frequently found in birch, gives luster of varying beauty, but the variation in vessel openings can result in a blotchy look when stained.

While figure may begin development in young trees, it tends to become more intense as the tree grows. This is probably due to increased crowding of newly divided cells in the cambium (the thin layer between the bark and the wood). The cells enlarge first by elongation. If there isn't room to squeeze between adjacent cells, their only option is to bulge outward. Some species (maple, sapele) tend to exhibit more figure than others, which may be due to cell shape and thickness, as well as the vigor of the cell-division process.

Because of figured wood's scarcity and value, it is often easiest to find by mail order. But first you must understand the terminology. Fiddleback, curly, tiger, pommele, blister—the variety of names is almost as broad as the types of figure, and in truth the labels given are inexact. I hope the brief guide to wood figure in this article will encourage you to go out and try some of these exotics in your next project.

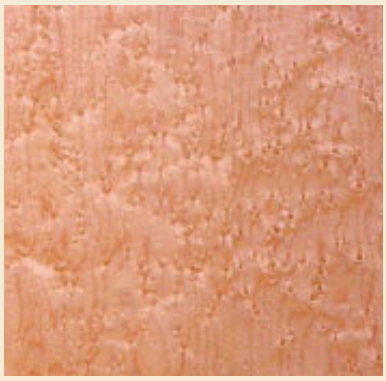
How to work figured wood

Part of the higher price you pay for figured wood is the greater difficulty working with it. However, there are tricks worth learning.

Planing bird's eye, either by hand or machine, often pulls out the eyes. A

Figure caused by abnormal growth

Although not all the reasons are known, stress and disease seem to play a role in creating the best figure in trees.



BIRD'S EYE

This unique figure is caused by a series of depressions in the cambium as new wood is added each year. Though it occurs in many species, bird's eye is best known in sugar maple. The eyes radiate out from the center, so plainsawn lumber gives the roundest eyes, and wide boards may display oval eyes at the edges.

BLISTER/QUILT

This figure consists of a series of forms, often varying in size, that visually resemble three-dimensional domes. Found most frequently in bigleaf maple, blister is usually round or oval. If the ovals are elongated, the figure may be referred to as cigar, while a rectangular shape is called quilted. If this type of wood is book-matched (left), one side will look concave, and the matching side will look convex.

BURL

The most difficult and beautiful of veneers, burl is the wood of kings and sultans. Starting from dormant buds, burls may be individual (and quite large) wartlike growths on trees, normally toward the bottom. Or there may be a number of smaller burls among normal straight-wood growth, a type known as cluster burl.

Burl occurs in many woods but is harvested commercially in relatively few, among them ash, maple, myrtle, and redwood. Most walnut burl comes from California orchards, where English walnut stems (for nut production) are grafted to black walnut or California walnut rootstock. The irritation caused at the graft line frequently causes large (up to 6 ft. dia.) and highly prized burl.

Because of the great complexity of grain direction, burl is difficult to use as lumber, though careful drying may give marvelous blanks for turning. Burl is rotary-cut as veneer.

Photos, this spread (bird's eye, blister, fiddleback, mottled, bee's wing, pommele): Thomas R. Schrunk

CURLY/TIGER/FIDDLEBACK

Curly is a generic term that refers to undulant or wavy growth patterns. These range from modest irregular waves (top) to full-blown fiddleback (bottom). The latter is named for its use in stringed musical instruments from the mid-16th century onward. A favorite of woodworkers, this intense figure consists of regularly spaced light and dark bands that look like hills and valleys. Where curly might be measured in rows per foot, fiddleback is measured in rows per inch. It occurs in many types of maple, and I've seen especially stunning examples from redwood, makore, and anigre.

The term tiger was once used to describe vigorously curly figure (center) in soft maple. It has been extended to include figure in soft and hard maple that is better than curly but not quite fiddleback.

MOTTLED/BEE'S WING

Found in tropical woods, mottle is ribbon-striped wood with the addition of tangential curly figure. The mottling may be fine and tight, as in razor mottle, or large and regular, as in this block mottle bubinga (above left). An inconsistent pattern is called broken mottle.

A very tight mottle that looks like an insect's wing under a magnifying glass is known as bee's wing. The most sought-after, expensive examples come from Ceylonese satinwood, but bee's wing also occurs in andiroba, eucalyptus (above right), mahogany, and narra.

POMMELE/PLUM PUDDING

One of the most distinctive figure types, pommele has the appearance of rain on the surface of water. The many rounded forms, often of surprising density, produce a luxurious figure. Pommele finds frequent use in high-end furniture and yachts, and comes from the largest of tropical trees including bubinga, sapele, and makore.

Mahogany occasionally develops a distinctive variant of pommele known as plum pudding. Popular in Chippendale period pieces, the plum-size rounded shapes sometimes feature color variations in the plums.

RIBBON-STRIPE

While we think of trees as growing straight, almost all trees grow with a slight twist, normally counterclockwise. Many tropical trees develop a significant twist for several years and then reverse to grow in the opposite direction. After many direction changes over the years, the entire trunk has interlocking grain, which when quartersawn reveals a ribbon-stripe light-dark pattern caused by light refracting from the differently angled cells. The closer the cut is to true radial, the tighter the spacing. Stripes as tight as ¼ in. apart are described as pencil stripe.

better method is to sand the wood, if necessary renting the use of a wide-belt sander at a commercial furniture shop.

When thicknessing any curly wood with a power planer, you can reduce tearout by wetting the surface and waiting a few minutes. This causes the fibers to swell, raising the short fibers so that they can be cut cleanly.

Another way to get clean cuts is to angle the board through the planer so that the knives will shear shavings on the bias rather than make chopping cuts along the grain.

The narrow bands of grain running in opposite directions in ribbon-stripe boards make hand-planing problematic, but closing down the mouth of the plane reduces tearout. Alternatively, use a scraper plane or a cabinet scraper to tame this wild grain. □

Working figured wood

By machine. *You can rent time on a wide-belt sander at a commercial lumber shop to thickness figured boards (above). Dampen and angle curly boards before power-planing them (right).*

By hand. *The high cutting angle of a cabinet scraper works well when smoothing curly boards that bench planes tear out.*

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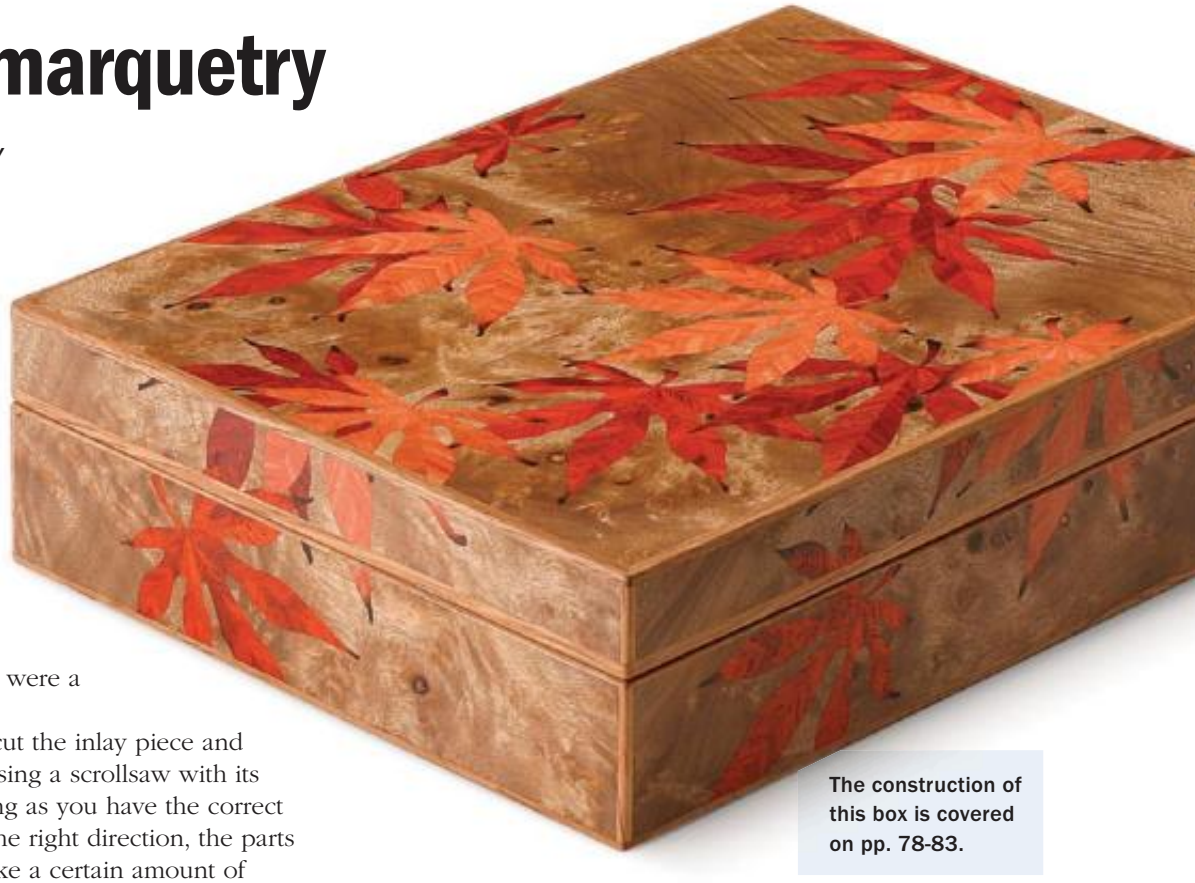
Maple-leaf marquetry

BY SETH JANOFSKY



The construction of this box is covered on pp. 78-83.

I use a variety of veneering techniques on the pieces I make. For this box, marquetry yields a pattern of overlapping Japanese maple leaves that cascade down the sides, a look inspired by Japanese prints and lacquerware.

Sometimes called double-bevel marquetry, my method involves inlaying each element into the background veneer as though it were a tapered plug in a tapered hole.

To achieve matching bevels, you cut the inlay piece and the background at the same time, using a scrollsaw with its table canted at a slight angle. As long as you have the correct table angle and move the work in the right direction, the parts will fit. Actually, the sawing does take a certain amount of head-scratching and some practice, but mainly it requires a tolerance for tedium. (I use a foot-powered, shopmade saw that cuts at a leisurely pace, but a motorized scrollsaw will work, too.)

Build blanks for leaves

The main task is preparing the veneer blanks for the leaves, which are made from a number of pieces glued together rather than a single sheet. The seams between the pieces mimic the veins in a real leaf.

First, saw a bunch of 1/16-in.-thick veneers for the leaves and for the background. I generally do this on a bandsaw. If the saw is well tuned and the blade sharp, the veneers may not need any thicknessing; otherwise, I cut them slightly thick and then sand them.

Making your own veneer

The best way to acquire veneer for a project like this marquetry box is to resaw your own from thicker stock. It's a good way to use wood that has interesting color, grain, or figure, but isn't long enough or wide enough for other uses. Begin by jointing and planing the stock square.

Bandsaw the strips. *A tall auxiliary fence helps support the work. Be sure the fence is set to account for blade drift. Joint the cut face of the stock after sawing each piece of veneer.*

Line up the patterns. *There are several ways to match up veneer sheets. Book-matching, for example, aligns facing sheets to mirror grain patterns.*

Photos, except where noted: David Heim; this page and drawings: John Tetreault

Assemble blanks for the leaves

I keep a supply of reddish and brownish woods around the shop to make veneer for the leaves. Part of the fun comes from trying out different woods. However, if you use padauk, keep in mind that the wood will become darker and duller. Also, an alcohol-based finish will cause the pigment in padauk to bleed, so avoid using shellac.

To make the blanks for the leaves, bundle consecutive cuts of straight-grained veneer and crosscut the bundle at a 45° angle, creating a bunch of trapezoidal pieces about ¾ in. wide. The more cleanly and accurately you cut these, the better.

Take one piece, flip it over, and book-match it to another, forming a chevron pattern, and edge-glue the pair.

When the chevrons are dry, use a jig on the tablesaw to put a steeper point on the already pointed ends, keeping the point aligned with the joint in the center (see photo, far right).

Then begin gluing these assemblies together—first three, then five, then seven pieces—with the points converging at the base of what will be the leaf.

Prepare the background veneer

For the background, glue up a sheet of veneers based on the size of the box you want to make. Because some leaves will cross the joint between top and sides, attach the end and side pieces to the top. The finished assembly will resemble a flattened cardboard box.

When making the background, remember that the size of the scrollsaw's throat limits the overall size of the veneer sheet (and the box). You have to swing the entire sheet around in a complete, if convoluted, circle as you saw in each leaf.

Let the leaves fall

When the glue has dried on the leaf blanks, pencil in the shape you'll cut. Be sure the point of each lobe of the leaf aligns with the glue line in the

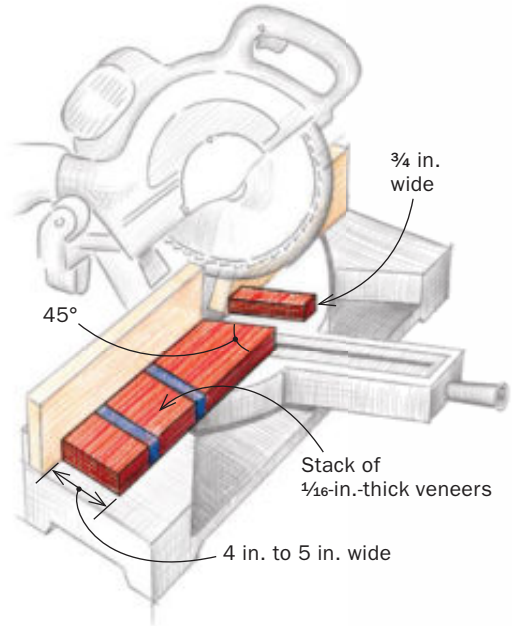
Leaves begin as simple shapes. *Use a miter saw to cut blanks at a 45° angle from the end of a stack of veneers. Cut plenty of blanks, because you need 14 for each leaf.*

Glue up pairs. *Edge-glue pairs of blanks to form a chevron or arrow-feather shape. The grain patterns will mimic veins in real leaves. Tape holds the pieces together.*

Glue groups of chevrons. *Edge-glue seven chevrons to complete the leaf blank. Work carefully to be sure that all the chevron points converge at a single point.*

Position a blank and draw the shape. *Tape the blank on the background veneer, then outline the leaf shape. You can draw freehand or trace a pattern, but let the shapes and sizes vary.*

CUT ROUGH PIECES ON A MITER SAW

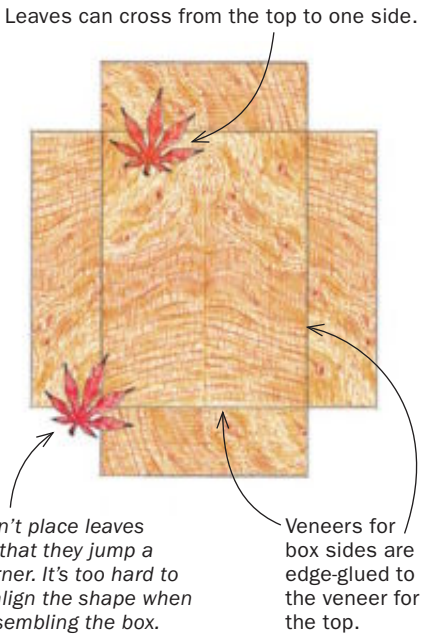


Point the ends. *A simple 18° jig that rides in a miter slot on the tablesaw is used to sharpen the point of each chevron. Use a fine-tooth laminate blade to keep the cuts as clean as possible.*

Cut out the leaves

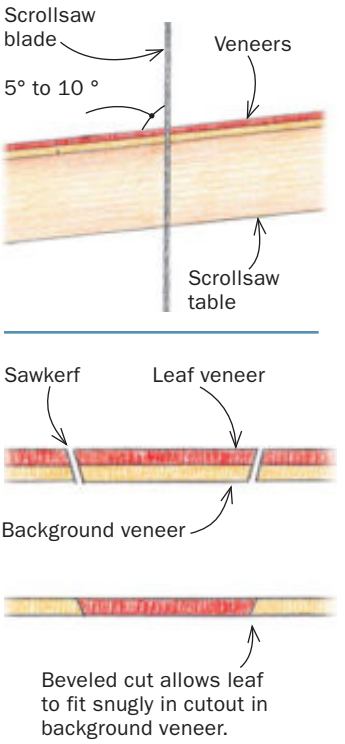
Drill a starter hole. *Make a tiny hole in the background veneer right where the points of the chevrons converge. Thread the scrollsaw blade through this hole.*

BACKGROUND VENEER: A BOX UNFOLDED



Cut at a slight angle. *A slight tilt to the saw table will leave cut edges beveled and allow the leaf to sit flush in the cutout in the background veneer. It's essential to rotate the workpiece in the correct direction; otherwise, the inlay piece will be too small.*

DOUBLE-BEVEL MARQUETRY



Remove the finished leaf. *Reach under the background veneer and gently push up to release the leaf shape and the corresponding piece of background veneer.*

Toast the tips. *Place the leaf cutout in a pan of hot sand for a few seconds to darken the tips. Too much heat will weaken the glue joints or cause the fragile tips to crumble.*

blank. The lobes decrease in size, with the longest in the center and the shortest at either end.

Fit the scrollsaw with a 2/0 wood-cutting blade (also called a universal #1 blade, from www.woodcraft.com, among several sources). Start by angling the saw table 5° to 10°, but get the angle dialed in exactly by practicing with scraps of veneer. The blade's kerf determines the angle. When it's just right, the inlay piece will fit tightly in the recess and come up flush with the background veneer. It's best if they're a little tight at this stage.

Tape a leaf blank onto the background veneer wherever you want it. Drill a tiny

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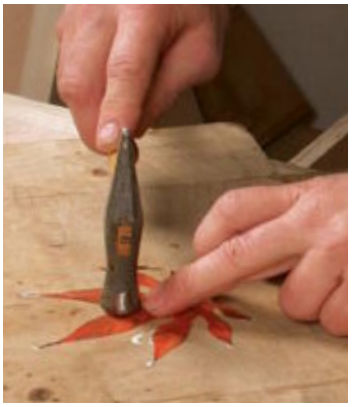
Glue the leaves in place

Glue in the leaf. *Be sure the inlay is glued all along the cut edge. A syringe makes it easy to work the glue into tight spaces.*



Seat the leaf. *A few light taps with a hammer will ensure that the leaf fits snugly in the background veneer. It's OK if the leaf is a whisker proud; sanding will bring all the surfaces flush.*

starter hole for the blade and begin sawing. If you drift from the line you've drawn, don't worry. These are leaves, and it's OK if they're irregular.

When you've cut the shape completely, remove it and the corresponding piece of background veneer. Save the background; you can use it to help decide where to place the remaining leaves.

Glue the leaf into its recess in the background, tap it in place lightly but firmly with a small hammer, hold it down with a couple of pieces of blue tape, and let it dry.

I like to build up a dense pattern of leaves laid over each other. The earlier ones should dry completely before new ones are cut in over them, or all the little pieces will fall out and you'll never figure out where they go.

Stems go in last

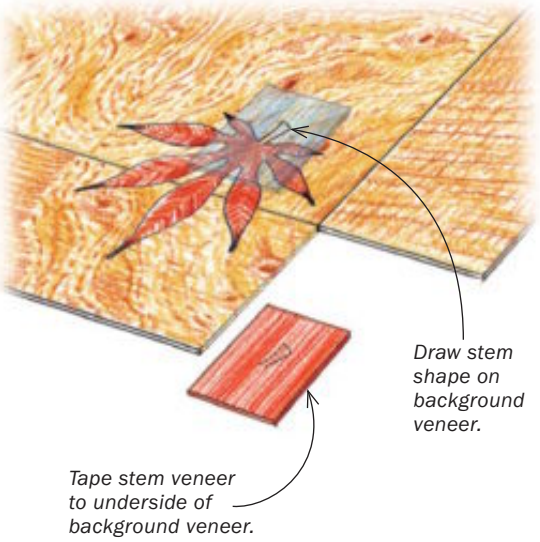
When you've finished inlaying all the leaves and you like the pattern you've created, add the little stem pieces.

These are bevel-cut like the leaves, but with one difference. To be sure you've placed this minute piece precisely at the base of a leaf, draw its shape on the background veneer and tape a larger inlay piece to the back of the background. Saw in the opposite direction (rotate the work counterclockwise if you moved clockwise when cutting the leaves), to make the inlay piece fit. Glue in the stems.

When the veneer is done, you'll have to cut the sides and ends from the top with a fine-toothed Japanese handsaw, and you're ready to glue the pieces onto the box carcase. Apply thin strips of binding to the corners and edges to help define the shape and provide some contrast. The article on pp. 78-83 explains how to cut the rabbets for this detail. □

Stems add a finishing touch

DOUBLE-BEVEL CUTS FOR STEMS



Cut stems in reverse. *To get tiny stem pieces positioned exactly, trace the outline to be cut on the background veneer, tape the other veneer to the backside, then cut. Move the work opposite to the direction you followed when cutting the leaf shape.*

Position the stems. *A little glue and a tap from the hammer will seat the stems.*

Fine-feathered illusion

BY JONATHAN BINZEN

Jacques Vesery's work, seen on the back cover, combines turning with carving to produce astounding texture and detail. Vesery uses a burning tool for the detail work, which gives him a tiny, crisply cut line, impervious to changes in grain direction. He then applies five layers of acrylic paint to the feathers, starting with black and working up to light browns. He leaves the shell unfinished but for a coat of wax.

1. Turn the egg and shell

From the same piece of wood (to ensure grain and color continuity), Vesery begins by turning a complete egg and a partial one, which he uses to make the broken shell. After turning the partial egg, he turns and sands the full egg until it is as close to finished as possible, then parts it off.

2. Crack the egg

Using a flexible-shaft, rotary-carving tool, Vesery removes wood inside the jagged "window" in the eggshell to a depth of about 1/16 in. To do the cutting, he uses a tapered burr. To achieve the control required for fine work, whether grinding or burning, Vesery holds the tool as close to the business end as possible—"like a pen or a paint brush." After relieving the area within the window, Vesery uses the grinder to establish the outlines and domed shapes of each feather.

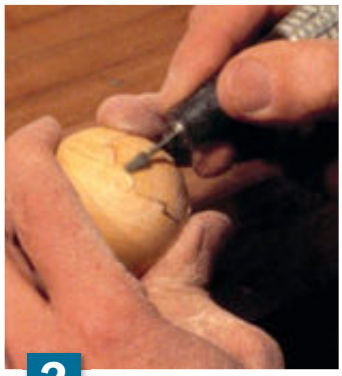
3. Fluff the feathers

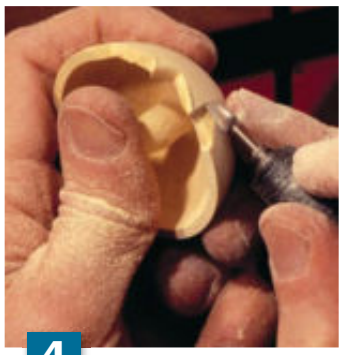
For the detailed carving, Vesery uses a short-tipped, fine-point, wood-burning tool that enables him to achieve a cut line rather than a torn one. Since clamping the work doesn't allow him to move the piece, his left hand serves as a vise and he steadies his right hand by resting the last two fingers against the workpiece. He doesn't just move the tool hand; the vise hand is always in motion, too, creating a fluid two-part movement.

4. Shape the shell

Vesery turns the walls of the partial egg to a thickness of about 1/8 in.—if he were to go much thinner, the piece would break apart while he worked it. He turns the broken piece of shell thicker at the center and thinner at the edges, which "creates the illusion of thinness without the vulnerability."

Vesery cuts out the jagged shape of the broken shell by grinding to a pencil line. To create the illusion that the piece really is eggshell-thin, Vesery grinds away more wood along the jagged perimeter, carefully removing material to create a gradual taper and a shell-thin edge. □





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One Unreal Egg

Jacques Vesery's carved turnings live on the line between the believable and the impossible. He is obviously a close observer of nature, but his work asks us to believe in things that couldn't possibly be real. A stay-at-home dad whose shop is a converted garage attached to his house in Damariscotta, Maine, Vesery has been turning and carving since boyhood. Just out of high school in the late 1970s, he joined the Navy as a navigator on a nuclear submarine. Wood was banned on board as a fire hazard, so he spent his spare hours carving detailed flowers inside blocks of Plexiglas. For several years after his tour, he worked doing scrimshaw—the whaler's art of etching ivory. Now that wood is again his medium, Vesery turns most of his pieces and carves them with flex-shaft rotary grinders and burning tools. He turned the nest-like platter of this piece from Swiss pear and burned in the twigs. Making and attaching the rim, he says, was the most delicate part of the project. Turned from a single disk of bird's-eye maple and rabbeted on the underside to mate with a ridge on the platter, the rim came off the lathe "like a piece of cooked spaghetti." To find out how Vesery turned and carved the seemingly impossible egg, see How They Did It, p. 110.

—Jonathan Binzen

Pro Portfolio: To hear Vesery discuss his work, visit www.finewoodworking.com.

Photos: Jacques Vesery