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#145, DECEMBER/JANUARY 2010



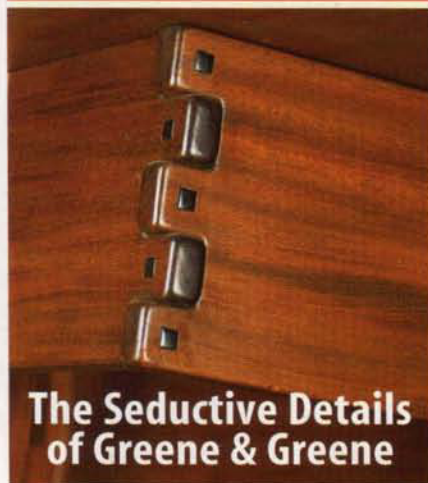
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Double-Duty Edge Guide p.10

Great American Woodworker p.32

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Features

39 How To Build A Torsion Box

It's amazingly strong, light and cheap!

48 Adjustable Height Assembly Table

Legs that ratchet up and down with ease.

54 Greene and Greene Furniture Details

An expert woodworker talks about what really gets him excited.

60 Office Cabinet

Store office necessities in style.

66 Arts & Crafts Hall Tree

Organize your gear with an oak classic.

72 Etched Brass Nameplates

Personalize your woodworking projects.



Departments

10 Workshop Tips

Making an indexed edge guide, building a T-square jig for biscuit joints, flattening warped boards using a planer sled, steadying molding for sanding, using two handscrews to rout small parts, identifying parts with tape, making a perf-board template for shelf-pin holes, and using a jig for routing toe spaces in cabinet sides.

16 Thrifty Woodworker

Making a marking knife from a bandsaw blade, making a band clamp from a rubber band and string, practicing on a turning's waste area, making a corner clamping jig, using a featherboard to index narrow rip cuts, plumbing with a water jug, turning a planer knife into a drawknife, and using soda caps as standoffs.

20 Well-Equipped Shop

23 new tools you should know about.

30 My Shop

It's as comfortable as a favorite tool.

32 Great American Woodworker

A former minister discovers a new calling.

36 Tool Nut

Old machines often have advanced features.

76 Tool Talk

New tablesaw blade guards are easy to live with.

82 Oops!

A cabinet's back, put on the front.

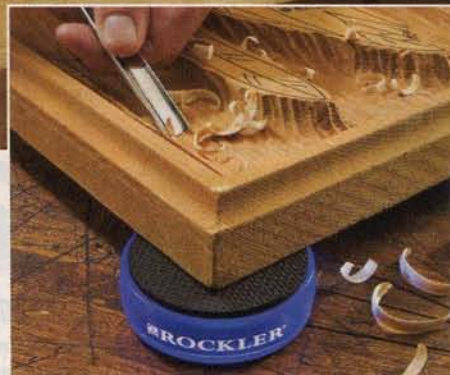




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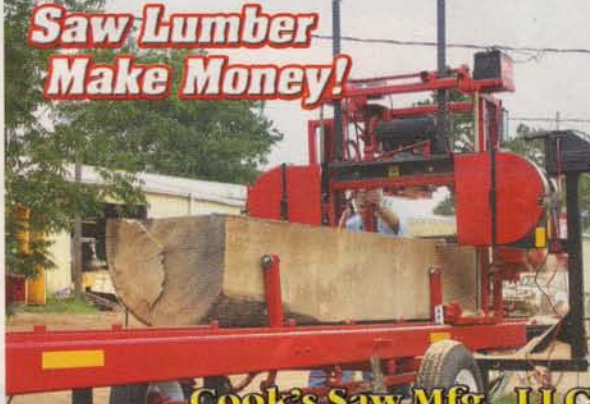
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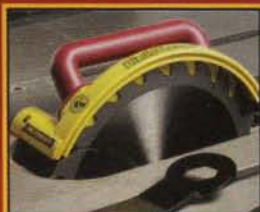
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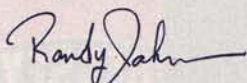
BECOMING A SKILLED WOODWORKER requires practice, patience, and a thorough understanding of numerous tools, materials and techniques. It's a skill that's not mastered quickly or easily, but the satisfaction of working wood and enjoying the final project is hard to beat.

Woodworkers love the challenge of solving problems. Yet, there are many times when we end up scratching our heads and wondering if there is a better way to do something (or worse, wondering if there was a better way). *American Woodworker* receives lots of calls and letters from readers with questions about their projects, shops and tools, and it has always been our business to provide useful information to our readers.

To continue this commitment, we've launched a new online Q&A forum. It's a place for woodworkers to interact, ask questions and share woodworking knowledge with each other. Even if you don't currently have a question, go online anyway and offer up your woodworking wisdom to others who do have questions. You'll find a link to the Q&A forum on the homepage of the *American Woodworker* website.

While at AmericanWoodworker.com, make sure to click over to the tip, project, technique, and tool stories. New ones are posted every week, and they're all free and complete.

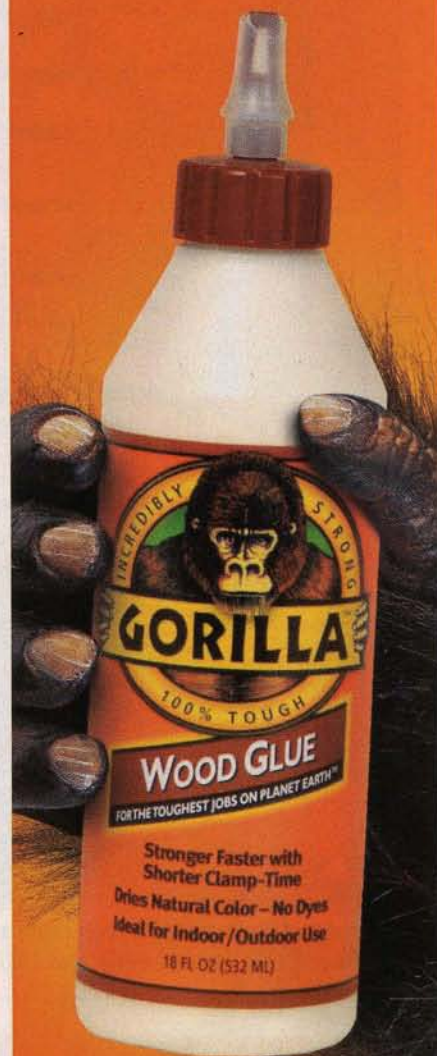
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Randy Johnson



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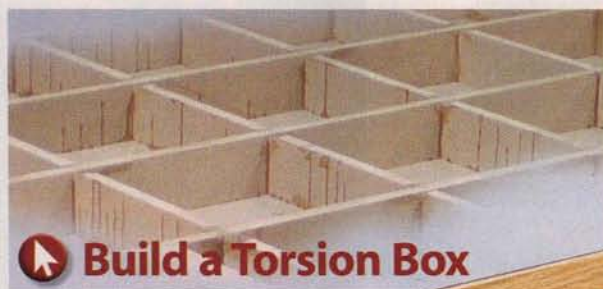


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Office Cabinet

For complete how-to on using drawer lock router bits, go to: www.AmericanWoodworker.com/145/DrawerLockBit



Build a Torsion Box

To see plans for a workbench using a torsion-box top, go to: www.AmericanWoodworker.com/145/TomsTorsionBoxBench



Great American Woodworker

To read more of Mark Love's thoughts on woodworking, go to: www.AmericanWoodworker.com/145/MarkLove



Assembly Table

To see a video showing how these legs work, go to: www.AmericanWoodworker.com/145/AdjustableLegs



Greene & Greene Details

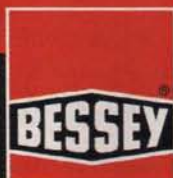
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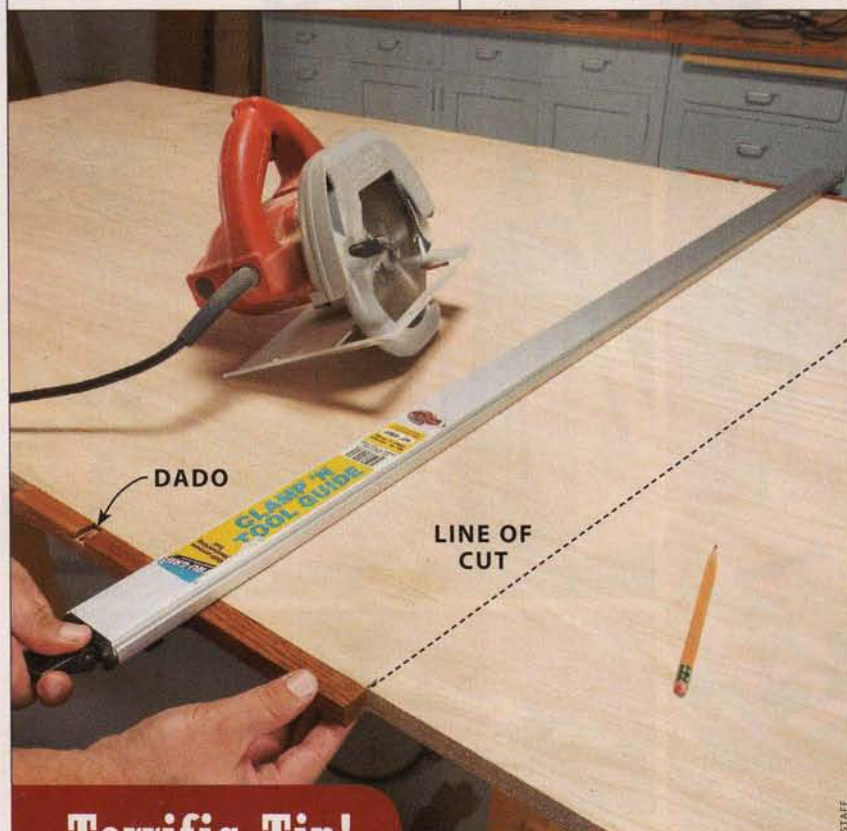
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Terrific Tip!

Double-Duty Edge Guide

INSTEAD OF MEASURING for my circular saw's offset each time I need to make a cut, I use a modified edge guide. I screwed two 3/4" x 3/4" x 12" hardwood blocks to the front and back clamp bars of the guide and clamped the guide to a board.

Next, I placed the saw's base against the edge guide and made a cut through the blocks and the board. The end of each block now indicates exactly where the saw will cut. I just line up the end of one block with a pencil mark on the panel, clamp the guide, and turn on the saw.

I also routed a dado in the other end of the hardwood blocks, using the same method. Again, instead of measuring my router's offset, I just position the dados in the blocks next to a pencil mark on the panel, and rout away.

Brett Bateman

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Mid-Field Biscuits

HERE'S A SIMPLE JIG for accurately cutting biscuit slots on the face of a wide board, such as the sides of a bookcase. The jig is just a large plywood T-square, made from three pieces of 3/4" x 3" x 22" plywood. Glue two pieces to make the blade. (The extra thickness provides more surface to register against.) Screw the blade to the third piece at a 90° angle.

To use the jig, mark the location of the shelf's bottom on the workpiece. Slide the jig's fence against the front edge of the workpiece, line up the top of the jig's blade with your mark, and clamp the jig in place. Stand your biscuit joiner on end to cut the slots. Cut the slots in the shelf by laying the shelf on a flat surface, so that the slots are registered from the shelf's bottom.

Patrick Minick

Universal Planer Sled

LET'S FACE IT: running a twisted board through the planer doesn't make it flat. The board will still be twisted when it comes out. The trick is to use a sled that prevents the board from rocking as it's being planed. That's not a new idea, but I've made a sled that accommodates a board of almost any size, no matter how twisted.

I made the sled 12" wide and 6' long. It can be glued up from narrow boards, made from MDF, or be a melamine shelf purchased from a home center. Whatever the source, it has to be flat. Glue a 1/2" thick stop block to the leading edge. Drill holes in the sled wherever needed and insert T-nuts from the bottom. Counterbore the T-nuts so their flanges don't catch on the planer's bed.

Next, mill a bunch of 1/2" thick hardwood strips. Bevel some of the strips' ends, and leave others square. Bandsaw adjustment slots down the strips' centers. The wedges steady a wobbly board, and the square-ended strips hold it in place. Secure the blocks and wedges by screwing pan-head machine screws and washers into the T-nuts. Make sure the screws don't stand proud of the board you're planing!

Wayne Clevenger

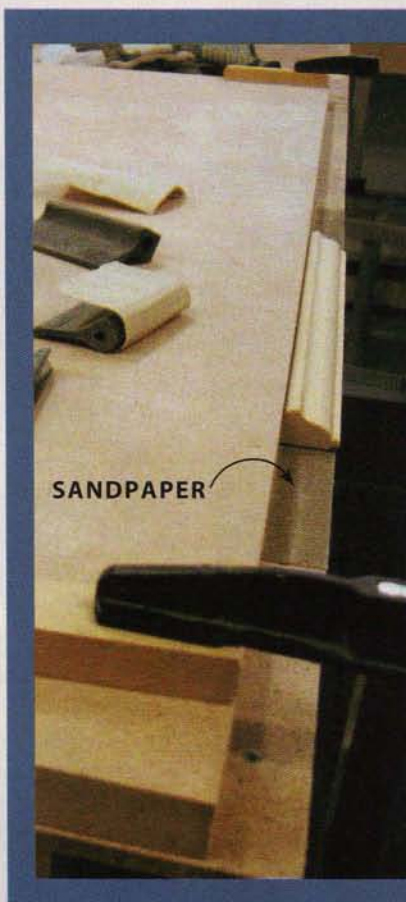


Two-Screw Technique

AS HARD AS I TRY to avoid it, every now and then I need to mill a small part on the router table. I've learned the hard way that you should never hold that part by hand, for three good reasons: first, your fingers would be way too close to the bit; second, the part makes very little contact with the fence; and third, small parts can easily become projectiles.

So here's how I do it: I lock the small part in the jaws of a handscrew. To make a broader bearing surface, I clamp a second handscrew around the first one, adjusting its position so that its tips bear against the fence.

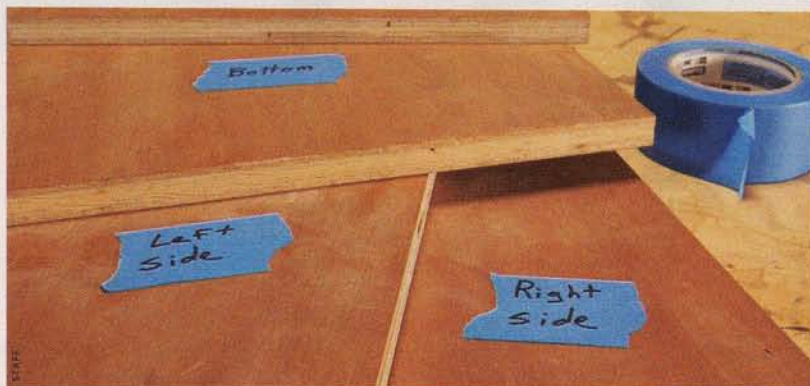
John English



Sanding Molding

HERE'S A VERY SIMPLE JIG to prevent molding from sliding around when you sand. First, place a few pieces of sandpaper along the edge of your bench (I use a worn out sanding belt, cut open to lay flat.) Next, clamp a backer board on top of the sandpaper, creating a rabbet that's slightly narrower than the molding. Butt the molding to the backer board, and you're good to go.

Serge Duclos



Make Your Marks On Painter's Tape

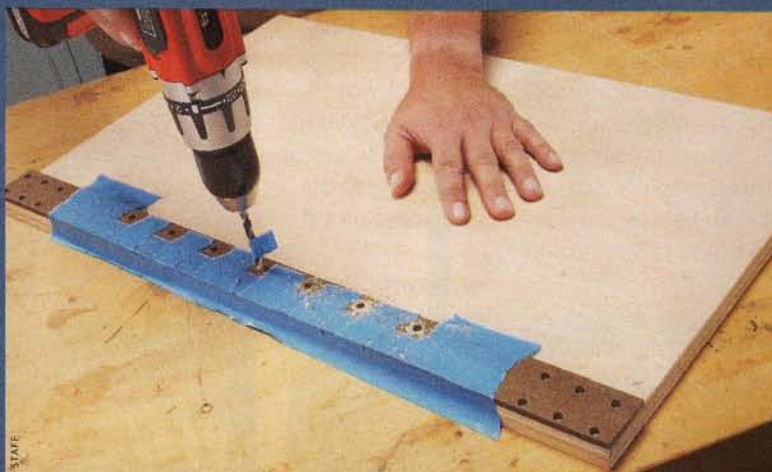
INSTEAD OF WRITING directly on a project's parts, I stick a piece of painter's tape on each part, and put identifying marks on the tape. Now I don't have to sand off pencil marks or stop during assembly to measure and make sure I'm using the right part.

Al Moreen

Perfect Shelf Pin Spacing

THIS IS AN INCREDIBLY EASY WAY to drill evenly-spaced 1/4" holes for shelf pins. Just cut a strip of perf-board 1-1/2" wide and trim it to the length of the panel. Cover the holes you're not using with masking tape, and then position the strip on the panel's side. Clamp or tape the jig in place. Flip the jig over to drill the other edge of the panel.

Heinz Rudau



Toe Space Router Jig

CUTTING TOE SPACES on the sides of base cabinets is lightning fast with this router jig. Make the jig from a 3/4" x 18" x 30" piece of plywood. Lay out a toe space on one corner of the plywood, then cut it out on the tablesaw. Make the rip

cuts a bit extra-long to get a precise corner—overcuts won't affect how the jig works. Add 2" wide hardwood stop blocks on the front and bottom edges of the jig. Center the blocks on the plywood, so you can position the jig on either a right or left cabinet side. To make a toe space in a cabinet's side, cut a rough



opening first with a saber saw. Clamp the jig to the workpiece and finish the job using a router with a top-bearing pattern bit. The router leaves a rounded corner, but that's easily squared up with a chisel.

Mitch Palmer

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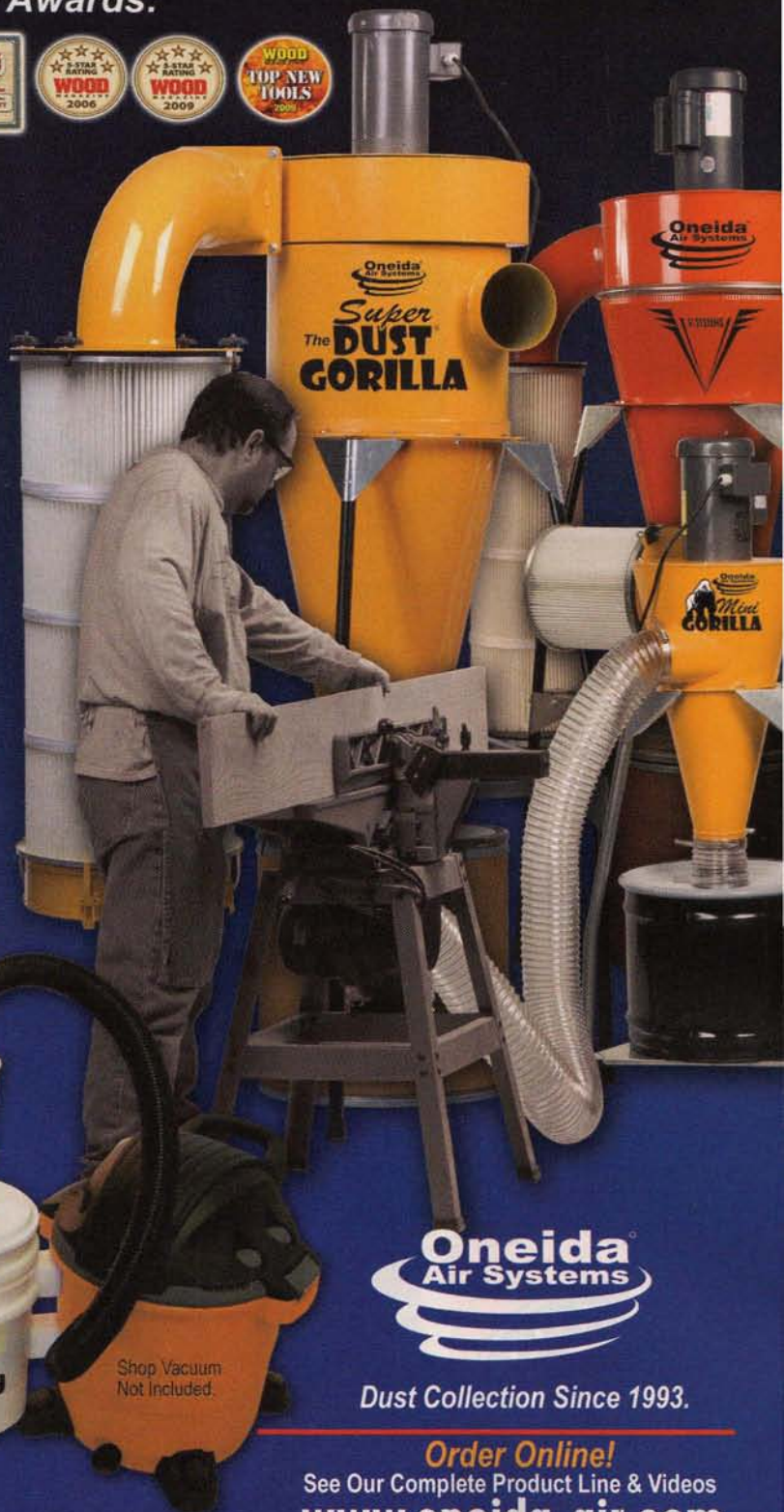
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Junk to Gem Marking Knife

OLD BANDSAW BLADES can easily be recycled into useful marking or carving knives. One blade nets you a slew of small pieces. Use a tin snip to cut off a piece of the blade, grind off the teeth, and then grind the profile. Quench the blade in water quite often so you don't burn it; a thin piece of metal can heat up very fast.

Next, file or grind the cutting edge's bevel. Make a two-part handle from scrap wood and fasten the blade using epoxy or rivets. Finally, hone the edge.

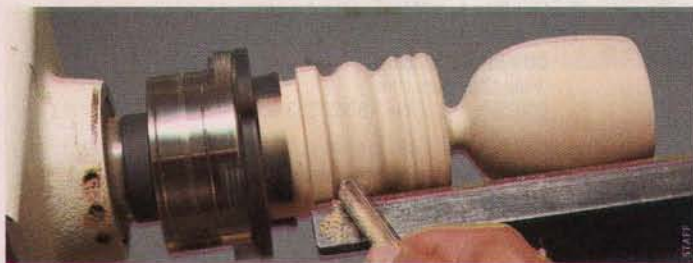
Robbie Dotson



String Band Clamp

WHILE MAKING A BASE for a wooden vase, I had to glue up a small octagonal shape. I made this simple band clamp from a piece of string and a rubber band. Here's how it works: first, tie one end of the string to the rubber band and loop the string around the workpiece; next, run the string through the other end of the rubber band and pull it tight. When you get the right amount of tension, clamp the loose end of the string. For more clamping pressure, use more rubber bands.

Cameron H. Daley



Turning Tune-up

I CAN'T STAND THROWING AWAY good wood. When I'm turning a goblet or any other object, I don't leave the waste areas blank. I pick up a gouge or a skew and use the waste to perfect my turning techniques.

Bob Patros

Corner Clamping Jig

WHEN BUILDING CABINETS, drawers or boxes, I use a jig to hold the corners at 90° while gluing or nailing. Commercial jigs range from \$20 to \$75, so I make my own. Here's how: first, cut a piece of MDF to a perfect square. Drill holes large enough for your clamp's jaw, about 1" apart, on two adjacent sides. To use the jig, insert the clamp's fixed jaw into the hole and the sliding jaw against the box's outer side.

Bill Monahan



2010 Design In Wood Exhibition

Call For Entries

**Entries Due:
April 30, 2010**

Show dates:
June 11 - July 5, 2010.

22 Entry classes,
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Furniture to Wood
Carving. \$21,000
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Design in Wood Exhibition is co-sponsored by the San Diego Fine Woodworkers Association and the San Diego County Fair. Design in Wood is the largest juried woodworking exhibition of its type anywhere. The exhibition is open to all interested adult woodworkers.

Download an entry form from www.sdfwa.org/designinwood2010 or send a #10 self-addressed stamped envelope to Design in Wood, San Diego County Fair, PO Box 685, Solana Beach, CA 92075. Online registration will start in mid-March 2010 and must be submitted at www.sdfair.com/entry/designinwood by 5:00pm Pacific Time on Friday, April 30, 2010. Digital photographs must accompany each entry along with fees. See photographs of previous exhibitions at www.sdfwa.org. For further information, contact Bob Stevenson, Design in Wood Coordinator, at 619-422-7338.



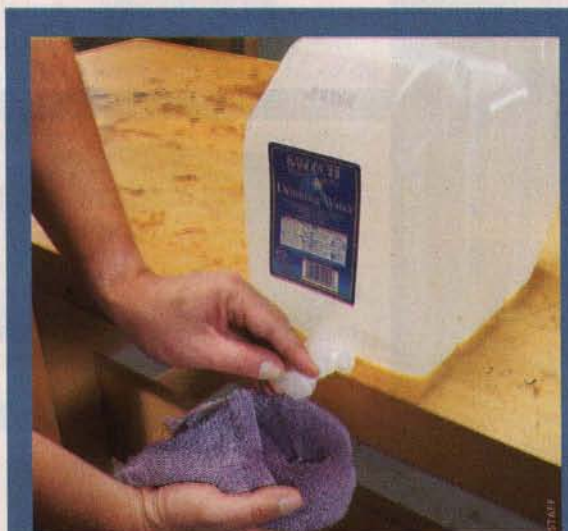
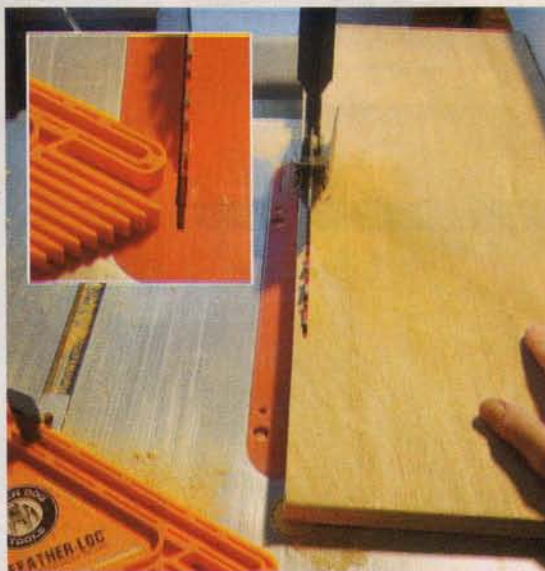
Featherboard Ripping Stop

I'M ALWAYS ON THE LOOKOUT for different ways to use the things I already own. I found that I didn't need to buy or make an extra jig for ripping thin, uniform strips on my tablesaw, for example. I use my featherboard.

The featherboard clamps into the saw's miter slot. I just turn it around, so the fingers point towards me, and temporarily place it next to the blade. I adjust the featherboard so that the distance between its end and the blade is the thickness I want to cut. Next, I slide the featherboard so it's in front of the blade and lock it in the miter slot. I set the stock against the featherboard, slide the fence up to the stock's right edge, and make the rip cut. To make the next cut, I reset the fence.

The advantage to this method is that I can leave the guard on my saw; in this photo, I've lifted it out of the way so you can see what's going on.

Jayne Thorson



Cheapest Plumbing Ever

WHenever I need a cup of water or a damp rag, I just turn the spigot on my \$3 water jug. That's much cheaper than plumbing my shop!

O'Neil Long



Planer Blade Drawknife

MY PORTABLE PLANER uses disposable blades. When the first set got dull, I didn't throw them away—I turned the two blades into very useful drawknives. I wrapped duct tape around the ends of the blades and touched up their cutting edges with a diamond paddle. The narrow duct profiles of these tools are perfect for cutting tight curves.

Howard Lambka



Soda Cap Standoffs

WHEN FINISHING a flat panel, I use plastic soda bottle caps as standoffs to raise the panel above the bench. First, I finish the back side of the panel. Then I set the wet side on the upturned soda caps and finish the front side. One small problem—the soda bottle tops have a series of protruding points, from breaking the safety seal, which leave a small ring. But that ring is easy to sand out.

Rich Flynn

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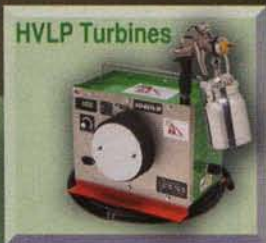
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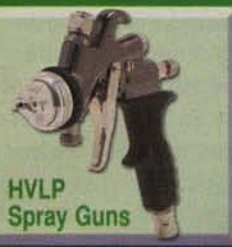


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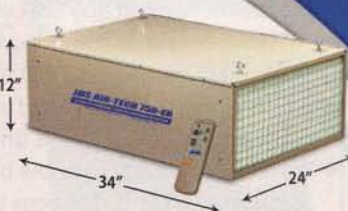
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Pro Slider

GENERAL INTERNATIONAL HAS REDESIGNED their Excalibur sliding table for its 20th anniversary.

First and foremost, they made the table more solid and stable by beefing up the cross bracing and adding an extra leg. A new brace bolts the entire table to the back of your saw. To compensate for uneven floors, they designed the legs to be easily adjustable.

The new design of the sliding quick-mount bracket adds substantial crosscutting capacity, which is the major benefit of a sliding table. You can crosscut or miter stock up to 49" wide with the fence at the front of the table. You can cut stock up to 72" wide with the fence positioned at the rear of the table.

General has also added positive stops for the fence at 15°, 22-1/2°, 30° and 45° to make setting up miter cuts quicker and easier.

The main table attachment

bracket has been redesigned for easier mounting— it's now two pieces. The bracket stays permanently attached to the saw and allows for the table to be detached and reattached without readjustment, which is great for smaller shops that need a sliding table but don't have the space to keep it set up.

Problems caused by debris wearing down the sliding mechanism are eliminated by using bearings instead of the Ultra-High Molecular Weight

(UHMW) runners used in previous versions. Brushes are also mounted with the bearings to keep the sliding mechanism clean.

Getting the table parallel to the tablesaw is easier, too. Once the table is level, you simply loosen the bolts holding the fence in place, move the table into alignment, and retighten the bolts.

Source: General International, www.general.ca, (514) 326-1161, Excalibur Pro-Series Sliding Table, 50-SLT60P, \$1380.



Powerful, Portable Dust Collector

THE GRIZZLY 1-1/2 HP CYCLONE Dust Collector is a great combination of power and portability. Rated at 866 CFM, the unit provides excellent air flow for a portable unit.

The great thing about a cyclone design is that heavy chips and dust are separated from the fine particles. Only the fine particles go through the impeller to the filter, which allows the motor and impeller to operate more efficiently.

One nice feature of this unit is that you can place a disposable bag in the dust barrel. That's made possible by a small hose that connects the barrel to the cyclone. Suction from the hose keeps the bag secured and fully open. To remove the bag, simply unlatch the barrel, wheel it out from under the unit, and lift the bag out. It's much easier than trying to dump a 30-gallon steel drum into a trash can.

Another handy feature is the manual handle for cleaning the .2 micron pleated filter. A quarter turn of the handle shakes dust from the filter and keeps it clear of suction-slowing debris. The pleated filter provides more surface area for capturing fine particles than standard-sized filter bags—and in a smaller space.

Running at only 65 dB, this unit is perfect for woodworkers whose families like peace and quiet. And, at just under 6' tall, it's small enough to fit in the basement, too.

Source: Grizzly Industrial, www.grizzly.com, (360) 647-0801, 1-1/2 HP Cyclone Dust Collector, G0703, \$825.





First-Class Planes

AFTER AN ABSENCE of over fifty years, Stanley has rejoined the ranks of premium plane makers. If you're interested in buying the best, they've just introduced five new tools that are definitely worth a close look.

The five planes are: a No. 4 smoother, a No. 62 low-angle jack, a No. 9-1/2 standard angle block plane, a No. 60-1/2 low-angle block plane, and a No. 92 shoulder/chisel plane. The smooth, jack and block planes all have 1/8" thick irons made from A2 steel, which holds an edge

longer than high-carbon steel. All of these planes also have Norris-style mechanisms, which incorporate depth-of-cut and lateral adjustments in one lever. The throat opening of each plane is adjusted by sliding a portion of the sole in front of the blade—a familiar feature on block planes and low angle jacks, but a novel one for bench planes, like this smoother.

Source: Stanley Tools, www.stanleytools.com, (800) 782-6539, #4 and #62, \$179; #9-1/2 and #60-1/2, \$99; #92, \$149.

New Chopmaster

FORREST'S CHOPMASTER IS THE FIRST BLADE in their new Signature Line series. It's a precision crosscutting blade for your miter saw or radial arm saw. Forrest has redesigned its original Chopmaster blade, adding 10 more teeth (90 versus 80) to make the blade run quieter and produce smoother cuts, with less tearout, than the original Chopmaster blade.

The addition of more teeth at a slightly negative hook (-5°) decreases cutting pressure, so there's less stress on the blade. The blade also has smaller gullets, which helps it run quieter.

The new Chopmaster is available in 10" and 12" diameters. Custom sizes are also available.

Source: Forrest Manufacturing, www.forrestblades.com, (800) 733-7111, 10" Signature Line Chopmaster, CM10905105, \$167;



12" Signature Line Chopmaster, CM12905115, \$179.

Souped-Up Bandsaw

THE LAGUNA 14X14 SUV (Souped-Up Version) is a deluxe 14" bandsaw that's the culmination of Laguna's 25 years of experience in manufacturing bandsaws.

It offers an impressive 14" of resaw capacity (most 14" bandsaws have a 6" or 12" capacity). With a 3 hp motor, it has all the extra power you need for resawing wide boards. It's also loaded with helpful features like a rack and pinion mechanism to tilt the table (assisted by a gas cylinder), a quick release for blade tension, and a foot brake that also turns off the saw.

The saw weighs 380 lbs. and has a 35-1/2" high cast-iron table that is 15" square. It accepts a 125" blade up to 1" wide, has a throat clearance of 13-1/4" and comes with a high-quality fence.

Source: Laguna Tools, www.lagunatools.com, (800) 234-1976, 14x14 SUV 14" Bandsaw, MBAND144200, \$1,495.



Multi-Viscosity Glue Kit

TITEBOND HAS PUT TOGETHER a very useful kit featuring four new CA adhesives. Each 2 oz. bottle has a different viscosity: thin, medium, thick and gel. These glues give you from 5 to 30 seconds assembly time, depending on their viscosity. They set in 3 to 20 seconds. An activator, also included, makes bonding even quicker.

Use the thin viscosity for bonding hairline cracks in wood or to repair loose veneer. The medium is perfect for bonding small moldings or for bonding pen tubes to pen blanks. The thick viscosity works great for quickly bonding jigs, fixtures and miter joints in crown moldings. The gel is great for use in cabinet installation or to bond MDF and other porous woods. Also included in the kit is a 4 oz. bottle of Titebond III, a waterproof wood glue with a 10-minute open time.

This kit offers you a chance to try out each viscosity, so you can decide which is best for your needs.

Source: Titebond, www.titebond.com, (800) 347-4583, Instant Bond Kit, \$35.



High-Capacity Tool-Actuated Switch

TOOL-ACTUATED VACUUMS are very convenient, but most tool-actuated vacs have a 15-amp limit (the vac and the tool can't use more than 15 amps combined). This means you can't use tool-actuated vacuums with power-hungry tools, such as a 3 hp router or a tablesaw. This unit is different—it contains two 12-amp circuits (and two power cords), so you can run a vacuum and the power tool on different circuits in your shop without worrying about overloading the switch.

Source: MBright Tools Inc., www.iVac-Switch.com, (613) 826-2200, iVac Switch, \$39.50.



Dedicated Blades for Better Cuts

THE DEWALT PRECISION TRIM SAW BLADE LINE features six

10" thin-kerf blades, and most are designed for a specific job. We had a chance to try out each one and felt spoiled. It's a treat to use a blade that's been engineered to perform one task better than any other.

The 24-tooth blade is great for ripping. The 40-tooth blade is a general-purpose tablesaw blade. The 50-tooth ATB+R blade is a combination rip/crosscut blade made for tablesaws. The 60-tooth ATB blade is designed for smooth crosscutting on table or miter saws. The 80-tooth ATB blade is designed for fine finish work on a table or miter saw. The 80-tooth TCG blade is designed for non-ferrous metals, plastics and fine trim on a table or miter saw.

All of these blades have a laser-cut hardened steel plate that allows for fast, smooth cutting with minimal material waste, according to DeWalt. Increased vibration dampening comes from expansion slots and harmonic slots cut into the body of each blade. This optimized plate design helps to eliminate blade flex and makes the blade quieter.

The blades' teeth have more carbide than standard blades, which allows for more re-sharpenings. The blades are also protected with an anti-stick coating that decreases heat and friction, resulting in cleaner cuts.

DeWalt also makes some of these blades in 8-1/2" and 12" sizes.

Source: DeWalt, www.dewalt.com, (800) 433-9258; 10" Precision Trim Saw Blades, \$30-\$60.

Four Powerful Drills in One

FESTOOL'S T 12+3 AND T 15+3 LITHIUM-ION

cordless drill/drivers combine interchangeable chucks with intelligent electronics, brushless motors and lithium-ion batteries for a great combination of power and versatility. The T 12+3 uses a 12-volt motor to achieve the performance of a 15-volt drill ($12+3 = 15$). The T 15+3 uses a 15-volt motor to achieve the performance of similar 18-volt drills ($15+3 = 18$).

Each drill can use five different chucks that can be changed quickly, without tools. The standard set includes four chucks: a quick-release chuck, a standard 1/2" chuck, a right-angle chuck and an eccentric chuck. A depth-stop chuck is available separately.

We really liked the versatility of these drills in the shop. The quick-release chuck is great for situations when you need to change bits for different size holes or for going from drilling to driving. The eccentric attachment is designed for working in spaces that are unreachable by standard drills, like the inside corners of a cabinet. The right-angle chuck also allows you to drill or drive in a tight spot. The standard chuck can handle bits with 1/2" shanks.

The drills' brushless motors have many benefits, including higher efficiency and reliability, reduced noise, and longer service life. Producing less friction, they make more efficient use of energy and allow a lower-voltage motor to deliver more power.

Each drill is available as a set that includes a charger, two 2.6 amp hour lithium-ion batteries and four chucks, packaged in a rugged case. The drills are also available in a stripped-down version with a charger, two batteries, the quick release chuck and a standard 1/2" chuck in a rugged case.

Source: Festool, www.festoolusa.com, (888) 337-8600, T 12+3 Set, \$525; T 15+3 Drill Set, \$575; T 12+3, \$400; T 15+3, \$450; FastFix Depth Stop Chuck, \$98.



Inexpensive Shop Assistant

MOST OF US KNOW all too well the hassles of working with large sheets of plywood. You get home from the lumberyard, drag your sheet into your shop and lean it against the wall. When it comes time to rip that sheet into usable pieces, you drag the piece over to your saw, somehow maneuver it on to the table, start ripping and hope for the best.

Gorilla Gripper's Leg-Up makes life just a little easier. It provides extra support in just the right place. Put your sheet onto the Leg-Up, swing it onto the table and you're set to go. The Leg-Up then drops slowly to its original position. We found it really handy for cutting numerous sheets of plywood. It attaches easily to your saw's table or fence rail and is easy to remove so it's not in the way when you don't need it.

Source: Gorilla Gripper, www.gorillagripper.com, (800) 423-5008, Leg-Up, 58008, \$49.95.



Part Clamp, Part Cookie

THESE APTLY NAMED BENCH COOKIES are clever and inexpensive problem solvers. A set of four elevates a board for sanding, routing or staining, while firmly gripping the piece in place. The cookie is composed of a plastic base sandwiched between two pieces of rubber-like material (like a blue Oreo).

In the shop, I was surprised at how well this simple device really worked. I placed a door on the

cookies—no clamps—and fired up a router to round over the edges. The door didn't even move. The pressure of the router alone kept the door firmly in place. And with the door elevated off the bench, I was able to roundover all four sides without repositioning it.

For less than the cost of a takeout lunch, you could have a set or two. I'm still finding new ways to use them.

Source: Rockler, www.rockler.com, (800) 279-4441, Bench Cookies (set of four), #26357, \$11.99.

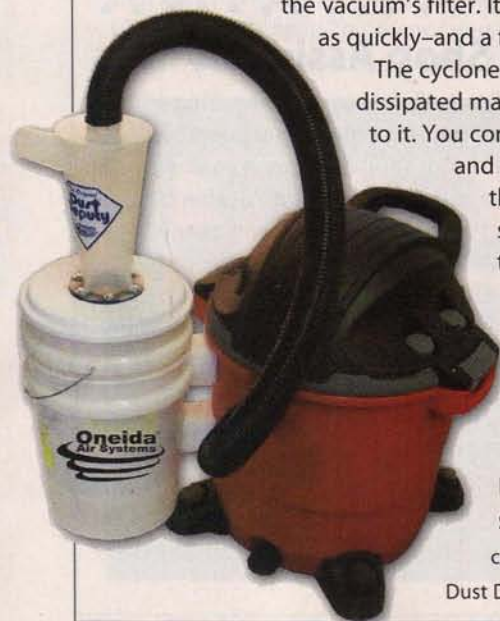
Make Your Own Mini Cyclone

THIS HANDY ATTACHMENT from Oneida allows you to add a cyclone to your shop vacuum, making it a two-stage dust collector. The cyclone keeps your filter clean, removing larger dust and debris before the air stream hits the vacuum's filter. It also means your vacuum won't fill up as quickly—and a full vac can easily clog a filter.

The cyclone itself is injection-molded, static-dissipated material—in other words, dust won't cling to it. You connect the cyclone between your hose and your vacuum. Larger dust falls into the cyclone's bucket instead of getting sucked into the vacuum canister or getting stuck in the filter.

The unit comes with two buckets. One bolts to your vac; the other nests inside and collects dust and debris. If you'd prefer to buy or repurpose your own five-gallon buckets, the cyclone is also available separately in a D.I.Y. package.

Source: Oneida Air Systems, www.oneida-air.com, (800) 732-4065; Dust Deputy D.I.Y., \$59; Dust Deputy Kit, \$99.



Portability and a Helical Head

STEEL CITY HAS INCORPORATED a helical cutterhead into its portable planer. The head is comprised of 26 indexed high-speed steel (HSS) inserts that provide a cleaner finish and quieter operation than two or three straight-knife designs.

Each insert has four sharpened sides (as opposed to two sides on disposable straight knives). If one of the inserts gets nicked, it's easy to rotate it to get a fresh cutting edge.

A 15-amp 120-volt single-phase motor drives the planer. It provides plenty of power for full-width planing or long-run jobs. The planer has a headlock to minimize snipe. Other features include a depth-of-cut indicator and extra-large foldaway in-feed and out-feed tables to support large boards.

Source: Steel City Tool Works, www.steelcitytoolworks.com, (877) 724-8665, 13" Deluxe Portable Planer with Helical Head, 40200H, \$699.

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Trusty Guide

MILESCRAFT'S TURNLOCK CIRCLE/EDGE GUIDE is a great, inexpensive way to cut circles, dados and grooves with a router. It's two guides in one. I found the circle guide surprisingly helpful for cutting short arcs on small pieces and for making circular table tops.

The edge guide allows you to cut grooves and dados. When parts are too large to cut on a router table, this is the way to go. If you don't have an edge guide for your router, we'd certainly recommend one—and this guide will fit most any router.

To use the device, you remove the baseplate from your router and install Milescraft's universal base (it's included with the Circle/Edge Guide). This base then snaps right into the Circle/Edge Guide; no tools are required. It's a very convenient system. Leaving the universal base on your router means that you can quickly go from routing edge profiles to cutting circles and back to edge profiles



again, all using the same interchangeable parts.

Source: Milescraft, www.milescraft.com, (847) 683-9200, TurnLock Circle/Edge Guide, #1203, \$34.99.

Most Versatile Dremel Yet

THE DREMEL 4000 is the company's most versatile rotary tool yet. It was designed to be easier to use and longer lasting than previous models. It's recommended for carving, engraving, routing, grinding, sanding, cutting, cleaning and polishing.

The tool features a 1.5-amp, variable-speed motor that runs from 5,000 to 35,000 rpm. Replaceable motor brushes extend the motor's

life and a larger fan motor keeps the tool cool. Electronic feedback control offers consistent power. The tool senses workloads and adjusts to maintain tool speed.

In addition, it's the only Dremel tool that interfaces with all previous Dremel attachments, including the multisaw and planer attachments originally created for the 400 Series XPR tool. New attachments made specifically for the 4000 include the Detailer's Grip, a pistol grip that



Handy Drafter

THE FLAT LYING TRAMMEL SET from M. Power Tools is a simple design that's quite useful for layouts. It's comprised of two heads that attach to any standard metal ruler or square. The ruler stays in a horizontal position, making it easier to draw circles and straight lines.

It's more versatile than a compass for drawing circles because the size of your circle is limited only by the length of your ruler. If you replace the pencil with the included cutting blade, you can cut circles out of card stock or veneer.

Another handy use is drawing parallel lines. Attach one head to your square and you can draw a line parallel to the edge of your board simply by running the square along the board's edge. Or, you could put pencils in both heads to draw two lines parallel with each other.

Source: M. Power Tools, www.m-powertools.com, (613) 525-3328, Complete Flat Lying Trammel Set, \$19.99.



gives you better control, and the Sanding/Grinding Guide, a fixed, straight-edge guide. It allows users to guide a workpiece to a securely mounted rotary tool (similar to using a router table) or guide the tool along the edge of a flat or beveled surface.

Source: Dremel, www.dremel.com, (800) 437-3635; Dremel 4000, \$79-\$149.

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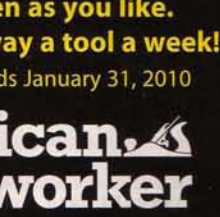
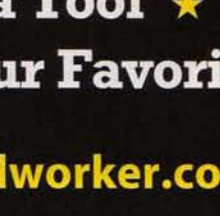
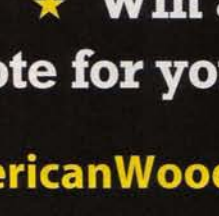
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American Woodworker

The Well-Equipped Shop

continued

One Battery—Many Tools

RYOBI HAS COMBINED THE LONG-LASTING POWER of lithium-ion batteries with a line of handy gadgets for woodworkers and hobbyists. All of the tools are based around the Tek4 battery, a 4v lithium-ion rechargeable battery just 3" long and 1" in diameter. The Tek4 battery outlasts up to 6,000 AA alkaline batteries and has over 2,000 recharge cycles, according to Ryobi.

The line includes the Self-Leveling Plumb Cross Laser, Professional Laser Distance Measure, Professional Digital Multimeter, Infrared Thermometer, DuraShot 8 MP Digital Camera, Motion Sensing Alarm, Digital Key Lock Box, LED Flashlight, Audio Plus Noise Suppression Headphones, Portable Power pack and a wall charger, rapid charger and a USB-powered charger. We liked the digital camera and noise suppression headphones the best.

The digital camera is handy for taking snapshots in the shop. It's durable and well protected, so you don't have to worry about dust getting into the controls. And, at 8 mega pixels, it has plenty of resolution to show off the details of your handiwork. The noise suppression headphones are also quite nice for the shop. They reduce outside noise up to 25 dB, but still let you listen to your tunes via a 1/8" jack.

Source: Ryobi, www.ryobitools.com, (800) 525-2579, \$11.97 - \$149.



Extend Your Miter Slot

IF YOU'VE EVER HAD the end of a cut go bad because your miter gauge or sled wiggled, the Accurate Track may solve your problem. The premise behind the Accurate Track is simple: its two adjustable bearings effectively lengthen your saw's miter slot by 6"-8". It's also useful for bigger crosscut sleds that need extra support behind the table.

Installation is easy, especially with the optional mounting brackets made to fit most table saws. Installation on our cabinet saw involved drilling three holes in the rear support bar, attaching the optional mounting bracket and then attaching the Accurate Track. Aligning the Accurate Track took only a minute and it was ready to use.

Source: Accurate Track, www.accurate-track.com, (800) 880-9976, Accurate Track, Model 101-A, \$129.95; Mounting Bracket, Model 101-O, \$21.49; Mounting Bracket, Model 102-O, \$20.95.

Mobile Cyclone

LAGUNA'S 2 HP MOBILE Cyclone Dust Collector combines the benefits of a cyclone with the portability needed for a workshop without a central dust collection system.

Cyclone collection separates wood particles and dust from the air stream before going to the pleated cartridge filter. Dust and debris are collected in a 29-gallon metal collection drum which has a quick release and its own casters for quick and easy emptying.

A motorized filter cleaner automatically shakes the filter after each use, keeping the filter clean and clear of suction-robbing debris. The unit comes standard with a remote control so you can start the machine from anywhere in the shop. It's also relatively quiet, rated at 74 dB, protecting your lungs and your hearing.

Source: Laguna Tools, www.lagunatools.com, (800) 234-1976, Mobile Cyclone Dust Collector, MDC0550-0145, \$1,695.



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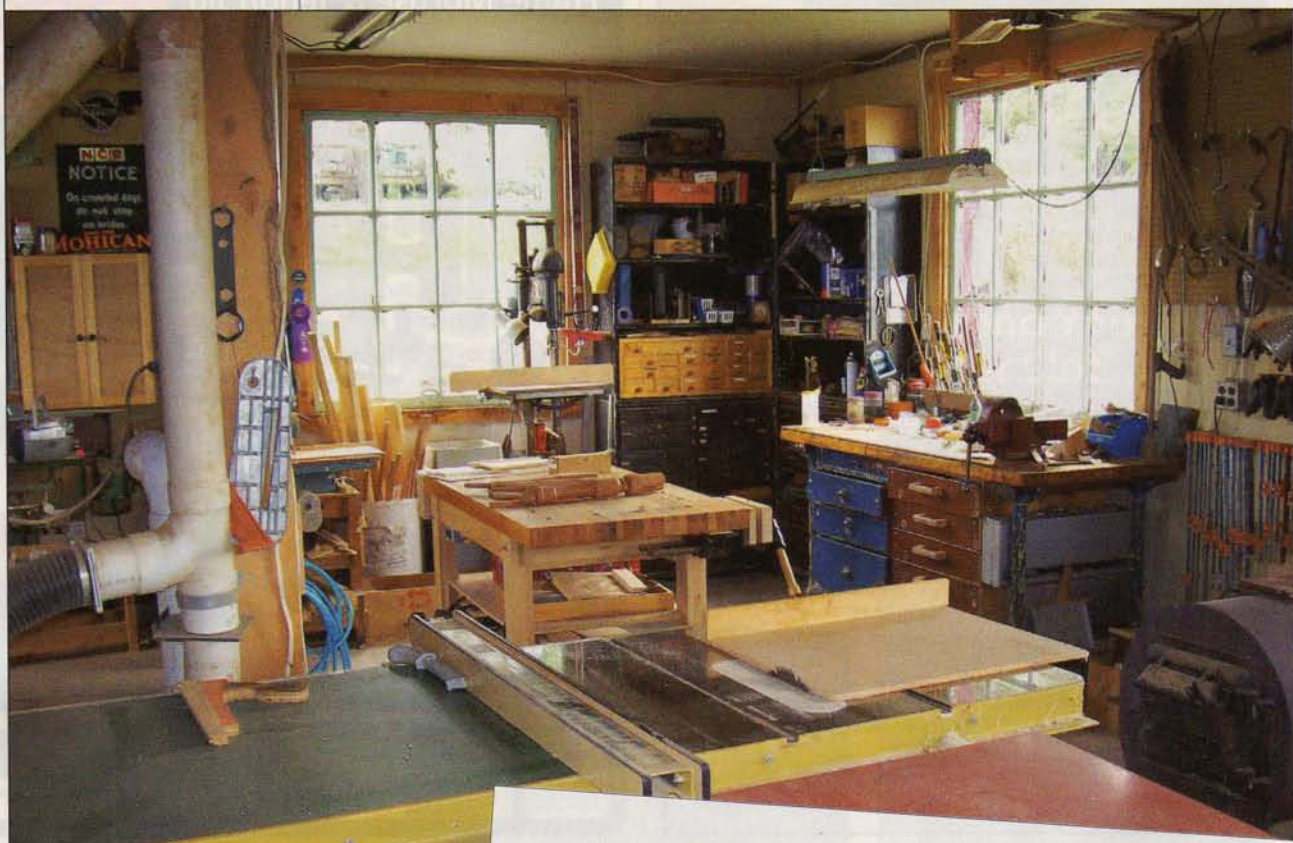


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Rural Shop

HAVING BEEN A WOODWORKER for well over fifty years, I knew what I wanted in a shop: an ample assembly area with plenty of natural light and my tools close at hand.

As I live on a small farm, my shop also had to provide room to work on my farm equipment and allow occasional welding and metal fabricating. But beyond its functionality, I wanted my shop to feel more like a favorite tool than a building.

My shop is constructed of native rough-cut lumber, much of which came from my own 55-acre farm. Its board and batten style exterior is topped with a metal roof. Wooden sliding doors provide easy access,



and five wooden-frame windows that were reclaimed from an old school building bathe the main shop area with light. This main area measures 720 sq. ft. and is complemented by a 9 ft. ceiling. I use the ventilated attic space above the main shop primarily for drying lumber.

I build most of my furniture

projects from local woods, some of which I harvest right here on the farm. I send the lumber to the local sawmill and then sticker it in the attic above the shop. Depending on the species and board thickness, it takes one or two years to dry to an acceptable moisture level.

My main shop area has an imagi-



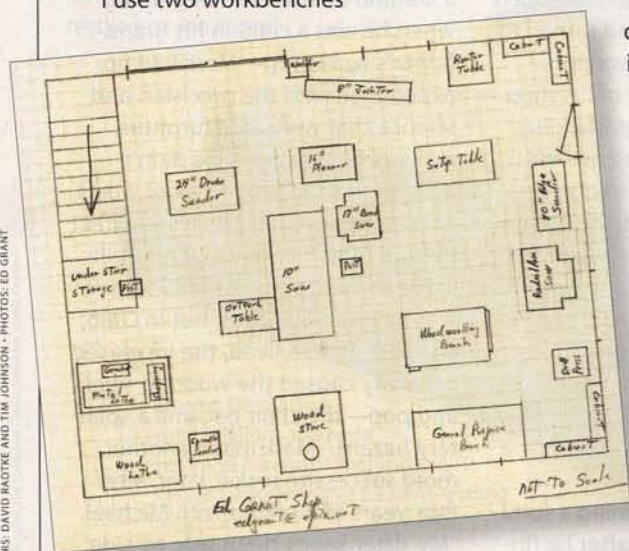
nary divider down the middle. I do most of my woodworking in the half where the workbenches are located. All of the machines are stationary in this area. In the other half, in front of the sliding doors, the machines are on mobile bases, so I can move them out of the way to work on my farm equipment.

I use two workbenches

for woodworking. One bench has two woodworking vises, but no tool tray, so I can keep it clutter-free. The second bench has ten large drawers. It keeps my tools close at hand and works great when I need a second work surface. I also have a third adjustable-height bench that I use for planing and jointing.

The blower for my dust collection system is located in the attic. It deposits sawdust directly into a small, specially-built trailer that's located outside the shop. When the trailer is full, I transport it to the barn, where I use the sawdust for animal bedding.

Ed Grant
Ulster,
Pennsylvania



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Mark Love

A former minister discovers a new calling.

By Chris Cander

WHEN MARK LOVE delivered sermons in his Austin, Texas church, he hoped to inspire his parishioners to change their lives. But gradually, Mark realized that he needed something more tangible than the job of transforming souls. So after five years of ministering, he stepped down from the pulpit and turned to another passion: woodworking.

In the peaceful quiet of his shop in the Texas Hill Country, Mark has discovered that the same qualities that made him a caring minister—perseverance, patience and an eye for grace—make him well suited to woodworking. Just as he saw promise in his parishioners, Mark now sees the potential for beauty in each piece of raw wood.

From the Word to woodworking

Mark's journey to becoming a furniture maker began right after he fin-

ished seminary in 1994. Uncertain of his chosen career, he began an apprenticeship with furniture-maker Michael Colca of Driftwood, Texas. "The first thing I learned from Michael was that I had so much to learn," Mark says. Despite a lifetime of interest—beginning when he was a child in his grandfather's workshop—Mark had no experience with the precision and science that went into furniture making. For example, he didn't understand the properties of wood, or how environmental factors affect design. "The first thing I ever built was a rocking chair for my niece. It was beautiful in Texas, but in Ohio, where my niece lived, the increased humidity caused the wood to swell and pop—the chair became a splintery hazard." Mark made another, more successful rocker later, after four years of working with Michael. "My sister keeps them side by side,

This elegant mahogany watchmaker's desk stands tall, to provide both comfort and close viewing during the watchmaker's delicate work.

Reminiscent of classic Greene and Greene design elements and proportions, Mark's Westmoreland table embraces the Arts and Crafts ethic.



and I still cringe whenever I see the first one."

Trusting his instincts

While honing his woodworking skills, Mark realized that the process of refining rough lumber was similar to his earlier aim of helping parishioners discover their spirituality. And he considers the art of combining form, proportion and detail to create a piece of furniture to be just as mysterious an undertaking. "I design by instinct," he says. "There are no rules in my head about how it should be done. I ask clients to send me photos of furniture or architecture they like, so I can understand their sense of aesthetic. I consider the parameters they've given me in terms of function or size, but the rest is just intuition."

Although Mark refers to the influences of celebrated architects and designers—notably Charles and Henry Greene, Frank Lloyd Wright, and Charles Rennie Mackintosh—he doesn't consciously apply their design principles. Instead, Mark absorbs what he thinks are the most appealing aspects of each master's design language into his own unique style. "I love the verticality and use of organic forms by Mackintosh, and the strong, wide-open horizontality of Wright. I think my own pieces reflect some of that," he says. "I want my designs

to be strong, simple and quiet. On a subconscious level, I want them to inspire a sense of dependability and comfort. But mostly, I want people to see the wood first. I hope to convey that something as familiar and ordinary as wood is also unique and majestic. It's a reflection of my spiritual journey. I want to honor what is profound and mysterious about the wood itself."

The spirit in the tree

"When you hold a piece of wood, it can feel as though you're touching the earth itself," Mark writes. "Wood



Echoing Frank Lloyd Wright designs, this bed's expansive horizontal lines and low, stepped silhouette give it a calm, relaxing presence.



The slatted lower shelf on this cherry and walnut sideboard is intended to hold shoes. Mark designed this piece for a client who was personally influenced by Japanese architecture and traditions.

contains warmth, energy that once shone as light from a generous sun, captured by broad, thirsty leaves and transferred into the dense fibers of branches, trunk and roots. This energy waits, imperceptibly, for calamity or decay to release and return it to the heavens whence it came. In this way, perhaps, a tree is like us. Our bodies are vessels for some mysterious bit of life, holding a tiny portion of energy from

the universe, storing it briefly, then releasing it again when our time on earth is complete. Perhaps this is why we feel such a strong connection to wood. Could it be that some part of us recognizes an unbreakable kinship with the tree?"

Answering his call

Mark builds about ten custom pieces each year, working thoughtfully to accommodate the unique

wishes of each client. Although his pieces reflect his aesthetic, Mark's designs are constantly evolving. "I'm intrigued by many design traditions," he muses. "There will always be things I haven't tried, and new things to learn."

Mark says he doesn't miss the ministry. "In designing and crafting pieces of furniture that I know others will enjoy," he says, "I've found my true calling."

To see more of Mark's work, visit www.marklovedfurniture.com.



In grand Arts and Crafts tradition, the legs on this white oak dining table are constructed of four mitered quartersawn pieces, so they match the quartersawn top from every vantage point.

Chris Cander is a freelance writer and novelist. Prior to writing full-time, she was a marketing and communications professional in the high-technology industry. Currently, she is a contributing editor to Oxygen, Clean Eating, and Maximum Fitness magazines.

To read more of Mark's thoughts on woodworking, go to: www.AmericanWoodworker.com/145/MarkLove



Reinterpreting Classic Arts & Crafts Elements

*In the elder days of Art,
Builders wrought with greatest care
Each minute and unseen part;
For the gods see everywhere.*
~Henry Wadsworth Longfellow

MARK HAS A DEEP AFFECTION for the honesty and integrity celebrated by the Arts and Crafts movement, which valued individual craftsmanship and sound construction over pieces that were cheaply made and mass produced. A defining principle was to reveal rather than hide the structural elements of the design. "It's full-disclosure furniture making," Mark says. "Exposing the joinery not only shows how the piece was put together, but it becomes a striking part of the design."

In the Westmoreland table, shown here (**Photo 1**) and on page 32, the four leaves store in plain sight. Their exposed ends add thickness to the center of the cantilevered top, so it perfectly balances the mass of the base.

Exposed drawer runners add visual interest to the watchmaker's desk shown here (**Photo 2**) and on page 33. "They're also an example of form following function," Mark says. "Normally the runners would be tucked inside, hidden behind the drawer fronts. Exposing them helps to identify the numerous drawers that define this piece."

Mark's pieces often contain elegant hidden surprises, such as the hand-made extension rails and through wedged tenon used to attach the center leg of the oak dining table shown here (**Photo 3**) and on page 34. "Most craftsmen would use screws, because it's not part of the exterior presentation of the table," Mark says. "But not only is the tenon stronger in the long run, it's a little reward for the person who reconfigures the table for the dinner party."



1



2



3

Restoration Man

I HAVE A SOFT SPOT for old wood-working machines. Many of them have features that you rarely find on new equipment, and once you get past the chipped paint and rusty metal, you'll often find a real gem. Here are three of my favorites.

—Rick Barozinsky

Delta Drill Press

I bought this early-40s drill press from its second owner. In those days, it was common for machines to be purchased without motors; the user then added their own. The motor isn't marked, but it's probably a Walker Turner. This model has a new feature that was introduced in '41: a center pulley, which gave the machine 12 speeds. Prior to that, similar Deltas came in two-pulley High or Low-Speed versions. I'm sure you've noticed that this machine has a foot feed, which was designed for production. I've found that it's perfect for mortising.

I completely refurbished this drill press, including all the bearings, and repainted it Pontiac Engine Blue.



Atlas/Craftsman Tablesaw

This beauty dates from 1939. The motor hangs off the back, like a contractor's saw, but the trunnions are bolted to the body, like a cabinet saw. The body is all cast iron; I made the base below from MDF. The saw weighs a hefty 330 lbs., less the base. A heavy saw is just fine with me, because there's no substitute for mass when it comes to dampening vibration.

Three other features are worth mentioning. First, under the table, the blade is surrounded by a shroud for better dust control. Second, the saw has a blade height indicator, which works quite well. And third, the fence has a lead-screw micro-adjust mechanism. A 1/4 turn of the crank results in the fence traveling a mere 1/64". It's not perfect, though—I have to help engage the mechanism by pinching it with my fingers, but when the fence moves, it's very sweet!



Duro 12" Bandsaw

I put a lot of work into this saw, which dates from the 1930s. I repainted it blue and built a new MDF base for it. That's right—what looks like steel is actually wood. After gluing the base together, I shaped the corners with a 1-1/4" roundover bit. I also added a pull-out handle and casters to the base, so the saw can be maneuvered like a wheelbarrow. I'm pretty proud of that!

Although the machine looks like it's running in the photo, it's not. The wheels are solid aluminum, with no spokes, and the doors have circular cutouts in them. The wheels also have a built-in crown, rather than crowned tires. A crown helps a blade track better—and with new tires, this saw runs as true as can be.



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by Alan Schaffter



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Strong, But Light

This huge torsion box is 8 ft. long, but it easily holds 300 lbs. of bricks and deflects less than 1/2". It weighs only 30 lbs., and is made from inexpensive 3/16" hardboard.

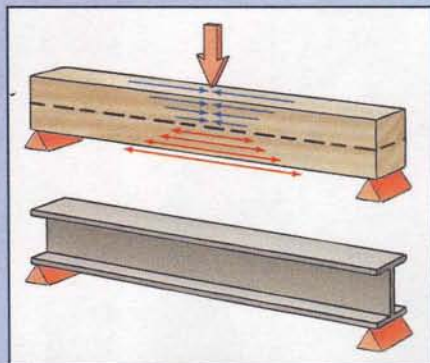
Torsion Boxes—the Real Story

"How can something made from such thin wood be so stiff?" That's what everybody asks when they first meet a torsion box. The engineering principles behind a torsion box are pretty simple; even so, there's a lot of misleading information about torsion boxes, particularly on the Internet. Without getting too technical, here's what you should know:

- A torsion box works like an I-beam (see below). It's almost as strong as it would be if it were made from solid material—but it's much lighter and less expensive.
- The thicker the torsion box, the stronger it will be—by a lot! If you increase a torsion box's thickness by 25%, for example, it will be 100% stronger. If you doubled the thickness, it would be eight times stronger. Strength increases by the thickness cubed.
- The stiffness of the skins isn't that important. A thick material, such as 1" plywood, doesn't necessarily make a stiffer box than using thin material, such as 1/4" plywood. Thickness does matter in another way, though: thin material will deflect more easily where it's unsupported, in the spaces between the web pieces. If you'll be pounding on a torsion box, clamping things to it, or setting heavy objects with narrow feet on it, a thick skin is better than a thin skin. Or you could space the web pieces closer together.
- The thickness of the web pieces isn't all that important, either. They can be relatively thin and lightweight, as long as they resist stretching and compression. For an MDF box, such as the one in this article, I usually space the web pieces 6" to 8" apart. The web pieces must be well-glued to the skins to prevent the skins from buckling, though. That means that the web material shouldn't be too thin—it must be thick enough to have a sufficiently wide glue surface. You don't need to use a special glue to assemble a torsion box—a PVA (yellow) glue works fine. And to clear up two misconceptions on the Internet: the webs don't have to look like miniature I-beams, nor do you have to cut dados in the skins to receive the webs. Torsion boxes don't need to be that complicated!

How an I-Beam Works

When you press down on a solid beam, you actually compress its top section and stretch its bottom section. These compression and tension forces are neutral at the beam's center. In an I-beam, most of the center is removed, to save material and weight, but the forces still act in the same way.



A TORSION BOX is a remarkable piece of engineering. It's stable, light and uses a minimum amount of material, yet it's extremely strong. The idea has been around for years, and you probably have one in your house: hollow-core doors are torsion boxes.

Making a torsion box doesn't require any specialized equipment or skills—a guy with a small shop and a decent tablesaw can easily handle the job.

When I needed a flat, solid, durable and inexpensive top for an assembly table, I planned on making it as a torsion box. I researched the subject and found a lot of conflicting information. I also talked to some experts—and learned a lot.

In this article, I'll show you how I built that assembly table top, but you can use this method to build a torsion box of any size or composition. If you stretch your imagination a bit, you can find many ways to use torsion boxes in furniture making: they can be desk or dining table tops, pedestal ends, shelves and, of course, doors.

Materials

A basic torsion box is composed of two types of parts: skins (the top and bottom) and webs (which form an internal grid, and include the sides of the box). Skins are usually made from an engineered material, such as ply-

wood, MDF or hardboard. The webs and sides may be made from engineered material or solid wood. The web pieces do not need to interlock, as mine do, but it is quicker and easier to make the grid that way. Plus, the box will be stronger.

I used 1/2" MDF for all three parts. Though heavier than plywood, MDF has a more consistent and uniform structure. It is flat and stays flat, if properly stored. It has no internal stresses, resists compression and tension along the surface, machines easily, holds glue relatively well, and is relatively inexpensive. Using the same material for all the parts minimizes the amount of sheetstock you have to buy, and gives you more flexibility in cutting it up.

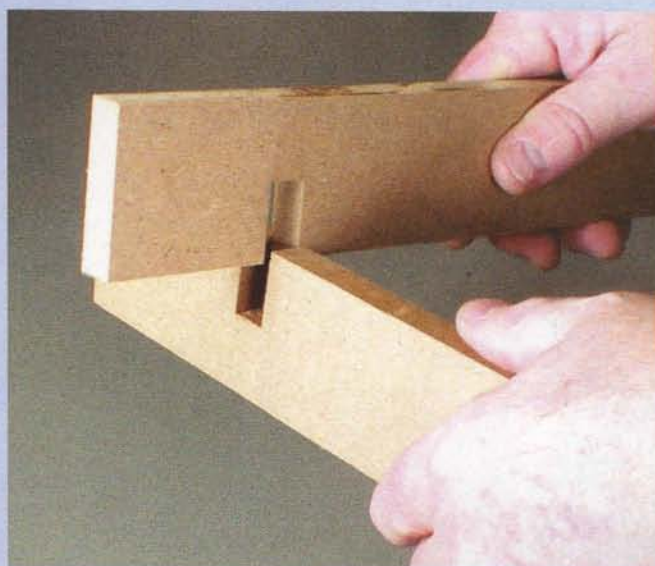
MDF that's 3/4" thick would work, too, but there's no significant advantage to it (see Torsion Boxes—The Real Story, page 40). Material that's 1/2" thick strikes just the right balance, I think—it's thick enough so you can safely nail into its edges, but thin enough to make a large table that's light enough to move.

Cut the web pieces

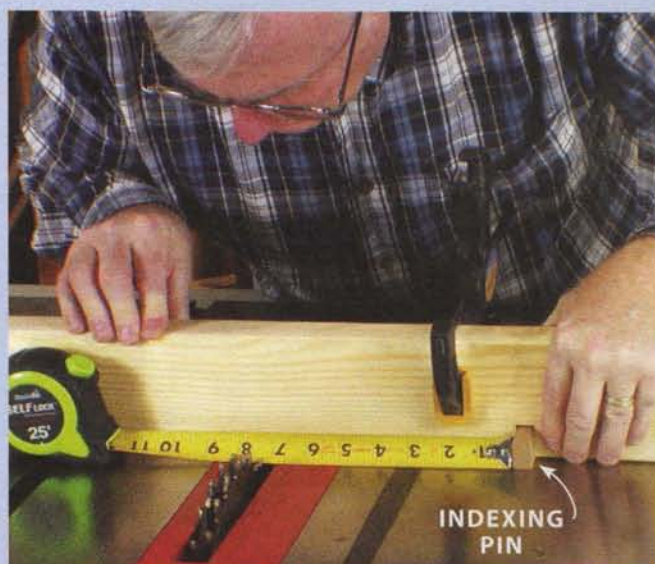
1. You will need only two sheets of 1/2" MDF to make the skins (A), web pieces (B and C) and sides (D and E). Break down the sheets into manageable pieces (Fig. E), then cut all the parts to exact dimension (see Cutting List, page 44). Rip the web, sides and leg socket reinforcing parts (F) at the same time to ensure they're exactly the same width.

2. Set up your tablesaw to cut half-lap joints in all the web pieces (**Photo 1**). First, adjust the width of a dado set to just a little bit over 1/2", or whatever it takes so the parts will easily slip by each other. Make an indexing jig to space the notches (**Photo 2** and Fig. B). The jig is just a fence for your miter gauge with a small notch cut into it, plus a pin to fit the notch. Cut the notch after you've adjusted the width of the dado set. Set the distance between the indexing pin and the blade (for this web, it's 7-1/4").

1 Inside this torsion box there's a grid of interlocking web pieces. Adjust the width of your dado set to make these pieces easy to fit together.



2 Make an indexing jig to space the web piece's notches. Adjust the distance from the jig's pin to the dado set, then fasten the jig to your miter gauge.



3 Cut equally-spaced notches on the web pieces. After cutting each notch, pick up the piece and reposition it on the indexing pin.





4 Make a dead-flat assembly platform to build the torsion box. Use a pair of winding sticks to check for twist. If the top edges of the sticks are parallel, you're good to go.



5 Place the top skin of the torsion box on the platform and cover it with plastic, which prevents glue from sticking to the skin. Assemble the box's frame with a brad nailer.



6 Construct the grid by gluing one row at a time. Place weights on the completed sections to ensure the grid stays flat as the glue dries.

Raise the blade to cut a notch $1/32$ " deeper than half of the pieces' width (for these 2" wide pieces, make the notches $1-1/32$ " deep). You don't want the notches bottoming out when the web is assembled.

3. Cut the half-lap joints (**Photo 3**). Make the first cut with one end against the alignment pin. Slip the first notch over the pin and cut the next one. Repeat the process until all notches are cut in all web pieces. The distance between the last notch and the end of the web piece may be slightly different than the spacing between the other notches, but this is not a problem. Mark an "X" on all pieces at the end you started cutting from. Place all the "X" ends in the same direction when you assemble the web.

Build a construction platform

4. To make a torsion box that's flat, you must build it on a flat surface. The best strategy is to make a temporary construction platform that you can adjust to become absolutely flat (**Photo 4**). All you'll need is a pair of sawhorses and some straight and knot-free 2x4s (Fig. C). Joint one edge of all the 2x4s and run them through the planer so they're all the same width. Place the sawhorses approximately 3' apart. Secure them to the floor with screws, nails, hot melt glue—whatever—so they won't move. Add bracing, if necessary, to make them stable and rigid.

5. Place the long 2x4s on the sawhorses, then use hot-melt glue to attach the short 2x4s on top. Make a pair of winding sticks by jointing and ripping two thin boards that are 2" to 3" wide by 4 ft. long. Paint one board white and the other black. Place the winding sticks on the first and last supports. Sight across the winding sticks (a white backdrop helps) and insert shims under the long supports until the top edges of the winding sticks are parallel. Without disturbing the platform, securely attach the long 2x4s to the horses with hot-melt glue.

6. Place *both* of the skins (A) on the

platform—this will give you a large, flat area to glue up the web and sides. Cover the topmost skin with thin poly sheeting to protect it from glue drips. Stretch the sheeting tight and anchor it with tape or thumbtacks.

Assemble the web and sides

7. Join one short and one long side (D and E) with glue and brads (**Photo 5**). Align and clamp these two sides to the edges of the skins. Place the long webs on the skins with the notches facing up. Slip one or two short webs in place to prevent the long webs from falling over.

8. Glue the web, starting from one end (**Photo 6**). Make sure the tops of both pieces are flush at each joint. Continue working towards the opposite end; apply glue and add one short web at a time. Place weights on the web as you complete each row.

9. Once all the webs have been glued, slide the grid away from the sides. Apply glue to the ends of the webs and position the grid back against the sides. Shoot a few brads through the sides and into the ends of the webs. Attach the remaining two sides with glue and brads. Remove any glue from the top of the webs, check that the grid is square, and let it dry.

Build leg sockets

10. This is an optional step. There are many ways to attach legs to a torsion box top—I chose to house them in sockets built right into the top. Begin building the sockets by adding reinforcing pieces (F) to the web's sides (**Photo 7**).

11. When the glue is dry, temporarily place a leg in the socket and glue and clamp the remaining reinforcing pieces (**Photo 8**). Remove the leg before the glue dries.

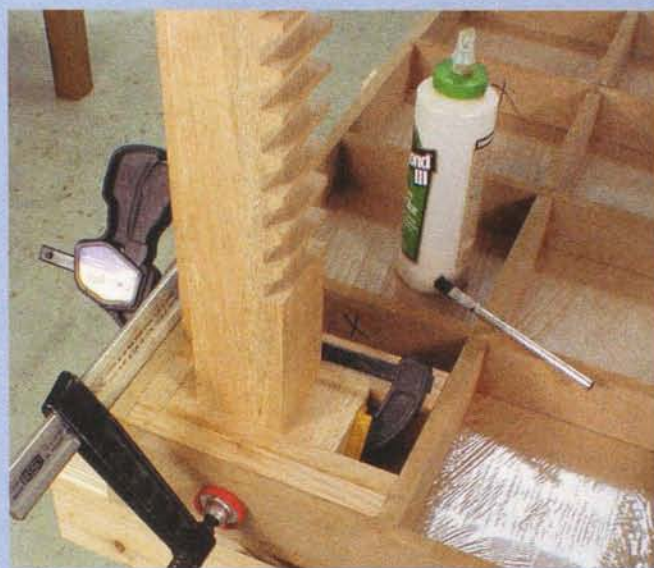
Add the skins

12. Draw layout lines on the bottom skin for attaching it to the grid with brads (**Photo 9**). First, remove the grid and both skins from the platform. Replace the skin with plastic

7 This torsion box has built-in sockets at the corners for removable legs (see Adjustable Height Assembly Table, page 48). Reinforce the corners with additional pieces of hardwood.



8 Temporarily set a leg in each corner. Fit additional reinforcing pieces around the leg and glue them in place. Remove the leg before the glue hardens.



9 Place the bottom skin of the torsion box on the grid. Mark the centerlines of the web pieces inside the box to guide your nailing in the next step.

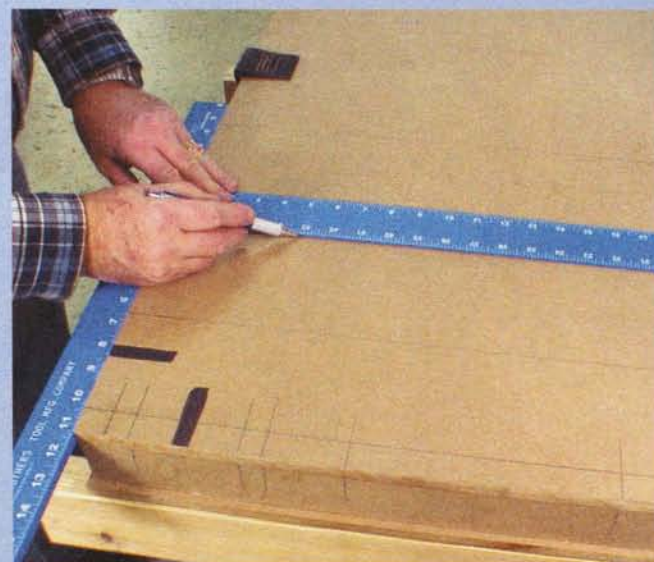


Fig. A Exploded View

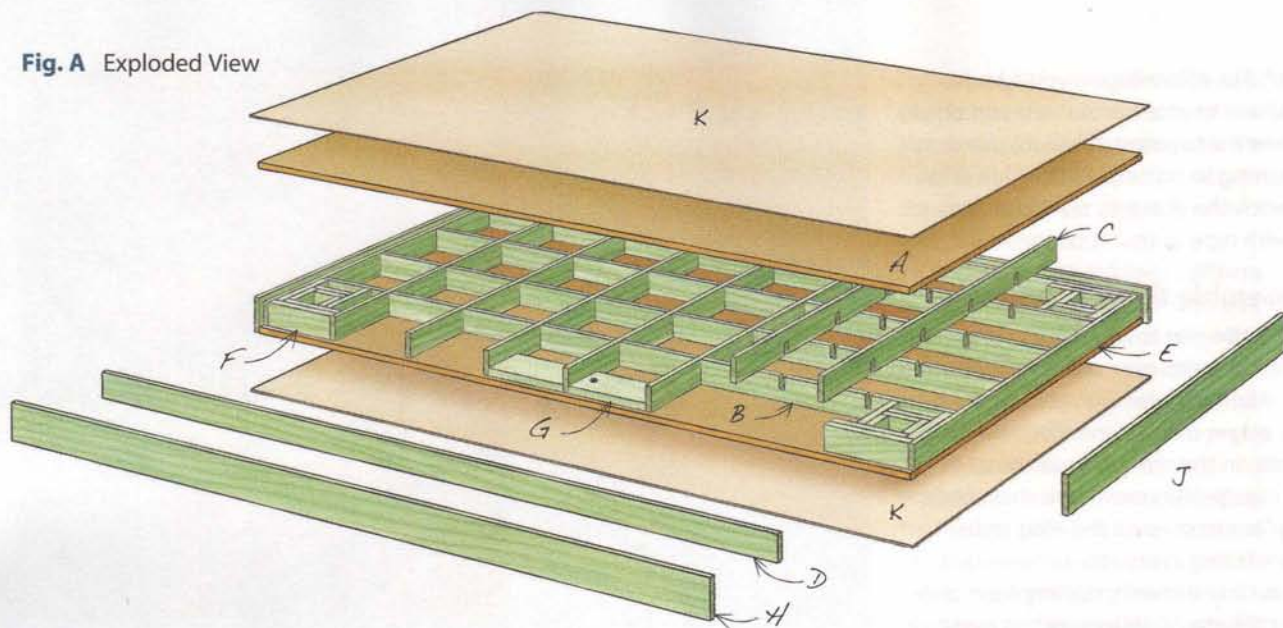


Fig. B Web Notch Layout

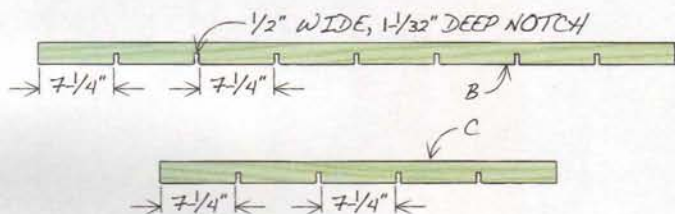


Fig. E Plywood Cutting Diagram

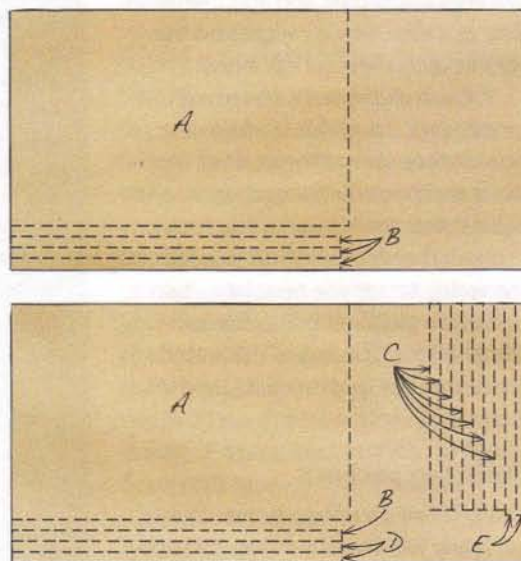


Fig. C Gluing Platform

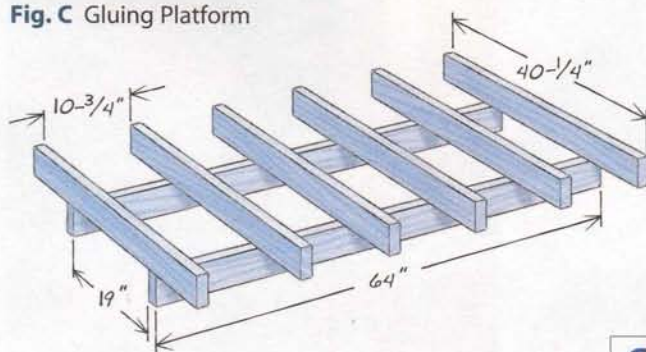
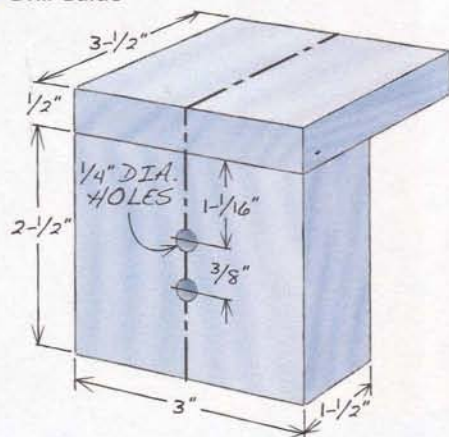


Fig. D Drill Guide



Cutting List

Overall Dimensions: 3" TH x 40-1/2" W x 63-1/2" L

Part	Name	Qty.	Material	Th x W x L
A	Skin	2	MDF	1/2" x 40" x 63" (a)
B	Long web	4	MDF	1/2" x 2" x 61-1/2"
C	Short web	7	MDF	1/2" x 2" x 38-1/4"
D	Long side	2	MDF	1/2" x 2" x 61-1/2"
E	Short side	2	MDF	1/2" x 2" x 39-1/4"
F	Leg socket reinforcing	*	Hardwood	3/4" x 2" x 192" (b)
G	Leg brace anchor pad	4	Hardwood	3/4" x 4" x 7-1/4"
H	Long side facing	2	Hardwood	1/2" x 3-1/16" x 65" [c]
J	Short side facing	2	Hardwood	1/2" x 3-1/16" x 41" [c]
K	Laminate	1		45" x 65" (a)

a) Oversize. Trim after installation

b) Cut to fit during installation

c) Oversize, width and length. Trim length during installation. Trim flush with skins after installation.

on it and put the grid on top. On the grid's sides, mark the centerlines of all the web and reinforcing pieces. Mark the centerlines of each leg socket on the sides as well (you don't want to shoot brads here). Place the remaining skin onto the grid and align two adjacent edges of the skin with the sides of the grid. Transfer your marks from the sides onto this skin, then use a straightedge or large square to connect the marks. This skin will be the bottom of the torsion box.

13. Glue the skin to the grid (**Photo 10**). To begin, remove the skin and place masking tape inside the leg sockets, to prevent glue from sticking here. Apply a liberal amount of glue to the edges of all sides, webs and reinforcing pieces. Work quickly and don't be concerned about drips or using too much glue. Place the bottom skin on the grid and align the same sides you used when laying out the nailing lines. Shoot 1-1/2" long brads, spaced every 3", along the layout lines and along the sides (**Photo 11**). Place weights on the skin to keep it flat.

14. Drill and rout the skin to open up the leg sockets (**Photo 12**). The top I'm making also required additional pieces (G) to accommodate bolts that secure a set of leg braces (for more information on the legs and braces, see Adjustable Height Assembly Table, page 48). To install these anchor pads, turn over the top and glue them to the bottom skin. After the glue is dry, drill holes through the skin and pads and install T-nuts in the pads.

15. Remove the plastic from the top skin and mark it using the same procedure as you followed for the bottom skin. Glue the skin to the grid. Use a router and flush-trim bit to make both skins flush to the sides all around.

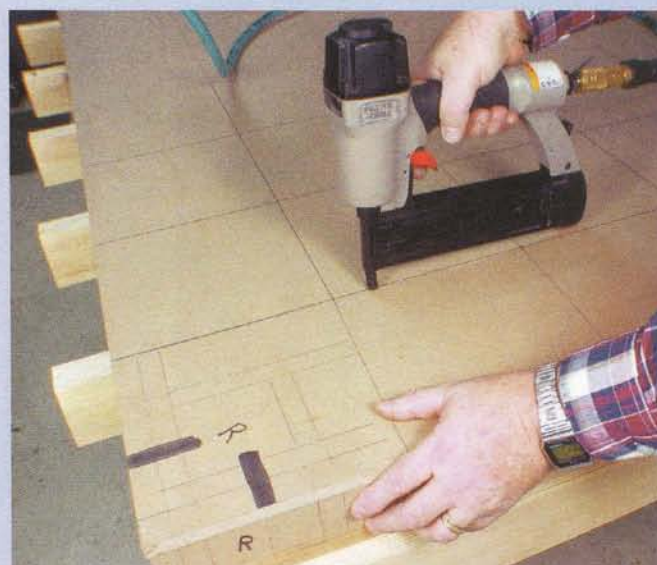


To see plans
for a workbench
using a torsion-box
go to: www.AmericanWoodworker.com/145/TomsTorsionBoxBench

10 Apply a liberal amount of glue to the entire grid, the frame and the leg reinforcing blocks. Work quickly so the glue does not harden before you install the skin.

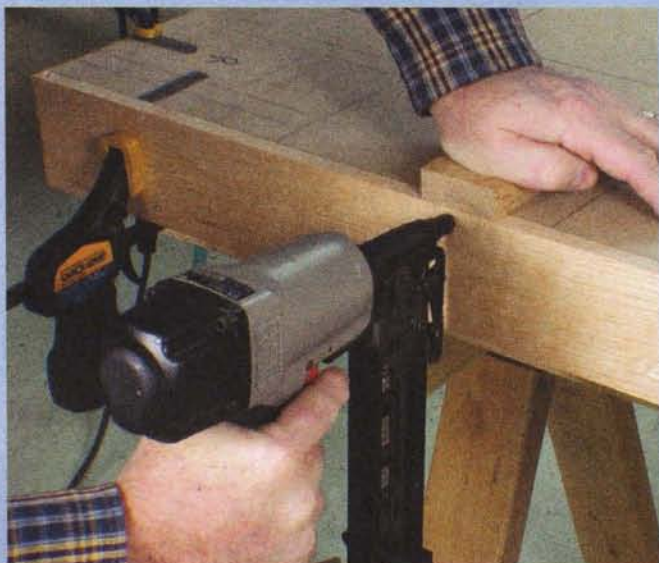


11 Place the skin on the grid, align its edges and attach it with brad nails. Using a router and flush-trim bit, trim the skin so that it's even with the sides.



12 Open the leg sockets. Drill an access hole, then use a router with a flush-trim bit to define the edges. Square the corners with a chisel. Turn the assembly over and glue and fasten the top skin.





13 Fasten hardwood faces on all four sides of the box. Use a block to align the top edge of each face with the skin. Trim the faces flush with the bottom skin using a router and a flush-trim bit.



14 Apply plastic laminate to the top skin. This makes an ideal working surface—laminate is smooth, resists scratches and is more durable than melamine. You can pop off dried glue from it with ease.



15 Drill holes through the faces and reinforcing blocks for bolts that will fasten the legs to the top. The bolts thread into T-nuts in the legs.

Add the facing and laminate

16. The torsion box is basically complete at this point, but I added hardwood faces (H and J) to the sides and plastic laminate (K) to the top. You can butt the faces together, miter them, or make box joints, as I did. I attached the facing to the torsion box with glue and brad nails (**Photo 13**) and trimmed it flush to the top.

17. Glue on the plastic laminate (**Photo 14**). If you want to avoid working with laminate, you could make the top skin from 1/2" MDF with one melamine face. It's not quite as durable as laminate, but better than plain MDF.

18. Sand and finish the facing and the bottom skin.

Add the legs

19. The legs that I designed for this table are removable. They're fastened to the top with bolts that pass through the box's faces and reinforcing blocks. The bolts thread into T-nuts on the back side of the leg. Make a drilling jig (Fig. D) to position the bolt holes and to ensure that the holes are perpendicular to the legs. The jig has two holes, one for each side of the leg. Before drilling, mark the holes' locations. Counterbore the holes so the bolts' heads won't protrude. Then drill the holes for the bolts, going into the legs (**Photo 15**). Finish drilling the holes through the legs at the drill press. 

Alan Schaffter is a retired Naval Officer and a lifelong woodworker and tinkerer. He lives in Washington, North Carolina.



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by Alan Schaffter

*"An adjustable assembly table, huh?
Well, you're wasting your time unless it's
a simple design that's easy to operate."*

That's what a fellow woodworker said when I described the latest scheme to improve my shop. I don't know how many times I've wished for a worktable that was shorter, or taller, than what I had.

I took my friend's advice as a challenge and went to work. He was just as pleased as I was with the result: a huge, solid table that goes up and down with ease.

These two-part legs employ a system of notches and locking arms (ratchets and pawls in engineering terminology) that allow you to change the table's height in 1" increments. The weight of the table and the geometry of the mechanism firmly force the leg sections together, so there's no wobble.

Operation of the legs is simple. To increase the table's height, just lift each end. As you lift, the ratchet arms move freely, "clicking" from notch to notch. They lock automatically once you stop lifting. To decrease the table's height, you step on a bungee cord, lift the table slightly to unlock the pawls, then lower the table. When you remove your foot from the bungee, the pawls engage the ratchet and lock the legs.

Make the ratchets

1. I used white oak to make the legs, but any strong hardwood will do. It's OK to glue them up from thinner pieces. Mill the upper legs (A) and lower legs (B) to size (see Cutting List, page 52). These legs will make a table that adjusts from 22" to 35" high. If you'd like a different range of heights, make the legs shorter or longer (see Leg Sizing Chart, page 53).

2. Begin making the ratchets in the upper legs (Fig. B) by cutting dadoes. Make an indexing jig for your miter gauge to ensure that all the dadoes are accurately spaced (**Photo 1**). My jig is 3/4" x 3" x 24", but the exact size isn't important. Use a dado set to cut a 3/8" wide by 15/32" deep notch in the jig's center. Glue a 4" long alignment pin in the notch—it should fit fairly tightly.

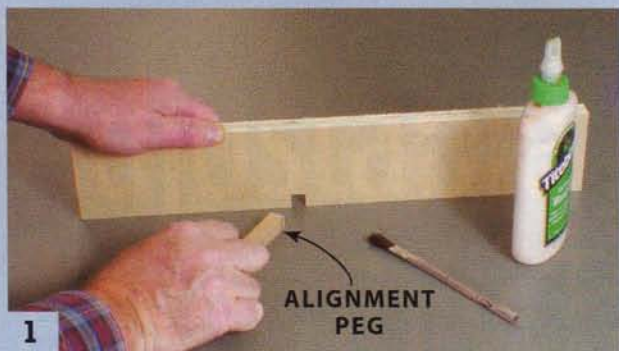
3. Position the jig on the miter gauge so that the distance from the dado set to the indexing pin is exactly 5/8". Make some test cuts to verify this spacing, then fasten the jig to the miter gauge. Raise the dado set 1/32" to cut a notch 1/2" deep.

4. Cut 14 dadoes down the length of each upper leg (**Photos 2 and 3**). Cut 6 similar dadoes in a scrap piece to help set up the next operation.

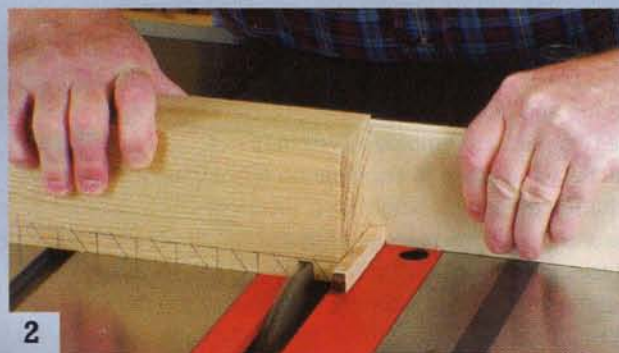
5. Cut the angled sides of the ratchets. First, remove the dado set and install a crosscut or general purpose blade. Tilt the blade to the 38° mark on the saw's bevel scale. Raise the blade to make a cut 1/2" high—the same as the notches. Reposition the indexing jig so that the blade cuts to the corner of the notch (**Photo 4**).



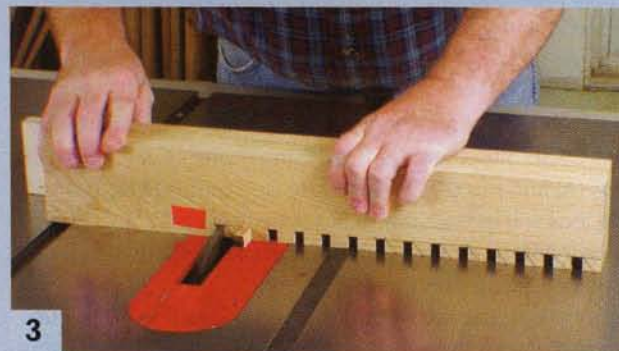
Height range: 22"-35"



1 Make an indexing jig for cutting ratchets in the legs. Cut a notch in the jig using a dado set. Glue an alignment peg in the notch and attach the jig to your miter gauge.



2 Use the jig to cut evenly-spaced notches in the upper sections of the legs. Place the bottom end of the leg against the side of the alignment peg to make the first cut.



3 Reposition the leg after each cut. Place the new notch over the indexing peg and cut the next notch. Repeat the procedure to cut all the notches.



4 Tilt the sawblade to cut a relief angle in each notch, making a ratchet. Reposition the indexing jig and make test cuts—the spacing is correct when a 1/2" bolt bottoms out in the ratchet.

(On a right-tilt saw, like mine, position the alignment pin on the left side of the blade. On a left-tilt saw, position it on the right side.) Temporarily clamp the jig to the miter gauge and make test cuts in your scrap piece. Check your accuracy by placing a 1/2" bolt in the ratchet—it should nest in the bottom. When everything looks good, fasten the jig to the miter gauge. Begin at the top of the leg (**Photo 5**) and finish cutting the ratchets.

Cut sliding dovetails

6. Large sliding dovetails keep the leg sections together when you adjust the table's height (Fig. C). To help guide your cuts, draw tails on both ends of one of the upper legs. Draw sockets on both ends of one of the lower legs. My dovetails have an 8° angle because I have a large 8° router bit in my collection, but a different angle would work OK, too. Whatever bit you use, it must be large enough to cut a 3/4" deep dovetail. Begin by removing most of the waste on all of the legs using the tablesaw. Install a 3/8" wide dado set in your saw and set its height to 11/16". Plow out the waste from the center of the lower legs (**Photo 6**), staying 1/16" away from the dovetail layout lines. For the upper legs, reset the fence and remove most of the waste in the same manner.

7. Finish the dovetails on a router table, beginning with the sockets in the lower legs. Raise the bit 3/4" high. Position the fence to make a light cut, then make two passes, one from each side of the leg. Reset the fence to make another light cut, and continue the sequence until you reach the layout lines.

8. Next, rout tails to fit the sockets. Lower the bit 1/32" so there will be clearance between the tail and socket. Before you begin, mark all the upper and lower legs in pairs: two A's, two B's, etc. Rout tails on each piece, again taking small cuts from alternate sides (**Photo 7**). Test the pieces as you go—you may have to remove more wood from some pieces than from others to get a good fit. The finished dovetails should slide easily but have minimal freeplay. When you're done, apply paste wax to all the sliding surfaces.

Fit the legs

9. My tabletop has sockets to receive the legs, but you can attach the legs to a base or a top by a variety of methods. I removed part of the tail on the upper legs so they would fit in the sockets (**Photo 8**). This cut is 2-1/2" long. For a permanent installation, you can glue the legs into the sockets. I made the legs removable, attaching them with machine bolts and T-nuts (**Photo 9**). (For details on how to make this top and how to mount the legs, see *How to Build a Torsion Box*, page 39.)

10. Use a drill press to make a 1/2" dia. hole in the top end of each lower leg (Fig. D). This hole will receive

a 1/2" bolt, part of the ratchet arm mechanism. A tight fit is OK—the bolt doesn't have to rotate.

11. Add stops (J) on the bottom of each upper leg to prevent the ratchet arm pawls from sliding off the legs if you lift the table too high (Fig. F). (If you add braces to the legs, an optional step shown below, these stops aren't necessary.) Make the stops from 3/8" x 3" x 3" metal corner braces. Use a hacksaw to cut one side of the stop. Use an existing hole or drill a new one on the other side of the stop and fasten the stop to the leg.

Make the ratchet arms

12. Make four ratchet arm assemblies, one for each leg (Fig. A). Each assembly is composed of two metal plates, which are available at any hardware store. One plate has a 90° angle—it's made from a flat corner brace. The other plate is straight—it's made from a mending plate or flat bar stock. You'll have to drill holes in the plates, and it's very important that all the holes line up with each other. Most mending plates and corner braces are pre-drilled, though, which could be a problem. If you attempt to drill a new hole that overlaps an existing hole, your drill will wander off center. You may need to be creative in locating the bolt holes. For one of the holes in the corner braces, I enlarged an existing hole. I couldn't find mending plates with suitable hole locations, so I used flat bar stock instead.

13. Make a jig to hold the plates while drilling the holes (Photo 10 and Fig. E). You can stack the plates or drill them one at a time. Use a center punch to mark the holes first, then begin with a 1/16" bit running at 1,000 rpm. Gradually increase the hole's size using larger diameter bits. Reduce the drill speed with each bit and lubricate the bit with machine oil. Drill all similar holes in both types of plates before repositioning the jig.

Assemble the legs

14. Assemble and attach the ratchet arm assemblies to the lower legs (Fig. A) using bolts (E and F), washers (G), and stop nuts (H). Tighten the stop nuts until the arms are parallel and there is minimal slop (Photo 11). The arms must rotate freely.

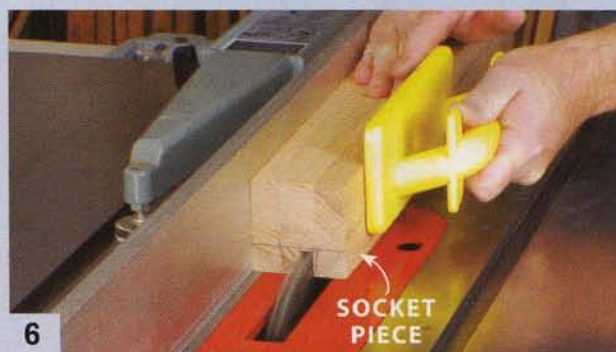
15. Lift the ratchet arms and slide the lower leg onto the upper leg. Temporarily clamp the leg sections together and attach the legs to the table.

16. Thread a 6" piece of vinyl tubing (L) over a 48" long piece of bungee cord (K). (The vinyl tubing protects the bungee from premature wear.) Thread one end of the bungee through the hole in the end of the ratchet arm and knot the end. Thread the other end through the other ratchet arm. Tie a knot so the cord hangs 6" above the floor, but is not tight. Leave the excess cord for now. If there is interference between the knots and the legs, slightly bend the ends of the



5

Saw all the relief angles. Start with the notch nearest the top of the leg and work your way down. All of the ratchets will be identical and evenly spaced.



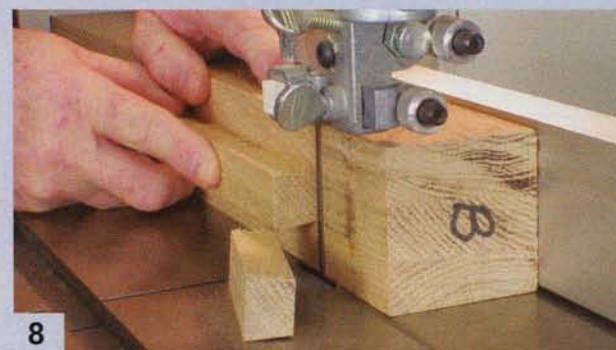
6

Begin making the legs' sliding dovetails by removing most of the waste. The lower half of each leg has a socket, shown here. Finish the socket using a dovetail bit in a router table.



7

Cut dovetails to fit the sockets using the router table. Make shallow cuts until the fit between each dovetail and each socket is just right.



8

Saw off the tails at the top of the upper legs. This leaves a square section to insert into the table's top.

Fig. A Exploded View

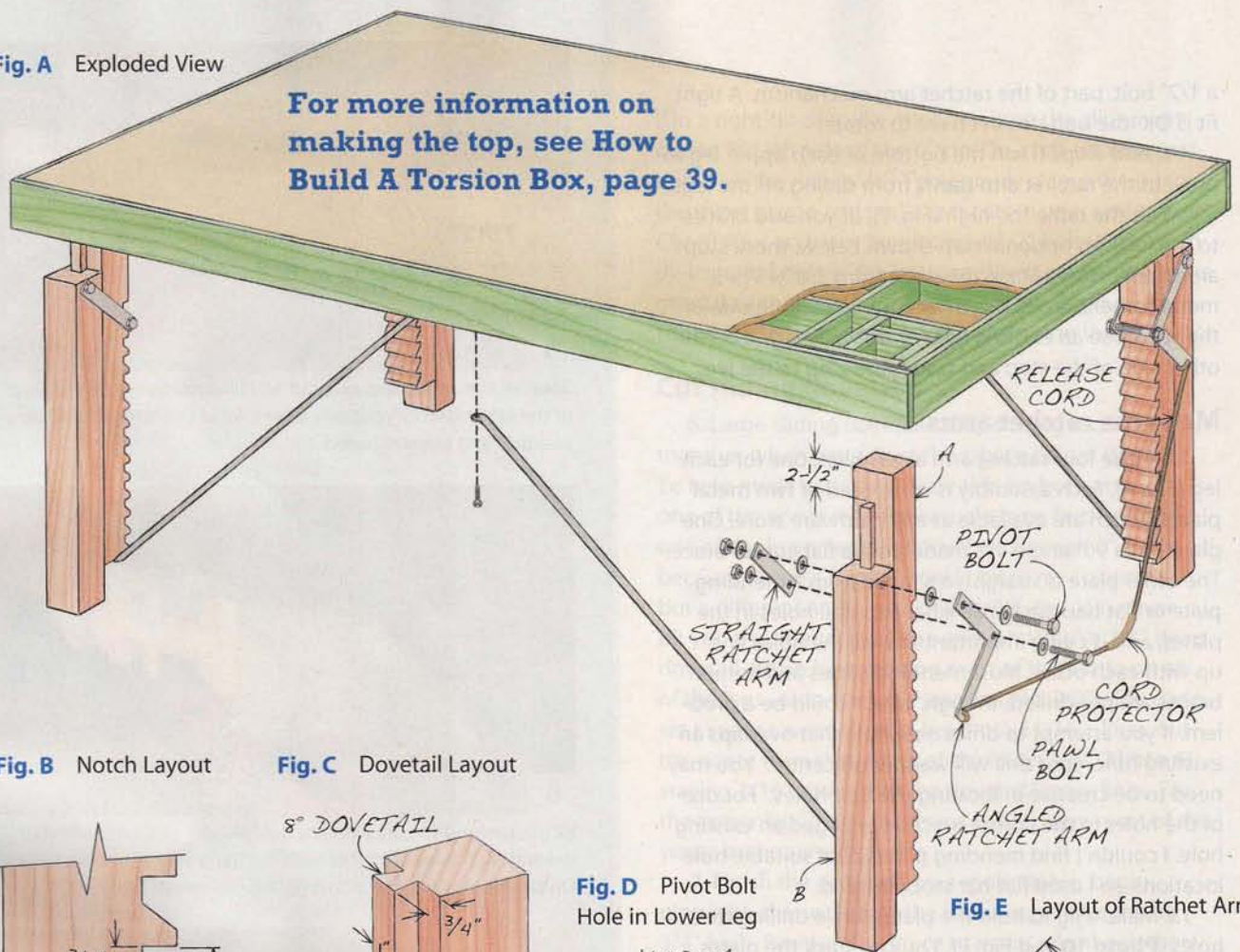


Fig. B Notch Layout

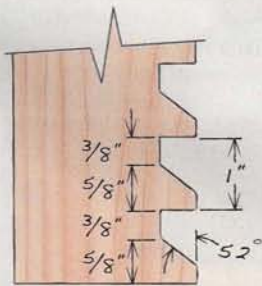


Fig. C Dovetail Layout

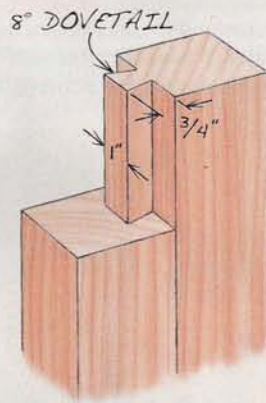


Fig. D Pivot Bolt Hole in Lower Leg

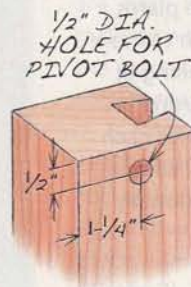


Fig. E Layout of Ratchet Arms

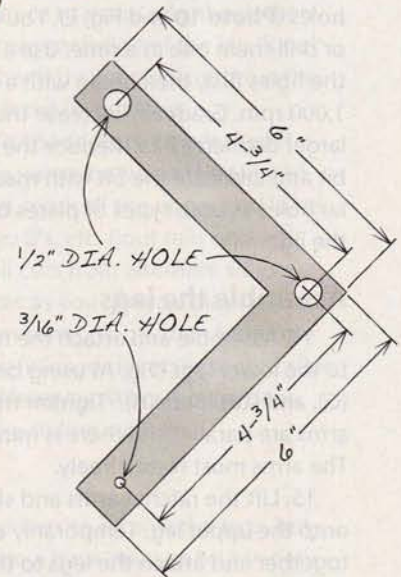
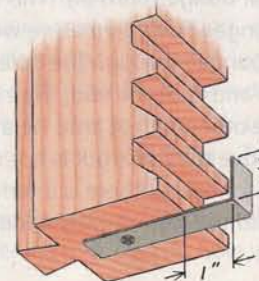


Fig. F Pawl Stop (J)



Cutting List

Part	Name	Qty.	Material	Th x W x L
A	Upper leg	4	Hardwood	2-1/2" x 3-1/4" x 20-1/2"
B	Lower leg	4	Hardwood	2-1/2" x 2-1/2" x 18-1/2"
Hardware				
C	Angled ratchet arm	4	Flat corner brace	3/32" x 1" x 6" x 6"
D	Straight ratchet arm	4	Flat bar stock	3/32" x 1" x 6"
E	Ratchet arm pivot bolt	4	Machine bolt	1/2" x 4"
F	Ratchet arm pawl bolt	4	Machine bolt	1/2" x 4"
G	Washer	24		1/2"
H	Stop nut	8	Nylon stop nut	1/2"
J	Ratchet arm pawl stop	4	Corner brace	3/8" x 3" x 3"
K	Ratchet arm release cord	2	Bungee cord	1/8" x 48"
L	Release cord protector	2	Vinyl tubing	3/16" x 12"

arms away from the legs.

17. Raise the table by lifting at each end. The ratchet arms should "click" freely from notch to notch. If they do not, you may need to loosen the ratchet arm stop nuts or enlarge the bolt holes in the ratchet arms.

18. Lower the table by stepping on the release cord and lifting the table slightly. The pawls should disengage immediately and allow you lower the table. If the ratchet arms swing, but the pawls don't fully disengage, shorten the bungee. As soon as you remove your foot from the bungee, the pawls should immediately fall under their own weight, re-engage the ratchet, and lock the table.

Optional braces

19. You can easily add two metal braces to each leg for additional stability (**Photo 12**). Fabricate the leg braces from 1/2" thin-wall EMT electrical conduit. On each brace, flatten both ends with a vise and/or a hammer. Make sure the flat sections have the same orientation.

20. On my table, the short braces are attached to the top with lag bolts, which go into reinforcing blocks around the legs. The long braces are connected to the top with machine bolts, which go into T-nuts in additional reinforcing blocks. To install the braces, start by removing the ratchet stops, if you've installed them. Drill a 3/16" by 1" deep pilot hole centered in the bottom of each upper leg. Drill the holes in the short braces, bend the ends to fit the table, and install the braces. For the long braces, drill holes on the ends that attach to the legs, and attach the braces to the legs. Mark the locations of the T-nuts on the other ends, remove the braces, and drill holes in the braces for the machine bolts that go in the T-nuts. 



9 The bottom of the assembly table has holes for each leg (see How to Build a Torsion Box, page 39). Bolts and T-nuts allow you to remove the legs so you can store the table out of the way.



10 Make four ratchet arms from ordinary flat corner braces. Drill identically-spaced holes in the braces by stacking the pieces in a jig.



11 Mount the ratchet arms to the lower legs. Add a bolt between the arms as a pawl to engage the ratchets.



12 To make the legs extra-sturdy, add braces made from electrical conduit.

Leg Sizing

These legs can be sized for different height ranges. Generally, every 1" change in minimum height results in a 2" change in maximum height. Here are examples of different leg configurations.

Min. Ht. ¹	Max. Ht. ¹	Range	Lower Leg	Upper Leg ²	Notches
17"	28"	11"	16-1/2"	16"	12
18"	30"	12"	17-1/2"	17"	13
19"	32"	13"	18-1/2"	18"	14
20"	34"	14"	19-1/2"	19"	15
21"	36"	15"	20-1/2"	20"	16

1. Add table (and apron if any) thickness to these values.

2. Add the length of the leg tenon to these values.

Shaded dimensions are for the legs built in this article.



Armchair from the
Blacker House, 1907

PHOTO COURTESY OF AMERICAN DECORATIVE ART 1900 FOUNDATION.

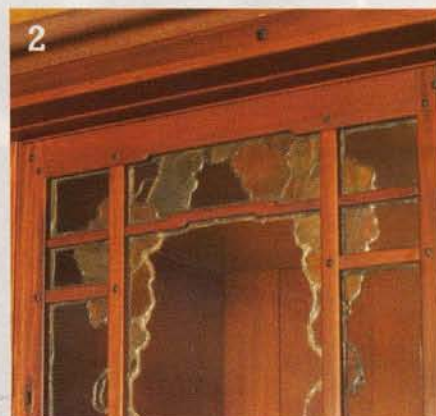
An expert
woodworker
talks about what
really gets him
excited.

Greene and Greene Furniture Details

By Darrell Peart

ONE OF MY FIRST TRIPS to see firsthand the furniture of Charles and Henry Greene, two early 20th century architects from Pasadena, California, was innocent enough: I took a sight-seer's tour of the house they built in 1908 for David Gamble. I came away a changed man. And as a furniture-maker, I was hooked for life.

Few furniture styles are as rich in detail as Greene and Greene. Details large and small await in every nook and cranny of the many homes they built. Something lures you back for a second look—most often one of the many small things you overlooked at first glance. "Wow! I didn't see that! Man! Is that not the neatest little detail? Look how it blends seamlessly with the overall design!" I've been known to get pretty worked up about these things.



1. These **cloud lifts** are large and bold. The ebony plugs look like structural components, but they're just decorative. *Gamble House living room rocker*
2. The **cloud lifts** on this built-in cupboard are smaller and more delicate than those on the rocker. *Thorsen House*
3. This is an early example of the Greenes' **bracket detail**. Chair from the *Tichenor House*, 1904
4. A later **single bracket** is slightly concave. *Robinson house dining room chair*, 1906
5. A **double bracket** helps convey a sense of strength to the joint between leg and rail. *Blacker House chair*; reproduction by Darrell Peart



6. This detail of a footboard shows a pierced **tsuba** (a stylized Japanese sword guard) and raised inlay. *Gamble House master bedroom*

7. These spline and butterfly details are an early example of **stylized joinery**. *Robinson House, 1906*

8. The top edges of these **ebony plugs** follow the upward arc of the crest rail, a detail that's easy to miss. *Gamble House master bedroom*

The spell of Japan

Japanese and Asian motifs played an important role in the Greenes' designs. C. R. Ashbee, a leader in the English Arts & Crafts Movement, visited Charles Greene in Pasadena. Ashbee later said, "Like Lloyd Wright, the spell of Japan is upon him."

The cloud lift

The cloud lift was one of the more common details employed by the Greenes. It's essentially a rise in a horizontal line that's formed by two connecting arcs. Stylized clouds were often depicted this way in Chinese art, and cloud lifts were occasionally used in Asian furniture. Not all of the Greenes' cloud lifts are alike, though. They could be large and bold or very small and delicate (**Photos 1 & 2**). Most often, they were somewhere in between.

Many Greene and Greene-inspired woodworkers have searched for an equation or a set of rules for drawing cloud lifts, but I don't think there's any magic formula. Changing one or both of the arcs can dramatically alter this detail's character. I work in CAD, and often stretch or compress a cloud lift, looking for the right shape. My advice for drawing a cloud lift is to simply draw and re-draw it until it looks right for the piece you're building. Context is everything.

Brackets

Scholars believe the Greenes' brackets were inspired by the low, swooping rafters used in Japanese temples.

Details that work together

The Greenes' designs were never mass produced. Each piece of furniture was made for a specific setting, usually a private house, and each setting had its own unique set of details. While some details were common to the larger style as a whole, most were specific to one piece of furniture or an individual room.

I've always thought that some elements in a good design shouldn't be apparent at first glance. That's certainly true of Greene and Greene furniture. Many of the details are very small indeed and do not reveal themselves readily; they require effort to be seen.

Many commercial millwork shops have a "three foot" standard to judge whether a piece is ready to go out the door. If a defect isn't visible from three feet away, the piece passes. This rule applies in reverse to Greene and Greene. If you stand three feet away, you'll miss much of the design! I've been back to the Gamble House many times, and on each visit, I've made a

new, close-up discovery.

While much of the magic of the Greene and Greene style lies in its details, those details, independent of each other, have little magic. Simply adding a spattering of great details to a piece does not by itself make for a good design. They must be used judiciously, in context, and work with one another to create a unified vision.

Charles Greene was a true master of this. It was his vision and artistic ability, for the most part, that brought together so many details to speak in a common language. The mature work of Greene and Greene always conveyed a strong, organic sense of unity. Borrowing terms from biology, their overall style would be an Order; each house, a Family; each room, a Genus; and each piece, a different Species.

There are far too many Greene and Greene details to cover here. I'll highlight the most common and better known ones, and add a few I've been drawn to that are not well known.

9. This classic Greene and Greene breadboard end has **exposed ebony spline**. *Thorsen house sideboard*

10. These **ebony plugs** appear to cover pins that go through the tenons, but they're just decorative. *Gamble House dining room table base*

11. This chair's crest rail also has an **exposed ebony spline**. *Thorsen House dining room chair*

This detail is often repeated by contemporary woodworkers, but the Greenes employed them on only three furniture projects, using a different design each time. The earliest example of this detail used on furniture is in the Adelaide Tichenor house of 1904 (**Photo 3**), where they employed a single puffy loop. By 1906, in the Robinson House (**Photo 4**), the bracket gains a bit of sophistication, displaying a concave surface.

The brackets reached their maturity in 1907 in the Blacker House living room furniture (**Photo 5**). These brackets are the most successful in conveying a visual sense of strength to the joint between leg and rail. The smaller loop appears to be adding support to the larger loop.

On all three variations, the bracket is let into the rail and leg ever so slightly. This small feature enhances the design in a very subtle way—one you can't see from three feet away.

The tsuba

A tsuba is a Japanese sword guard, separating the blade from the handle. Often found in museums, tsubas are genuine works of art and come in a variety of shapes. Charles Greene collected them and often employed a double ovoid tsuba shape as a design element.

Walking through the Gamble House, you'll see tsubas in a number of places, from the outline of the dining room table top, to a chair back detail, electrical plates, doorbell plates, lamp base and more (**Photo 6**).



Elements of structure as adornment

The furniture of the American Arts & Crafts Movement celebrated joinery by exposing it to view. Elements of structure, such as through tenons and the pins that hold mortise and tenon joints together, became part of a piece's design. Greene and Greene took this idea a half step further. They saw those elements as opportunities for creating new design details that were not functional, but purely ornamental.

Knowing that much of the Greenes' visible joinery served no other purpose than decoration, you might doubt the soundness of the real joints. Some of their early work wasn't constructed to the highest

standards, but by 1906 the stage was set for what would become a remarkable collaboration with another set of brothers, John and Peter Hall. The Hall brothers were highly skilled Swedish immigrants believed to have been trained in the home Sloyd method.

The majority of Greene and Greene furniture, including all the mature work, was built by the Halls. The underlying joinery is quite sound. One hundred years later, most pieces are in excellent shape (**Photo 7**).



12. In this detail from the underside of a table, a box joint has proud and **pillowed fingers** that are "pinned" by ebony plugs. *Thorsen House dining table*

13. The **waterfall shelf** detail is an ingenious and beautiful solution for adding strength. *Thorsen House living room bookshelves*

14. This chair's center splat appears to be pulling apart, but the **ebony connectors** secure the two halves in place. *Gamble House living room rocker*

15. The Greens were masters of **relief**. Every structural element exists in its own plane and is rounded over before stepping down to the next level. *Drawer from the Thorsen house*

16. The **waterfall leg** is a new take on a classic tapered leg. *Chair from the Gamble House master bedroom*



flat panel from warping. Traditionally, breadboard ends were flush with the panel, but Greene and Greene made their breadboard ends proud, both on the top and sides (**Photo 9**). They also added a long ebony spline to the sides of the joint. The breadboard was functional, but the ebony spline was for decoration only—the actual working spline remained hidden inside.

Faux ebony splines were also used where the back leg of a chair meets the crest rail (**Photo 11**). There's a real mortise and tenon joint inside, but the spline is not a functional part of the joint. Perhaps one of the most notable and successful uses of a faux ebony spline was on the Blacker living room armchair (page 54). The spline is quite prominent at the point where the arm joins the front leg.

Exposed finger joints

Greene and Greene employed proud, exposed finger joints in a number of instances, (**Photo 12**), but they were

Ebony plugs

You might think that the ebony plugs used by the Greens are an essential part of the joinery, but most of them aren't functional. Some of the plugs do cover screws, particularly on breadboard ends, but most plugs are just set in their own little mortises. Plugs were placed strategically, usually with the implication of pinning a tenon, but occasionally the relationship to joinery was disregarded and their placement was based on aesthetics alone.

Plugs were made in an infinite variety of sizes and shapes. When used on furniture, the plugs were slightly pillowed and proud, but in low profile. On built-ins, the treatment of the plugs varied widely. Some have surfaces that are almost flat, while others have a much more pronounced domed face (**Photos 8 & 10**).

Exposed ebony spline

The breadboard end is a classic wood-working technique used to prevent a

More information about Greene and Greene

Websites

- To see many more examples of Greene and Greene furniture, visit the Greene & Greene Virtual Archives at www.usc.edu/dept/architecture/greeneandgreene/
- To join online discussions with Greene and Greene woodworkers and scholars, visit the Greene & Greene group at Yahoo. Go to www.groups.yahoo.com/group/Greene-style-furniture/join
- To contribute to the ongoing restoration of the Thorsen House go to www.calsigmaphi.org
- To see a fully restored Greene and Greene masterpiece, and for the ultimate thrill, visit The Gamble House at www.gamblehouse.org
- Just a few miles from the Gamble house is the Huntington Library, home of a large display of Greene and Greene furniture. For more information, go to www.huntington.org

Selected Books

- Greene & Greene: Design Elements for the Workshop*, Darrell Peart (2006). Step-by-step instructions for re-creating Greene and Greene details and a condensed history of their work.
- Greene & Greene: Furniture and Related Designs*, Randell Makinson (1979). The most comprehensive book on Greene and Greene furniture. It's out of print but well worth a search.
- Greene & Greene*, Edward R. Bosley (2003). This is the most thorough history of Greene and Greene architecture and furnishings.
- Shop Drawings for Greene & Greene Furniture: 23 American Arts and Crafts Masterpieces*, Robert Lang (2006). A wonderful book of measured drawings.
- Greene & Greene: Masterworks*, Bruce Smith and Alexander Vertikoff (1998). An informative book, with beautiful photography.
- A New and Native Beauty: The Art and Craft of Greene & Greene*, Edited by Edward R. Bosley and Anne E. Mallek. A fascinating book with contributions from several leading Greene & Greene scholars.
- Greene & Greene: Poems of Light and Wood*, David Mathias, Coming September 2010. The first book to focus on the details themselves, with fabulous photography.



For an X-ray look inside Greene & Greene furniture, go to: www.AmericanWoodworker.com/145/GreeneAndGreene

16



most notably used for drawer fronts. Drawer fingers were usually in lower profile than fingers on casework. On all joints, the fingers were usually "pinned" with an ebony plug, but I don't know whether there are screws or dowels beneath most of the plugs.

Waterfall shelves

A really good designer can transform an apparent problem into a positive design feature. As most woodworkers know, bookshelves that must carry a lot of weight have to be made extra-thick, or be supported underneath. From an aesthetic point of view, both of these choices are undesirable. The Greenes solved this problem in a beautiful way.

Seen from the front, the built-in bookshelves in the Thorsen House living room are relatively thin and pleasing to the eye (Photo 13). A closer inspection reveals yet another delightful Greene and Greene detail: a sort of waterfall effect on the underside. The waterfall detail is in reality a clever method to add thickness and strength to the shelf, but it also enhances the beauty of the piece.

Back splat connectors

The backs of several Greene and Greene chairs have small decorative connectors joining the splats (Photo 14). While their usefulness may be debatable, the connectors' value as a design feature is not. On the Gamble House living room chairs, the splats appear to be pulling apart, while the

connectors exert an opposite force, giving the impression of holding the splats in check.

Relief detail

The relief detail has a profound effect on the overall design, but it's a very simple concept: every element exists in its own plane. No two surfaces are allowed to meet at the same level. Every level is rounded over before dropping down to the next level. Relief adds depth and shadow, highlighting each and every structural component of the design (Photo 15). Even when the Greenes used inlay, it was in relief, proud of its surrounding surfaces.

Leg details

Charles Greene apparently did not like simply pulling a classic design detail off the shelf and borrowing it. He had to give it a distinctive Greene and Greene twist. Such is the case with a couple of leg bottom details.

The waterfall leg is a take on the classic detail of tapering the two inside faces of a leg, making the leg increasingly narrow as it reaches the floor. The waterfall leg tapers in a series of three short steps that are shaped as vertical cloud lifts (Photo 16).

The Blacker House armchair's leg-indent detail anchors the design to the ground, like a classic claw and ball foot. The indent pushes down and transfers the weight of the piece to the very bottom of the leg.

See it up close

I hope this article whets your appetite for more Greene and Greene design. May you someday make the pilgrimage to Pasadena and see their work as it should be experienced—in person. Soak it in, and make your own little discoveries. But beware—Greene and Greene may become habit-forming.

Darrell Peart lives in Seattle. See his work at www.furnituremaker.com

Office Cabinet

Store office necessities in style.

by David Radtke



For complete how-to on using drawer lock router bits, go to
www.AmericanWoodworker.com/145/DrawerLockBit



THIS HANDSOME LITTLE CABINET just might solve the universal problem of never having enough drawer space. Small enough to tuck under a desk, it's also designed to stand on its own, and its wide top can easily accommodate a printer or a fax machine.

You can build this cabinet in a weekend or two, because it's made with simple joinery. The case assembles with biscuits and pocket screws, and the drawers go together with lock rabbet joints. There's no fussy drawer hardware to install, just cut-in hand grips and screwed-on hardwood runners to guide the drawers.

Despite its simple joinery, this cabinet is very sturdy, and it can be easily altered. Make it taller. Change the drawer sizes. Add doors. And don't let the "office" designation fool you—

switch to MDF or Baltic birch to build a great shop cabinet.

Square and flat

Both the cabinet and the drawers must be perfectly square to allow the drawers to glide freely without binding. Make sure that your lumber is milled flat; ditto for your glued-up top and sides. Draw accurate layout lines and verify that your tool set-ups are square.

Build the cabinet

1. Milling and gluing solid wood for the sides and top does take a fair amount of time, so keep in mind that you can substitute edge-banded hardwood plywood for these parts, without compromising the integrity of the cabinet.

2. Joint and plane your stock to thickness. Then select and cut boards for the top (A, Fig. A) and the sides (B).

3. Glue the panels together. To keep the board faces flush, I glue the joints one at a time (**Photo 1**).

4. Trim the glued-up panels to final size. After trimming, stack the two sides, to make sure they're identical in width, length and squareness.

5. Cut the side arches. Then finish-sand the sides and the top.

6. Locate the sides on the bottom of the top (**Photo 2**). Make sure your layout lines are square to the front edge and parallel to one another.

7. To locate the biscuit slots on the top and sides, clamp each side outside-face up to top's bottom face (**Photo 3**). Align the side's inside top edge with the layout line and make sure the back



1 Glue up the panels for the sides and top. Work on a flat surface and glue the joints one at a time.



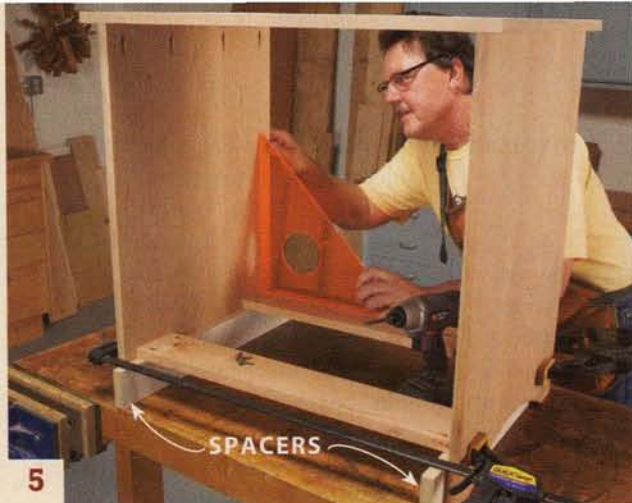
2 Mark the location of the sides' inside edges on the top's bottom face. Use a large square for accuracy.



3 Cut biscuit slots in the top and sides. Then drill holes for pocket screws on the inside face of each side.



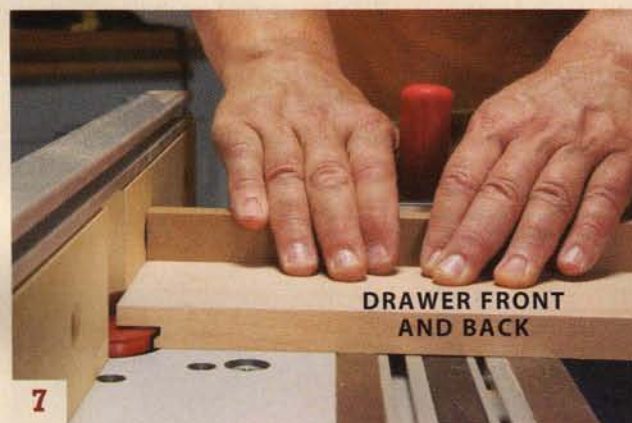
4 Fasten the sides to the top with glue, biscuits and screws. Clamp a fence to the outside edge of the top, to hold the side in position as you drive in the pocket screws.



5 Use spacers and clamps to accurately position the stretchers, so you can drive the pocket screws. Frequently check the cabinet during assembly, to make sure it remains square.



6 Use a drawer lock bit to create the drawer joints. First, rout both ends of each drawer side. A shopmade jig stabilizes the workpiece, holds it against the fence, and prevents blowout on the back edge.



7 Reposition the fence to shape the ends of drawer fronts and backs. Set the fence so the depth of the cut matches the thickness of the drawer sides.



8 Saw the runner slot in the outside face of each drawer side. These slots will be used to mount the assembled drawer in the cabinet. Always orient the bottom edge of the workpiece against the fence.

edges are flush. Cut the slots into the sides. Then stand the biscuit joiner on edge and butt it against the cabinet side to cut the slots into the top. Complete the other side in the same manner.

8. Drill pocket holes in the inside faces of each side, as shown in Fig A. The locations aren't specific; center them between the slots and keep them at least an inch away from the outer edges. Drill pocket holes in the stretchers (C) at this time as well.

9. To assemble each joint, glue biscuits in the slots in the top, spread glue into the slots in the side pieces, and screw the pocket screws through the sides into the top (**Photo 4**). Use a large square to make sure the sides remain square

to the top as you drive the screws.

10. Flip the cabinet over onto a flat surface and position 2-7/8" wide spacers on the inside (**Photo 5**). Set the stretchers onto the spacers. Locate the front stretcher 1-1/8" back from the front of the cabinet, and the back stretcher 1/4" away from the back. Clamp the sides to the stretchers and then drive in the pocket screws.

Build the drawers

11. Rip the drawer fronts, sides and backs (D through J) to width and then cut them to length.

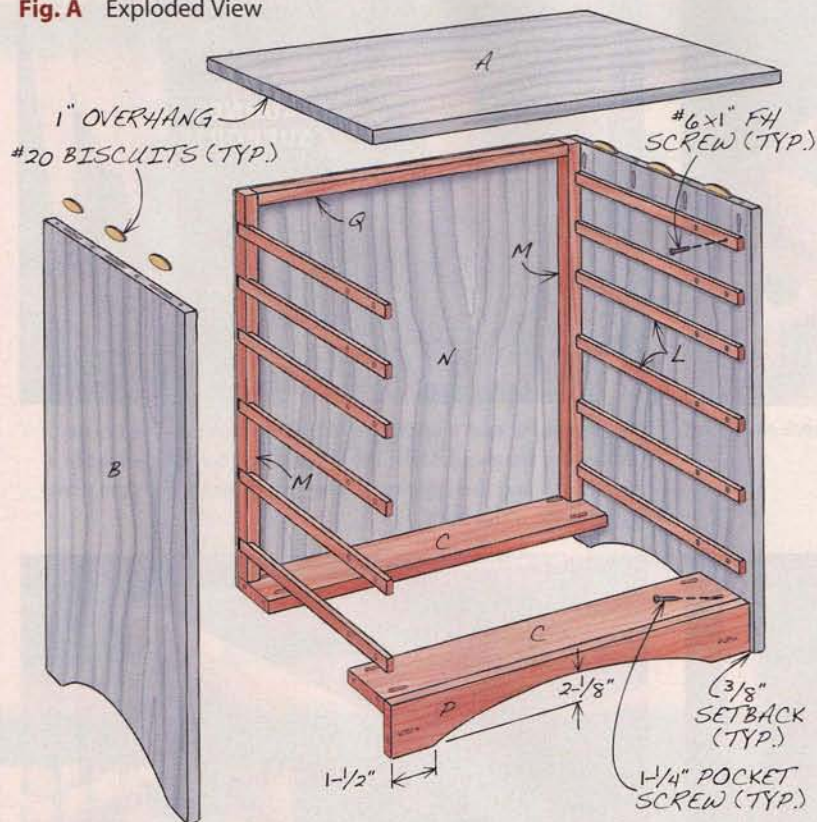
12. Install a drawer lock bit (see Sources, page 64) in your router table and make test cuts in scrap stock to correctly adjust the bit's

height. (For complete how-to on using drawer lock router bits, visit www.AmericanWoodworker.com/DrawerLockBit or see "Lock Rabbet Drawer Joinery," AW #92, Feb '02, page 60). Rout the ends of the drawer sides first (**Photo 6**). Then change the fence and rout the ends of the drawer fronts and backs (**Photo 7**).

13. Cut 1-1/8" by 5-1/8" hand grips in the drawer fronts and smooth the curves by sanding.

14. Cut a groove for the drawer bottom (K) in each drawer piece, starting 3/8" from the bottom edge. These grooves always go on the routed face. Match the groove's width to the thickness of your drawer bottom material. Cut six drawer bottoms to final size.

Fig. A Exploded View



15. Install a dado blade in your table saw and cut a 3/8" deep by 3/4" wide runner slot in the outside face of each drawer side, starting 1-1/2" from the bottom edge (**Photo 8**).

Using the same setup, cut notches through the ends of all the drawer backs, so that the runner slots and notches align when the drawers are assembled. Install a tall auxiliary fence on your miter gauge to support the drawer backs when sawing these end grain notches. DO NOT cut notches in the drawer fronts.

16. Assemble the drawers (**Photo 9**). Apply glue to each lock joint and run a bead of glue in the grooves to secure the bottom. Gluing in the bottom helps to keep the drawer solid and square. I find that it works best to glue and nail one joint, seat the drawer bottom into this corner assembly, and then add the remaining parts. I check to make sure the drawer is square, and then nail the remaining three joints. Brad nails effectively clamp the joints while the glue dries, but if you don't have a brad nailer,

simply clamp the drawers and make sure they're square before setting them aside to dry.

Build and install the drawer runners

17. The drawers slide on runners (L) installed inside the cabinet. For the drawers to operate smoothly, these runners must be correctly located and precisely sized. The first step is to make supports (M) that will automatically position the runners. Two of these supports will be permanently installed inside the cabinet (one on each side, at the back),

Fig. B Drawer Runners and Supports

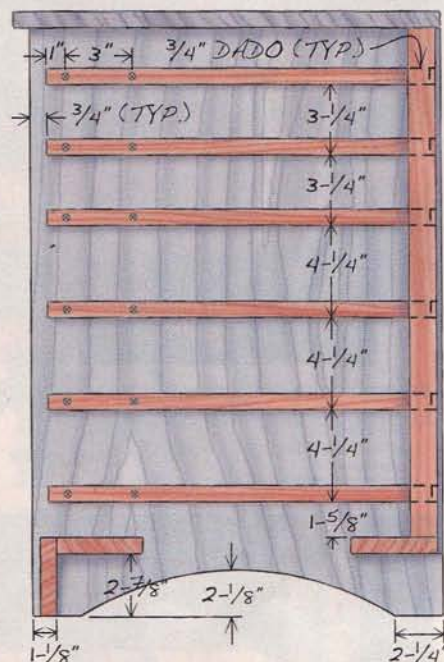
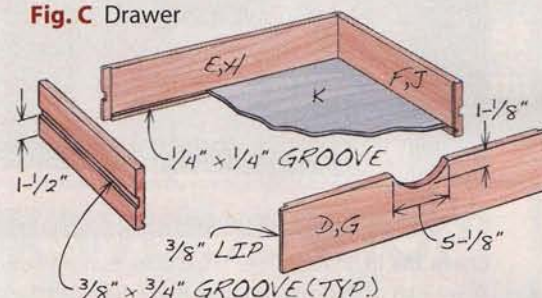


Fig. C Drawer



to allow for the solid wood's seasonal movement. Start with a 6" x 22-5/8" board (it should fit snugly inside the cabinet, between the bottom stretcher

Cutting List		Overall Dimensions: 27" H x 28-1/4" W x 19-3/4" D		
Part	Name	Qty	Material	Th x W x L
A	Top	1	Cherry	3/4" x 19-3/4" x 28-1/4"
B	Side	2	Cherry	3/4" x 19" x 26-1/4"
C	Stretcher	2	Cherry	3/4" x 4" x 24-3/4"
D	Small drawer front	3	Cherry	3/4" x 3-1/8" x 24-5/8"
E	Small drawer back	3	Beech	3/4" x 3-1/8" x 24-5/8"
F	Small drawer side	6	Beech	3/4" x 3-1/8" x 16"
G	Large drawer front	3	Cherry	3/4" x 4-1/8" x 24-5/8"
H	Large drawer back	3	Beech	3/4" x 4-1/8" x 24-5/8"
J	Large drawer side	6	Beech	3/4" x 4-1/8" x 16"
K	Drawer bottom	6	Hardboard	1/4" x 15-3/4" x 23-5/8"
L	Drawer runner	12	Beech	7/16" x 23/32" x 17-3/4"
M	Runner support	2	Beech	3/4" x 1-1/4" x 22-5/8"
N	Back	1	Hardboard	1/4" x 24-3/4" x 23-3/8"
P	Apron	1	Cherry	3/4" x 3-5/8" x 24-3/4"
Q	Top cleat	1	Beech	3/4" 1-1/4" x 23-1/4"



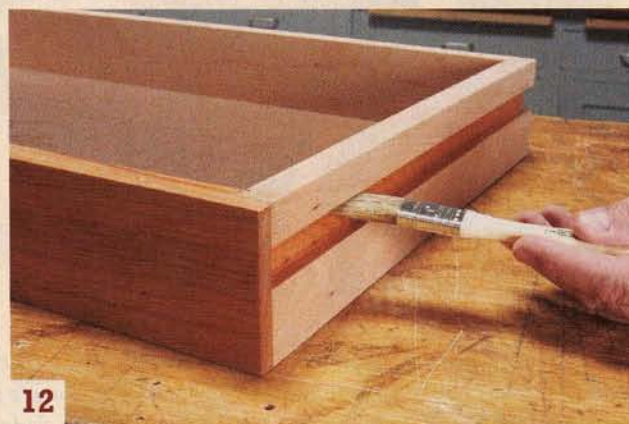
9 Assemble the drawers with glue and brad nails. Check each joint to make sure the drawer is square.



10 Use supports and a spacer to accurately position the drawer runners for fastening. Make the supports by cutting dadoes in a wide board and then ripping it. The spacer establishes the drawers' setback at the front.



11 Check the fit. If the drawer is too tight, remove both runners and shave a bit of thickness from each one. Reinstall the runners and try again. Keep removing and shaving until the drawers slide freely.



12 To make the drawers slide effortlessly, brush a coat of shellac into the runner slots and onto the runners. Let the shellac dry and then sand lightly.

and the top). Using the dimensions in Fig. B, and measuring from the bottom to the top, lay out the six $\frac{3}{4}$ " dadoes that will house the runners. Raise the dado set to $\frac{13}{32}$ " and cut the dadoes, using your miter gauge.

18. Rip the dadoed board into three or four $1\frac{1}{4}$ " wide pieces to create the runner supports. Mark the bottom end of each piece, for reference.

19. Mill the drawer runners and test their fit in the drawers' runner slots—the runners must slide freely. If the fit is too tight, shave a bit from the runners' width.

20. Tip the cabinet on its side and clamp a $\frac{3}{4}$ " wide spacer flush with the front edge (Photo 10). This spacer positions the runners so the drawers will be slightly recessed inside the cabinet.

21. Position a pair of runner supports between the cabinet top and the stretchers. Fasten the rear support to the cabinet side, $\frac{1}{4}$ " inside the back edge (flush with the stretcher), to allow room for the cabinet back (N). Slide the runners through the supports' dadoes and butt them against the front spacer. Fasten the front end of each runner with two countersunk screws. Then remove the front runner support. The back ends of the runners are held in position by the permanently installed support. Tip the cabinet onto its other side and install the remaining runners.

22. Cut and fit the front apron (P). Drill pocket holes in the back and cut the arch at the bottom. Glue and clamp the apron to the front stretcher and install the pocket screws.

23. Test fit the drawers (Photo 11). A tight fit is good, because it's pretty easy to make the runners thinner. If the fit is too loose, you'll have to make new runners or glue strips of veneer into the drawers' runner slots.

24. Once you like the fit, it's easy to make the drawers slide "like buttah" (Photo 12).

25. Install the top cleat (Q) $\frac{1}{4}$ " inside the back edge, so it's flush with the runner supports. Cut, fit and install the cabinet back.

26. Apply your favorite finish. I like an oil/varnish blend, such as MinWax Antique Oil. 🛠️

Sources

Freud, www.freudtools.com, (800) 334-4107, 2" Drawer Lock Bit, #99-240, \$39.99.

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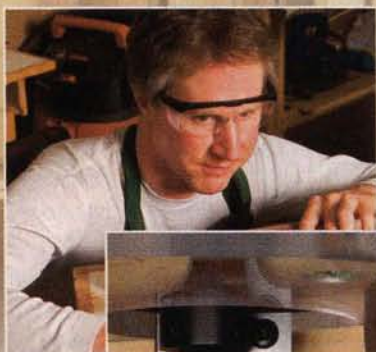
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Arts & Crafts Hall Tree

**Organize your gear
with an oak classic.**

By Steve Lehmann

I'VE ALWAYS WANTED a mud room in my house—you know, a place where you can throw your coats, gloves and boots before entering the living room or kitchen. I don't have enough space for one, so I started thinking: what could I build that would hold all those things?

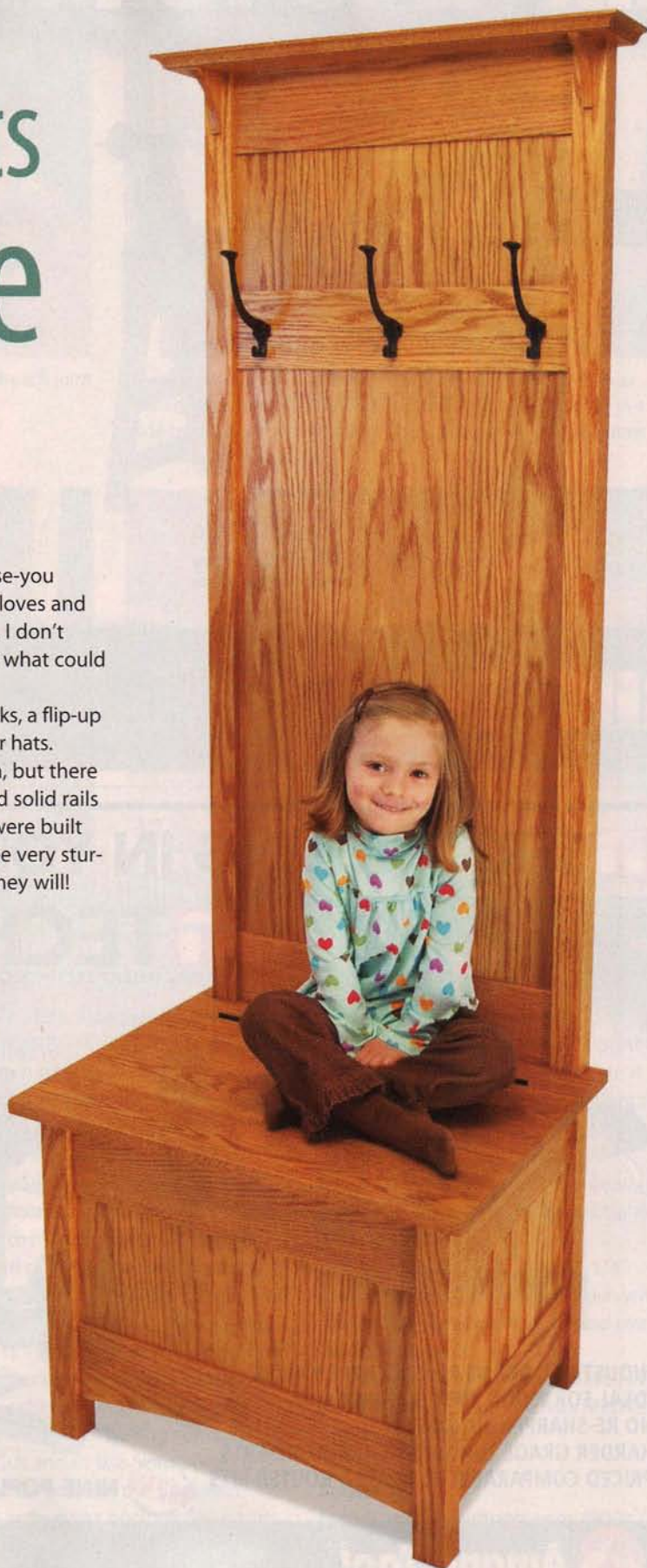
A hall tree. A big one—one with three large hooks, a flip-up seat and storage space underneath. Plus a shelf for hats.

The design uses frame and panel construction, but there are no mortises to make. The plywood panels and solid rails just fit into grooves, the same way these pieces were built years ago. Gluing the plywood makes the hall tree very sturdy—strong enough for my kids to stand on. And they will!

Make the legs

1. Start by milling the front and back legs (A1 & B1). The back legs are quite long, so joint and plane them in stages, over the course of a few days, to ensure that they stay straight. Trim the back legs to their final length. Make the front legs about 6" extra long for test cuts.

2. The joinery in the hall tree is pretty straightforward (Fig. A). All of the legs have long, stopped grooves that receive the plywood panels and the rails' tenons. These grooves should exactly fit your plywood, which is probably thinner than its nominal thickness of 1/2". The best way to make the grooves is to use a plunge router, a 3/8" bit and an edge guide. To set up your router, make some test grooves in the extra-long portion of the front legs. Rout from both sides of the legs to center the grooves (**Photo 1**). Once you've



correctly adjusted your edge guide, trim the front legs to final length. Then lay out the grooves on both of the leg's inside faces and rout them (Fig. B).

3. Rout similar grooves on the inside faces of the back legs (Fig. C). Square the ends all of the grooves with a chisel.

Make the seat, rails and panels

4. The seat is composed of two pieces: a lid (D1) and a rail (D2) that is fixed to the case. In order to make the grain of the seat continuous across these two parts, and to ensure that they're the same thickness, glue up the seat as one large blank, then rip it into two pieces.

5. Mill all of the rails (A2-A5, B2-B3, C1-C2). Cut them to width and length.

6. Cut grooves in the rails for the plywood panels (Figs. D, E and F). While you could use your router again, it's easier to cut the grooves on the table saw (Photo 2). Set up a 3/8" dado set and cut from both faces, as you did with the router.

7. Cut tenons on all the rails (Photo 3 and Fig. D). Add a chipper to the dado set, making it 1/2" wide. Clamp a sacrificial board to the saw's fence in order to house a portion of the dado set. Cutting from both faces of each rail, raise the dado set until the tenons fit the grooves.

8. Cut shoulders on the tenons by lowering the dado set and standing the rails on edge.

9. In the back rail-seat (A4), cut a rabbet (Fig. D) that is half the thickness of the seat's back section (D2). On the back rail-upper (A2), cut two rabbets to form a tenon for the shelf (E1).

10. On the lower rails (A5, B3 & C2), cut grooves to receive the bottom panel (D4) (Photo 4).

11. Draw and cut the arch in the lower front rail (B3) (Photo 5 and Fig. E).

12. Assemble each side of the hall tree, without glue, and double-check the measurements for the panels (A6,

1.

Begin by making the front and back legs. Rout grooves in the legs to exactly fit the plywood panels.



2.

Cut grooves in all the rails to fit the plywood, too. Use a feather-board to press the rail tight against the fence..



3.

Cut tenons on the rails using a dado set.



4.

Cut grooves in all the lower rails to receive the bottom panel of the storage area, under the seat.



Fig. A Exploded View

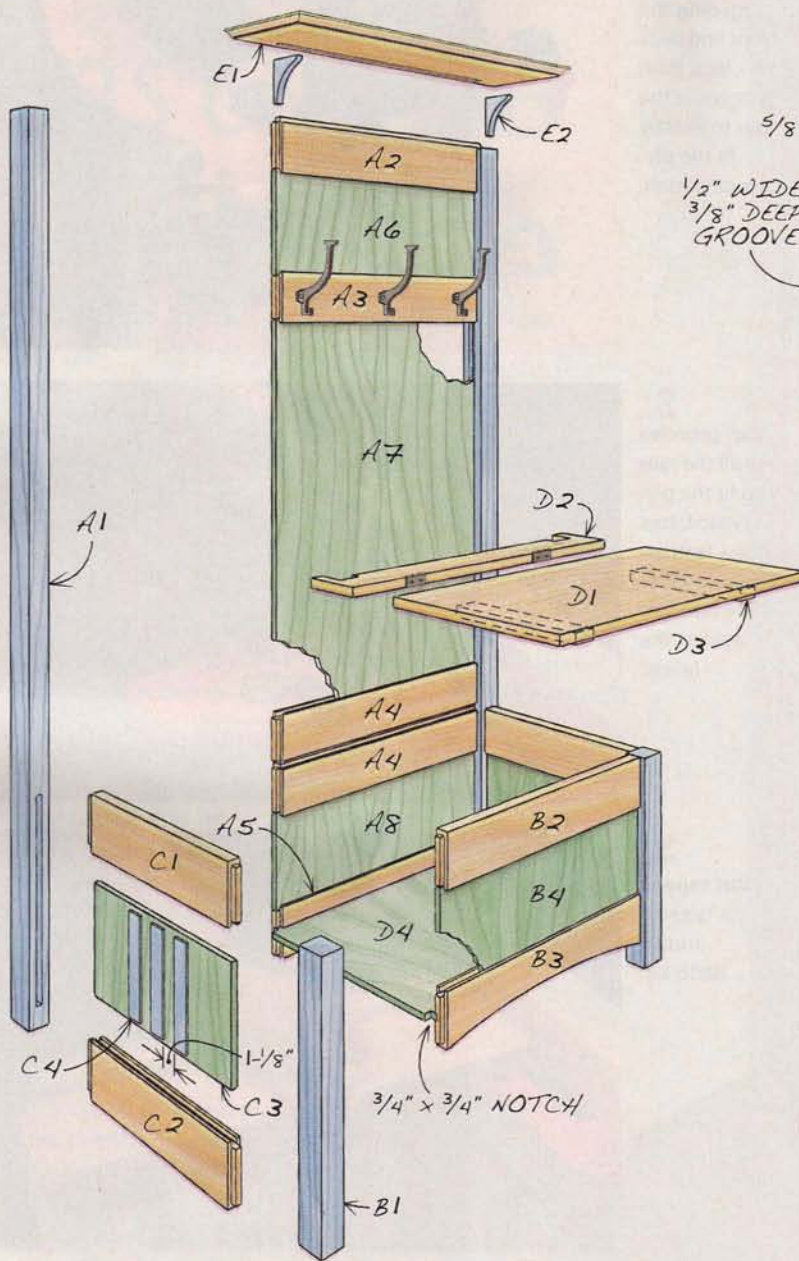


Fig. B Front Legs

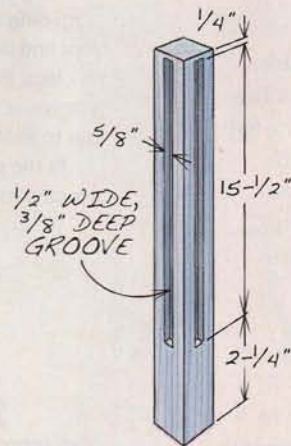


Fig. C Back Legs

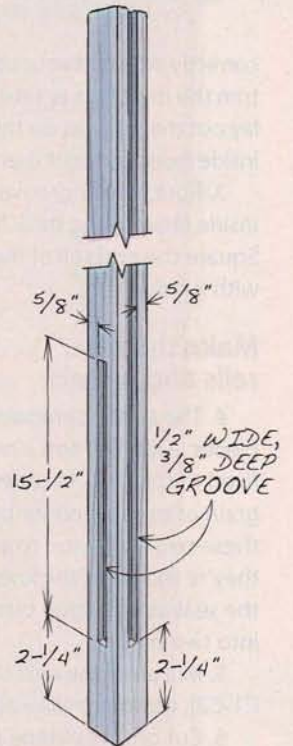


Fig. D Back Rails

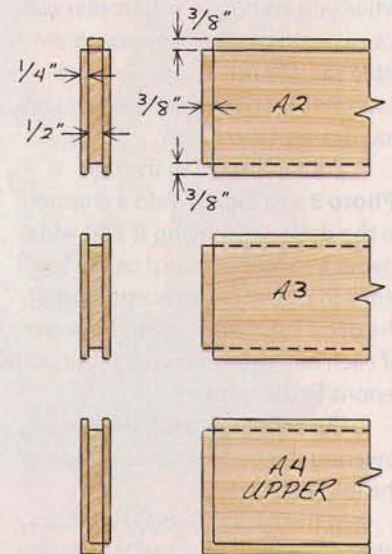


Fig. E Front Rails

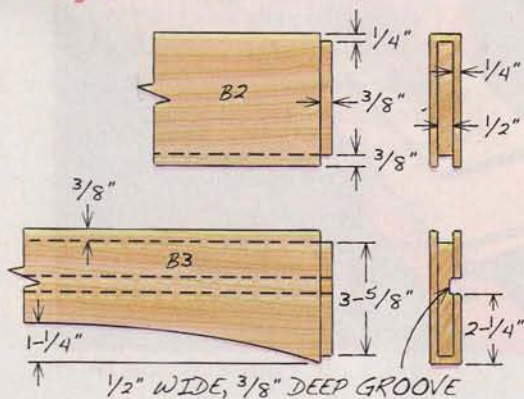
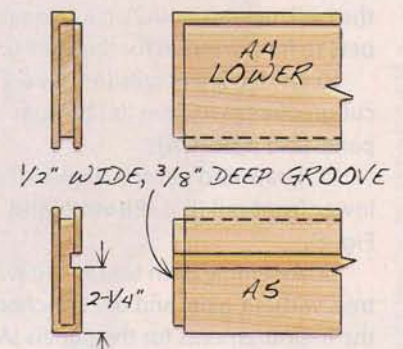
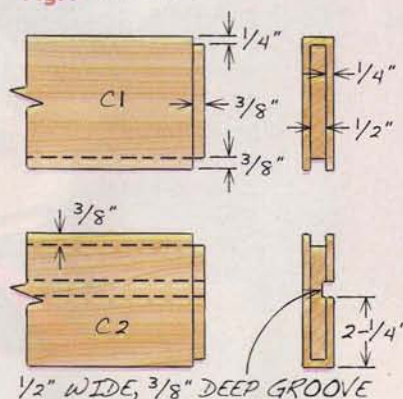


Fig. F Side Rails



A7, A8, B4, C3 & D4). Cut the panels about 1/16" undersize and ease their edges with sandpaper to make assembly easier.

For a complicated assembly, I only put glue on one side at a time.

Assemble the front and back

13. Test fit the pieces for the front. Finish sand them and glue.

14. Test fit all of the pieces for the back, then glue it together (**Photo 6**). Make 7-1/2" long spacers to fit in the upper and lower panel areas—they'll help align the rails. To reduce anxiety, I glued one side of the back at a time. For the first glue-up, I only put glue on one end of all the rails and panels. I clamped the other leg onto the assembly, without glue, to keep the assembly square and flat. Once the glue was dry, I glued the other side.

15. Cut notches in the seat rail (D2) to fit the legs and rails (**Photo 7** and Fig. G). Glue this piece to the back assembly.

Assemble the carcass

16. On the bottom (D4), cut notches for clearance around the legs (**Photo 8**). You may want to cut ventilation slots in this piece to allow damp gloves and boots to dry.

17. Check the fit of the side pieces and the bottom. Make sure you are able to keep the legs square (**Photo 9**). Finish sand all of the side pieces and glue.

18. Now the project is really starting to take shape. Make the side slats (C4). Sand and glue them in place.

5.

Draw an arch on the lower front rail. Use spring clamps to hold a bent stick while you draw the curve.



6.

Glue the back. There are a lot of pieces to manage, so I glue one side at a time. Spacers help align the inner rails.



7.

Cut notches in the rear section of the seat, so that this piece fits around the back legs and rail.



8.

Cut notches in the storage area's bottom panel. Screw an extra-tall board to your miter gauge for support.



Add the shelf and seat

19. Make the shelf (E1). Rout a cove and fillet all the way around the piece using a cove bit and a straight bit (**Photo 10** and Fig. J). Using your plunge router and edge guide, rout a groove on the bottom of the shelf to fit the long tenon on the upper back rail (Fig. H). Glue the shelf in place.

20. Make the shelf brackets (E2) (Fig. K). Glue the shelf supports to the back legs and to the shelf.

21. Cut the seat battens (D3). Rout a 45° chamfer on their edges. Drill holes for mounting the battens to the seat (**Photo 11**). Elongate the outside holes to allow the seat to shrink and swell. Attach the battens to the seat's lid.

Wrap it up

22. Install hinges to join the seat lid to the seat's back rail. To prevent the lid from slamming down on little fingers, mount a lid support between

Fig. K Shelf Bracket

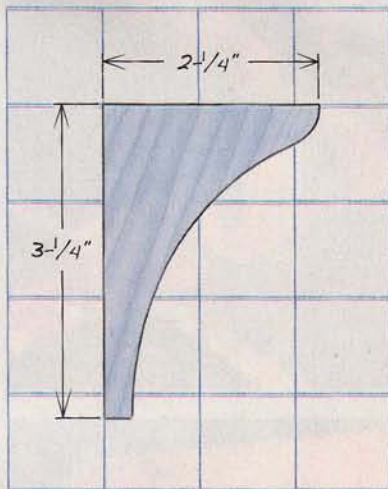
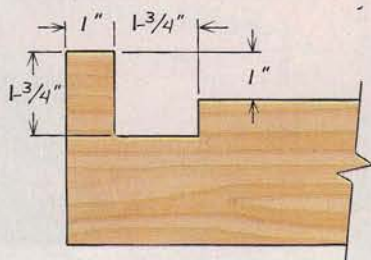


Fig. G Seat



Hall Tree Overall dimensions: 72-3/4" H x 26" W x 19" D					
Section	Part	Name	Qty.	Material	Th x W x L
Back	A1	Back leg	2	Red oak	1-3/4" x 1-3/4" x 72"
	A2	Back rail-upper	1	Red oak	1" x 4-5/8" x 19-3/4"
	A3	Back rail-mid	1	Red oak	1" x 4-1/4" x 19-3/4"
	A4	Back rail-seat	2	Red oak	1" x 4-5/8" x 19-3/4"
	A5	Back rail-lower	1	Red oak	1" x 4-1/4" x 19-3/4"
	A6	Back panel-upper	1	Red oak plywood	1/2" x 19-3/4" x 8-1/4" (a)
Front	A7	Back panel-mid	1	Red oak plywood	1/2" x 19-3/4" x 33-3/4" (a)
	A8	Back panel-lower	1	Red oak plywood	1/2" x 19-3/4" x 8-1/4" (a)
	B1	Front leg	2	Red oak	1-3/4" x 1-3/4" x 18"
	B2	Front rail-upper	1	Red oak	1" x 4-1/4" x 19-3/4"
Sides	B3	Front rail-lower	1	Red oak	1" x 4-1/4" x 19-3/4"
	B4	Front panel	1	Red oak plywood	1/2" x 19-3/4" x 8-1/4" (a)
	C1	Side rail-upper	2	Red oak	1" x 4-1/4" x 15-1/4"
	C2	Side rail-lower	2	Red oak	1" x 4-1/4" x 15-1/4"
Seat	C3	Side panel	2	Red oak plywood	1/2" x 15-1/4" x 8-1/4" (a)
	C4	Side slats	6	Red oak	1/8" x 1-1/8" x 7-1/2"
	D1	Seat lid	1	Red oak	3/4" x 15" x 24-1/2"
	D2	Seat rail	1	Red oak	3/4" x 4" x 24-1/2"
Shelf	D3	Seat batten	2	Red oak	3/4" x 1-3/8" x 10"
	D4	Bottom panel	1	Red oak plywood	1/2" x 20-1/2" x 16" (a)
	E1	Shelf	1	Red oak	3/4" x 26" x 5"
	E2	Shelf bracket	2	Red oak	1/2" x 3-3/4" x 2-1/4"

Note: (a) approximate length and width. Cut the panels 1/16" undersize in length and width to make assembly easier.

Fig. H Shelf Groove

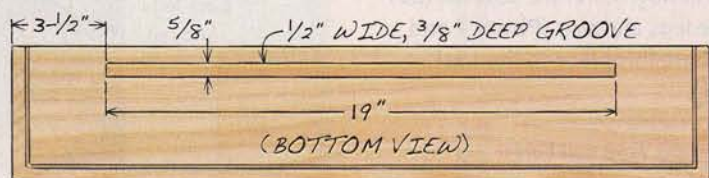
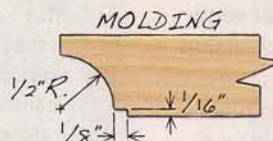


Fig. J Shelf Molding



I always dry fit a case and make sure it's square, before actually gluing it.

the seat and an upper side rail (**Photo 12** and Sources, next page). Mount the coat hooks and leveling feet, if you need them. Remove all the hardware; paint the hooks flat black and add a clear coat of lacquer.

23. Apply a stain and two top coats of poly to the whole case.

24. Re-attach the hardware and install felt dots on the underside of the seat where it contacts the front legs and upper rail. You're ready for a snowy day! 🌨

SOURCES

• **Rockler**, www.rockler.com, (800) 279-4441, Hinge No Mortise w/o Finial 2-1/2", #28696, \$2.49; Lid Support Left Mount, #26195, \$6.99; Screw Washer Head #7 x 1-1/4" fine, #38502, \$4.79; Glue Extended Open, #24623, \$6.49.

• **Woodworker's Hardware**, www.wwhardware.com, (800) 383-0130, Leg Leveler 5/16"-18, #HB33 6600S, \$0.62/each; T-nut, 5/16"-18, #SCT51618, \$0.68/each.

• **House of Antique Hardware**, www.houseofantiquehardware.com, (888) 223-2545, Coat Hook, #R-010BM-9907, \$4.19 each.

Steve Lehmann is an Electrical Test Engineer. He lives in Michigan's Upper Peninsula, where the long winter nights are ideal for working in the shop.



9.

Glue the front, then dry fit the whole assembly. Does it come out square? If so, you're ready for the big glue-up.



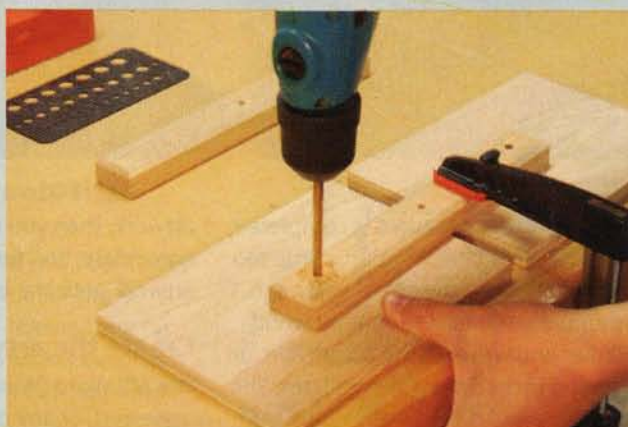
10.

Route a cove molding all the way around the shelf that sits on top of the hall tree.



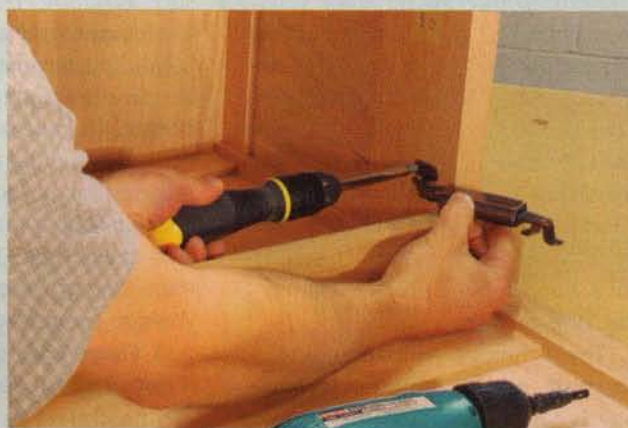
11.

Drill screw holes in two battens that go underneath the seat. Elongate the outer holes so the seat is free to shrink and swell.



12.

Attach a lid support underneath the seat. This spring-loaded hardware cushions the seat as it closes, to protect little fingers. My kids love hiding stuff inside their new hall tree!



Etched Brass Nameplates

**Personalize your
woodworking projects.**

By Charles Mak

DO YOU FIND SIGNING a completed project with a pencil or pen a little too ordinary? I did—so several years ago, I attended a seminar, taught by woodworker and writer Kathy Somerville, on creating etched brass nameplates. She taught a hand-signing technique that I have used and experimented with ever since. Last year, I found out that the seminar was no longer offered, because Kathy had moved away. So, I decided to start it up again, to share the technique and pass on the refinements I had discovered. In this article, I'll show you how to design and produce personalized brass nameplates—for a woodworking project, a family pet, or even a shop sign.

The technique, which combines chemistry and PC computer technology, is easy to learn because there are only three steps. First, you create the

artwork, then you create the blank nameplate, and finally, you etch the artwork onto the blank.

Create the artwork

Use MS Word (Windows version, 2003 or newer), or any graphic software such as Adobe Photoshop Elements to create artwork to transfer to your blank. You can even use your scanned handwritten signature or digital photos. It's important to remember, however, that the artwork must be reversed (or mirrored), because the image will be transferred to the blank face-down. Here's how to use the imbedded graphic function of MS Word to complete the artwork:

1. Frame and install the image (**Photo 1**). First, open a Word document and create a text box. To create a text box, click "View" on the toolbar,

then "Toolbars" and "Drawing" on the drop-down menus. This opens the drawing toolbar. Now click on the "Text Box" icon and then click on the document to create the text box. Size the text box appropriately for your nameplate. Insert (copy and paste) an image you've chosen or created inside the text box. Here, the image is a bow-saw picture that I downloaded from the internet.

If the image is not reversed, flip it horizontally by clicking on the "Draw" icon, selecting "Rotate or Flip," and then clicking on "Flip Horizontal." If you have trouble, go to Word "Help" and type in "rotate or flip."

2. Create internal text boxes for your text (**Photo 2**). Click on the "Text Box" icon again and then click inside the main text box to create internal text boxes. My design has two internal

text boxes.

3. Add text (**Photo 3**). Double-click inside the first text box you created and then click on the "Insert WordArt" icon. This opens the WordArt Gallery. Choose and click on the word style you prefer. Press "OK." Then enter your text in the font and size you desire (I used a different font size for each box). Click "OK."

4. Remove the internal text box borders (**Photo 4**). Click on the text box in the image and then click on the "Line Style" icon. Click on "Choose Lines" and then "More Lines" where you'll see the "Line Color" box. Click on this box and select "No Line." Click "OK" to exit. Repeat the process for each internal text box.

5. Reverse the text (**Photo 5**). Click once on the text that you've created, and click on the "Draw" icon. Select "Rotate or Flip" and then click on "Flip Horizontal." (You can find out more about the Word's graphic functions in its "Create a mirror image of an object" section as well as its "WordArt" section.)

6. Print the artwork on transparency film, so it can be attached to the blank nameplate (**Photo 6**). You can use a laser printer or a photocopier, but not an inkjet printer. (Laser printers and photocopiers use toner instead of black ink. For etching, the artwork must be printed with toner.) If you use a laser printer, print the artwork on a sheet of 3M CG3300 transparency film (see Sources, page 75). Otherwise, photocopy it on a 3M PP2500 Transparency film or the dull matte side of a Technicks Press-n-Peel Blue sheet. I prefer the 3M transparency films because they're cheaper, easier to use when you align your artwork on the blank (the blue color makes lines hard to see), and available at most local office supplies stores.

Create the blank nameplate

You can buy blank brass nameplates pre-cut, but it's also easy to make your own. Select a brass sheet that's 0.032" or 0.040" (0.8 mm to 1 mm) thick. This sheet must be absolutely flat for the

artwork to transfer properly—later, I'll show a trick for making sure this piece is flat. Mark the desired shape on the piece with a felt-tipped pen. Then cut out the shape, following the waste side of the line. It's best to use a scroll saw equipped with a metal-piercing (jewelers) blade or a skip tooth blade (Univ. No. 3/0 to 5) for this step. But you can also use a jigsaw outfitted with a metal-cutting blade.

Sand to the line (**Photo 7**). I use my oscillating spindle sander for this step, but you can also use a disc sander or belt sander. Using a metal file is also an option, but do not use a grinder. Nonferrous metals such as brass and copper clog the pores of the grinding wheel and may cause it to overheat and explode.

Prepare the blank for etching. First, make sure it is absolutely flat (**Photo 8**). Adhere the blank to a wooden block with double-faced tape. Then flatten the blank by sanding on 220-, 320-, 400- and 600-grit sandpaper affixed to a dead-flat surface, such as a piece of marble or the top of your tablesaw. Wash the blank with soapy water, rinse it, and dry it with a paper towel.

Etch the artwork onto the nameplate

To etch metal, you need two substances: an acid (ferric chloride for brass, bronze and copper, or ferric nitrate for silver) and a resist (the artwork's toner ink) to that acid. The process requires five steps.

STEP 1: TRANSFER THE ARTWORK TO THE BLANK, TO CREATE A MASK.

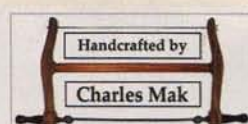
Center the transfer film on the blank with the image-face down, and secure it along the edges with masking tape (**Photo 9**). Then use an old clothes iron to transfer the resist and create the mask (**Photo 10**). Set the iron to between 250° F and 350° F (the silk or polyester setting). Do not turn on the steam function. Cover the film with a piece of paper. Then iron the film for four to six minutes, until the film's black image looks slightly



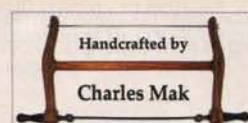
1. Create the artwork for your nameplate on a computer. Insert the image you've selected in a text box that you've opened in a Word document. Reverse (or mirror) this image.



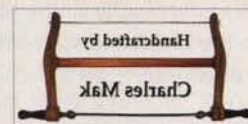
2. Open text boxes inside the main text box.



3. Insert the text. Here I've used two different font sizes.

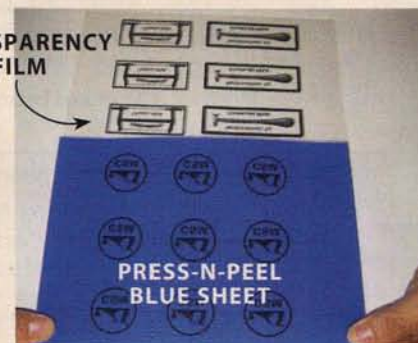


4. Remove the internal text box borders. (This step is optional). I often include the main text box border as part of the design. It also helps to position the artwork on the nameplate blank.



5. Reverse the text.

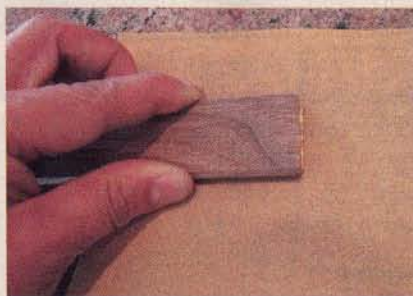
TRANSPARENCY FILM



6. Print the artwork on 3M transparency film or Technicks Press-n-Peel blue sheet, so you can transfer the image to the nameplate. You must use a laser printer or a photocopier for this step, so the image is created with toner, rather than black ink.



7. Cut out the blank and smooth the edges.



8. Prepare the blank for etching by sanding it absolutely flat.



9. Tape the transfer film to the blank, image-face down.



10. Use heat to transfer the image from the film to the blank. Once it's transferred, the toner ink mask will resist the acid used to etch the brass.



11. Touch up the transferred mask, after letting the blank cool and peeling off the transfer film. You can add color where it's missing, or remove color where it isn't wanted.



12. Cover the blank with acid, brush it occasionally, and let it soak. After a while, check the edge of the mask with a toothpick. Eventually, you'll be able to feel a ridge.

Troubleshooting Tips

Practice makes perfect. No one likes mistakes, but second chances are abundant with this technique. For example, if the mask transfers badly to the blank, you can remove it with acetone and try again. If you don't like the etched results, simply flip the blank and start over—that's one reason tape is applied to the back. Here are solutions to other problems you might encounter.

Problem	Possible Causes	Remedy
Artwork is poorly transferred to the blank.	1. Blank is not flat, it's sanded unevenly, or it's contaminated. 2. Film has been under- or over-heated.	1. Sand blank on a flat surface, do not skip any grits, and hold the sanded blank only by its edges. 2. Re-read the heating instructions. Reheat the film longer, if necessary.
Artwork appears smudged.	1. Film has been overheated. 2. The transfer film was peeled off too aggressively, or it was removed before the piece had sufficiently cooled.	1. Check the film while ironing, to make sure it doesn't overheat. 2. Remove the film gently, and only after the blank feels cool.
Etched artwork is not pronounced.	1. Etching time was too short. 2. Etchant (the acid) has been reused too many times.	1. Try longer etching time, say 45-60 minutes. 2. Use fresh etchant.
Patina is not even or too dark.	Darkening solution is not evenly applied onto the surface, or it is too strong.	Apply diluted darkening solution, quickly brush the surface with a circular motion, and then rinse.



13. Remove the etched blank from the acid and thoroughly rinse it.



14. Tone the brass by brushing on a metal darkening solution.



15. Remove the mask by rubbing the blank with a soft cloth dampened with acetone.



16. Seal the nameplate's etched and patinated surface with lacquer.

bubbled. (Exact ironing time varies, depending on the temperature setting, size and thickness of the piece). Let the blank and film completely cool. Then gently peel off the film. Use nail polish or an enamel paint pen to fill any voids or defects, and remove any unwanted spots or overrun with a sharp knife (**Photo 11**). The mask is now created on the blank.

STEP 2: ETCH THE IMAGE ONTO THE BLANK.

Cover the back of the blank with tape. Then place it mask-face up in a plastic or glass tray. Pour in some ferric chloride, just enough to cover the surface. Brush the blank with a soft brush

every few minutes, to stir the solution (**Photo 12**). After 15 to 30 minutes, you'll be able to feel a raised ridge at the edge of the mask with the tip of a toothpick. The longer the blank is left in the etching solution, the more pronounced the ridge will be. Remove the etched blank with a pair of tweezers and rinse it under running water (**Photo 13**). Then dry it. Store the used ferric chloride in a bottle, as you can reuse it a few times before disposing of it properly as a hazardous waste.

STEP 3: CREATE PATINA BY DARKENING THE BRASS.

Pour a little JAX darkener on the blank and quickly brush it with a tooth-

brush to create an even appearance (**Photo 14** and Sources). The longer you leave the solution on the blank, the darker the patina will be. For lighter patina, slightly dilute the solution with water before applying it. Rinse the blank again, and let it dry. Remove the tape from the back. If you want a colored background, spray the blank with a coat of enamel paint, instead of using the darkening solution.

STEP 4: REMOVE THE MASK.

If you applied a darkened patina, remove the mask by soaking a piece of cloth with acetone and rubbing the blank (**Photo 15**). If you used paint in Step 4, don't use acetone, as it will also remove the paint. Instead, lay the blank with the mask-face down on 600 grit sandpaper affixed to a flat surface. Then rub lightly, to remove the mask. Don't oversand or you'll remove the paint, too.

STEP 5: PROTECT THE PIECE.

Spray on a few coats of lacquer (**Photo 16**). If you've used enamel paint to add color, use spray polyurethane instead of lacquer. Mission Accomplished! 

Sources

- Speedy Metals, www.speedymetals.com, (866) 938-6061, Brass Sheet, .032" thickness, \$31.43 for a 12" x 12" piece, .040" thickness, \$41.70 for a 12" x 12" piece.
- Staples, www.staples.com, (800) 378-2753, 3M CG3300 Transparency Film, #220970, \$36.99 for 50 sheets; 3M PP2500 Transparency Film, #219949, \$29.99 for 100 sheets.
- Reactive Metals Studio, www.reactivemetals.com, (800) 876-3434, Press-n-Peel Blue Sheets, \$8.08 for 5 sheets.
- MG Chemicals, www.mgchemicals.com, (800) 201-8822, Ferric Chloride, #415, \$9 for a 17 oz. bottle.
- JAX Chemical Company, www.jax-chemical.com, (914) 668-1818, Brown-Black Darkener, #BB-Pint, \$12.95 for a 1 pt. bottle.

Charles Mak is a businessperson in Alberta, Canada. During his spare time, he can be found woodworking in his shop (sometimes in freezing temperatures), or at his local Lee Valley Tools store. Charles teaches classes in decorative brass etching, automata/mechanical sculptures and geometric pens. Contact Charles at signyourworkinbrass@gmail.com.





New Tablesaw Blade Guards

By Tim Johnson

UNTIL RECENTLY, tablesaw blade guard systems have remained in the Stone Age. These relics block the view of the blade, interfere with sawing operations, and are a pain in the neck to remove and re-install. Oh, let's get real. Once these guards are removed, they're rarely re-installed.

Fortunately, saws with newly-designed guard systems like the ones shown here are now available. And within a year, thanks to revisions to UL 987, the Standard for Stationary and Fixed Power Tools, nearly every new tablesaw will be equipped with one. As you'll see, these new systems address virtually all of the

issues that plagued their old-style counterparts.

Beneficial changes

UL 987 specifies several notable changes for blade guard systems. First, all saws must now be equipped with a riving knife that rises and falls with the blade (**Photo 1**). Like a spreader, a riving knife greatly reduces the possibility of a kickback, by keeping a board from pinching against the blade during a rip cut. In addition, a rise-and-fall riving knife stays in close proximity to the blade at any height, which further reduces kickback chances. And because a riving knife stands

lower than the blade, it can remain on the saw during many types of non-through cuts.

The next change follows from the first. The spreader on a guard/spreader assembly must now mimic a riving knife (**Photo 2**). Old-style spreaders don't rise and fall with the blade, so lowering the blade increases the gap between the two parts, which reduces the spreader's effectiveness.

A third change stipulates that both the guard assembly and the riving knife must be easy to remove and install (**Photo 3**). This is really good news, because difficult re-installation provided an easy excuse

STAFF

PHOTOGRAPHY: COURTESY OF MANUFACTURER, UNLESS NOTED.

for permanently parking an old-style guard in the trash. Most new guard systems snap in and out in seconds, thanks to quick-release mechanisms featuring levers or spring-loaded knobs or pins. Blade guards and anti-kickback pawls must also feature quick-release removal.

Complying with the standards doesn't mean an end to creative thinking. The riving knife and blade guard assembly can be separate pieces (**Photo 4**), or the riving knife can be part of a combined guard/spreader/knife system (**Photo 5**).

Tracking the new designs

Saws from several manufacturers feature new guard systems built around the dual-purpose riving knife (**Photo 6**). This innovative new design is the result of cooperation by several members of the Power Tool Institute (PTI), a trade organization. The Cadillac version of this system appears on Delta's new Unisaw (shown on page 76), but it also appears on virtually every size saw (**Photo 7**). On many versions of this design, the guard arm (also called the top barrier) is slotted, to provide an open view of the blade while setting up a cut. (While sawing, however, the slot does allow some sawdust to fly out.) In addition, the side barriers lift out of the way almost effortlessly and lock in a stored position.

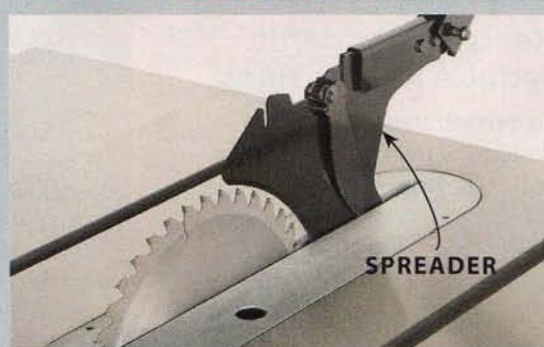
Another group of saws are equipped with an upgraded version of an old standby (**Photo 8**). The dual side barriers on this guard/spreader assembly are less obtrusive than those in the PTI design, but they aren't as easy to lift out of the way. Instead, you lift the entire guard, which pivots at the back of the arm.

Some guard/spreader assemblies include dust collection ports (**Photo 9**). These guards feature one-piece construction, to maxi-

1. A riving knife that rises and falls with the blade is one new requirement for UL approval. Unlike a guard/spreader assembly, a riving knife doesn't have to be removed to make non-through cuts with the regular blade.



2. The spreader on a new-style guard/spreader assembly must rise and fall with the blade, just like the riving knife does. A new-style spreader is easy to spot, because it doesn't bolt behind the saw table, like an old-style spreader.



3. Easy on ... easy off. To meet the new standard, users must be able to remove or install either the riving knife or the blade guard assembly in 30 seconds or less. That means quick-release mechanisms.



4. The guard/spreader assembly and the riving knife may be separate components. This traditional approach is still an option.



5. A dual-purpose riving knife is a new option. The knife changes position to function as the spreader in the guard assembly. The blade guard and anti-kickback pawls simply snap into notches in the knife.



RIVING KNIFE POSITION

SPREADER POSITION

Tool Talk

mize dust collection capability. When the blade is tilted, though, most one-piece guards partially expose the top side of the blade. An overarm guard system is another guarding option allowed by UL 987 for controlling dust from the top of the blade.

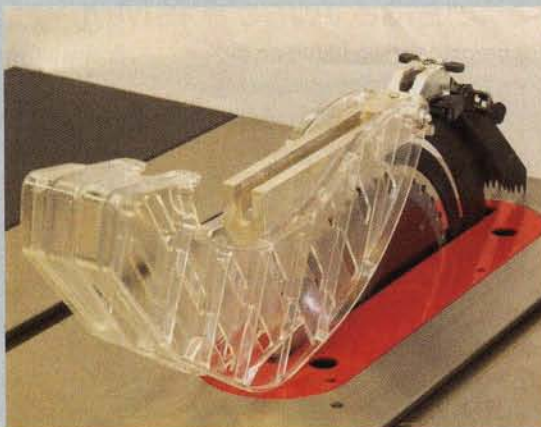
Revised standards require new designs

To develop standards for safe design and performance, power tool manufacturers work together with the U.S. Consumer Products Safety Commission (CPSC), Underwriters Laboratories, Inc. (UL) and other independent organizations such as the American National Standards Institute (ANSI) and the Canadian Standards Association (CSA). These standards—including specifications for tablesaws—are spelled out in UL 987, the Standard for Stationary and Fixed Electric Tools.

By developing and updating these standards, manufacturers avoid the issuance of government-mandated standards. Tools that comply with the standards are given UL (or CSA) approval, a safety endorsement that can be used for marketing. Currently, compliance with the standards is voluntary—that means UL approval is not required to sell tools in the U.S. market.

The seventh revision of UL 987 goes into effect on January 31, 2010, and it includes specifications for tablesaw blade guard systems that make old-style guards obsolete. In anticipation, most table-saw manufacturers have already introduced saws with new guard systems. So for a while, as retailers sell through stocks of saws with old-style guard systems, buyers will have additional choices. That means this is a great time to be in the market for a new tablesaw! 

6. This guard system features a dual-purpose riving knife and dual side barriers that cover both sides of the blade, whether it's positioned at 90° or tilted to any angle. The "V"-shaped side barriers drop to the table more quickly after a cut than straight barriers do.



7. You don't have to spend big bucks to get a new-style guarding system. Several manufacturers worked together to design the dual-purpose riving knife system, so variations of it appear in almost every saw category.



8. This new system looks familiar, because it's derived from a style that's been around for decades. These dual side barriers won't drop to the table quickly after a cut is completed, but they do always cover the back of the blade.



9. Some new guard systems facilitate dust collection. This guard/spreader assembly combines a one-piece "V" shaped guard with articulated side wings to enclose the blade.



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Oops!

Crazy Mistakes Woodworkers Make



Backside Out

AFTER DABBLING with woodworking for a couple of years, I finally got up the courage to build some kitchen cabinets, starting with an 8' long upper unit. I composed a detailed drawing, cut all the pieces, and glued the cabinet together. Everything went smoothly, and I was really enjoying myself.

Before stopping for the day, I cut the plywood back panel, glued it to the cabinet, and nailed it all around the perimeter and across the shelves. I left the shop feeling very proud of myself, and triumphantly invited my wife to go out to dinner.

Brimming with confidence, I returned to the shop the next morning, only to realize that I had attached the back panel to the front of the cabinet. I suspect I'll be eating crow for a while.

Dean O. Travis

Time Trials

I BUILT TWO SHAKER-STYLE wall clocks for a local dentist, to match the décor in her office. We agreed on white pine for the cases, with antique-style glass and authentic-style dials. Using quartz movements with long-drop pendulums—which I purchased online—was one concession to modernity she approved. I delivered the clocks on schedule, and just before leaving her office, I set the hands and tapped the pendulums, to start the movements.

The next morning, I received a call. "I really like the clocks," the dentist said, "but there's a problem." I waited for news that I was sure would ruin my day. "The hands are all moving backwards." I revisited the website, and discovered my mistake. The order number for the "backwards" movement was the same as the "regular" movement, except for one digit.

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