

9  
PRODUCT  
REVIEWS

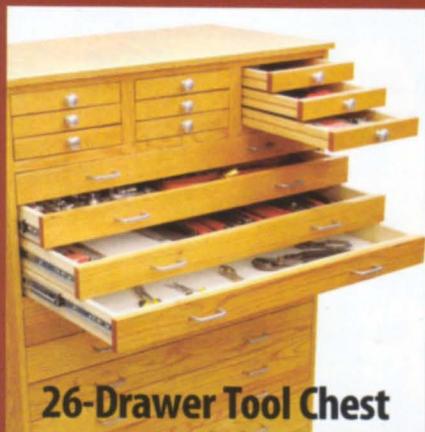
**DUST COLLECTORS: A NEW BREED**

# American Woodworker

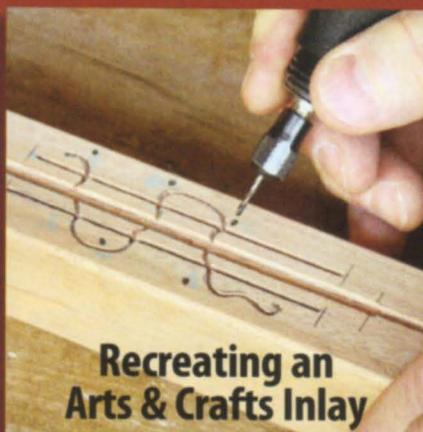
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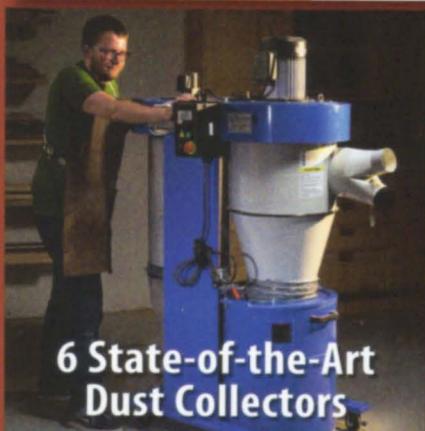
**26-Drawer Tool Chest**



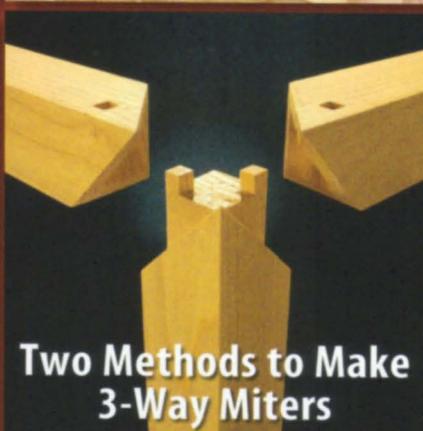
**Recreating an Arts & Crafts Inlay**



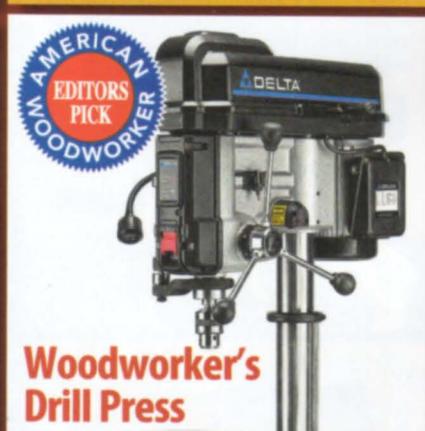
**3-D Puzzle Maker**



**6 State-of-the-Art Dust Collectors**



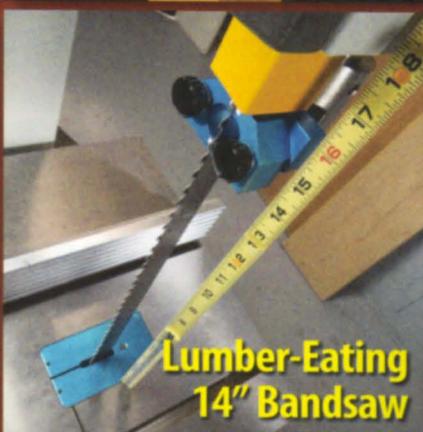
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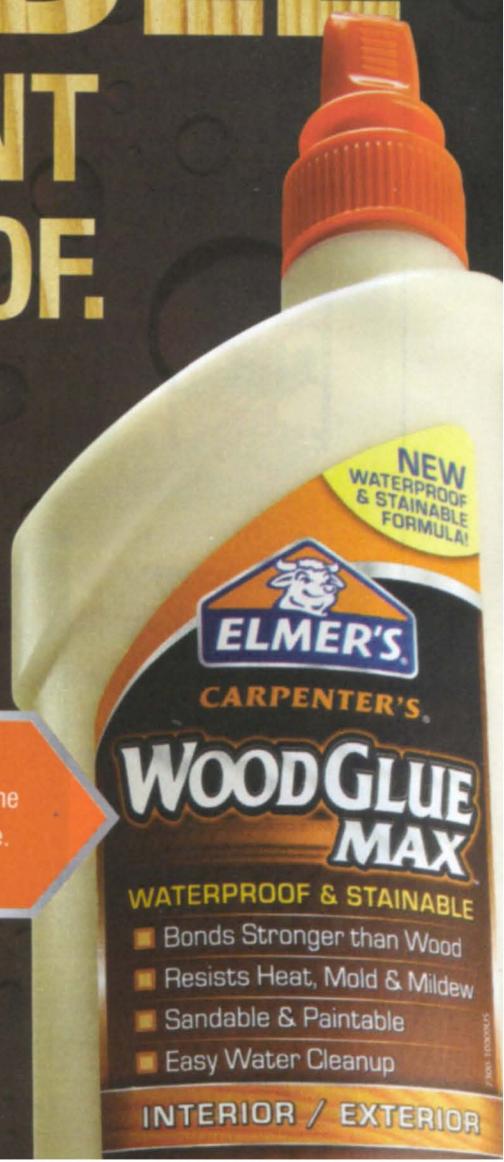
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INTERIOR / EXTERIOR

## DUST COLLECTORS: A NEW BREED

# American Woodworker

#151, December/January 2011

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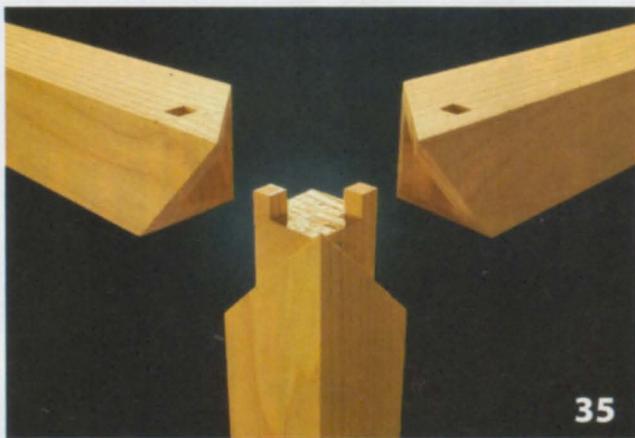
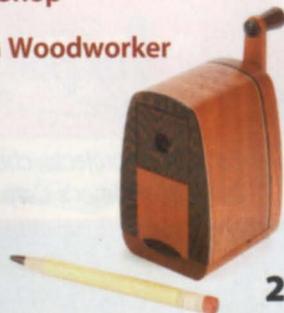
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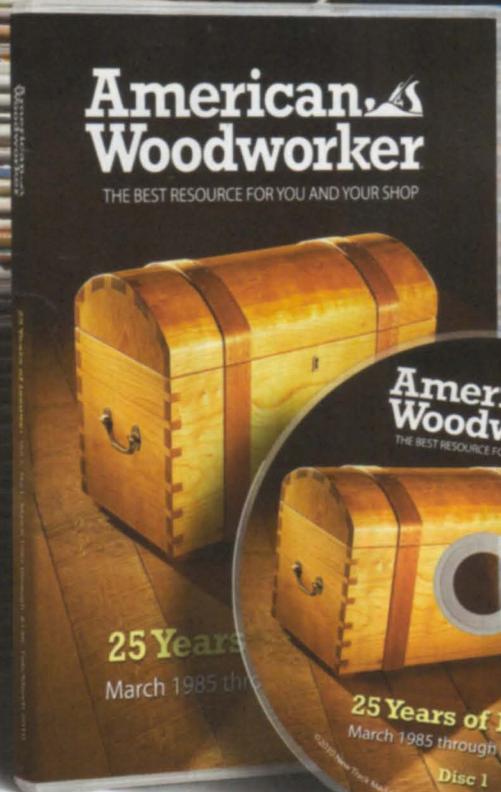
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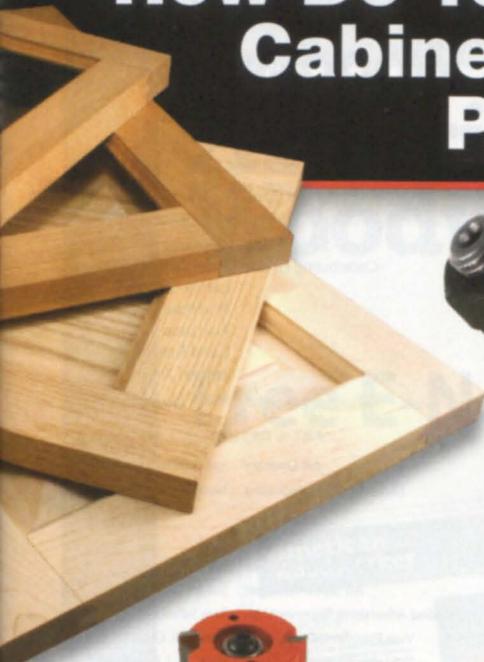
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#151, December/January 2011

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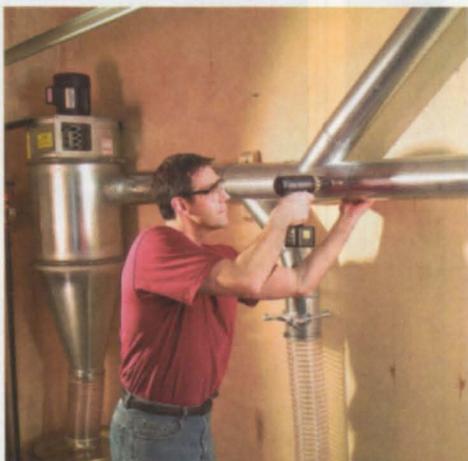
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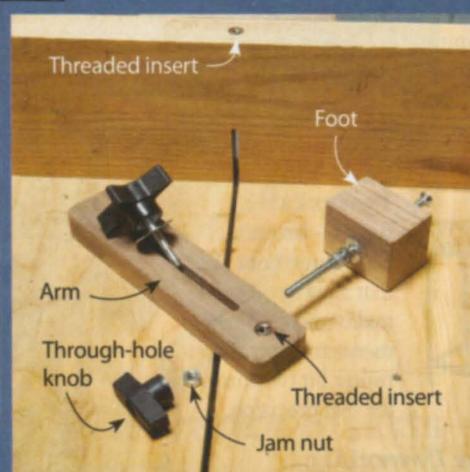
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## Terrific Tip!



## Crosscut Sled Upgrade

**ADDING A HOLD-DOWN** to my shop-made crosscut sled makes the sled easier and safer to use. My parts don't slip and my fingers are far from the blade because I don't have to hold the workpiece. The hold-down swivels so I can place it on either side of the blade.

To build the hold-down, you'll need three hardwood blocks (the arm, the foot and a support block), two 1/4-20 threaded inserts, two 1/4-20 jig knobs (one with a through hole and one with a 1" stud), a 1/4-20 flathead machine screw, two 1/4" washers, and three 1/4-20 nuts. Make the arm 3/4" x 2" x 8". The foot is 2" x 2" x 2-1/2" and the support block is 2" x 2" x 6". Glue the support block to the sled's fence, flush to the top.

Rout a 1/4" x 4" slot in the arm and install a threaded insert in one end of the arm. Install another threaded insert in the fence's top, in line with the blade slot. Drill a 1/4" hole through the

foot, countersink the bottom end of the hole and insert a 1/4-20 machine screw through the hole. Slip a washer onto the screw, then thread two nuts onto the screw all the way down to the foot. Tighten the nuts against each other, leaving the foot free to swivel.

Thread the machine screw through the arm's insert. Install a jam nut about 1/2" down from the end of the screw. Thread a through-hole jig knob onto the screw, then tighten the jam nut against the knob.

To use the hold-down, slide the arm over the piece to be cut. Tighten the arm, then tighten the foot.

*Will Nickles*

**SOURCE:** Rockler, [www.rockler.com](http://www.rockler.com), (800) 279-4441, 5-Star Jig Knob, 1" x 1/4-20 stud, #23838, \$2; 2" T-Knob, 1/4-20 through-hole, #71506, \$2; 1/4-20 Threaded Inserts, #28803, \$6.50/8 pack.



## Terrific Tips Win Terrific Tools!

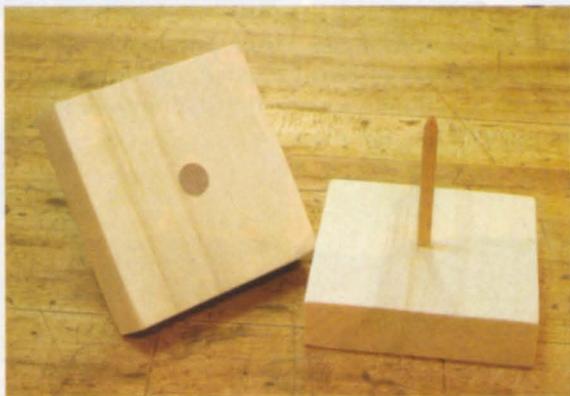
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## Golf Tee Finishing Stands

**WHEN I'M FINISHING A PROJECT,** I support it on small stands. They raise the project off the bench so I can get at its lower edges. I've seen stands like this before, but mine have a new twist: They're made from old golf tees. I built the stands from pieces of wood that are 3" square, and drilled and countersunk holes for the tees. For small projects, I stick three or four tees through the holes of a piece of 1/4" perf-board.

*Darrell Altizer*

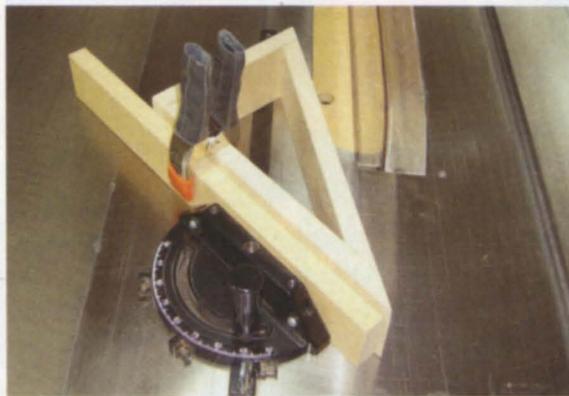


## All-Angle Miter Gauge

**ATTACHING A TRIANGULAR JIG** to your miter gauge enables you to safely cut shallow angles, or any angle beyond the normal range of the miter gauge.

The jig is just a 30-60-90 triangle made from 3/4" MDF, fastened with glue and countersunk screws. To cut the jig's two 30° angles, tilt your saw's blade and cut the parts flatwise. Screw a backer board to your miter gauge to provide clamping support for the jig. Be sure to clamp your workpiece to the jig.

*Serge Duclos*



## Planer Blade Sharpening Jig

**I RE-SHARPEN DISPOSABLE** planer blades a few times, using a shop-made jig, before tossing the blades away. I use a set of three diamond hones to sharpen the blade at an angle 5° higher than the factory bevel to minimize the amount of metal I have to remove.

The jig is a single block that's 1-1/2" thick, 2-1/2" wide and about 15" long. My blades have a 45° bevel, so I cut a 50° bevel on one side of the block. I also cut a rabbet on the top of the block for the blade to nest in. The blade barely protrudes over the block's bevel when it's nested in the rabbet. I drilled some holes in the top of the block so I can secure the blade with screws when honing.

The lower end of the stone rests on the jig when I hone. This maintains the same angle with each stroke. Typically, I make five passes each with coarse, fine and extra-fine diamond hones. I count the number of strokes used on each edge so the knives end up the same width.

After honing the bevels, I turn the blade over and remove the wire edges with the extra-fine hone.

*Tom Kingston*

**SOURCE:** Highland Woodworking, [www.highlandwoodworking.com](http://www.highlandwoodworking.com), (800) 241-6748, DMT Mini Stone Set, #448000, \$22.





## Pick-Up Stick

I LIKE TO WORK IN MY DRIVEWAY when the weather is nice. To avoid flat tires, I built a magnetic tool to pick up wayward screws and nails. It captures and releases these hazards quite easily.

The pick-up stick is very simple. It's composed of a 3/4" x 3' dowel, a plywood ring with a few rare-earth magnets epoxied to it, and a large plastic lid fastened to the end of the dowel. Drill a hole in the ring large enough to allow it to freely slide on the dowel.

To capture screws and nails, slide the ring down on top of the lid. To release them, slide the ring up the dowel.

*Dick Ayers*



## Hardware Storage Cabinet

PLASTIC BINS ARE EXCELLENT for storing hardware and other small items. After purchasing all the types and sizes of bins I needed, including some complete cabinets, I made this shelf unit to neatly house them in one place.

*A.J. Hamler*



## Shop Apron Magnets

SMALL TOOLS ARE EASIER TO REACH since I added two rare-earth magnets to my apron. I epoxied the 1/2" dia. magnets to two 1" square pieces of leather, punched 1/2" holes in the apron, and then epoxied the leather squares to the apron's back side.

*Mark Thiel*

## Keyless-Chuck Grip

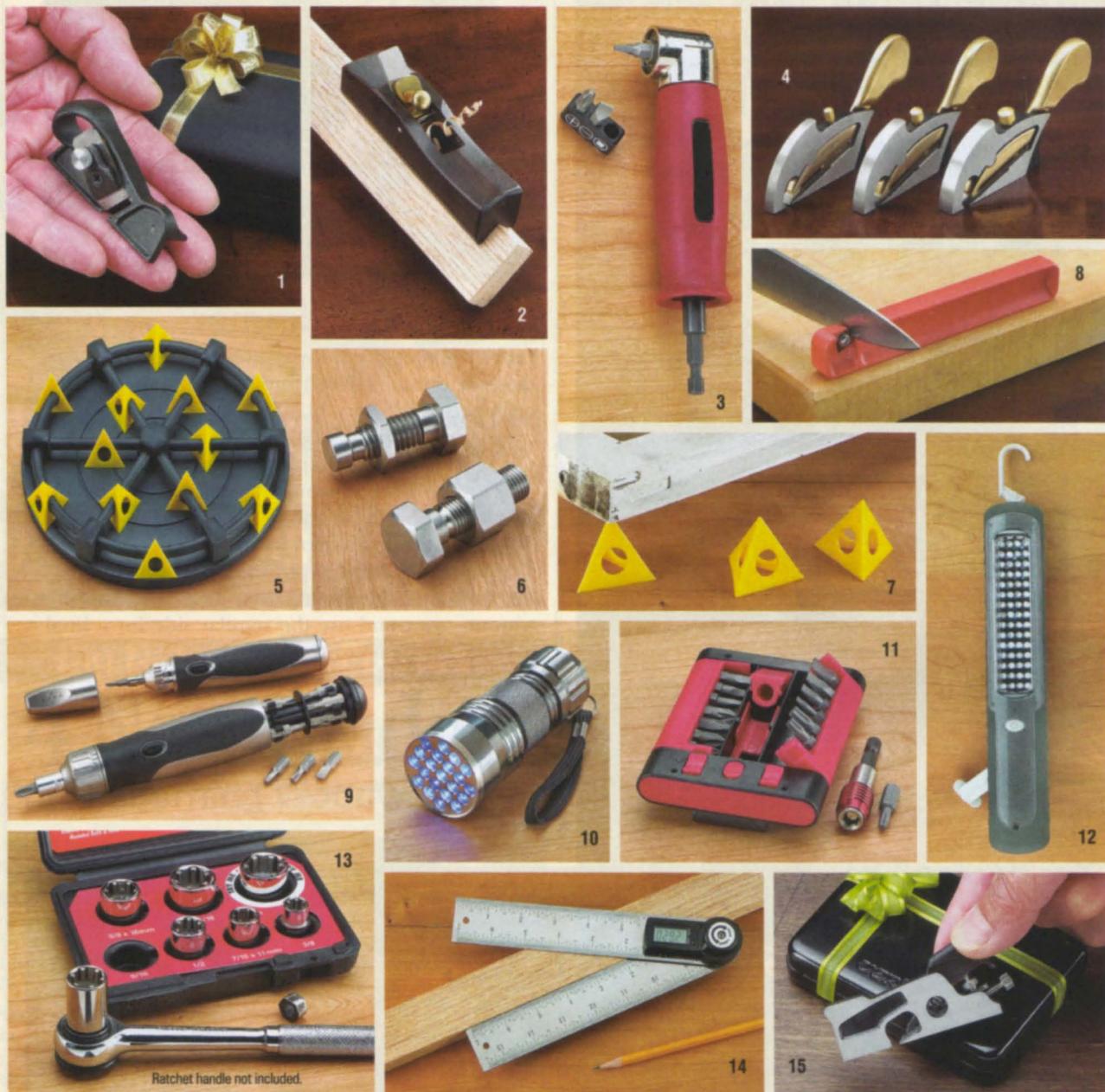
I BOUGHT A KEYLESS CHUCK for convenience, but I found it hard to tighten and loosen by hand. The knurling on the chuck wasn't very deep, so my hand just slipped. I often resorted to using a pair of channel-lock pliers, but that defeats the whole purpose of a keyless chuck, doesn't it?

While wandering the aisles of my local home center, I happened on a roll of traction tape and threw it in the cart. Back in my shop, I wrapped a piece of the tape around the chuck. Problem solved.

*Charles Mak*



# 15 High-Impact Gift Ideas for the Woodworker



1. Veritas® Miniature Edge Plane 05P81.01 \$34.50; 2. Mini Edge-Rounding Plane 07P15.07 \$21.50; 3. 90° Angle Driver 46J82.12 \$21.50; 4. Veritas® Set of 3 Imperial Detail Planes (1/4", 5/16", 3/8") 05P75.30 \$175.00; 5. The Finishing Turntable™ 88K58.75 \$39.50; 6. Pair of Trick Bolts 50K26.10 \$19.50; 7. Painter's Pyramid™, pkg. of 10 88K58.70 \$6.80; 8. Carbide Knife Sharpener 70M46.50 \$15.95; 9. Pair of Ratcheting Screwdrivers 17K01.99 \$19.95; 10. 21-LED Flashlight 67K74.47 \$7.50; 11. Universal Adapter & Bit Set 17K02.05 \$12.50; 12. Dynamo Worklight 99K10.50 \$14.50; 13. Grip-Tite™ Sockets, boxed set of 7 25K17.17 \$25.50; 14. Digital Protractor 88N99.00 \$19.90; 15. Veritas® Miniature Shoulder Plane 05P80.01 \$29.50.

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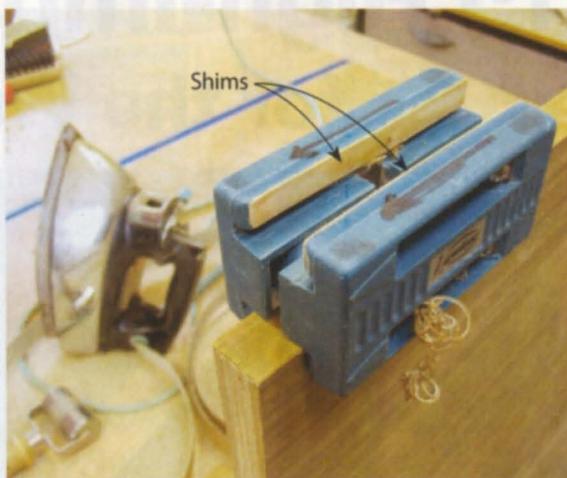
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## Dowel Depth Stop

**ACCIDENTALLY DRILLING** shelf pin holes all the way through a cabinet's side can really spoil a good day. To prevent the bit from going too deep, I use a stop made from a dowel.

The hole in the stop is the same diameter as the bit, so the stop won't slide off. I butt the stop up against the drill's chuck and adjust the bit's depth of cut by sliding the bit in or out of the dowel before tightening the chuck.

*Richard Helgeson*



## Improved Trimmer

**I LOVE THE TOOL** I use for trimming hot-melt edge tape—a double-edge trimmer—but I've made it even better. Its sharp blades can remove the tape's overhang in a single pass, but sometimes the tool is too aggressive. If the tape overhangs too much, or if its grain runs the wrong way, I get nasty tearout.

I fixed this problem by adding two shims to one side of the trimmer, limiting its depth of cut. The shims are simply pieces of edge tape. I use the shimmed side for the first pass, then flip the trimmer over and use the regular side for a final pass. If I notice tearout after the first pass, I reverse the trimmer's direction for the final pass.

*Miles Clay*

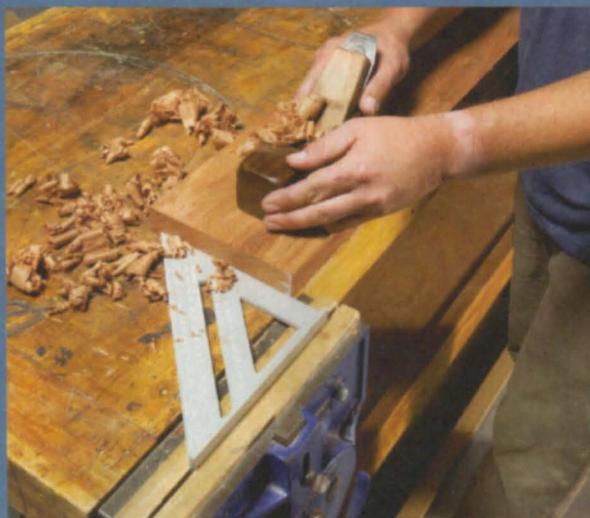
**SOURCE:** Rockler, [www.rockler.com](http://www.rockler.com), (800) 279-4441, Double-Edge Trimmer, #43208, \$20.

## Speed-Square Stop

**I ONCE USED A STOP BOARD**, screwed to my bench, to keep boards from sliding when planing. It was a pain—I'd have to remove it every time it got in the way of other jobs.

One day, as I was getting ready to screw down the stop board, I noticed my speed square lying right next to my vise. A lightbulb came on in my head. I clamped the square's base in the vise, making an instant stop—but only for boards thicker than the square!

*Chad Stanton*



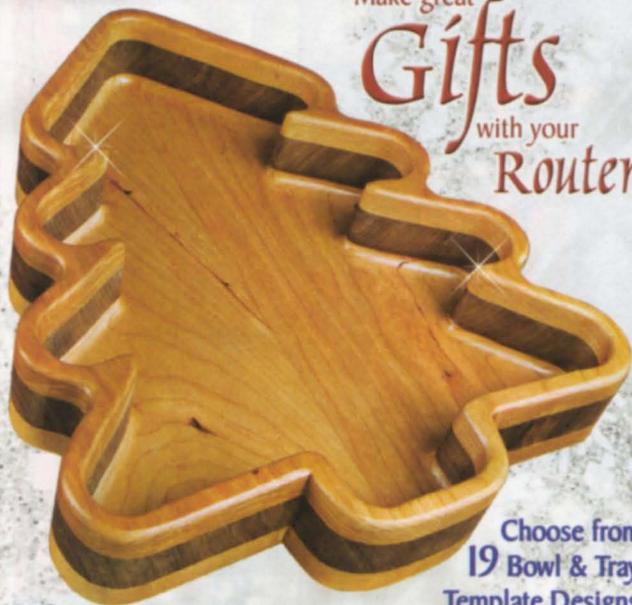


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## Big News From Forrest

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- **Woodworker II 48-Tooth Blade** for general-purpose applications. Features a 20° face hook, a 25° bevel, and sharp points for clean cross-grain slicing and quiet, smooth cutting.

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- **2-Piece & 4-Piece Finger Joint Sets** with reversible, interlocking 8" blades. Ideal for rabbets and grooves. Blades have 24 teeth and standard 5/8" bore. Reversible for 3/16" and 5/16" cuts or 1/4" and 3/8" cuts.

- **Thin Kerf Dados** for clean cutting of 3/16" to 1/4" grooves in thin plywood and man-made materials. Available in two-piece and three-piece sets for table or radial arm saws.



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# HOW SMART IS THE NEW SMART DUST COLLECTOR?

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



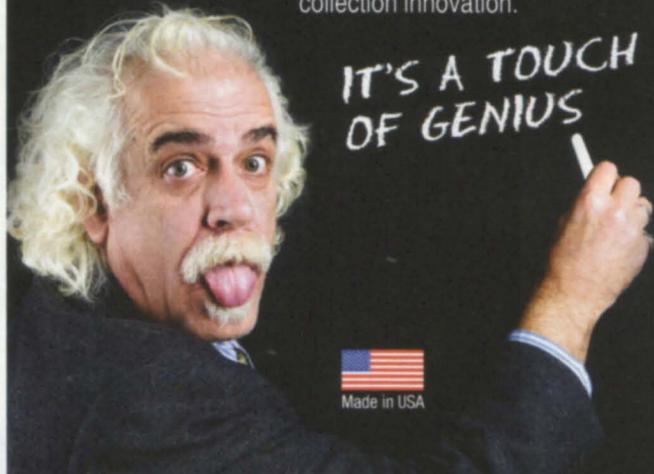
The SMART system has infinitely variable performance, automatically adjusting suction to maximize dust collection at each woodworking tool. It's a breakthrough in dust collection technology.

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

And you can stow the shop vacuum away, because the Smart Dust Collector does it all, regardless of size of ports or hoses. For large, 4 - 6" dust ports, it provides much more air volume and pressure, 2 to 3 times that of a standard dust collector. And for small diameter hoses or woodworking tools with 3" or smaller dust ports, you'll get high suction, similar to a shop vacuum. It's a best-of-both-worlds design that collects the most dust possible.

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

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## A Unisaw That Just Keeps On Going

**HAVE YOU HEARD OF THE NICKEL TEST?** Try standing a nickel on a machine while the machine is running. If the nickel remains upright after a minute, the machine passes the test. If the nickel falls over from excessive vibration, it doesn't pass. The test is simple, but brutal—many woodworking machines won't pass. This Unisaw, made in 1947, aces it.

I know the saw's exact age because I acquired the machine from my neighbor, Brad, who was its original owner. Brad remembers the day he bought it quite well. The saw cost \$300 (a princely sum at the time). He said that his wife gave him three \$100 bills for his birthday to pay for the saw, but she wouldn't reveal where she got the money! That kind of story sticks with a tool.

Brad used the saw in his machine shop quite a lot. He installed new belts in 1971 and a new 220V switch in 1979; otherwise, the Unisaw is completely original equipment. I disassembled it, washed it with grease



remover, used phosphoric acid to remove some light rust, painted all the parts, lubricated the inner workings and reassembled it. I took some liberties with red and black paint, though. My highlights are really all that is new!

*Gordon Alton*

## Truck-Building Toolbox

**BACK IN THE EARLY 1920s**, my grandfather, John Rudzki, built wooden truck bodies in Pittsburgh, PA. Customers would order the chassis for a refrigerated truck, a moving van or some other kind of specialty vehicle, and he would build the body behind the cab. The trucks are long gone, but I still have the homemade toolbox—and all the tools—that my grandfather used every day.

The box is still remarkably sturdy, and his tools are in perfect working order. Both box and tools are pretty banged up, though. Clearly, they were used hard—like the trucks he made. After World War II, my grandfather used these tools to fulfill a lifelong dream: building his own house in Pittsburgh's Polish Hill neighborhood.

I understand that intact sets of tools like these aren't very common. Most are broken up, raided for their valuable tools, and then scattered to the winds. I think they're an important record of the



history of our craft, though. If you come across one, I hope you can keep it together. This one is a snapshot of a brief time when 19th century hand tools were used to build 20th century machines, as well as the legacy of a great man: my grandfather.

*Mark Huminski*

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

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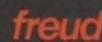
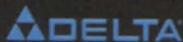


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## Woodworker's Drill Press

**DELTA'S NEW 18" DRILL PRESS** is specifically designed for woodworking. The difference is in the table: It's a big improvement over the tables designed for metalworking on most drill presses.

First off, Delta's table is quite large: 20" wide by 14" deep. That extra width is particularly useful for supporting long pieces, such as rails and legs. Second, the table has two T-slots, running front to back, for clamping a shop-made fence. (Delta's fence is quite nice—it has cam-action clamps—but it's an accessory.) Third, the table tilts forward 48° as well as 90° left or right, which enables you to drill, mortise and sand compound angles. Most drill press tables only tilt left or right. And fourth, the table includes a replaceable 3-1/4" square plate for preventing blow-out when drilling all the way through a board. The plate is easy to remove for spindle sanding.

Delta has also made changing speeds much easier. They've added an idler wheel, controlled by a large, convenient lever, for tensioning the belts. This is a welcome improvement over tensioning systems on conventional drill presses. This drill press has 16 speeds, from 170 rpm to 3000 rpm. There's a speed chart above the belts for four different kinds of bits.

If you're a penmaker, you'll appreciate this machine's 6" stroke. Most pen blanks are 5" to 5-1/2" long, and many drill presses can't drill all the way through them. No problem here.

The drill press is powered by a 3/4 hp motor and has a 5/8" chuck. It also has a very handy gooseneck lamp and crosshair lasers.



**SOURCE:** Delta, [www.deltaportercable.com](http://www.deltaportercable.com), (800) 223-7278, 18" Laser Drill Press, 18-900L, \$829; Biesemeyer 24" Drill Press Fence, 18-901, \$75.

## Small-Shop Pneumatics

**A COMPRESSOR IS A BONUS FOR ANY SHOP**, whether you're powering a nailer to quickly assemble a jig or using an air nozzle to blow out a dust collector's filter. But a compressor can be large and heavy—less than ideal for a small shop or a job site. If you're looking for a compact model, Porter-Cable has the answer.

Their redesigned pancake compressor is only about 15" across, 17" tall and weighs 29 lbs. Running at a high pressure (165 psi), this four-gallon unit holds more air than conventional, lower-pressure pancakes. It also has a fast recovery time (2.6 standard cubic feet per minute). Both factors mean that the motor will cycle on and off less frequently than on older models. The compressor is rated at 75.5 decibels, 30% quieter than the model it replaces. It comes with a heavy-duty 25 ft. polyurethane hose.

Porter-Cable has also issued a new 23-gauge pin nailer—a type of nailer we've found very useful in our shop. Its motor utilizes a dual-stack ring system, with the outer ring designed to minimize internal friction. You never need to oil it. The nailer features a dry-fire lockout; when the nailer stops firing, it's time to reload. The nailer takes both headless and small-headed nails from 1/2" to 1-3/8" long.

**SOURCE:** Porter-Cable, [www.deltaportercable.com](http://www.deltaportercable.com), (888) 848-5175, 165 PSI, Four-Gallon Compressor, C2004-WK, \$199; 23 Gauge 1-3/8" Pin Nailer, PIN138, \$149.

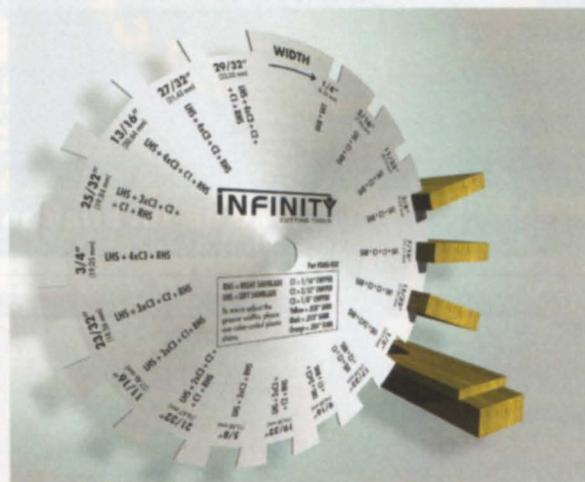


## No-Math Dado Setup

**IN-BETWEEN SIZE DADOES** are much easier to set up using this go/no-go gauge from Infinity. Usually you have to make a lot of trial-and-error cuts to create a tight groove for an in-between piece of wood, such as an undersized piece of plywood. The Infinity gauge simplifies all that guesswork. You just put your piece in the closest-fitting slot and read the label next to it. The gauge tells you exactly what combination of chipbreakers and shims you need, without any measuring.

The gauge is designed for Infinity dado sets, but it could easily be adapted for use with other ones. It's a great idea: Anything that quickly takes care of the details, like setting up a dado, allows you to spend more time focusing on the big picture.

**SOURCE:** Infinity Cutting Tools, [www.infinitytools.com](http://www.infinitytools.com), (877) 872-2487, Dado Measuring Gauge, DMG-800, \$29.99.



JASON ZENTNER

## Handy Layout Square

**SQUARING A LINE AROUND AN EDGE** is no easy task. It takes a bright light, good eyes and a steady hand—or a clever device such as the Combination 3D Square from M-Powered Tools. It has a large saddle square built right in.

The 3D Square also has a short, folding bevel gauge and an attachment for drawing lines parallel to an edge. The square's main blade is 9" long and is set at precisely 90° (within 1/100° over 9", according to M-Power). You can reset the blade if you happen to drop the square and knock it out of alignment.

**SOURCE:** M.Power Tools, [www.m-powertools.com](http://www.m-powertools.com), (613) 525-3328, 3D Combination Square, \$50.

## Two-Handed Sander

**EVER WISH YOU HAD AN EXTRA HANDLE** on your sander? Not for extra pressure—that would create unwanted swirl marks. But another handle would give you extra control and relieve the tedium of sanding with only one hand. If you're on board, take a look at Makita's new 5" random orbit sander: It has a detachable handle that can rotate to any position.

This variable-speed sander features a 3-amp motor which is significantly more powerful than the 2-amp motor on Makita's previous model. The sander's 1/8" orbit is a good compromise between fast material removal and minimal swirl marks. (You'd want a larger orbit to remove stock quickly, or a smaller orbit to minimize the size of any swirl marks you might leave behind.) The sander comes with a dust bag, but you'll probably have to rig up an adapter to connect its 13/16" o.d. port to a vacuum hose.

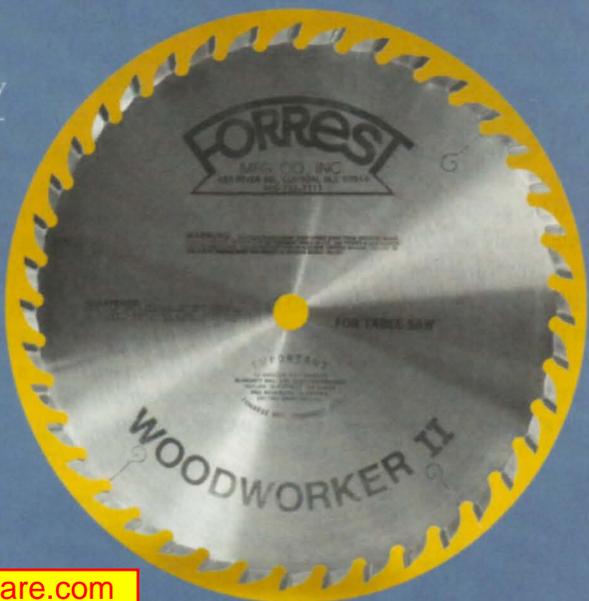
**SOURCE:** Makita, [www.makita.com](http://www.makita.com), (800) 462-5482, 5" Random Orbit Sander, BO5041K, \$100.



## Blade for Small Box Joints

IF YOU'RE A BOX-MAKER, you've probably considered many ways to join a box's corners. How about 1/8" or 1/10"-wide finger joints? They're very strong and have a sleek appearance—you've probably seen them on old recipe-card boxes. However, you can't make nice-looking finger joints this small with a general-purpose tablesaw blade, because it won't cut a flat-bottomed groove. Forrest has a solution.

They've just introduced two Square-Top versions of the well-known Woodworker II sawblades. Forrest says that they cut a true 90° groove, without leaving score marks. Beyond finger joints, we can also see a use for these blades in cutting rabbets, raised panels, tenons and fillets for moldings.



**SOURCE:** Forrest Manufacturing, [www.forrestblades.com](http://www.forrestblades.com),

(800) 733-7111, 1/8" Kerf Square-Top Woodworker II, #Ww10401100, \$138; 3/32" Kerf Square-Top Woodworker II, #Ww10401100, \$138. [WhereWeShare.com](http://WhereWeShare.com)

## New Era Knife Sharpener

"CAN YOU SHARPEN THIS FOR ME?" You get the picture—your spouse impatiently holds up a dull kitchen knife. Dinner hangs in the balance. Surely, with all that equipment in your shop, you can sharpen one measly knife. But it's not that easy, is it? Well, it would be with the Knife & Tool Sharpener from Work Sharp Tools.

The KTS is basically a mini-strip sander with a couple of interchangeable angle jigs. It's very easy to use—and fast. You just install a coarse, medium or fine sanding belt, snap on the 40° or 50° jig, turn on the machine, and draw the knife through one of the jig's notches, alternating left and right sides of the blade. The coarse belt (80 grit) removes nicks pretty fast; the medium belt (220 grit) makes a knife "tomato sharp"—sharp enough for most uses; the fine belt (6000 grit) hones an edge as sharp as a razor. That's no exaggeration. We were able to slit a piece of notebook paper with all of our freshly sharpened knives, and that's a tough test to pass.

The KTS can also do much more. It sharpens pocket knives and hunting knives. It can handle scissors, using a 60° notch. It can renew serrated knives (if they are beveled on one side and flat on the other side). And it can put a new edge on lawn mower blades, pruners, shears and other bypass cutting tools, using the tool freehand, without a jig.

What about woodworking tools? We were so pleased with the job the KTS did on our kitchen knives that we couldn't resist experimenting on some shop tools. It did a



great job on a chip carving knife, a marking knife, a Sloyd knife and a utility knife. The KTS isn't designed for chisels and plane blades, though. The KTS can make them sharp, but it's very hard to maintain a straight edge. However, you can freehand a curved blade, like the iron for a scrub plane, by removing the guide jig.

The manufacturer says that you can expect to sharpen up to 50 knives with a set of 3 belts. By that time, you probably won't get asked anymore—you'll volunteer. Using a machine that works this well is a real pleasure.

**SOURCE:** Work Sharp Tools, [www.worksharptools.com](http://www.worksharptools.com),

(800) 597-6170, Work Sharp Knife & Tool Sharpener, \$69.95; Knife & Tool Sharpener Replacement Belt Kit (two belts of each grit), \$9.95.

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### Premium Blade Set

**UPGRADING A BLADE AND CHIPBREAKER** can turn a pretty good plane into a dream tool. If you've been thinking about buying a premium plane, here's an alternative plan: Get an old Stanley, tune it up, and replace its blade and chipbreaker with this new set from IBC/Pinnacle. You'll be amazed at what an old tool can do.

We sure were. When we put the IBC set in an old smooth plane, we noticed a big improvement in the tool's performance. The plane felt much more solid, and we were able to make tissue-thin shavings with ease.

A standard blade and chipbreaker can perform quite well in a tuned-up old plane, and may be all you need. But when the going gets tough—when you're planing figured maple, for example—a standard blade may chatter or tear out the grain. For this kind of work, you need a thick blade that will retain its edge plus a stiff chipbreaker, equivalent to the irons in a premium plane.

The IBC/Pinnacle blade and chip breaker are the thickest available for Stanley and other Bailey-style planes. Extra thickness helps fight chatter, but up until now you couldn't use a blade thicker than .100" in one of those planes, because the plane's depth-of-cut adjusting lever couldn't accommodate it. IBC has teamed with plane expert Rob Cosman to come up with an elegant modification of the chipbreaker that allows you to use a very thick blade.

The IBC blade is .140" thick, over 85% thicker than a vintage Stanley blade. It's made from state-of-the-art A-2 tool steel, hardened to 60-62 HRC and cryogenically treated. It will hold an edge much longer than that vintage blade. The IBC chipbreaker is made from O-1 tool steel



JASON ZENTNER

and is .125" thick, for added stiffness.

There is one catch to using the IBC blade: You'll probably have to widen the plane's mouth, using a file, to accommodate the blade's thickness. That's not hard, though; instructions are included with the blade set. The back of the blade is very flat, but will probably require additional lapping and polishing. But if you create a back bevel, you'll be ready to go right away.

Matched sets of blades and chipbreakers are available in 1-3/4", 2" and 2-3/8" widths for Stanley planes #3 through #7. These sets will also fit other vintage professional-grade planes, such as Millers Falls, Keen Kutter and Stanley Bedrock.

**SOURCE:** Woodcraft Supply, [www.woodcraft.com](http://www.woodcraft.com), (800) 225-1153, Pinnacle/IBC Matched Chip Breaker and Blade Set, 1-3/4" wide, #150812, \$99.99; 2" wide, #150813, \$99.99; 2-3/8" wide, #150814, \$104.99.

### Box Joint Cauls

**GLUING UP BOX JOINTS** isn't an easy task. Clamping across the middle of a box may seem like the best method, but this can cause the sides to bow, leaving gaps between the fingers. Rockler's solution is to use stepped cauls that apply pressure directly to the fingers on each side of a corner. The result is a tight, gap-free joint.

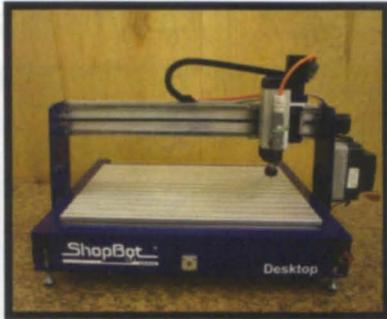
The cauls come in packs of four and are available in finger widths of 1/4", 3/8" and 1/2". They're a little over 6" long, depending on the finger size. Band clamps are necessary, but not included.

**SOURCE:** Rockler, [www.rockler.com](http://www.rockler.com), (800) 279-4441, 1/4" Box Joint Cauls, #33792, \$9.99; 3/8" Box Joint Cauls, #32993, \$9.99; 1/2" Box Joint Cauls, #34974, \$9.99; Web Band Clamp, #60545, \$11.79.



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# Perry McDaniel

A puzzling sort of woodworker.

by Spike Carlsen

IF YOU THINK IT TAKES PRECISION to turn out 16 identical legs for a set of dining room chairs, try stepping into Perry McDaniel's shoes for a day. And if you feel assembling the parts for those chairs is puzzling, try stepping into Perry's shop. Because standing there you'd find not dozens, but hundreds of pieces of wood. And you'd find assembling those pieces to be a puzzling endeavor in the truest sense. Because Perry's craft and passion revolves around just that—puzzles. Big puzzles and little puzzles. Puzzles of purpleheart and walnut. Puzzles in the shape of pencil sharpeners, salt shakers and slices of frosted cake. Puzzles

that can be solved with the shake of a wrist and puzzles that can take hours, days or forever to solve. Welcome to the eccentric world of puzzle-making.

## Becoming Rube Goldberg

Perry's 15 years as a land title researcher for an abstract company ("as boring as a job can get") may have steeled him for the detailed work of puzzle making, but it did little to spark his interest in woodworking. It was the simple act of cutting miters for some picture frames that got him hooked. Picture frames led to boxes, boxes led to craft shows and craft shows led him to Robert and Norman

Sandfield, two renowned puzzle designers who asked him if he could turn their graphite doodles into real wood puzzles.

The first puzzle he made for them was a lidded box with dovetails on four sides, a puzzle concept dating back to the 1800s that seems impossible to open—until you slide the lid diagonally. Later, Perry added a magnet and pin mechanism to make the solution even more of a head-scratcher, and his boxes just kept getting more and more puzzling.

Initially Perry built only boxes designed by the Sandfields (usually in limited-edition runs of 100) that the brothers would swap with

other collectors and designers at the invitation-only International Puzzle Party (IPP) exchange. Eventually Perry was formally invited to join the "Party," but only after going through the requisite rite of passage of attending as an assistant to learn puzzle-swapping etiquette.

Gradually, Perry began designing puzzle boxes of his own. To date, he has made more than 5,000 of them and continues to crank out hundreds more each year. Though he does an occasional one-off, most of his shop time and energy revolve around producing limited-edition puzzles for the IPP, now in its 30th year. The IPP is an international affair with events held in such far-flung locales as England, Belgium and Japan. Perry is still buzzing after his recent return from this year's event in Japan. Many of his creations are swapped, but others have sold for between \$25 and \$500.

## A puzzling craft

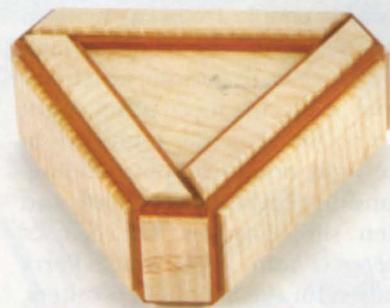
How does one come up with the idea for, say, a puzzle in the shape of a pencil sharpener that requires a particular twist of the crank and insertion of a handcrafted pencil to open? (Photo, top). "Give me a long plane trip with nothing to do and a pencil, and the ideas just start flowing," Perry explains. As a collector, other boxes and mechanisms inspire him, but more often he designs puzzles around the tools and skills he has.

With puzzle parts that have tolerances measured in 1/1000" and dozens of parts that need to interact flawlessly, exactness is critical. Perry honed his penchant for precision during his 22-year tenure as operations manager and technical go-to guy at Incra Precision Tools. He possesses the unlikely combination of traits a prolific puzzle maker must have: Inventiveness coupled with the ability to repeat a task hundreds of times without losing focus. "It's tedious work," Perry says. "But with the right equipment and the



**Solving *Sharpen Your Wits*** requires going through the motions of sharpening a pencil.

***Sixties I*** is composed of 60° angles.



***Sixties II*** has 10 decorative panels that each contain six "T"s.

right mind set, there's nothing more satisfying."

While Perry uses domestic woods such as walnut, cherry and oak for some parts, he favors exotics such as padauk, bubinga, purpleheart and curly koa for their stability and beauty. He prefers film-forming finishes like shellac that dry quickly. Oil finishes are likely to seep into the joints and gum up the mechanisms.

Part of creating a great puzzle is coming up with a name that's as enigmatic as the puzzle. Perry's *Sixties I* puzzle (Photo, middle)

made for Norman Sandfield's 60th birthday, contains loads of 60° angles as well as six packets of tea ("six teas"). *Nickel Rebate* contains five stacked pennies. *Happy Hour*, a puzzle Perry crafted for the Sandfields, featured an unlocking sequence that employed the numbers 2, 4 and 1 ("two for one").

## Types of puzzles

Puzzle makers are both a cooperative and competitive lot. They love exchanging ideas, but love perplexing one another even more. "One box at a recent puzzle

## A Great American Woodworker

continued

party required 3,546 moves to open,” Perry recalls. “The most legendary puzzle makers hail from Japan. They’ve been at it the longest, but others from around the world are catching up fast.”

Perry uses a wide variety of locking mechanisms: magnetic pin locks, curved dovetails, centrifugal force and visual deception. *Sixties II* requires 24 moves to open (Photo, page 27). Sometimes he includes components that rattle loudly to prevent people from engaging in “puzzle speak,” the act of listening to a puzzle to determine which way a pin or locking mechanism might move. One puzzle requires—in the right order—tapping, sliding, transferring, lifting, spinning and then sliding again. On *Salt & Pepper* (Photo, top), which Perry crafted for the Sandfield brothers, the reassembly instructions simply start with the ominous words “GOOD LUCK!”

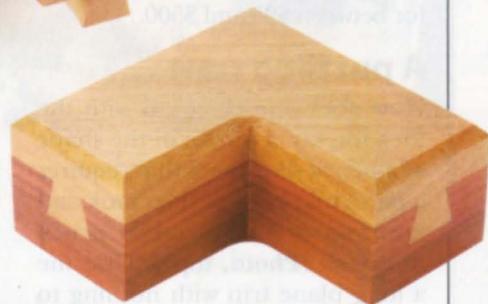
Perry loves a good dovetail. “For many people a dovetail is the pinnacle of woodworking. It’s something they aspire to,” he explains. Perry is so enamored with the joint that for several years his boxes were themed around the “impossible dovetail” (Photo, middle). But for the past several years his theme has turned to baked goods—cakes, pies, you name it. His limited-edition *Petit Four* puzzles come boxed as delectable confections, each with a unique opening sequence. Their names, like *Pineapple Down Side Over Cake*—often contain clues to solving the puzzle. At a recent puzzle exchange he could be found wearing a chef’s jacket and handing out his culinary puzzles with a serving tong (Photo, bottom). Nearby, his “Puzzled Guy Bakery” sign touted, “Enjoy our high-fiber healthy alternative desserts to increase concentration and improve circulation.”



**Salt & Pepper** requires interaction between the two shakers to open.



**Elbow Dovetail** appears to be an impossible construction ... obviously, it's not!



**Puzzles resembling pastries** are one of Perry's specialties. At shows he often peddles them as chef of the “Puzzled Guy Bakery.”



## Tools of Mass Production

When one person gears up to make 400 puzzle boxes, each with 20 precision-cut wood parts, you might suspect a CNC router tucked away in a back room. But you won't find one in Perry's shop. He does the lion's share of the work with standard woodworking tools. He relies heavily on three router tables, each set up for a specific operation to mass-produce parts without switching back and forth. His other must-have tools are a pair of tablesaws—one set up for ripping, the other for crosscutting.

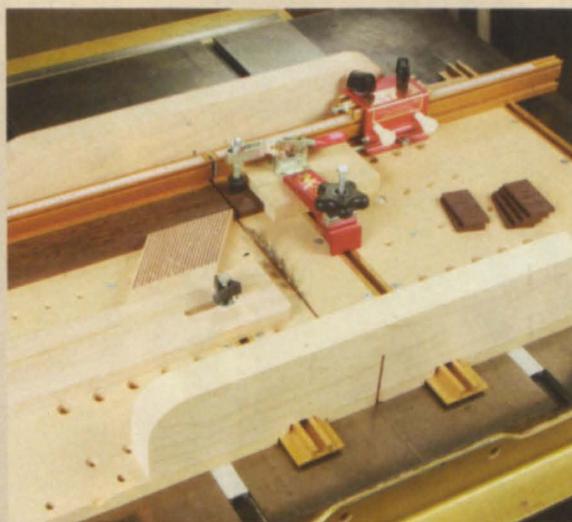
His sliding crosscut sled (**Photo, top**) is a work of art itself. It includes a precision stop block, an adjustable toggle clamp for holding the workpiece, and an adjustable featherboard for holding the working stock. It has Inkra Track fences adjustable in 1/32" increments and can accurately and safely cut pieces as small as 1/2".

For assembly Perry relies on a clamping station made with off-the-shelf clamps (**Photo, middle**). Since a clamp can outweigh the clamp-ee by 500 to one, Perry brings the piece to the clamp rather than vice versa. He applies glue to the pieces with an artist's brush, squares them up on a small L-shaped jig and then clamps the box while applying finger pressure to the top. He rotates four clamps in and out of the clamping area to keep the assembly line moving.

The best clamps he's found for sanding are his fingers, sheathed in nitrile-coated gloves (**Photo, bottom**). "When you're working with pieces that are 1/2" x 1/2", fingers are really the only clamps that work," he muses. He crafts small sanding blocks from scraps of wood and PSA-backed 180 and 220 grit sandpaper.

He even has a method for cutting flowers for the tops of 400 *Petit Four* puzzle boxes without going mad: He tapes together four thin layers of wood, then gang-cuts them into flowers on his scroll saw.

Of course, with any system of mass production comes the possibility of mass mistakes. "One time I was making a puzzle with a three-dovetail sandwich and made 200 parts with the female rather than male part of the joint," Perry chuckles. "I've still got those parts. Someday I'll make lemonade out of those lemons."



See the 2010 International Puzzle Party Design Competition entries at [AmericanWoodworker.com/WebExtras](http://AmericanWoodworker.com/WebExtras)

**Spike Carlsen** is the author of *A Splintered History of Wood: Belt Sander Races, Blind Woodworkers and Baseball Bats*, which is available at [www.AmericanWoodworker.com/awbookstore](http://www.AmericanWoodworker.com/awbookstore)

# A Gutsy 14" Bandsaw

WhereWeShare.com

by Tom Caspar

**RESAWING TAKES GUTS.** It takes courage to saw a big, beautiful board in half—the guts to just go for it. Your bandsaw needs guts, too—the raw muscle to power through a huge cut.

Although you may be up for the challenge, your saw may not. When we last tested 14" bandsaws, many felt underpowered when we resawed a very wide board. Since then, we've been searching for a 14" saw that would compare with the performance of a 16" or 18" saw, which can usually resaw wide boards with ease. Laguna Tools has been on a similar mission. They've developed a new 14" saw, the LT14 3000, that is truly built for resawing.

Of course, we use bandsaws for much more than resawing, so it's not the only criterion for choosing a saw. You may not need a lot of power—ever; but if you're interested in a machine that can easily resaw wide panels as well as make smaller scrolling cuts, and is not as large or expensive as many 16" and 18" saws, read on.

## Capacity and power

The LT14 3000 has a resawing capacity of 14" (Photo 1). The maximum capacity of a standard 14" cast iron saw is 6"; when you add a riser block, it's 12". If you're fortunate enough to find a 12" to 14" wide board to cut open, the Laguna can handle it; a saw with a riser block can't.

Any saw that's going to be used to rip boards this wide should have the power to match. Most 14" saws run on 120 volts. The largest motors on these saws typically





**1** This machine's resaw capacity is a huge 14". That's 2" taller than the capacity of a 14" bandsaw with a riser block.



**2** Extra power is essential for resawing very wide boards. This saw has a rugged 3 hp Leeson motor; most other 14" saws have 1-3/4 hp motors, at best.



**3** Wide blades are best for resawing. This machine will accept a 1" blade; most 14" bandsaws only take a 3/4" blade.



**4** Widely spaced ceramic guides keep a blade running true and cool, without twisting or bending.

develop 1-3/4 hp, which is the most power you can wring from a 15 amp circuit (the typical wiring in a small shop). In our experience, a 1-3/4 hp motor is adequate for resawing a 12" wide board, but you must proceed slowly and carefully to avoid bogging down the motor, which can lead to a wandering cut. More power really helps improve performance, and the LT14 3000 has it (**Photo 2**). The saw comes in two versions: the STD (Standard), which has a 2hp 240V motor, and the SUV (Souped Up Version), which has a 3hp 240V motor. (We tested the SUV, and recommend its extra power.) Both motors are made by Leeson, a manufacturer with a long and solid track record.

### Blades and guides

Successfully resawing wide boards also requires wide blades and large blade guides. Again, the LT14 3000 saws stand out against the field (**Photo 3**). These saws can handle blades up to 1" wide, while most other 14" saws take 3/4" blades, at most.

The wider the blade, the greater its beam strength (beam strength is a blade's resistance to

bending when pushed straight back). Wide blades are more likely than narrow blades to produce a straight, perfectly vertical cut, and are preferred for resawing. The ability to make a straight cut is particularly important when you need a smooth, flat surface to maximize yield, or when you're resawing a board into thin pieces of veneer.

An important note about 3/4" and 1" blades for 14" saws: Don't get one that's .032" thick. Although it will work for a time, it may break prematurely from metal fatigue (.032" blades are OK for 16" and larger wheels, however). For 14" wheels, we recommend special 3/4" or 1" blades that are .025" thick. These blades are available from Laguna (see Source, page xx).

Laguna's unique blade guide system helps keep the blade from twisting or bending during a heavy cut. It's available on all of their saws, including the LT14 3000. Both the upper and lower guides are composed of pairs of ceramic blocks (**Photo 4**). These blocks are deep enough to completely support a 1" blade front to back,

which prevents the blade from twisting. The blocks are also widely spaced apart, which prevents the blade from bending. Few—if any—14" saws have guides that offer this much support. Ball-bearing guides, which are becoming more common on bandsaws, may offer deep support from front to back, but don't offer wide support top to bottom, as do the Laguna guides.

The ceramic blocks in the Laguna guides are extremely hard and durable. They never need to be trued because they don't wear down. However, you must be careful in adjusting them because the blocks could damage a blade's teeth. Laguna recommends that you install a set of optional guides when using blades less than 1/4" wide. These guides use Cool Blocks, a phenolic material that won't damage a blade's teeth.

Adjusting the Laguna guides requires using two hex wrenches and takes some patience. This adjustment system isn't as user-friendly as the tool-free systems on some other 14" saws, but the Laguna guides do offer more support, which, for resawing, is more important than convenience.



5

**Robust construction** leads to good performance. The guidepost hardly budes when you simulate the pressure of resawing by pushing on it.



6

**A wide table** won't budge when you push down, simulating the weight of a heavy timber. The table's tilt is controlled by a stout rack-and-pinion mechanism.



7

**The fence can be angled** for drift, which ensures a straight cut. Many fences on other bandsaws don't have this important feature.



8

**Stepping on the saw's footbrake** turns off the power and quickly slows down the blade.

## Robust construction

A good bandsaw needs heavy-duty construction to withstand the extra tension required by a wide blade. The sliding mechanism that allows the upper wheel to travel up and down, for example, must resist bending and twisting when the blade is tensioned. The LT14 3000 mechanism, similar to that of larger Laguna bandsaws, is quite robust.

Resawing also puts a lot of strain on the guidepost, the vertical arm that carries the upper blade guides. The Laguna guidepost rides in a heavy-duty carriage in the upper wheel housing, and this carriage resists backward and side-to-side pressure quite well (Photo 5).

## Wheels

The LT14 3000 wheels are massive pieces of cast iron. Heavy wheels are desirable on a bandsaw—they dampen vibration and provide extra momentum for maintaining speed while cutting through a knot.

The tires on the wheels are crowned—they're higher in the center than on the edges. This design is common on 14" saws (larger saws generally have flat wheels), because it helps keep narrow

blades centered on the wheel.

## Table and fence

A machine designed for resawing needs a sturdy table to handle the weight of a heavy board. Laguna's table doesn't budge when you push down on one corner, as a test (Photo 6). Many other tables on 14" saws don't pass this test.

The table is a generous 15" square, has a 90° stop, and can tilt 45° leaning away from the column and 15° leaning towards the column (just what you need for cutting dovetails, for instance—at least 10° tilt either way). The table stands only 35-1/2" from the floor, however. That's a comfortable height for pushing a big, heavy board, but a bit low, we think, for scrolling cuts. The table on most 14" bandsaws is about 44" high. If you want the Laguna's table to be higher, you could place the machine on a box.

The fence on this saw is as sturdy as the table. It's unlikely to shift if you accidentally bang into it while positioning a large board for resawing, nor will it budge if you bear hard against it while pushing a board through the saw. It can

also be angled for drift (Photo 7), a feature you may need when using 1/2" or smaller blades. Stock fences on many 14" saws cannot be angled.

Other features of the saw are worth mentioning, too: a footbrake, available only on the SUV (Photo 8); a window for tracking the blade; a 4" dustport; and a quick-acting blade release mechanism, which enables you to rapidly take the tension off the blade when the machine is not in use, and speeds up the process of changing blades.

## The bottom line

Some tools break away from the pack when they're pushed to the limits. For a bandsaw, the extreme test is resawing at maximum capacity. This machine, unlike many others, passes with flying colors.

### SOURCES

Laguna Tools, [www.lagunatools.com](http://www.lagunatools.com), (800) 234-1976, LT14 3000, \$995; LT14 SUV, \$1,495.



For reviews of bandsaws, go to [AmericanWoodworker.com/WebExtras](http://AmericanWoodworker.com/WebExtras)

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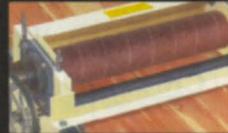
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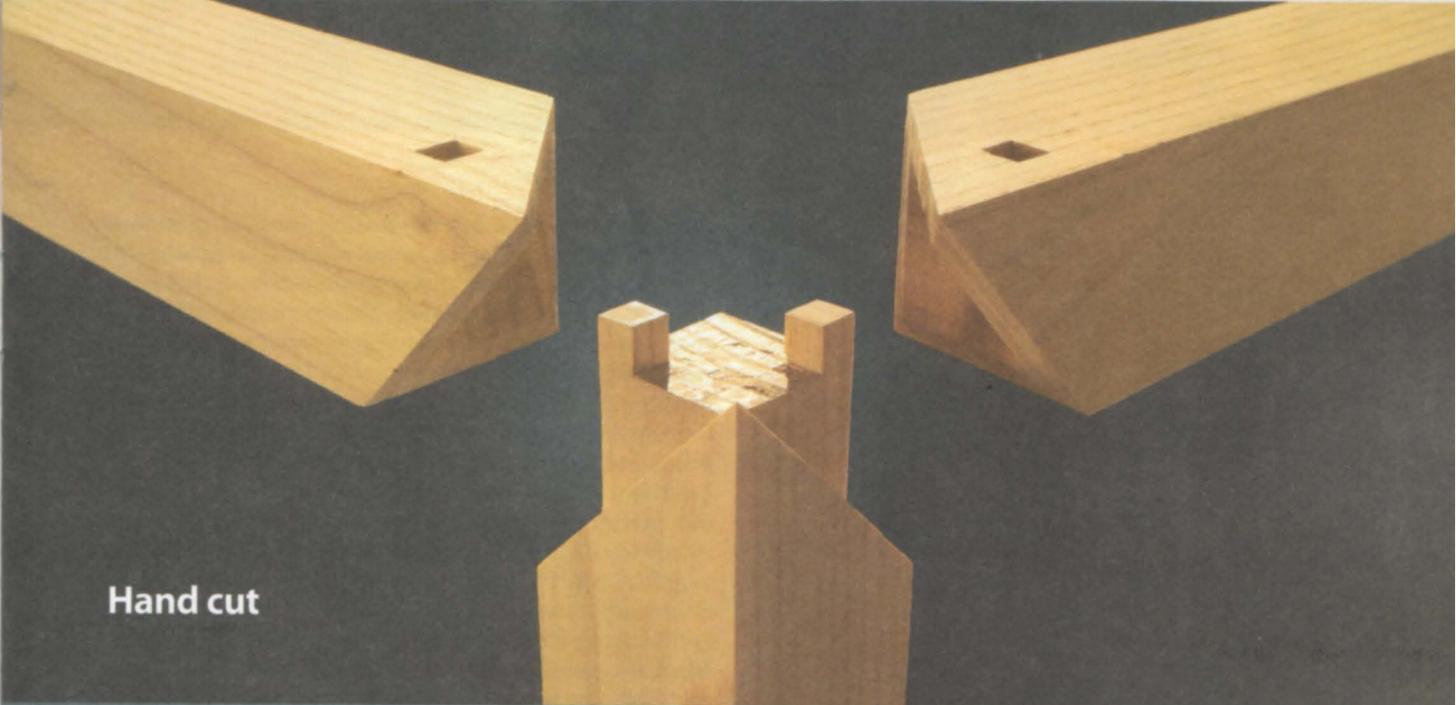
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Hand cut

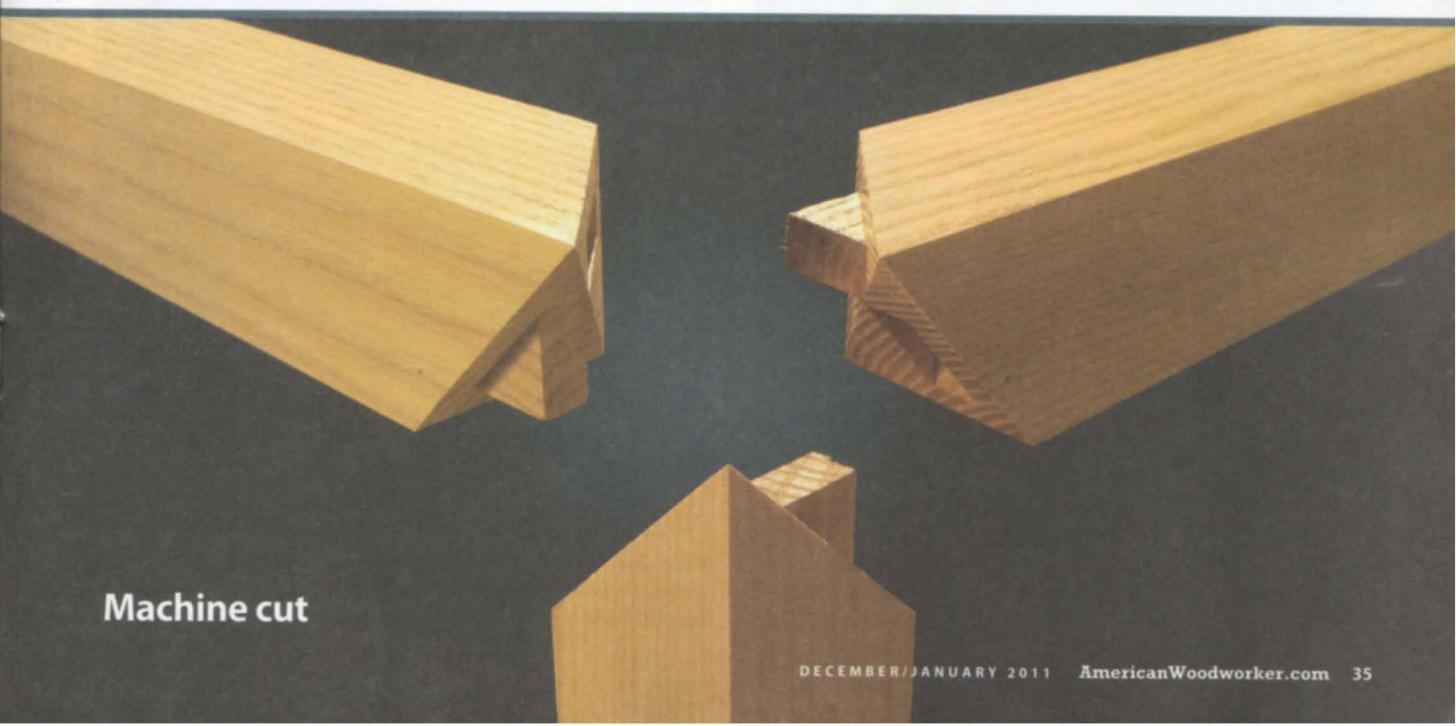
# 2 Ways to Cut a 3-Way Miter

Create this impressive joint by hand or with power tools.

by Garrett Glaser

ADMIRING THE COMPLEX 3-WAY MITERED JOINT between the leg and aprons in an antique Chinese table is natural. But the thought of cutting and fitting this interlocking joint by hand is enough to make most woodworkers run up a white flag. Fortunately, the same joint appears in contemporary designs, which means there's also a modern (easier) way

to complete it. In this story I'll demonstrate both methods and provide all the information you need to build a table with 3-way miters. Whether you love the challenge of using hand tools or love the reliability and predictability of modern power tools, there's a straightforward way to fashion this elegant, versatile and time-tested joint.



Machine cut

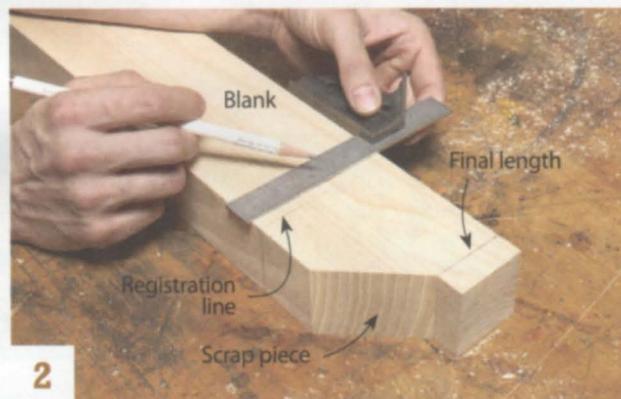
# Machine-Cut 3-Way Miter Joint



## The machine-cut joint



**1** Use a scrap piece marked with a registration line to set up the saw. Clamp the piece to the saw and miter the end. Then without moving the piece, transfer the registration line to the saw.



**2** Use the mitered scrap piece to mark all the blanks. Align the tip of its miter with a line drawn on the blank to indicate its final length. Then transfer the registration line.



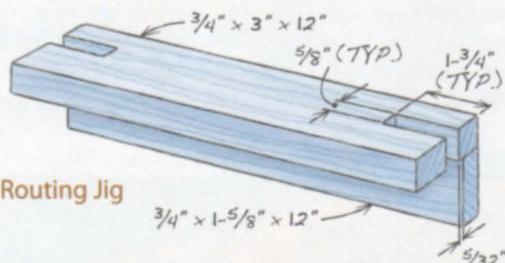
**3** Align the registration lines to cut miters on adjacent faces of all the leg and apron blanks. To minimize tearout, always cut the second miter with the first miter facing up.

**SIMPLICITY DEFINES THIS JOINT**, because the cuts on all three parts are identical. Each part has two miters and two slots for loose tenons. Only two setups are required, one for mitering and one for routing. This method is based on a miter saw, but a tablesaw can also be used. A simple shop-made jig is used for routing.

The miters must be precise, so a saw that cuts accurately is a must. Set up the saw to make a perfectly plumb 45° cut. Don't rely on the saw's scales—if the miters are off by even a tiny amount, the joints won't close tightly. Make test cuts on scrap stock to ensure accuracy.

Start with straight, square stock. Crosscut both ends at 90°, about 1" longer than final dimension. Mark the final length on each piece; mark both ends of the apron blanks. Set aside a 12" length of the same stock for layout. Mark a registration line on the layout piece about 4" from one end. Clamp this piece to the saw and cut a 45° miter. Without moving the layout piece, transfer the registration line to the saw's fence (**Photo 1**). Remove the layout piece and position it next to a leg blank so the tip of its miter aligns with the final length mark (**Photo 2**). Transfer the registration line to the leg and continue it around all four sides. Mark every blank this way—mark both ends of the apron blanks.

Cut miters on two adjacent faces of each blank. Align the registration lines on the blank and the saw before making each cut (**Photo 3**). To minimize tearout, orient the blank so that the second miter is always made with the first miter facing up. If the cuts don't meet exactly at a point on the inside corner, something is awry—check the



**Fig. A Routing Jig**



**4** Rout slots for loose tenons with a straight bit, a guide bushing and a simple jig. Square the slot ends by hand. Then cut loose tenons to fit.

saw's setup. When mitering the aprons, make sure that the pointed ends of the miters are on the same edge!

Loose tenons reinforce all the miters. Rout mortises for the loose tenons using a 3/8" straight bit, a 1/2" guide bushing and a simple jig (Fig. A). Use one end of the jig to rout the left facet of each joint and the other end to rout the right facet (Photo 4). Square the end of the mortises with a chisel. Then make loose tenons to fit the slots.

As all of the joints are interrelated, it's best to check the way they fit with the table assembled. A positioning jig and a band clamp stabilize the pieces during this process (Photo 5). The jig positions the legs and keeps them plumb; the clamp equalizes pressure on the joints. To make the jig, cut a piece of MDF to match the table's footprint (it's defined by the lengths of the short and long aprons). Position the legs flush with the corners. Press corner blocks against both inside edges of each leg. Then fasten the blocks to the MDF.

With the table assembled, examine the joints and mark surfaces that need finessing. Then true each joint in stages, round-robin-style, using a rabbeting plane, a chisel or even a sanding block. Keep a couple of bar clamps handy to strategically apply additional clamping pressure. If you need to apply downward pressure on the aprons, raise the jig on blocks to provide a clamping lip.

When the joints fit satisfactorily, disassemble the table. Apply glue to the legs and short aprons and install the appropriate loose tenons. Assemble the ends and clamp them in the positioning jig. Apply glue to the remaining joint surfaces and install the remaining tenons. Spread the end assemblies to install the long aprons. Then install the band clamp and any necessary "tweaking" clamps.



**5 Assemble the table using a jig** to keep the legs in position. Install the short aprons and tenons. Spread the ends to install the long aprons. Then use a band clamp to draw the joints tight.

## Build a Table with 3-Way Miter Joints

The legs and aprons of tables joined with 3-way miters form an open frame whose dimensions are determined by the lengths of the three components. Adding a top can be as simple as attaching cleats inside the aprons and cutting a piece to fit.



### Cutting List

3-Way Miter Table Overall Dimensions: 22" L x 14" W x 26" H

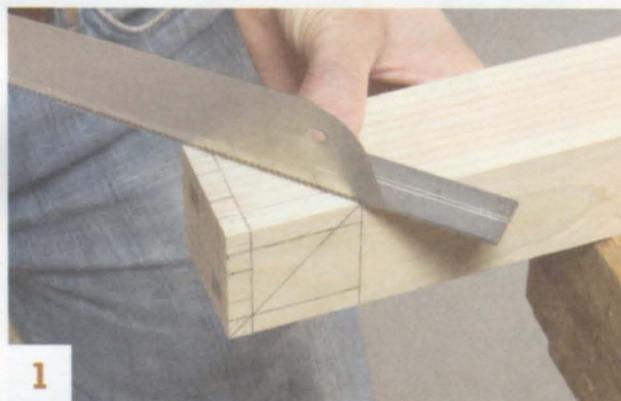
Part	Name	Qty.	Material	Th x W x L
A	Leg	4	Ash	1-3/4" x 1-3/4" x 26"
B	Short apron	2	Ash	1-3/4" x 1-3/4" x 14"
C	Long apron	2	Ash	1-3/4" x 1-3/4" x 22"
D	Loose tenon	12	Ash	3/8" x 1" x 1"
E	Short cleat	2	Ash	3/4" x 3/4" x 10-1/4"
F	Long cleat	2	Ash	3/4" x 3/4" x 16-1/2"
G	Top	1	Mahogany plywood	

# Hand-Cut 3-Way Miter Joint

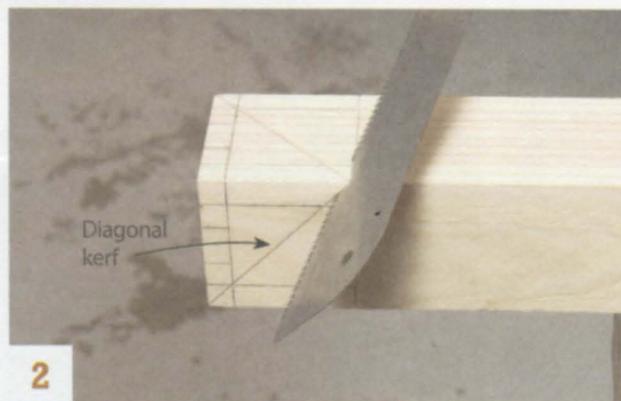


**MOST TRADITIONAL CHINESE 3-WAY MITER JOINTS** consist of three (or more) interlocking pieces, each with their own configuration of tenons and mortises. I've created a simplified version that requires only two pieces, the leg and two identical but mirror-image aprons. My joint won't win awards for authentic traditional joinery, but it's a good jumping-off point. Mastering this joint develops skills that will allow you to tackle more complex versions. A good place to start looking for authentic examples is Gustav Ecke's excellent book *Chinese Domestic Furniture* (see Source, page 42).

Creating a 3-way miter by hand requires three skills: precise layout, sawing straight lines (see "Using a Pull Saw," page 40) and accurately removing waste. No single step is especially difficult, but there are a good number of



**1** Start by sawing four diagonals on each leg, one on each face. Use a straightedge to guide the saw. Attach sandpaper to the back of the straightedge so it won't slip.



**2** Saw the bottom edge of the miter on the two inside faces. Use the diagonal kerf from the previous step to establish the 45° slope. Then work back to the diagonal kerf on the opposite edge.

Fig. B Leg Layout

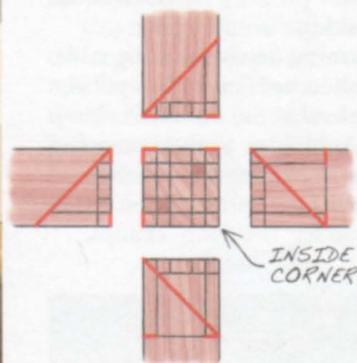
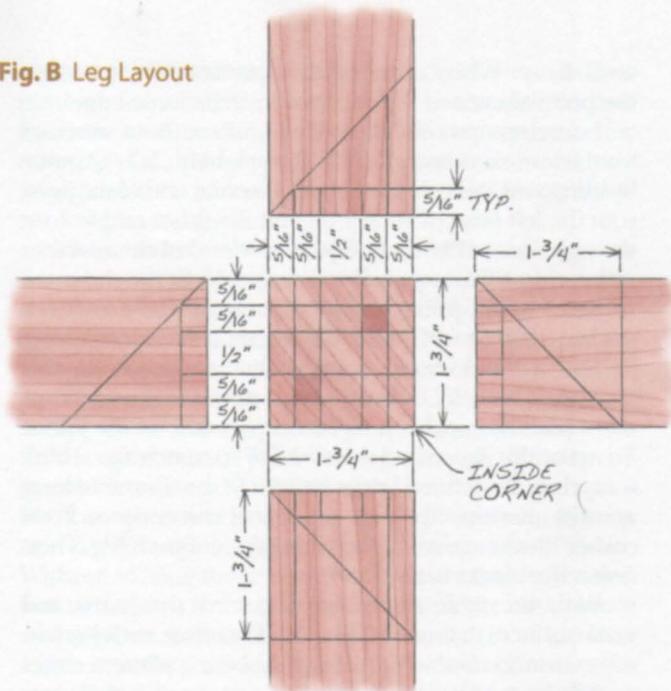


Fig. C First Cuts

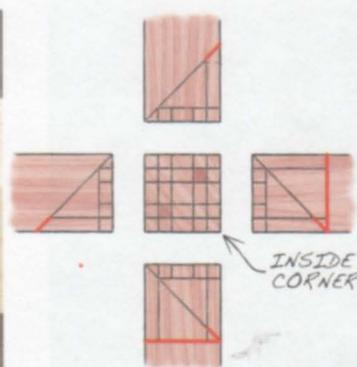


Fig. D Second Cuts

them. The order in which you complete the steps is the key to success. A fourth requirement isn't so much a skill as a personality trait: patience. Mastering this process takes practice.

Start by milling the stock. Use light-colored wood at first, so your layout lines will be easy to see and imperfections will show clearly as dark crevices in the assembled joints. In 3-way miters, the aprons and legs are squared to the same dimensions. Every piece must be straight. If one piece has a twist or bend, it won't matter how masterfully you cut and chisel—the joint will never close tightly.

Cut the aprons and legs to final length—the aprons on opposite sides must be identical (or all four aprons, if the table is square). Lay out all of the cuts on the top and all four faces of each leg (Fig. B). Use an accurate square and a sharp pencil or a knife to create the lines.

## The Leg Joint

The first cuts on each leg are diagonal and stopped (**Photo 1** and Fig. C). The two diagonal cuts on the outside faces are the most visible of all the cuts you will make, so use a metal straightedge to ensure clean, straight cuts. Position the straightedge so the blade will split the layout line. Hold the saw against the straightedge and flat on the workpiece. Then saw a groove just deep enough to keep the saw from jumping out as you complete the cut. Remove the straightedge. Keep the blade in the groove while using its heel to make a perpendicular cut down the adjacent side to the first stop line. Then slowly angle the blade forward and use its toe to cut down to the stop line on the opposite side.

The second cuts run across the leg's two inside faces (**Photo 2** and Fig. D). They're the only cuts that aren't perpendicular to the surface. Use one of the diagonal cuts you just made to position your saw at the correct angle, then saw back across the face to the diagonal cut on the opposite side.

The third cuts form a tic-tac-toe grid across the top (**Photo 3** and Fig. E). Although most of these cuts will be removed later, making them now ensures square tenons, because it's much harder to cut a perfectly true short line than a long one. These stopped cuts also act as a guide for waste removal.

The fourth cuts create shoulders for the miter joints (**Photo 4** and Fig. F). Establish a straight, shallow groove and then saw diagonally until you reach the outside edge of the top and the bottom edge of the miter on the

adjacent face. If the triangular waste piece doesn't come loose, make sure the diagonal cut was sawed to a uniform depth—rocking the saw from heel to toe sometimes leaves a high spot in the middle.

The fifth cuts remove waste and reveal angled

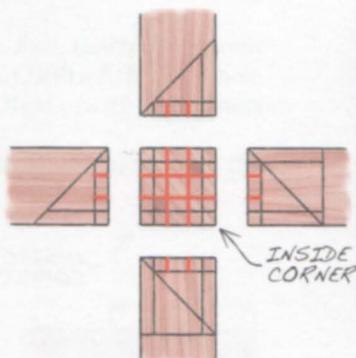


Fig. E Third Cuts

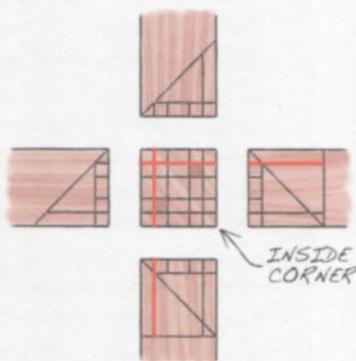


Fig. F Fourth Cuts

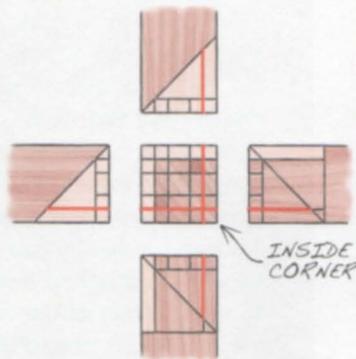
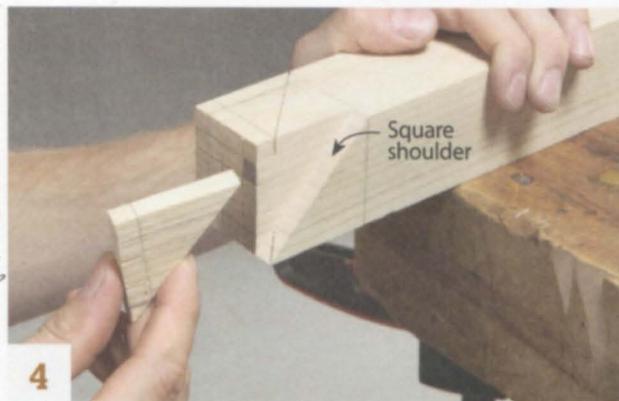


Fig. G Fifth Cuts



Create the tic-tac-toe grid on the top by making four straight cuts. Saw to the upper layout lines on the adjacent faces.



Create square shoulders on the two outside miters by sawing diagonally across the top and one adjacent face. Waste removal begins with these cuts.

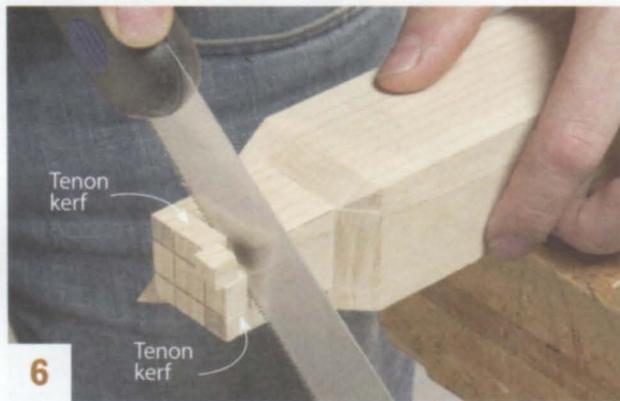


Make deep stopped cuts across both inside faces to reveal the angled shoulders. You'll have to re-mark some of the layout lines in order to make these cuts.

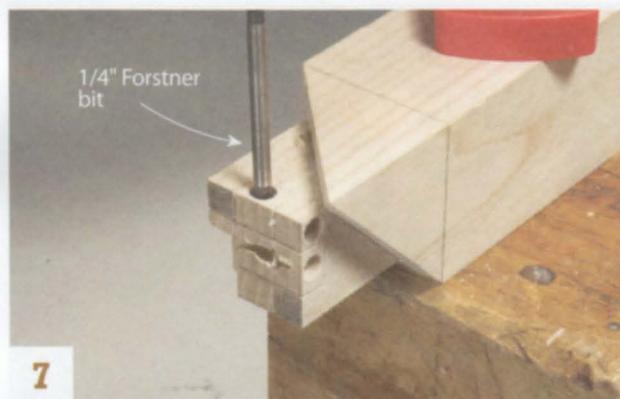
# Hand-Cut 3-Way Miter Joint continued

shoulders on the inside faces (**Photo 5** and **Fig. G**). Make a pair of deep stopped cuts that run across the top and down both adjacent faces. Be careful not to cut into the mitered shoulders on the outside faces, as doing so will leave a visible mark when the joint is assembled.

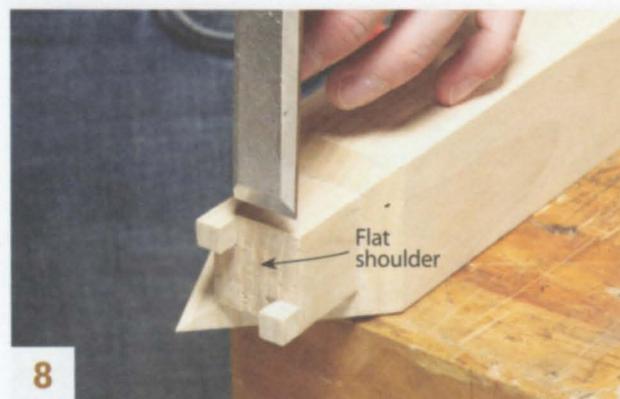
The final cut establishes the flat shoulder at the the



**Complete each leg joint** by removing the waste from around the two tenons. Sawing across the inside corner to the tenon kerfs creates a flat shoulder at the base of the tenons.

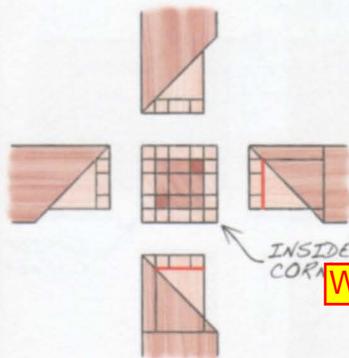


**Remove the bulk of the waste** that remains between the tenons by drilling through the tic-tac-toe blocks.



**Complete the joint** by paring across the grain to create a flat shoulder beneath the tenons.

base of the tenons (**Photo 6** and **Fig. H**). Start by marking guide lines on both inside faces, 5/16" down from the top and running from the inside corner to the saw kerf that defines the tenon cheek. Use the lines to cut diagonally to the kerfs—be sure to stop before you saw into the tenons!



**Fig. H** Final Cut

Use a 1/4" Forstner bit to remove as much of the waste as you can (**Photo 7**). Then switch to a chisel (**Photo 8**). The shoulder's surface must be absolutely flat, so finish by paring across the grain. Be sure to remove any corners.

## Using a Pull Saw

The art of sawing straight and square with a pull saw isn't as mysterious as you might think. I'll explain it here and you can see photos showing the process at [www.AmericanWoodworker.com/WebExtras](http://www.AmericanWoodworker.com/WebExtras).

I use a fine-tooth flush-cut pull saw to cut 3-way miters. (The teeth on a flush-cut saw have no set, which means they don't flare beyond the body of the blade). You can spend a lot of money for this type of saw, but I get great results using a \$10 version from a home improvement store—and I don't have to worry about the replacement cost if I kink the blade or break a tooth.

When you saw, the goal is to split the layout line. Don't worry—it's easier than it sounds. Just make sure that the outside edge of the blade follows the center of the line, so half of the line remains on the workpiece and the other half becomes sawdust.

To make a through cut, you follow two adjacent lines, one across the top of the piece and one continuing down the side that faces you. Focus first on the top line. Hold the blade nearly parallel to the surface, but with the heel (the end closest to the handle) raised slightly, and saw lightly along the line from the far side to the near side until you've made a shallow groove across the top. Keep the saw in the groove and switch your focus to the vertical line on the side. Using the heel of the blade, saw your way down the line until the teeth of your saw meet the ends of both lines. If you are cutting square stock, this puts your saw at a 45° angle. Keep your saw at this angle to complete the cut. The kerf you've created keeps the saw square and plumb for the rest of the cut.

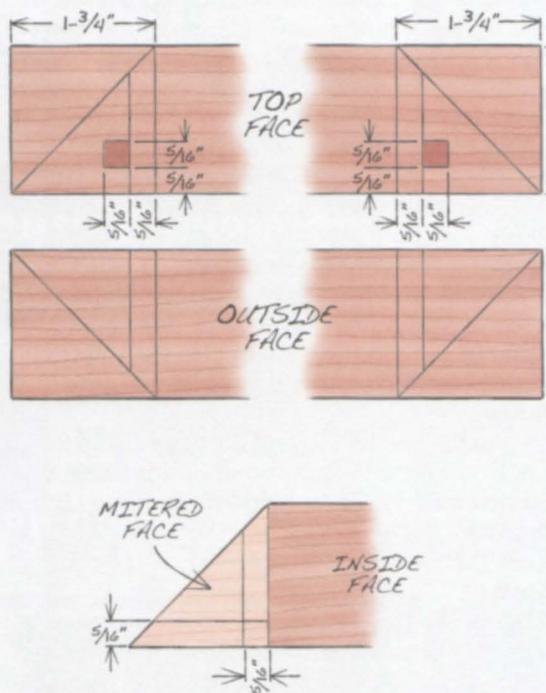
## The Apron Joint

Mark the aprons for cutting and mortising (Fig. J). The first cuts create miters on the top and outside faces (Photo 9). These diagonal cuts are just as visible as those on the leg, so start them the same way, using a straightedge. Use the heel of the blade to saw the line on the adjacent face and finish the cut by sawing at a 45° angle.

Cut the mortise in the top face. (Each apron joint houses one of the leg tenons.) Drill a 3/8" deep hole with a 1/4" Forstner bit and then square the corners with a chisel (Photo 10).

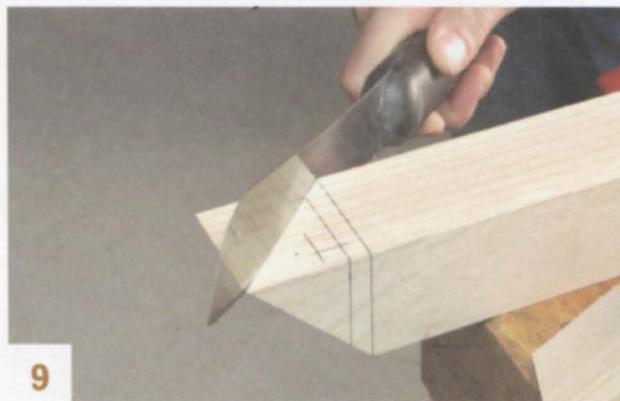
Draw guide lines on the two mitered faces on the

Fig. J Apron Layout



inside of the joint (Fig. J). One line is located 5/16" from the outside edge and the other 5/16" from the bottom of the miter—these lines align with the mortise on two sides.

When removing the waste, use one line to guide the side of the chisel and the other to establish



9 Start each apron corner by making two through diagonal cuts, one on the top and one on the outside face.



10 Square the mortise after drilling a stopped hole to remove most of the waste.



11 Hollow the inside of the joint after marking the shoulders on both mitered faces. Remove the waste with a series of shallow chisel cuts, working from front to back.

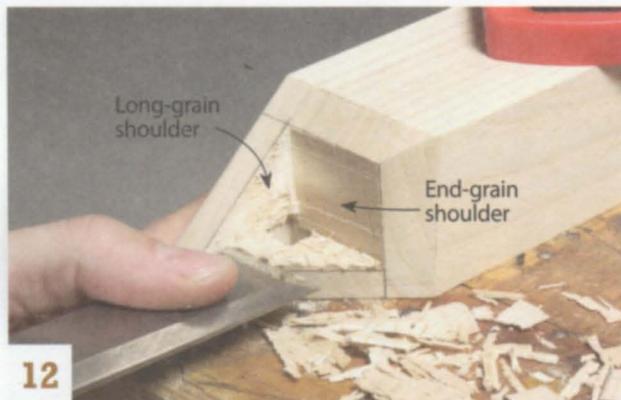
To make a stopped cut you need three lines—the line across the top and stopped lines on the opposite adjacent faces. Begin the cut as you would a through cut, creating a groove across the top and then cutting with the heel to the bottom of the first stopped line. But instead of putting pressure on the heel to continue the cut, make the toe of the saw do all the work, cutting down the line on the opposite face, slowly leveling the blade so that the teeth connect the two points where the cut should stop.



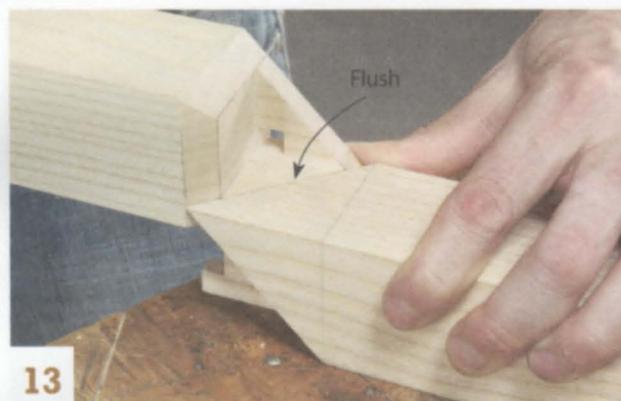
See how to cut straight and square with a pull saw at [AmericanWoodworker.com/WebExtras](http://AmericanWoodworker.com/WebExtras)

# Hand-Cut 3-Way Miter Joint continued

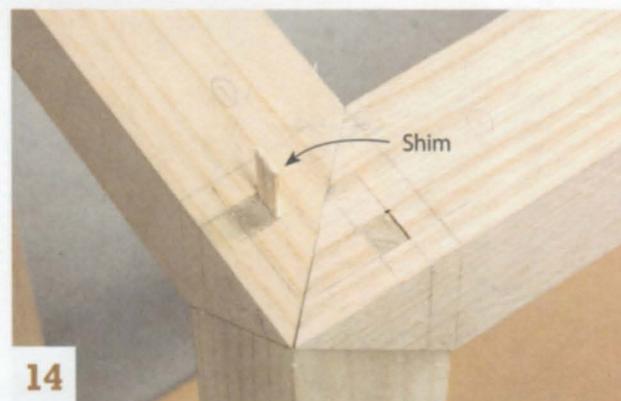
the depth (**Photo 11**). Barely tap the chisel for the first cuts—the grain is so short at the front that it's easy to remove too much. You should be left with one relatively clean end-grain shoulder and two fairly ragged long-grain shoulders. Make sure the end-grain shoulder is absolutely



**12** Pare to the guide lines and square the end-grain shoulder. Removing the waste reveals the mortise—it's flush with the corner formed by the end-grain and long-grain shoulders.



**13** Fitting the joints takes time. Make sure that the shoulders of each joint are the same thickness, that all of the mating surfaces are absolutely flat and that the mortises aren't too small.



**14** All of the joints are interrelated, so assemble the table as soon as you can. Then work a little on each joint in rotation. Here, a temporary shim shows high spots that require further work.

flat. Pare the long-grain shoulders to exactly 5/16" thickness (**Photo 12**).

## True the fit

When you first assemble a leg and apron, don't be alarmed if the pieces don't even go together. Truing the fit requires patience and thoughtful sleuthing. Look carefully to determine what might be gumming up the works (**Photo 13**). Make sure the mortise fits the tenon without binding—if this joint is too tight it can keep the other parts of the joint from fitting. Once the mortise and tenon fit properly, check the other joint surfaces for irregularities.

Don't spend too much time fitting an apron and leg before adding the second apron. After all, this is a three-piece joint, and having all three parts together shows much more than two parts can show. You'll quickly learn how a small adjustment on one piece can affect the way the other two pieces fit.

In fact, because all the joints are interrelated, the best strategy is to assemble the legs and aprons as soon as possible and true each joint in stages, round-robin-style, using a rabbet plane and a chisel (**Photo 14**). Use the positioning jig shown earlier to keep the legs plumb while you finesse the joints. Temporarily shimming the mortises during this process can help to identify problem areas. Once all the joints have been fit, you'll probably have to permanently shim some of the mortises. That's OK; the shims will be virtually invisible after they're glued and sanded flush.

Use the assembly jig and the band clamp for glue-up. If you need to apply downward pressure on the aprons, raise the jig on blocks to provide a clamping lip. 

## SOURCE

Tools for Working Wood, [www.toolsforworkingwood.com](http://www.toolsforworkingwood.com), (800) 426-4613; Gustav Ecke, *Chinese Domestic Furniture*, Mineola: Dover Publications, 1986, AQ-1037, \$13.56.



**Garrett Glaser** is a furniture maker who lives and works in St. Paul, MN. See more of Garrett's work at [www.garrettglaser.carbonmade.com](http://www.garrettglaser.carbonmade.com)

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# Mobile Cyclones

by Andrew Zoellner

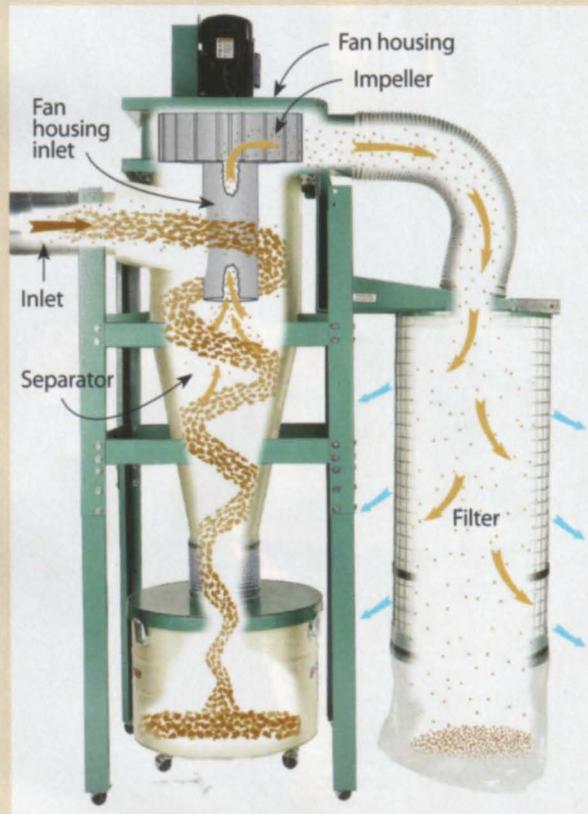
These advanced dust collectors are now more versatile than ever.



## How a Cyclone Works

A cyclone is a two-stage dust collector. During the first stage, the collection stream enters the cyclone at the inlet and debris is flung to the outside of the separator, where it spirals down into the collection drum.

The fan-housing inlet tube begins the second stage. The tube hangs down in the middle of the cyclone body clear of the spiraling debris stream. The relatively clean air is pulled into the impeller, then pushed through the filter. The filter scrubs out the remaining fine particles.



## 2 Important Terms

**CFM** (Cubic Feet per Minute) is the volume of air that's moving through a hose or duct. CFM is calculated using the speed of the air and the diameter of the duct it's moving through. The higher the CFM, the more chips and dust the collector will collect.

**Static Pressure** can be thought of as the resistance of air moving through a duct or hose in a dust collection system. Friction from the wall of the duct slows down the air, and this slow-down is calculated as static pressure loss. Flex hose creates much more friction than smooth-walled duct, raising static pressure loss and lowering CFM. Bends and reductions in duct diameter also increase static pressure loss.

**DUST COLLECTORS FOR THE SMALL SHOP** have come a long way since the days of a broom and a pan. The latest generation—two-stage cyclones on casters—are more powerful, more efficient and quieter than any previous machines of a similar size.

There are at least six mobile cyclones on the market right now, and more are probably on the way. This is still a young, emerging field with plenty of competition. In this article, we'll explain how cyclones work, compare the performance of the six machines, and give you a rundown on their features.

## Benefits of a cyclone

There are two basic types of small-shop dust collectors: single-stage and two-stage. Single-stage machines have been on the market for quite a while, and you're probably familiar with their two-bag look. In a single-stage collector, the dust stream goes directly through a large fan blade, called an impeller, and then into a collection bag. Fine particles are captured by a second bag—or a cartridge—acting as a filter. Single-stage collectors aren't very complicated, so they generally are fairly inexpensive.

Cyclones are two-stage machines. They're much more efficient than single-stage collectors, and have two significant advantages: Cyclones can generate higher CFM and overcome greater static pressure loss. (See *How A Cyclone Works* and *2 Important Terms*, left.) In simple terms, they suck harder.

Early stationary cyclone models were quite large, often over 8' tall—a non-starter for many small shops. They were designed to be the heart of a central dust collection

**Using a 5" hose  
instead of a 4" hose  
boosts CFM by about 40%**

system, with ductwork running far across a shop. Mobile cyclones are a new breed. They're smaller (all are under 8' tall) and lighter. They're ideal for a garage shop, where large machines are placed on wheels so they can be stowed away. You can roll a mobile cyclone right to your jointer or planer, hook up a flex hose, and be in business in no time. All of the machines we tested would do well in this situation (see *Test Results*, page 49). To maximize CFM, the diameter of the hose should be as large as possible. As our test results show, using a 5" hose instead of a 4" hose boosts CFM by about 40%. In addition, the length of the hose should be kept to a minimum.

A mobile cyclone could be used for a small central system, too. If you have your table saw, jointer and planer in a cluster, for example, you could position a cyclone in the middle and collect from two or three machines using separate hoses. We put this proposition to the test with each machine. Three of the cyclones came with reducers that had two 4" ports, so we set up all of the models with two 10' long runs of 4" hose, leaving open both runs. We found that this is not an ideal setup, however. It reduced

CFM by about 1/3 at the machine, causing some cyclones to pull less than 400 CFM, the recommended minimum for most woodworking machines. For a cluster setup, we recommend that you install blast gates on both runs and keep only one gate open at a time.

Consider another situation: Your shop is small, but your machines aren't grouped together. They're spread out, and you'd like to connect them to a central collector with short runs of duct. Would one of these mobile cyclones work? The top-performing models will, we're happy to report; but of course their effectiveness depends on how long your runs are, and how well the runs are designed (see Optimizing CFM, page 48).

## Features

Power aside, a number of features can make one cyclone more user-friendly than another. (To compare machines, see the individual reviews on page 50.) These features are:

- **Remote control.** This device will turn your dust collector on and off from up to 30' away or more, depending on the model (top photo, right). Some remotes are programmable to run the collector from one hour to eight hours or more. When you've got a remote, you're more likely to turn on the collector, even for quick cuts. It's a big plus.

- **Mechanical filter cleaning.** A dust-clogged filter decreases airflow, so it's important to keep it clean. Some machines have a handle above the filter that's connected to a paddle inside. Rotating the handle knocks off most of the dust (center photo, right). Some experts contend that this cleaning isn't adequate. They recommend that you blow out the filter, from the outside, with an air hose. If you don't have a compressor, a mechanical cleaner is the next best thing.

- **Easy emptying.** All of the chips that you make by planing or jointing end up in a barrel underneath the cyclone. It's essential to empty the barrel before it overfills. If you don't, the chips will back up into the cyclone and eventually spill over into the filter. The filter then gets tightly packed with chips, airflow drops, and you're faced with a huge, dusty cleanup job. All of this can be easily avoided if you visually

## We really like a barrel connection system with toggle clamps

monitor the level of the chips in the barrel and routinely empty it—or if your cyclone has an overflow sensor (see 2 New Features, page 48). However, some barrels are much easier to disconnect from the machine than others. With the awkward ones, you're tempted to put off the chore and perhaps suffer the consequences. For that reason, we really like a barrel connection system that's easy to use. The best design employs two toggle clamps that use the weight of the collector to seal the lid on the barrel (bottom photo, right).

## 3 Key Features



**A remote control**—standard equipment on some models—enables you to turn the cyclone on or off from wherever you're working.



**A mechanical agitator** knocks dust off the inside of the filter. Keeping the filter clean maximizes airflow.



**Toggle clamps** for detaching the barrel from the cyclone make it much easier to take out the trash.

• **Small tool dust collection.** Can you connect a cyclone to a router table or sander? If you're using a small-diameter hose, the answer for most machines may be: Not really, because you won't get adequate CFM. (A small-diameter hose creates a great deal of static pressure loss.) One model, however, has electronic circuitry that improves CFM when using small-diameter hoses (see 2 New Features, below).

• **Mobility.** If you need to wheel a cyclone around the

shop, note our comments on which models are easier to steer into tight quarters. The collection drums on most models have casters—a nice convenience.

• **Inlet size.** Bigger is better. A bigger inlet allows more air into the cyclone, making it easier for the motor and impeller to move air through the cyclone.

## The bottom line

If you're planning on rolling a cyclone up to a single machine, all six models we tested will do fine under optimum conditions.

You can also hook up a mobile cyclone to longer runs of duct or flex hose, but there are clear differences in performance among the models (see Test Results, next page).

Once you've figured out which model is powerful enough for your situation, check out its other features. You'll find them described in our individual reviews on page 50.

## 2 New Features

One of the machines we tested, the Oneida Smart Dust Collector, has two features that break new ground in cyclone design.



An overfill sensor lights up when the barrel is full. Overfilling a barrel is bad news—the extra chips may jam up the cyclone's filter and drastically reduce airflow. Some barrels have viewing windows for monitoring the level of chips inside, but a light is more convenient.



**Electronic feedback** makes a cyclone more versatile. The Smart Dust Collector has electronic circuits that adjust the speed of the impeller according to the amount of resistance the machine senses. In practical terms, this means higher CFM and 2-3 times the suction (static pressure) when you connect a small-diameter hose to your router table or sander.

## Optimizing Your System

Here are some guidelines to improve the efficiency of your dust collection system:

- Use as little flex hose as necessary. Use as large a diameter as feasible.
- Increase the size of a machine's dustport, if possible.
- Locate your dust collector near your machines, to minimize the necessary length of duct or hose.
- Use gradual curves, not right-angle bends, for hoses or duct.
- Use smooth-walled metal duct for long runs. At the inlet, the duct should be the largest diameter your dust collector will accept.
- If you're connecting your cyclone to multiple machines with more than one hose, put the cyclone nearest to the machine that creates the most dust and chips. Install blast gates on each run.



For more information on setting up a dust collection system, go to [AmericanWoodworker.com/WebExtras](http://AmericanWoodworker.com/WebExtras)

## Test Results

**Some cyclones** are clearly more powerful than others, regardless of their horsepower. We've measured the CFM each machine delivers in four hypothetical situations. The minimum suggested CFM numbers are widely used industry standards.

• **2" Flex Hose.** You'd use this hose to connect to a router table, combo disc/belt sander, or a benchtop tool. Our test hose was 10' long.

• **4" Flex Hose.** Most dustports and hoses are 4" dia. We ran our tests using a 10' long hose. Shortening the hose will increase CFM—somewhat. We found that reducing the length of the hose to from 10' to 6' only increases CFM by an average of 6%.

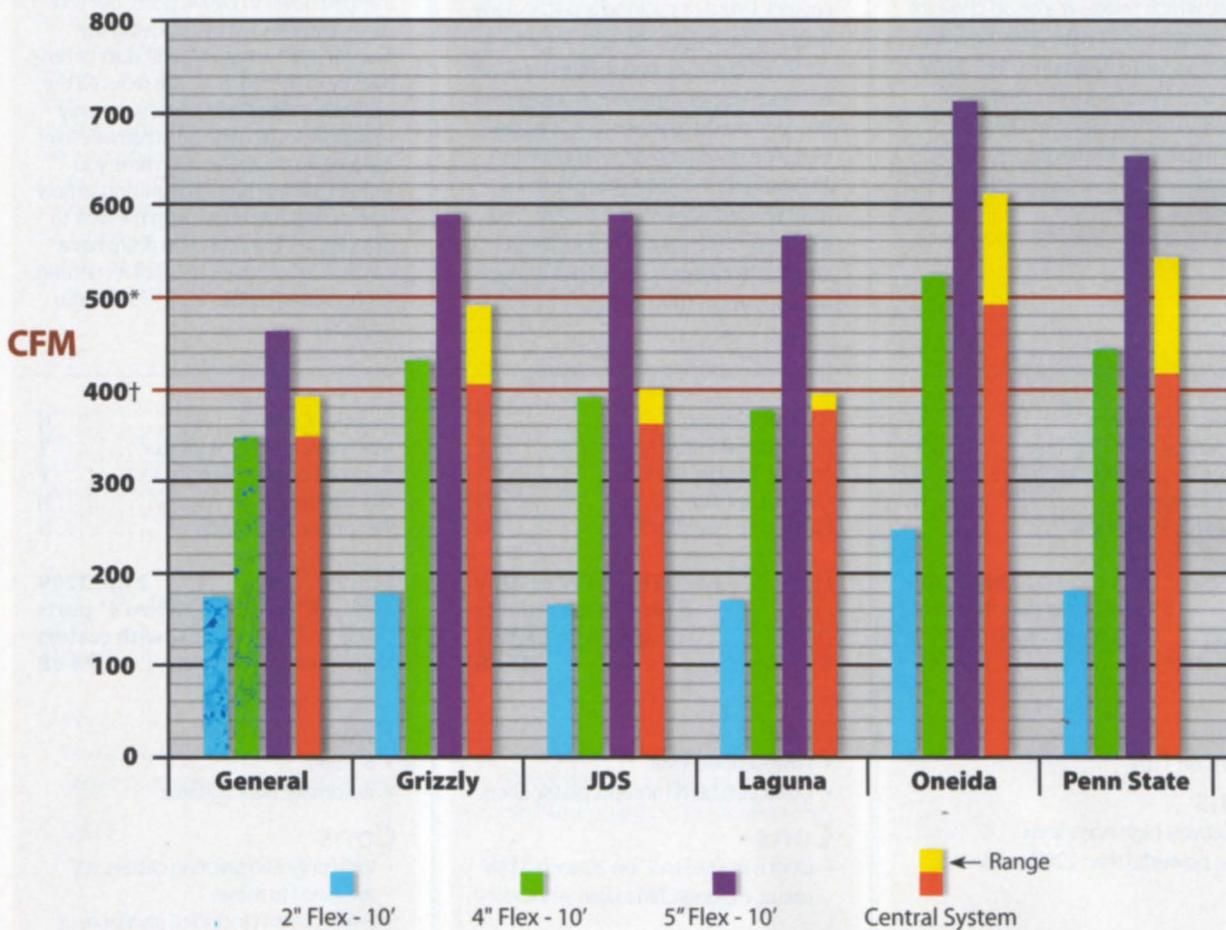
• **5" Flex Hose.** All of the collectors can accommodate a 5" hose; we used one that was 10' long. The dustports on some machines are 5" dia., or can be enlarged to 5" dia. We found that increasing the diameter of a 10' long hose from 4" to 5" raises CFM by an average of 40%.

• **Central system.** We built a 40' long central system with smooth-walled duct. It began with 6" duct at each cyclone's inlet (5" duct for the General International cyclone, which has a 5" inlet). The line was stepped down in diameter at three drops (5", 4" and 4") spaced at 10' intervals. We installed gates and 5' of flex hose at the end of each drop. We've reported CFM as a range. At the top of the range, the first gate (5") is open and the other two are closed; at the bottom of the range, the third gate (4") is open and the first two are closed.



For more information on our tests, go to [AmericanWoodworker.com/WebExtras](http://AmericanWoodworker.com/WebExtras)

### CFM in Four Different Setups



**Minimum suggested CFM**

\* Planer, Tablesaw, Drum Sander  
† Jointer, Bandsaw



**General International  
10-800CF M1**

\$1,199

This 1-1/2 hp cyclone runs on a standard household 110V, 15-amp circuit, which makes it a good choice if your shop doesn't have 220V service. It's less powerful than the other 220V units we tested, but still capable of achieving recommended CFMs for most machines, if you use a 5" hose. The collection drum has casters.

Remote Control ..... **Y**  
 Mechanical Filter Agitator ..... **Y**  
 Bucket Toggle Clamps ..... **N**  
 Overfill Sensor ..... **N**  
 Electronic Feedback ..... **N**

Motor ..... **1-1/2 hp, 110V**  
 Inlet .... **5", split into two 4" ports**  
 Drum ..... **30 gal., with casters**  
 Noise level ..... **.80 dB**

**Pros**

- Runs on 110V.

**Cons**

- Relatively high noise level
- Less powerful than 220V models.

**Contact**

General International, [www.general.ca](http://www.general.ca),  
 (888) 949-1161.



WhereWeShare.com

**Grizzly GC703**

\$928 with 220V switch;

\$850 with 110V switch

We tested this model running at 220V. Equipped with four rotating casters, Grizzly's cyclone is particularly easy to maneuver. You can also use a removable plastic bag inside the drum to make emptying easier. A suction hose inside the barrel holds the bag taut. The collection drum has casters. This model's 1-1/2 hp motor comes from the factory wired for 110V. You must use 5" or smaller duct for a 20-amp 110V circuit; you can use 6" duct on a 30-amp 110V circuit.

Remote Control ..... **Y**  
 Mechanical Filter Agitator ..... **Y**  
 Bucket Toggle Clamps ..... **N**  
 Overfill Sensor ..... **N**  
 Electronic Feedback ..... **N**

Motor ..... **1-1/2 hp, 110V or 220V**  
 Inlet ..... **.6" or 5" with reducer**  
 Drum ..... **30 gal., with casters**  
 Noise level ..... **.65 dB**

**Pros**

- Lowest noise level.
- Collection barrel accepts plastic liners.

**Cons**

- Duct is limited to 5" on 20-amp, 110V circuit, making CFM lower.

**Contact**

Grizzly Industrial, [www.grizzly.com](http://www.grizzly.com),  
 (800) 523-4777.



**JDS 2100-CKV**

\$1,299

This cyclone is a powerful, compact machine with a big 8" inlet. The inlet is stepped down to two 4" ports, but you can maximize CFM by removing the reducer and running 6" or 8" duct or hose directly to the machine (we reduced the inlet to 6" for our tests). This is the only model we tested with an automatic filter agitator that operates each time you turn off the machine, maximizing airflow by keeping dust build-up in the filter to a minimum. The collection drum has a window for checking how full it's getting. A 3 hp version (3100-CK, \$1,799) is also available.

Remote Control ..... **N**  
 Mechanical Filter Agitator ..... **Y**  
 Bucket Toggle Clamps ..... **Y**  
 Overfill Sensor ..... **N**  
 Electronic Feedback ..... **N**

Motor ..... **2 hp, 220V**  
 Inlet .. **8", reduced to two 4" ports**  
 Drum ..... **35 gal., with casters**  
 Noise level ..... **.74 dB**

**Pros**

- 8" inlet.
- Automatic filter agitator.

**Cons**

- With only two pivoting casters, it's awkward to move.
- A remote isn't included (available as an accessory for \$89).

**Contact**

JDS Company, [www.jdstools.com](http://www.jdstools.com),  
 (800) 480-7269.



### Laguna MDC0560-0145

\$1,245

This is the only model we tested that has all three basic convenience features. It's very compact and is easy to move around. It's the shortest unit, standing only 61" high. The collection barrel has a window for viewing the level of the chips inside, and it uses a toggle-clamp connection system for easy emptying. A small-diameter hose connected to the cyclone provides suction to hold a barrel collection bag in place. The collection drum has casters. A 3 hp version (MDC3560-0145, \$1,545) is also available.

Remote Control .....	<b>Y</b>
Mechanical Filter Agitator .....	<b>Y</b>
Bucket Toggle Clamps .....	<b>Y</b>
Overfill Sensor .....	N
Electronic Feedback .....	N

Motor .....	<b>2 hp, 220V</b>
Inlet .. 6", reduced to two 4" ports	
Drum .....	<b>29 gal., with casters</b>
Noise level .....	<b>74 dB</b>

#### Pros

- Easy to maneuver.
- Collection barrel accepts plastic liners.

#### Cons

- The agitator handle is at knee level.

#### Contact

Laguna, [www.lagunatools.com](http://www.lagunatools.com), (800) 234-1976.



### Oneida 2 hp Smart Dust Collector

\$1,987

This is the only model we tested with electronics that adjusts the speed of the impeller to overcome the higher static pressures created by a long run or a small-diameter hose. It is also the only machine in the test that has a brand-name motor—Baldor—with a proven track record of reliability. The collection drum rides 1/2" off the ground when connected to the cyclone. When you detach the clamps, the drum lowers onto its casters for easy removal. A 3 hp model (XXS030100, \$2,360) is also available.

Remote Control .....	<b>Y</b>
Mechanical Filter Agitator .....	N
Bucket Toggle Clamps .....	<b>Y</b>
Overfill Sensor .....	<b>Y</b>
Electronic Feedback .....	<b>Y</b>

Motor .....	<b>2 hp, 220V</b>
Inlet .....	<b>6"</b>
Drum .....	<b>.35 gal., with casters</b>
Noise level .....	<b>80 dB</b>

#### Pros

- HEPA filter certified by G.E. to capture 99% of dust .3 - .5 microns.
- Has flame guard arrestor for fire safety.

#### Cons

- Relatively high noise level.

#### Contact

Oneida, [www.oneida-air.com](http://www.oneida-air.com), (800) 732-4065.



### Penn State TEMP2PCX

\$895

This is a high-performing, bare-bones cyclone at a relatively low price. It does have one unique feature: a hose and blast gate for emptying debris from the filter canister. This is much easier to use than a bag or canister under the filter. At 84" high, this model is by far the tallest we tested. It may be too high for shops with doorways or low ceilings. The cardboard collection drum does not have casters.

Remote Control .....	N
Mechanical Filter Agitator .....	N
Bucket Toggle Clamps .....	N
Overfill Sensor .....	N
Electronic Feedback .....	N

Motor .....	<b>2 hp, 220V</b>
Inlet .....	<b>6"</b>
Drum .....	<b>.35 gal., no casters</b>
Noise level .....	<b>76 dB</b>

#### Pros

- Blast gate and hose to empty filter debris.

#### Cons

- 84" tall.

#### Contact

Penn State Industries, [www.pennstateind.com](http://www.pennstateind.com), (800) 377-7297.

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# Wine Rack

Elegant results from a humble beginning.

by Peter Schmitt



**THIN STRIPS OF WOOD** littered the shop floor after I completed the doors for a custom kitchen. Throwing these “toothpicks” away didn’t seem right, but neither did storing them. So instead I used them to build this great little wine rack. It stores up to 15 bottles of wine and tucks away into the tightest spaces. Yet it always gets noticed, and my dinner guests love the story of its humble origin.

## Start with straight pieces

Mill hardwood stock for the legs, stretchers and rails (A–D, Fig. A, page 54). Make sure the edges are square and weed out any pieces that are bowed. Include extra pieces for making test cuts. Lay out the mortises on one leg. Then transfer the marks to the other legs (**Photo 1**). Follow the same method to lay out the mortises on four of the stretchers.

Use a mortiser or a drill press outfitted with a mortising attachment to chop the mortises (**Photo 2**). Make sure the bit is square to the fence. Then position the fence exactly  $3/16$ " behind the bit to center the mortises. Use the layout lines to position the bit before chopping each mortise.

Cut tenons on the stretchers and rails on the tablesaw (**Photo 3**). Set the dado blade  $3/16$ " above the table and position the stop block  $11-1/2$ " from the blade. Cut test tenons to check the fit and make any necessary adjustments—the tenons should fit without binding or wobbling. The 1" wide top rails require an extra step. Raise the blade to  $7/16$ " to cut the top shoulder of each tenon.

Saw and sand coves on both ends of the top rails to complete the reveal beneath the rack’s top. Then drill shank holes for the screws that will fasten the top. Elongate the end holes to allow the top’s seasonal movement.

## Assemble the sides and rails

Finish-sand all of the parts and then assemble each side without glue to check the fit. Disassemble the parts. Then glue and clamp each side separately. Make sure each assembly is square and that the mortises in the top and bottom rails face the same direction. Use a



1

**Transfer the mortise locations** to all four legs after laying them out on one leg. Follow the same procedure to lay out mortises on four of the stretchers.



2

**Chop square mortises** in the legs and stretchers. These mortises are centered from side to side.



3

**Use a miter gauge with a fence** and a stop block to cut square tenons on the stretchers and rails. Each tenon requires four passes to complete, one on each face.



4

**Assemble the base** in stages. First, glue the stretchers between the legs to create the sides. Then glue the top and bottom rails between the two sides.

damp cloth to remove squeezed-out glue.

Remove the clamps when the glue has dried and smooth the joints by sanding. Assemble the sides and rails without glue to check the fit. Then glue and clamp together the base (**Photo 4**). Make sure the coves on the top rails are correctly oriented.

### Make and attach the slats

Cut the slats (E) from wide blanks milled to 1/2" thickness and cut to final length (**Photo 5**). Before cutting the slats, finish-sand the blanks and saw or rout 45° chamfers on both ends. After cutting the slats, turn them on their sides and clamp them together for sanding to remove the saw marks.

Use spacers to position and install the slats (**Photo 6**). Cut ten 1-3/8" wide spacers to go between the slats and two 5/8" wide spacers to go between the slats and the legs—adjust the width of these outside spacers to true the fit. Starting at the bottom, align the slats with the stretchers at both ends. Slightly lift the ends of each slat and insert a drop of glue. Press the slats down onto the stretchers and recheck their alignment. Then fasten each slat with 3/4" 23-ga. pin nails. Remove the spacers and move to the next level.

### Finish and final assembly

Cut and finish-sand the top (F). This is a perfect spot for a special piece of wood—one with rich color and spectacular figure.

Apply your favorite finish. For this project I prefer polyurethane. I use an HVLV gun, but aerosol cans also suffice. I start with the base upside down and spray on two very light coats. Then I flip the base right side up and spray on two coats. I've found that this is the best way to prevent drips and get all sides of each part finished. I spray the top the same way, bottom side first. After the finish has dried, I lightly sand all the surfaces with 400 grit and then wipe on a final coat of polyurethane.

Attach the top to the base after the finish has thoroughly dried. These pieces are easy to align because their dimensions match (**Photo 7**). Clamp a couple boards to your bench to create a square corner. Snug the top into the corner—make sure its top face is oriented towards the bench and that there's a clean surface between it and the bench. Place the base on the top and snug both parts into the corner. Mark pilot holes for the screws in the top. Remove the base to drill the holes. Then reposition the base, snug both pieces to the corner and install the screws. Done! 🛠️



5

Rip the slats from wide blanks with chamfered ends. Use a bandsaw to safely cut these narrow pieces.



6

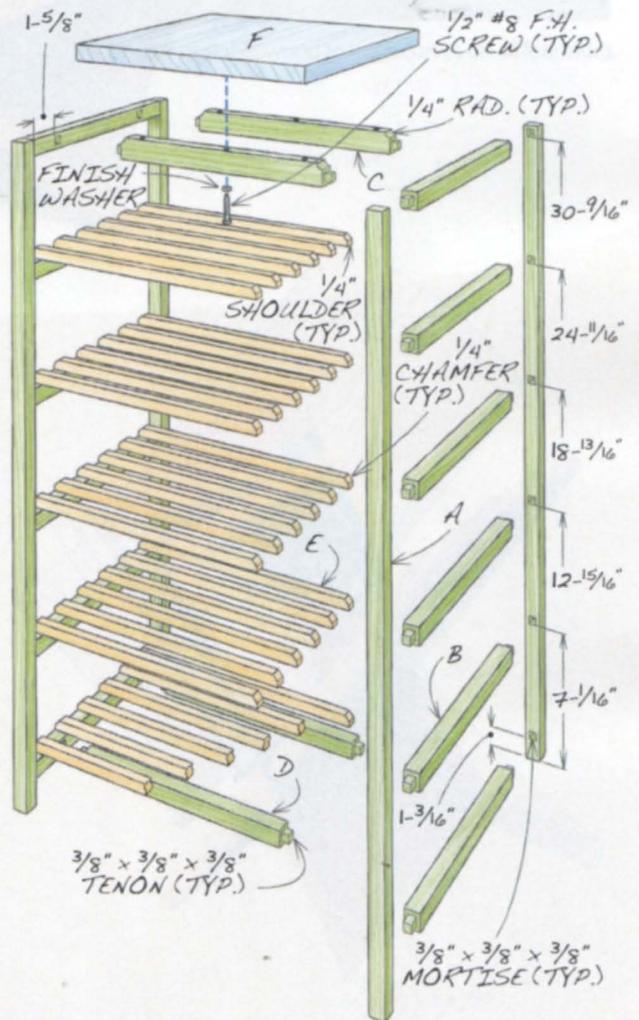
Attach the slats with spacers, glue and 23-ga. nails.



7

Use a shop-made square corner to attach the top to the base. Their dimensions are the same, so the edges are flush.

Fig. A Exploded View



## Cutting List

Overall Dimensions: 32-1/8" H x 12-5/8" L x 12-5/8" D

Part	Name	Qty.	Material	Th x W x L
A	Leg	4	Mahogany	3/4" x 3/4" x 31-1/8"
B	Stretcher	12	Mahogany	3/4" x 3/4" x 11-7/8" (a)
C	Top rail	2	Mahogany	3/4" x 1" x 11-7/8" (a)
D	Bottom rail	2	Mahogany	3/4" x 3/4" x 11-7/8" (a)
E	Slat	30	Mahogany	1/2" x 1/2" x 12-5/8" (b)
F	Top	1	Mahogany	3/4" x 12-5/8" x 12-5/8"

Notes:

- a) 3/8" x 3/8" x 3/8" tenons on both ends.
- b) 45° miters on both ends.



**Peter Schmitt** trained at the Thomas Chippendale School of Furniture in Scotland and now runs Schmitt Custom Furniture in Minneapolis, MN. See Peter's work at [www.schmittcustomfurniture.com](http://www.schmittcustomfurniture.com)

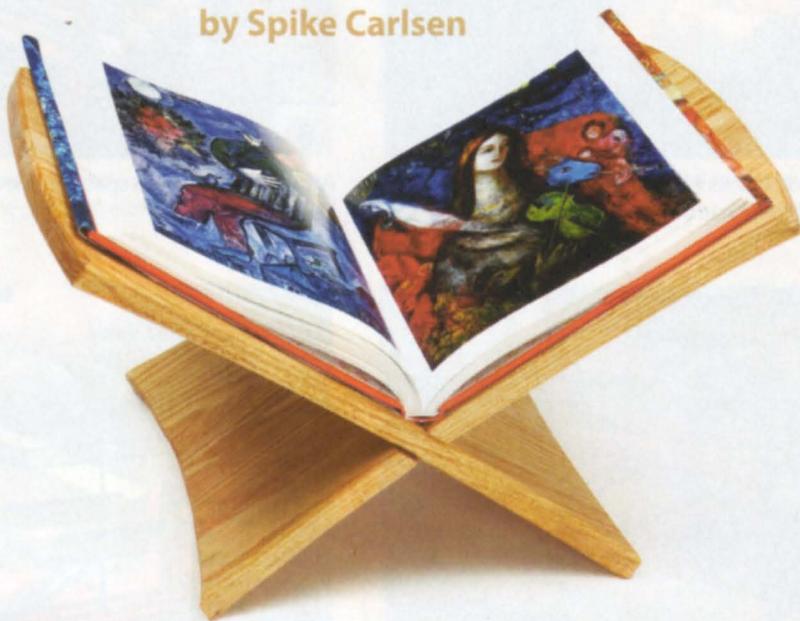


See how to chop square mortises using a drill press at [AmericanWoodworker.com/WebExtras](http://AmericanWoodworker.com/WebExtras)

# Flip-Flop Rack

Books or magazines—this stand will hold both!

by Spike Carlsen



To convert the book stand to a magazine rack, slide the two pieces apart and reassemble them in the opposite direction.

**HERE'S A ONE-DAY PROJECT** for displaying your favorite books, photo albums or magazines. It's composed of just two identical boards that are notched to fit each other.

I used 1x12 oak for the project, but you could glue 3/4" thick boards together—of contrasting colors, perhaps—to create panels 11-1/2" wide. Cut two pieces 18" long, then mark a 3/4" wide notch on each board (Fig. A). Make the notches 1/32" longer than half the width of the boards (5-3/4" long for a 1x12).

Set your jigsaw or bandsaw at 22-1/2° and make two parallel cuts (**Photo 1**). Square the ends of the notches with a chisel or file. Test-fit the two pieces by sliding the grooves together. If they don't fit easily, carefully widen the cuts with a file, coarse sandpaper or your saw.

Draw the curved sides on one board (**Photo 2**). Flex a thin piece of metal or wood into a gentle curve of your choosing. Draw the top first, then draw the sides and bottom. Cut the board and use it as a template for tracing the same pattern onto the other board.

Sand the edges smooth with a power sander or with sandpaper wrapped around one of the cutoffs (**Photo 3**). Slightly soften the edges with sandpaper or use a router with a roundover or chamfer bit to shape the edges. Stain the boards, and then apply two coats of clear finish.



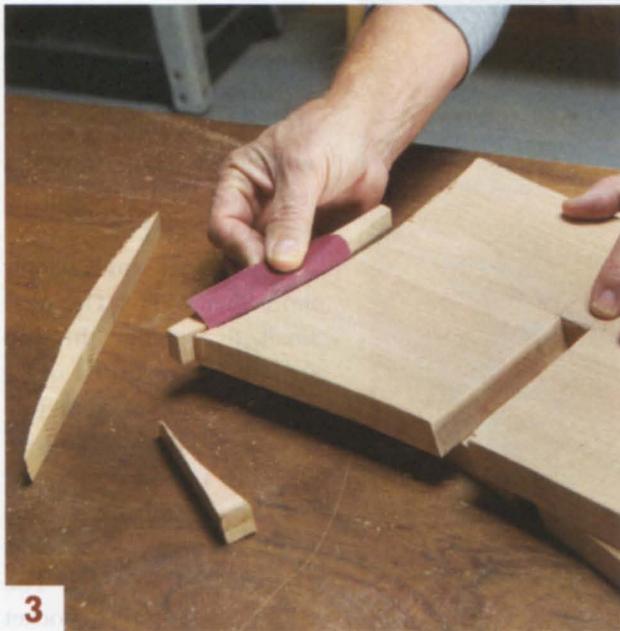
1

**Cut angled notches** in both boards. Note that the notches slant in the same direction.



2

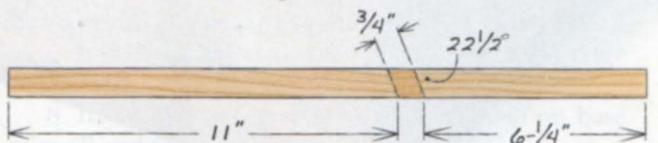
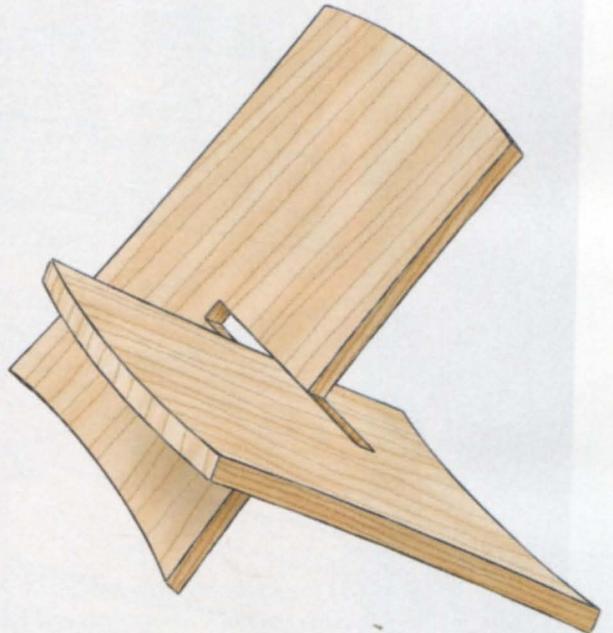
**Flex a thin piece of metal** or wood to mark curves on all four sides.



3

**Wrap sandpaper** around one of the cutoffs to smooth the edges.

**Fig. A Exploded View and Side View**



This and 40 more clever, easy-to-build woodworking projects are featured in Spike Carlsen's upcoming book, *Ridiculously Simple Furniture Projects*. Spike is also the author of *A Splintered History of Wood*. For more information, go to [AmericanWoodworker.com/AWBookstore](http://AmericanWoodworker.com/AWBookstore).

# Ginormous Shop Cabinet

26 drawers for tools and supplies.

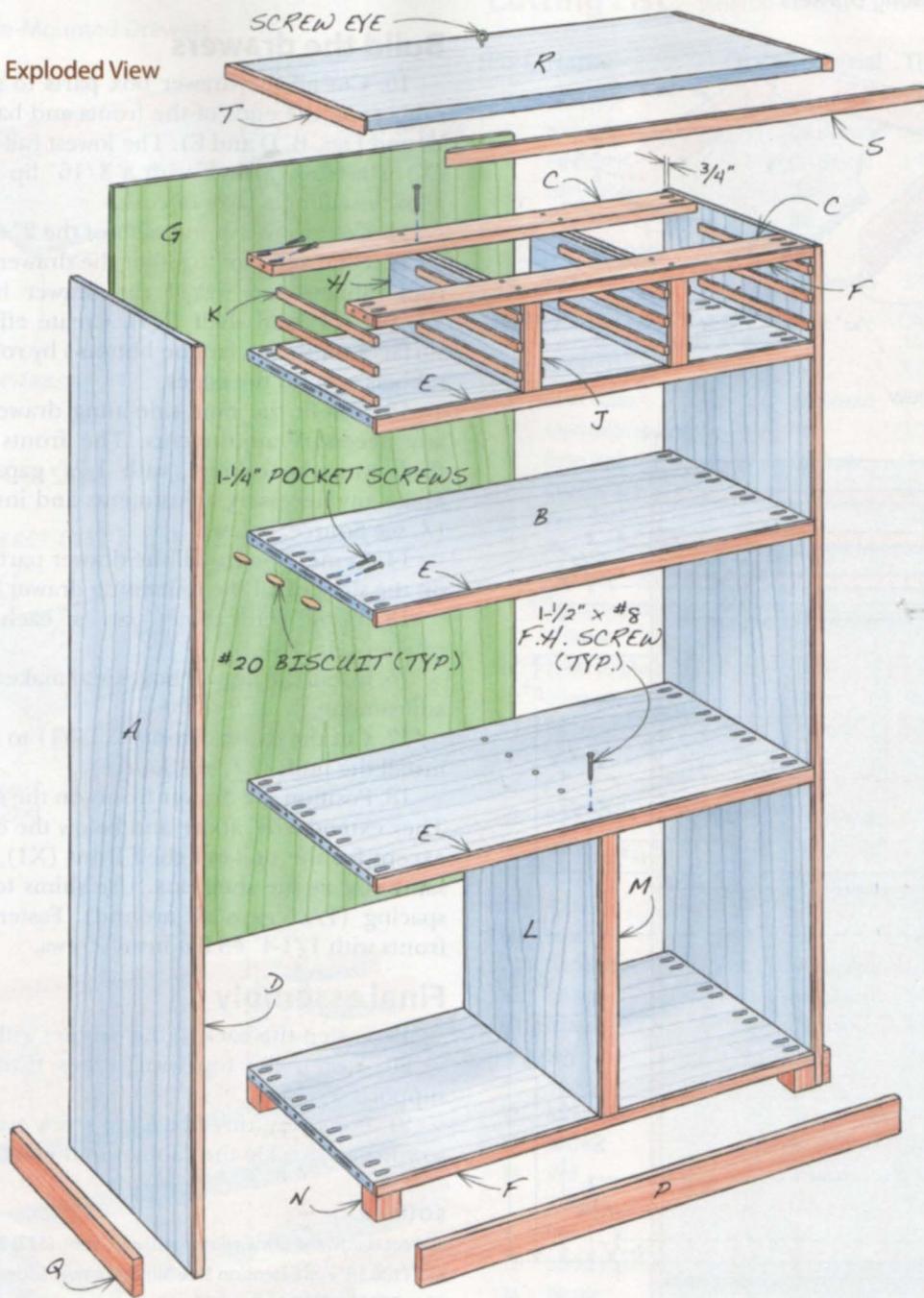
by Dr. Warren Kragt



**MY BEAT-UP** garage-sale seven-drawer metal tool cabinet was an eyesore. I wanted something bigger and better, but mostly I wanted something that looked like it belonged in a woodworking shop. Online I found a wooden version that fit the bill, but at \$5,000 it was far too expensive. After calculating that I could build a bigger and better cabinet for a lot less, I decided it would be my next project.

My cabinet stands slightly more than 5' tall. The nine small drawers at the top are side-hung. All the other drawers are mounted on full-extension slides (see Source, page 60). The narrow drawer just above the bank of side-by-side drawers is actually a handy pull-out shelf. The joinery is simple—pocket screws, biscuits, half-laps and rabbets—but the results are rock-solid. You could easily reconfigure this cabinet to suit your needs. Replace a bank of drawers with doors, for example, or reduce the overall size.

**Fig. A Exploded View**



## Build the cabinet

1. Cut the sides, horizontal dividers and top supports (A-C, Fig. A, above) to final size after gluing on their edgebands (D-F). Note the different edge band widths.

2. Assemble the sides, dividers and supports with pocket screws, biscuits and glue (Fig. C, page 60). Temporarily install the back (G) to keep the assembly square.

3. Glue together two pieces of plywood to create the upper dividers (H). Install shims between the pieces to match the 1-1/2" width of the edge band (J). Glue on the edge bands. Then cut the assemblies to final dimension.

4. Fasten drawer supports (K) to both sides of the dividers and to the cabinet sides. Use 7/8" and 1-1/2" spacers to position the supports.

5. Install the upper dividers with screws and glue.

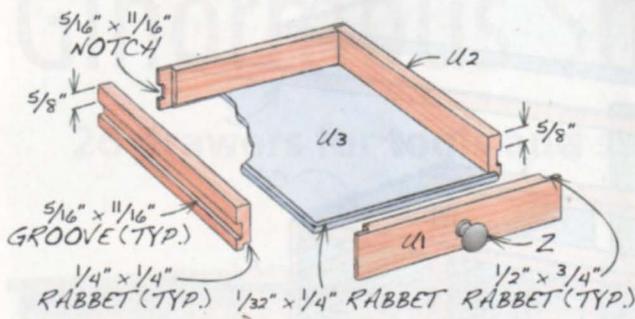
6. Glue together two pieces of plywood (with shims between) to create the lower divider (L).

7. Install the lower divider. Then glue on its edge band (M).

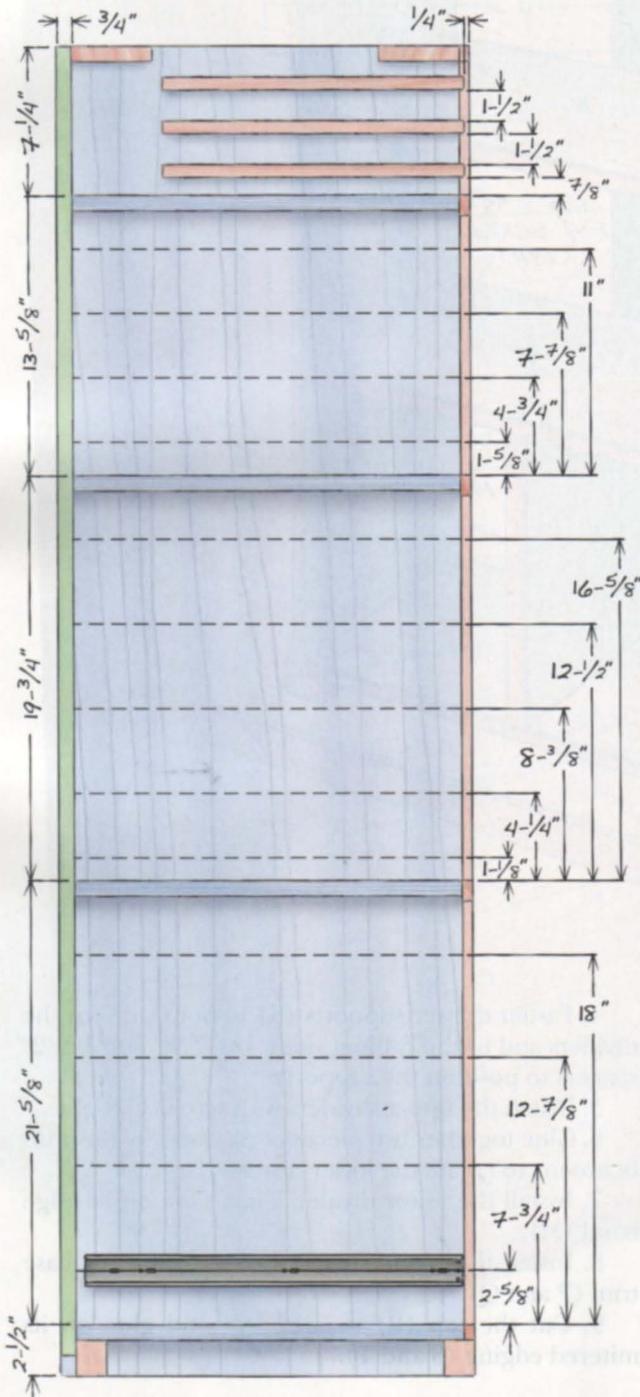
8. Install the corner blocks (N) and glue on base trim (P and Q).

9. Cut the top (R) to final size and glue on its mitered edging (S and T).

**Fig. B Side-Hung Drawers**



**Fig. C Side View**



## Build the drawers

10. Cut all the drawer box parts to size and rout rabbets on the ends of the fronts and backs (U1, V2-Y2 and Figs. B, D and E). The lowest full-width drawer (X) is actually a shelf with a 3/16" lip at the top to allow installing a layer of cork.

11. Cut grooves in the sides of the 2" drawers (U2).

12. Glue and nail together the drawer boxes. Then rout rabbets and install the drawer bottoms (U3, V4, W4, Y4) and shelf (X4). Create effective gluing surfaces on the melamine bottoms by routing shallow rabbets around the edges.

13. Test-fit the nine side-hung drawers and make any necessary adjustments. The fronts should stop flush with the cabinet, with 1/8" gaps all around. Make any necessary adjustments and install the pulls (Z, see Source, below).

14. Center and install the drawer part of each slide on the sides of all the remaining drawer boxes.

15. Install the cabinet part of each slide in the cabinet (Fig. C).

16. Install the drawer boxes and make any necessary adjustments.

17. Cut the drawer fronts (V1-Y1) to final size and install the pulls (ZZ, see Source).

18. Position the drawer fronts on the drawer boxes. They extend 3/8" above and below the drawer boxes, except for the pull-out shelf front (X1), which is the same size as the shelf box. Use shims to create even spacing (1/8" gaps all around). Fasten the drawer fronts with 1/1-4" #8 flat head screws.

## Final assembly

19. Fasten the back to the cabinet with screws.

20. Fasten the top with screws through the top supports. [WhereWeShare.com](http://WhereWeShare.com)

21. For safety, thread a large screw eye into the top so you can shackle the cabinet to the wall. 🛠️

## SOURCE

eDirect Hardware, [www.edirecthardware.com](http://www.edirecthardware.com), (877) 281-7905, KVT100 18" Full Extension Side Mount Drawer Slide, 100 lb, #641-TT100-18, \$8.25/pair, (13 pair req.); Amerock Dull Chrome Wire Pull, #639-76312CS-26D, \$1.09 each, (26 req.); Amerock Dull Chrome 1-1/4" dia. Knob, #639-1950-26D, \$3.57 each (9 req.).

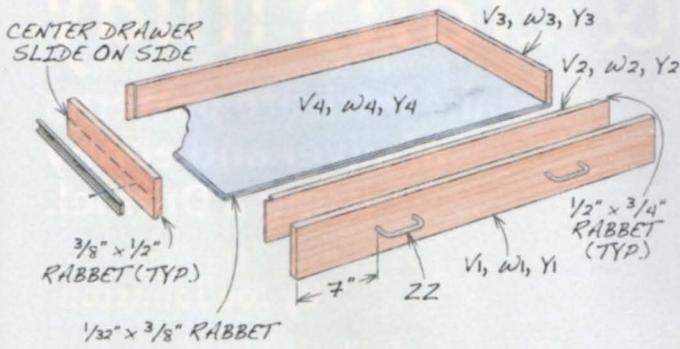


### Dr. Warren Kragt

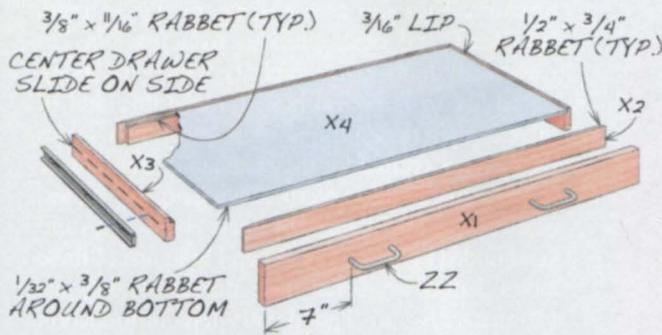
operates a private chiropractic practice in Ritzville, WA, where he's also vice chair of the school board, a Lions club member and a youth league umpire. In addition to woodworking

and remodeling, his hobbies include golf, boating, skiing, auctioneering and model railroading.

**Fig. D Slide-Mounted Drawers**



**Fig. E Pull-Out Shelf**



Part Name	Qty.	Material	Th x W x L
A Cabinet side	2	Oak plywood	3/4" x 20" x 64-3/4"
B Horizontal divider	4	Oak plywood	3/4" x 19-1/4" x 39-3/4"
C Top support	2	Oak plywood	3/4" x 4" x 39-3/4"
D Side edgeband	2	Oak	3/4" x 1/2" x 64-3/4"
E 1" edgeband	3	Oak	1/2" x 1" x 39-3/4"
F 3/4" edgeband	2	Oak	3/4" x 3/4" x 39-3/4"
G Back	1	Oak plywood	3/4" x 39-3/4" x 63-3/4"
H Upper divider	2	Oak	1-1/2" x 6-1/2" x 20" (a)
J Upper divider edgeband	2	Oak	1/2" x 1-1/2" x 6-1/2"
K Drawer support	18	Oak	3/8" x 5/8" x 15"
L Lower divider	1	Oak plywood	1-1/2" x 20-7/8" x 19-1/4" (a)
M Lower divider edgeband	1	Oak	1/2" x 1-1/2" x 20-5/8"
N Corner block	4	Oak/Poplar	2" x 2" x 1-3/4"
P Base trim front	1	Oak	3/4" x 2-1/2" x 42-3/4"
Q Base trim return	2	Oak	3/4" x 2-1/2" x 20-1/2"
R Top	1	Oak plywood	3/4" x 20-1/2" x 41-1/4"
S Top edging front	1	Oak	3/4" x 3/4" x 42-3/4" (b)
T Top edging return	2	Oak	3/4" x 3/4" x 21-1/4" (c)
U 2" Drawer	9	Oak	2" x 12-1/8" x 15-1/2"
U1 Drawer front/back	18	Oak	3/4" x 2" x 12-1/8" (d)
U2 Drawer side	18	Oak	3/4" x 2" x 15" (e)
U3 Bottom	9	Melamine	1/4" x 11-1/8" x 14-1/2" (f)
V 3" Drawer	4	Oak	3" x 39-1/2" x 18-3/4"
V1 Front	4	Oak	3/4" x 3" x 39-1/2"
V2 Box front/back	8	Birch plywood	3/4" x 2-1/4" x 38-3/4" (g)
V3 Box side	8	Birch plywood	3/4" x 2-1/4" x 17-1/2" (h)
V4 Bottom	4	Melamine	1/2" x 38" x 17-1/4" (j)
W 4" Drawer	4	Oak	4" x 39-1/2" x 18-3/4"
W1 Front	4	Oak	3/4" x 4" x 39-1/2"
W2 Box front/back	8	Birch plywood	3/4" x 3-1/4" x 38-3/4" (g)
W3 Box side	8	Birch plywood	3/4" x 3-1/4" x 17-1/2" (h)
W4 Bottom	4	Melamine	1/2" x 38" x 17-1/4" (j)
X Shelf	1	Oak	2" x 39-1/2" x 18-3/4"
X1 Front	1	Oak	3/4" x 2" x 39-1/2"
X2 Box front/back	2	Birch plywood	3/4" x 1-13/16" x 38-3/4" (k)
X3 Box side	2	Birch plywood	3/4" x 1-13/16" x 17-1/2" (l)
X4 Shelf	1	Melamine	1/2" x 38" x 17-1/4" (m)
Y 5" Drawer	8	Oak	5" x 18-7/8" x 18-3/4"
Y1 Front	8	Oak	3/4" x 5" x 18-7/8"
Y2 Box front/back	16	Birch plywood	3/4" x 4-1/4" x 18-1/8" (g)
Y3 Box side	16	Birch plywood	3/4" x 4-1/4" x 17-1/2" (h)
Y4 Bottom	8	Melamine	1/2" x 17-3/8" x 17-1/4" (j)
Z Knob	9	Dull chrome	1-1/4" dia.
ZZ Pull	26	Dull chrome	3" C-C

**Notes:**

- a) Glue two 3/4" pieces together with shims between to achieve 1-1/2" thickness.
- b) Both ends mitered.
- c) One end mitered.
- d) 1/2" x 3/4" rabbets on both ends; 1/4" x 1/4" rabbet for bottom.
- e) 5/16" x 11/16" groove for drawer guide; 1/4" x 1/4" rabbet for bottom.
- f) 1/32" x 1/4" rabbet around top edge.
- g) 1/2" x 3/4" rabbets on both ends; 3/8" x 1/2" rabbet for bottom.
- h) 3/8" x 1/2" rabbet for bottom.
- j) 1/32" x 3/8" rabbet around top edge.
- k) 1/2" x 3/4" rabbets on both ends; 3/8" x 11/16" rabbet for shelf.
- l) 3/8" x 11/16" rabbet for shelf.
- m) 1/32" x 3/8" rabbet around bottom edge.

# Arts & Crafts Inlay

Make intricate patterns of silver and ebony using a Dremel.

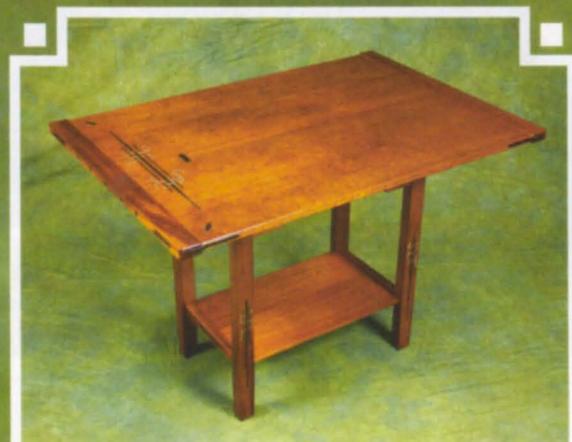
by Joe Johnston

**Ebony and silver**—black and white—are a stunning combination. The architects Charles and Henry Greene, masters of Arts & Crafts detail, used these materials to create intricate inlay for their furniture. They also used abalone, mother of pearl, lapis lazuli and other precious materials; but I'm particularly drawn to the simplicity of silver and ebony.

I'd like to show you how to make this kind of inlay using a design found on a set of three tables the Greenes created for the Freeman A. Ford house in Pasadena. In this pattern, flowing organic "vines" of silver wire are balanced by linear ebony strips and surrounded by silver dots. When I built one of these tables, I discovered that these designs—using just two materials—are a good entry-level introduction to the world of Arts & Crafts inlay. I'll be showing you how to make the inlay on one of the table's legs.

This inlay may look quite complicated at first glance, but the techniques used to make it are very simple. To create the recesses for the inlay, you'll need a Dremel rotary tool with a plunge base and a few small bits. You don't need much material—just a couple of pieces of jeweler's silver wire and a little bit of ebony (see Sources, pages 66).

I traced this design from a drawing by Charles Greene, but you shouldn't be limited by his patterns. Once you've seen how the technique works, you can create your own ebony and silver inlay design and add a unique touch to any special project, like a jewelry box or picture frame.



## Draw the pattern

Work with loose pieces of your project, before they're glued together. Trace the inlay's pattern (Fig. A) using dressmaker's tracing paper (Photo 1). This paper comes in several colors; blue shows well on mahogany. You could also use black carbon paper, but the lines may be hard to see on dark woods. Trace the entire pattern all at once.

## Rout the curves

I use dead-soft round Argentium silver wire for the vine inlay. It's sold by the foot (see Sources). I ordered 4' of 14 ga. wire and 8' of 16 ga. wire for all of the inlay on this table.

The easiest way to cut grooves for the wire is to use a Dremel with a plunge base, routing freehand (Photo 2). You could also carve grooves by hand using narrow carving chisels, which is probably how the original inlay was made.

If you use a Dremel, you'll need an appropriately sized end mill with a 1/8" shank (see Sources). The goal is to make the groove slightly narrower than the wire. I use 16 ga. wire for the vine sections of the inlay, which requires a 3/64" end mill. Rout or carve the curves to a depth of 1/16".

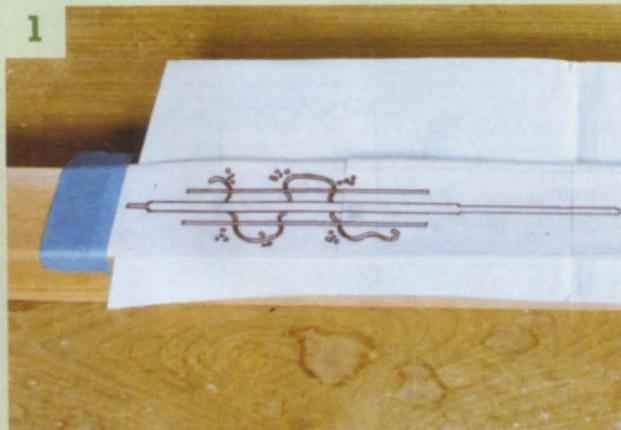
## Rout the strips

Use the Dremel to rout the stopped grooves for the ebony strips (Photo 3). You'll need 1/16", 3/32" and 1/8" dia. end mills with 1/8" shanks. If the groove you want to make is wider than one of your end mills, cut the groove in two passes.

Use a fence to ensure that the grooves are straight and parallel to the edge. Rout the grooves 1/8" deep. Square the ends of the grooves with a small chisel.

The center strip in this pattern steps down in width at both ends. You'll create this shape by using all three bits. Start with the 1/16" bit first, to make the narrowest groove. Rout the full length of the entire strip. Remove this bit from your router and install the 3/32" bit. Without changing the fence setting, rout a shorter groove for the middle-width step on the bottom end of the pattern. Finally, rout the widest groove using a 1/8" bit. This process keeps all the grooves centered, so the steps between the strips will be equal on both sides.

**Trace the inlay's pattern** onto the wood using blue dressmaker's tracing paper.



**Rout or carve the curved lines** of the pattern using a very small bit. These grooves will receive a silver wire inlay.



**Rout the straight lines** in the pattern using a fence. I use a Dremel rotary tool mounted in a plunge base.



**Drill small holes** to create the dots in the pattern. Some of the holes are angled to make an oblong shape.

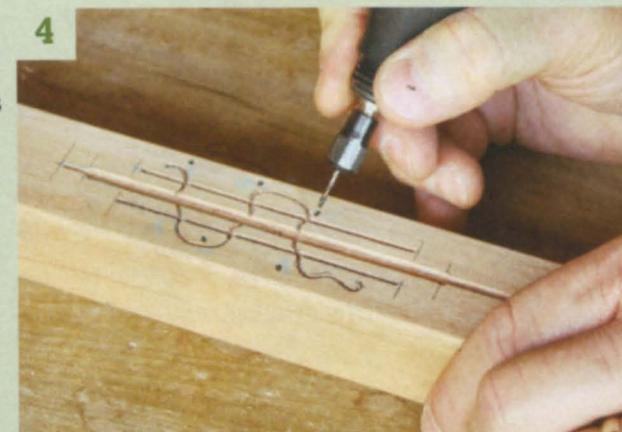
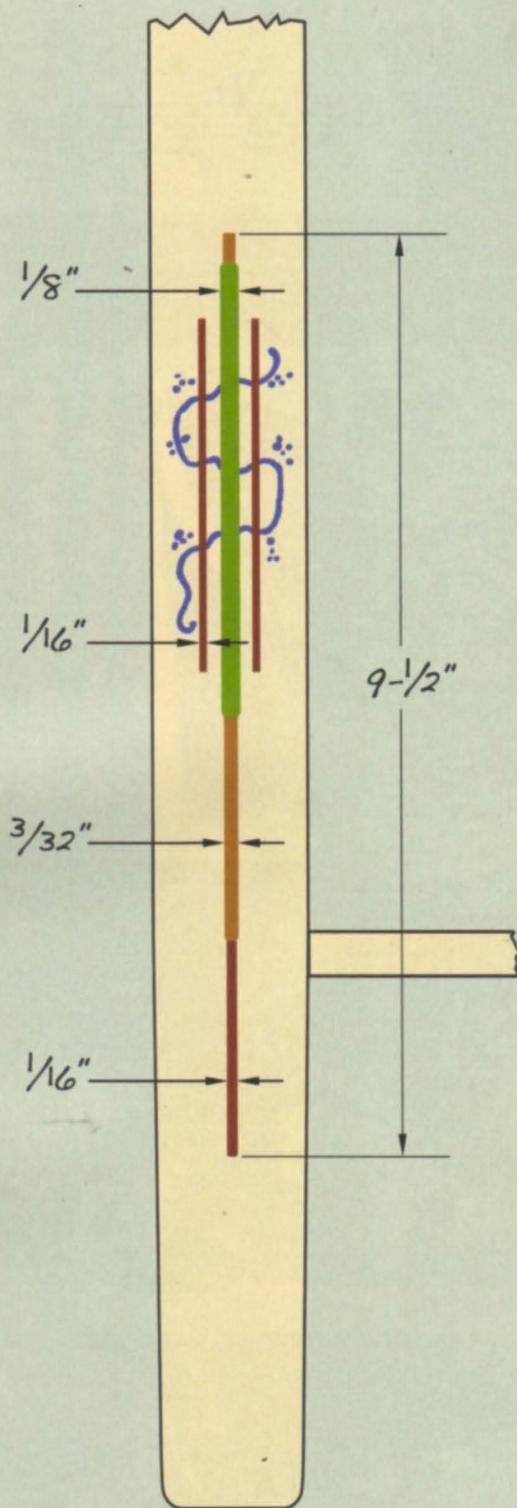


Fig. A Greene and Greene Leg Inlay Pattern



Learn more about Greene and Greene Furniture at [AmericanWoodworker.com/WebExtras](http://AmericanWoodworker.com/WebExtras)

## Drill the dots

Use 14 and 16 ga. wire for the round dots that are sprinkled around the vines. Make holes for the dots using miniature-sized drill bits in the Dremel (**Photo 4**, see Sources). Some of the dots in the pattern are oblong; create these holes by angling the bit.

## Install the vines

Glue in all the silver wire pieces before adding the ebony strips. You'll file and sand the wire so that it will be slightly lower than the ebony, so it's best not to have any ebony in the way.

To try out the process and avoid wasting silver, I highly recommend making a small sample inlay on a piece of scrap. Copy part of the actual pattern in order to practice making the bends used in the design.

Before cutting the wire into short lengths, fold a piece of 220 grit sandpaper in half and pull each piece of wire through the sandpaper. Roughing up the wire will help the glue stick to it.

Pre-bend the silver wire to fit each groove (**Photo 5**). The wire is too stiff to bend with your fingers; use needle-nose pliers instead. Cut the wire with diagonal pliers. If one end of a vine runs into one of the straight grooves, cut the wire a bit extra-long, so that it extends into the groove. You'll trim off the extra length later on. Sand and polish the ends of the wires that don't terminate in a groove.

Next, apply a coat of wax resist to the face of the workpiece. This prevents any glue from becoming embedded in the wood, which will spoil the finish. I use Waxilit (see Sources), but you could also use a silicone-free wax, such as Johnson's Paste Wax. Avoid getting wax in the inlay grooves; glue won't adhere to it.

You're ready to install the wire. First, drip a small amount of thick cyanoacrylate (CA) glue into one of the grooves (see Sources). I've found that CA glue works better than 5-min. epoxy—it sets faster and seems to stick better—but you must work fast; CA glue sets up almost immediately. Place the wire in the groove, then lightly tap the wire with a block and hammer (**Photo 6**).

Shorten the ends of the wire that extend into the straight grooves using a rotary diamond-impregnated disk chucked into a cordless drill (**Photo 7**, see Sources). Run the drill at low speed

to avoid generating too much heat. Silver wire is an excellent conductor and heats up very rapidly. Overheating the wire will burn the wood or cause the glue to let go.

## Install the dots

To make the dots, apply a drop of CA glue to the end of a length of wire. Embed the wire into a hole (**Photo 8**). After the glue sets, snip off the wire about 1/8" above the surface. Repeat this process until all the holes are filled.

## File, sand and polish

Next, file the ends of the dots so they're about 1/64" or so proud of the wood's surface (**Photo 9**). Protect adjacent pieces of wire and wood with a layer of blue painter's tape. The vine pieces should be about 1/64" high, too. If any are too tall, file them as well.

Leaving the tape in place, start sanding all of the silver wire with 220 grit paper. Continue up to 600 grit. Sand across the vines, rather than along their length. The goal is to round over the wire, not flatten it. After the 600-grit sanding, remove the tape and use a nonwoven abrasive, such as Mirlon, to remove any scratches from the silver's surface (see Sources). I buy Mirlon in a pack that contains three grits, and use all three.

After sanding and polishing, blow off the wood with compressed air to remove any silver dust. Lightly clean the wood with mineral spirits to remove the wax resist. When you're done, look closely into the wood's pores to ensure there are no small filings of silver left behind (they'll produce shiny spots under a finish).

## Make ebony strips

Make the strips using your tablesaw (**Photo 10**). I use a thin-kerf blade (see Sources) and a zero-clearance insert. To prevent binding, I've added a splitter into the insert's slot (see Sources). Start with 3/4" thick stock that's at least 12" long and rip strips that are about .001" thicker than the grooves they'll fit into. Rip extra pieces of each thickness—you may need them.

Next, rip the strips 1/4" wide. At this width, they'll be much easier to handle and install and less prone to breakage. Use sandpaper to taper the sides of each strip. Tapering makes the strips easier to start in the grooves.

**Pre-bend and cut** the silver wire with needle-nose pliers to fit the pattern. Put a small amount of thick CA glue into one of the grooves.



**Tap the wire** into its groove using a block and hammer.



**Grind the ends** of the wire flush with the grooves using a diamond cutoff wheel.



**Glue the end** of a short piece of wire in each hole, then snip the wire off about 1/8" above the surface.





9

**File down the ends** of the wire. Protect the wood with tape.



10

**Saw ebony strips** that are slightly thicker than the grooves. Taper their sides using sandpaper.



11

**Glue the strips** in the grooves. With a tapered fit, the strips must be tapped in place.



12

**Plane the strips** down to within 1/32" of the surface. Sand them with fine paper until the ebony glows like the silver wire.

Cut the strips to length using a fine-tooth hand saw, such as a Japanese Dozuki, and glue them into the grooves (**Photo 11**). For the stepped grooves, start with the outer (narrowest) pieces first. Cut them to length and glue them in place. Work your way from the ends to the center, cutting and gluing pieces as you go. Bevel the ends of each step with sandpaper, so they appear rounded.

Once the glue is dry, place tape around the strips to protect the surrounding wood and silver. Level the strips with a block plane (**Photo 12**). Plane until the strips are within 1/32" of the surface—slightly higher than the silver.

Sand the strips by hand. Go perpendicular to their direction to create a humped shape, as you did with the vines. Start with 220 grit paper and continue up to 600 grit. Finish with Mirlon, again using all three grits. Like the silver, ebony will take a very high polish. They're made for each other!



## Joe Johnston

is an avid woodworker in the Bay area with twenty-five years of experience building furniture.

Since 2007, Joe has pursued a passion for the Greene and Greene aesthetic.

## SOURCES

- American Carbide, American-Carbide.com, (781) 582-8093, 1/16" end mill, #129600, \$7.14; 3/32" end mill, #129622, \$6.49; 1/8" end mill, #129644, \$6.23; 3/64" end mill, #129589, #7.16.
- Dremel, www.dremel.com, (800) 437-3635, Plunge Router Attachment for Dremel rotary tool (edge guide included), #335-01, \$30.45;
- Drill bit set, #628-01, \$12.10, Diamond Wheel and mandrel, #545, #21.10.
- Freud, www.freudtools.com, (800) 334-4107, Thin Kerf Combination Blade, LU83R, \$60.
- Lee Valley, www.leevalley.com, (800) 871-8158, Waxlilt, #56Z99.61, \$14.90 for 7 oz.
- MicroJig, www.microjig.com, (407) 696-6695, Thin Kerf M J Splitter, #SP-0100TK, \$24.95.
- Rio Grande, www.riogrande.com, (800) 545-6566, Round Argentium dead soft silver wire, 14 ga., #103314; 16 ga., #103316.
- Rockler, www.rockler.com, (800) 279-4441, 3/4" Thick Gaboon Ebony, #84583, \$70/sq. ft.
- Titebond, www.titebond.com, (800) 669-4583, Instant Bond CA Adhesive—Thick, \$10/2 oz.
- Woodcraft Supply, www.woodcraft.com, (800) 225-1153, Mirlon Assorted Grit 3 Pack, #148880, \$6.79.

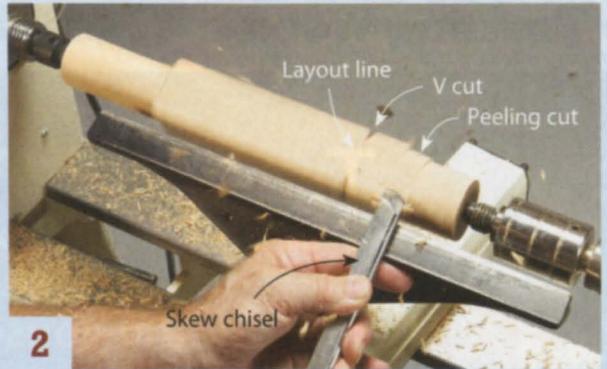
# Turned Door Stop

Perfect for the house that has everything.

**TAKE THE HUMBLE RUBBER DOORSTOP—PLEASE!** Then head to your lathe and create something that you can't buy in a store—a doorstop that looks as great as it works. In addition to creating a functional item and a unique gift, this simple project provides an excellent opportunity to practice the art of creating pommels (a pommel is any part of a spindle turning that's left square). Disaster lurks at the end of a pommel, where the turning changes from round to square, because one wrong move can cause ruinous splintering. That's why artfully making the transition is an important technique to master. As each blank produces two doorstops, you'll be able to practice creating pommels in both directions with every blank.



**1** Divide the blank into three parts. Only the end portions will be turned, as each blank contains two doorstops. The pommel will be cut diagonally to create the wedge-shaped stops.



**2** Rough out the pommel with the skew chisel, alternating between shallow V cuts made slightly outside the layout lines and peeling cuts used to round the ends.



**3** Square each pommel shoulder after rounding the ends, by cutting in at the layout line, using the skew with its long point down.



**4** Round the pommel shoulders in stages by making successive rolling cuts with the skew (long point down) or the detail/spindle gouge.

Doorstops take a real beating, so use tough wood; oak, maple, cherry and walnut all work well. A 12" long by 1-1/2" to 1-3/4" square blank is a good size to start with, although the pitch of the stop's wedge and its overall length will often be dictated by the gap under the door.

A parting tool, a skew chisel and a detail gouge are the only turning tools you'll need. A bandsaw and a stationary belt sander are desirable, but not absolutely necessary—a handsaw and a sanding disc mounted on the lathe also work quite well. Add a straightedge, a square, an awl and a pencil and you're ready to go.

1. Square the blank using a tablesaw or planer and remove any milling marks by sanding.

2. Create centered mounting holes on both ends of the blanks. Carefully scribe from corner to corner using the straightedge and the awl. Push in with the awl where the two lines intersect to make the holes.

3. Mount the blank, making sure that both lathe centers are in the mounting holes.

4. Both ends will be turned into knobs, so measure about 2-1/2" in from the ends and mark a line at both points (Photo 1). The area between the lines (the

pommel) will be left square. Marking all four faces makes the lines easier to see when the workpiece is spinning. Use a white or yellow pencil if the blank is a dark-colored wood.

5. Start the turning process by creating square shoulders on the ends of the pommel. Creating a clean square shoulder is one of the hardest parts of the entire process; so practicing on waste material is good preparation. Using the skew chisel long point down, make a series of V cuts slightly away from the lines, in the areas that will be turned into knobs. Because of the skew's bevel, the initial V cuts cannot go very deep. Instead, alternate between shallow V cuts and peeling down the turned end portions to create clearance (Photo 2). Go easy, as a peeling cut that goes deeper than the preceding V cut can splinter the pommel. When the end sections are nearly rounded, cut in a clean square shoulder right at the layout line (Photo 3). Square shoulders can also be created with a parting tool, but it's risky: Delicate cuts are necessary to avoid splintering the shoulders. Finish by truing the two rounded sections with the skew—make planing cuts moving from the outside end right up to the shoulder.



5

**Shape the knobs** with the detail/spindle gouge and the skew. The knobs don't have to match, because you're creating two separate doorstops. Ball or bulb shapes are easiest to grip.



6

**Cut diagonally across the pommel** to create two wedge-shaped doorstops. The sawn edges are the bottoms. Flatten them by sanding.



7

**Round the end** of each doorstop to reduce chipping and create a more graceful look.



8

**Keep the doorstops from slipping** on hardwood or tile floors by attaching a piece of foam or cork to the bottom. Trim the waste with a utility knife.

6. Use either the long point of the skew or a detail/spindle gouge to round over the pommels' shoulders (Photo 4). Rounded shoulders are much more durable than square ones, which are prone to splintering.

7. Shape the knobs (Photo 5). Turn the knob at the tailstock end first, to avoid working with a weak spot (the narrow neck) near the drive center. The knobs' concave and convex shapes can both be cut with the detail/spindle gouge, but a skew will leave a cleaner surface on the convex shapes. (Using the skew, though, requires more skill and practice.) Leave at least 1/4" waste at both ends for removing the mounting holes.

8. When you're happy with the knobs you've created, reduce the diameters at both ends. Then finish-sand to 220 grit.

9. Take the blank off the lathe and remove the waste at both ends with a small saw. Then finish-sand the ends by hand.

10. Mark one of the blank's flat pommel faces from corner to corner. Then saw this line to create two wedge-shaped doorstops (Photo 6). Sand their sawn faces flat.

11. Shape the end of each doorstop (Photo 7).

12. Use any finish you like—or none at all. Leave the bottom face unfinished if the doorstop will be used on wooden or tile floors, so you can glue on cork, foam or some other anti-slip material (Photo 8). Check out drawer or toolbox liners sold at home centers and hardware stores. The self-adhesive cork liner shown in the photo costs about \$8 for a 4' roll—that means you'll have plenty left over to upgrade your tool drawers. 🐿️



**Alan Lacer** is a woodturner, writer and instructor who lives near River Falls, WI. To see more of Alan's work, visit [www.alanlacer.com](http://www.alanlacer.com)



Learn how to turn perfect pommels at [AmericanWoodworker.com/WebExtras](http://AmericanWoodworker.com/WebExtras)



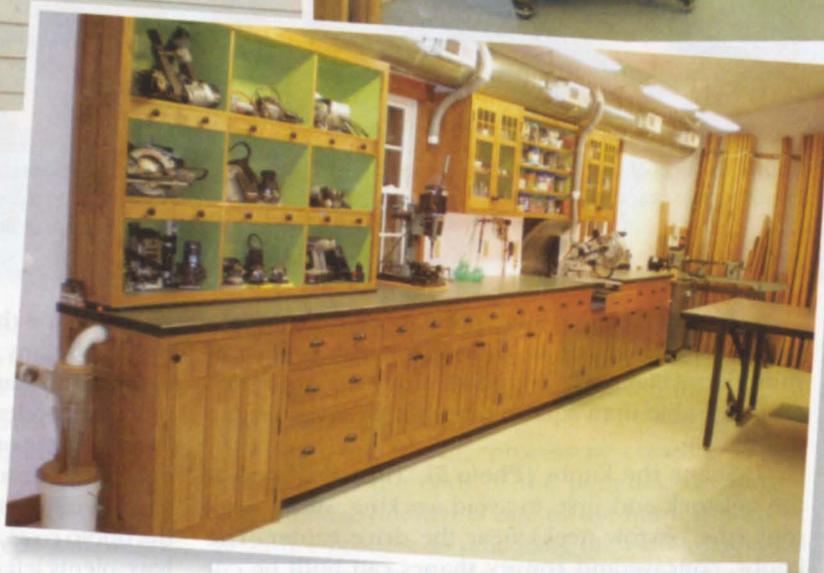
## Second-Story Shop

**BASEMENTS AREN'T RECOMMENDED** in this part of North Carolina, and our lot was too small for a detached shop. That meant my woodworking was either going to have to dodge cars in the garage—or I could turn the space above the garage into a shop.

As this was going to be my first real shop (my military career kept me moving from place to place), I wanted to do it right. To get the most out of the upper story, my builder and I had to rework the original house and garage plan. We added a third garage bay, reinforced and lowered the floor, relocated the stairwell and changed the gabled roofline to create a full 8' rear interior wall. We also added dormers and rear windows for natural light. All this added up to almost 900 sq. ft. of glorious shop space.

I solved the largest conundrum—how to get the heavy machinery and lumber into the shop—by designing a stow-away I-beam hoist that can lift almost anything up or down without assistance. Small items travel the old-fashioned way—I carry them up the stairs!

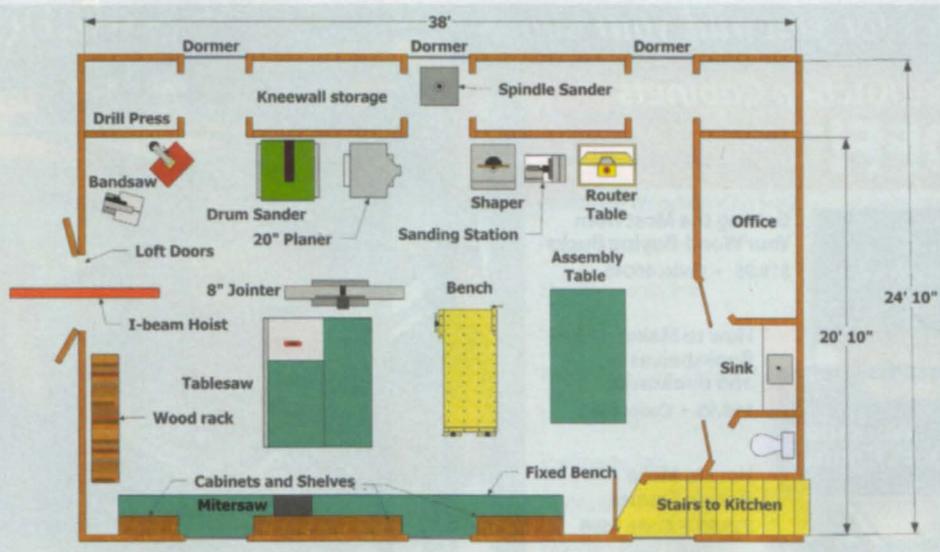
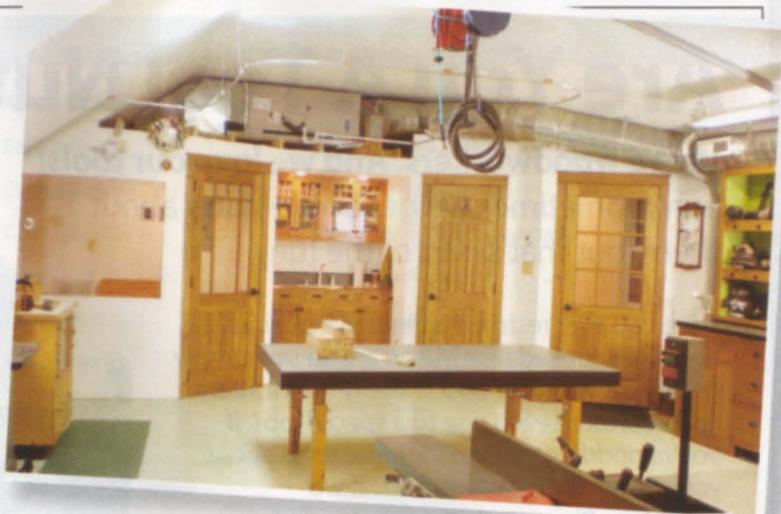
I took my time thinking through all aspects of shop construction, from wiring and plumbing to dust collection and tool layout. This includes storing my wood vertically to make access easier, building mobile bases to facilitate



tool set-up and running compressed air lines throughout. To increase efficiency, I've designed a fully automatic dust-collection system with self-actuated blast gates that open or close when each tool starts or stops. I designed and built all the shop cabinets using oak harvested from the lot before construction began. I also built my own adjustable-height workbench.

Now that I have a full complement of machine and hand tools, I'm able to tackle nearly any woodworking project. As evidenced by my shop cabinets, I have a special affinity for Arts and Crafts design. I've accepted a few commissions, but I primarily build furniture for my family and friends. I'm still tinkering and have just recently invented a new jig that I was fortunate enough to license to a respected U.S. manufacturer of woodworking accessories. With a little luck it will be on the market this fall. 🛠️

*Alan Schaffter  
Washington, North Carolina*



### Tell Us About Your Shop

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

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



See videos of Alan's adjustable-height workbench and automatic dust-collection system at [AmericanWoodworker.com/WebExtras](http://AmericanWoodworker.com/WebExtras)

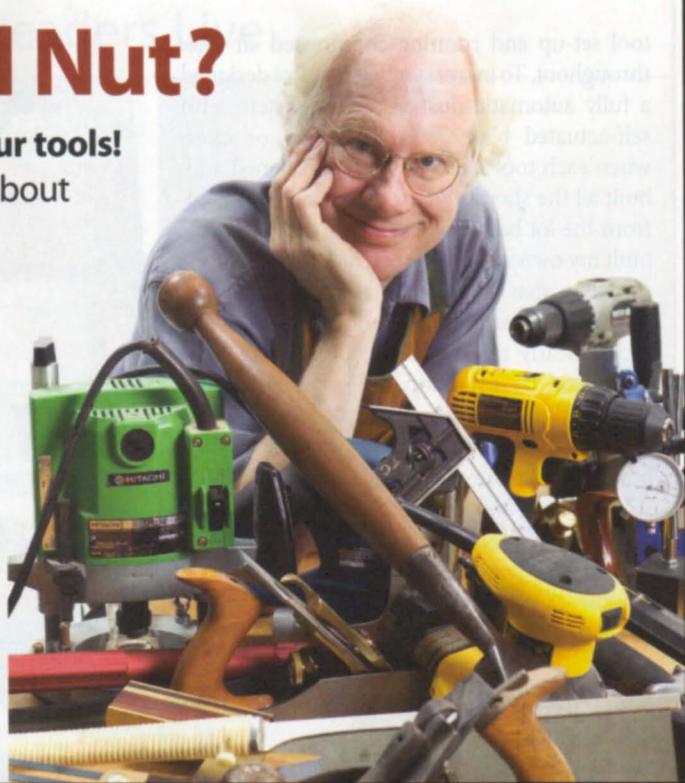
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E-mail your entry to [toolnut@AmericanWoodworker.com](mailto:toolnut@AmericanWoodworker.com) or write to us at The Tool Nut, American Woodworker magazine, 1285 Corporate Center Dr., Suite 180, Eagan MN 55121.

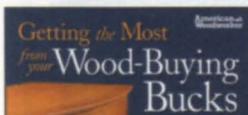


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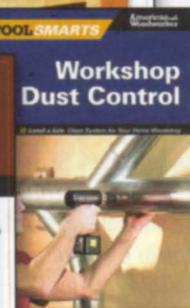
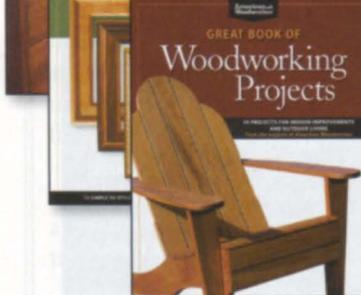
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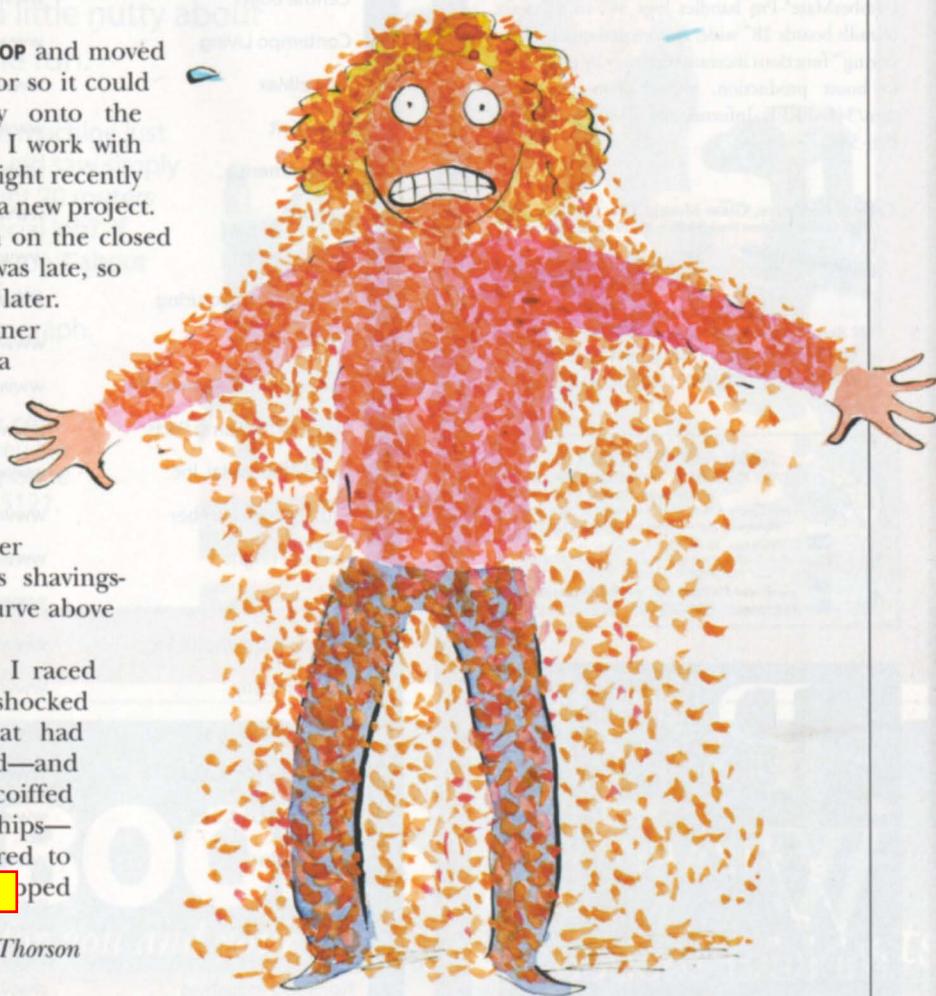
## Shavings Shower

**LAST SPRING I REORGANIZED MY SHOP** and moved my planer near the garage door so it could spew its shavings harmlessly onto the driveway. Now that it's colder, I work with the garage door closed. One night recently I planed a bunch of boards for a new project. Chips and shavings piled high on the closed door's horizontal ribs. But it was late, so I decided to clean up the mess later.

The next morning my partner started a new job. Wearing a favorite fuzzy sweater, she pushed the garage door opener and headed out through the garage to her car, which was parked outside. Unfortunately, she walked under the opening door just as its shavings-loaded section rounded the curve above her head.

Hearing a hideous shriek, I raced to the garage. There stood a shocked and disoriented creature that had just received an unexpected—and prickly—shower. Her perfectly coiffed hair was loaded with wood chips—but that was nothing compared to her [WhereWeShare.com](http://WhereWeShare.com)opped the shavings like a magnet.

*Jayne Thorson*



## Angle Tangle

**MY WIFE ASKED ME** to build a wall-mounted coat rack for the entryway in our new house. I bought a suitable board and four nice-looking spindles for the project. Then I carefully designed and built a jig that would allow drilling holes in the board at exactly 15° so the spindles would angle slightly.

I clamped the jig onto the drill press table and started drilling. The first two holes were perfect. But when I moved the board to drill the third hole, it bumped into

the tool cabinet that stood next to the drill press. No big deal. I turned the board around and drilled from the opposite end. It wasn't until I installed the spindles that I realized that the last two holes were drilled at opposite angles to the first two holes.

My dual-angle rack now hangs by the back door, where it remains a somewhat useful addition as well as a source of conversation and laughter.

*Gerry Saunders*



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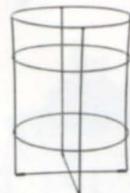


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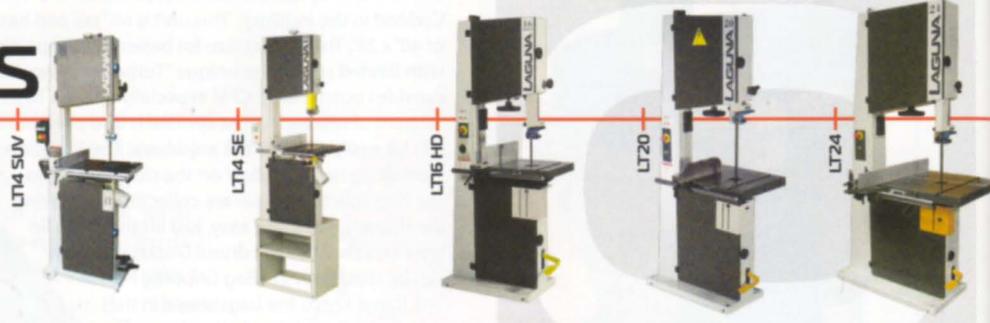
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# Ev·o·lu·tion

- noun: 1. any process of formation or growth

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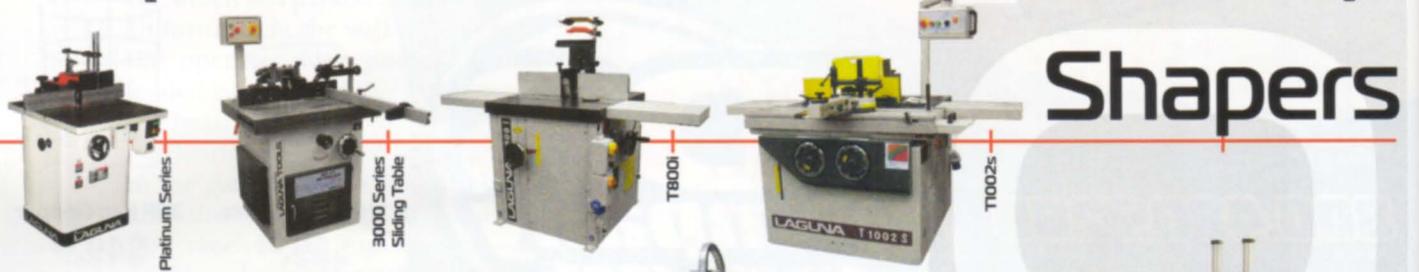
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