14 TOOLS THAT CHANGED WOODWORKING

25TH ANNIVERSARY ISSUE

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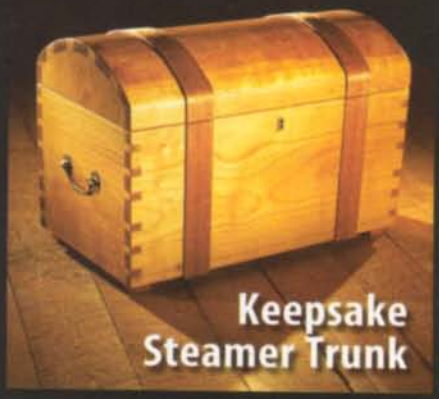
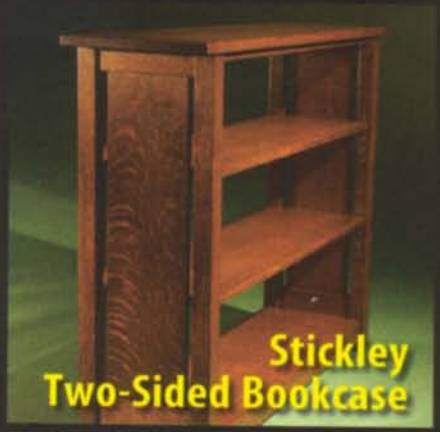
#149, AUG/SEPT 2010



Keepsake Steamer Trunk

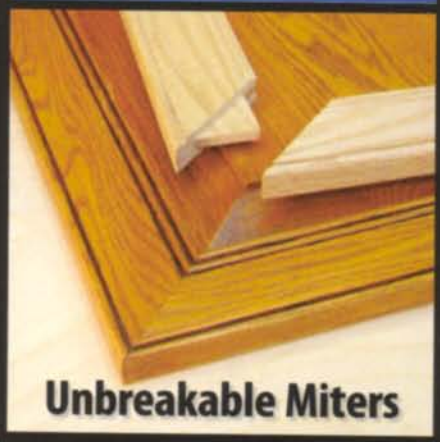
Weekend Project: Cedar Planter

Hot Pipe Bending



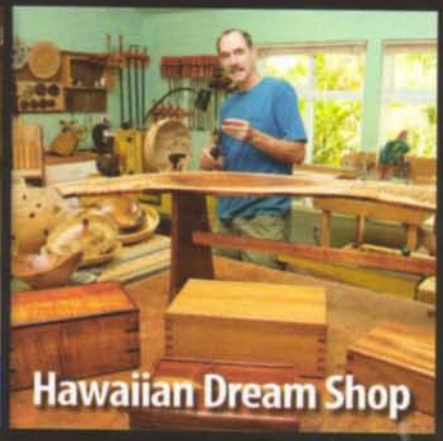
Stickley Two-Sided Bookcase

AMERICAN WOODWORKER 25 YEARS



Unbreakable Miters

CNC Laser: The Future?



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25TH ANNIVERSARY ISSUE

American Woodworker

#149, August/September 2010

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Strong, simple joinery provides lasting beauty.

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How Do You Create Endless Cabinet Door Making Possibilities?

IWF booth #6349

Profile Shown:
Round Over
(#99-760)

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Game-Changing Tools

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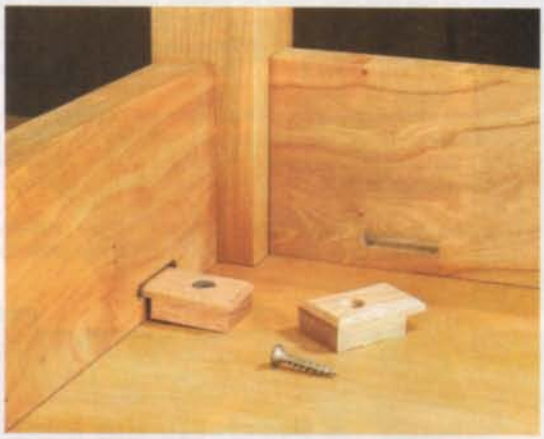

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From the Editor's Desk

Celebrating 25 Years

Twenty-five years ago, I was studying furniture-building in the mountains of North Carolina and eagerly learning everything I could about woodworking. That same year (1985), not far away in Tennessee, another woodworker named Jim Jennings was pursuing his dream as well. Jim started *American Woodworker* out of his love for woodworking and a desire to bring useful and inspirational woodworking information to fellow craftsmen.

After a few years, Jim passed the tasks of editor and publisher to David Sloan in Pennsylvania. David nurtured the fledging magazine into a nationally recognized brand. His team of editors produced stories that deeply inspired woodworkers, including me. David's team also created the Woodworking Shows, the first of their kind and staffed by some of the best woodworkers in America.

In 1998, *American Woodworker* moved to Minnesota, and the editorial pen was passed to Ken Collier. Under Ken's leadership and a new team of editors, *American Woodworker* continued its strong tradition of producing solid woodworking how-to articles, including projects, in-depth tool tests, tips, techniques and shop-improvement stories. It added up to a rich mix of practical and useful advice. I joined the *American Woodworker* team in 2001 and became editor in 2006.

Over the past four years, our focus has remained on providing useful "build your skills" information. We've also opened our pages to authors from around America and beyond. I'm a firm believer that there is a lot of great woodworking being practiced in shops across the country, and *American Woodworker* is the perfect place for woodworkers to tell their stories. Whether it's focused on a project ("Keepsake Trunk," page 39), a technique ("Mitered Frames," page 60), favorite tools ("Tool Nut," page 63), or a new way to build furniture (Origami Woodworking," page 67), *American Woodworker* remains: **The Best Resource for You and Your Shop!**

Keep the chips flying,

Randy Sahn

Issue #1, 1985

Issue #64, 1998

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JASON ZENTNER

Terrific Tip!

Cabinet Jacks

I USUALLY WORK ALONE, but when I install upper cabinets, I always enlist the help of two shop-made cabinet jacks. They're steadier than an extra pair of hands. The jacks stand on the lower cabinets. To position and level the upper cabinets, I just turn two bolts in each jack.

The jacks are 15" tall and 12" deep. Make them from 2x4s, with 2x6 bases. In the jack's top members, pound two 1/2" x 2" coupler nuts into tight-fitting holes. Thread a 1/2" x 6" full-thread hex-head bolt through each coupler nut and cap it with a rubber chair-leg tip.

Boyd Card

Shaper Wings

I LOVE MY SHAPER, but always wished it had a bigger top to help balance large parts. Rather than buy a new shaper, I enlarged the top by adding hardwood extensions. The extensions on the sides are 1" thick and 3" wide; the extension on the front is 1" thick and 6" wide.

To fasten the extensions, I drilled and tapped holes in the edges of the table. Then, I glued and screwed 1" by 2" cleats to the edges of the extensions. I used a Forstner bit on the side extensions and a dado set on the front extension to create recesses for tightening the bolts.

John English

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EDITOR: BRAD HOLDEN | PHOTOGRAPHY COURTESY OF CONTRIBUTOR UNLESS NOTED

Thousands of small shop owner/operators will attend IWF in August. Here are just a few reasons why:

- In one place they'll find products specifically engineered for their shop and priced for their budget
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- A trip to IWF will have these small shops getting under the hood to test, contrast and compare to find the best fit for their business.

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Pressure Spreaders

GETTING READY TO GLUE some pre-finished edging on a huge countertop, I realized that I didn't have enough clamps. Rather than buy more clamps, I increased the area each clamp would cover by screwing a 6" long block to its front jaw. I glued cork to the face of each block to protect the edging.

Paul Darnell

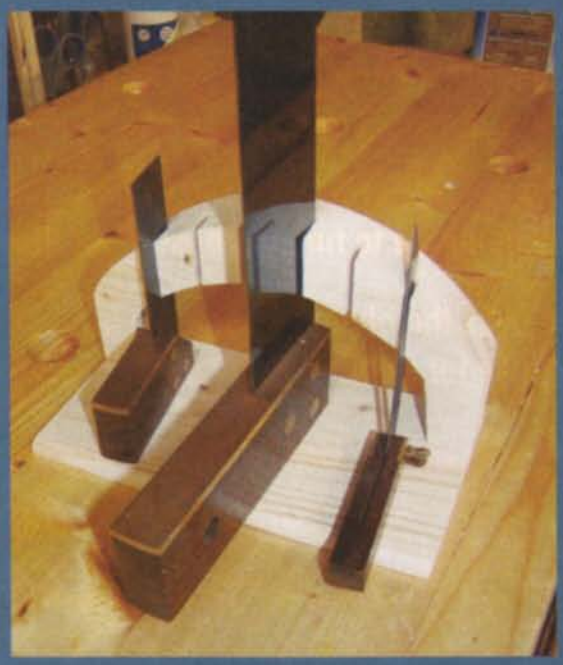
JASON ZENTNER

Blade-Flattening Block

FLATTENING THE BACK OF A SPOKESHAVE'S BLADE on sandpaper is a pain. The blade is so small that it's hard to get a grip on it. A 1-1/2" thick MDF block sized to fit my hand makes the job easy. I stick the blade to the block with double-faced tape.

One problem: If the blade gets too hot from friction, it won't stick to the tape anymore. The solution is easy. When the blade starts to get warm, just set the block–blade side down–on a cast-iron surface, such as a tablesaw's top, for about 30 seconds. Cast iron absorbs and dissipates the blade's heat quite rapidly.

Bill Larsen



Square Rack

I WANT MY SQUARES CLOSE AT HAND when I work, but I don't like to have them just lying around my bench, where they can get dinged or knocked to the floor. This simple rack made from a 2x4 cutoff keeps them safe and sound.

To make the rack's base, resaw a 1/2" thick strip from the 2x4. Use your tablesaw to cut 1/2" deep kerfs in the remaining piece, then cut this piece on the bandsaw to create an arch. Glue and screw the arch to the base.

Mark Thiel

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Chad Stanton

JASON ZENTNER

High And Dry Ply

AFTER RUINING FOUR $90 SHEETS OF PLYWOOD by storing them on a damp floor, I came up with a simple fix: PVC feet.

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Bruce Kieffer

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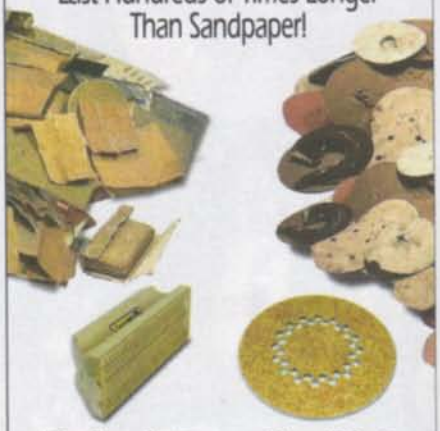

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Swing-Under Bench Tools Revisited

A TIP IN ISSUE #147 NEEDS SOME CLARIFICATION. The tip involved making a device to store small stationary power tools under your bench. Peter Unger, the author of the tip, pointed out that the device we built and photographed would work fine for lightweight tools, but heavier tools require more stability.

Peter's actual rig is shown at right. He made the slots in the swinging arms quite long. When he swings the tool up, the platform on which the motor rests clears the front of the bench. Then he slides the platform back, so that part of the weight of the motor sits on the bench itself.

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Handsome Patio Planter

Strong, simple joinery provides lasting beauty.

by Brad Holden

IF YOU'VE BEEN THINKING ABOUT BEAUTIFYING YOUR PATIO, and you want to do it in a weekend, I've got just the thing. This sturdy planter is made from readily available materials with simple joinery, waterproof glue, and exterior stain for maximum durability.

You'll need two 12' cedar 5/4 x 6 deck boards for the rails, one 8' cedar 2x4 for the legs, and six 10' cedar 1x4s for the slats and bottom boards. When you're at the home center, dig through the lumber piles to find the straightest boards with the fewest knots.

EDITOR: TOM JOHNSON | PHOTOGRAPHY: JASON ZIMMER | ILLUSTRATIONS: FRANK ROMBACH

1

Start by ripping the rails to width from 5/4 cedar boards. This project is made with materials from the home center.

2

Rout a centered groove in one edge of each rail, to house the slats.

3

Rout rabbets on both edges of the inside slats, but on opposite faces, so the ends look like a "Z." The end slats are rabbeted on only one edge.

4

Rout tenons on the ends of each slat, using a rabbeting bit. Make one pass on each face. Use a backer board to guide the workpiece and prevent blowout.

5

Assemble the panels. Spacers between the slats create uniform gaps. Glue the end slats flush with the ends of the rails. Nail the rest at the top and bottom.

Build the slatted panels

Start by cutting the rails to length (A–D, Fig. A and Cutting List, page 20). Joint and square one edge, and then rip the rails to final width (**Photo 1**). Where possible, rip off any loose knots.

Rout a centered groove, 5/16" wide x 3/8" deep, on one edge of all the rails (**Photo 2**). Slightly chamfer the top edges of the bottom rails (but not the ends), to promote water runoff.

To make the slats, plane the 1x4s to 5/8" thickness and crosscut them into workable lengths. Joint one edge and then rip each length 3-5/16" wide.

Rout 5/16" x 5/16" rabbets on both edges to make the inside slats (E and **Photo 3**). Leave about 8 lineal feet with only one rabbeted edge, to make the end slats (F). The outer edge of each end slat is square. Because these slats go on opposite ends of the panel, the rabbets are on the front face on half of them and on the back face of the other half. Often, the 1x4s will have one good face and one not-so-good face. So, when you cut the end slats to final length, make sure that half of them are rabbeted on the "good" face and half are rabbeted on the "bad" face. This ensures that only the "good" faces will show on the completed planter. Cut all of the slats to final 9-7/8" length.

Use a rabbeting bit to rout centered 5/16" x 5/16" tenons on both ends of each slat (**Photo 4**). Adjust the bit's height and make test cuts on scrap stock to dial in the thickness; use the fence to set the length. Use a squarely-cut backer board with a screwed-on handle to support the workpiece and prevent blowing out the back edge.

Assemble each panel inside-face up. But before you start, mill a pile of 1/8" x 1" x 2" spacers. Lay the rails on a flat work surface. Then, starting with an end slat, slide each slat into position in the rails' grooves. Slip spacers between the slats at the top and the bottom. Install the remaining end slat to finish the job. Make sure both end slats are flush with the ends of the rails, that the assembly is square, and that the inside faces of all the pieces are oriented correctly.

Remove the end slats, apply waterproof glue, such as Titebond III

(see Sources, page 20), and then glue them into the rails, flush with the ends. Make sure all of the internal slats are evenly spaced. Then nail them to the rails (**Photo 5**).

I used a BeadLOCK jig to drill the centered 7/8" deep mortises (**Photo 6** and Sources). Layout is simple. Just mark the midpoint of each mortise on each rail, 1-1/4" from the top edge on the top rails and 1-3/4" from the bottom edge on the bottom rails. The jig comes with shims that allow centering the mortises in stock of different thicknesses.

Use the offcuts from the 5/4 x 6 rails to make 1" x 1" ledgers (G) to support the planter's bottom boards (H). Glue and nail a ledger to the inside of both side panels, positioned at the height you want. You can mount the ledgers on the bottom rail and stack bricks to position the pots, or you can let the height of the pots or the amount of soil that you plan to use determine the ledgers' location.

Make the legs

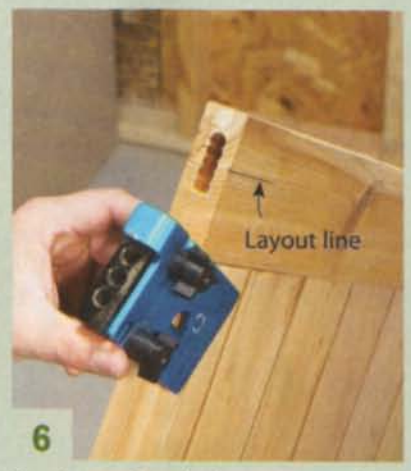
Make the legs (J) by ripping a 40" length of 2x4 into two pieces that are 1-9/16" wide. Plane the sawn faces to square the stock. Then cut the legs to final length and round over all the edges.

Lay one of the panels on a flat surface and position one leg so it protrudes 3/4" at the panel's top and 1-1/8" at the bottom. Transfer the mortise layout marks from the panel to the leg. Then use the marked leg to transfer the layout lines to the other legs (**Photo 7**). Be sure to locate the mortises so that the legs' good sides will face out. Install the appropriate shims in the BeadLOCK jig to center the mortises, and then drill.

Assemble and finish

BeadLOCK supplies tenon stock that you simply cut to length to create the 1-3/4" long loose tenons (K). Miter one end of each tenon—the end that goes in the leg. Install the loose tenons when you glue and clamp the legs to the side panels (**Photo 8**). After the glue has set, repeat the process to glue and clamp the end panels between the side panels (**Photo 9**).

Apply the finish (**Photo 10**). I used a lightly pigmented exterior oil-based



6

Create mortises for loose tenons in the rails, using a BeadLOCK jig or other mortising tool. BeadLOCK tenon stock fits the unique mortises shown here.

7

Mark the legs for mortising by transferring the layout lines from the panels. Each leg will have mortises on two adjacent faces.

8

Glue and clamp the legs to the side panels. Swab glue in the mortises and on the ends of each panel. Install the BeadLOCK tenons; then install the legs.

9

Complete the planter by gluing the end panels between the assembled sides.

10

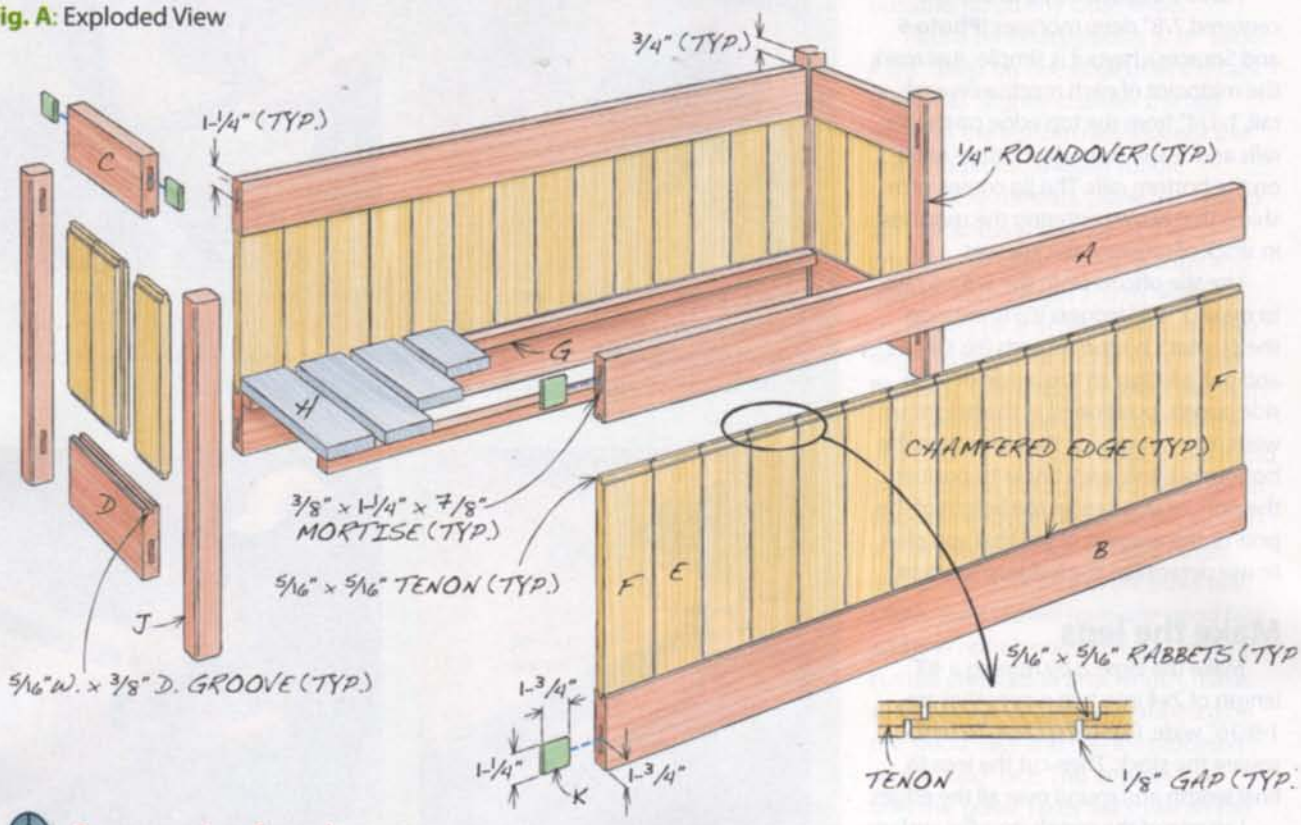
Apply an exterior stain to add color and protection from the rain and sun. Periodically reapply the stain to maintain the finish.

stain (see Sources). The pigment provides a measure of UV protection, so the finish lasts longer.

Place the bottom boards on the ledgers, leaving 1/4" to 1/2" between them for drainage.

Line the planter with heavy-duty plastic, poke some drainage holes, and fill it with soil; this is the perfect setup for a miniature herb garden. Or skip the soil and create instant color by filling the planter with potted flowers.

Fig. A: Exploded View



See more projects for gardeners at **AmericanWoodworker.com/WebExtras**

Cutting List

Overall Dimensions: 47" L x 12-1/2" W x 18-1/8" T

Part	Name	Qty.	Material	Th x W x L
A	Side top rail	2	Cedar decking 5/4 x 6	1" x 3-1/4" x 44" (a)
B	Side bottom rail	2	Cedar decking 5/4 x 6	1" x 3-3/4" x 44" (a)
C	End top rail	2	Cedar decking 5/4 x 6	1" x 3-1/4" x 9-1/2" (a)
D	End bottom rail	2	Cedar decking 5/4 x 6	1" x 3-3/4" x 9-1/2" (a)
E	Inside slat	26	Cedar 1 x 4	5/8" x 3-5/16" x 9-7/8" (b, d)
F	End slat	8	Cedar 1 x 4	5/8" x 3-5/16" x 9-7/8" (c, d)
G	Ledger	2	Cedar decking 5/4 x 6	1" x 1" x 43-3/4"
H	Bottom boards	10	Cedar 1 x 4	3/4" x 3-1/2" x 9-5/8"
J	Leg	4	Cedar 2 x 4	1-1/2" x 1-1/2" x 18-1/8"
K	Tenons	16	BeadLOCK tenon stock	3/8" x 1-1/4" x 1-3/4" (e)

Notes: **(a)** Rout a centered 5/16" w x 3/8" d groove in one edge. **(b)** Rout 5/16" x 5/16" rabbets on both edges. **(c)** Rout 5/16" x 5/16" rabbet on one edge. **(d)** Rout 5/16" x 5/16" tenons on both ends. **(e)** Miter one end of each loose tenon.

SOURCES

Rockler Woodworking and Hardware, www.rockler.com, (800) 279-4441, 3/8" Beadlock Basic Starter Kit, #34802, $29.99.

Cabot, www.cabotstain.com, (800) 877-8246, Clear Solution Transluscent Oil Finish, #3002 Cedar, $11.99 per qt.

Titebond, www.titebond.com, (800) 669-4583, Titebond III Ultimate Wood Glue, $13.99 per qt.

Rockwell, www.rockwelltoolsdirect.com, (866) 514-7625, Jawhorse, #RK9000, $178.

TaskHorse Brackets, www.taskhorsebrackets.com, (509) 745-8983, Tradesman Brackets, #THT-MP, $100 per pair, to make two sawhorses.

Brad Holden is a Minneapolis-based woodworker with a deep interest in making, restoring and using traditional tools.

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Benchtop CNC Lasers

When Epilog designed the Zing, a line of entry-level lasers, they didn't settle for entry-level quality. The Zings have the same precision and control as much larger models–features that have made Epilog one of the top laser manufacturers.

There's a lot you can do with a Zing. Custom-engraved and cut graphics are great ways to add distinction to your wood products and profits to your business. Cutting wood with a Zing lets you create intricate designs and highly detailed inlays. Users are not only engraving key chains–they're also making prototypes, building models, and putting their Zings to work in many creative ways.

Hooked up to your computer just like a printer, the laser cuts designs you create in a graphic software program. Set up your page size to the size of the piece you are engraving, create your image, and print it to the laser. A Zing will even engrave and cut the material in the same job!

Zings come in two basic sizes. The Zing 16 Laser features a 16" x 12" engraving and cutting area, high-speed stepper motors, a shielded roller bearing assembly on a ceramic-coated aluminum guide rail, waveguide laser tubes up to 40 watts strong, and standard USB and Ethernet connections. The Zing 16 is a great way to get started in the creative world of lasers, and a great tool for expanding your woodworking capabilities.

If you need more power to cut through thicker material or bigger capacity to work on larger projects, move up to the Zing 24 Laser. It has a 24" x 12" work area and more features, like radiance high-energy optics, laser head parking, heat-controlled cooling fans, an easy-access drop-down door, and power choices up to 60 watts.

New Rotary Attachment

The Zing 24 Rotary Attachment allows users to engrave on cylindrical objects. It turns the piece as it's engraved, giving you the ability to engrave 360° around the workpiece. It was designed with convenience in mind, so users can switch from one item to the next in seconds, without removing the attachment from the engraver. The attachment allows for accurate image scaling, so there's no need to input diameter or circumference calculations for different objects.

Cylindrical items such as flashlights, glasses, vases and mugs have always been popular items for customization, and highly profitable for engraving shops. Turners will appreciate the attachment for customizing their work. The rotary attachment can accommodate items up to 5-1/4" in diameter and is now available from Epilog Laser.

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with an Epilog Laser System

EPILOG LASER

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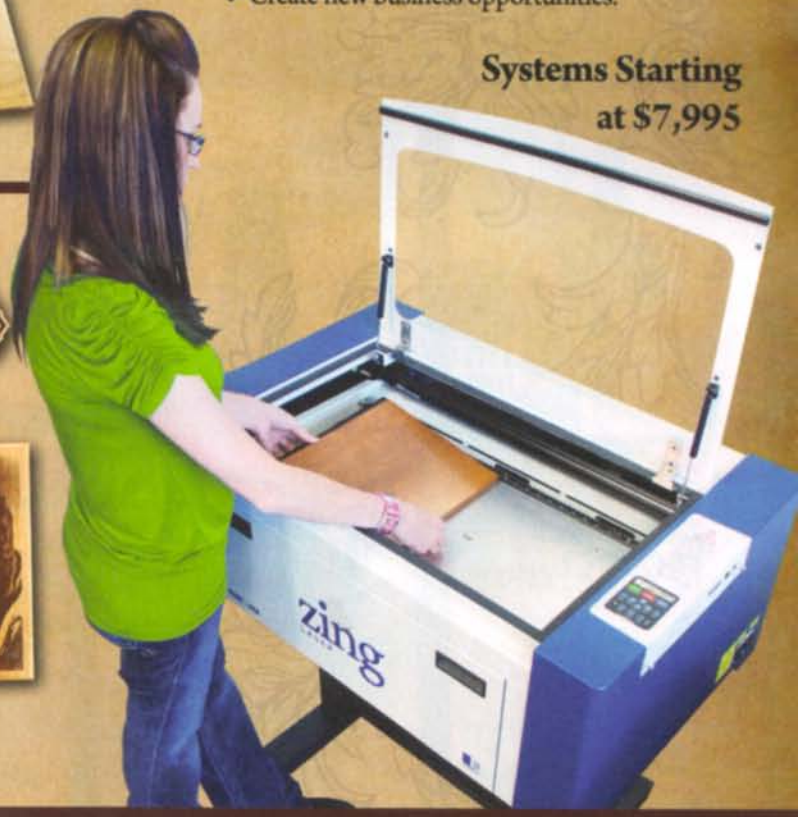

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Creative woodworkers need a variety of glues that dry fast, work with all varieties of wood, fill gaps, or bond to metal. With four types of glues to choose from, Gorilla has you covered.

Wood Glue

Gorilla Wood Glue is the go-to adhesive for most projects. It has a 5 to 10 minute open time and a 20 to 30 minute clamp time. Gorilla Wood Glue gets tacky very fast, so it works well in situations where you're concerned about parts slipping. It dries in a natural, wood color (unlike "yellow" wood glues). Gorilla Wood Glue is also water resistant (it's a Type II PVA glue), sandable and paintable.

Super Glue

If you're in need of a quick fix, check out Gorilla Super Glue. This CA glue sets in as little as 30 seconds, with no clamping required. Gorilla Super Glue bonds a wide variety of materials, including wood, metal, stone and rubber. With tiny rubber particles added to the formula for flexibility, this impact-resistant CA glue handles bumps and drops for a strong, long lasting bond, stronger than many other glues on the market. Gorilla Super Glue doesn't run on vertical surfaces, a plus for quickly bonding broken trim work.

Epoxy

Turn to Gorilla Epoxy for larger and tougher repairs. Gorilla Epoxy fills gaps, sets in just 5 minutes, and bonds steel, aluminum, wood, ceramics and more. Gorilla Epoxy is water resistant–a good choice for outdoor projects. Mixing Gorilla Epoxy isn't a matter of guesswork. You'll find it easy to dispense equal amounts of resin and hardener from the double syringe because the two ingredients have similar viscosities. Gorilla Epoxy is a cinch to make up in small or large quantities.

Polyurethane Glue

The original Gorilla Glue bonds many different materials, such as stone, metal, ceramic, foam, glass, and just about any other common building material you can think of. It is also ideal for bonding oily and exotic woods, where traditional wood glues might not work. It's waterproof–not just water resistant–so Gorilla Glue is an ideal choice for outdoor projects made from cedar, redwood, and other woods that are still pretty green. When cured, Gorilla Glue is sandable, paintable and stainable.

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The Future of Dust Collection

Oneida Air Systems

It seems everything today is getting smarter–like smart phones, smart cars and smart cameras. Now Oneida Air Systems has a new Smart Dust Collector series. These patent-pending cyclonic dust collectors are designed with intelligent and useful features that optimize dust collection from a wide range of tools–from planers and tablesaws to routers and palm sanders. It's a portable, one-machine solution for dust collection in a small shop.

The breakthrough in the Oneida Smart Dust Collector is a smart system which senses resistance and then increases pressure, always providing maximum possible airflow. The Smart Dust Collector optimizes dust collection from all tools, regardless of the size of their ports or poor duct/hood design. All of this is targeted at getting the most possible air through the hose & out at the woodworking tool in order to remove dust at the source–not allowing it to escape into the shop.

Conventional dust collection systems are designed for a narrow band of airflows and pressure ranges–and a narrow band of tools. Performance is diminished when collecting dust through flexible hoses, from problematic tools with small ports or through poorly designed ductwork systems. Typically, conventional portable collectors have a maximum vacuum of approximately 8-10 inches of pressure measured in water column. The Smart collector has a maximum vacuum of 26 inches! For example: a conventional 2 hp portable collector, connected to 10′ of 4″ flexible hose maxes out at 393 CFM. The 2 hp Smart collector connected to that same hose maxes out at 620 CFM.

The collector features a certified HEPA media filter (99.97% - 0.3 micron material). This ensures that even material too small to see stays in the filter and is not released back into the shop air and your lungs. It also has a Flame Guard Arrestor to keep you and your shop safe. The Flame Guard Arrestor will suppress or arrest a propagating flame front sparked by an ignition of flammable material in the air stream/ collector.

The Smart Dust Collector can also be used like a traditional shop vacuum with a 2″ hose to vacuum the floor with a wand– a new concept in a portable dust collector. It features an available drum overfill sensor with a strobe light, so you know when it's time to empty the drum. Its compact size makes it easy to move from tool to tool or store out of the way when not in use.

Oneida has a Smart Dust Collector to cover most shops. They're currently available in three sizes: 2 hp, 3 hp, and 5 hp. A 7 hp model is in the works for release later in the year. See more at www.oneida-air.com.

If you're looking for something at the other end of the technology spectrum, check out Oneida's very popular Dust Deputy, released last year. The ingenious design puts a small cyclone into the path of your shop vacuum, making it a two-stage dust collection system and saving you from having to clean shop vacuum filters. Most waste is filtered out by the cyclone into an easy to empty bucket before it even gets near the filter. More recently, Oneida launched their Ultimate Dust Deputy package complete with integrated bag hold down system which captures dust in an easy to empty plastic bag and can mount on top of Festool dust extractors or be used with any shop vacuum. See more at www.dustdeputy.com.

HOW SMART IS THE NEW SMART DUST COLLECTOR?

Let's just say, Mr. Einstein would have appreciated it.

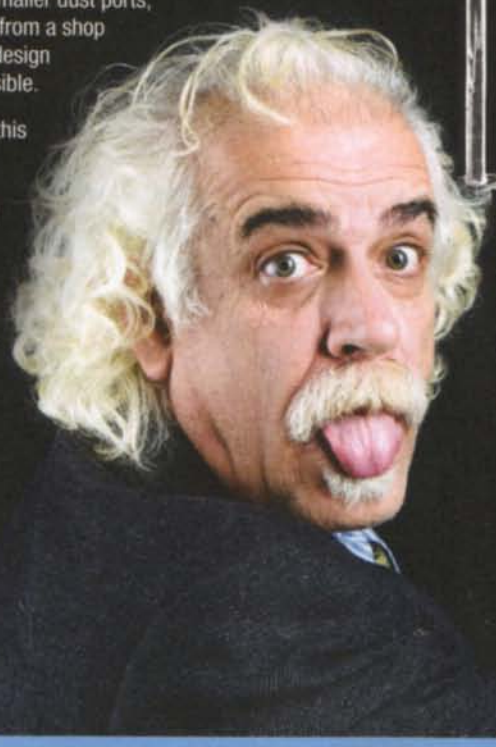
How's this for smart? The SMART system has infinitely variable performance, automatically adjusting suction to maximize dust collection at each woodworking tool. For shops like yours, there's simply never been anything like it. It's a breakthrough in dust collection technology that is unlike all traditional collectors.

You'll like the thinking behind our filtration system too. We thought it would be smart to combine the power of our high-efficiency cyclone with the proven performance of HEPA filtration. Greater than 99% of waste is pre-separated, and clean air is returned to the shop through GE H12 certified HEPA filter media.

And you can stow the shop vacuum away, because the Smart Dust Collector does it all, regardless of the size of ports or hoses. For large, 4-6" dust ports, it provides high air volume like a standard dust collector. And for small diameter hoses or woodworking tools with 3" or smaller dust ports, you'll get high suction, just like from a shop vac. It's a best-of-both-worlds design that collects the most dust possible.

Safety is enhanced as well, as this revolutionary unit includes a patent-pending Flame Guard Arrestor, with both passive and active fire safety features.

Learn more. Get smart. Contact Oneida, the experts in dust collection innovation.



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One-handed bar clamps with high clamping pressure are ideal for quick glue-ups and assemblies. With sizes ranging from 6" to 36" long, EZS clamps work well for all kinds of projects, from jewelry boxes to kitchen cabinets. And, the foot and head are covered with removable non-marring pads to protect your work.

If you need more clamping pressure–gluing up a table top, for example–Bessey's Vario K Body REVO clamps provide up to 1500 lbs. of force. Both the head and foot are moveable, so you can balance the clamp on your work. The jaws of the new clamp also boast 30% more clamping surface than the previous-generation K Body clamp. They're covered with removable, non-marring, glue-repellent caps. With a wide, long jaw design, the clamps have more reach and there's less chance that the clamp will slip.

Additional clamping heads (KR-J2K), feet (KR-VO) and rail extensions (KBX20) are available for the REVO, meaning you can add an extra foot or head or extend the length of your clamp. The rail extensions allow you to join together any combination of rails, heads, and feet to do some serious clamping. Imagine gluing up five sets of drawers with a single clamp system, fully parallel, with up to 1500 lbs. of pressure!

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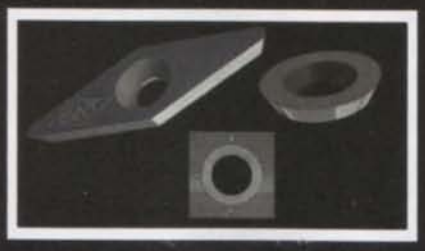

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Four Air-Powered Sanders

DYNABRADE

The "Take About" Sander features a heavy-duty, 1.3 hp motor for aggressive material removal. The tool features a 3" x 24" abrasive belt, a pistol-grip handle and top control knob. It runs at 12,000 rpm and weighs 12.5 lbs. It's ideal for use with coated abrasive belts., but also works well with non-woven nylon belts (for stainless steel).

The Dynaline In-Line Finishing Sander produces 2,400 strokes per minute for in-line sanding applications on a variety of materials, including wood and stainless steel. It features a 2-3/4" x 8" long sanding pad that is weight-mated to the tool, making the tool easier to use with low vibration and smooth operation. It weighs in at just 2.6 lbs.

The Dynafine Finger Sander features an offset sanding arm approximately 3/4" wide x 2" long. With its unique shape and orbital motion, the sander is particularly useful for sanding hard-to-reach places. It's great for those difficult but often-necessary sanding tasks, like sanding between wooden shutters or molding details. The tool runs at 15,000 rpm and features a 1/32" dia. orbital pattern.

The Dynafine "Backsplash" Sander is designed for use on coved backsplashes and other solid surface materials. It weighs only 1.6 lbs and runs at 15,000 rpm. The sander comes with a 3/8" radius bullnose backsplash pad and a 3/4" concave radius pad. Other profiles are available separately or in a kit, which includes the tool, all five sanding pads and pads for PSA mounted abrasives.

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Making dovetails is often a difficult, two-part process. First, you need to precisely lay out your pins and tails. Second, you need to accurately cut those matching angles. Fortunately, Peachtree Woodworking Supply has done most of the layout work and the math for you. They have milled the exact cuts that need to be made in an aluminum, heavy-duty, and easy-to-use dovetail jig. The key to the Peachtree system for making through dovetails is the use of precision bearing guides on the shank of the router bit instead of brass bushing guides commonly used with other dovetail jigs.

The jig will work with two different thicknesses of stock at the same time. And, it doesn't limit your stock width. You simply make your first cut, slide the jig down, realign and make your second cut. Or you can attach a second 15" Peachtree Dovetail Jig with tabs (sold separately) and make the longer width cuts all at once without moving the jig. For a unique joint, you can also skip a space on the jig. This means the types of projects you can do with this jig are virtually endless!

Setting up to cut the joint is fast and easy because the bearing is already centered on the bit. Peachtree has milled the aluminum template to match the bearing size so that the bit is perfectly centered and there is no slop, no wear and no waste.

The Kit includes a 15" Aluminum Dovetail Jig, a 1/4" shank 7° dovetail bit with bearing, a 1/4" shank 5/8" straight bit with bearing, and full color instructions. The bits that come with the Peachtree Dovetail Jig will cut dovetails in stock from 1/2" to 3/4" thick. Optional router bit sets are available for thinner stock or box joints. The jig can be used with a 1-1/2 hp hand held router or on a router table.

The Peachtree Dovetail Jig Clamping Kit (sold separately) includes two sections of Mini T-Track and two 1/4" T-Track Hold Downs with non-marring rubber pads. The kit allows you to build a base for your Peachtree Dovetail System with a standard piece of 3/4" stock (not included).

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The Johann Eberhard GmbH manufactures premium tools for professional applications, sold worldwide, in modern, highly-engineered and automated facilities in Europe. With its production facility based in Austria, and subsidiaries in France, Johann Eberhard GmbH specializes in the manufacture of boring and routing tools for woodworking. Around 100 skilled workers produce drilling and routing tools of the highest quality for industry, trade and do-it-yourselfers.

At every stage of the manufacturing process, quality has top priority.

All FISH-Tools by Johann Eberhard GmbH are made out of the best raw materials, either by the traditional method of forging and giving the tool its geometric shape, or by chipping. One of FISH-Tools' secrets is that all their Forstner bits are still forged in the traditional way. Through high-quality European steel processing, Johann Eberhard GmbH ensures the consistent high quality of materials for their products.

Johann Eberhard GmbH manufactures premium tools with state-of-the-art, CNC-controlled production machinery. Its loading systems and robots result in the highest precision in production. The final quality control guarantees a product consistent with Eberhard's slogan: "quality, precision and strength since 1946."

In addition, the Eberhard group has for many years implemented a quality management system in conformity with DIN ISO 9001:2008. The continuous improvements of their company processes are part of the reason why their international customers are so satisfied with their products. The Johann Eberhard GmbH, with its FISH-Tools brand, guarantees 100% product quality, 100% supply readiness, excellent customer service, and custom products made according to customer needs.

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One of Penn State Industries' most popular sets is the Advanced Pen Making Starter Set, which includes a 1 hp, cast-iron base Turncrafter Commander midi lathe. This lathe has a generous 12" swing, variable speed control, a work light and a bed with an 18" capacity. The set comes with enough accessories, tools, supplies and blanks to make 40 Slimline wood pens and pencils (Penn State's most popular pen style). The Turncrafter Commander midi lathe is powerful enough for you to move on to more advanced turning projects–such as bowls, spindles, and bottle stoppers–when you are ready.

Penn State Industries also has a huge selection of pen kits and wood and acrylic materials, along with just about anything else you'll need for your pen-turning journey. Your friends and customers will marvel at the handmade beauty of a turned pen. Just don't tell anyone it took you only 15 minutes to turn your masterpiece!

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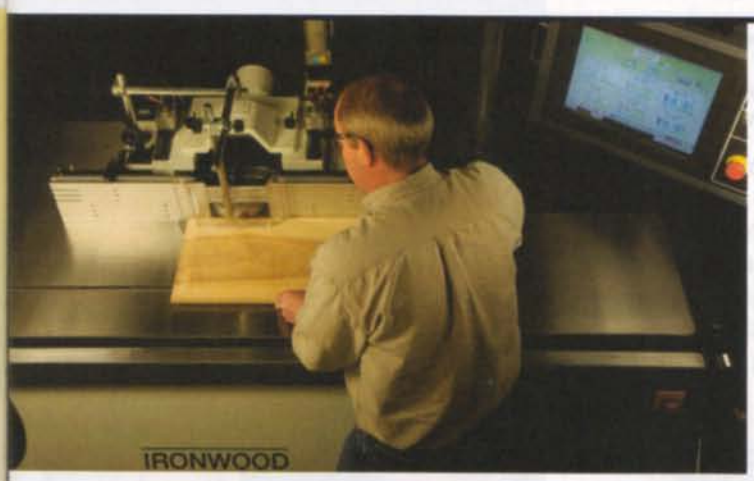
For 45 years, Stiles Machinery has taken pride in playing a role in being a total production solutions provider, offering new technology, well-engineered equipment and strong customer support. This year, Stiles Machinery is embarking on a new, exciting path by launching a full line of Ironwood classical equipment for small-shop woodworking. Stiles intends to make Ironwood the new name to remember for quality.

The New Ironwood Line

Stiles first introduced the Ironwood line in 2009 with boring and drilling equipment and straight-line rip saws. This year, Stiles introduces its series of jointers, planers and shapers to join the Ironwood brand. These machines offer quality equipment for the right price. The Ironwood products are distributed through the Stiles Shop Solutions division, dedicated to helping entrepreneurs and small businesses in the woodworking industry.

Classical pieces of equipment are true woodworker's tools, those that require a hands-on approach to achieve quality craftsmanship. From apprentice to professional, woodworkers using classical equipment share a devotion to creating finished pieces that exemplify fine workmanship.



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If you've ever seen a CNC router in action, you know that it's capable of quickly and precisely machining parts and pieces for just about anything. But, if you're a small shop owner, you've probably had second thoughts about its size and affordability. Well, Shopbot has listened to requests for a more compact and inexpensive machine, with the same usability of their larger machines. And they've delivered.

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The Tyro comes with Shopbot's PartWorks software, the same software packaged with their larger machines. It's perfect for learning the basics of CNC machining without having to invest in a large machine. This makes the Tyro great for schools and shop programs. The Tyro could be the machine that takes your woodworking to the next level.

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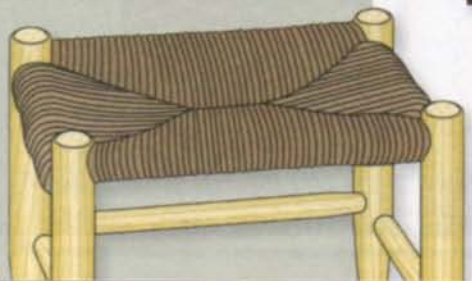

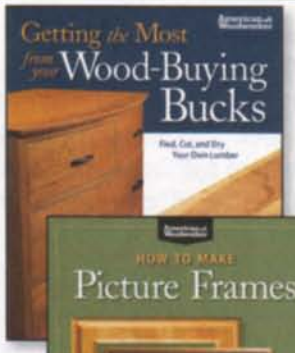

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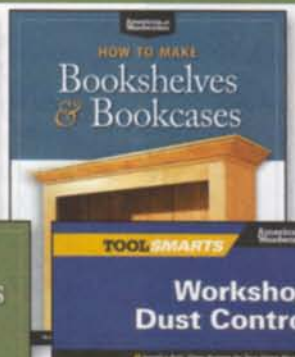

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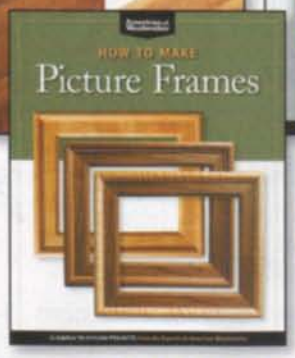

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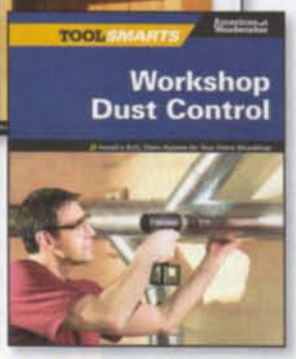

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Keepsake Trunk

As special as the treasures it will hold.

by Garrett Glaser

AN OLD, NEARLY DISINTEGRATED STEAMER TRUNK in my grandfather's basement held forgotten treasure—letters, photos, and a hand-written recipe for figgy pudding from my grandmother's early life on a Kansas farm during the depression. Not pirate's gold, of course, but treasure to me, nonetheless. So, when a gentleman asked me to design and build a dozen keepsake trunks for his twelve grandchildren, I leapt at the chance. "Who knows what treasures will get stashed in these trunks?" I thought.

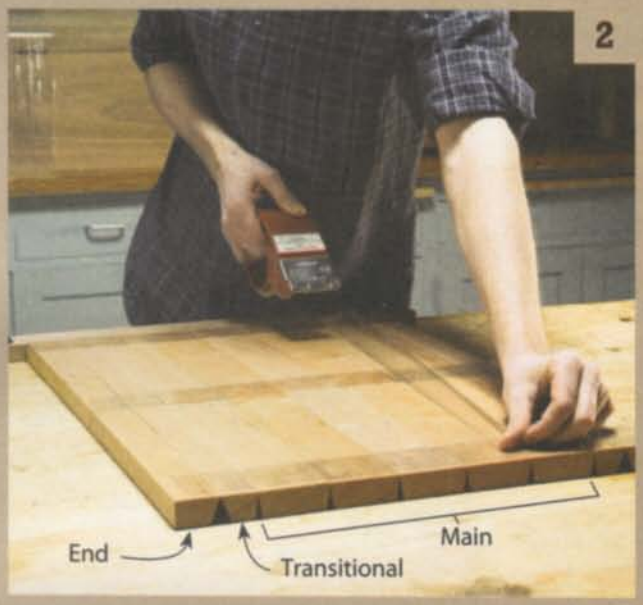
The trunk's rounded lid is made by gluing together narrow strips with beveled edges (called "staves"). I chose Luan (Philippine mahogany) for the strapping, because it responds very well to hot-pipe bending, the method I used to mold it to the arched top. I used the tablesaw and bandsaw to cut the finger joints.

You'll need only about 14 bd. ft. of 4/4 lumber to build this trunk. Although it's no crime to glue together narrow boards, I think the trunk looks best when its sides and ends are made from single, wide boards. As these pieces are fairly short, it's worthwhile to check out the #1 Common pile at the lumberyard. You may find beautiful wide boards that were downgraded just because they have a defect smack in the middle. Paying considerably less per board foot is always nice, too.

EDITOR: TIM JOHNSON | PHOTOGRAPHY: JASON ZENDER | ILLUSTRATION: FRANK SCHUMA

1

Start by beveling the edges of the pieces that make the curved lid. These pieces are called "staves."



2

Arrange the staves in order and use tape to hold them together for gluing. Flip over the assembly and drizzle glue into the open seams. Then draw the assembly together, using tape to close the seams and form the lid.

3

Confirm the lid's 12" width. Packing tape is elastic, so you can make slight adjustments to the width by changing the amount of tension on the tape. If your lid ends up to be a different dimension than 12", simply alter the box dimensions to match.

Bevel the staves

The lid's beveled staves form a faceted arch when they're glued together. (The facets disappear later, when the top is rounded.) Cutting the bevels is fussy, because even a 1/10° variance in the angle, repeated over nine staves, will change the shape of the lid's curve and its overall width. But don't worry. Just plan to build the box to to match the lid's dimensions, whatever they end up to be. The bevel angles are specific to 1/10°, so I recommend using a digital angle finder to set up your tablesaw (see Sources, page 46).

Start by planing blanks for the staves to 13/16" and ripping them 1/8" oversize in width. Note that there are three types of staves: main, transitional and end (A–C, Fig. A, and Cutting List, page 46). Stack and sticker the blanks overnight, or longer, to let them acclimate–toss any that bow or twist. Bevel the edges of the "true" staves (**Photo 1** and Fig. B). Then crosscut them to length.

Glue the staves together

Lay out the staves in order, wide side up. Make sure that the transitional staves (B) have the shallow (7.8°) bevel towards the center and that the grain in every piece runs in the same direction–this will reduce the risk of tear-out later, when the facets are rounded.

Carefully align all the ends and make sure there are no gaps between staves. Then secure the assembly with clear packing tape (**Photo 2**). Plastic packing tape works better than masking tape: It's more elastic, so you can pull the joints tight, it reveals the entire joint, and it costs less. First, tape across both ends and in the middle. Next, tape the length of each seam. Rub down the tape with a plastic burnisher or a library card. When you lift the middle stave, the arch should automatically form, by hanging down on both sides.

Flip over the stave assembly, so the open seams face up, and drape the assembly over an upside-down bowl, to fully open the seams. Drizzle a bead of glue into each open seam, making sure that it gets all the way into the point of the "V". The glue will get squeezed away from that point when you pull the

assembly together. Pull the assembly into an arch, and hold it together by adding more bands of packing tape. Check the width and make adjustments, if necessary (**Photo 3** and Fig. B). Remove the tape after the glue has dried.

Rout a rounded lip

Make a jig (Fig. C) to rout a lip for the end cap (D) around the inside of the lid's arched ends.

To make the jig, draw vertical and horizontal lines centered on a 15" square piece of MDF (Fig. D). Stand the lid on end and place it on the MDF, so that its bottom edges rest on the horizontal line and the vertical line bisects the center stave.

Trace both sides of the lid's faceted shape onto the MDF. Using the vertical centerline, strike a long arc that intersects the points on the inside edge where the staves meet. This arc will extend about 1/16" above the bottom edge of each of the five main staves at their centers.

Draw a vertical line 1/16" inside the inner edge of each end stave. Continue these lines all the way to the bottom of the MDF. Strike a small arc inside each corner, to ease the transition between the large arc and the vertical line.

Precisely cut out the arched shape you've drawn and sand it smooth. Glue blocks along the outside profile to precisely position the lid on the jig.

Stand the lid on end and clamp it to your bench. Install a flush-trim bit in your router and set its depth-of-cut to match the end cap's thickness. Clamp the jig on the lid and rout the rabbet (**Photo 4**).

Cut finger joints

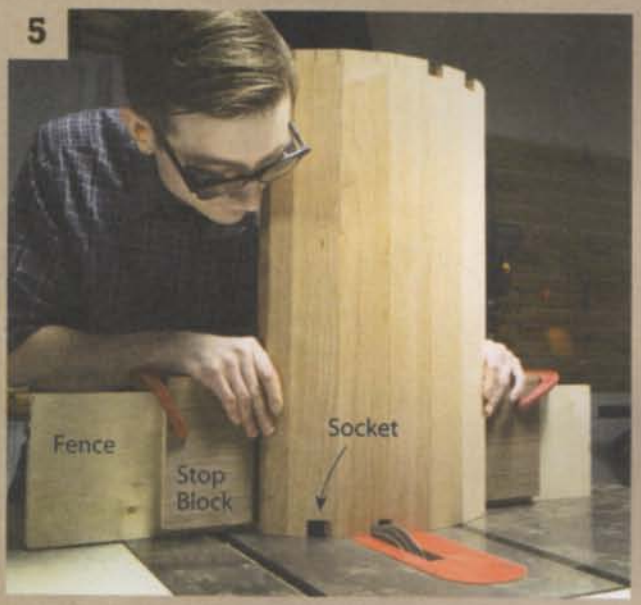
Lay out the finger joints on one end of the lid (Fig. E), and clearly mark the four sockets that you'll be cutting out. Use a dado set and a miter gauge equipped with a tall sacrificial fence to make the cuts (**Photo 5**). The sockets are wide enough to require two passes to complete. Position the lid against the fence, align the dado set with the first layout line and set the first stop block. Shift the lid to align the opposite layout line with the dado set and set the other

Use a jig to rout an arched rabbet inside both ends of the lid. This rabbet rounds the lid's inside edge, so that when the end cap is installed, the lid will appear to bend around it.

4

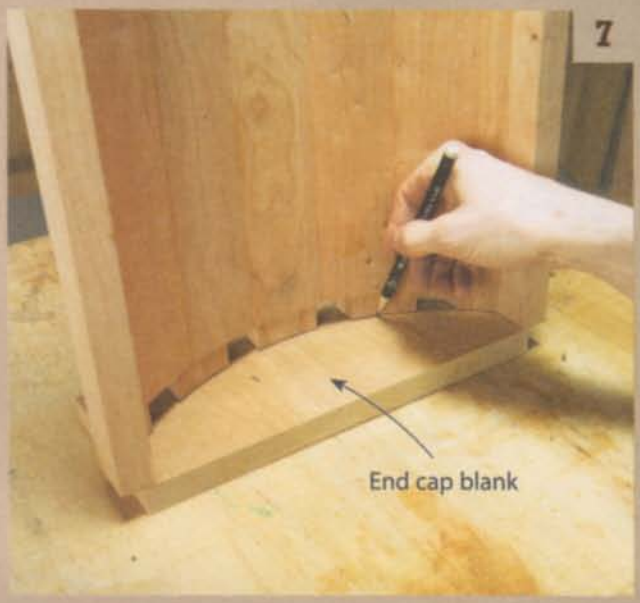
Cut finger joints in the lid, using a miter gauge with a tall fence. Two sockets (one in each end) can be cut from each setup. Reposition the workpiece and the stop blocks after cutting each pair.

5

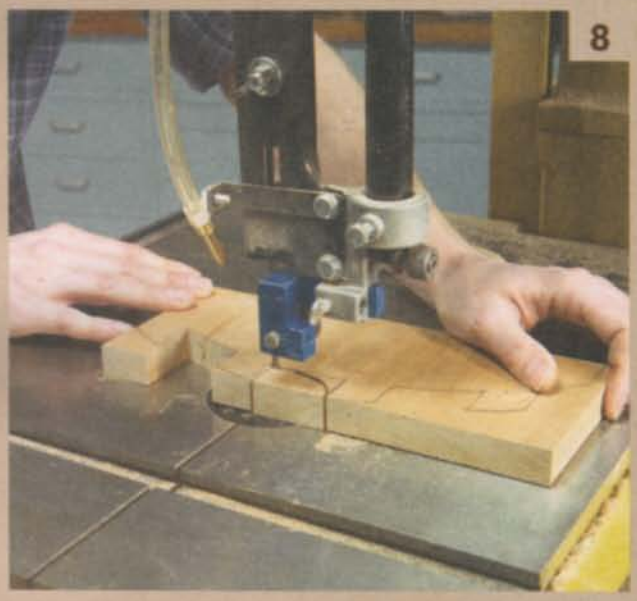


Round the top by removing all the high spots. Use your hands to find irregularities in the curve that need additional attention.

6



Transfer the lid's round shape and finger locations onto each end cap blank.



Saw out the fingers and rounded profile on each end cap. Use a fine-tooth blade and cut to the outside edges of your marks.

Cut finger joints in the box sides. The setup is similar to the one used earlier, but this time the sockets are only 1/2" wide, so you only need one stop block, and you can cut four sockets from each setup.

stop block. Raise the dado set to make a 3/4" deep cut. Bear against one stop block to make the first pass and against the other block to make the second pass. Flip the lid end-for-end to cut the same socket in the other end. Then reposition the lid and the stop blocks to cut the next socket. Four different setups are required to complete all of the sockets.

Complete the lid

Use a hand plane to round the lid (**Photo 6**). If you use a belt sander for this step, wait until you've glued on the end caps.

Position the lid on each end cap blank, flush at the bottom. (Note that the grain runs vertically on the end caps.) Then transfer the lid's edge profile (**Photo 7**). Carefully bandsaw the profile, cutting on the waste-side edges of the lines you've drawn (**Photo 8**).

The joints probably won't slide together perfectly when you first dry-fit the end cap. I use the bandsaw, chisels and a 1" wide stationary belt sander to fine-tune the trouble spots. When the fit is satisfactory, glue in the end caps and sand the protruding fingers flush.

The box

Measure the length and width of the completed lid and build the box to those dimensions–change the dimensions in the cutting list accordingly, as necessary. Cut the box sides and ends (E and F) to final size. Lay out the finger joints on one of the side pieces (Fig. F). Then cut the sockets, using a setup similar to the one used earlier to cut the lid (**Photo 9**). At each setting, flip the board over and rotate it end-for-end to create four perfectly symmetrical fingers. Be sure to cut sockets in both side pieces before you change each setting.

Mark the sockets on a test end piece (**Photo 10**). These sockets are wide, so you'll have to set two stops and make two passes to complete each one. Use the test piece to set the stop blocks and test-cut each socket before you commit to the real end pieces. As with the side pieces, you can cut four sockets from each stop block setting.

Make a super-strong bottom by

gluing together two pieces of 1/4" luan plywood (G; note: 1/4" plywood is usually about 3/16" thick). Glue the pieces A-sides-out, and you'll create a bottom that looks good on both sides. Rout 3/8" wide grooves for the bottom in the box ends and sides—the grooves in the sides are stopped, so they don't ruin the finger joints. Install the bottom and glue the box together (**Photo 11**).

Cut a mortise for the escutcheon (see Sources) in the front of the box. The escutcheon is purely decorative, unless you decide to install a lock. Cut mortises for the hinges in the back of the box and in the back of the lid.

Bend the straps

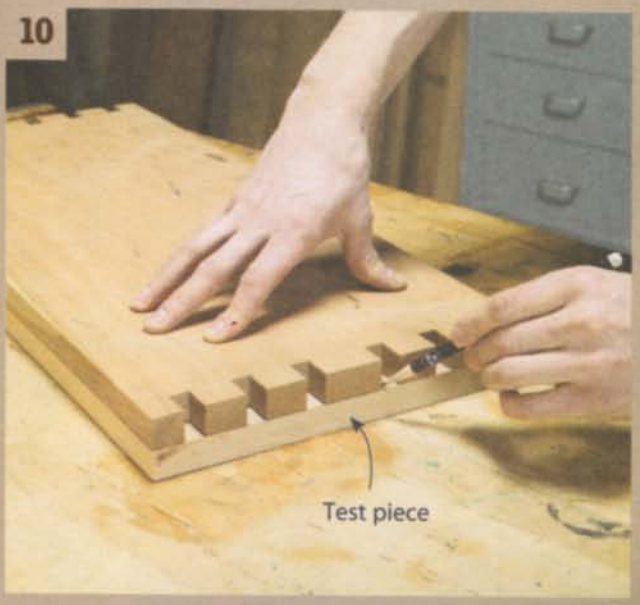
Re-saw a pair of long blanks to make the straps (H and **Photo 12**). Remove the saw marks by planing or sanding to final 1/8" thickness.

Cut each strap blank into the pieces that will wrap around the box and lid (J–L). Cut the lid straps (J) about 4" long, to facilitate the bending process. Mark the back sides of these pieces, to keep them correctly oriented. Use a permanent marker, so the marks don't disappear during the bending process.

Soak the lid straps in water overnight. If you don't have a large enough container to completely immerse the straps, wrap them in a soaking wet towel sealed in a plastic bag. Then use a hot pipe to bend the straps to match the curves of the lid (see "Hot Pipe Bending," page 47 and **Photo 13**).

Fit the lid's first sharp curve by bending the strap about a third of the way around the pipe. Nest the bent strap at the first curve, roll it over the lid (without sliding) and mark in pencil where the second sharp curve will start. Then create the larger, more gradual arc by bending a series of micro-curves (**Photo 14**). When the strap fits around the lid all the way to the pencil mark, make the second sharp bend. Both sharp bends need to be accurate, but it's okay if the larger arc is a little off–nailing will draw the strap tight against the lid. When the straps have dried enough so that they can be sanded smooth, they're dry enough to be installed. Nailing the straps to the lid takes care of any springback.

10



Transfer the finger and socket locations from the box side to a test piece that's exactly the same width and thickness as the box ends. Use this test piece to verify the socket locations before cutting the real end pieces.

11

Glue the box together. Use toothed cauls on both sides of each joint to make sure all of the fingers are fully seated.

12

Resaw two long blanks to make the straps. Crosscut each blank into five pieces, preserving their order and orientation, so they'll appear to wrap around the box.

13

Bend each strap over a hot pipe. Use a sponge to keep the strap wet and apply steady, gentle pressure. Rock the strip slightly against the pipe until you feel the wood relax. Then increase the pressure.

14

Shape each curve gradually, stopping often to check the fit.

15

Fasten the lid straps with nails through pre-drilled holes. First, drive in nails near the ends. Then drive in the rest randomly, checking and adjusting the strap's placement as you go.

Install the straps

Clamp the bent straps in place on the lid. Then mark the edge of the lid in the front and the top of the hinge mortise in the back. Remove the straps and use the marks to determine the spacing of the decorative brass nails that are used fasten the straps (Fig. F and Sources). Mark and pre-drill 5/64" dia. holes for the nails in all of the strap pieces. To allow seasonal movement, lengthen the holes vertically (following the grain) to about twice their width, by waggling the drill bit back and forth in the hole. You might want to try this move out on a piece of scrap first–too much waggle and the hole won't be covered by the nail head.

Finish-sand all the parts. Then clamp the lid straps in place and drill centered 1/16" pilot holes in three of the elongated holes in each strap, one near each end and one in the center. (If you drill all of the holes right away, some of them may not line up properly as the strap draws tight to the surface of the lid.) Hammer nails into the three holes, checking the strap's position as you go (**Photo 15**). When you are sure the strap is correctly seated, drill pilot holes and hammer in the rest of the nails.

Trim the straps flush with the edge of the lid in the front and the top of the hinge mortise in the back. Place the lid on the box and use the lid straps as guides to mark the locations of the box straps (K). Install the box straps. Then install the wraparound straps (L).

Final details

Cut out the feet (M). Rabbet two adjacent top edges, so the feet will nest inside the bottom of the trunk. Gently round the remaining edges. Drill shank holes in the box bottom and attach the feet with pan head slotted screws.

I applied a Danish oil finish. If you plan to finish your box with a film finish such as polyurethane, apply it before you attach the straps; otherwise it will be difficult to avoid drips. You won't have to sand around all those nail heads between coats, either.

Install the escutcheon, the hinges, the lid stay, and the chest lifts (see Sources), and your trunk is ready for treasure.

Fig. A Exploded View

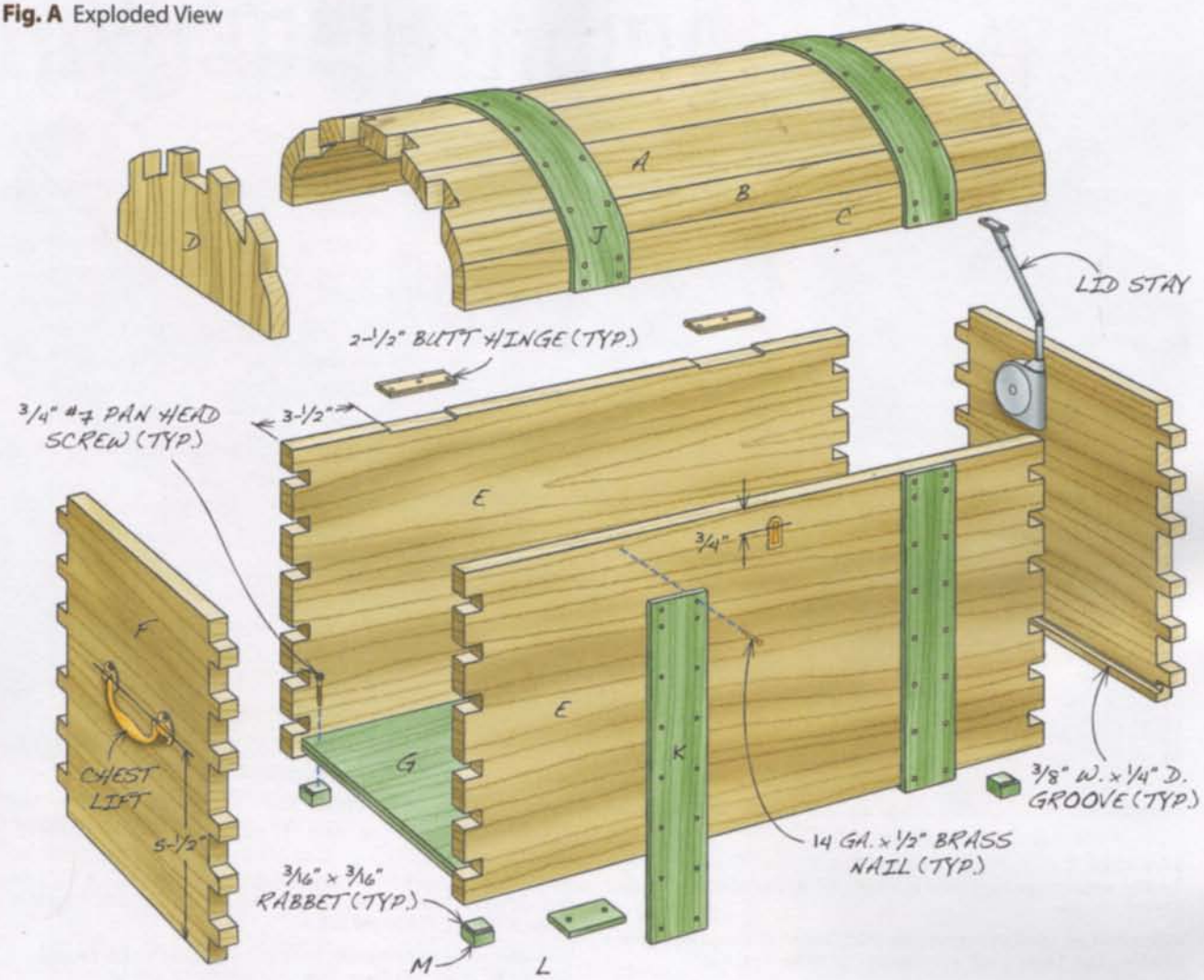


Fig. B Lid Staves

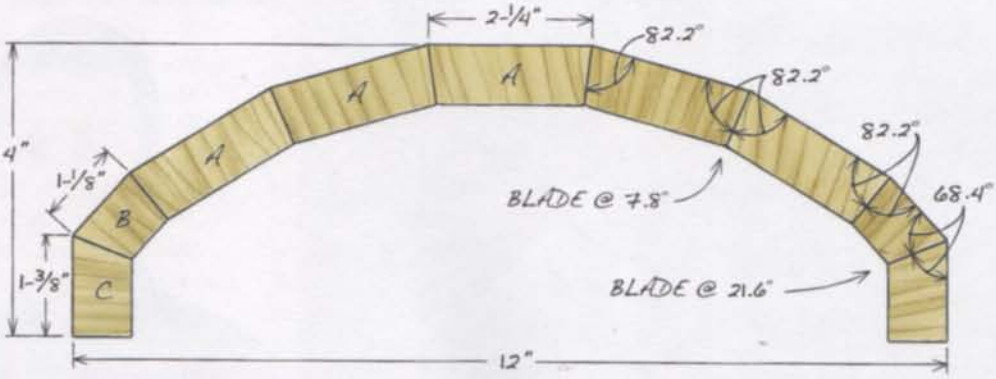


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Fig. C Routing Jig

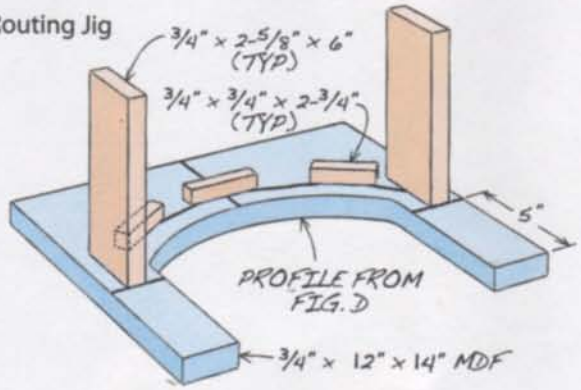


Fig. D Routing Jig Layout

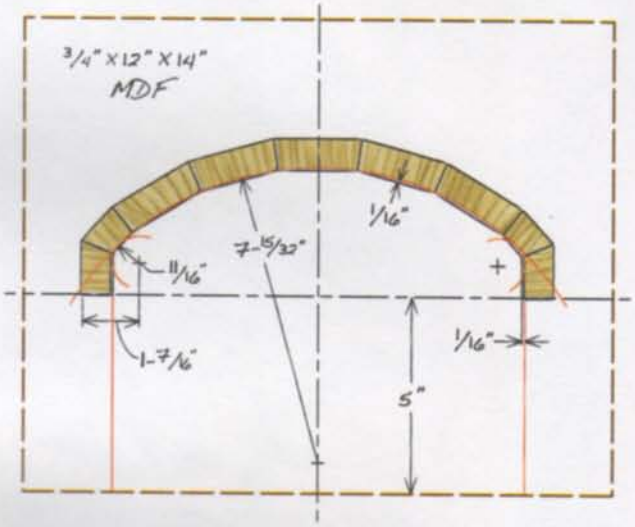


Fig. E Lid Sockets

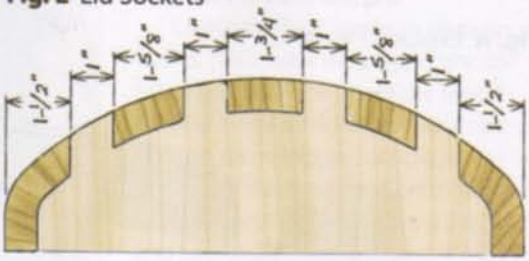
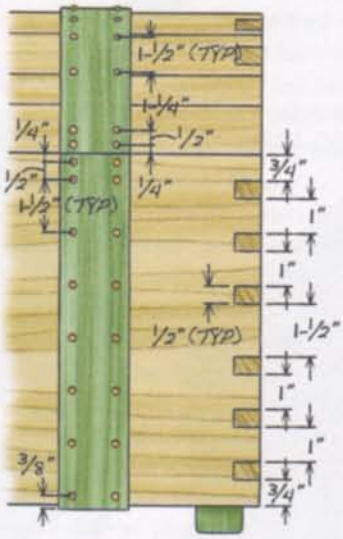


Fig. F Front View



SOURCES

Rockler, www.rockler.com, (800) 279-4441, Wixey Digital Angle Gauge, #27487, $39.99.

McMaster-Carr, www.mcmaster.com, (330) 342-6100, Brass Decorative Finishing Nail, 14 ga. x 1/2", #97936A161, $3.88 for a pack of 125 nails.

Horton Brasses, www.horton-brasses.com, (800) 754-9127, 4-1/2" Cast Brass Rosette Chest Lifts, #H-558L, $11.50 each; 2-1/2" Solid Brass Butt Hinge, # PB-409, $14.00 per pair.

Lee Valley, www.leevalley.com, (800) 267-8735, AB Flat Key Escutcheon, #01A49.09, $2.40; Soft-Down Flap Stay, #00T02.10, $20.40.

Cutting List

Overall Dimensions: 22" L x 12" W x 14-3/4" H

Part	Name	Qty.	Material	Th x W x L
A	Main stave	5	Cherry	13/16" x 2-1/4" x 22" (a, b)
B	Transitional stave	2	Cherry	13/16" x 1-1/8" x 22" (a, c)
C	End stave	2	Cherry	13/16" x 1-3/8" x 22" (a, d)
D	End cap blank	2	Cherry	3/4" x 4-1/4" x 10-3/4" (e)
E	Box side	2	Cherry	3/4" x 10" x 22"
F	Box end	2	Cherry	3/4" x 10" x 12"
G	Box bottom	2	Plywood	1/4" x 11" x 21" (f)
H	Strap blank	2	Luan	1/8" x 2" x 41" (g)
J	Lid strap	2	Luan	1/8" x 2" x 19" (e)
K	Box strap	4	Luan	1/8" x 2" x 10-1/4" (e)
L	Wraparound strap	4	Luan	1/8" x 2" x 3/4"
M	Foot	4	Luan	15/16" x 1-5/16" X 1-5/16" (h)

Notes: (a) Width is measured on the top face. **(b)** Both edges slope at 82.2°. **(c)** One edge slopes at 82.2° and one edge slopes at 68.4°. **(d)** One edge slopes at 68.4°. **(e)** Cut to fit. **(f)** Plywood thickness is nominal. **(g)** Each part H is cut, in order, into: L, K, J, K, L. **(h)** Rout 3/16" x 3/16" rabbets on two adjoining top edges.

Garrett Glaser is a furniture maker who lives and works in St. Paul, Minnesota. To see more of Garrett's work, visit: **www.garrettglaser.carbonmade.com.**

Hot Pipe Bending

by Garrett Glaser

Shape wood with a propane torch.

The pipe is ready when water droplets bounce off the surface. If the droplets stick and boil, the pipe isn't hot enough.

This bending method resembles blacksmithing, because each piece is shaped to fit, one curve at a time.

HERE'S A SIMPLE, BUT EFFECTIVE WAY TO BEND THIN STOCK (1/4" thick or less). The only tools you need are a length of 1-1/2" galvanized pipe, a propane torch, a jig to hold them both, and a fire extinguisher–just in case. The pipe is attached to a flange through a hole in 3/4" plywood. A jig securely holds the propane torch (**Photo**, above). This jig rests on the bench and clamps in a vise.

Any woods that take to steam bending are suitable for hot pipe bending, including oak, ash, elm, hickory, beech, birch, maple and walnut. Although there are exceptions, most softwoods and exotic woods are not good candidates. In general, air-dried wood bends more easily than kiln-dried wood. Kiln drying "sets" the adhesive compound between the wood fibers (called lignin) in a way that makes it resistant to the softening effects of heat and moisture. This doesn't mean kiln-dried wood is impossible to bend; bending it is just more difficult.

Always start by making test bends, using extra pieces from the same batch of blanks that you've prepared for the real McCoy. Having plenty of extra blanks is important, because you never know where a hidden weakness might lie, and watching a piece break when you don't have a spare is a real bummer.

Soak in water overnight the pieces that you plan to bend. If you don't have a large enough container to completely immerse the pieces, wrap them in a soaking-wet towel sealed in a plastic bag.

Ignite the torch, adjust the flame to low, and clamp the torch into position on the cradle, with its nozzle 1" or so inside the pipe. It will take a few minutes for the pipe to get sufficiently hot. Test by dripping water onto the pipe. If the water boils in place, the pipe isn't hot enough. When the water skitters off, you're good to go (**Photo**, top right).

To create a tight curve, slowly rock the strip against the hot pipe with a seesaw motion and apply steady, gentle pressure until you feel the wood relax. Then increase the pressure. When the bend is near the end of the strip, hold the strip with Vise-Grip pliers to protect your hand from the hot (really, really hot!) pipe. To create a larger, more gradual curve, move the strip along the pipe in 1/2" increments, applying five to ten seconds of pressure in each spot, just enough to feel the slightest bend. Check the fit as you go (**Photo**, above). To unbend a curve that's too sharp, simply flip the strip over. To make S-curves, work both sides of the strip.

To keep from scorching the wood, lift the strip off the pipe every fifteen seconds (or any time the surface near the pipe begins to look dry) and quickly rewet it with a sponge before continuing. A little scorching is okay if the damaged surface will be hidden. But scorching can also ruin a piece; at the very least, it'll require additional sanding.

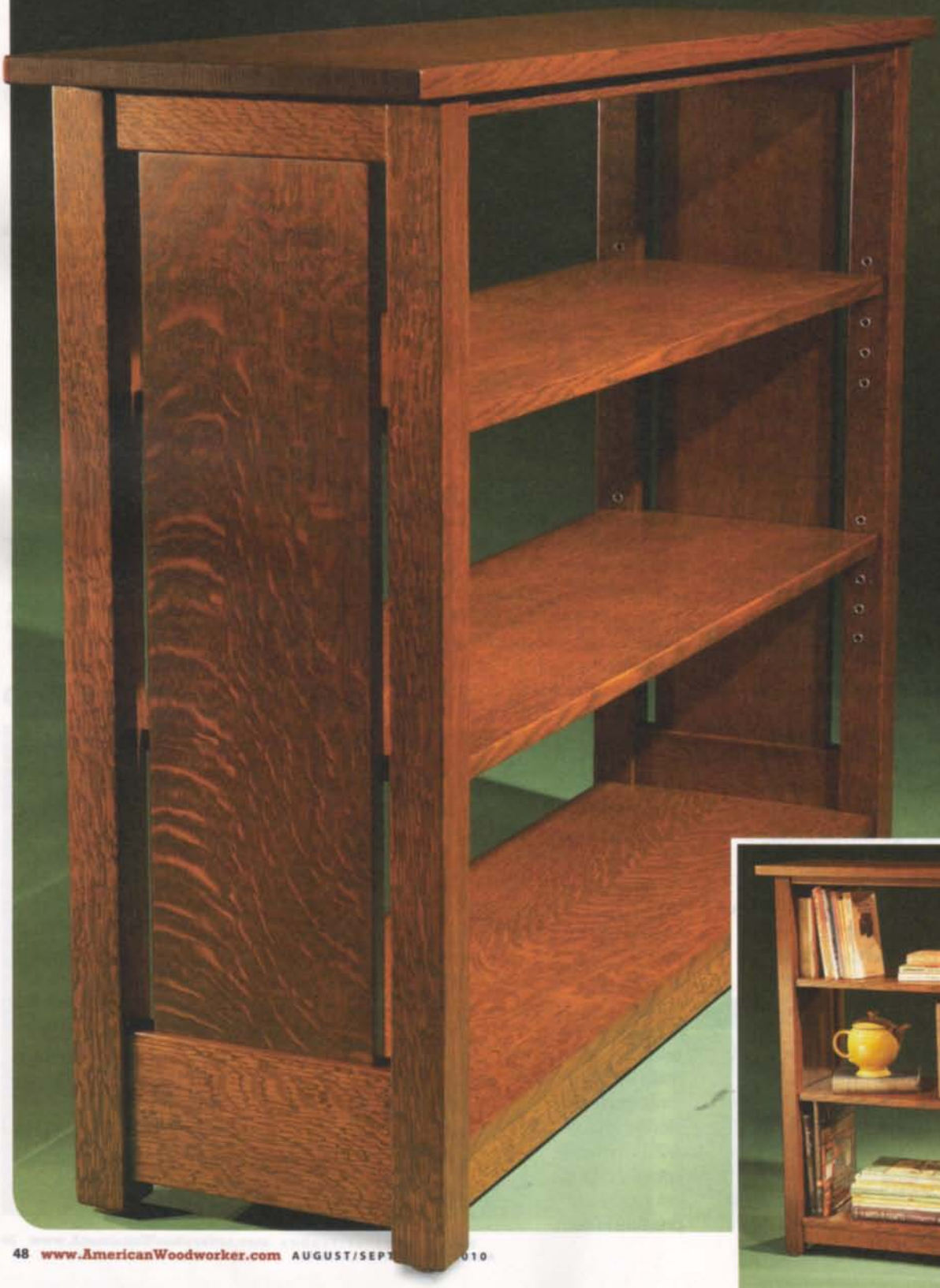
As with steam bending, springback is likely to occur as the pieces dry. How much the piece moves depends upon a number of factors, including the type of wood used, the character of its grain, and the whims of fate.

To see hot pipe bending first-hand, visit **www.AmericanWoodworker.com/WebExtras**

Stickley Bookcase

How to build a strong bookcase without a back.

by Laurie McKichan



WHEN I'M DESIGNING FURNITURE, I often turn to the Arts and Crafts era for inspiration. I love this style. It's simple, but elegant. When a client commissioned me to build a small bookcase, I knew exactly what to start with: a photograph of a piece built by L. & J. G. Stickley around 1904.

This Stickley bookcase was perfect for my clients' modern condo. They wanted a bookcase with an open back, so it could be accessed from both sides and used as a room divider. I changed the Stickley piece's dimensions and design a bit, but kept the distinctive look of its side panels.

As it turned out, my clients moved just as I was completing their bookcase. They didn't need a divider in their new living room, but they did need a piece to fit behind their sofa. The bookcase was a natural. It's proven to be a very versatile design!

Materials and tools

I built this bookcase from quartersawn white oak, the same kind of wood that was used to build most Arts and Crafts furniture. This wood's most prominent feature is its ray fleck, but some quartersawn boards have much better-looking figure than others. Before I got started, I set aside the best boards for the side panels and the top.

The double tenons I used on this bookcase can be tricky to machine. I've found that the easiest method is to make them as loose pieces, like dowels or biscuits. This requires a lot of accurately machined mortises, made with a plunge router. You can make your own jigs to guide the router, but I used the Leigh FMT, which is designed for this kind of work (see Sources, page 53).

Make the joints

Begin by making the legs (B). Cut them to final size and mark the best sides to face front and out. Rout all the mortises in the legs (**Photo 1** and Fig. D).

Mill all the rails (C, D, E, F and K). Be sure to trim all of the side

1 **Begin by routing** double mortises in the legs. I'm using a Leigh FMT Pro, a jig which has templates of various sizes to guide the router. Many types of shop-made jigs can make these joints, too.

2 **Rout similar mortises** in the ends of the rails. This jig holds work both horizontally and vertically.

3 **Mill some long,** thin pieces to make loose tenons. Round the edges of these pieces to fit the mortises.

4 **Cut the tenon** stock into short pieces and glue them into the rails.

EDITOR: TOM CASPAR | PHOTOGRAPHY: JASON ZENTNER | ILLUSTRATION: FRANK ROHRBACH

Strong Joints Reduce Racking

ALTHOUGH THIS BOOKCASE is relatively small, it's pretty heavy when it's loaded up. To handle that load, and to withstand being picked up and shoved around, it needs to be strong. Most bookcases have backs, which help stiffen what's essentially a box with an open front. My bookcase doesn't have a back, so I had to design joints that were very strong, without resorting to increasing the width of the rails. That would have spoiled the look of the bookcase.

Instead, I made the rails quite thick (1-1/4"), and used mortise and tenon joints. Most of these joints have double tenons–two tenons side by side–rather than one large tenon. This strengthens the joints by doubling the area of their gluing surfaces. I made sure that the mortises in the legs didn't intersect each other, which could weaken the legs. Instead, the mortises are staggered.

I also added one unusual element to strengthen the case: a piece I call an "anti-racking" rail. There's one on each side of the bookcase, just under the top. They reinforce the joint between the upper rails and the sides, to prevent the case from twisting, or "racking."

rails (E and F) and the anti-racking rails (K) to the same length. Rout mortises in their ends, to match the mortises in the legs (**Photo 2**).

Make loose tenons (M, N, P and Q) to fit the mortises. They're all the same thickness, but have different widths. Make each batch of tenons from one piece that's at least 12" long (shorter pieces aren't safe to mill).

Note that the tenons for the front and back upper rails are 1/8" narrower than their corresponding mortises. This important detail requires a little explanation. These mortises are horizontal, rather than vertical. The tenons are narrower than the mortises so you can adjust the position of the rails side to side later on, to accommodate the length of the anti-racking rails (K). If the tenons were exactly the same width as the mortises, you'd have to mill the joints very precisely so that all the parts would fit together. While that's not out of the question, my approach–leaving some room for adjustment–is much easier.

Round the edges of the tenon stock on the router table (**Photo 3**). Cut the stock into short pieces and glue the tenons into the rails (**Photo 4**). On the front and back upper rails (the ones with the narrower tenons), glue the tenons in the middle of the mortises.

Build the sides

Mill the side panels (G), but leave them 1" extra long. Assemble the sides, without glue, and measure the distance between the rails (**Photo 5**). Cut the panels to this exact length (it's best to take off a little at a time, until they fit perfectly). Disassemble the sides.

Cut three biscuit slots in the ends of the panels and in the upper and lower side rails (**Photo 6** and Fig. A). Pre-finish the edges of the side rails that have the biscuit slots. The panels will contract when the weather is dry; pre-finishing prevents this shrinkage from revealing unfinished wood.

Glue the sides together, all in one shot. I use Titebond Extend (see Sources) for complicated assemblies like this. Its open time is longer than the open time of most yellow glues, so I don't have to rush as fast. Start by

Fig. A Exploded View

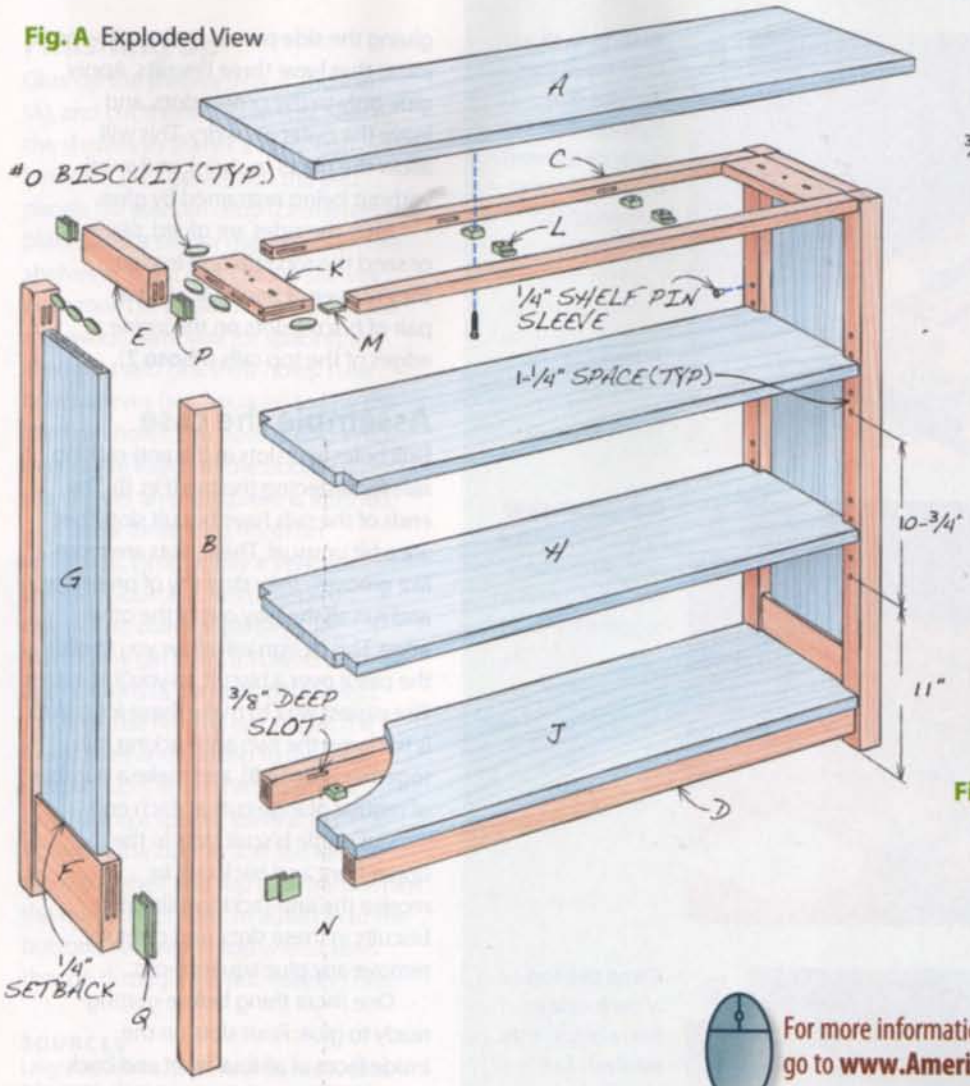


Fig. B Upper Rail Joinery

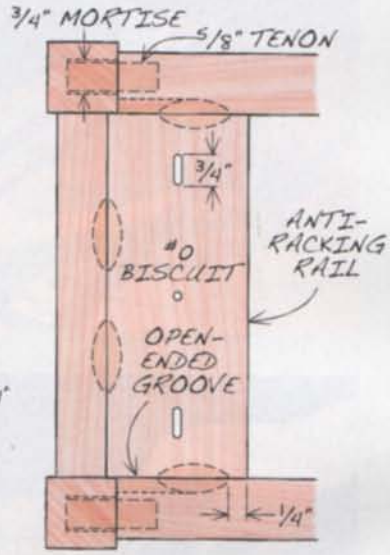
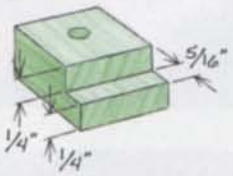


Fig. C Shelf Button



For more information on making tabletop buttons, go to **www.AmericanWoodworker.WebExtras**

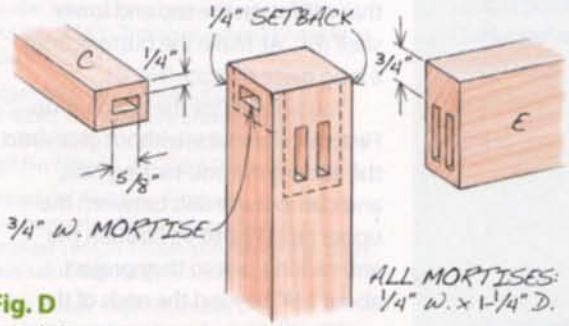
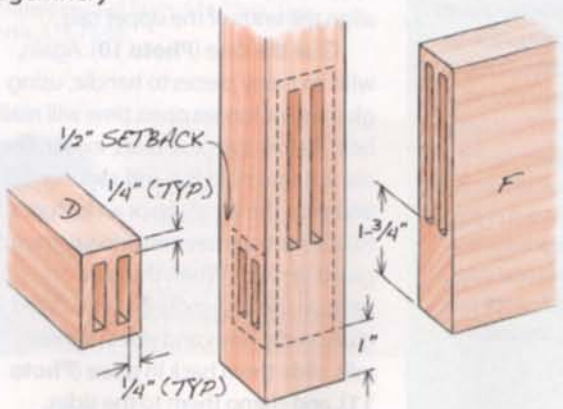


Fig. D
Leg Joinery



Cutting List

Overall Dimensions: 36-5/8" H x 45-1/2" W x 13-1/4" D

Part	Name	Qty.	Th x W x L
A	Top	1	7/8" x 13-1/4" x 45-1/2"
B	Legs	4	1-3/4" x 1-3/4" x 35-3/4"
C	Upper rail, front/back	2	3/4" x 1-1/2" x 38"
D	Lower rail, front/back	2	1-1/4" x 1-3/4" x 38"
E	Upper rail, side	2	1-1/4" x 2" x 9"
F	Lower rail, side	2	1-1/4" x 5" x 9"
G	Side panel	2	3/4" x 7-1/2" x 27-3/4"
H	Shelf, middle/top	2	3/4" x 12" x 38-7/8"
J	Shelf, bottom	1	3/4" x 12" x 38-3/8"
K	Rail, anti-racking	2	5/8" x 3-1/2" x 9"
L	Button	10	1/2" x 1" x 1-5/16"
M	Tenons, upper rail	4	1/4" x 5/8" x 2-1/2" (a, b)
N	Tenons, lower rail	8	1/4" x 1-1/4" x 2-1/2" (c)
P	Tenons, upper rail, side	8	1/4" x 1" x 2-1/2" (c)
Q	Tenons, lower rail, side	8	1/4" x 3" x 2-1/2" (c)

Notes: **a)** Tenon stock should be at least 13-1/2" long. This includes 2" on either end for planer snipe. **b)** Make these tenons 1/8" narrower than their mortises. **c)** Tenon stock should be at least 25" long or two pieces 14-1/2" long.

5

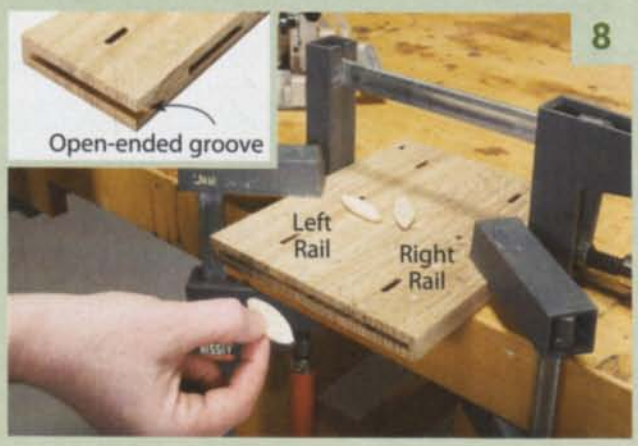
Assemble the bookcase's side, without glue. Measure the distance between the rails. Cut the side panels to this length.

6

Cut biscuit slots in the ends of the side panels. Glue the sides together.

7

Plane the top of each side so the rails and legs are flush. Cut biscuit slots on the inside face of the top rails.



8

Make two "anti-racking" rails, and clamp them together. Cut a series of biscuit slots in their ends, to make one long groove. When you separate the pieces, the groove will run out the side of each piece (see inset, top left).

gluing the side panels to the rails–the joints that have three biscuits. Apply glue only to the center slots, and leave the outer ones dry. This will allow the panel to shrink and swell without being restrained by glue.

After the sides are glued, plane or sand the top rails and legs so they're even, if necessary. Cut a pair of biscuit slots on the inside edges of the top rails (**Photo 7**).

Assemble the case

Drill holes and slots in the anti-racking rails for fastening the top (Fig. B). The ends of the rails have biscuit slots that are a bit unusual. These slots are more like grooves–they stop shy of one edge, and run all the way out of the other edge. This design will allow you to slide the piece over a biscuit, as you'll see later. The easiest way to make these long slots is to clamp the two anti-racking rails together (**Photo 8**), and make a number of regular plunge cuts at each end.

Cut single biscuit slots in the upper front and back rails to receive the anti-racking rails. Glue biscuits in these slots, and carefully remove any glue squeeze-out.

One more thing before getting ready to glue: Rout slots on the inside faces of all four front and back rails to receive the wood buttons (L) that will fasten the top and lower shelf (Fig. A). Make the buttons from a long piece of stock (Fig. C).

You're ready for the big glue-up. First, place biscuits–without glue–into the ends of the anti-racking rails, and clamp these rails between the upper rails (**Photo 9**). Position the anti-racking rails so they project about 1/4" beyond the ends of the upper rails. Use a framing square to align the ends of the upper rails.

Glue the case (**Photo 10**). Again, with so many pieces to handle, using glue with a longer open time will really help. Before the glue dries, loosen the clamps that hold the anti-racking rails and slide these rails back an inch or so, to ensure that they aren't inadvertently glued in place. When the glue dries, remove the anti-racking rails. Spread glue on the ends and sides of these rails, slide them back in place (**Photo 11**), and clamp them to the sides.

Finishing up

Glue up the shelves (H & J) and top (A), and cut them to final size. Notch the shelves so there's a 1/16" gap between the shelves and the end panels (so you can drop the shelves in place), and a similar gap between the shelves and the legs (so the shelves have room to expand in width). Make a plywood template for spacing the shelf pins and drill their holes. I use brass sleeves (see Sources) to line the shelf pin holes; the sleeves add a nice decorative touch to the bookcase. Install the sleeves after the piece is finished.

I use a three-step finish on white oak. First, I apply a yellow dye (see Sources). Next, I wipe on one or two coats of Bartley's Jet Mahogany gel stain, followed by three applications of Bartley's gel varnish.

After the finish is dry, fasten the lower shelf and the top to the case (**Photo 12**). Center the top on the case. Using a spacer, leave a 1/8" gap between the button and the rails, to allow the shelf and top to expand when the humidity is high. In addition to the buttons, secure the top with screws that go through the anti-racking rails.

SOURCES

Leigh Industries, www.leighjigs.com, (800) 663-8932, FMT Pro, $929; Super FMT, $449.

Franklin International, www.titebond.com, (800) 877-4583, Titebond Extend Wood Glue, $7.50 for 16 oz.

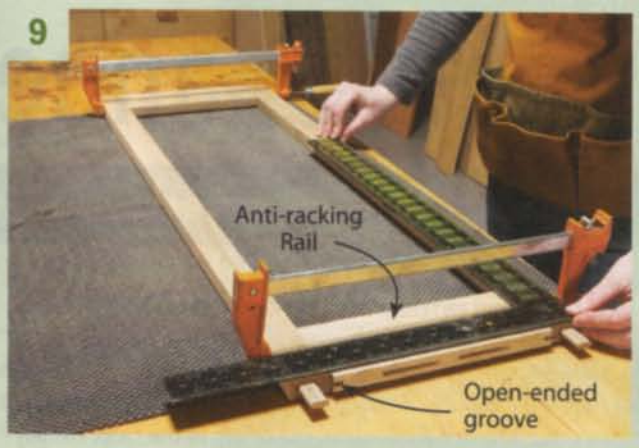
Widget Mfg. Co., WidgetCo.com, (800) 877-9270, 1/4" Antique Brass Shelf Pins, #1-250-ATQ-S, $0.29 each; 1/4" Antique Brass Shelf Pin Sleeves, #1-250-ATQ-G, $0.15 each.

Homestead Finishing Products, www.homesteadfinishingproducts.com, TransFast Lemon Yellow powdered dye stain, water soluble, #3287, $25.95/ 4 oz.

Bartley Classic Reproductions, www.bartleycollection.com, (800) 787-2800, Jet Mahogany Gel Stain, $16.75/qt; Gel Varnish, $16.75/qt.

Laurie McKichan designs furniture to be "simple, honest and direct." You can see more of her work at **www.lauriemckichan.com**

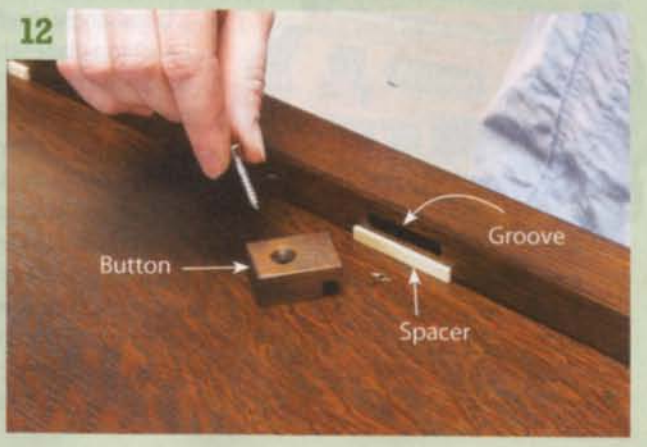
9 **Cut biscuit slots** in the upper rails to receive the anti-racking rails. Clamp the parts together using biscuits, but no glue. Align the ends of the upper rails with each other.



10 **Glue the case** together. Slide out the anti-racking rails before the glue dries.

11 **Spread glue on** the ends and inner edge of the anti-racking rails, and slide them back in place. Clamp the rails to the sides.

12 **Fasten the lower shelf and top.** I like using shop-made wooden buttons, which fit into grooves in the rails. Buttons add a classy look–although you have to get on your hands and knees to see them!



Game Changers

by Tim Johnson

Tools that changed woodworking in the last 25 years.

WOODWORKING ENTERED THE 21ST CENTURY ON A ROLL. Since 1985, when *American Woodworker* appeared on the scene, woodworkers have benefited from the introduction of thousands of new tools to outfit their workshops and methods to develop their skills. A few of these ideas, the cream of the crop, literally changed the way we think about and participate in this marvelous craft. They are game changers.

To rave about these tools or lobby for tools that didn't make this list, visit **AmericanWoodworker.com/WebExtras**

Low Cost Asian Imports

FIRST INTRODUCED IN THE 1970s, Asian-made tools and machinery brought stiff competition to the American market. Low prices were the initial draw, and the increased buying power they provided made it much easier to outfit a woodworking shop. In many cases, imported tools cost half as much as similar domestic models.

Power tools from import brands such as Makita quickly developed a loyal following based on innovative design, performance and durability. Once available only by mail order, Jet's woodworking machines now occupy prime real estate in woodworking specialty stores nationwide. Grizzly Industrial became a powerhouse by developing an enormous woodworking product line, a comprehensive online catalog, superstore showrooms, and annual scratch and dent tent sales that have customers lining up before sunrise. Due to the success of these and other Asian manufacturers, domestic manufacturers eventually began to import Asian-made tools of their own. In effect, Asian-made machinery lowered the price of virtually all woodworking tools, allowing many woodworkers to fulfill a dream that they previously couldn't afford to pursue.

The Benchtop Planer

BY MAKING IT POSSIBLE TO MILL ROUGH LUMBER on household current with a tantalizingly small investment, the benchtop planer changed woodworking. Before its introduction in 1985, the only options for processing most hardwood species were to pay additional milling charges at the lumberyard (per foot and for each setup) or to spend thousands for a large stationary machine. Reducing a board's thickness was problematic, and using self-harvested lumber for anything but bowl turning was a pipe dream. In retrospect, it's safe to say that this tool played an important role in woodworking's growth in popularity during the 1990s.

Ryobi's AP-10 planer started the party, and today's benchtop models build on the original design. Rigidly locking cutterheads with indexed, disposable knives and 13" width capacity are now the norm, and multiple speeds are common. But the promise of access to unlimited lumber choices for an exceptional price remains as a benchtop planer's most beneficial feature, along with the opportunity to explore and develop new woodworking skills.

New Tablesaw Safety Technology

VIRTUALLY EVERY WOODWORKER KNOWS ABOUT THE "HOTDOG" SAW. SawStop's innovative blade brake mechanism (right, top), which stops and retracts the blade within milliseconds when triggered, is certainly the biggest woodworking newsmaker of the past twenty-five years.

But just as important are two recent improvements in blade guard systems. New tablesaws must now be equipped with a riving knife that rises and falls with the blade. A riving knife greatly reduces the possibility of a kickback, which is the most common cause of tablesaw injuries, according to a recent study conducted by the Center for Injury Research and Policy.

A second new requirement stipulates that tablesaw users must be able to remove and install either the riving knife or the blade guard assembly in 30 seconds or less. On saws from several manufacturers, the blade guard and anti-kickback pawls now simply attach to the riving knife (right, bottom).

These improvements represent significant, welcome advances in tablesaw safety. But we still strongly encourage woodworkers to use two other safety tools that aren't so new: a push stick and a brain.

JASON ZENTNER

JASON ZENTNER

To see the SawStop blade brake in action, visit **AmericanWoodworker.com/WebExtras**

The Random Orbit Sander

BEFORE RANDOM ORBIT SANDERS WERE INTRODUCED in the early 1990s, sanding was pure drudgery. Even the best orbital sanders worked slowly, produced clouds of dust and left insidious swirl marks that required additional tedious sanding by hand or with a finishing sander to remove.

Today, a single random orbit sander can replace three conventional sanders, because its sanding pad oscillates and rotates—the same dual-action movement found in industrial air sanders. This movement cuts aggressively, almost as fast as a belt sander, and the marks it leaves are much less noticeable than orbital swirl marks, virtually eliminating the need for a finishing sander. Effortless hook-and-loop style sanding disc changes, effective dust collection, ergonomic design and low prices are now standard features.

Sanding may still be a chore, but today's random orbit sanders speed the process and corral the dust.

For tips on using random orbit sanders, visit **AmericanWoodworker.com/WebExtras**

The Do-It-All Dovetail Jig

JIGS FOR PRODUCING HALF-BLIND DOVETAILS DOMINATED the market in 1984, when Leigh Industries D1258 jig was introduced. The D1258 was a winner for two reasons. First, it created dovetails that looked hand cut, because they could be variably spaced—and it created them in a fraction of the time that hand-dovetailing would require. Second, in addition to half-blind dovetails, the D1258 could create sliding dovetails and through dovetails in stock up to 1-1/4" thick and 24" wide. In short, the D1258 could do it all.

Hand-cut dovetails are the ultimate sign of craftsmanship, but not every woodworker has the time or inclination to produce them. The Leigh D1258 and its successors (including the current D4R Pro and do-it-all type jigs produced by other manufacturers), allow woodworkers of all stripes to create dovetails with the same pleasing appearance, precision and structural integrity as dovetails that have been cut by hand.

To read about other dovetailing jigs and to see a classic blanket chest built with a Leigh dovetailing jig, visit **AmericanWoodworker.com/WebExtras**

PHOTOGRAPHY: COURTESY OF MANUFACTURER, UNLESS NOTED

Effective Dust Collection

MANAGING SAWDUST HAS BEEN IMPORTANT ever since woodworkers moved inside, and especially since the invention of power tools. The development of portable dust collectors in the early 1980s provided an attractive alternative to the traditional dustpan and broom. These early collectors were great for sucking up chips and shavings directly from the source, but they weren't so adept at capturing tiny dust particles, which are the most hazardous.

Today, filter bags capable of capturing particles as small as one micron can be found on even the lowest priced dust collectors, and newly designed compact collectors provide state-of-the-art performance for small shops.

Even the humble shop vacuum has evolved. Some are now specifically designed to extract the fine dust from sanders and other portable power tools. Given their compact size, reasonable price, and benefits to shop and health, it's easy to see why many woodworkers have moved a dust collector to the top of their "must buy" list.

JASON ZENTNER

The T-style Tablesaw Fence

IT'S HARD TO IMAGINE A TABLESAW WITHOUT A T-STYLE FENCE. And yet, 25 years ago, most saws were saddled with fences that were cumbersome to adjust, because they had to lock at both ends of the fence arm to stay in position. They weren't always accurate, either, so you had to keep a ruler handy.

In 1978, Bill Biesemeyer had a better idea: a fence based on a draftsman's T-square. Its head would be long enough to contain both locking points, so only one rail (of square tubing) would be necessary, and the arm, rigidly attached to the head, would be free to float across the saw table. The fence could be calibrated to the blade by a tape measure scale attached to the rail, with repeatable accuracy to 1/64". Adjusting the fence would be as easy as lifting the lock lever and sliding the head along the rail.

Biesemeyer's fence gained national recognition in 1982 by winning the IWF Challengers Award. Six years later, Biesemeyer fences were available on Powermatic's iconic Model 66 tablesaws. Delta acquired Biesemeyer's T-Square system in 1995. And today, smooth-gliding, precisely setting, easy-locking T-style fences are the industry standard.

JASON ZENTNER

The Cordless Drill

HERE'S HOW TO START A REVOLUTION: Just cut the cord! Battery-powered drills may be the most significant innovation of them all, because they paved the way for an entirely new class of woodworking tools that includes everything from circular saws to brad nailers.

The first cordless drills (from the late 70s and early 80s) offered limited power, ran down quickly, and were slow to recharge—but they sure were handy to have! Today's lithium-ion-powered drill-drivers are lightweight, compact, and powerful, and they come in sizes and variations for virtually every drilling and driving task, including screwdrivers, impact drivers and hammer drills.

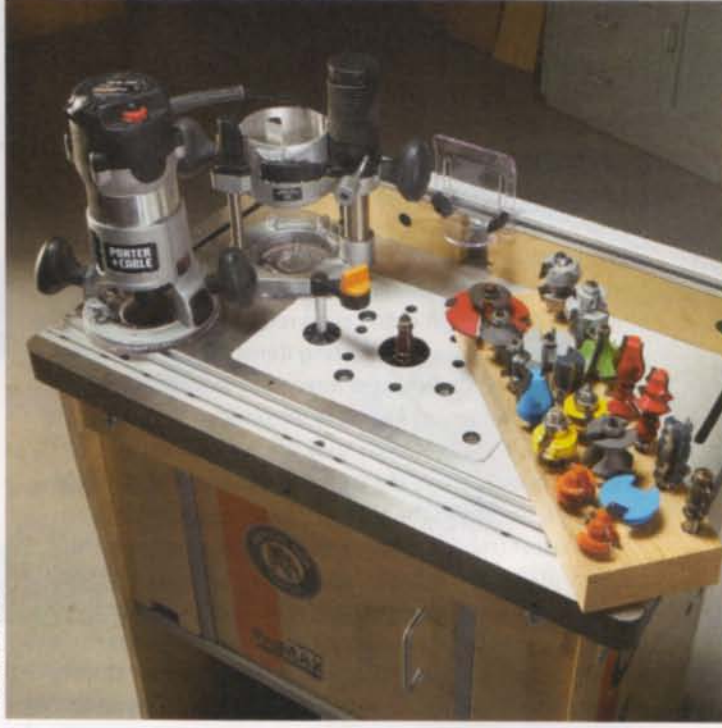
With the improvement of battery technology, the need to keep a corded drill handy has virtually disappeared. Amazon.com currently lists nearly 200 cordless drills, with prices starting under $20. Does any modern shop not have at least one?

Routers and Accessories

TWENTY-FIVE YEARS AGO, many woodworkers did just fine without a router. In those days, routers were primarily used to create edge profiles, and having a router that could plunge mortises was a luxury. Today, routers are essential tools in virtually every shop.

The main reason for the router's enormous popularity is its versatility. Routers are available in all sizes and they're complemented by a huge selection of bits, jigs, router tables and joint-making machines. You can take a router to the work, or install it in a table and bring the work to it. Use the smallest router to trim laminate or round over sharp edges; use the largest router to raise entry-door panels or create architectural moldings. Turners mount routers on lathes, to create flutes and spirals. CNC machines depend on routers to make every cut.

In a small shop, a single mid-size router can be used for template routing, plunge routing, and inlay work; to create edge profiles, picture frames and cabinet moldings; and to complete complex woodworking joints such as lock miters, dovetails, mortises, tenons, and stiles and rails. No other woodworking tool, even at twice the price, can do half as much.



JASON ZENTNER

To see an easy-to-make fully-featured router table, visit **AmericanWoodworker.com/WebExtras**

The Sliding Compound Miter Saw

WHEN THE FIRST SLIDING MITER SAW APPEARED in 1988, the radial arm saw took a back seat. That first slider combined the convenience and accuracy of a motorized miter saw with the crosscutting capability of a radial arm saw. Its ability to cut from the top of the board improved safety and its innovative slide mechanism permitted ample cutting capacity with less travel than a radial arm saw required.

Today's sliders make simple and compound cuts well beyond 45° in both directions and provide 12" crosscut capacity for stock that's well over 2" thick. The best models feature user-friendly controls, easy-to-read scales, and automatic blade guards that completely enclose the blade. Compact front-to-back footprints require less space behind the saw, a consideration when space is an issue.

Sliders are portable, so they don't require permanent shop space. However, many woodworkers build dedicated stands with fences and support for long stock, to maximize their saw's efficiency. Several manufacturers offer stands that provide support, roll to a jobsite, and collapse for storage. Given the accuracy and portability of sliding miter saws, it's no wonder the radial arm saw is now virtually obsolete.

To see a do-everything miter saw stand, check out **AmericanWoodworker.com/WebExtras**

The Small Lathe

BENCHTOP WOOD LATHES HAVE BEEN AROUND FOREVER, but in 1986, Bonnie Klein's mini lathe started a trend. Designed to create jewelry and other small turned objects, it was compact and portable. Suddenly, turning wood didn't require a large, expensive piece of machinery. Heck, it didn't even require a shop. The notion of creating interesting items on a tiny, affordable lathe kindled new interest in woodturning, and when pen-turning kits were introduced in the late 1980s, mini lathes really took off. According to industry sources, there are currently tens of thousands of active pen turners in the U.S.

The latest trend is for greater capacity, to allow turning bowls and vessels up to 12" in diameter in addition to pens and other small objects. So, most mini lathes have bulked up. These new "midi" lathes typically feature cast iron construction, increased swing capacity, induction motors and electronic variable speed. Bed extensions can be added to many of these lathes, giving them the spindle capacity of a full-size machine.

By combining portability, ample capacity and low cost with the chance to complete cool-looking projects in a day or less, today's small lathes offer a tempting opportunity to add woodturning to your woodworking skills.

To see a workshop dedicated to pen turning, visit **AmericanWoodworker.com/WebExtras**

Abrasive disc system

Water stones

Wet-grinding system

User-Friendly Sharpening Methods

WATER STONES FIRST GAINED NATIONAL ATTENTION in the early 1980s, when they were featured in *Popular Science* magazine. Before then, sharpening chisels and plane irons was a time-consuming process. Manufactured by combining abrasives with a binder (usually clay) to create a porous, friable surface, water stones simplify sharpening by cutting much faster than oil stones.

In 1972, Sweden's Torgny Jansson pioneered sharpening systems by combining an electric drill, a water-cooled grindstone and a simple speed-reduction mechanism to create the first Tormek slow-speed wet grinder. With the introduction of an electrically-powered version in 1994, Tormek's slow-speed wet-grinding system simplified sharpening for woodworkers of any skill level, and its success has spawned a number of similar designs.

The newest sharpening systems eliminate the stone altogether, in favor of abrasive discs. Like slow-speed wet grinders, these systems make sharpening easy. The big difference is that these abrasive disc systems create keen edges significantly faster.

For sharpening tips, reviews of abrasive disc and wet grinding sharpening systems, and to browse a huge selection of water stones and power sharpening machines visit **AmericanWoodworker.com/WebExtras**

New Joinery Methods

THERE'S NO DENYING THE ENDURING APPEAL OF TRADITIONAL JOINERY, such as draw-pinned mortise-and-tenon joints. First developed for utilitarian purposes, these joints eventually became symbols of expert craftsmanship. While machines have replaced most of the handwork, traditional joinery still governs most furniture construction.

But the times are a-changin', thanks to innovative new joinery methods. Lamello's compressed wood biscuit and biscuit joiner revolutionized building with plywood in the late 1960s. But it wasn't until twenty years later that low-cost biscuit joiners made the technology widely available to woodworkers. At about the same time, in 1986, the Kreg Jig was introduced. This tool simplified pocket screw joinery and made it available and affordable to all woodworkers. The most recent addition to the "new joinery" group came just five years ago with the introduction of Festool's Domino system, which combines many of the benefits of dowel, loose tenon and biscuit joints.

While traditional joinery isn't going away, in many situations, these new methods provide useful and practical alternatives. We'd love to be around 100 years from now, to report how the innovative new quantum mortiser will surely replace the old-fashioned laser mortiser that has been a shop mainstay since the 2050s.

JASON ZENTNER

Water-Based Finishes

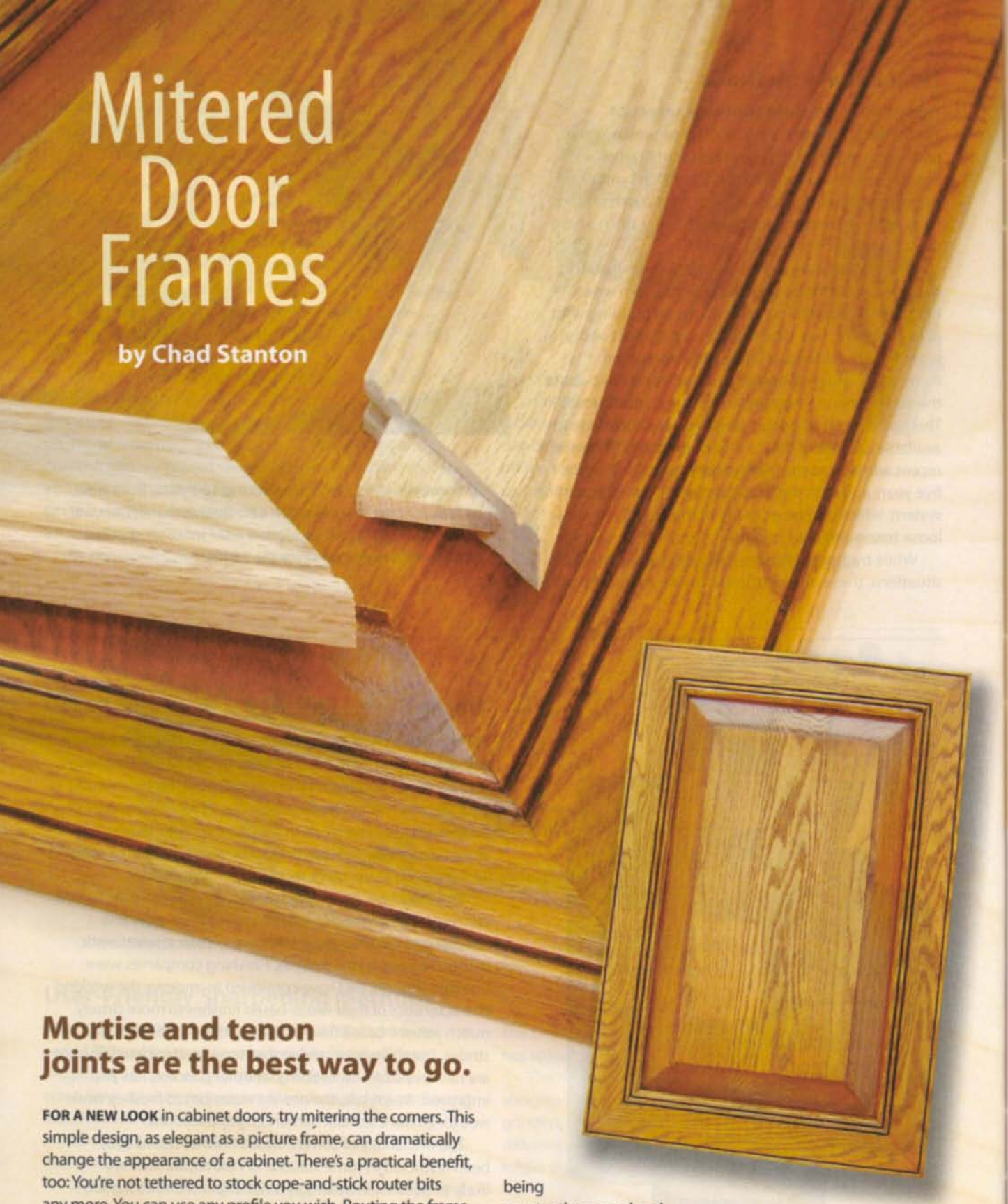
REGULATIONS LIMITING VOC (VOLATILE ORGANIC COMPOUND) EMISSIONS FIRST APPEARED ABOUT 20 YEARS AGO. Finishing companies responded with the introduction of water-based finishes, which are complex emulsions of solvent-based resins, water and other chemicals that make the oil and water "get along." These new finishes proved convenient for their soap-and-water clean up, quick recoat time and low odor.

Woodworkers, however, gave them mixed reviews. Typical concerns were that early water-based finishes were less durable and failed to impart the amber color characteristic of most solvent-based finishes. Finishing companies were listening though, and have continued to improve the working characteristics of their water-based finishes to more closely match solvent-based finishes. In fact, they've made huge strides. Durability is up and amber-toned water-based finishes are now available. Sand-ability, another concern, has also improved. As a result, the newest water-based finishes work well for all but the most demanding applications.

The availability of solvent-based finishes has already been restricted in some states and VOC regulations are likely to become increasingly strict. That means it's a good idea to try out the newest water-based finishes and tell the manufacturers what you like and dislike. Your input will lead to even better finishing products.

Mitered Door Frames

by Chad Stanton

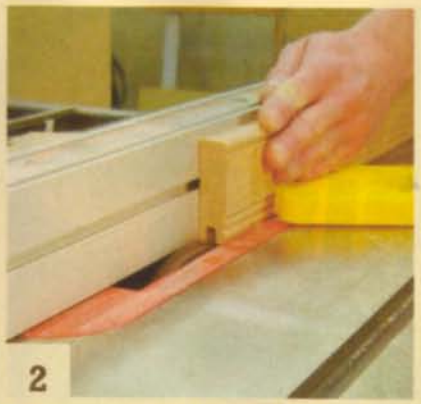


Mortise and tenon joints are the best way to go.

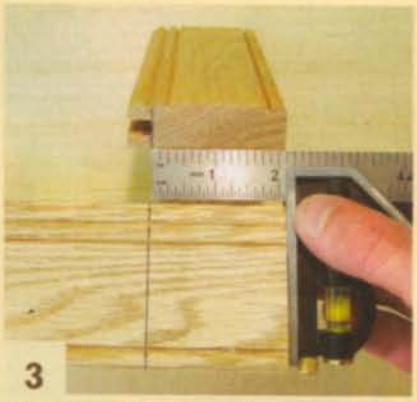
FOR A NEW LOOK in cabinet doors, try mitering the corners. This simple design, as elegant as a picture frame, can dramatically change the appearance of a cabinet. There's a practical benefit, too: You're not tethered to stock cope-and-stick router bits any more. You can use any profile you wish. Routing the frame is just like making a molding. You can mix and match a wide variety of shapes.

Mitered doors have to be strong to withstand the strain of being constantly opened and closed, so I build them with mortise and tenon joints. The procedure is technicallly challenging, but it's also fun and rewarding.

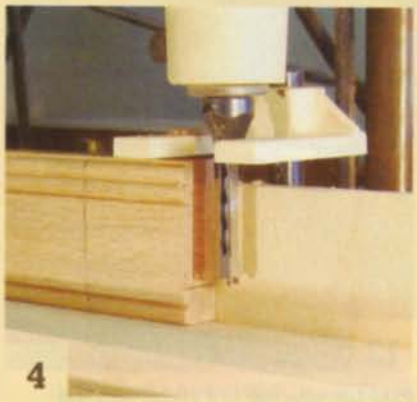
Start by routing moldings on the faces of the door's stiles and rails. I'm using a beading bit, but you can use any profile bit you like.



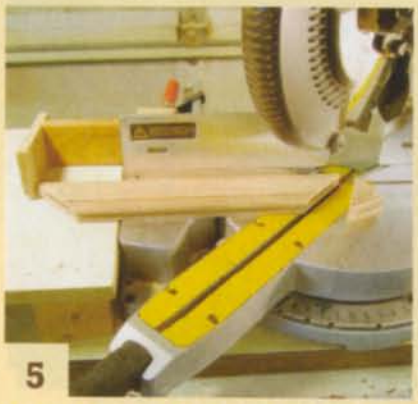
Saw grooves for the panel. Cut from both faces, so the groove is exactly centered. Cut all the pieces to final length–but without miters.



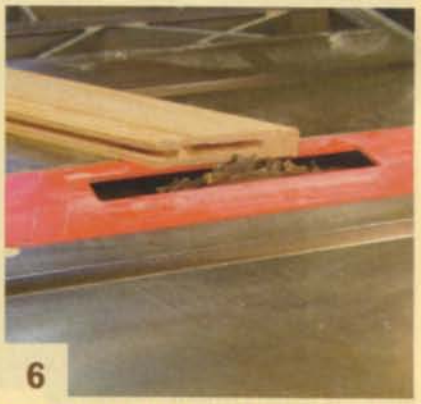
Mark the rails for mortising. Measure the distance from the outside edge of any piece to the bottom of the groove. Transfer this distance to the top edge and face of each rail.



Mortise the rails. Start each mortise on the marked line, and continue it out the end of the rail. Cut the mortise a second time, from the opposite face, to center it.



Miter the ends of the rails. Cut exactly to the tip, so the overall length of the rails stays the same.



Set up a dado blade in the tablesaw for cutting tenons on the stiles. Raise the blade level with the bottom edge of the mortise in one of the rails.

Moldings and grooves

To begin, mill all your frame pieces to the same thickness and the same width. Make a few extra pieces, to test setups. Trim the actual pieces 1" longer than their final length.

1. Rout the molding on your stiles and rails (**Photo 1**). It can go on the inside or outside edges of the frame–whatever you like. Set up a featherboard on your router table to ensure that all the cuts are smooth and the same depth.

2. Cut grooves for the panel using a dado set (**Photo 2**). For 3/4" thick doors, I make the grooves 1/4" wide and 3/8" deep. The grooves should be exactly centered. The best way to ensure this is to make one cut, flip the piece, and cut the groove a second time–once from each side. This may result in the groove being a tiny bit wider than 1/4", but that's OK. Centering the grooves isn't required (you can cut the grooves off center, if you wish), but cutting the tenons later will be much easier if the grooves, mortises and tenons are centered.

3. Cut the stiles and rails to their final length, but don't miter their ends yet.

Cut the mortises

4. The mortises will go in the rails, and the tenons will go in the stiles. They could go the other way around, too–it really doesn't matter. The first step is to mark the inner end of the mortises on the rails (**Photo 3**). The depth of the groove determines the location of this mark. Using any piece, set a combination square to the distance from the outside edge to the bottom of the groove. Draw lines at this distance on the top edge and face of the rails.

5. Install a 1/4" bit in your mortising machine. Adjust the depth-of-cut so that the bit stops 3/8" above the table. Adjust the fence so the chisel rides against the back side of the groove. Cut the mortises, starting at the pencil line (**Photo 4**). Continue the mortise all the way to the end of the rail. To ensure that the mortise is centered and the same width as the groove, flip each piece around and cut each mortise a second time, as you did when cutting the grooves.

6. Cut miters on the ends of the rails (**Photo 5**). This is a finicky cut, so it's best to creep up on it by gradually readjusting the position of a stop block. The idea is to miter the corners of the rails without making the rails any shorter, tip to tip.

EDITOR: TOM CASPAR | PHOTOGRAPHY: COURTESY OF CHAD STANTON

7

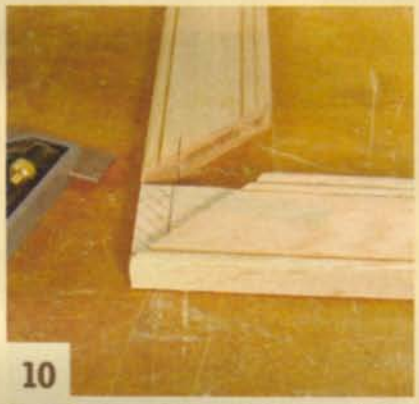
Dado both sides of a scrap piece to form a tenon. Adjust the blade's height until the tenon slides nicely into the mortise.

8

Set the saw's miter gauge to 45°, then make a series of dado cuts on the stiles to form one side of the tenon. Cut both ends of each stile, from opposite faces.

9

Reset the miter gauge's angle in the opposite direction. Cut each tenon's opposing face.

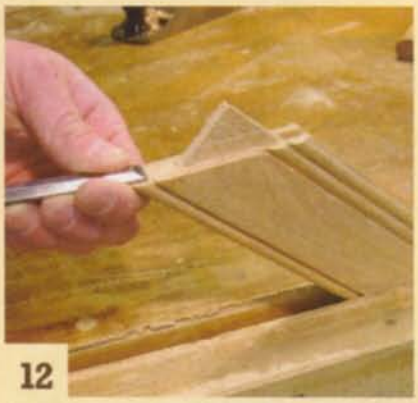


10

Mark the tenon's length. Measure the distance from the outside edge of a rail to the bottom of the mortise. Mark this distance on the end of the tenon.

11

Make two cuts to trim the tenons.



12

Pare the saw cut so it's flush with the shoulders.

Watch Chad's Video on making these joints at **AmericanWoodworker.com/WebExtras**

Make the tenons

7. Make the tenons on the tablesaw using a 1/2" wide dado set. First, adjust the blade's height. Place one of the rails next to the blade, then raise the blade until it's even with the bottom of the mortise (**Photo 6**). Next, using a scrap piece that's exactly the same thickness as your rails and stiles, set your miter gauge to 90° and make a test tenon by dadoing both sides of the piece (**Photo 7**). If it doesn't fit–and chances are it won't on the first try–cut off the tenon, raise or lower the blade, and dado a new tenon, again making the same cut from both sides.

8. Set up your miter gauge to cut the actual tenons (**Photo 8**). Again, start with a test piece. Swivel the miter gauge to 45°, either way. Fasten a fence to the miter gauge and clamp a stop block to the end of the fence. The exact position of the block will require some fine-tuning. Use a test piece that's the same width as your stiles and rails. Position the stop block so that your dado set cuts right to the tip of the test piece. Once the stop is positioned, cut the stiles. This requires more than one pass. Start with the stile pulled away from the stop, then make a series of overlapping cuts. Cut both ends of each stile this way.

9. Reset your miter gauge to cut 45° in the opposite direction (**Photo 9**). Again, make some test cuts to position the stop block. The shoulder this cut creates must be exactly in the same plane as the one you made in the last step. Once you're all set, cut the opposite sides of all the tenons.

10. Cut the tenons to length. First, set a combination square to the distance from the edge of a stile to the bottom of a mortise (**Photo 10**). Extend the square's blade another 1/32" or so for clearance, then mark this distance on all the tenons. Saw the waste on a bandsaw or by using a handsaw (**Photo 11**). When sawing the mitered portion, stay 1/32" or so away from the shoulders. Pare this cut with a chisel (**Photo 12**), and the joint is complete.

Chad Stanton is a self-employed carpenter and furnituremaker. He hosts the web show Wood Choppin'Time! **www.woodchoppintime.com**, a mix of serious woodworking and light comedy.

Spindle Sander Search

ALTHOUGH I'VE NEVER REALLY NEEDED IT, I spent six years searching for an old, cast-iron oscillating spindle sander. I finally found the right one: a Max OVS-1, made in the early 1980s. It will likely outlast my more modern machines.

At auction, it was an ugly duckling. The top was heavily rusted, the power switch was missing, it had a three-phase motor, and, worst of all, the spindle was seized. But it came with an almost-complete set of spindles and a box full of sanding sleeves.

Back in my shop, I tore the machine completely apart. Removing the rust took a lot of elbow grease. The switch and motor were easy to replace, but despite my best efforts, I couldn't free the spindle. A local machine shop came to the rescue.

One new paint job later, I've got a machine that is quiet and runs silky smooth. Once I find the right spot for Max, I will be looking for any excuse to use it!

Alan Schaffter

Pull-Through Tablesaw

MY GRANDFATHER'S 10" CRAFTSMAN TABLESAW IS A MOST UNUSUAL MACHINE. To make a crosscut, you snug a board against a fixed miter gauge, grab a handle above the blade guard, and literally pull the blade through the wood. It's like an upside-down radial-arm saw. In 1960, working on my grandfather's carpentry crew as a 16-year old greenhorn, I yanked that handle until my arm ached.

According to the manual, this tablesaw is "particularly designed for cutting long pieces," such as rafters, plates, studs and joists. Craftsman called it a "Builder's Saw." You could make angled cuts, too, by pivoting the miter gauge and securing it in a series of holes drilled into the tabletop. The saw's crosscutting capacity is an amazing 15-3/8".

That's not all–you could do much more with a Builder's Saw. By locking the blade's carriage and using a fence, you could make rip cuts. You could place a standard miter gauge into the right-hand miter slot and push the work into the blade, like a regular tablesaw. The saw also accepted a dado set.

I'm not sure when this workhorse was made, but I believe it dates to the mid-1940s. After my grandfather passed away, it was left to rust in the milk house of a dairy barn. I restored it many years later. Although I had to replace some gears, it still works fine. Years ago, pulling that handle for hours on end wasn't exactly a thrilling job, but along the way, a young kid learned to love woodworking–the hard way.

Glenn Borreson

We'll pay you $100 to share your favorite tools, new or old, with fellow readers. Contact us by e-mail at **toolnut@americanwoodworker.com**, or mail us at American Woodworker, 1285 Corporate Center Drive, Suite 180, Eagan, MN 55121. If possible, please include digital photos of your tools.

EDITOR: TOM CASPAR | PHOTOGRAPHY: COURTESY OF CONTRIBUTORS

The Ultimate Grinding Rig

Grind more accurately with shop-made tool rests.

by Mario Rodriguez

LET'S FACE IT, the tool rests on most grinders just don't cut it. They may be fine for sharpening scissors or lawnmower blades, but when it comes to woodworking tools, forget it. They're often too small and too hard to adjust. In addition, they usually have to be set at an awkward angle that's really hard on your wrists.

You're way better off making your own tool rests. I've designed a pair that will give you accurate and consistent results that can easily be repeated. Using these rests, you'll spend less time at the grinder. You'll be able to hone your tools and get back to work much faster.

My replacement tool rests will fit almost any grinder. They're fastened to a plywood base, rather than directly to the grinder. This way, they can be positioned to accommodate almost any machine. These rests are designed to fit a 6" Delta grinder, but their dimensions are easy to change for a different model or an 8" grinder.

For more information on selecting and using a grinder, go to **AmericanWoodworker.com/WebExtras**

Chisels and Plane Irons

MAKING A STRAIGHT EDGE is the biggest problem most woodworkers face when grinding chisels and plane irons. That's because most tools are wider than the grinding wheel, so you have to slide the tool from side to side to grind its whole face. That's really hard to do with a standard tool rest, but a cinch with this one.

The tool is securely clamped in a commercial tool holder (see Source, right), which slides back and forth on a long piece of electrical tubing. You can lift the holder off the tube at any point to inspect your progress.

The second problem most woodworkers have with a standard tool rest is fine-tuning the grinding angle. Precisely matching an existing angle saves you lots of time on the grinder. This tool rest is easy to adjust: To change the grinding angle, you just move the rest in or out.

SOURCE
Lee Valley Tools, www.leevalley.com, (800) 871-8158, Veritas Grinding Jig, #05M06.01, $24.50.

The left tool rest is simply a piece of electrical tubing mounted on a block. A Veritas tool holder fits it perfectly, and can be slid back and forth or lifted off at any time.

To adjust the angle of the tool's bevel, simply move the tool rest in or out. A knob locks it in place.

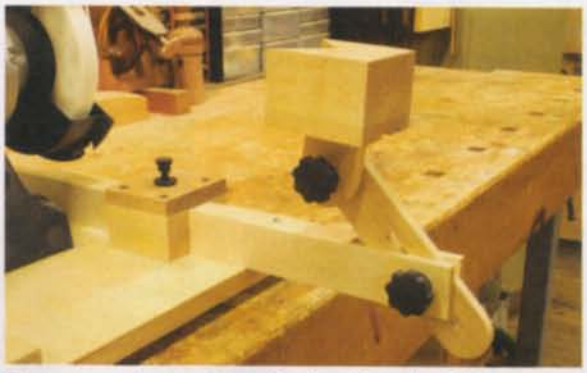
Turning and Carving Gouges

MANY GOUGES HAVE A BEVEL that's created by rotating the tool, but making a smooth, even bevel is difficult using a standard tool rest. Steadying the tool is tricky. This extension arm makes the job much easier. Just nest the end of the tool in the arm's V-shaped cradle, rotate the gouge, and you're all set.

This arm accommodates gouges of all lengths. It's hinged in two places to give you maximum flexibility in setting up your tool. Raising and lowering the cradle makes major changes to the bevel angle; to fine-tune the angle, you slide the arm in or out.

Caution: Always place the tool high up on the wheel, as shown in the photo, and use light pressure.

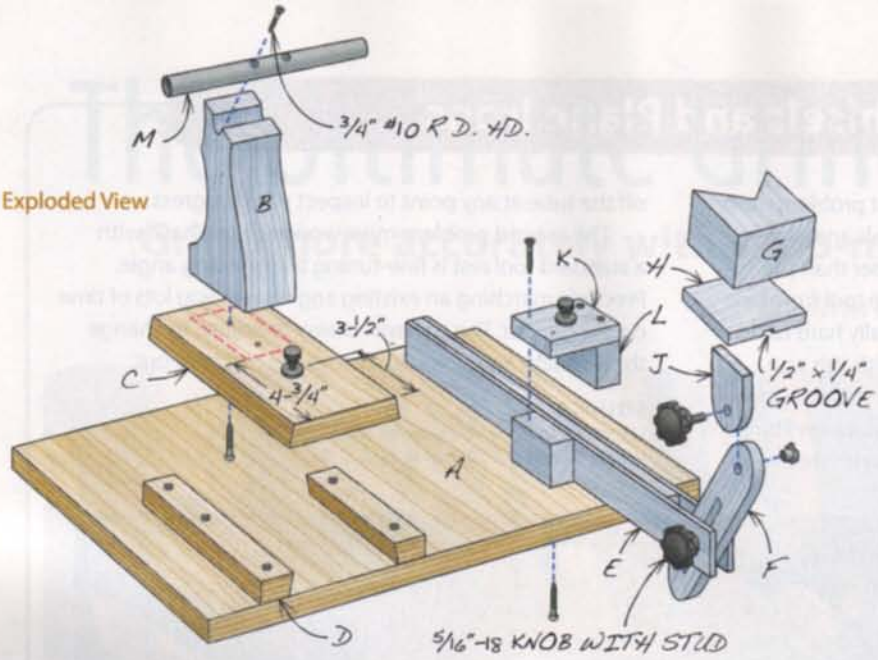
The right-hand tool rest is an articulated arm. To create a perfectly even bevel on a gouge, just rotate the tool.



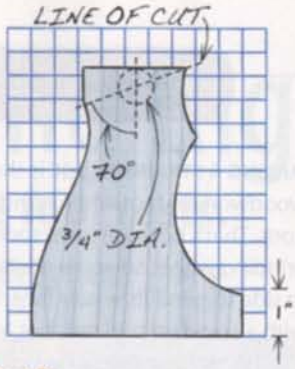
The arm can be configured to handle tools of almost any length.

EDITOR: TOM CASPAR | PHOTOGRAPHY: MARIO RODRIGUEZ | ILLUSTRATION: FRANK ROHRBACH

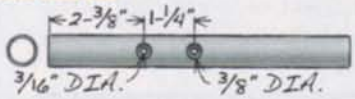
Exploded View



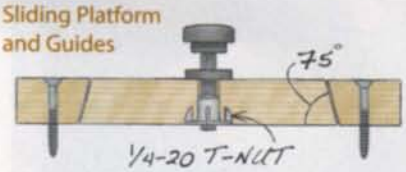
Tower



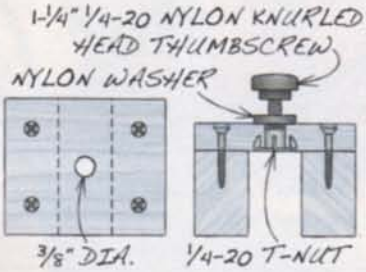
Tool Rest Bar



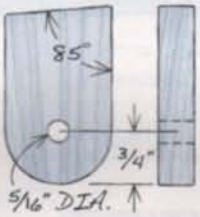
Sliding Platform and Guides



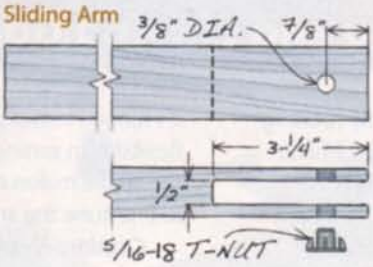
Sliding Arm Lock



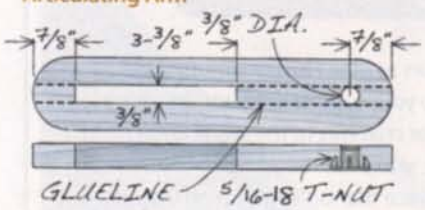
Pivot



Sliding Arm



Articulating Arm



Grinding Jig

Part	Name	Qty.	Material	Th x W x L
A	Base	1	Plywood	3/4" x 14" x 20"
B	Tower	1	Hardwood	2" x 4-1/2" x 5-5/8"
C	Sliding platform	1	Plywood	3/4" x 4-3/8" x 10"
D	Platform guide	2	Plywood	3/4" x 1-1/4" x 8" (a)
E	Sliding arm	1	Hardwood	1" x 1-1/2" x 22" (b)
F	Articulating arm	1	Hardwood	1/2" x 1-1/2" x 7-1/2"
G	"V" tool holder	1	Hardwood	1" x 2-1/2" x 3"
H	Tool holder base	1	Hardwood	1/2" x 3" x 2-1/2" (c)
J	Tool holder pivot	1	Hardwood	1/2" x 1-1/2" x 2-1/2" (d)
K	Top of sliding arm lock	1	Hardwood/plywood	1/2" x 3" x 2-1/2"
L	Side of sliding arm lock	2	Hardwood	1" x 1-9/16" x 2-1/2" (e)
M	Tool rest	1	EMT	3/4" dia. x 7-1/2" L

Notes: **(a)** One guide is cut down to 5-3/4" long. **(b)** Glue up from three pieces; the inner piece is 1/2" thick, the outer pieces are 1/4" thick. **(c)** Glue to tool holder. **(d)** Cut top end to 5°. **(e)** Screw to base from underneath.

Building notes

Base (A) This is simply a piece of 3/4" veneer-core plywood. The base will be easier to pick up and move if you put feet under its corners. Leave a margin on either side of the base so you have room to grip it. Use flat-head machine screws to fasten the grinder to the base; their heads go under the base, in holes that are countersunk. Make sure the grinder is square to the base, so the tool rests will be easier to align.

Tool Rest (M) This is just a length of 3/4" electrical metal tubing (EMT). To drill holes for the mounting screws, first make a long, V-shaped cradle in a 12" long block of wood to support the tube. Drill the holes using a drill press. Drill the smaller ones first, all the way through the tube. Then, drill larger holes to accommodate the heads of the screws and your screwdriver.

Tower (B) This part supports the tool rest. Measure your grinder to determine the tower's exact height. The tower should hold the tube just above the axis of the grinding wheel. The tower's shape is designed to nest as close as possible to the grinder. You may have to alter the shape to fit your machine. The semi-circular cutout that holds the tool rest is actually the lower half of a hole. Make the tower an inch or two extra tall, as shown in the diagram. Drill the hole, then cut the top of the tower at the indicated angle.

Sliding Platform and Guides (C & D) Install the guides one at a time. Bolt the grinder to the base first, then center the sliding platform on the grinder's wheel. Make sure the platform is square to the base and clamp it in place. Fasten one guide next to the platform, then place a piece of notebook paper on the other side of the platform, to use as a temporary shim, and fasten the second guide in place.

Articulating Arm Assembly (E - L) Maple is a good choice for these parts because it's hard, strong and machines well. Glue up the articulating arm (F) from four pieces in order to create a slot.

Origami Woodworking

Creative design and near zero laser kerf make it possible.

by Christy Oates

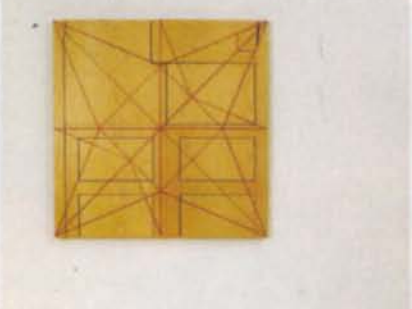
MY FURNITURE HANGS ON THE WALL as two-dimensional art, until the parts are removed and folded to create chairs and other functional pieces. The folding process resembles origami, the Japanese art of folding squares of paper into representational objects. In fact, I engrave the surfaces of my work with origami-like images to symbolize its folding nature.

I design my furniture in Rhino CAD and cut the pieces from plywood, using a 250-watt Beam laser cutting and engraving machine with a 48" x 48" bed. Because of its extremely tight cutting tolerances, laser cutting is perfect for my work; the laser leaves a kerf of only .006". Laser cutting is perfect for my work. This ultra-thin kerf allows cutting parts out of one sheet of material with virtually no waste, and the tight-fitting joints it creates are perfect for my folding designs. Cutting these designs with a regular saw or router wouldn't be possible.

Finding a company that had large bed lasers and was willing to work on one-off projects proved difficult, until I discovered RMS Laser of El Cajon, CA (near San Diego). The amazing folks at RMS Laser enjoy working with artists and woodworkers. They'll ship anywhere—and even give you a discount if you mention *American Woodworker*! You can find more information about their cutting services at www.rmslaser.com.

You can view more pictures and videos of my folding furniture at **www.christyoatesdesign.com**.

Mosquito Lamp



Folding Chair

A thin area in the shade allows the light to shine through.

Hidden hinges aid the transformation.

The light shade folds out.

Ready for real use.

Christy Oates started in the furniture industry at age five, in her mother's upholstery shop in Wisconsin. After earning an Associate Degree in Interior Design and working in kitchen design, she earned her BFA in Furniture Design from the Minneapolis College of Art and Design in 2006. Christy is currently finishing her MFA in Furniture Design at San Diego State University.

EDITOR: RANDY JOHNSON | PHOTOGRAPHY: COURTESY OF CHRISTY OATES

Keyed Cabinet Moldings

by Steve Bunn

Dovetailed keys allow seasonal movement.

FASTENING MOLDING around a cabinet that has plank-style solid wood sides is challenging, because there's a good chance that over time, one of two things will happen. Either the mitered corner joints will break apart or the side molding pieces will break loose from the cabinet. The cause is cross-grain construction, a classic woodworking problem. In this case, the molding's grain runs across the grain of the plank sides. But the real culprit is seasonal movement, wood's continuous expansion and contraction across the grain due to changes in humidity. Molding that's rigidly attached with nails, screws or glue is no match for this natural force.

My solution employs sliding dovetail keys to mount the side molding pieces. This method allows the plank sides to freely expand and contract beneath the molding, so the miter joints aren't stressed.

Install the front molding piece

1. The first step is to cut pieces of molding for the front and sides. It's best to cut all three pieces from a single length of molding, so the color and grain will match. For the best appearance, cut the front molding piece from the middle, leaving approximately 2' on each end as the molding pieces for the sides. When the molding is installed, the grain will run fluidly from piece to piece.

2. Check the fit between each piece of molding and the cabinet. The cabinet's sides and face frame must be flat for the molding to seat properly. Plane or sand as necessary.

3. Finish-sand enough of the face frame and case sides so that you don't have to sand right up to the attached molding after it has been installed.

4. Miter the front molding to fit the cabinet. Cut a 45° miter on one end of the molding and clamp it to the cabinet with the proper overhang on the cut end. Then mark and cut the miter on the opposite end of the molding.

5. Glue and clamp the front molding to the cabinet.

Groove the side molding pieces

6. Use a router table to rout a dovetailed groove in each side molding piece (**Photo 1**). Install a 1/2" dovetail bit and raise it to cut a 1/4" deep groove. Then adjust the fence to locate the groove on the back of the molding–centered is best. However, if centering creates a weak spot, because the groove runs too near the molding's concave surface, it's okay to slightly reposition the groove, to create more "meat."

7. Miter one end of each side molding piece and true its fit with the mitered front piece. Allow the opposite end of these pieces to run long.

Make the dovetail-shaped keys

8. Thickness-plane a 4" x 20" piece of hardwood to 7/32".

9. Use the bandsaw to cut this piece into long key blanks with beveled edges. Tilt the bandsaw's table to match the pitch of your dovetail bit. Then use the rip fence to bevel one edge of the blank.

10. Reset the rip fence to cut a 1/2" wide key blank (**Photo 2**). Before cutting, check to make sure the bevels will slope in opposite directions

11. Cut a 4" long key from the blank and test its fit in the molding's dovetailed groove (**Photo 3**). If the key binds as it slides in and out, it's too wide. Lightly sanding one or both beveled edges often solves this problem. A key that's too wide may cause the molding to split as it's being installed; a key that's too narrow will result in a loose fit between the molding and the cabinet.

12. Here's the real "fitness" test: Slide the key halfway into the groove. Then watch the key's housed end while pressing down on its free end. If the housed end rises above the surface, the key is too narrow. Ideally, the housed end will rise to within 1/64" of the wood's surface, remaining ever-so-slightly below it.

13. Adjust the bandsaw's fence as necessary and flip the workpiece to cut additional long key blanks, until the test key fits properly. Cut each key blank into 4" to 5" long keys. It's a good idea to check the fit of each key and to have extra keys available. The number of keys and their exact length depends on the width of the plank sides. The goal is to install as many keys as possible, while leaving about 2" at the front of the cabinet and about 3/4" between keys.

14. Mark the mounting screw hole locations on each key that you plan to use–they're located about 3/4" from each end and centered.

Install the keys

15. Make a jig to accurately install the keys on the cabinet (**Photo 4**). Simply glue a piece of scrap wood to the top of a 4" length of grooved molding, so that it acts as a 90° fence. When the jig is in position on the cabinet, its fence exactly aligns the top surface of the molding with the top (or bottom) edge of the cabinet. It's a good idea to make a new jig whenever you make a new batch of molding.

16. Insert a key in the jig and place the jig on the cabinet, about 3" away from the front molding piece. Slide the key

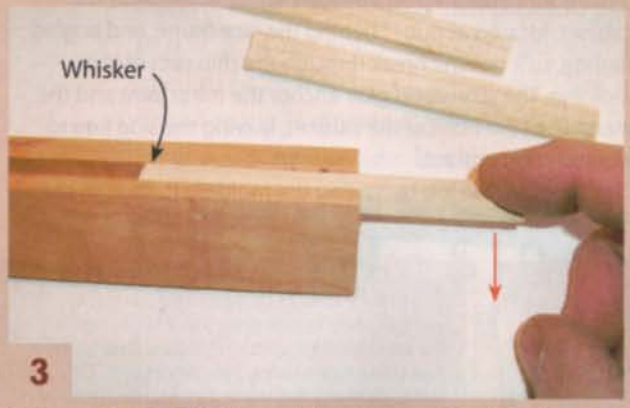
1

JASON ZENTNER

This method for mounting moldings uses sliding dovetails to allow for a cabinet's seasonal movement. The first step is to rout a dovetailed groove in the side molding pieces.

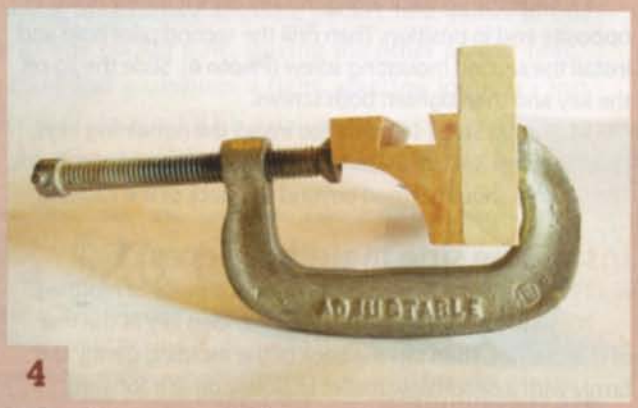
2

Saw dovetail-shaped keys to fit the grooves. First, saw long dovetail-shaped blanks. Then cut each blank into 4" to 5" long keys.



3

Test each key's fit in the molding by installing it halfway and pressing on the free end, to make the housed end rise. Ideally, the housed end will stop a whisker below the molding's surface.



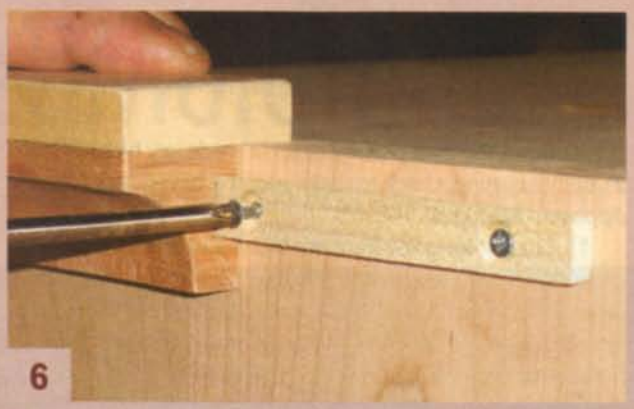
4

Make a jig to mount the keys on the cabinet, so the molding will mount flush with its top. Simply glue a block on top of a short length of molding.

EDITOR: TIM JOHNSON | PHOTOGRAPHY: ALEXANDER BUNN, UNLESS NOTED

5

Position the first key about 2" from the front of the cabinet. House the key in the jig so that it extends just far enough to drill a pilot hole. Then install the first screw.



6

Finish installing the key. Slide the jig back as far as possible, while still keeping the key engaged. Then drill another pilot hole and install the second screw.

7

Slide the molding onto the keys, using gentle taps from a dead blow mallet. Stop when the molding gets within 4" of the front of the cabinet.

8

Apply glue to the miter joint and about the first 3" of the cabinet. Then drive the molding home.

9

Clamp the joint until the glue has completely dried. Remove the clamps and trim the molding flush with the back of the cabinet.

toward the front molding piece until it extends 1" to 1-1/2" beyond the jig. Hold the jig firmly against the cabinet and drill a countersunk pilot hole. Then install a 3/4" #4 flat head screw (**Photo 5**). Leave the screw slightly loose, so the jig slides smoothly.

17. Slide the jig back along the key until it barely holds the opposite end in position. Then drill the second pilot hole and install the second mounting screw (**Photo 6**). Slide the jig off the key and then tighten both screws.

18. Repeat Steps 16 and 17 to install the remaining keys, spacing them 3/4" to 1" apart and working from front to back. The last key should extend beyond the back of the cabinet.

Install the side molding pieces

19. Wax the dovetailed groove in each piece of molding.

20. Slide the molding onto the extended key at the rear of the cabinet. Then tap the back of the molding gently but firmly with a dead-blow mallet to slowly drive it forward over each key (**Photo 7**). Stop when about 4" of the cabinet remains exposed.

21. Apply glue to the cabinet and to the mating surfaces of the miter joint (**Photo 8**). Then drive the molding forward, until the miter joint closes. Use a scrap block and the dead blow mallet to adjust the molding up or down as needed, to align it with the front molding piece.

22. Clamp the molding until the glue is thoroughly dry (**Photo 9**). Install a 1-1/4" #8 wood screw from inside the cabinet, located about 1" behind the face frame, and angled slightly, so it doesn't break through the thin part of the molding. The screw and glue anchor the miter joint and the molding at the front of the cabinet, leaving the side free to expand and contract.

Complete the job by sawing the molding flush with the back of the cabinet.

Steve Bunn owns and operates a cabinet shop in Bowdoinham, Maine, where he specializes in crafting Windsor chairs. Steve has also written articles for Woodwork, Fine Woodworking and Home Furniture magazines. Visit **www.stevenbunn.com** or contact Steve by e-mail at sbunn@suscom-maine.net.

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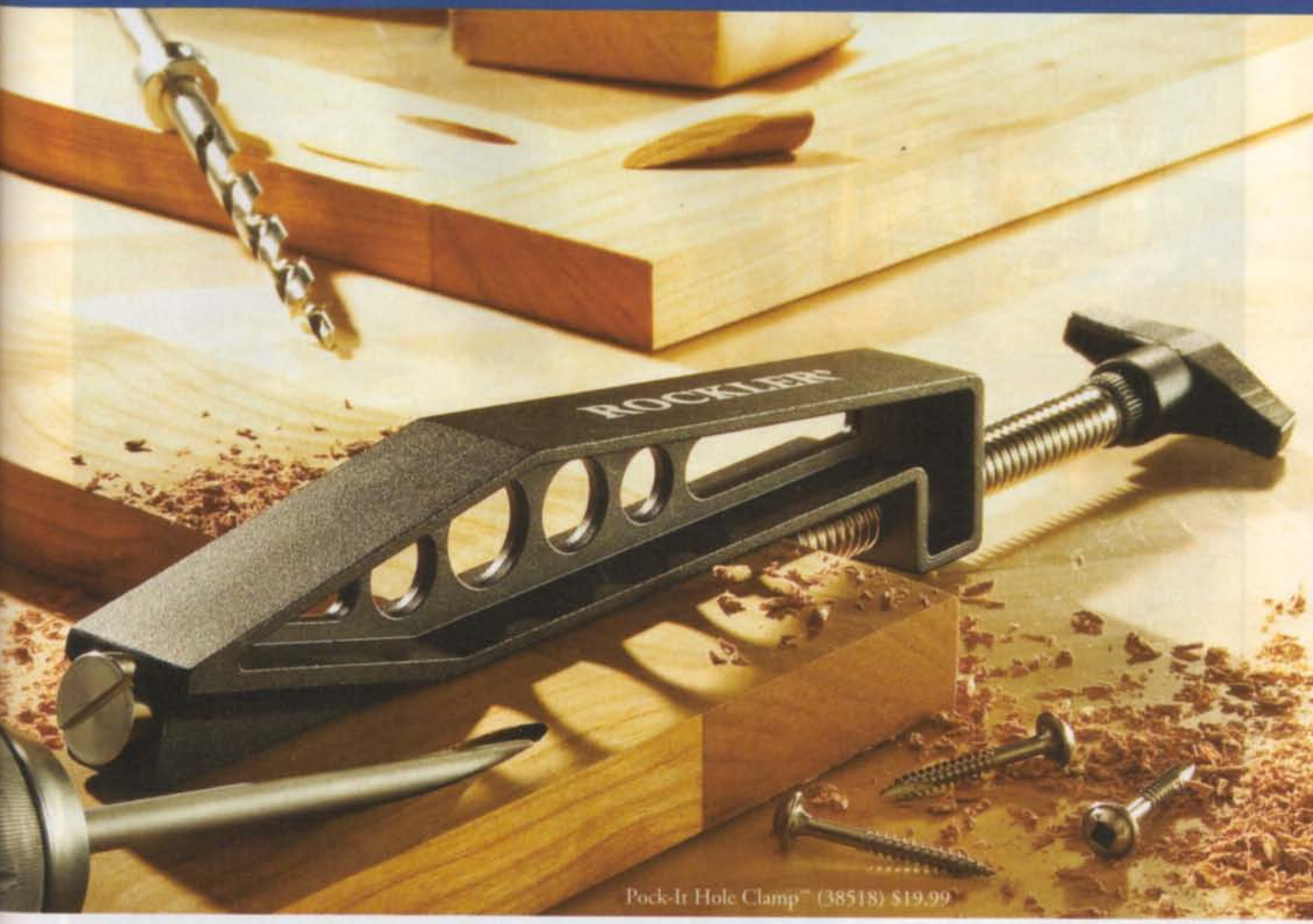

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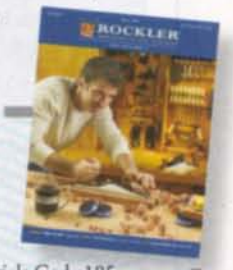

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Solar Powered Shop

WHEN MY WIFE AND I MOVED to the Hawaiian island of Kauai eight years ago, she allowed me to indulge in constructing a detached two-car garage with a breezeway–and a woodshop! What sealed the deal was the idea that the shop space could someday be converted to a guesthouse. (Over my dead body!) The 550 sq. ft. shop area is finished with sheet-rocked walls, hardwood flooring (local eucalyptus robusta), skylights and track lighting.

Hawaii is a virtual paradise for a woodworker, with a seemingly endless supply of exotic hardwoods and many talented professionals who are happy to offer encouragement and advice. My friendships with local tree trimmers and my proficiency with a chainsaw allow me to obtain most of these species at no cost. The down side of this abundance is that my "garage" has now turned into a wood storage facility.

The shop itself has the usual array of stationary and mobile-based power tools. Two independent remote-controlled dust collectors are located under the building and are plumbed through the floor directly to fixed machines, or through hoses to the mobile units. One corner of the shop is dedicated to bowl turning, which is one of my favorite activities. I also enjoy making jewelry boxes, Nakashima-style tables, and garden benches.

Most of my projects are given to friends or donated to charity auctions. Of course, my wife keeps the best stuff!

While this setup sounds like paradise, the cost of running the machinery and lights is another story, because Hawaii has the highest electricity rates in the nation (as high as 50 cents per kilowatt hour, which is four times the national average). As a result, I've equipped my shop with solar collectors.

The professionally-installed system consists of 10 roof-mounted photovoltaic panels. It's rated at 2.2 kilowatts per hour and is tied directly to the grid. After all the tax credits, the system cost $12,000 to install.

After over a year in operation, I am pleased with the system's performance. As I work in the shop during the day, virtually all of the power is now provided by the sun, and my electrical bills have fallen from an average of $180 per month to $25 (of which $21 is a fixed customer charge). Excess solar-generated electricity is sold back to the utility at the wholesale rate. One advantage of the system is that I can run dust collectors and an air cleaner full time without worrying about the cost. Mother Nature foots the bill. With this success in mind, we have now installed a similar photovoltaic system on a less important building–our house!

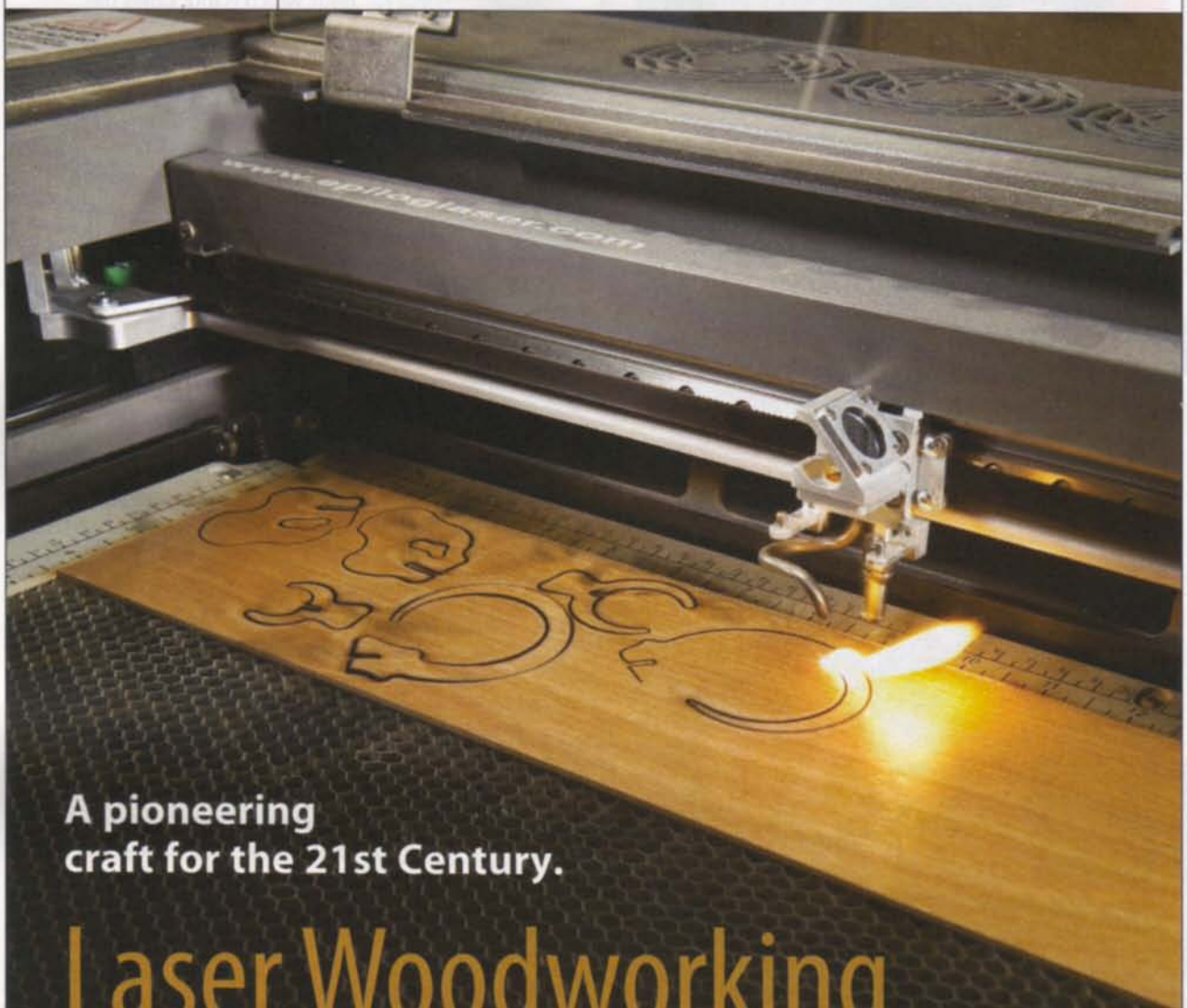
Robin Clark
Lawai, Hawai

Tell Us About Your Shop

Send us photos of your shop, a layout drawing, and a description of what makes your shop interesting. Tell us what you make in it and what makes your shop important to you. If "My Shop" features your shop, you'll receive $100.

E-mail your entry to **myshop@AmericanWoodworker.com** with digital photos attached. Or mail your description with digital photos on a disc to My Shop, American Woodworker, 1285 Corporate Center Drive, Suite 180, Eagan, MN 55121. Please include your phone number. Submissions cannot be returned and become our property upon acceptance and payment. We may edit submissions and use them in all print and electronic media.

EDITORS: DAVID RADTKE AND TIM JOHNSON | PHOTOS: COURTESY OF ROBIN CLARK



A pioneering craft for the 21st Century.

Laser Woodworking

by Andrew Zoellner

EACH GENERATION, a new technology in woodworking enables us to work faster, with more precision and more creativity. Carbide-tipped bits and a whole new set of portable power tools, for example, have improved how we work and what we build. For the next generation, CNC lasers may also be one of those tools that transform our shops.

I'm a young, 21st Century woodworker. When Epilog, a maker of CNC lasers, asked me to try out the Helix , a mid-size machine from the Legend Elite series, I jumped at the chance. What can it do? How does it work? How far can I push it? Dozens of questions came up. I'll introduce you to what I found, but one thing I'll tell you up front: There's way more to this technology than meets the eye. After days of experimenting, I only scratched the surface.

EDITOR: TOM CASPAR | PHOTOGRAPHY: JASON ZENTNER

What A Laser Can Do

The Epilog can burn a shallow picture or drawing on wood. You can reproduce any digital image, including your own photo or sketch.

The Epilog can also be set to burn deeper, for shallow relief carving. A laser can quickly and precisely duplicate intricate patterns.

Set to full strength, the Epilog can cut all the way through material. You can duplicate parts large or small, such as these interlocking puzzle pieces.

PHOTO COURTESY OF TREVOR GNAUCK

Using pattern cutting and relief carving techniques, the Epilog can cut out an inlay *and* the recess in which it fits.

What is a CNC laser?

To understand a CNC laser, think of it as having two components. First, there's the CNC (computer numerically controlled) part. You're probably familiar with CNC machines–they're common in factories, and are making their way into small woodworking shops, too. In woodworking applications, a CNC usually controls a router. OK, let's replace that router bit with a high-intensity beam of light–a laser. That's the second part of the machine.

Consider a CNC laser as a type of printer. A computer program moves the machine's head. But the head shoots a laser, instead of ink.

What can a laser do?

A CNC laser's beam essentially heats and vaporizes the wood it contacts. By adjusting the intensity of the light, you can determine the depth that it cuts. Usually, the waste is just reduced to smoke, but when the laser is set on high, you may even create a small flame!

You can fine-tune the depth-of-cut however you wish, but think of it as having three levels: shallow, medium and deep. They correspond to three different applications: engraving, relief carving and pattern cutting.

Lots of folks have bought a CNC laser for engraving things like nametags, keychains and other quickly personalized trinkets. It's a great small business–there's one in virtually every city in the country. You can copy your own images or download them from the Internet. Basically, any image that can be digitized can be engraved.

Cutting deeper into the wood with a laser creates a three-dimensional effect, similar to low-relief carving. The laser is extremely precise. You can create very intricate patterns, perfect for medallions, awards, moldings or any design that will embellish a project.

Cutting deeper yet, you can go all the way through a relatively thin piece of solid wood or plywood (up to 3/8" on the Helix I tested). You're not making images anymore–you're making shapes. Lasers are commonly used to make wooden clock parts, dollhouse furniture, models, 3-D animal sculptures and more (see Origami Woodworking, page 67). For workshop applications, you can use a laser to create extremely accurate plywood templates, based on CAD drawings, for shaping parts on a router table. You could also use a laser for intarsia, marquetry or scroll-saw patterns.

That's just the tip of the iceberg. There's a wide community of Epilog users online (www.EpilogLaser.com), supported and encouraged by Epilog to push the boundaries of what a laser can do. If you buy a laser for woodworking, or rent time on one, consider yourself a pioneer. Many applications have yet to be discovered!

How does the laser work?

The Epilog's laser tube is located in back of the machine. The beam of high-energy light passes through a series of mirrors and lenses to a CNC-controlled head, which moves in an X/Y plane (**Photo 1**). The head moves in a totally sealed and safe compartment containing the workpiece.

The Epilog interfaces with your computer much like a printer. After you've set up your project in Corel Draw, the software included with the Epilog (which can be used with a wide variety of graphic-editing programs), you hit print and bring up a print driver screen, which Eplilog refers to as the dashboard (**Photo 2**). The dashboard is where you make your adjustments. The most important are speed (how fast the laser moves over your material) and intensity (how strong the laser is, and how deep it will cut). Once you've zeroed in on your settings for a particular project, you can save and recall them at any time.

What does the Epilog require?

On the hardware side, you'll need a computer to run the Epilog. You'll also need an exhaust system, to remove particulates and odor from the machine's exhaust (**Photo 3**). Most users in a fixed installation opt to exhaust the fumes out of their shop with a hose or ductwork, but portable filtration units are available for mobile applications (like shows and fairs). Most lasers and filtration units only need 120-volt circuits.

On the software side, the Epilog is designed to empower even a novice computer user to get started creating quickly. You don't have to be an expert! Having grown up in the information age, that part of the operation didn't faze me, but I was surprised to see how easy the software was to use at its most basic levels.

How It Works

1

The Epilog laser's head moves like a printer. It will scan back and forth or follow a continuous line, depending on how it's programmed.

2

The Epilog's settings are adjusted in a printer driver window on your computer. By adjusting rate, frequency, intensity and other parameters, a variety of materials can be engraved or cut.

3

The laser beam produces smoke and fumes, so you'll also need an external exhaust system or a portable filtration unit.

4

The future for CNC laser woodworking is wide open. This shallow relief carving, based on a photo of a tree, cuts through one layer of plywood to reveal the layer below. It's a beautiful effect that we found with creative experimentation.

Types of Epilog lasers

Epilog has two lines of lasers: Zing and Legend Elite. The major differences between the lines are capacity (the size and depth of the bed), power (expressed in watts) and resolution (dots per square inch).

The Zings are entry-level lasers with smaller beds and lower-power, capable of cutting through 1/4" wood. They start at $7,995.

The Legend Elite series lasers have a larger capacity, more powerful beams capable of cutting through wood up to 3/8" thick, and cost from $9,995 to $40,000, depending on power and accessories. Legend series lasers can also engrave at a faster speed than the Zings.

Both lines of lasers have a repeatability of ±.0005". Zing series machines engrave up to 1000 dpi; the Legend series goes up to 1200 dpi.

The Helix I tried out has a 24" x 18" bed, a 60-watt laser, and costs about $22,000. The exhaust system we used is about $3,000.

The bottom line

An Epilog is an investment, no doubt about it. But it can be the foundation of a profitable small business or the tool that propels your woodworking to an entirely new level. To find out more about laser woodworking, contact your local Epilog distributor. He can probably locate an Epilog in your area and help you contract some work or rent some time on the machine. After seeing how quick and easy it is to personalize a project or engrave an intricate design, you just might catch the laser bug. Our photographer sure did–he achieved some remarkable results (**Photo 4**).

For more information, visit **www.EpilogLaser.com**

Handles for Turning Tools

Customize their fit for comfort and performance.

DECADES AGO, woodturning tools came without handles, and turners would simply fashion their own. This makes perfect sense, because a handle that fits and feels "right" gives a turner confidence. And who better to custom-fit the handle than the person who'll use the tool?

Turning and installing your own handles is a great exercise in designing, turning to fairly tight tolerances, and drilling wood on the lathe. To get started, you can buy tools unhandled (still an option) or remove their commercial handles (really easy).

Use strong, dry wood

Select stock with straight grain, especially for the tool end of the handle (use the strongest grain orientation for this critical area). Traditional hardwoods, many exotic woods, and even local woods that you harvest and dry yourself are all good options. Do not use weak woods such as pine, poplar, butternut, willow, spruce and fir.

Make sure the wood is dry. If you have any doubt about the moisture content, let the handle stabilize for several days (or longer) after rough-turning and drilling the initial hole.

EDITOR: TIM JOHNSON | PHOTOGRAPHY: JASON ZENTNER

1

Choose straight-grained hardwood for the handle. Use brass, copper or steel fittings to make the ferrule, which reinforces the joint between the tool and the handle. Copper couplings make excellent ferrules.

Turning tool shanks (or "tangs") are either round or flat. Both types mount in holes bored in the end of the handle. Flat-tang tools require stepped holes to accommodate their tapered shape.

2

3

Start by drilling a pilot hole for the tool's tang in one end of the handle blank. Then use a cone-shaped center to mount the blank on the lathe, so the pilot hole will be centered when the blank is turned round.

Drive on the ferrule after turning a tenon to fit. This ferrule is a copper coupling that's been cut in half. If the tenon is longer than the ferrule, use another ferrule (the other half of the coupling) to drive the first one home.

4

I make each handle unique, by using different woods and finish colors, so that I can immediately identify each tool. I normally start with stock that's 1-3/4" to 2" square (**Photo 1**). The length of the blank depends on a number of factors, including personal preferance and the tool itself. Figure A (below) lists handle lengths that work well for me. It's always better to make a handle too long, rather than too short.

Fig. A: Suggested Handle Lengths

Parting tool	12" to 14"
Skew chisel	12" to 16"
Spindle/detail gouge	10" to 14"
Spindle roughing gouge	14" to 18"
Scraper	14" to 16"

Ferrule stock

Every woodturning tool handle must have a metal ferrule to reinforce the joint between the handle and the tool's shank, or "tang" (**Photo 2**). Hardware stores and salvage yards are good sources for ferrule stock. Copper couplings (used to join copper pipe and tubing) are some of the best. They're available in a variety of diameters and each one can be cut in half to make two ferrules. Choose a diameter that allows plenty of wood between the tool's shank and the ferrule, usually at least 1/4"–if there's any question, go with a larger diameter.

Make a handle

1. The first step is to drill a 3/8" dia. x 3/4" deep pilot hole for the tang in the blank (**Photo 3**). Note: If the tang is smaller than 3/8", match the pilot hole's diameter with the tang. The end you choose for mounting the tang should have straight grain and be free of checks and knots. Clamp the blank in a vise and use a hand-held drill.

2. Install a live center with a cone in the tailstock (see Sources, page 79). The cone will automatically center the pilot hole when the blank is mounted on the lathe. If you don't have a cone-type live center, turn a tapered piece of wood to fit into the blank's pilot hole and protrude about 1/2" beyond it. When you mount the blank, center the live center's point on the protruding end.

3. Turn the ferrule end–or the entire blank–to round, using a spindle roughing gouge.

4. Turn a tenon on the end to match the ferrule's length and inside diameter–go for a driven-on fit. Slightly taper the tenon's end to help get the ferrule started. Drive on the ferrule, factory end first, all the way to the tenon's shoulder (**Photo 4**). This orients the ferrule's rough-cut end with the end of the tenon. Turn down this rough edge after reinstalling the blank on the lathe. If the edge is very rough, use a mill file, off the lathe.

5. For safety, turn a bulb over the part of the handle that will house the tang (**Photo 5**). This provides maximum strength in the event of a catch or dig-in.

6. Turn the blank to a diameter slightly larger than final size. Then use a detail/spindle gouge to round the back end of the handle.

7. Turn the gripping area of the handle into a shape that you like (**Photo 6**). Be sure to test the grip with

Turn a bulb directly behind the ferrule, to provide the greatest support for the tool's tang. Most of the handle's shaping can be done with a spindle roughing gouge.

Shape the handle to fit your grip, gradually and selectively reducing the diameter, until it feels just right. Remove the handle often, to check the way it feels in your hand.

Install a chuck in the headstock to drill the tang hole. With the lathe running at slow sped, simultaneously grip the handle (so it doesn't turn) and crank the tailstock, to carefully drive the handle onto the spinning bit.

Drive the handle onto the tang, using a waste block to protect the edge. Check frequently to make sure the tool and handle remain properly aligned.

To learn more about turning tool handles, go to **AmericanWoodworker.com/WebExtras**

the hand that you will use to control the tool. As the gripping area nears perfection, shape the transition to the bulb to create the optimal feel and balance, but beware of making any portion too thin.

8. Finish-sand the handle and ferrule to 150 grit, with the lathe running. Turn off the lathe and sand with the grain to finish the job.

9. Remove the tool rest to drill the tang hole (**Photo 7**). For round-tang tools, the hole's depth should be one fourth to one third of the tool's length. For flat-tang tools, the hole should house the entire tang—almost to the tool's shoulder. Mount a Jacobs-type drill chuck in the headstock (see Sources) and install an ordinary tapered-point bit (other types of bits won't enter the pilot hole accurately). Place the handle's pilot hole against the bit, bring up the tailstock, and lock it. Advance the live center to engage the center hole on the waste end of the tool handle. Put on a full-face shield and set the lathe's speed between 400 and 600 rpm.

10. Turn on the lathe and check to see that the handle runs true. There should be little or no "ghosting" at the ferrule end. If you see ghosts, stop the lathe and re-center the drill bit in the pilot hole. Once all is running well, take two simultaneous actions to drill the hole: Grasp the spinning handle about halfway back with one hand while cranking the tailstock's handwheel with the other. Go slowly. If you feel too much resistance, slowly back out of the hole, to remove chips.

11. If the hole must be made larger, to accommodate round tangs that are larger than 3/8" dia., simply repeat the drilling operation, using the appropriate larger tapered-point bit. Drill stepped holes to accommodate tools with flat tangs. Drill the small dia. hole the full length of the shank; drill the larger hole only as far as necessary.

12. Finish the back end of the handle off the lathe. Simply cut off the waste with a handsaw and then sand.

13. Set the tool into the handle. This step is critical. I'm a firm believer in using epoxy to anchor the tool, so start by pouring a generous amount into the hole. Drive the handle onto the tang (**Photo 8**). Stop about every quarter of the way to check for alignment—sighting the tool and handle much as you would sight a gun. Look for misalignment left or right and up or down. Tap the tool with the mallet to make corrections.

14. My favorite tool-handle finish is the one that comes from hard use: sweat, dirt, wear–and maybe even a little blood. A pure oil finish is another option, but any film-forming finish (including wipe-on oil-varnishes) will make the handle too slick.

To see more of Alan's work, visit: **www.alanlacer.com.**

SOURCES

Oneway Manufacturing, www.oneway.ca, (800) 565-7288, Live Center with Cone (#2 Morse taper), #2064, $120.95.

Packard Woodworks, www.packardwoodworks.com, (800) 683-8876, Jacobs-Style Keyless Chuck (#2 Morse taper), #111022, $37.95.

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Oops! Crazy Mistakes Woodworkers Make

Planer-Puss

After my friend Jason and I purchased a truckload of rough lumber, we headed for his garage workshop to plane the boards before divvying them up. All of Jason's tools are on mobile bases, because he has to share the space with the family cars. So, as he horsed the planer into position, I wheeled out the dust collector and slid the hose onto the planer's dust port. It fit pretty tightly, so I didn't bother to fetch a screwdriver to tighten the band clamp.

We stacked the boards next to the planer and took our stations; Jason would feed the boards into the machine and I would support them as they came out. Jason switched on the planer and hoisted the first board. I started the dust collector and readied myself behind the planer's outfeed table. Unfortunately, the second the board entered the planer, the collection hose blew loose. *Whap-ap-ap!* I was plastered by a hail of wood shavings. Next time, I'll get the darn screwdriver.

Joe Gohman

Bowl Bonk

I HAD A MINI-LATHE TWENTY YEARS AGO, when I was in college. At that time, a face shield wasn't in my budget. Besides, I always wore prescription glasses with safety lenses. One morning, I was rushing to finish a Christmas gift, a small potpourri bowl. I was using a spindle gouge to undercut the bowl's lip—I didn't know the difference between spindle and bowl gouges back then, and being new to woodworking in general, I didn't know anything about keeping tools sharp, either.

To this day, I'm not sure if the tool or the bowl caught me in the forehead, but I still have a scar above my right eyebrow and a small gouge bent at a 45° angle to remember that morning. When I found the bowl, a big chunk was missing from its lip. I didn't have the time to start over, so I clamped the bowl to my drill press and used a Forstner bit to reshape the damaged area. It looked good, so I drilled all around the rim, to create a scalloped edge. Because of this unusual edge treatment, my friend thought she'd received the greatest turned bowl ever, and she never connected my bandaged forehead with her gift.

Dale Gillaspy

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Ev·o·lu·tion - noun: 1. any process of formation or growth

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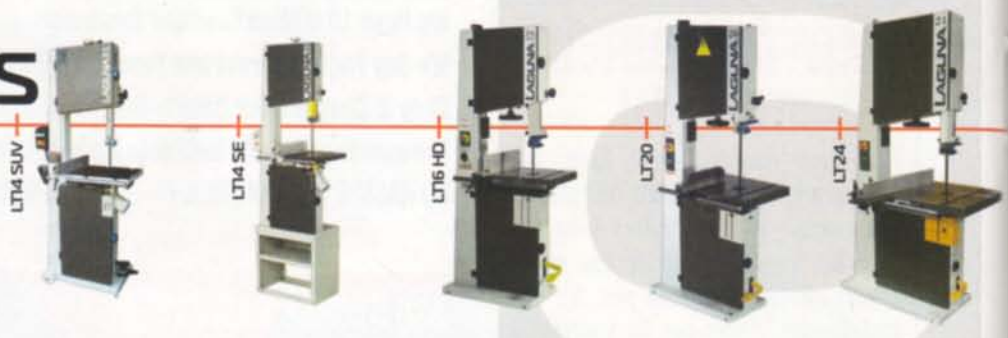

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