TODAY'S WOOD SCREW TECHNOLOGY: SURPRISING DETAILS (p. 44)

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Woodworker's Journal

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August 2015 Volume 39, Number 4

Projects

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The fact that you're reading this tells me that you love learning about woodworking. I'm guessing you may even get a little impatient waiting for the next issue of *Woodworker's Journal* to arrive. I get it. I'm a woodworker, too, and I'm always interested in hearing about the latest tools or looking for a new project to tackle. One of the best ways I've found to scratch that itch is by opening my weekly issue of the *Woodworker's Journal eZine*. It's filled with the latest tool updates, woodworker interviews, expert advice and project plans. And, it shows up in my email inbox every week for FREE!

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— Dan Cary

P.S. Know what else is online? Great deals like cool T-shirts!

Check out the new Woodworker's Journal T-shirts: three versions in two color choices — all with fun woodworking sayings. They are $14.99 at woodworkersjournal.com/store

Letters

Styling in the Shop!

IT'S T-SHIRT WEATHER!

Not everybody likes T-shirts, but most woodworkers I know wear them all the time. So, a while ago, in our eZine (*www.woodworkersjournal.com/ezine*) we hosted a contest asking for great woodworking sayings that would look good on a T-shirt. Now, I am pleased to announce, we have put those slogans on T-shirts with groovy-looking graphics and have them for sale on our website store. The slogans are:

"I came, I sawed, I conquered!"

"In this world, nothing is certain but death, taxes and wood movement"

And my personal favorite:

"Woodworker's Journal: Based in Minnesota for your protection."

For me, looking good while letting folks know that I am a woodworker: that's as good as it gets. And even though my significant other has given me a list of where I can wear (grocery store, out for a walk, yes) and where I can't wear (church, business meetings, fancy restaurants, no) my new duds, I can't wait until I see all the jealous looks as I walk through the lumberyard. If you are looking for a bit of sartorial splendor, see page 6 for more info. And if not, you'll just have to make up your own slogans!

— Rob Johnstone

Disapproves of Design

In Ernie Conover's article, "Carving Linenfold Panels" [April 2015], he commits two cardinal sins. The cabinet is built with flatsawn rails and stiles, and he carved the linenfold panels out of the same flatsawn lumber. The figure on the wood fights with the design, such that it's hard to read the design of the cabinet. There's a reason that rails and stiles are made with straight grain lumber, which is the same reason that carvers use wood with the least apparent grain: so you can read the design. Ernie's cabinet has a visual battle royal going on.

Barry Saltsberg
Plainview, New York

Framing Jig Upgrade

Although I originally built the "Framing Jig" which appeared in the April issue to handle mostly smaller frames, it will, as built, handle frame sizes up to 8½" x 15". I recently had the need to build a larger size frame and found the large adjustments using the star knob to be tedious. My solution was to turn the star knobs into

Continues on page 10 ...

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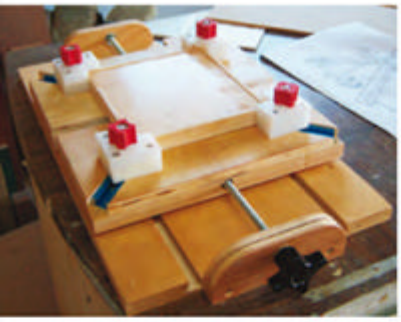


Raymond LaRochelle upgraded the adjustment system of his Framing Jig by adding a crank.

cranks using a dowel, a piece of HDPE plastic and a few bolts. To provide clearance for the crank, I added 1½"-high feet to the base. Large adjustments are now much faster than before.

Raymond LaRochelle
Livermore, California

Dead Nails a Clincher

I smiled when I read your trivia topic about deadening nails [*Did You Know*, April 2015]. My family was in the salvage business. Wood we salvaged had the dead nails removed. Dead nails really work: I have doors on my outbuildings that have nails that are bent dead. They are still solid with well over 100 years of use.

Dan Debenedetto,
Halfmoon, New York

If you were a carpenter in the Midwest where the majority of them were of German descent, the "dead nail" bent over was called "clinching."

Don Elenz
Sun City, Arizona

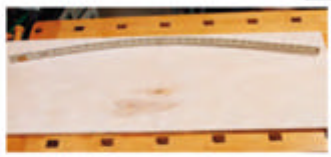
Article Solves Another

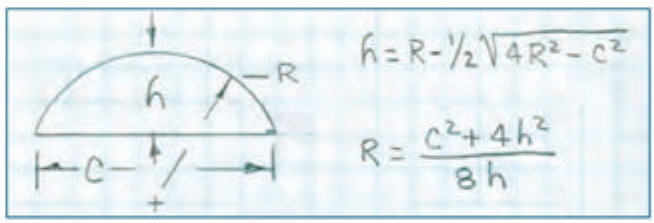
I just finished reading the April issue. The first thing that grabbed me was a letter from Paul Johnson and I quote, "One of the easiest things to do is find fault with someone else's design." That gave me a chuckle. But, in reality, it's usually followed by a refinement to the design. Then I read about Sandor Nagyszalanczy's "Mid-Century Coffee Table" project. I was impressed with his circle jig on the back patio. We woodworkers always have jigs, shop aids and template-making on the brain.

Later, I read about Larry Okrend's "Bowfront Hall Table." In looking at his curved layout using three nails and a metal straightedge, I then recalled Sandor's patio setup. I thought there must be a way to mathematically calculate any radius and then use the three-nail system for layout. Out came an old engineering book, and there are some relatively simple equations.

Mike Loveland
Edmond, Oklahoma

A reader's reaction to two articles in the April issue added up to a mathematical formula for calculating a radius.





In Mike Loveland's equation, C = the chord, R = the radius and h = the height distance between the chord and the radius.

Lock Miter Bit Routing

I enjoyed reading Michael Crow's "L. & J.G. Stickley-Inspired Settle" article [April]. It had some great tips on building in the Arts and Crafts style. However, when routing with a lock miter bit, Crow states that the cut must be completed in one pass. While it is true that you must not change the bit height between passes, you can certainly change the fence settings. I like to dial in my fence setting for a perfect lock miter. Then I add a 1/4" spacer to make the first pass. After that, I remove the spacer and complete the second pass. It makes much cleaner cuts, and it is perhaps easier on the router as well.

Willie Sandry
Camas, Washington

There's more online at woodworkersjournal.com

www.woodworkersjournal.com
MORE ON THE WEB

Check online for more content covering the articles below:

Woodturning (page 22): *Shoulder transition cuts on spindles with square spots (video)*

Picnic Table (page 28): *Using a circular saw to cut a slot normally done on a table saw (video)*

Greene and Greene Nightstand (page 38): *Using a vacuum bag system for laying up thick veneer (video)*

Today's Shop (page 44): *Improvements in wood screw technology (video)*

Tool Preview (page 52): *Overview of the Leigh RTJ400 Router Table Dovetail Jig (video)*

Small Shop Journal (page 54): *Using a routing jig to form lattices (video)*

Tricks of the Trade

Clever Tweaks to Improve Tools

Tested and photographed by Chris Marshall

Cardboard Stands Save Effort

It's tough to hold long pieces of quarter round molding for priming and painting, but recently I had 300 ft. of it to prepare for our new home. So, I used cardboard from our moving boxes to make four of these triangular stands, taped together, with V-notches cut along the top. The notches were shallow enough to hold the molding's curved edge "proud" for easy finishing.

Tom Kaye
Louisville, Kentucky

Simple Scribes are in the Cards

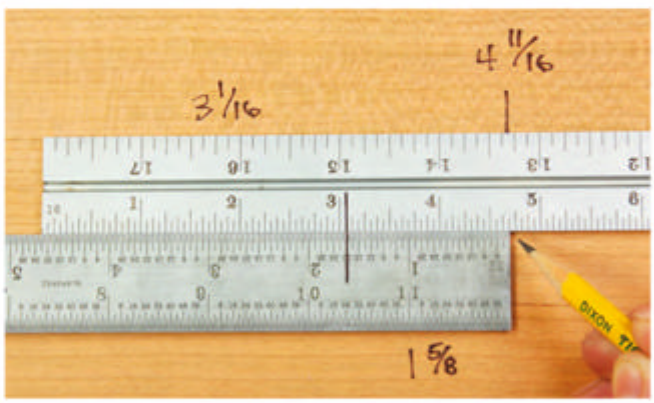
When I need to scribe an inside corner, two playing cards make it easy. I match the shape by overlapping the cards and fitting them around it, then holding them together with a few paper clips. Now I've got an exact template for scribing the mating workpiece.

Serge Duclos
Delson, Quebec

Bull's-eye Level Keeps Drilling on Target

Even though a drill press is best for drilling holes perpendicular to a workpiece, sometimes your only option is a hand drill. To help me drill more squarely, I attached an inexpensive bull's-eye level to the back of my drill with hook-and-loop tape. Thanks to this fix, I can get very close to drill press accuracy by keeping the bubble centered as I drill.

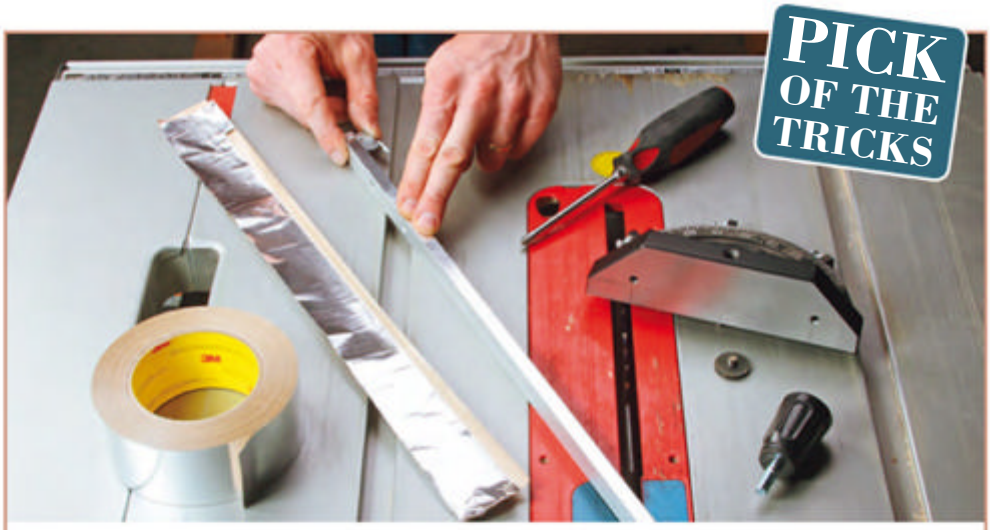
Bill Wells
Olympia, Washington



Two Rules Tackle Fractions

Here's an old carpenter's trick for solving fractions that works either with two tape measures or steel rules. If you need to add or subtract two fractional measurements, place the two side by side and align them according to the lengths that need to be added or subtracted. It doesn't matter if the denominators of the fractions match, because you're simply comparing two distances, not computing two fractions. For instance, in the photo here, $3\frac{1}{16}$" (top rule) + $1\frac{5}{8}$" (bottom rule) = $4\frac{11}{16}$". The ends of their overlaps tell you the sum. Subtract the same way: the end of the overlap minus one rule's length shows you the answer. No complicated math required.

Charles Mak
Calgary, Alberta



PICK OF THE TRICKS

Foil Tape Snugs Up Sloppy Miter Bar

My portable table saw suffered from a loose-fitting miter bar in the table slots, which made it inaccurate. So, I applied a couple of layers of metal foil HVAC tape along the edge of the miter bar to serve as shims. I was able to widen the bar just enough to allow for smooth, "slop" free action. If you try this trick, apply full-length strips and not short pieces, and use a utility knife rather than your best scissors to cut it. The metal tape will dull them.

Peter Moore
Oakland, California

In addition to our standard payment (below), Peter Moore of Oakland, California, will also receive a RIDGID 10" Dual Bevel Miter Saw (R4112) for being selected as the "Pick of the Tricks" winner. We pay from $100 to $200 for all tricks used. To join in the fun, send us your original, unpublished trick. Please include a photo or drawing if necessary. Submit your Tricks to Woodworker's Journal, Dept. T/T, P.O. Box 261, Medina, MN 55340. Or send us an email: tricks@woodworkersjournal.com

Safety First Learning how to operate power and hand tools is essential for developing safe woodworking practices. For purposes of clarity, necessary guards have been removed from equipment shown in our magazine. We in no way recommend using this equipment without safety guards and urge readers to strictly follow manufacturers' instructions and safety precautions.

Questions & Answers

Plane Answers

THIS ISSUE'S EXPERTS

Ian Kirby is the author of *Sharpening with Waterstones* and the DVD Sharpening Planes and Chisels.

Sandor Nagyszalanczy is a writer/photographer of several woodworking books and a frequent contributor to *Woodworker's Journal*.

Rod Burrow is quality assurance/customer service manager at RIKON Tools.

Contact us

by writing to "Q&A," Woodworker's Journal, 4365 Willow Drive, Medina, MN 55340, by faxing us at (763) 478-8396 or by emailing us at: QandA@woodworkersjournal.com

Please include your home address, phone number and email address (if you have one) with your question.

Our expert explains that to avoid plane marks in your workpiece, you need to sharpen your plane irons with a subtle curve.

Q I have run across the statement several times that the corner on bevel-up plane blades (irons) must be more pronounced than on bevel-down blades. What is the reasoning behind this?

R.E. Jones
Saginaw, Michigan

A The bodies of early planes were made of wood. The only metal involved was the blade assembly. It consisted of the iron and the cap iron. The cap iron has kept its name. Now most woodworkers refer to the "iron" as the blade.

If you sharpen a blade so that the sharp edge is absolutely straight and then use it to plane a piece of wood that is wider than the plane — say, a tabletop — you will take off a shaving that is the full width of the blade. This shaving will leave behind two steps on the surface, one at each side of the shallow groove you just cut. The height of the step is the thickness of the shaving — it's called a "plane mark." To avoid this, the blade is not sharpened straight but with a slight curve. The curve is visible if you hold the blade to the light and gently place a rule or a straightedge on it.

The amount of the curve is related to the thickness of the shavings you are going to remove. "Hogging" off the wood with thick shavings requires more curve than "cleaning up" when the shavings will be one or two thousandths of an inch thick. Making the curve is a matter of practice, and it's done with a few strokes on the fine stone at the end of the sharpening process. The goal is to create a curve that will make a shaving that is about 90% of the width of the blade.

Rounding the corners of the blade does not accomplish what the curved edge will give. The plane marks are still there, just a little less pronounced. Whether the plane is a low angle or a normal bench plane makes no difference — the blade is sharpened with a curve in the same way.

— Ian Kirby

Flooring tiles like Dri-Dek allow you to customize the areas you and your tools stand on in the shop.

Q I'm getting ready to retire in the coming months and am in a position to build an actual workshop for my woodworking toys instead of sharing with the garage. I know my wife would be happy to have a place to park her car out of the elements. My question: if I build a two-car garage, what should I use for flooring?

I know standing all the time on concrete is tiresome and can cause problems with leg issues that I would like to avoid, but are rubber mats the answer or should I consider something else?

Lee Nalley
Ellerslie, Georgia

A While you might want to discuss the relative merits — and costs — of installing a wood floor in your shop instead of a concrete one, you're correct in saying that rubber mats are the cheapest way to make concrete floors more comfortable to stand on. I find the 24" by 36" anti-fa-

Continues on page 16 ...

What's More Precious Than Silver or Gold?

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Stumpers

"No More Free Milk"

Or, "tough love, Old McDonald style"

What's This?

This mystery tool belongs to Mark Patrick of Ionia, Michigan. Do you know what it is? Send your answer to *stumpers@woodworkersjournal.com* or write to "Stumpers," Woodworker's Journal, 4365 Willow Drive, Medina, MN 55340 for a chance to win a prize!

Woodworker's Journal editor Joanna Werch Takes compiles each issue's Stumpers responses — and reads every one.

Lavern Zimmerman of Shiloh, Ohio, commented about the April issue mystery tool (from **Rick Kerns** of St. Joseph, Missouri): "I am very curious to know how many other people know what it is!"

Answer? 974. There's a lot of readers out there with a farm background (no word on whether they've seen Par-ee), plus a few "bovine veterinarians" like **Todd Plocher** of Salem, Ohio.

Grant Coffin of Black Hawk, South Dakota, said, "This device is called, locally, a blab." Other names, from **Syp Vander Dussen** of Chowchilla, California, include "a calf trainer, or a nose spider." "It is a weaning device for cattle," said **Carla Meyers** of Curtis, Nebraska.

"The round balls go into the calf's nostrils," explained **Jim Pease** of Waterville, Ohio. "You would tighten down the bolt to hold it snugly in place," added **Joe Robertson** of Chickasha, Oklahoma. "Additionally, a strap is attached to the eyelets," said **J.M. Ferguson** of Sweet Home, Oregon.

Pat McDonnell of Homer, Alaska, described its purpose as "tough love, Old McDonald style." "When the calf tries to nurse, the prongs prick the cow," said **Byron DeLong** of Ocqueoc, Michigan. **Keith Hodgin** of Coleridge, North Carolina, said the cow's reaction would be "evasive action," while **Larry Darrow** of Salina, Kansas, noted, "A few kicks from Mom, and the youngster learns that there is no more free milk."

It's not always "Mom": "Sometimes, you have a calf who thinks every cow around is a free meal," said **David Miller** of Mercer, Pennsylvania. Or, as **Dick Smith** of Leawood, Kansas, said, "Occasionally a cow would get the habit of drinking her own milk, straight from the source."

By the time the calf weaner is removed, said **Dean Budde** of Avon, Minnesota, the calf has "transformed its nourishment source to the green pastures surrounding him/her."

photo courtesy of SteerPlanet.com

Joe Price of Clinton, Mississippi, noted that modern versions of the April mystery tool are less aggressive.

Winner! Ricky Schlatter of Cochran, Georgia, wins a Hitachi 23-Ga. Pin Nailer (NP35A). We toss all the Stumpers letters into a hat to select a winner.

Questions & Answers

continued

tigue mats made for use in commercial kitchens and factories are just right for use in front of benches, stationary machines and workstations. For more complete floor coverage, you might consider installing interlocking rubber or plastic floor tiles typically sold as garage flooring. You can customize tile layout to cover all the areas of your shop where you walk and stand, yet save money by leaving the areas under machines, benches, cabinets, etc., uncovered. Tiles are reconfigurable, should your shop layout change in the future. There are two basic types of interlocking tiles: textured solid surface tiles (e.g., ModuTile workshop tiles) and mesh-style "open weave" tiles (e.g., Dri-Dek®).

Solid surface tiles provide a continuous, nonslip surface that's easier to clean but don't typically provide the same amount of cushioning that thicker mesh-style tiles do. Open mesh tiles allow spilled liquids or moisture seeping through the concrete to readily evaporate, but they also trap sawdust as well as accidentally dropped small parts and screws. However, you can usually vacuum the sawdust out — and recover lost parts — without having to disassemble the tiles.

— Sandor Nagyszalanczy

Q Like most band saws, mine has two speeds: 1,445 and 2,950. I've always been curious as to when it is most beneficial to use the slow speed. Is this a softwood/hardwood issue? I've always left my saw set

at the higher speed because I've never had the need to change it. I'm sure that there is a good reason for more than one speed or it wouldn't be there. Would you be so kind as to shed some light on this subject for me?

Edward Burns
Mount Holly, North Carolina

A Band saws with a two-speed option give workers and artisans alike the ability to introduce different types of material into their workpieces. It is suggested to use high speed for all wood cutting, especially if your saw is equipped with cast-iron wheels. The theory is to use the mass of the wheels to help the motor power the blade through rough cutting, such as resawing, without stalling.

The usefulness of a two-speed band saw is most prevalent at low speed. With proper blade selection, one can cut plastic, foam, composite and nonferrous materials. The best example is the ability to cut a Lexan sheet down to size to use as a window for a picture frame without melting or curling the edges. Another example is to cut brass strips to use as inlay in a coffee table.

— Rod Burrow

Winner!

For simply sending in his question on band saw speeds, Edward Burns of Mount Holly, North Carolina, wins a General International 7-piece Deluxe 8" Dado Blade Set (item 55-185). Each issue we toss new questions into a hat and draw a winner.

Shop Talk

Restoring Civil War Flag Frame

Below: Veterans Council Commander Bob Page posed, the week it was found, with the flag and frame meant to honor Solon A. Perkins (shown above).

photo courtesy of Richard P. Howe, Jr.

This rifle detail from the frame's left side is shown how it now looks after conservation treatment.

In January 2014, Steve Purtell and Gus Kanakis made a discovery at the Veterans Memorial Auditorium in Lowell, Massachusetts: a Civil War flag and carved frame.

Steve Purtell said, "We found the flag leaning behind a piano one day in basement storage and knew there was much more history behind this unique piece. I have never seen anything like it."

They brought it to the attention of the Greater Lowell Veterans Council, then under Commander Bob Page, which jumped into action to restore the flag and 73" wide x 54" high frame, bringing it to Camille Breeze of Museum Textile Services in Andover for the restoration of the flag itself and to Melissa Carr of Masterwork Conservation in Arlington for the restoration of the frame.

Whose Flag?

The story behind this flag began when 24-year-old Solon A. Perkins joined a cavalry unit, the Independent Battalion of Massachusetts, later becoming part of the Third Massachusetts Cavalry. Perkins was commissioned on February 20, 1862 and was killed in a skirmish on June 3, 1863 in Clinton, Louisiana. After his death, the flag was sent to his mother.

Lowell historian Richard Howe says, "We can't know for sure, but I believe he was so highly regarded by his men that they sent the guidon

Paint restorer Adeline Myers worked to clean and restore the inscription at the bottom rail of the inner frame: "Under this flag at Clinton, La., June 3, 1863, Solon A. Perkins was killed."

The sword hilt is shown at left before undergoing restoration and, above, after treatment.

restoration photos courtesy of Melissa Carr

The eagle is one of the three-dimensional carvings on the frame. The carving style is similar to that of John Haley Bellamy.

to his mother as a special honor for her." Mrs. Perkins kept it for many years, later giving it to Charles Knapp, a banker at Lowell's Middlesex National Bank, who commissioned the elegant frame.

The main purpose of a "guidon" flag is to literally "guide on" the troops. Soldiers would know where and when they were to move by watching their flag. Historian and consultant Steve Hill, of the Dupage Military Flag Company, said of the piece, "Clearly this particular guidon, judging by the magnificent job of framing, was very important to those who originally carried it."

He also clarified that this particular type of guidon was common after 1862. "At the beginning of the Civil War, guidons were simple swallow-tailed flags of two colors: the upper half red, and the lower half white. The Union guidons were redesigned as small, swallowtailed versions of the Stars and Stripes."

Preserving It

When conservator Melissa Carr started the project, she did a thorough evaluation of the frame, which was actually two frames, one inside the other. There were three phases: cleaning, stabilization and loss replacement. She also had to analyze the carvings. Were the carvings of the military equipment replicas of actual weapons or simply approximations of carbines, sabers, etc.? The carbine, for example, was missing the trigger, trigger guard, sight and hammer assembly.

The Internet was a valuable resource, yielding photographs in enough angles to be able to reproduce the missing parts and identify it as a Joslyn .52 caliber carbine, model 1862 or 1863. Whoever carved it had also carved the backs of the attachments as well as the front. They were in 3D, even though those sections would not be seen.

The quality of the frame has led to speculation that it might be the work of master nineteenth century carver John Haley Bellamy, who was in the area at the time — but that might never be known for sure.

Historian Richard Howe says, "The guidon is a tangible object that was with these men in Mississippi, many of them from my home city of Lowell. I regard it as a way to communicate with the past."

Legacy

Conservator Melissa Carr says, "What struck me from the beginning and all along the project is the caring attached to this flag and frame. The men originally with Perkins cared enough to save this flag. How did his mother feel when she received the flag? What were the circumstances that she gave the flag to Charles Knapp? Was she dying? There was a huge amount of care initially, then 120 years later, the Veterans Council's care. The veterans group came into my studio as if they were carrying a newborn baby. The word legacy is overused, but people have kept caring about this flag and frame."

At presstime, the Greater Lowell Veterans Council had raised $9,400 toward the $15,000 restoration costs. Further information can be found in their video or at *www.lowellvets.org*.

— Helen Hannon

www.woodworkersjournal.com
MORE ON THE WEB

VIDEO For a video on the Greater Lowell Veterans Council's efforts to restore the flag and frame, please visit our website woodworkersjournal.com and click on "More on the Web" under the Magazine tab.


John Gable


Colin McGuckin


Christy Kobasa

Cool Kids' Stuff

From time to time, Springfield High School instructor George Trout sends *Woodworker's Journal* updates on the work his 14- to 18-year-old students have been doing in the Industrial Materials program at the Pennsylvania, school. After purchasing their own lumber, in the rough, from Delaware County Supply Company, the students put problem-solving, critical thinking and creative expression skills together into their choice of project, which must be completed within one school year. See more at *ssdcougars.org/webpages/gtrout*.


Brooke Shea


Kayla Howard


Karlene Raines

Who Says a Spindle Has to Be Round?

By Ernie Conover

Our author describes how to use flat segments as an element of design and utility.

We tend to think of spindles as round, but it is often necessary to leave flat spots.

In some cases, a spindle may have four sides left square. Most table legs have a section at the top called the "pommel," left square to accept the aprons. Some table and chair legs also have square sections near the bottom to accept stretchers. Most newel posts have a square section at the top to accept the railing, and also a section at the bottom to accept a rail into which the balusters are mortised. Turned bedposts need a square section into which the rails are mortised or bolted.

On wingnuts, ratchet paws and other mechanical parts; wooden forks and spoons; and tool handles, you will often find two sides flat.

One side may be flat on a chair stretcher, to serve as a footrest, or on the plug for the mouthpiece of whistles and recorder flutes.

These variations on the theme are what I call "flat/round" work.

Work Sharp

In turning spindles that have portions left square or flat, the importance of sharp tools cannot be overemphasized! Spindle tools, like the roughing-out gouge, spindle gouge, skew chisel and beading and parting tools, have to be just as sharp as bench tools, with long bevels in severe 25° to 30° angles. Tools that are less than keen

These chairs in the Yale University Furniture Collection are prime examples of legs with square sections near the bottom to accept stretchers.

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MORE ON THE WEB

VIDEO For a video on making various shoulder transition cuts, please visit woodworkersjournal.com and click on "More on the Web" under the Magazine tab.

Most newel posts have a square section at the top to accept the railing, and a section at the bottom to accept a rail for the balusters.

The handles on these antique screwdrivers were made with flat spots, which tell the user the alignment of the top and provide more purchase to torque screws home. After first turning a handle with flat spots, it's easy to make it into an oval handle (see inset) by rolling the flats against a belt or disc sander.

and/or have short bevels will make leaving flat or square portions much more difficult by causing ragged and chipped edges.

In flat/round work, precise layout saves time and material. It is the key to getting everything right the first time around. Jointed stock that is cut to uniform squares or rectangles is imperative.

For spindles with areas left square, it is just a matter of accurate centering on each end when mounting the blank. The easiest way to accomplish this is by scribing diagonal lines between the corners. This method works equally well with slightly rectangular stock.

For things like screwdriver handles or forks and spoons, using a marking gauge and dividers is the surest way to find center on both ends.

Lathe Speed

Enough, but not too much, speed on the lathe helps greatly in making the transitions from square to round. For 2" square and smaller

For relatively flat boards that are going to be turned into things like salad forks, dividers and a marking gauge (seen in the tool well in the photo above) give speed and accuracy to finding the center and the layout.

These ratchet pawls are on a Swedish band loom. The tall column to which the pawls are attached is square with the top section turned: it is flat/round.

The fipple plug for the mouthpiece of whistles and recorder flutes (seen above) has to have an exactly sized flat spot so the right volume of air hits the sharp edge of the bore.

Shouldering the Burden: The Most Difficult Area

It only stands to reason that if you have a flat area on a round spindle, there is an area where the round changes to flat (or vice versa). This is called a transition, and there are three basic ways to form the transition — each can be modified to suit the turner's aesthetic.

A **hard square shoulder** transition is most commonly encountered in table and chair legs. The best tool for this is the skew, presented with the toe down and the edge absolutely vertical. The handle must be angled such that the appropriate bevel is 90° to the work, making it kiss the shoulder throughout the cut.

Hard Square Shoulder

For a **half bead shoulder**, the cut is made with a spindle gouge after first making a square face with a skew. It is a half bead, rolled mostly on air. It makes an elegant transition and is used mostly on table legs, bedposts, new posts and balusters. It is helpful to draw a pencil line a set distance from the square face to give yourself a starting point.

Half Bead Shoulder

The cut for a **half cove shoulder** is done entirely with a sharp spindle gouge. It differs from a half bead cut only in that it is a cove instead of a bead. Either is cut mostly on air. The trick is to start with the handle low and touch the bevel of the gouge to the work. Slowly bring the handle up until the edge just cuts. Now, roll the bead.

Half Cove Shoulder

The author turned the stretcher on this three-legged stool in two axes, with an intentional flat spot meant to serve as a footrest.

spindles, 1,000 to 1,800 rpm is appropriate; however, the higher end of this spectrum is for the experienced turner with a heavy lathe. The beginner, using a lighter lathe, is well advised to stay closer to the 1,000 rpm speeds. For 4" square and larger spindles, speeds between 500 and 800 rpm are better, depending on lathe and experience.

The Transition

The difficult part of leaving an area square focuses on the shoulders, where the transition occurs. This transition can take three different basic forms, as shown in the photos in the sidebar at left. (You can also watch me make these three cuts in my More on the Web video.) As with learning any new technique, practice makes perfect, and testing these various forms is best done on scrap lumber rather than on your prized stock intended for project use.

Safety Consideration

For some flat work, such as salad forks, it is often easier and safer to use the band saw to remove excess material. Square and flat work also presents some pinch potentials in areas where the flat parts are spinning near the tool-rest. The novice is well advised to stop the lathe when moving the tool-rest or the banjo. And for the same reasons, it is a good idea to completely remove the tool-rest during sanding.

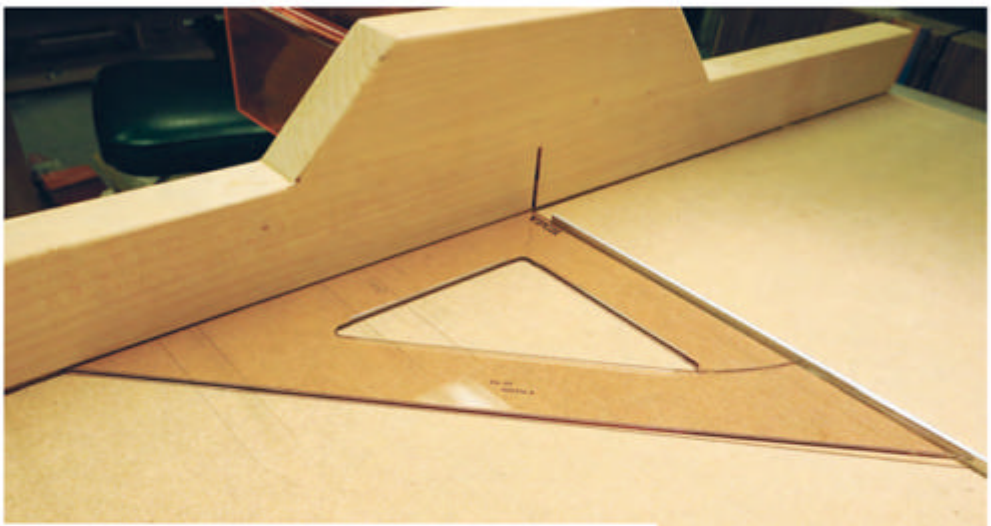
When he turned six replacement balusters with tapered octagonal sections, the author found the turning easy. The difficult part was tapering the octagon, which he did at the bench with a #97 plane.

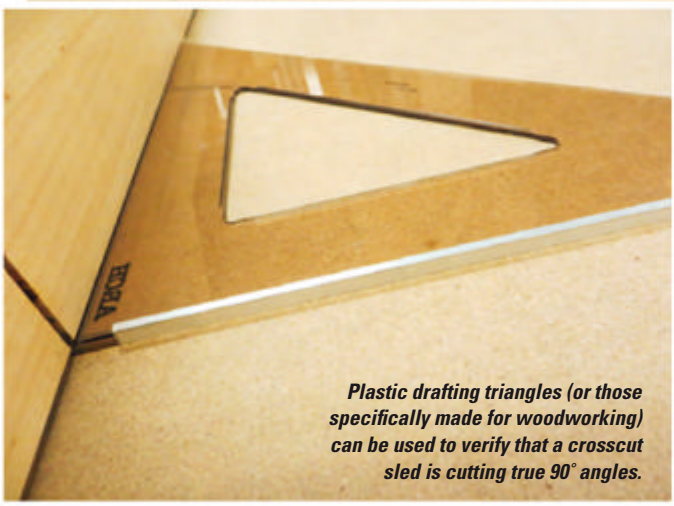
Ernie Conover is the author of The Lathe Book, Turn a Bowl with Ernie Conover *and* The Frugal Woodturner.

Dead-on Angles in the Woodshop

By Al Goldstein

Here's an inexpensive, easy and super-accurate way to align your crosscut sled and miter gauge.





Plastic drafting triangles (or those specifically made for woodworking) can be used to verify that a crosscut sled is cutting true 90˚ angles.

Al Goldstein

Making accurate angle cuts on the table saw can be a challenge. This technique is a great way to be sure that your setups are dead-on accurate. It is easy to implement and does not depend on aging eyes or shaky hands.

The first step is to verify that the table saw blade is parallel to its miter slots. The second step is to use plastic drafting triangles to set accurate angles. They are inexpensive and highly accurate.

Table Saw Sleds

When it comes to crosscut sled construction, the crucial element is setting the front fence exactly perpendicular to the saw kerf in the sled's base. After mounting the unfinished sled on the table saw miter slot(s) and partially cutting through its base, one end of the front fence is attached to the sled base and then rotated to be exactly perpendicular to the saw kerf.

The key to this technique is to use mechanical contact of one 90˚ side of a plastic triangle to the saw kerf in the sled base and the other 90˚ side to the front fence. This is accomplished by placing a flat reference surface in the saw kerf to contact the triangle. For standard saw blades, I find aluminum bar stock 1/8" thick works well. Thinner blades will require a thinner reference surface. The reference surface must be at least 1/8" proud of the sled base to contact the plastic triangle.

Hold the triangle so that one 90˚ side is always in contact with the aluminum bar and slide the triangle toward the front fence. Take care that the fence does not contact the aluminum bar. When the other 90˚ edge of the triangle is in full contact with the fence, it will be exactly perpendicular to the saw kerf. (See top photo, above left.) With a bit of practice, you can align the front fence with your eyes closed.

The triangle can also be used to verify that an existing fence is properly aligned. Place one 90˚ side against the aluminum bar in the saw kerf and then slide it toward the index fence and verify that the other 90˚ side makes full contact with the fence. The

An accurate woodworking version of the drafting triangle is available for purchase on our website:
#31545 ..... $15.99
woodworkersjournal.com/store

bottom photo, opposite page, shows this verification, with the triangle in contact with both the 1/8" aluminum bar and the front fence of this sled.

Miter Gauge

The alignment of miter gauges is accomplished in much the same manner, making use of both miter slots: the miter gauge in one and a reference surface in the other. Of course, this technique relies on the fact that the two miter slots are parallel.

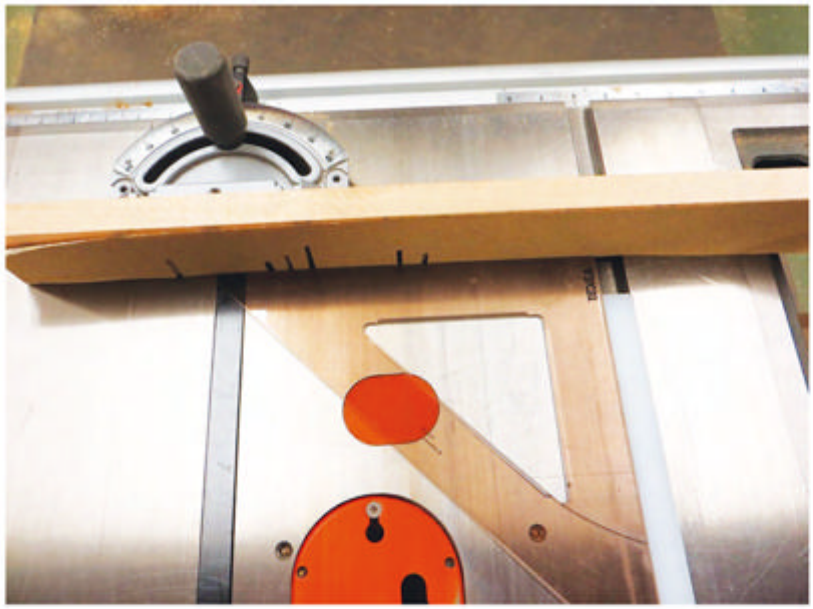
The most convenient reference surface is a commercially available — or shop-made — miter bar placed in one miter slot and elevated higher than the table saw surface by placing pennies underneath as spacers.

Slide the miter gauge in the other miter slot with its fence free to rotate. Position the plastic triangle between the two miter slots with one 90° side held against the elevated miter bar. Slide the miter gauge toward the triangle, allowing its fence to rotate until it makes full contact with the other 90° side of the triangle. Make certain that the end of the elevated miter bar does not contact the miter gauge fence. Lock the miter gauge, and it will be dead-on perpendicular to the miter slots — and, hence, the saw blade. (See the top photo, above.)

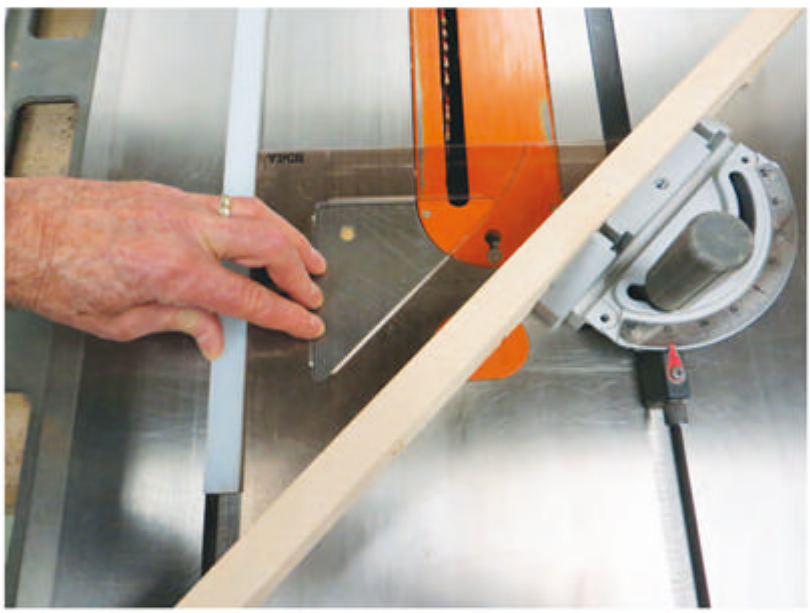
In a similar fashion, a 45° miter gauge angle may be achieved accurately using a 45° triangle with its long side placed in contact with the elevated miter bar. The bottom photo, above, shows a 45° angle being aligned on a miter gauge.

This method has the benefit of being highly accurate and easily repeatable. And, of course, if you have other triangles with other angles, you can also convert those into dead-on angles for creating great woodworking joinery!

Al Goldstein is a retired medical physicist, using his experience in making accurate measurements to advance his woodworking to a higher level.



After placing a miter bar into the right-hand miter slot and raising it up with pennies placed underneath, the author uses a drafting triangle to set the miter gauge for a perfect 90° cut.



In a method similar to that for setting a 90° angle, the author can also set up his miter gauge to cut a perfectly accurate 45° angle — a common-sense solution to a tricky setup.

Mission Picnic Table

By A.J. Hamler

With a slight twist on the usual flavor of picnic table design, you can dine al fresco in style.

If Yogi Bear had spent more time building picnic tables instead of robbing from them, I suspect Ranger Smith's job would have been less stressful. Not sure what Yogi's furniture tastes were (he was probably more concerned with what was in the pic-a-nic baskets), but chances are good that his table would have been the typical attached bench, A-frame style picnic table found in every park. Yawn.

When I thought about the design for this picnic table, it occurred to me that most are boringly utilitarian. You rarely see one in a distinct furniture style. With that in mind, I couldn't see any reason why a picnic table couldn't be just as sturdy and serviceable with a Mission flavor. (Who doesn't love Arts & Crafts?) With its complementary horizontal and vertical lines along with the side slats, typical of the Mission style, you can bring flavor to your outdoor dining in more ways than one.

Cut table components to size per the **Material Lists**, *but keep in mind the variances common in cedar's width and thickness.*

Wood Considerations

The first thought for any outdoor furniture is making it to withstand the elements. Regular pine dimensional lumber is inexpensive but should be painted or stained regularly if you want it to last. Treated construction lumber is also commonly used, although it's very heavy and sometimes oddly colored.

Although more expensive, the best choices are woods that naturally resist both weather extremes and insect damage. Almost any lumber suitable for decks works great, with redwood, Western red cedar and even white oak being favorites. For the perfect balance between durability and weight, I've chosen Western red cedar.

Keep in mind that cedar typically comes with one or more sides left rough, which can slightly alter the dimensions from what you're used to working with. It's important when using cedar dimensional lumber to carefully measure your workpieces, and adjust component sizes accordingly. For example, typical pine 2x4s (smooth on all four sides) measure 1½" x 3½", but a cedar 2x4 (rough on all four sides) measures 1¾" x 3¾". The *Material Lists* on pages 31 and 33 list the actual sizes of the cedar used for this project.

If you've never worked with cedar before, take a look at the sidebar "Rough, but Ready" for some handy tips and advice.

Getting Started

Cut your workpieces to size per the *Material Lists*. Keep in mind the actual dimensions of the cedar you get when cutting.

Rough cedar has a surface that can be quite splintery, especially on the corners of all straight edges. To make the stock easier to work with — and lower your chances of getting splinters — chamfer or bevel the edges a bit. A small block plane does great, as seen in the photo at right, but a sanding block with coarse

The author chamfers the corners of his cedar components. It not only helps to prevent slivers, but it looks great, too.

Rough, but Ready: Working with Cedar

Western red cedar is a delightful wood. It's great for outdoor products, it takes screws and nails readily, and your shop smells wonderful when cutting it. (And for days afterward!) But there are a couple of odd things about it you should know.

Cedar width and thickness is typically a bit larger than comparable dimensional lumber. The rough cedar 2x4 shown here measures 1¾" thick.

• Cedar typically comes with rough, unplaned faces; 1x dimensional cedar lumber usually has one rough face, while 2x stock is rough on all four faces. This roughness adds both thickness and width wherever it occurs. A dimensional pine 2x4 measures 1½" x 3½", but a cedar 2x4 is 1¾" x 3¾". This extra thickness may vary from board to board — or even within the same board — but count on an additional 1/8" for each rough face. Always measure your stock, and adjust workpiece size and nail/screw length to account for any variance.

When working cedar with a dado cutter, watch out for flying splinters.

• Cedar is splintery, really splintery, so handle it with care. Knock splinters off edges and corners with a plane or sanding block whenever possible. Take extra precautions when cutting cedar, particularly with a router or a dado cutter on the table saw, as splinters and knots — some of them surprisingly large — can fly in all directions even when using dust collection.

Mark the notches for the vertical slats on the table and bench end assemblies. A square is a must for this task.

Cut each notch by first defining the ends, then plow out the waste between them. Be sure to set the cutter height to accommodate your stock's actual thickness.

Cut the profiles of the top and bottom components of the bench and table end assemblies on the band saw as seen here, or with a jigsaw or handsaw.

paper also works fine. If you're feeling ambitious, a small roundover bit in your router is another option.

I started the construction process with the benches, so that's what you'll see in most of the photos, but the procedure for building the ends of the main table and the benches is nearly identical: your construction can go in pretty much any order. However, you might find it more efficient to cut all your mortises for the side slats on both table and benches at the same time. For this task, I've installed a 3/4" dado set in my table saw, but you could also make the notches with a circular saw and bench chisels, as seen in my video.

Lay out the notches by first measuring the thickness of the 1x4 side slats and setting the height of the dado cutter to match. (Remember, it's probably slightly more than the typical 3/4".) Starting in the center, carefully measure the spacing of each notch using a rule and square for accuracy. Since some of your marks are pretty close together, it's a good idea to mark the waste areas.

With all the notches marked, start each with a pass over the dado cutter on your marks to define the width of the notch, and then just remove the waste in the center. Between the table and the two benches, you'll have a total of 36 of these notches to cut, so pace yourself accordingly.

Finish the preparation of the end pieces by mitering the corners for both the top and bottom, and cutting the relief on the underside of the bottom pieces. The band saw is perfect for this, but a jigsaw or handsaw works just fine, too.

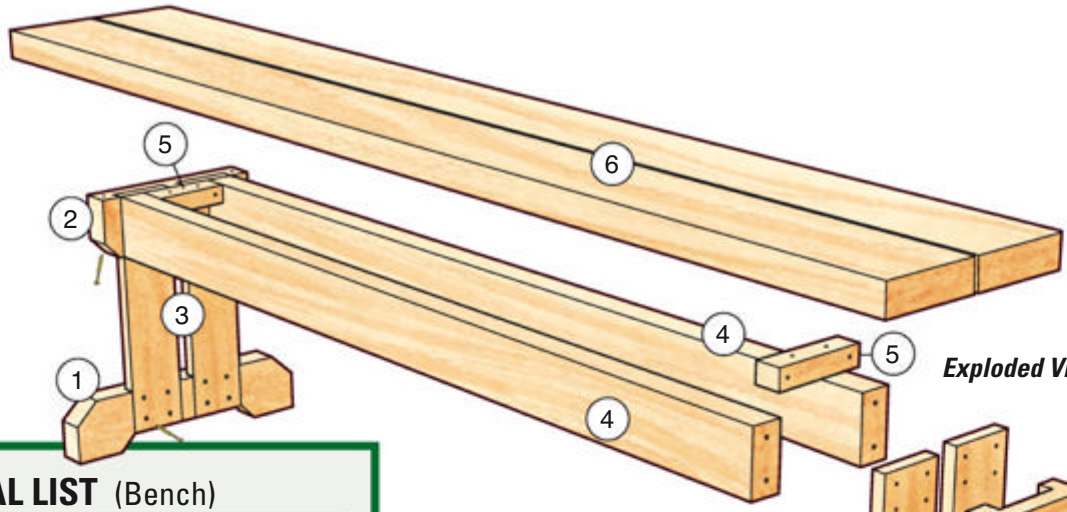
Assembling the Ends

Line up the top and bottom end pieces, making sure to orient the corner notches toward the middle. Be aware that 1x dimensional cedar is typically rough only on one side, so orient the slats with the smooth side facing inside the benches and table to give a uniform appearance on the outside.

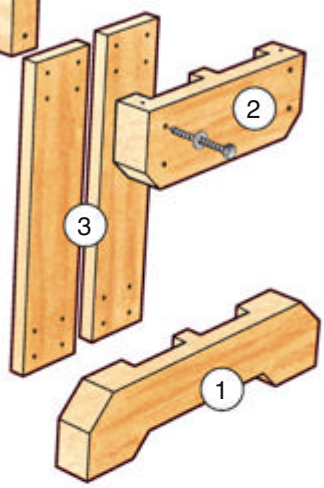
Apply weatherproof glue into each notch and bridge the top and bottom pieces by dropping the slats into place. Drill countersunk pilot holes, then drive four exterior screws into each joint. With regular pine dimensional lumber 1¼" screws are best to avoid piercing the other side, but with the typically thicker cedar, you should be able to use screws a full 1½" in length. Be sure to measure first.

Speaking of screws, you're going to need a bunch: With 36 of these joints to secure, you'll need 144 of them.

The boards for the tabletop and bench seats are secured via cleats from the underside. However, before attaching the cleats, give the inner top of each end piece a quick sanding to ensure that it's flush across the slats. Due to the nature of cedar lumber, there may be a slight variance in thickness at the end from one slat to another. The difference probably won't be much, if any, but you want to be sure it's flush for the cleat to attach securely.



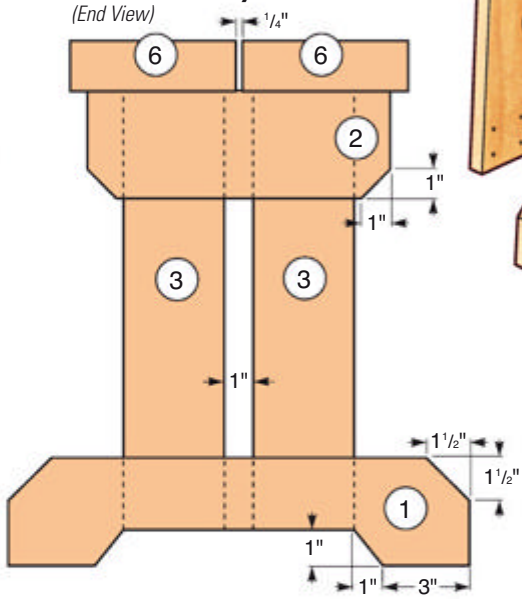
Exploded View



MATERIAL LIST (Bench)

	T x W x L
1 Bench End Bottoms (4)	1¾" x 3¾" x 16"
2 Bench End Tops (4)	1¾" x 3¾" x 10½"
3 Bench Slats (8)	7/8" x 3½" x 15¼"
4 Bench Stretchers (4)	1¾" x 3¾" x 52"
5 Bench Cleats (4)	1¾" x 1¾" x 4½"
6 Bench Seat Boards (4)	1¾" x 5¾" x 72"

Bench Assembly
(End View)



The cleats themselves are 1¾" x 1¾" strips that I ripped from a 2x4. After making the cut, one side will be smooth from the saw blade, so use this side for the mating surface, and attach with glue and screws. For the thicker cedar, use 3" screws, but slightly shorter screws if using regular dimensional lumber.

Making the Frames

For rigidity, the bench and table frames are joined with 2x4 stretchers underneath the top boards, while the table gets some additional bracing.

Cut the stretchers to length — the bench stretchers are sized smaller to allow the bottoms of the benches to fit between the ends of the table for comfortable seating. Clamp the stretchers to the ends of the mounting cleats, making sure that everything is flush along the top. Now, drill 1/4" pilot holes for four evenly spaced 5/16" x 4½" lag bolts through the bench and table ends, then drive the bolts in with washers as in the photo at left on the top of page 32.

Topping it Off

Lay the top boards on your workbench or assembly table, orienting the boards so their presentation sides are face down, and then upend and center the frames on your boards. The benches are

Set the vertical slats securely into their notches with weatherproof glue and exterior-grade screws for outdoor durability.

Before attaching the mounting cleats, sand the cleat location flush, if needed, to ensure a secure attachment.

Center the mounting cleats on the inside tops of the table and bench end assemblies, and secure with weatherproof glue and exterior screws.

Drill a pair of 1/4" pilot holes for each stretcher through the bench and table ends, then drive home 4½"-long lag bolts for a solid frame.

Upend the bench and table frames onto the 2x6 top boards, and drive 3" screws through the cleats to hold them in place.

pretty easy to handle, but you may want to enlist a helper for the table frame.

With the frame in place, drive a pair of exterior screws through the cleat and up into the undersides of each board. Note in the photo at right (above) that I'm using some small pieces of 1/4"-thick scrap to act as spacers to get the boards uniformly spaced along their length. As before, 3" screws work well with thicker 2x cedar, but adjust screw length accordingly for regular dimensional 2x lumber.

The cleats don't extend past the stretchers, so, for the last attachment screws, countersink a diagonal pilot hole through each of the end pieces. Drive in a 3½" screw at each point to secure the edges of the outer boards.

For the outer edges of the last boards, countersink diagonal pilot holes through the bench and table end pieces, and secure with screws.

Construction of the benches is complete, but the table needs one last component. Because of their low height, the stretchers in the benches are sufficient to make them solid, but the table requires a bit more bracing. Accomplish this with a pair of 36½" braces, mitered 45 degrees on each end. Locate the lower ends at the center of the table bottoms, allowing the tops to rest naturally where they fall on the underside of the table's center board. Attach the lower ends to the table sides with a pair of countersunk 3" screws driven from the inside. Check the table ends for square, then anchor the upper ends on the underside of the table the same way, as seen in the top photo at right.

Finishing Up

By now you've certainly realized that cedar can be splinter-prone. (You probably got several while building; I know I did.) To keep from getting small splinters while dining at your new table, give the tabletop and the tops of the benches a good sanding to remove the roughness. A first pass with 100-grit paper knocks down the roughness quickly, while a followup with 150-grit gives a nice, smooth surface. While you're at it, it's a good idea to lightly sand the edges of both the tabletop and bench seat boards, as well. Another benefit of sanding the top of the table is that removing the roughness makes it easier to clean after your picnic.

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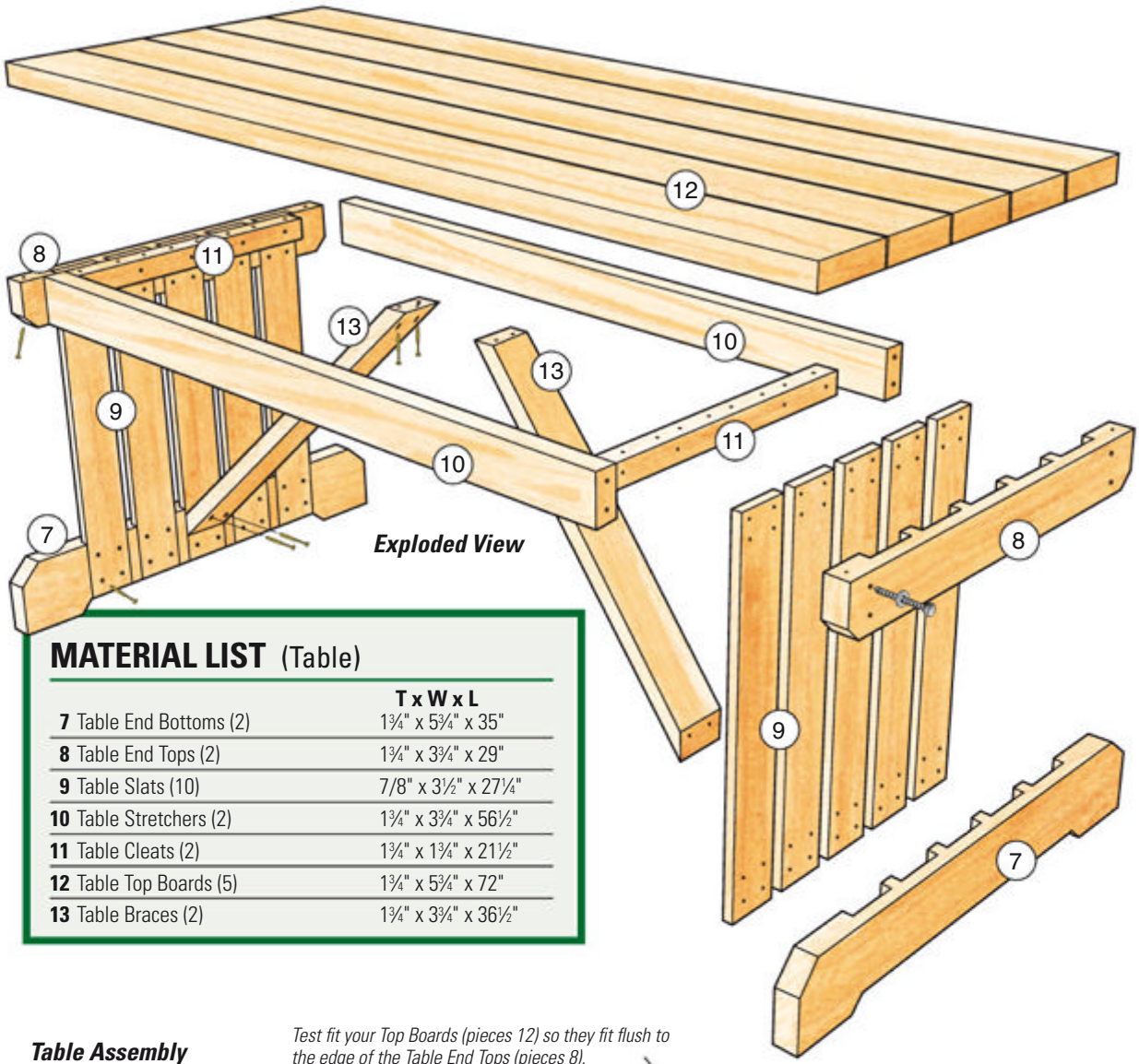
MORE ON THE WEB

VIDEO For a video on cutting notches with a circular saw and bench chisels, please visit woodworkersjournal.com and click on "More on the Web" under the Magazine tab.

Finish up the table assembly with a pair of diagonal braces. Attach these underneath the table with 3" exterior-grade screws.

To avoid getting splinters during use and to help make the table and bench tops easier to clean, sand the rough surface smooth.



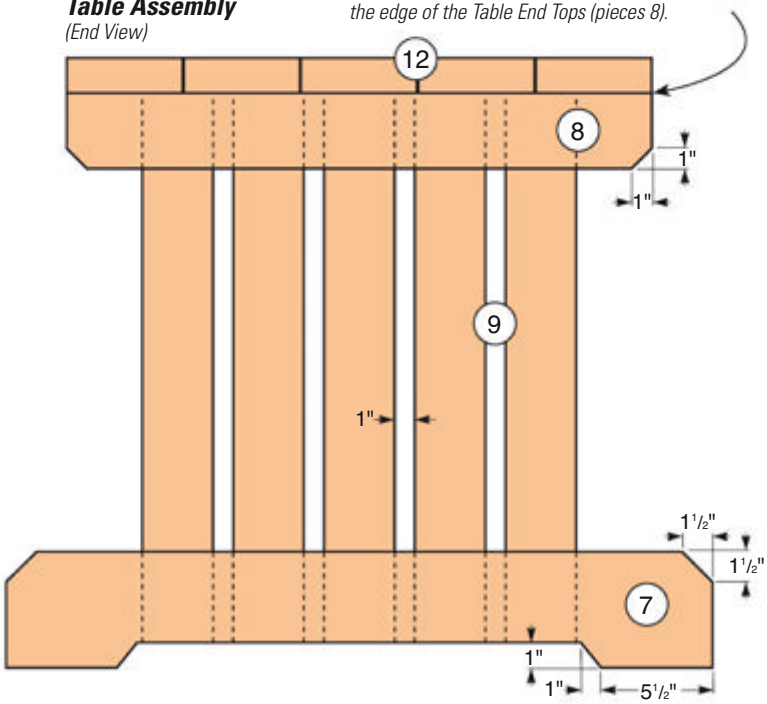
Exploded View

MATERIAL LIST (Table)

	T x W x L
7 Table End Bottoms (2)	1¾" x 5¾" x 35"
8 Table End Tops (2)	1¾" x 3¾" x 29"
9 Table Slats (10)	7/8" x 3½" x 27¼"
10 Table Stretchers (2)	1¾" x 3¾" x 56½"
11 Table Cleats (2)	1¾" x 1¾" x 21½"
12 Table Top Boards (5)	1¾" x 5¾" x 72"
13 Table Braces (2)	1¾" x 3¾" x 36½"

Table Assembly
(End View)

Test fit your Top Boards (pieces 12) so they fit flush to the edge of the Table End Tops (pieces 8).



Because cedar is naturally resistant to both weather and insects, no finish is really necessary. The table will last for many years as the color of the wood darkens to a silver-gray patina. If you'd like, however, an application of a sealer can extend the natural color a bit longer, and make it even easier to clean after picnicking. And if you like a darker appearance, you're in luck: almost any sealer for outdoor wood darkens it. Any product for decks or other outside wood furniture, such as Thompson's® Water-Seal®, does a good job.

The unique styling of this Mission-influenced picnic table will make your backyard the envy of the neighborhood. Ranger Smith would certainly approve.

A.J. Hamler is the former editor of Woodshop News *and the author of* Civil War Woodworking, Volumes I *and* II.

Easy-to-Build Benches

By Simon Watts

These easy-to-make benches are attractive and practical. Our author suggests you size them to fit your needs.

I made the first of these benches from a large piece of driftwood that had washed up on the beach of my island home in Nova Scotia. The sand, of course, ruined the saw, and the gritty wood was impossible to plane. I still have that bench, it still smells of the sea, and I keep it as a reminder that driftwood is better left on the beach.

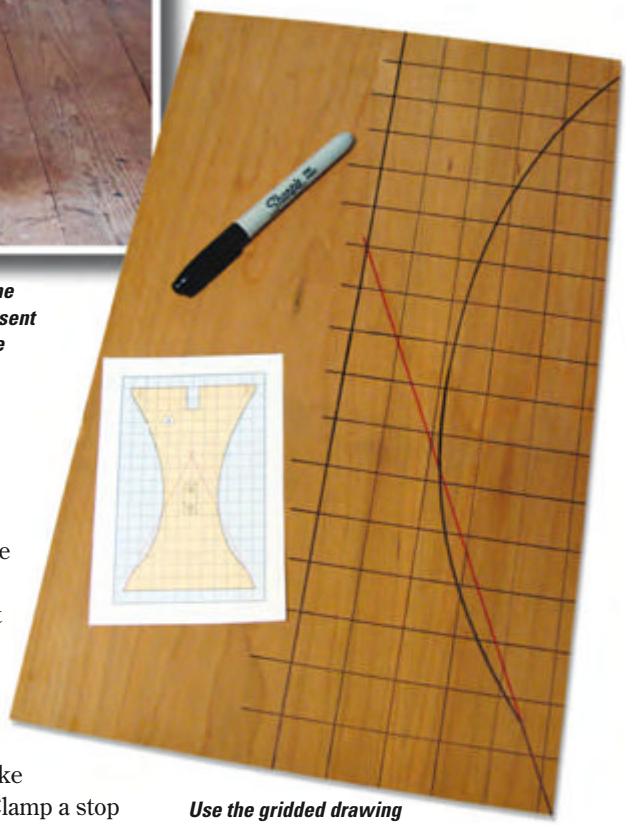
You can adapt the basic structure of this bench to make one of practically any size, but I think the one at the top of the opposite page looks about right. With a 44"-long top, 11" wide, it seats two comfortably. The overhang is only 8½" long, so there is little chance of flipping it by sitting on the end.

The only "tricky" joint is a sliding slip joint between the apron and the two supports. You can make this on the table saw or cut it by hand — if you trust yourself to hand saw to a line accurately. I used local white ash (I'd just bought a butt log from our local sawyer), but any reasonably hard wood such as maple, oak, walnut, cherry or even fir would do equally well.

Bench

For children, you could very well reduce the overall size of this bench 80%, 75% or even 50%. It's best not to reduce the thickness of the supports by

The technical drawings and the **Material List** *on page 37 represent the "adult-sized" bench in the photo above.*

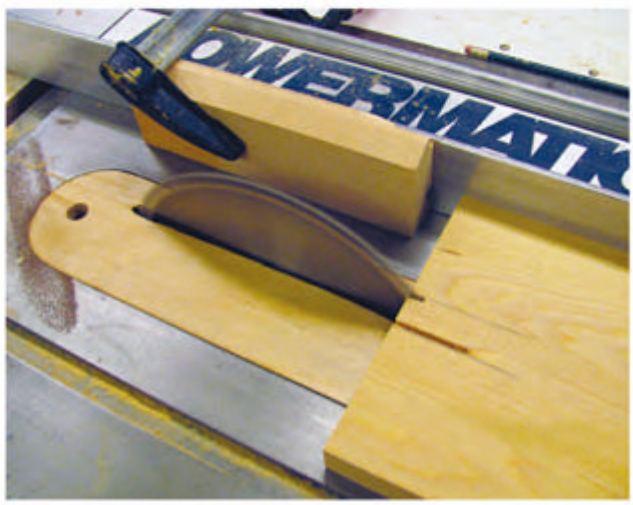


Use the gridded drawing on page 37 to guide you as you lay out the hourglass-shaped leg template. Cut the template and fair the curve, then use it to transfer the leg shape to your working stock.

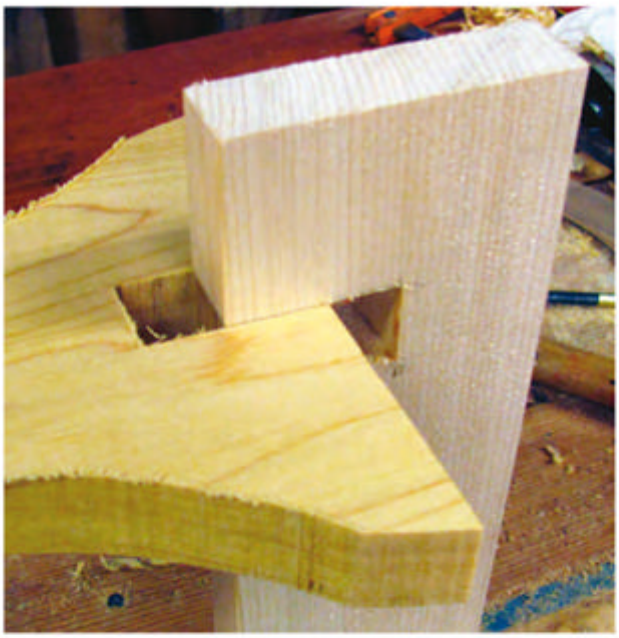
the same amount, or it will begin to look frail. The bench in the photo above is reduced 50% from the adult version, so it is only 22" long and 8" high. Instead of reducing the width of the top in proportion, I left it a little wider for stability — 7½" instead of 5½".

The first step is to make an accurate, full-size, half-pattern of the hourglass-shaped vertical supports. I use the 1/8" plywood known as doorskin, which makes excellent pattern stock (photo at right). Use the pattern to mark out the two end supports, but leave these as rectangular blanks until after sawing the slip joints. That way, you can use the table saw fence to make accurate, identical cuts. Clamp a stop block to it, as shown below, so you don't oversaw. Complete the cut by chiseling out the waste or using a coping saw. Finish cutting out the supports by band sawing just clear of the curved lines, then clean up the sawn edges with an inside spokeshave that has a convex sole. Finish with a 2" drum sander mounted either in a drill press or a handheld electric drill.

Cut out the stretcher, then notch it on the table saw to fit the slots already cut in the verticals. These must be a close, sliding fit: too snug and you are likely to split the ends of the stretch-



The notched joinery on the legs and upper stretcher can be formed using a table saw (as shown above), or cut by hand. The lower stretcher is held in place with dowels.



Test the sliding slip joint and adjust it until the pieces slide together with a smooth friction fit. Once those pieces fit together, use a jig to bore holes for the dowels, chamfer the edges, and do your final sanding.

Then you're ready to get out your clamps and glue the pieces together, as shown in the photo at right.

er; too loose, and you'll end up with a bench that wobbles (see photo above). A Japanese Shinto saw file, which has both a coarse and a medium side, is the best tool for fitting end grain joints such as these.

Now cut the stretcher to length and, with the aid of a doweling jig, drill two holes in each end for 3/8" dowels (see photos below). Use doweling points to transfer the hole centers to the two supports. Glue the stretcher in place and adjust the clamps so the two supports toe out slightly — not more than 1/8" or 3/16". This helps compensate for the optical illusion of parallel lines appearing to converge when seen from above.

The top of this bench is best attached to the base with 1/2" dowels. To facilitate dismantling for moving or storage, glue the dowels into the base only, not the top.

Instead of rounding the sharp edges with a wood file or sandpaper, I think it looks better to plane a neat 45° chamfer. This makes a crisper impression than the blunted look of a soft, rounded edge. Chamfer the inside curves — both sides, inside and out — and be consistent: make a uniform 1/8" or 3/32" flat.

The child's bench is made in exactly the same way, but you may need to use smaller dowel pins.

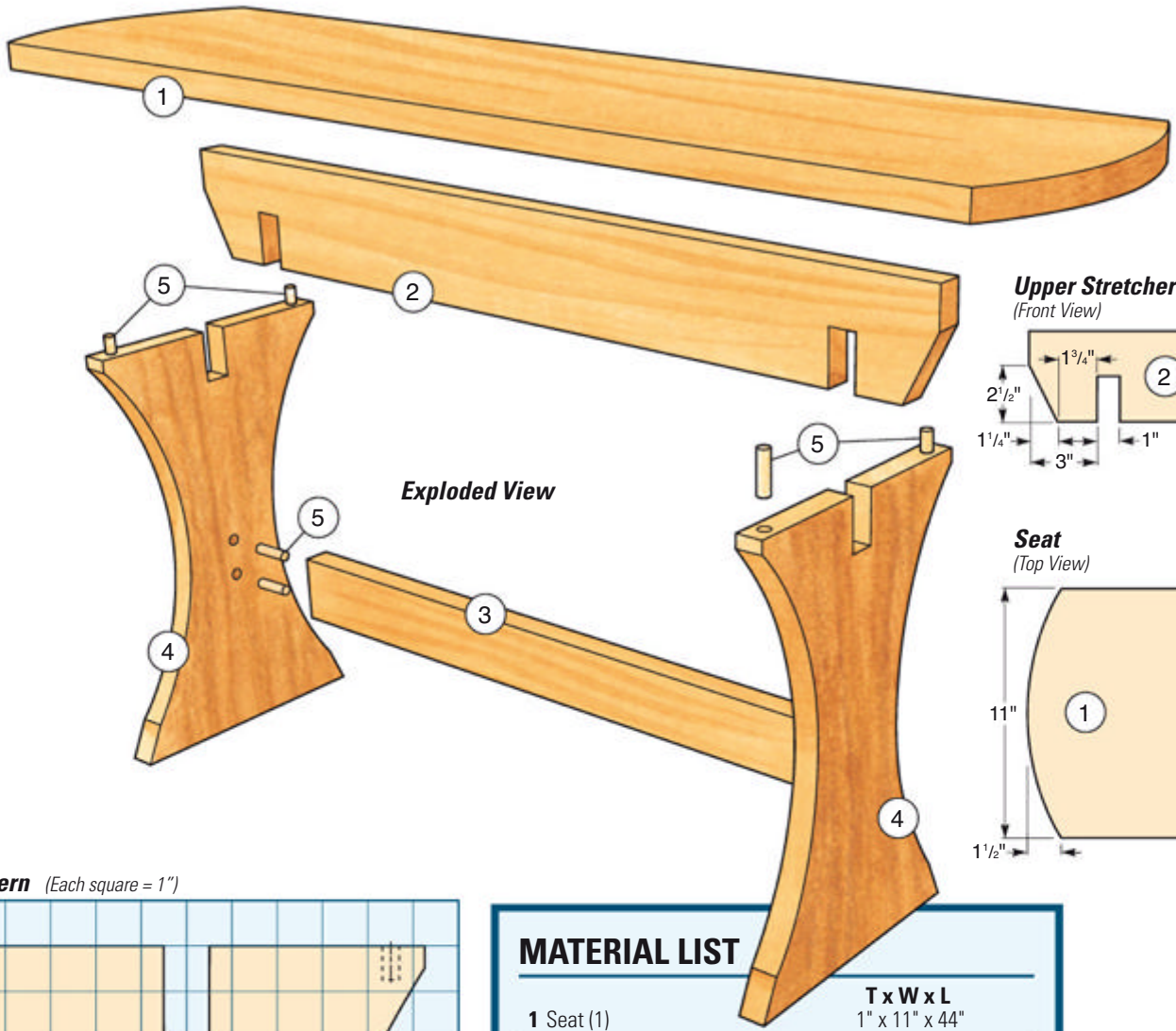
The author used a drilling jig to accurately locate the dowel holes in the ends of the lower stretcher and the legs. Then he used dowel points to transfer the dowel locations to the inside face of the legs and the lower face of the seat.

Finishing

If you plan on using the bench indoors, you can finish with Watco® oil: two applications, with a light sanding in between, using #600-grit wet/dry abrasive paper and oil as the lubricant. Be sure to wipe off the surplus within 30 minutes, or you'll be contending with a nasty, yellow, wrinkled finish. Remember to treat the oily rags as incendiary bombs — douse them in water or put them outside on a safe surface to dry.

If the bench is going to live outdoors, consider using a wood that weathers well: teak would be my first choice, mahogany second and any of the cedars third. If you use a wood such as red oak, which is prone to check severely in rain and sun, treat it with Epifanes®, a penetrating outdoor sealer widely used on boats. Of course, the lowest maintenance finish of all is a couple of coats of good paint — you might even acquire the almost forgotten skills of painting and graining it to look like teak!

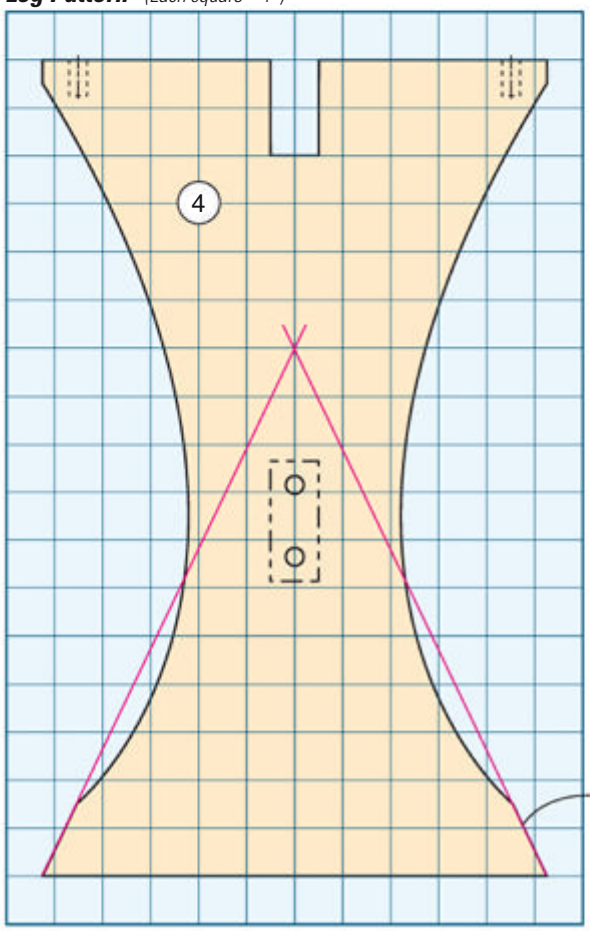
Simon Watts is a boatbuilder, teacher and writer. He lives in San Francisco during the winter months and on an island home in Nova Scotia during summers.



Upper Stretcher
(Front View)

Seat
(Top View)

Leg Pattern *(Each square = 1")*

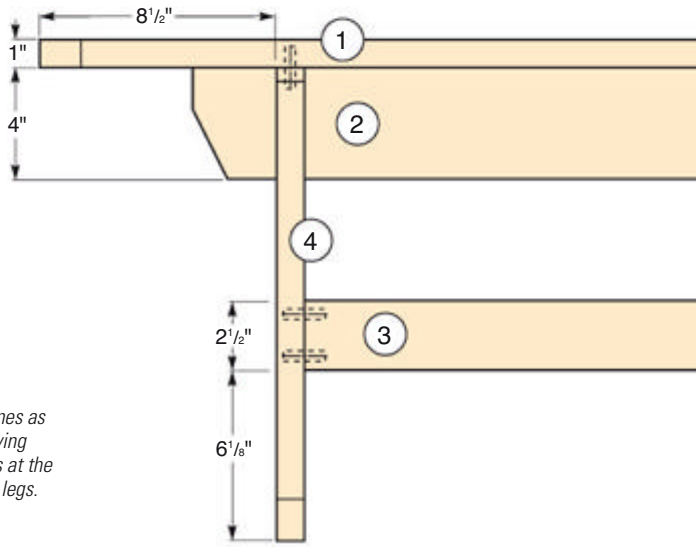


Use the red lines as a guide for laying out the angles at the bottom of the legs.

MATERIAL LIST

		T x W x L
1	Seat (1)	1" x 11" x 44"
2	Upper Stretcher (1)	1" x 4" x 33"
3	Lower Stretcher (1)	1" x 2½" x 25"
4	Legs (2)	1" x 10½" x 17"
5	Dowels (8)	3/8" Dia. x 1½"

Assembled Bench
(Front View)

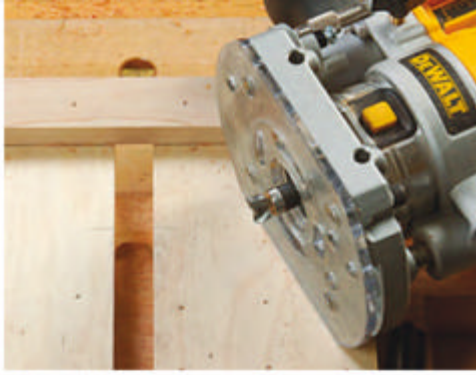


GREENE & GREENE-INSPIRED NIGHTSTAND

By Chris Marshall

Here's a tailored complement to our Greene & Greene Bed project featured in the February 2015 issue.


GREENE & GREENE-INSPIRED BED



A clamp-on routing jig, with a slot sized to match the fixed shelf and bottom panel plywood thickness, ensures accurately made dadoes in the legs. The author used a piloted hinge-mortising bit (see inset) to mill these 1/4"-deep, 1"-long cuts. A back stop on the jig limited the cutting length.

When I delivered my client Jo Ellen her Greene & Greene bed (February 2015 issue), she soon asked about other pieces that could fill out her bedroom suite. So, this custom nightstand is the second installment. I used quartersawn mahogany to capitalize on its handsome ribbon-stripe grain pattern, which also gave me the chance to try my hand at vacuum-bagging the side panels' special quartersawn veneer. In all, it's an ambitious and fun project that's well worth your effort.

Making the Legs

The *Material List* on page 41 lists quantities for one nightstand, and that's how I'll describe the building process here. Double the part list if you build two. Round up some 6/4 stock for four legs, and mill them to final-sized blanks, then study the *Drawings* carefully. You'll see that the side panels fit into long grooves, and the fixed shelf and bottom panel slip into shallow dadoes that intersect those grooves. So, start with those pairs of short dadoes. I routed mine using a simple shop-made, slotted jig (see photos, above). Mill these 1/4" deep. Be sure to mirror the dado orientations on the front and back leg pairs. Then, head to the router table to rout the 1/4"-deep side panel grooves with a 1/2" bit. Stop them 2¼" up from the leg bottoms.

While you're still at the router table, and with the same bit, you can cut 1/4"-deep mortises on the inside edges of the front legs for the top, middle and bottom rails. The 3/4"-long top rail mortise is open at the tops of the legs, while the middle rail's 1"- and bottom rail's 1½"-long mortises are closed on the ends, as usual. Position them all 3/8" back from the front faces of the legs.

This project's back panel is 3/4" thick, so switch to a router bit appropriate for your plywood thickness (I used a 23/32"-diameter undersized plywood bit) and mill the back panel grooves 1/4" deep. Set your router table fence so these grooves are located 1/4" in from the outside faces of the back legs. Stop them 1¾" up from the leg bottoms.

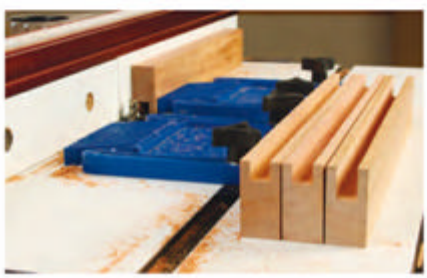
With the leg joinery now tackled, you can chisel all the groove and mortise ends square. Then, make a short template of the legs' cloudlift shape from scrap, and use it both to trace leg profiles for initial rough-cutting at the band saw, then to template-rout the cloudlifts to final form. Drill some shelf pin holes in the legs now, too — those will be much tougher to do later.

Building the Side Assemblies

The side rails are your next order of business. Cut four blanks to size, and head back to the router table to mill their side-panel grooves. Notice that,

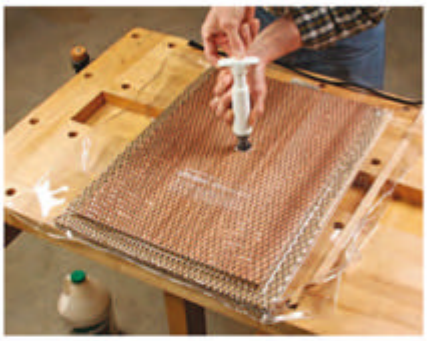
Mill the front legs' rail mortises at the router table with a 1/2" straight bit. Mark the bit location on the table to guide these "drop" style cuts.

The cloudlift leg profiles are best made against a template secured with double-sided tape. Use a piloted flush-trim bit to follow the template.



The side panels require two different groove depths in the side rail blanks (shown): 1/2" deep for the bottom rails; 3/4" deep for the top rails.

Roll wood glue onto the side panel veneer and its substrate, then assemble the lamination and tack near one edge to keep the panels aligned.



A heavy-duty vacuum bag, one-way valve and hand pump made easy work of pressing the side panel veneers flat against their substrates.

Form two side assemblies by gluing the legs, side rails and panels together. Glue the side panels into their grooves — their veneer/plywood construction makes wood movement a nonissue here.

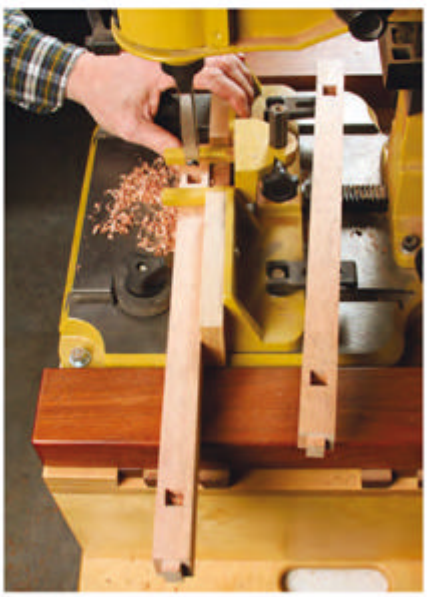
while these centered grooves are all 1/2" wide, the bottom side rail grooves happen on top and are 1/2" deep, while the top side rail grooves are situated on their bottom edges at 3/4" deep; label your rails and work carefully. Once the grooves are cut, raise 1/4" tenons on the rail ends at the router table or table saw. Then, make a double cloudlift template so you can mill these shapes onto the bottoms of the rail edges, too.

Given the striking pattern of the door and top's ribbon-stripe figure, it would have been a shame for the side panels to be made from mediocre-veneered plywood stock. Why not make these side panels showstoppers, too?! So, I resawed and glued up some 3/8"-thick panels of quartersawn mahogany for the side panel veneer, then planed those down to 1/4" thick. I cut backer panels for these veneers from 1/4" mahogany plywood, which fattened the overall side panel thickness to 1/2". You could use a conventional veneer press and armloads of clamps to glue and press the veneer and substrates together, but when I laid up these two panels, I tried a 26" x 28" Thin Air Press™ Kit from *roarockit.com* (see center photo, left) instead. Vacuum pressure alone does the clamping work beautifully. Once my two custom-veneered panels were out of the bag, I trimmed them to final size.

Final-sand and glue up the legs, rails and side panels into two side assemblies. Set them aside for now.

Assembling the Carcass

There's plenty left to do while the side assemblies dry. Continue on by follow-



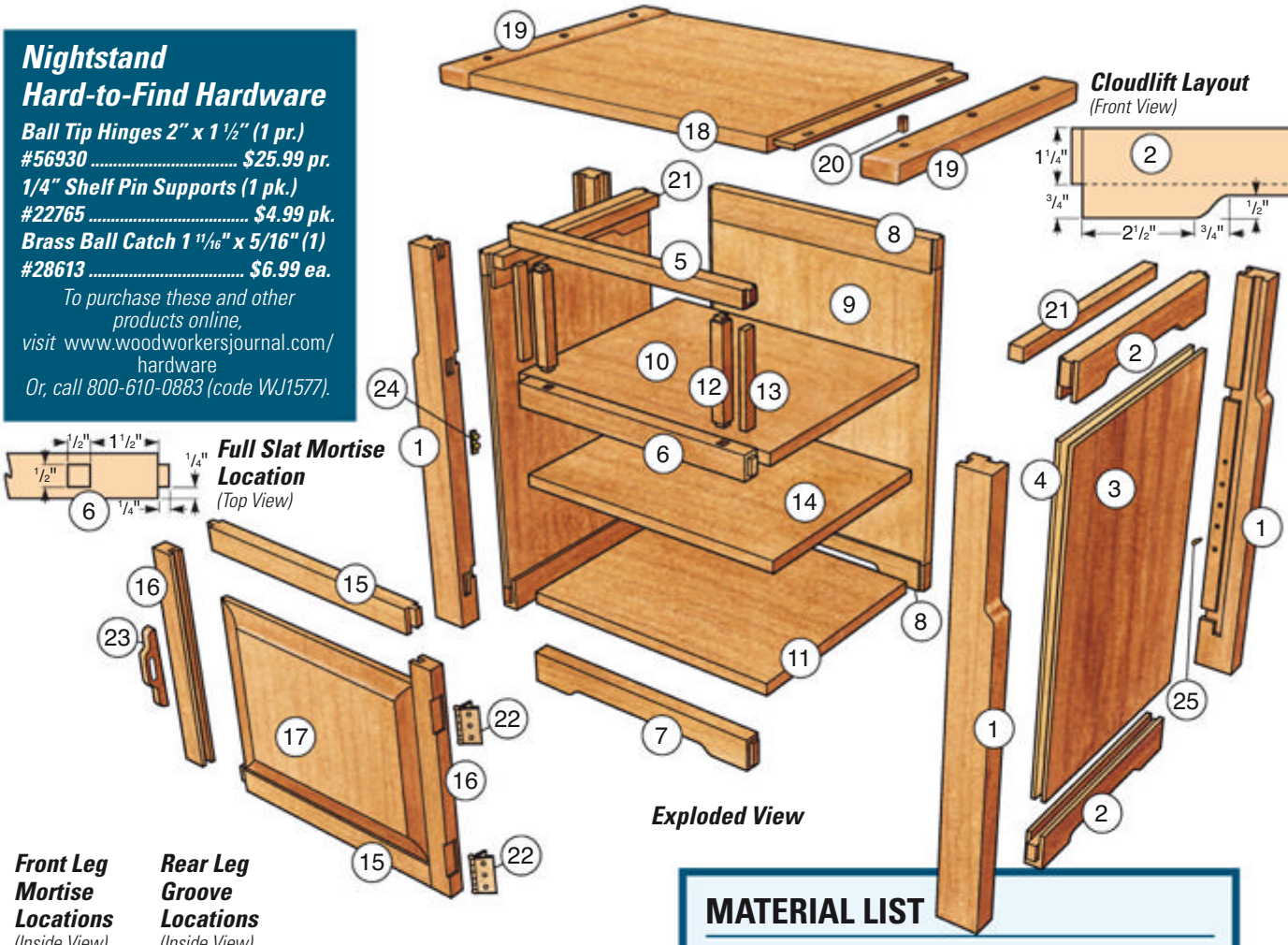
Chop 1/2" x 1/2" mortises 1/4" deep into the top and middle front rails for the full slats. The half slats have no tenons that would need mortises.

The back panel and rails form a third major subassembly, while the top and middle front rails and full slats make a fourth subassembly. Gluing these parts together now reduces the total number of wet glue joints in the final big carcass glue-up — and that makes the whole assembly process easier.

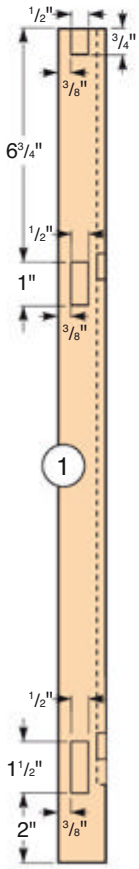
Nightstand Hard-to-Find Hardware

Ball Tip Hinges 2" x 1 ½" (1 pr.)
#56930 ..... $25.99 pr.
1/4" Shelf Pin Supports (1 pk.)
#22765 ..... $4.99 pk.
Brass Ball Catch 1 11/16" x 5/16" (1)
#28613 ..... $6.99 ea.

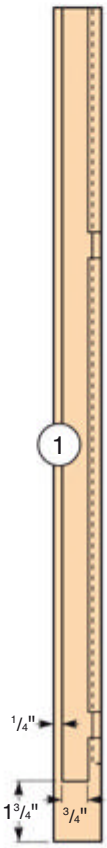
To purchase these and other products online, visit www.woodworkersjournal.com/hardware
Or, call 800-610-0883 (code WJ1577).



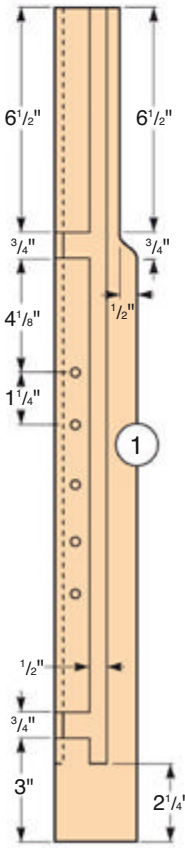
Front Leg Mortise Locations
(Inside View)



Rear Leg Groove Locations
(Inside View)

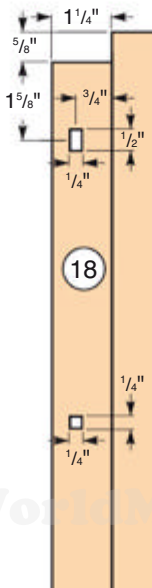


Front and Back Leg Groove Locations
(Inside View)



Note: Mill the same grooves in all four legs for the side panels. Then, the front legs receive mortises for the front rails, while the back legs require a wider groove for the back panel.

Plug Locations
(Top View)



MATERIAL LIST

		T x W x L
1	Legs (4)	1⅜" x 2⅜" x 24⅛"
2	Side Rails (4)	1" x 2" x 13¾"
3	Side Panel Veneer (2)	1/4" x 13¾" x 19⅝"
4	Side Panel Substrates (2)	1/4" x 13¾" x 19⅝"
5	Front Rail, Top (1)	1" x 1" x 16"
6	Front Rail, Middle (1)	1" x 1½" x 16"
7	Front Rail, Bottom (1)	1" x 2" x 16"
8	Back Rails (2)	1" x 2" x 16"
9	Back Panel (1)	3/4" x 16" x 18⅞"
10	Fixed Shelf (1)	3/4" x 13¾" x 17½"
11	Bottom (1)	3/4" x 13¾" x 17"
12	Full Slats (2)	3/4" x 3/4" x 6"
13	Half Slats (2)	3/8" x 3/4" x 5½"
14	Adjustable Shelf (1)	3/4" x 13" x 17¼"
15	Door Rails (2)	3/4" x 1¼" x 13¾"
16	Door Stiles (2)	3/4" x 1¼" x 12⅜"
17	Door Panel (1)	1/2" x 13 11/16" x 10⅝"
18	Top (1)	3/4" x 16¼" x 21¾"
19	Breadboard Ends (2)	1" x 2" x 16½"
20	Pegs (6)	1/4" x 1/4" x 15/16"
21	Cleats (2)	3/4" x 3/4" x 13¼"
22	Hinges (2)	2" Butt
23	Door Pull (1)	7/16" x 1" x 4½"
24	Catch (1)	Brass, ball-type
25	Shelf Pins (4)	1/4" Antique brass

Pocket screws driven from the bottom panel and fixed shelf into the front bottom and center rails strengthen these joints and ensure that the visible seams are tight from above.

A large raised-panel cutter with a cove shape reduced the door's 1/2"-thick panel to fit the frame grooves while also adding a decorative profile around its face. Take several rounds of deepening passes for safety and to help minimize burn marks.

ing the *Drawings* to make top, middle and bottom front rails with 1/2"-thick, 1/4"-long tenons on their ends to match the front leg mortises. The bottom front rail receives a cloudlifted bottom profile. The middle and top rails will also need a pair of 1/2" x 1/2"-square mortises, cut 1/4" deep, along their inside edges to house the full slats, yet to come.

Make two back rails now, as well. These receive centered, 1/4"-deep grooves along their inside edges to house the plywood back panel. Cut the grooves carefully: their width needs to match your plywood thickness, and the walls of the grooves are just 1/8" thick. When the grooves are done, mill 1/4"-long tenons on the back rails; their thickness must match the groove width on the inside faces of the back legs. Then template-rout a cloudlift profile along the bottom edge of the bottom back rail to match the front bottom rail.

You're ready to cut plywood blanks to size for the back panel, fixed shelf and carcass bottom. After a light sanding with 180-grit paper, bore pocket screw holes into the bottom faces of the fixed shelf and bottom panels along their front edges: they'll connect to the rails, later.

Create blanks for the two 3/4" x 3/4" x 6" full slats next, then form 1/4"-long tenons on their ends to fit the top and middle front rail mortises.

It's time to dry-assemble the rails, slats, back, fixed shelf and bottom on the side assemblies to check the fit of all the carcass parts. If everything registers well, glue the back panel into the back rails to create a third subassembly. Form a fourth glue-up of the top and middle front rails and slats.

Bring the four subassemblies together again in another dry fit. Rip and crosscut two half slats to fit against the legs between the top and middle front rails. Glue them to the legs to wrap up the last of the carcass parts you'll need. At this point, stain and topcoat these big components while you can still lay them flat.

When the finish cures, cut the two hinge mortises on the inside edge of one front leg, depending on which way you want the door to swing. You can rout or chisel these shallow mortises; I made a simple clamp-on routing jig for this job and routed the hinge mortises with my piloted hinge-mortising bit.

You're finally ready to glue and clamp the carcass together, with all the parts you've made so far. While you're at it, drive 1¼" pocket screws through the fixed shelf and bottom panel to draw these panels tight to the front rails.

Glue up a panel of solid wood for the adjustable shelf next, and trim it to final size. Check its fit inside the carcass before you sand, stain and apply finish.

Making the Door

The door's construction is stone-simple cabinetry work: stub tenons on the ends of the rails fit into the grooves in the stiles that also house the center panel. Start by milling stock for the door rails and stiles. At your router table or table saw, plow 1/4"-wide, 3/8"-deep continuous grooves along the inside edges of

Continous tenons on the ends of the top panel fit into matching mortises in the breadboard ends. Aim for a snug friction fit of these joints.

Square pins driven into the breadboard ends and through the panel tenons fasten the parts together. The outer pegs fit into slotted tenon holes.

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MORE ON THE WEB

VIDEO For a video showing the side panel vacuum-bagging process, please visit woodworkersjournal.com and click on "More on the Web" under the Magazine tab.

A simple shop-made jig makes quick, precise work of cutting the hinge-leaf mortises. Its opening matches the exact hinge-leaf proportions.

all four door frame parts for the center panel. Then machine 3/8"-long stub tenons on the ends of the rails using a dado blade in your table saw or at the router table. Lastly, glue up a 1/2"-thick panel of solid wood for the door panel, and trim it to final width and length.

I used a cove-shaped, raised-panel cutter in the router table to add curved profiles around the front face of the door panel, and to reduce its edges to slip into the frame grooves. (It's the same bit I chose for the bed's two center panels.) Shape the panel in several rounds of passes, raising the bit about 1/16" each time, to minimize burning.

Sand the door frame parts and panel, then go ahead and stain and finish the door panel now. When that cures, glue up the door frame with the panel installed: this enables you to trim the "raw" frame to fit its opening, scrape or sand the corner joints flat, if needed, and cut the door hinge mortises. Once these tasks are done, stain and finish the door frame to complete it.

Forming the Top

Breadboard tops with thicker ends are quite common on Greene & Greene furniture, and the ends of this top provide 1/8" "step-ups" that add attractive shadow lines where they meet the thinner center panel. Glue up the top's 3/4" center panel, and cut a pair of 1"-thick blanks for the two end pieces.

Since my panel is made from quartersawn mahogany, its cross-grain wood movement will be minimal. So, I resolved that its tenons could be continuous, rather than divided up — an otherwise typical necessity for wide breadboard panels made of more reactive, flatsawn stock.

I started by routing 3/8"-wide, 1¼"-deep continuous mortises in the breadboard ends, stopping them 1/2" short of each end and centering them on the part thicknesses. The panel received matching tenons at the table saw, followed by a quick trip to the band saw to trim their end shoulders 5/8" shy of the panel edges. After rounding their corners, I installed the breadboard ends with a bead of glue along just the middle 6" of tenon length, and three 1/4" x 1/4"-square pegs driven into mortised holes through the tenons. The center peg fits tight in the tenon, but the two outer pegs are nested into 1/2"-long slotted holes in the tenons that run cross-grain. This enables the panel to expand and contract while still staying centered on breadboard ends. I gently sanded the top ends of the pegs to "pillow" them before tapping them home. Their tops protrude 1/16" above the faces of the breadboard ends — a nice tactile detail.

Rout the cloudlifted door pull's finger slot first, "drop-cut" style, at your router table. Then cut out the shaped profile and round over the edges before rip-cutting the pull free at your band saw.

Finishing Up

Once you've applied finish to your top, install it with a pair of cleats screwed to the top insides of the side rails. I used four attachment screws for the top: the front two are driven into round pilot holes in the cleats and the back two fit in slotted holes.

After hanging the door on its hinges, I made a cloudlifted pull for the door and mounted it with a pair of countersunk #8 x 1⅛" wood screws. A ball catch came last to hold the door closed. Rest the adjustable shelf inside on its shelf pins, and your graceful nightstand is ready for bedside sentry duty. Jo Ellen's are next to hers now.

Chris Marshall is senior editor of Woodworker's Journal.

Today's Wood Screw Technology

By Sandor Nagyszalanczy

From heads to drives, points to threads, platings to coatings, our author gives you a thorough education in the options available in the world of modern screws.

Screws are undoubtedly the most versatile fasteners used in woodworking. Wood screws are handy for quickly building jigs and clamping forms, joining cabinet and furniture parts, mounting hardware and trim, and much more. Screws form strong connections between parts made from solid wood, plywood and other sheet goods without the need for cut joinery or adhesives (and unlike glued joints, screws are removable, so you can take apart whatever you've built). Screws are also good for reinforcing parts assembled with traditional joinery — for example, pinning tenons in their mortises.

Choosing the right wood screw used to be simple: pick a zinc or brass screw with the right size and length for the job at hand. But technological developments in construction and wood products manufacturing have spawned an extensive range of new screws in recent decades. There are so many choices, it'll positively make your head spin!

I've written this article to serve as a short primer on wood screws. Close examination of the various parts of a screw — the material it's made from, the design of its head, drive style, point and threads, the platings and coatings that protect it from corrosion — will give you a better understanding of all the design and technology that goes into the manufacture of every single screw. Hopefully, this exploration will better empower you the next time you need to choose the right screws for the project at hand.

Screw Types & Materials

Among the many materials wood screws are made from — brass, bronze, aluminum, etc. — steel screws are the most useful for woodworking and interior DIY projects. They're strong, affordable and readily available in a vast range of sizes. But old-fashioned tapered steel wood screws can be a pain to use. Many woodworkers switched

Old-fashioned tapered steel wood screws are made from relatively weak steel, so their slot recesses tend to deform and cam out. The shanks of drywall screws often snap when driven with ambitious force.

Originally developed for the building and wood products industries, production screws, as well as construction and deck screws, are made from carbon steel heat treated to provide a good balance of hardness and toughness.

to inexpensive drywall screws when they became readily available a few decades ago. Made from harder steel that can penetrate wallboard and studs, drywall screws drive in quickly and without the need for predrilled pilot holes. However, they're relatively brittle and will snap when subjected to high drive forces or stress, making them a poor choice for projects requiring strong construction.

Fortunately, a different kind of screw has largely replaced traditional tapered and drywall screws. "Production screws" have points and threads sharp and strong enough to penetrate the hardest woods and man-made materials — even some metals. Their heads and shanks are durable enough to withstand high torque delivered during driving with a power drill or impact driver, and can withstand the punishing stresses that screw-joined furniture or cabinet parts may be subjected to. Hardened-steel screws with brands including GRK Fasteners™, SPAX®, PowerPro™ and Saber Drive™ are often sold as "construction screws" or "multipurpose screws."

Unless they're specifically plated/coated for exterior use, hardened steel screws aren't especially weather resistant, and they are best reserved for indoor projects. Deck screws are basically production screws that have been plated and/or coated to increase their corrosion resistance. They're great for outdoor projects, like playhouses or decks. For even greater resistance to rust and corrosion, the two best screw materials are silicon bronze and stainless steel. Weaker than regular steel screws, chromium alloy stainless steel screws come in two popular grades: Grade 305 stainless is good for applications where coated deck screws don't have sufficient corrosion resistance, while grade 316 (sometimes referred to as marine-grade stainless) are best for projects that are exposed to salt air or in areas where severe corrosion is likely to occur.

Head Type

Regardless of a screw's material, size or length, the shape of its head has a significant impact in how well it works in any particular application. Head designs can be divided into two groups: those that sink flush with the work surface and those that stand proud of it. In the first group, trim head screws and bugle head screws have heads designed to automatically sink flush in all but the hardest materials (e.g., rosewood, ebony). Bugle head screws drive in quickly and have good holding power in most materials. Trim head screws are a good choice when you only need modest holding power and don't want the head of the fastener to show too prominently. When driven into pre-drilled holes, they are a better choice than finish nails for setting door jambs or mounting trim and moldings: trim head screws are less likely to split thin or delicate wood parts.

Traditional flat and oval head screws lend a nice clean look to projects but require a conical recess for their heads drilled with a countersink. In contrast, most flat head production screws are self-coun-

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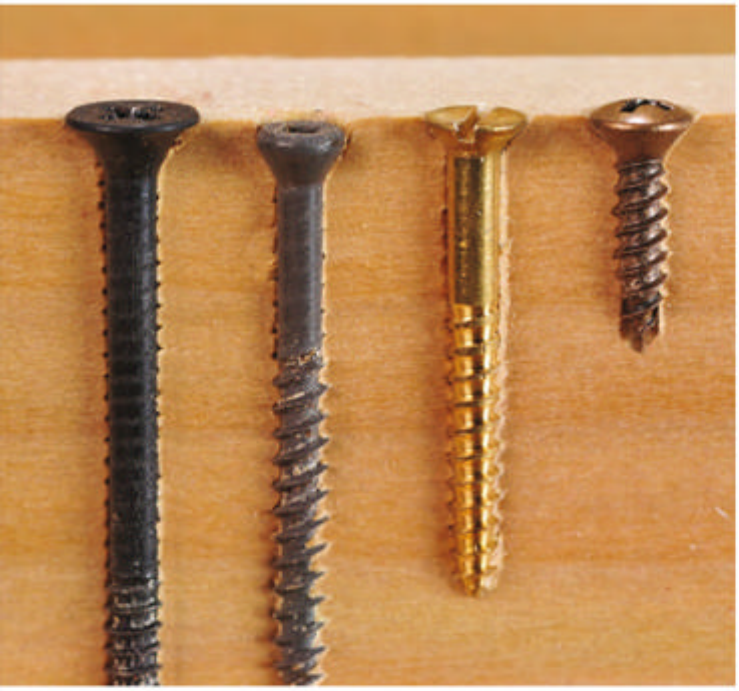
VIDEO For a video on advances and advantages of modern screw technology, please visit woodworkersjournal.com and click on "More on the Web" under the Magazine tab.

The best screw materials for resistance to rust and corrosion are silicon bronze and stainless steel. (Brass screws, shown second from left, also work outdoors, but will tarnish and aren't as strong as silicon bronze.)



Screws with heads that sink flush (or near flush) with the work surface are, left to right: bugle head, trim head, flat head and oval head.

The underside of the heads of (left to right) the SPAX MULTI Head, Quickscrews' Funnel Head and GRK's R4 has nibs or serrations that slice into the surface to create their own recess.

tersinking: they create their own recess that allows the head to sit flush (see photo, above). Quickscrews' unique "Funnel Head" screws, designed for use with veneered plywoods and coated sheet materials like melamine, have double serrations, with very fine teeth that cut into delicate surfaces without tearing them up.

Among the screw head types that sit proud of the work surface are traditional round head, pan head and cheese head (aka fillister head) screws. Each has a relatively small head with a flat bottom that bears against the surface of the workpiece. This offers a reasonable amount of hold in hardwoods, but in softer species, the smaller heads tend to crush the wood at the surface. When the joined pieces are stressed, the screw's effective hold is reduced. Screws with larger heads offer more contact area with the work surface and a greater resistance to penetration and pull-through.

Truss head screws (aka "mushroom head" screws) have a head much like a metalworker's pan head screw, only the overall head is flatter and larger in diameter. These are a great choice for mounting hardware such as drawer slides, where you want good contact with the hardware but need the screw head to not stick up too far. Washer head screws look like regular round head screws with small washers set under their heads. The added surface area on the underside of the head prevents them from sinking too deeply, especially when driven with power drivers. Appropriately named "super washer head" screws have even larger diameter washer heads. They excel wherever two parts are joined but must remain adjustable, such as attaching a drawer front to a drawer box. Wafer head (and flanged head) screws have large, flat coin-like heads. Most wafer heads, including FastCap®'s "PowerHead" screws, are not only large, but are also very thin, giving them great retaining power and a low profile.

Screw heads that stand proud of the surface include: (front) round head; (left to right, middle row) pan, fillister, truss; and (back row) washer, super washer, flange and wafer.

Drive Type

Unless they are building period-style furniture, few woodworkers still use traditional tapered wood screws with slotted heads, as they tend to slip off the screwdriver or driver bit and "cam out" easily, especially when driven with a cordless drill or impact driver.

However, many woodworkers still do use Phillips head screws, which came into production in the 1930s and became popular because their cross-slot recess automatically centers on the tip of the screwdriver. They do have a tendency to cam out, especially when used with power drivers. But a little-known fact is that Henry Phillips *designed his screws to do this on purpose*! To help speed up automobile production, the cam out helped prevent workers from over-tightening Phillips head screws with early power drivers, which lacked torque-limiting adjustability. Today's woodworkers reduce the tendency to cam out by carefully setting the clutches on their power drivers. POZIDRIV®, a modern variant of the Phillips drive, was developed to retain centering while reducing caming out. It is a good choice for larger/longer screws that require lots of torque when driven into hard materials.

Although there are dozens of modern drive styles found on screw fasteners (hex, polydrive, spanner head, etc.), two have become particularly popular in recent decades: Robertson square and TORX® star drives. The square "Robertson" drive was developed in Canada in the early 1900s, but Peter

Wood screw drive and driver styles include (left to right): Outlaw, Posisquare (combo), TORX (star), Robertson (square), Phillips and traditional slotted (which are most prone to caming out: the driver slips out of the screw head, distorting the slot).

L. Roberston's reluctance to license his screws to industrial users (like Henry Ford) kept it from becoming popular in the United States. Only in recent decades have companies like online fastener retailer McFeely's started marketing them to woodworkers. TORX drive screws, with a distinctive six-point star pattern, came out in the late '60s and quickly became a popular production fastener used on everything from cars to motorcycles to consumer electronics. The majority of TORX-drive woodworking fasteners are deck screws, but the drive style is gaining popularity for general-purpose construction and cabinet screws, too. Robertson drivers come in six sizes, but #1 (green), #2 (red) and #3 (black) drivers are used for wood screws from size #3 to size #14. TORX drivers come in two dozen different sizes (T1 to T100), but T15, T20 and T25 drivers cover most common wood screws.

Both Robertson and TORX drives have two qualities that make them a great choice for woodworkers who use power drivers: stick fit and resistance to cam out. Stick fit is the ability of the driver bit and drive recess to form a temporary connection. Once you set a square or star drive screw on the tip of a drive bit, you can drive it without having to hold onto the screw. This not only frees up your extra hand, but it allows you to drive screws into all

Hiding or Covering up Screw Heads

Screws can provide a nice decorative detail on a project: imagine a row of shiny brass screws punctuating the edge of a walnut cabinet or a mahogany jewelry box. But when you don't want screw heads to show, hiding them or covering them are both options. The simplest way to make flat head screws disappear is to set them into counterbored holes topped with flush-trimmed wood plugs that match the workpiece. You can drill pilot holes and counterbores in separate steps, or use a special bit that performs both tasks at once. Starborn Industries' Pro Plug® system is a very nice kit designed to make the entire process quick and easy. It includes a special countersink/counterbore bit, a glue bottle tip (as shown in photo above) designed for applying glue into the holes, screws and tapered wood plugs (available in a dozen different wood species).

If you'd rather enhance the presence of fasteners instead of entirely hiding them, decorative domed or button plugs or screw covers are the way to go. You can see a variety in the photo below. Decorative wood plugs glue into counterbored holes and can lend a nice detail while keeping screws hidden. Craftsman-style hole plugs (available from *www.rockler.com*) are sized to fit into 3/8" holes, but they have square heads with pyramid-shaped tops that resemble the chiseled ends of small through tenons traditionally used in Mission style furniture. For modern style woodwork, try metal hole caps, available in various metallic finishes. I really like the look of black anodized aluminum plugs on a blond wood surface. Inexpensive and quick to install, FastCap plastic screw cap covers have small tabs that snap into the head recesses of square drive, flat head screws. White caps are perfect for camouflaging screws in melamine cabinets, and you can remove the caps if you need to disassemble the piece in the future.

The one-handed operation that's possible with square or star drives allows you to drive screws into places that are a stretched-arm's length away.

A traditional tapered screw's (left) threads and shank are the same diameter; a production screw's threads are larger.

kinds of hard-to-reach places. TORX and Robertson drives both feature deep recesses into which the head of the driver fits snugly. The recess has near-vertical sidewalls, which means very little need for down pressure on the driver to keep it engaged. This not only significantly reduces the chance of cam out, but also reduces driver wear and damage.

Two other screw drive styles are worth mentioning: Pozisquare® and Outlaw drive. Pozisquare (aka combo drive) is a hybrid that combines a #2 Phillips and a #2 square drive in a single screw head recess. You can use either a Phillips or Robertson bit to drive them, but a special Pozisquare (combo) bit gives you better stick fit and cam out resistance. The new kid on the block, Outlaw Fasteners, raised more than $100k via Kickstarter and created their own line of unique deck screws. A three-tiered hexagonal head recess offers 18 points of contact for a super stick fit with virtually no cam out. In lieu of using their special driver, Outlaw screws can be driven with a regular hex driver.

Screw Points & Threads

A wood screw's point and threads have a mighty big task to accomplish. They must pierce the surface of wood, then pull the screw in, without causing the wood to split or splinter. Once driven, the threads have to hold the screw firmly in the wood so that it doesn't pull out or allow the parts it joins to separate, even if they're stressed. An old-school tapered wood screw needs a pilot hole when driven into all but the softest materials: their points are relatively dull and their shallow threads don't offer much holding power.

In contrast, production, construction and deck screws have very sharp points and threads that are larger in diameter than the shank of the screw itself. This enables them to penetrate most materials without the need for a pilot hole, which adds up to a huge time savings when installing them! There's no area of wood screw development that's seen more innovation in recent years than thread and point design. Let's look at both features in depth:

The Point

A good screw point bites into non-pilot-drilled surfaces rapidly, pulling the screw down quickly and creating an entry hole for the screw's shank and threads. The majority of production/construction/deck screws rely on a Type 17 auger point to get this job done. This needle-sharp point penetrates even the hardest materials — and your fingers, so be careful when handling them! A self-tapping flute just behind the point cuts a hole through the surface while channeling debris up the shank of the screw. This helps to pull the screw in while reducing outward pressure that can cause splits and bulges. In lieu of a fluted auger point, some SPAX construction screws feature a 4CUT™ point with a squarish end that pushes aside wood fibers as the screw is driven instead of cleaving them.

The Threads

Once the point has pulled a wood screw down into the material, it's up to the threads to continue driving it the rest of the way in. Conventional wisdom has always been that screws with fine threads are best for hardwoods — oak, cherry, maple, birch, etc. — while coarse-threaded screws drive and hold better in softwoods, plywood and composite sheet goods (particleboard, MDF, etc.). However, newer thread designs have changed the rules and made many production/construction screws suitable for use in a wide range of materials and applications.

Some threads, including the QuickCutter™, lead spiral and cross-cut threads, are designed to reduce the torque needed to drive the screw. In some specialized screw threads, a section of knurled shoulder thread, just above the regular thread of the screw, enlarges the hole slightly as the screw is driven, allowing the screw

The sharp Type 17 auger point found on most production screws enables the screw to quickly penetrate most woods without the need for a pre-drilled pilot hole.

shank to turn more easily while helping to increase the clamping force between joined parts. Here are some of the newer thread designs and their intended advantages:

QuickCutter thread (Quickscrews production screws): Deep threads and an extra-long flute above the point.

Lead spiral thread (Quickscrews Funnel head screws): A spiral thread just above the tip pulls the screw into the wood quickly.

Cross-cut thread (Power Pro outdoor wood screws): A dual thread design with a standard outer thread and an inner thread that helps reduce friction at the root of the screw.

Hi-Lo thread (Rockler Hi-lo screws; Kreg® Hi-lo pocket-hole screws): A dual-thread screw with a coarser, sharper outer thread and a finer inner thread. Creates a multipurpose screw that offers good holding power and less strip-out in all woods and sheet goods.

CEE™ thread (GRK R4™ and RSS™ screws; Outlaw deck screws): A knurled shoulder just above the regular thread of the screw.

Reverse thread section (Starborn Cap-Tor xd deck screws): A section of reversed thread just under the head of the deck screw helps prevent dimpling and mushrooming (raised area around the screw head). A similar reverse thread on SPAX stainless steel wood deck screws helps prevent the screw from backing out as the lumber dries out.

Euro screw thread Melamine, particleboard, and MDF are notorious for their poor holding power when joined with regular screws. In the 1970s, German hardware manufacturer Hafele introduced Confirmat oversized screws specifically for building ready-to-assemble Euro-style furniture and cabinets. Confirmat (or similar Firmit) fasteners act like threaded steel dowels, forming a strong, stiff butt joint between parts.

W-Cut™ thread (GRK RSS and Cabinet screws) and **Serrated thread** (Saberdrive and SPAX screws): A saw-like serrated edge cut into the threads designed to slice through wood like a circular saw blade. (See photo, top of page 50.)

Plating and Coatings

In the final step of manufacturing, most steel wood screws receive some kind of plating (a metallurgical process done to bare metal screws) or coating (applied to either bare metal screws or already-plated screws). Screws are plated and/or coated for three reasons.

1. Prevent Corrosion

Regular steel screws rust quickly when exposed to moisture. Plating not only helps keep the screw itself from rusting, but prevents rust that forms on the screw from staining the wood around it. The most common plating on wood screws is bright zinc, largely a decorative finish that provides only a small amount of corrosion resistance. Zinc screws can develop a dull white corrosion ("white rust") unless protected with a clear coating or a colored chromate, such as yellow zinc. Bright golden yellow zinc screws have more corrosion resistance than bright zinc, so this coating is common on construction screws. Black oxide (black phosphorous) plating prevents steel screws from rust staining wood, but offers little protection against serious corrosion.

Galvanizing processes, e.g., electroplating and hot dipping, have traditionally provided screws with the best protection against rust, but

Modern screw thread designs (left to right): QuickCutter, lead spiral, cross-cut, Hi-Lo, CEE, reverse and Euro screw.

A serrated thread on a screw reduces required driving torque and splitting, and it allows the screw to develop and maintain high withdrawal strength.

modern deck and construction screws are also available with high-tech coatings or plating/coating combinations for outdoor environments:

Blue-Kote™ (Kreg pocket-hole screws): Blue screws with three anti-corrosion layers; weather-resistant.

NoCoRode PLUS Pro-Master wood screws (sold by McFeely's): almost 20 times more corrosion-resistant than standard yellow zinc plating; work well with most outdoor woods.

Epoxy Coated: Starborn's Deckfast® Epoxy Coated screws provide corrosion resistance and come in four colors (gray, green, red and tan) to match treated lumber.

Climatek™: A GRK coating consisting of six layers of zinc and polymers; approved for use with highly corrosive pressure-treated lumber.

HCR™: SPAX "high corrosion resistance" screws have a dual barrier coating system with an electrically applied substrate and a proprietary organic topcoat designed to extend the longevity of the screw even when used with treated lumber.

Weather Maxx™ Bronze Ceramic Coat: Power Pro brand screws with multiple layers of zinc and polymer-based coatings. Recommended for use with ACQ, CA and CCA treated lumber, plus cedar and redwood where they won't stain the wood.

2. Enhance Appearance

Other color choices are available besides silvery bright zinc. Brass-plated screws mimic solid brass screws but are stronger and cost less. Black oxide plated screws' look works well with contemporary style projects.

To help hide fasteners without counterboring and plugging, some screws come with heads coated with epoxy paint. White or sand (tan) heads match the color of white or almond melamine sheet material. Starborn's HEADCOTE® stainless-steel screws have heads colored to match commonly used decking lumber as well as PVC and composite materials.

3. Reduce Friction

The better the surface lubricity of a screw, the easier it is to drive and the less power it takes to drive it in. Slippery screws are also less likely to cam out, break or get stuck when they encounter knots or dense grain.

You can lubricate screws yourself by rubbing them with candle or beeswax before driving them, but it's much easier to buy screws already treated with a lubricating coating. Berenson coats both their plain and zinc-plated screws with a thin wax coating, which reduces friction and leaves no residue. Square-X Drive screws and Highpoint screws have specially formulated dry coatings that make them easier to drive while preventing surface corrosion (they're recommended for interior applications only). For outdoor projects, FastenMaster TrussLOK® construction screws have an anti-friction topcoat applied over their corrosion-resistant epoxy coating.

Metallic platings and synthetic coatings provide wood screws with varying degrees of protection against corrosion and staining the wood they're driven into.

Sandor Nagyszalanczy is a contributing editor to Woodworker's Journal.

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Leigh RTJ400 Router Table Dovetail Jig

by Chris Marshall

Leigh's newest dovetailing jig solution produces up to a dozen dovetail and box joint sizes with quick setups, foolproof repeatability and minimal fuss.

The RTJ400 provides an inverted configuration compared with many typical dovetail jigs: you steer the jig and workpiece over the bit rather than balancing a handheld router on the jig.

www.woodworkersjournal.com
MORE ON THE WEB

VIDEO For a quick video overview of the Leigh RTJ400 Router Table Dovetail Jig, please visit woodworkersjournal.com and click on "More on the Web" under the Magazine tab.

Some dovetail jigs are frustrating to learn: hours upon hours of test cuts, multiple adjustment variables to resolve and the sinking feeling that you'll have to repeat the laborious setup process for every new project. Ugh.

Thank goodness Leigh is making router dovetailing substantially easier with the new RTJ400 Jig I tried recently. In about an afternoon, and thanks to the clearly written manual, I milled the six different glue-ready joints you see on the facing page. That included jig changeovers, just two or three test cuts per joint and no previous experience. Impressive.

The RTJ400's basic design isn't altogether revolutionary: it consists of an aircraft grade aluminum template fashioned to mill pin slots on one side and tails on the other. That styling has been around for decades. But, Leigh's refinements to the template principle include a number of standout features that set it apart from other router table-specific jigs of this sort, and those are key to its simple and repeatable performance.

For one, Leigh has incorporated its patented cam style "eBush" guide bushings into this system. Sized for typical 1¾6" router plate openings, they have numeric index marks that allow you to adjust

a loose- or tight-fitting joint by simply twisting the base collar left or right. Its elliptical bushing widens or narrows in .001" increments to help dial in a perfect cutting width for the template slots. Even better, in most cases you can make the first side of a joint, then refine the fit of just the mating piece by changing the eBush setting, rather than re-routing both parts.

Leigh has designed the vertical fence portion to unclamp from the template. Then, pin locators under the end handles fit into various holes and slots on the template. Those are well-marked and automatically position the fence for different joint setups. No trial and error process here. This pin-and-slot index enables the jig to cut five sizes of through dovetails in two pitches, three sizes of half-blind dovetails and four box/finger joints in workpieces up to 16" wide. Be aware that the pin and tail pattern produced by the RTJ400 is regular — there's no variable spacing option.

Another handy feature is the side stops: when you center a board over the template to cut the first half of a joint and tighten the side stop against it, that sets the mating board's position, too. It's particularly useful for half-blind dovetails — probably the trickiest router-made joint to dial in well, because the pins and tails are cut in one operation.

Sturdy cam-action clamps lock workpieces securely, and a handle on each end of the fence makes the jig stable to move around your router table top. While a "business-end-down" jig like this has gravity working in your favor — no tippy router to steer and balance — the cutting action happens in front of the jig, so you do need to lean forward to monitor your progress. Luckily, the stance doesn't feel awkward.

The RTJ400 comes with four carbide bits, "e10" guide bushing, other necessary supplies and a tutorial DVD for around $359. An accessory kit ($175) provides nine more bits, an "e7" bushing and a 1/2" to 8 mm collet reducer, in order to cut the jig's full range of dovetail and box joint sizes.

Chris Marshall is Woodworker's Journal's *senior editor.*

Numeric indexing on Leigh's "e10" eBush makes adjusting the fit of a joint's mating parts as easy as twisting the elliptical bushing left or right and re-routing one piece.

A pin under each handle enables the vertical fence to be repositioned in template holes to well-marked, automatic settings for various joint sizes and styles.

Stepped side stops position pin and tail boards accurately — very helpful for half-blind dovetails where both joint parts are milled simultaneously.

You can form both dovetails and box joints with this new RTJ400 Jig from Leigh.

Translucent-Screen Shutters

By Larry Okrend

These interior shutters let in light but don't compromise privacy. They're a straightforward millwork project with parts that can be produced in quantity and adjusted to fit various sizes of window casings.

Windows are meant to deliver light into your home's interior, but they can also provide an unwanted view into your home. That's why almost everyone wants and needs some form of window covering in their home (unless you live in the middle of nowhere or don't care about privacy). Although window treatments vary greatly in style and function, I think the best kind are the ones that ensure privacy while still letting in light — and ones that you can make in your shop.

This interior shutter project has a lot going for it, including excellent light transmission that doesn't compromise privacy and simple modular construction. You can use almost any wood for these shutters, but typically it's best to either match or complement your existing woodwork. I used vertical-grain pine that has a naturally attractive ribbon pattern and a medium ivory color. It's also easy to work and relatively inexpensive. A translucent shoji-style fiberglass material works well for the screen, but there are a number of other materials you can use (see final caption, page 62) such as rice paper and plastic-coated paper. Keep in mind that this is a millwork project, so it doesn't require quite

the high level of workmanship you might devote to a furniture project. The thickness and width of the parts work for most window sizes, so you only need to adjust the length. For very large windows, you might want to scale up the size of the parts or add more lattice strips to the grid. The variations on this project are almost infinite, so you'll likely want to add your own special touches.

A Festool Domino is a quick way to make strong mortise-and-tenon joints for the shutter frames. Dowels, plate-joining biscuits and pocket-hole screws are good alternative joining methods.

When assembling the frames, spread glue evenly inside the mortises and on the tenons. A silicone brush works well here and can be easily cleaned because glue won't adhere to it.

Measure, Mill, Join Frames

You'll need to start by measuring your window casing and checking it for square. Measure the exact opening, then subtract about a quarter inch from the sides and top/bottom to allow a little room for swing clearance and space for the hinges. (Most carpentry isn't as precise as your woodworking, so you may need to make some adjustments after you assemble the frames.) For large windows or ganged windows, consider making bifold or multiple shutters to span the area.

Because this project lends itself to mass production, it's best to mill the frame parts for all the windows you intend to cover before doing any joinery, to ensure consistency. (Read on to learn more about making the lattice strips.) A jointer and planer are almost a necessity to achieve straight, square and uniform stock. You might want to sand the parts lightly before you start the joinery.

There's a lot of flexibility when it comes to joinery. I used a Festool Domino to make floating mortise-and-tenon joints. This tool can quickly make strong, precise joints. However, a plate joiner is just as fast and makes acceptably strong joints. You can also attain very good results with dowels or pocket-hole screws.

Once you've glued and clamped the frames, you can sand them with 150-grit paper. Be sure to ease the edges enough so they won't splinter, but don't round them too much. If your shutters are a matching pair like this project, mark the top edges with arrows that point to the front and inside stile edges. This will serve to keep the shutters paired and correctly oriented. Check the bare frames in the window casing to be sure they fit with some room to spare and make necessary adjustments. If the fit is too tight, trim the inside stile edges that form the closure between the shutters.

Now is as good a time as any to cut the translucent screen material. This should be done before fastening any lattice parts inside the frame because the bare frame serves as a pattern. The easiest way is to lay the frame on top of the screen material and trace around the inside with a pencil; then use a metal straightedge and a utility knife to cut the material.

Clamp the frames with even pressure applied on the center of the joints. Check for square by measuring diagonally across the frame from corner to corner with a tape measure.

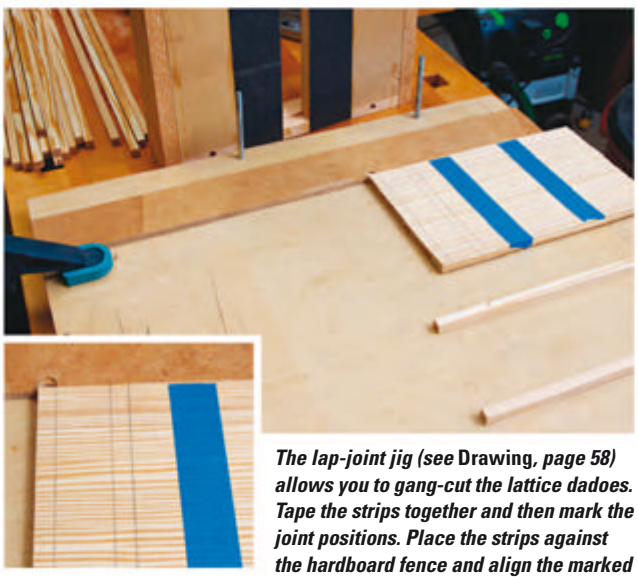
Photo at left: To use a band saw to make the 3/8"-square lattice strips, rip pieces slightly less than 1/2" wide from larger stock. (The piece shown is roughly 2 x 2".) Photo at right: Next, with the band saw fence at the same setting, make the second cut. Use a planer to clean up the strips and mill them to exactly 3/8" square. You could also make the strips on a table saw, but there would be more waste, due to the wider saw blade kerf.

Make Lattice Strips and Router Jig

If there's a fussy part of this project, it's making the lattice. The 3/8" x 3/8" lattice strips must be uniform, and the half-lap joints that form the grid must be precisely made. There are a number of ways to make the strips, but I've found that using a band saw and a planer is efficient and it keeps waste and dust to a minimum.

First, rip wide pieces from 3" or 4" stock roughly 7/16" thick. Next, rip 7/16"-square strips from these pieces. Now you need to remove the saw marks and mill the strips to exactly 3/8" square. Run the strips through your planer making four total passes: the first two on perpendicular sides of the strips to remove about 1/32" and then a third and fourth pass on the opposite sides for the final 3/8" dimension. The strips might not be perfectly square, but the deviation with pieces this small will be insignificant — try making a few practice pieces first. (If your planer won't adjust down to 3/8", you can make a sub-base out of particleboard or MDF to fit under the planer's cutterhead.) Make more pieces than you'll need because you'll unavoidably have some ruined pieces.

You can use a table saw to make the half-lap joints, but I think a router jig is more accurate and makes cleaner joints. The router jig (see *Drawing*, page 58) is simple and easy to make with MDF or particleboard and a few bits of hardware. There are two basic parts: the base and the router carriage. The base has a thin hardboard fence attached to it to align to workpieces so they're perpendicular to the router carriage. The router carriage is adjustable for different stock thickness with the carriage bolts and should be made to fit your router (or at least the guide rails positioned for your router's base). Adhere sandpaper or self-adhesive abrasive strips to the carriage bottom to prevent stock from shifting. To ensure that the jig makes accurate cuts, all the parts should be square, the carriage bolt holes should align perfectly in the base and router carriage, and the fence on the base should be perpendicular to the slot in the router carriage. The fence should be the last piece you install because it's dependent on how the base and router carriage are aligned. Finally, run the router into the fence with a 3/8" bit to create an alignment mark.



The lap-joint jig (see **Drawing**, *page 58) allows you to gang-cut the lattice dadoes. Tape the strips together and then mark the joint positions. Place the strips against the hardboard fence and align the marked joint with the cutout in the fence from a previous router pass. (The router carriage has been removed for photo clarity. Also, note the self-adhesive abrasive strips on the bottom of the router carriage that prevent the workpieces from slipping. Use sandpaper to make your own.)*

Cut Half-lap Joints

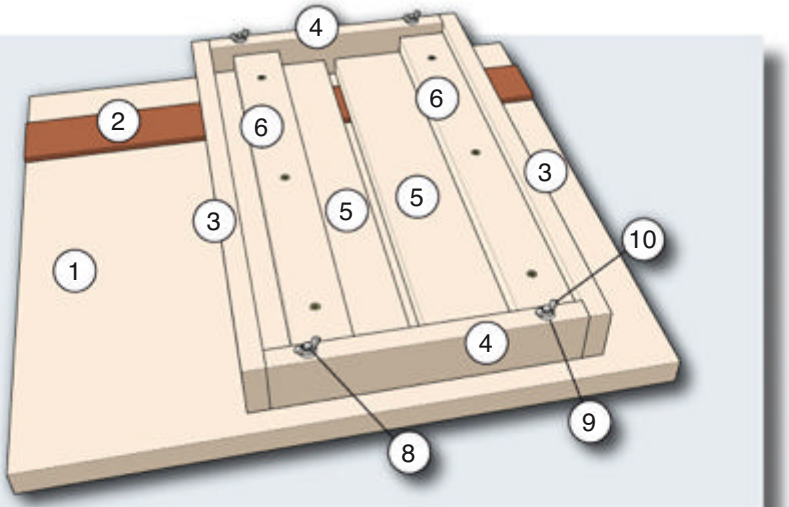
There are several tips that can increase your success in cutting the half-lap joints. You should cut all the strips to the exact length before you cut the joints. Use the shutter frames to determine the fit, and you might want to make dedicated sets of strips for each frame in case there are slight dimensional differences.

Once you cut the strips, use masking tape to gang them together with the ends perfectly flush. Mark the joint locations in pencil, and then scribe the joint lines with a utility knife. This will help prevent any chipping or tearout from the router. When you place the ganged strips in the jig, be sure they're abutting the fence, that the joint lines correspond with the router alignment mark on the fence and that the carriage bolts are securely tightened. Also, place an extra piece of lattice to the outside of

Continues on page 58 ...

MATERIAL LIST (Jig)

	T x W x L
1 Base (1)	3/4" x 20¾" x 22"
2 Fence (1)	1/4" x 2½" x 22"
3 Frame Sides (2)	3/4" x 2" x 19½"
4 Frame Ends (2)	3/4" x 2" x 10½"
5 Frame Bases (2)	3/4" x 5" x 18"
6 Guide Rails (2)	3/4" x 2" x 18"
7 Self-adhesive Abrasive (2)	2½" x 19"
8 Carriage Bolts (4)	4" x 1/4"-20
9 Washers (4)	3/8"
10 Wingnuts (4)	1/4"-20



Use a plunge router and 3/8" straight bit to cut the dadoes in the lattice strips. Set the fences in the router carriage to work with your router's base. In this case, twisting the router between the fences produced the least amount of friction and the best stability and accuracy.

the ganged pieces to help balance the height of the router carriage.

Rout the joints with a 3/8" straight bit and make the cuts in two passes while keeping the router pressed against the guide rails. Work carefully and don't force the router through the cut. Use dust collection if your router has it. It will enable you to see the start and stop of the cut much more easily.

Assemble the Lattice

You'll assemble the front lattice in the frame and the rear lattice as a stand-alone unit. The rear lattice acts as a retainer for the screen material and provides visual balance when the shutters are open.

Begin by marking the 1/8" setback guidelines for the front lattice inset with a combination square and pencil. Before you start, make a dry run to ensure the grid strips fit properly in the frame. The strips don't need to be glued; pin nails provide all the needed fastening. The holes made by the nails are so small, they're almost invisible and don't need to be filled. Attach the vertical lattice strips to the stiles, then the horizontal ones to the rails. Now

Continues on page 60 ...

The inward facing lattice grid (the side that faces into the room) is permanently attached to the frame. Establish the grid's 1/8" setback with a combination square and pencil.

Use a pin nailer to attach the vertical perimeter strips first, then the horizontal strips. There's no need to glue the strips, and it's unnecessary to fill the pin-nail holes because they're almost invisible.

Continue the grid assembly with the inside vertical strips and, finally, the two inside horizontal strips. Glue these joints together and use small clamps if needed. Assemble the rear grids as stand-alone units; just be sure they fit into the frames easily.

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Voice Dial	FREE	FREE
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The rear grid serves as a retainer for the translucent screen material and needs to be fastened to the front grid with brass screws. Bore pilot holes and countersinks for the screws in the four intersections inside the grid.

Next, install the brass screws in each hole to set the threads. You might want to use steel screws of the same size because they're less likely to break.

you can add the inside vertical strips with a little glue in the joints followed by the horizontal strips.

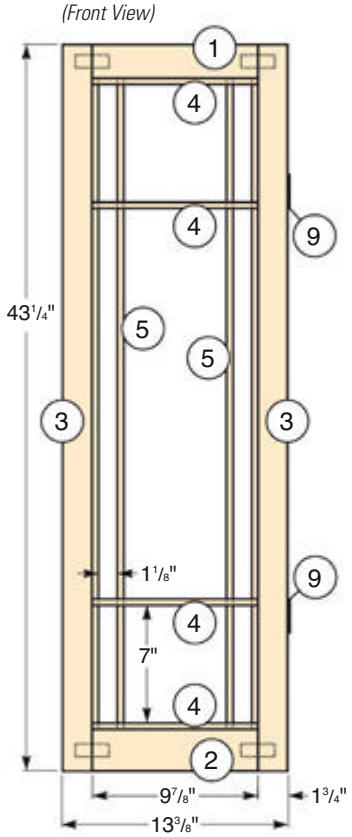
The rear lattice goes together the same way with glue in all the joints, but it's not permanently attached to the frame. You just need to check that it fits flush over the front grid and isn't too large (or small) for the frame. To fasten the front and rear grids together, you need to bore screw holes and countersinks for #4 x 5/8" brass screws through the rear grid into the four inside grid intersections. Install the screws to cut the threads before you finish and assemble the shutters.

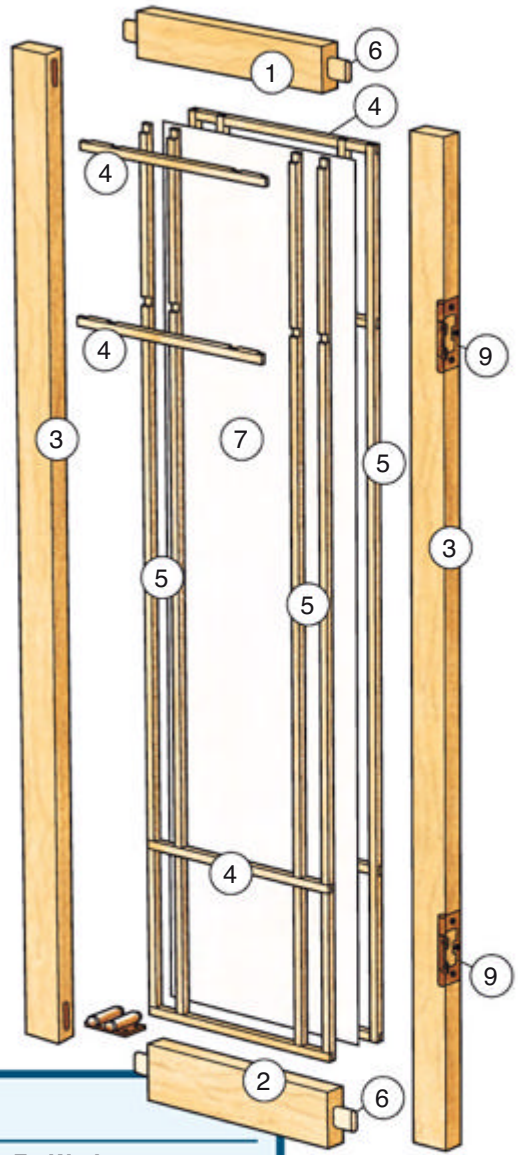
With the grids completed, now is a good time to set the hinge positions. The shutter hinges have removable pins so they work on the left or right side. Unless your shutters are very large or heavy, stick with two hinges on each side. Three or more hinges can cause binding and complicate installation. It's important that the screw holes are perfectly centered to keep the hinges aligned. I used a self-centering Insty-Drive bit for this purpose. Remove the hinges before finishing.

www.woodworkersjournal.com
MORE ON THE WEB

VIDEO For a video on using the jig to form the lattices, please visit woodworkersjournal.com and click on "More on the Web" under the Magazine tab.

Shutter Screen
(Front View)





Exploded View

MATERIAL LIST*

	T x W x L
1 Top Rails (2)	1" x 2" x 9⅞"
2 Bottom Rails (2)	1" x 2½" x 9⅞"
3 Stiles (4)	1" x 1¾" x 43¼"
4 Horizontal Lattice Strips (16)	3/8" x 3/8" x 9⅞"
5 Vertical Lattice Strips (16)	3/8" x 3/8" x 38¾"
6 Domino Tenons** (8)	8 x 50 mm
7 Translucent Screens (2)	9⅞" x 38¾"
8 Brass Screws (8)	#4 x 5/8"
9 Shutter Hinges (2 pr.)	3" Non-Mortise Butt Hinges

**The length of all pieces is dependent on the window frame size.*
***Dominos can be substituted with plate-joining biscuits or 3/8"-dia. dowels.*

Continues on page 62 ...

The screen hinges don't require mortising and they have removable pins, so they can be mounted on either the left or right side. Use a self-centering bit to ensure that the screw holes are perfectly centered. Remove the hinges before applying finish.

Translucent Shutters Hard-to-Find Hardware

Double Magnetic Touch Latch (1) #28415 ..... $5.99 ea.
3" Non-Mortise Butt Hinges (1) #47658 ..... $6.49 pr.
Solid Brass Screws - 4 x 5/8" (1 pk.) #30503 ..... $3.49 pk.
Rockler Silicone Glue Brush (1) #45624 ..... $4.99 ea.
Insty-Drive Self-Centering Bits (1) #69053 ..... $29.99 ea.

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Finish, Assemble, Install Shutters

Sand the assemblies with 150-grit paper and be sure to ease all sharp edges. There's no need to sand too much or with a finer grit paper — the finish will hide many imperfections. Thoroughly clean off all the dust before applying finish.

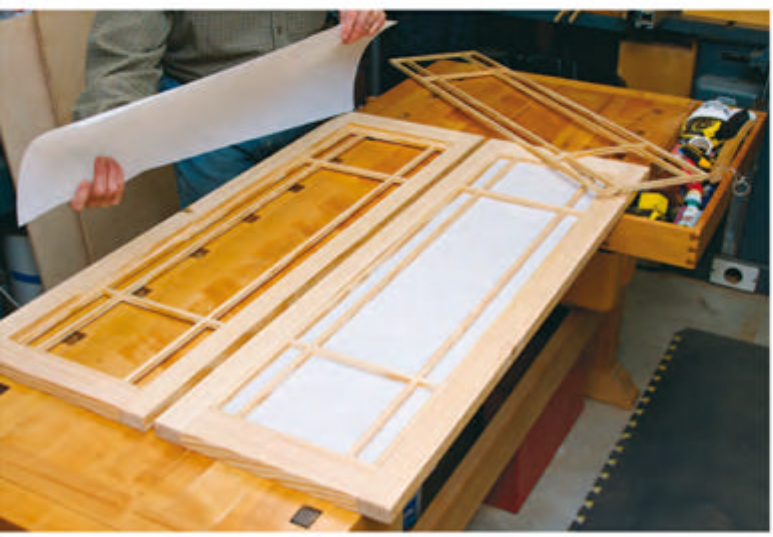
Because the shutters are next to windows, they're exposed to more light and temperature variations than other woodwork in your home. A film finish will help reduce seasonal wood movement and protect the wood from wear and tear. I brushed on two coats of a clear waterborne interior finish and opted not to stain because the natural color of the wood was appealing without alteration. For a smooth finish, sand lightly with 320-grit paper between coats to remove dust nibs.

Once the finish has cured, install the screen material. The fiberglass shoji that I used is stiff enough so that no glue, tape or staples were needed to retain it in the frame. But you might need to fasten thin paper screen to the back of the front grid if it doesn't stay put. Install the rear grid over the screen and install the brass screws; then reinstall the hinges.

Installing the shutters isn't difficult, but there a few steps you can take to reduce any possible frustration. Use a thin spacer between the window casing and the shutter to eliminate the possibility of binding. The hinges also have a slotted hole to allow for vertical adjustment, so use only this hole until you've installed the opposing shutter and can align the pair. If the shutters are a little twisted in the frame, you can try moving one of the hinges slightly out to compensate. And if the gap where the shutters meet isn't even, use a shim behind the hinge leaf. When the shutters seem reasonably well aligned, install the rest of the screws. I installed a magnetic touch latch to retain the shutters. It eliminates the need for knobs to open and close the shutters to maintain a clean appearance.

If you're like me, once you've built a few of these shutters you'll want to make more sets for other rooms in your home. They'll help keep your rooms light and airy even on the most dreary days.

Larry Okrend is the former editor of HANDY *magazine.*



Before finishing, check the fit of the screen material and trim if necessary. There's no need to glue or staple the material to the grid: the rear grid and screws will retain it securely.

The author bought Synskin fiberglass shoji material from tapplastics.com; you can also find paper, vinyl or fiberglass options at decorativefilm.com or Water-star Chinese rice paper at amazon.com.

Chicago Doctor Invents Affordable Hearing Aid

Outperforms Many Higher Priced Hearing Aids

Reported by J. Page

CHICAGO: A local board-certified Ear, Nose, andThroat (ENT) physician, Dr. S. Cherukuri, has just shaken up the hearing aid industry with the invention of a medical-grade, affordable hearing aid. **This revolutionary hearing aid is designed to help millions of people with hearing loss who cannot afford—or do not wish to pay—the much higher cost of traditional hearing aids.**

"Perhaps the best quality-to-price ratio in the hearing aid industry" – Dr. Babu, M.D.
Board-Certified ENT Physician

Dr. Cherukuri knew that untreated hearing loss could lead to depression, social isolation, anxiety, and symptoms consistent with Alzheimer's dementia. **He could not understand why the cost for hearing aids was so high when the prices on so many consumer electronics like TVs, DVD players, cell phones and digital cameras had fallen.**

Since Medicare and most private insurance do not cover the costs of hearing aids, which traditionally run between $2,000-$6,000 for a pair, many of the doctor's patients could not afford the expense. Dr. Cherukuri's goal was to find a reasonable solution that would help with the most common types of hearing loss at an affordable price, not unlike the **"one-size-fits-most" reading glasses** available at drug stores.

He evaluated numerous hearing devices and sound amplifiers, including those seen on television. Without fail, almost all of these were found to amplify bass/low frequencies (below 1000 Hz) and not useful in amplifying the frequencies related to the human voice.

Inspiration From a Surprising Source

The doctor's inspiration to defeat the powers-that-be that kept inexpensive hearing aids out of the hands of the public actually came from a new cell phone he had just purchased. **"I felt that if someone could devise an affordable device like an iPhone® for about $200 that could do all sorts of things, I could create a hearing aid at a similar price."**

- **Designed By A Board-Certified Ear, Nose, and Throat (ENT) Doctor**
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- **Free Shipping Available**
- **Batteries Included! Comes Ready To Use**
- **100% Money Back Guarantee**

Affordable Hearing Aid With Superb Performance

The high cost of hearing aids is a result of layers of middlemen and expensive unnecessary features. Dr. Cherukuri concluded that it would be possible to develop a medical grade hearing aid without sacrificing the quality of components. The result is the **MD**HearingAid® ***PRO***, well under $200 each when buying a pair. **It has been declared to be the best low-cost hearing aid that amplifies the range of sounds associated with the human voice without overly amplifying background noise.**

Tested By Leading Doctors and Audiologists

The **MD**HearingAid® ***PRO*** has been rigorously tested by leading ENT physicians and audiologists who have unanimously agreed that the **sound quality and output in many cases exceeds more expensive hearing aids.**

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"LOWEST AFFORDABLE PRICE"

"I have been wearing hearing aids for over 25 years and these are the best behind-the-ear aids I have tried. ***Their sound quality rivals that of my $3,000 custom pair of Phonak Xtra digital ITE."***
—Gerald Levy

"I have a $2,000 Resound Live hearing aid in my left ear and the **MD**HearingAid® ***PRO*** *in the right ear.* ***I am not able to notice a significant difference in sound quality between the two hearing aids."*** —Dr. May, ENT Physician

"They work so great, my mother says she hasn't heard this well in years, even with her $2,000 digital! ***It was so great to see the joy on her face.*** *She is 90 years young again."*
—Al Peterson

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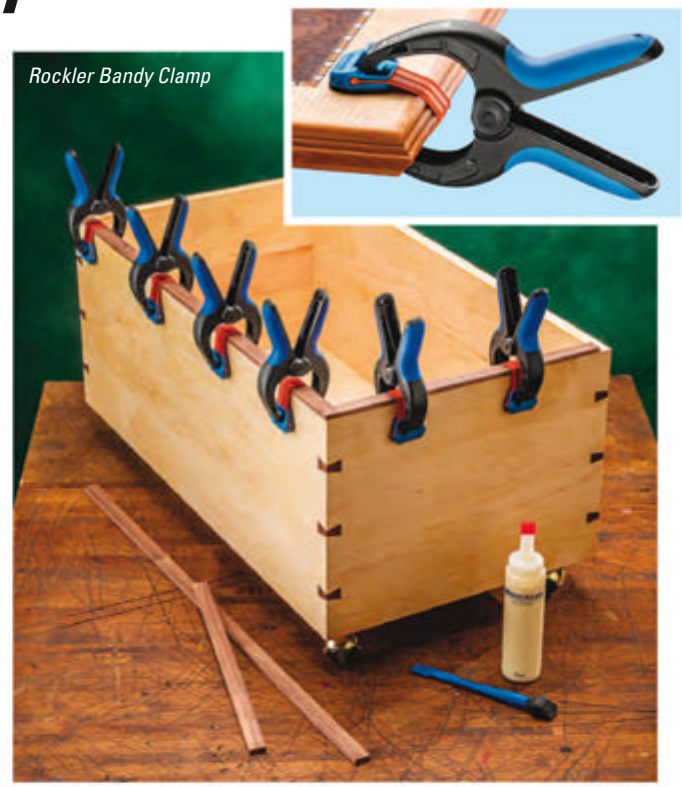
Rockler Bandy Clamp

The *Bandy Clamp* edge clamp from **Rockler** allows quick, one-handed clamping of edges, including ornate or decorative designs or oddly shaped profiles. "Squeeze and push the clamp onto any piece that fits inside the jaws, and Bandy Clamp will hold it," said Steve Krohmer, vice president of product marketing. Each Bandy Clamp features a built-in flexible rubber band made of tear-resistant rubber, with three extra-strength splines molded into it. The rubber band stretches to conform to the shape of an item. Anti-slip clamp pads on pivoting jaws accommodate different angles with full pad contact. The Bandy Clamp opens to 2" and has a jaw depth of 1⅝". Bandy Clamps (item 54258) are priced at $19.99 a pair.

The **OLFA**® line of utility knives is manufactured by a family-owned Japanese company — inspired, in the aftermath of World War II, to create snap-off knife blades after seeing how pieces of chocolate broke off of Hershey's® bars distributed by American GIs. Among the OLFA knives are the *25mm Extra Heavy Duty Utility Knives*, which offer both non-slip and cushion grip handle options, ratchet-lock or auto-lock mechanisms, and blade options that include a 25mm saw blade manufactured from Japanese carbon tool steel with a 59° edge angle. Seven-segment snap-off blades are also available. All the OLFA knife handles feature tool-free blade replacement. Suggested pricing for the 25mm Extra Heavy Duty Utility Knives, depending on handle and locking style, ranges from $16.99 to $19.99, with the HSWB 25mm Saw Blade (model #1105914) priced at $14.99.


OLFA 25mm Extra Heavy Duty Utility Knife

Kreg's *Precision Router Table System* combines three elements: the Precision Router Table Fence (item PRS1015), the Precision Router Table Top (PRS1025), and the Multi-Purpose Shop Stand (item KRS1035) into one system (item PRS1045), sold for $499.99. (The components are also available for individual purchase.)

The self-squaring Fence features a T-square style design, ensuring that the fence remains parallel to the miter/T-slot. Independent sliding fence faces allow it to be adjusted, or used as a jointer. A measuring scale adjusts to bit sizes, while a micro-adjust wheel adds to accuracy.

The 24" x 32" Table Top has an Easy-Slide™ laminate low-friction surface, heavy-duty insert plates that

Kreg Precision Router Table System

can be swapped out, and four Precision Insert Plate Levelers. Three Level-Loc reducing rings, with 1"-, 1 3/16"- and 2 5/8"-diameter openings, twist in and out of the plate to adjust for different bit sizes.

The Shop Stand is constructed from heavy-gauge steel, with legs that can be adjusted to any custom height between 29" and 35". Leg levers reduce wobble and adjust to uneven floors.

The *BORA Saw Plate* and *Rip Guide Handle* from **Affinity Tool Works** work together to create a circular saw guide for precise, consistent straight-line cuts, without wander or twist, which prevents binding or stalling. The BORA Saw Plate works with any right- or left-handed circular saw and connects to the saw at three points for added stability. An adjustable channel is designed to work with any straightedge guide up to 3½" wide. The BORA Saw Plate will rip material up to 50" long (longer with an optional Extension Kit). The Saw Plate is priced at $29 and the Rip Guide Handle at $20.

BORA Saw Plate

Continues on page 66 ...

What's In Store continued

General International 90-040M1 12" Wood Cutting Bandsaw

The *90-040M1 12" Wood Cutting Bandsaw* from **General International** offers a welded steel frame and a 15¾" x 21½" cast-iron table. The saw will rip cut up to 12"-wide material on the inboard (frame) side of the blade, and provides 6½" of throat depth for resawings or when cutting thick workpieces. A 6.4-amp, 2/3hp induction motor drives the blade at 1,444 or 3,150 rpm for cutting hardwoods or softwoods. General also includes a unique dust port with concentric openings for attaching 2"-, 3"- or 4"-dia. shop vacuum or dust collector nozzles. The 90-040M1 12" Wood Cutting Bandsaw is priced at $559.99.

Rockler Dust Right Universal Small Port Hose Kit

The *Dust Right® Universal Small Port Hose Kit* from **Rockler** includes two sizes of swiveling hose ports: 1" and 1½" inside diameter. They are equipped with rubber ends that stretch to provide an airtight fit on a variety of handheld power tool ports. A flexible 1½" inside diameter hose that expands from three to 15 feet long is provided to extend reach. Also included in the kit is a 2¼" outside diameter swivel port for connecting to standard shop vacuums, or other Dust Right accessories. All of the ports in the Small Port Hose Kit have tool-free installation: they reverse thread into the hose for an airtight friction fit. The Dust Right Universal Small Port Hose Kit (item 48212) is priced at $39.99.

Woodworking Tools & Supplies Index



August 2015

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Finishing Thoughts

Water-based Coatings

By Michael Dresdner

Water-based coatings are becoming more popular, and there are good reasons why. Manufacturers have kept what was good but fixed a host of old problems.

Michael Dresdner is a nationally known finishing expert. He shares his expertise on the DVD *The Way to Woodwork: Step-by-Step to a Perfect Finish,* available through the store at *woodworkersjournal.com.*

Clear water-based finishes have been around since 1980, but lately they've been gaining converts, with some 50% of woodworkers saying they now use them. Why the change?

To be honest, when water-based clear lacquers and polyurethanes first came on the market, they had lots of problems. Many of those issues have now been solved, and some new finish options have been added, making water-based a much more enticing alternative. Let's look at what's changed, what's the same, and the best ways to apply them. We'll also look in on some of the newer offerings in the field.

What's Different

The original water-based coatings were difficult to brush and spray, and did not flow out well. They were very sensitive to even the slightest surface contamination, and demanded near ideal temperature and humidity controls during application and cure. To make matters worse, the final coats were often less durable than many of their solvent-borne counterparts. In short, they were harder to work with and sometimes left a poorer final finish.

Thanks to some interesting additives, the new generation of finishes go on and flow out much better. Those same additives make the coating less sensitive to contamination and give them better adhesion when applied over oil-based stains and sealers.

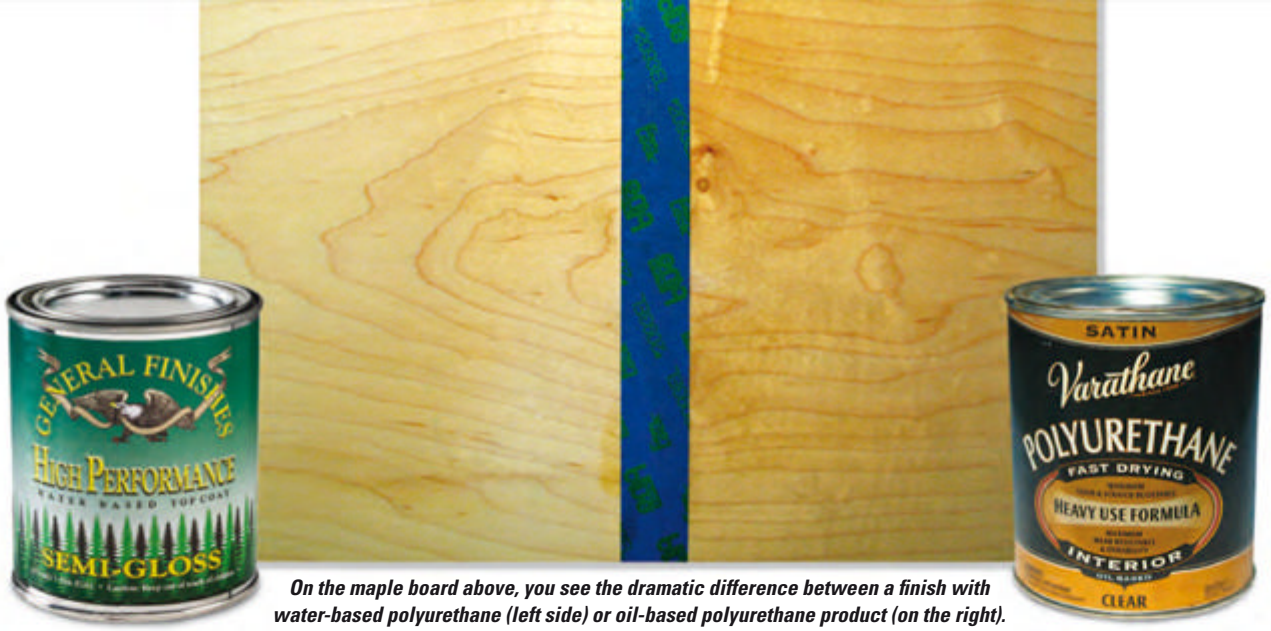
Along with better adhesion comes better films. Expect more durability across the board, with higher resistance to water, heat and chemicals, and, in some cases, even improved resistance to abrasion. There's also a wider range of materials available, with new items that make the whole finishing experience more pleasant and varied. (More on that later in this article.)

What's the Same

From the beginning, water-based had some advantages, and they're still there. Water-based coatings are nonflammable, low odor, contain fewer hazardous solvents, dry faster and have a higher solids content. Why the first three are advantageous is pretty self-evident, but the other two deserve a closer look.

Faster drying means that you may be able to finish a project completely in one weekend, something that means a lot to those of us who only have limited woodshop time. Pair water-based stains and glazes with water-based topcoats, and drying and handling times plummet from days to hours. You'll wait less after staining and between topcoats.

Higher solids is a less obvious advantage. The solids content is the amount of finish that remains on



On the maple board above, you see the dramatic difference between a finish with water-based polyurethane (left side) or oil-based polyurethane product (on the right).

the surface, as opposed to the amount of solvent that evaporates off. For instance, most solvent-based lacquer is shot at below 20% solids after thinning. That means for each coat you spray on, less than one fifth of it remains to form a finish, with all the rest evaporating. Water-based coatings typically have solids contents almost twice as high, so they tend to build faster.

Then there's the color, which can be either a boon or a bust. Most water-based topcoats dry water clear, as opposed to the amber hue of most solvent- and oil-based coatings. That can be an advantage when you want to keep light woods from turning yellow. Of course, you can always tint the coating with amber dye, so you can get the best of both worlds.

Application Techniques

Good application techniques still make a big difference, and rule number one is to apply it sparingly. Because of how water-based coatings cure, you'll get much better results applying a coat that is just barely uniformly wet. Don't pile it on; go for thin but evenly wet. Once it's on, be patient.

Unlike solvent finishes, water-based coatings do not look particularly good when wet, but they flow out considerably during drying. That's especially true when spraying. While wet, you'll see dramatic orange peel, but don't try to "fix" that by spraying heavier. Stop and wait, and it will eventually flow out far smoother than you expect.

I still prefer using a paint pad on large, flat surfaces, either vertical or horizontal. A paint pad has a huge application surface compared to a brush, and it's easier to lay down a smooth, thin layer quickly. When you must resort to a brush or foam-on-a-stick applicator, be gentle. Flow rather than scrub to avoid foaming — those tiny air bubbles that get trapped in the finish. If you work quickly, you'll now have more work-

A paint pad provides a larger surface than a brush for applying water-based finish — it's easier to apply a smooth, thin layer.

The easiest way to apply any stain, including the water-based variety, is to flood it on liberally, and wipe it off evenly.

Contact us with your finishing questions by writing to Woodworker's Journal, 4365 Willow Drive, Medina, MN 55340, or by emailing us at: finishing@woodworkersjournal.com. Please include your address, phone number and email address (if you have one) with your thoughts or questions.

Finishing Thoughts continued

ing time to blend and even up the coat. If you're curious, my favorite bristle brush options are Purdy's Chinex® or Syntox™ brushes.

Spraying

When spraying, use a small fluid aperature (1 mm or slightly larger) and spray sparingly, until the entire surface is just barely wet. Use a good quality gun that lets you control both the fluid and air flows, and hold the gun a tad closer to the wood (6" vs. 8"), especially with HVLP or LVLP guns. With standard compressed-air guns, dial the pressure back a bit so the finish lays out gently rather than smacks onto the surface. Oh, and clean the guns (and brushes) immediately and thoroughly with soap and water or, better yet, proprietary cleaning solvents.

Hold an HVLP or LVLP spray gun about 6" from the piece when spraying water-based finishes.

For spraying water-based finishes, the Titan Gravity Feed HVLP Spray Gun (above and left) works if you have a compressor that will handle a conversion gun. If you don't, or want a freestanding option, you might try the Earlex Spray Station 5500 (at far left).

Color Add-ons

You'll see a lot more water-based pigment and combination stains available than ever before, and they can be either wiped on and off, or sprayed on. Dye stains, pre-mixed and ready to use, apply the same way, but without the mess of mixing and the fear of colors that don't match from batch to batch. All can be intermixed to create custom colors and can be added in small amounts to clear coatings to make tinting lacquers.

Some of the more enticing new offerings are from General Finishes. Their Glaze Effects (solid color) and Pearl Effects (pearlescent colors) are thicker versions of stain that can be used on raw wood or in between coats of finish to create shading, antiquing and special effects. Then there's their Enduro-Var water-based polyurethane varnish, which is the closest thing to "old world" oil varnish you can find in a faster drying water-based mode.

Bottom line? If you haven't already done so, maybe it's time to take another look at water-based coatings.

Water-based dye stains can be mixed to create custom colors. Here, a 2:1 ratio of General Finishes Orange to Medium Brown creates an appropriate color on mahogany for Greene and Greene style pieces.

HEY Did You Know?

Woodworking trivia: a forest of facts

Bodgers were itinerant woodworkers who set up in forests where they cut, hewed, shaped and turned green wood on-site, making chair legs and stretchers to be sold in bulk. Their tools included the shaving horse and drawknife, saws, axes and pole lathe. A talented bodger could make upwards of 12 dozen (144) legs and stretchers in a day, all without power tools.

What Does It All Mean?

A quick guide to terms from the world of woodworking.

Dimensional Lumber: Wood building material cut to standard sizes, both in width and thickness, such as a 2x4, and sold in various lengths

Hardwood: Any lumber from a deciduous tree

Shaving Horse: A combination bench and seat for carving; a movable end piece is held with the foot to clamp a workpiece in place, freeing both hands

And the award for most ornate goes to ... Coachmaker's planes, like the one pictured at left, are among the most unusually shaped hand planes. Rather than cutting flats, many were used to shape the complex contours in fancy coaches.

Lignum Vitae (Latin for "wood of life") is extremely hard and so dense it won't float. The wood remains self-lubricating both in and out of water, and therefore has been used as wet bearings (as seen at right) on dam turbines, submarines and ships. It has also been used as belaying pins, British police truncheons, mortars and pestles – even the neck wood of the late Pete Seeger's banjo.

photos courtesy of Lignum-Vitae-Bearings.com

Submit your own trivia ...

Send in a curious fact about your favorite topic and ours: woodworking. If it is selected for use, you will win an awesome prize!

Submit your Trivia to Woodworker's Journal, Dept. Trivia, 4365 Willow Drive, Medina, MN 55340. Or send us an email: *trivia@woodworkersjournal.com*

Your Trivia Test:

Q What wood has been instrumental in keeping Navy submarines running silent?

Answer Seawater naturally lubricates lignum vitae, used in propeller shaft bearings until recently displaced by space-age substances. The wood bearings were very quiet

Father Chrysanthos of Etna, California, will receive a SENCO FinishPro 23SXP 23-ga. Headless Pinner, 1 Gallon Finish & Trim Air Compressor (model PC1010N) and pack of 23-ga. Pins (item A101009) for having his contribution selected for the Trivia page.

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