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- Max. width of cut: 12"
- Planer feed rate: 22 FPM
- Max. planer depth of cut: ⅛"
- Max. planer cutting height: 8"
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- Max. depth of cut: ⅛"
- Max. rabbeting depth: ½"
- Cutterhead dia.: 3"
- Cutterhead speed: 5000 RPM
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- Approx. shipping weight: 500 lbs.

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8" X 76" JOINTERS

- Motor: 3 HP, 220V, single-phase, TEFC, 3450 RPM
- Precision-ground cast iron table size: 8" x 76⅜"
- Infeed table size: 8" x 43⅜"
- Cutterhead knives (G0490): 4 HSS, 8" x ¾" x ⅛"
- Cutterhead speed: 5350 RPM
- Cutterhead dia.: 3⅜"
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- Motor: 3 HP, 220V, single-phase
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- Max. cutting depth: ⅛"
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- Max. cutting height: 8"
- Max. cutting depth: ⅛"
- Feed rate: 16 & 20 FPM
- Cutterhead dia.: 3⅛"
- Cutterhead knives: 4 HSS (G0454)
- Cutterhead speed: 5000 RPM
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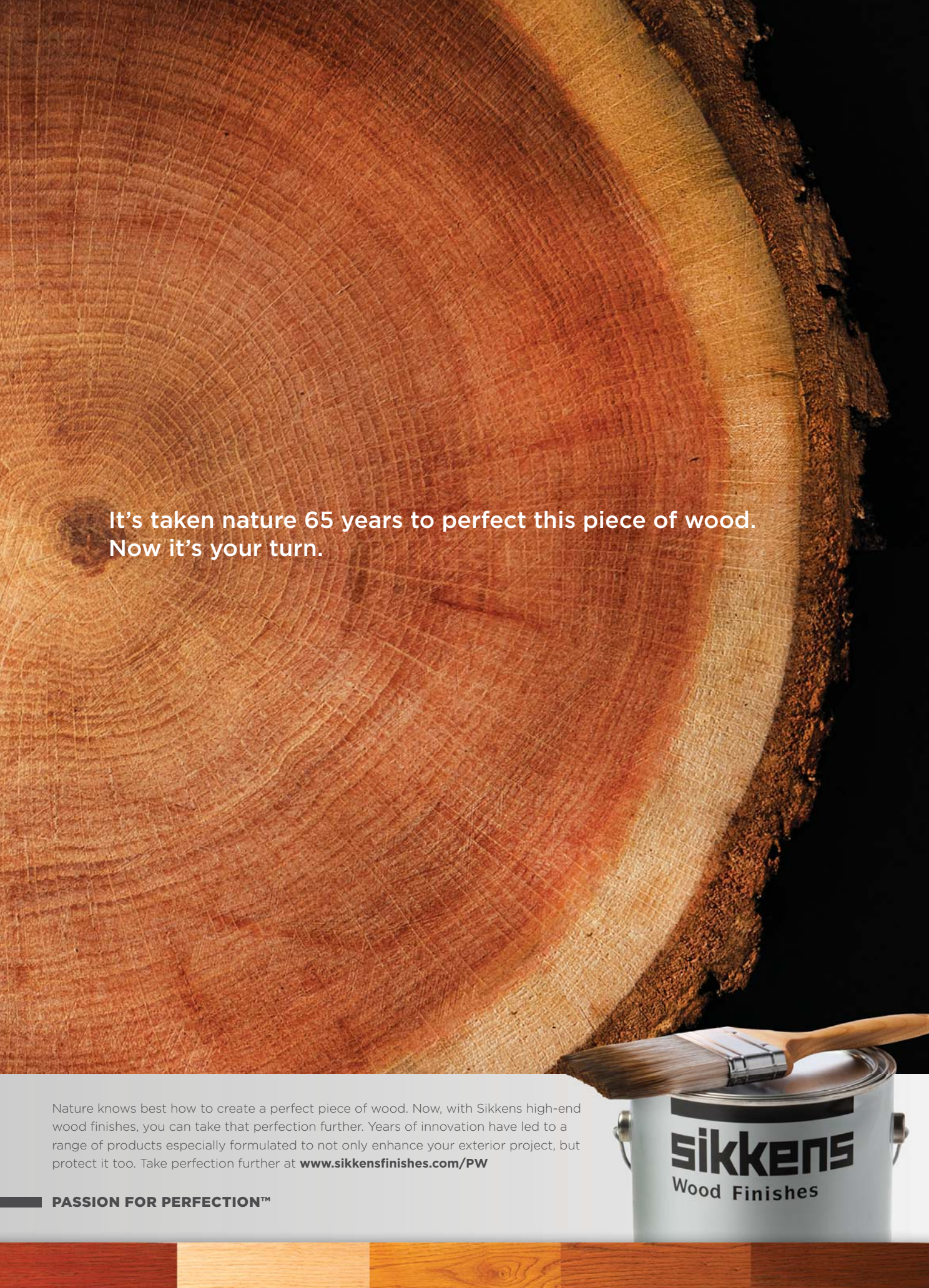

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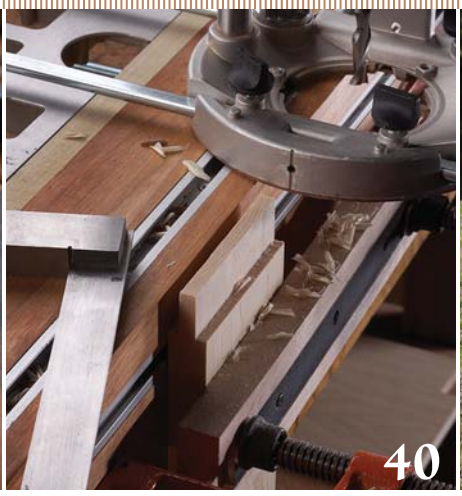

FEATURES

COVER PHOTO BY AL PARRISH; ACANTHUS LEAF PHOTO BY LAURA SPARROW; ROORKHEE CHAIR PHOTO BY CHRISTOPHER SCHWARZ; GIZMOZILLA & SPOKESHAVE PHOTOS BY AL PARRISH

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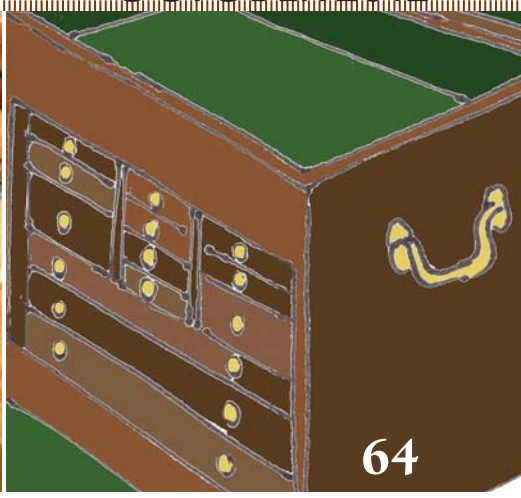

REGULARS

I Can Do That

60

POPULAR WOODWORKING MAGAZINE

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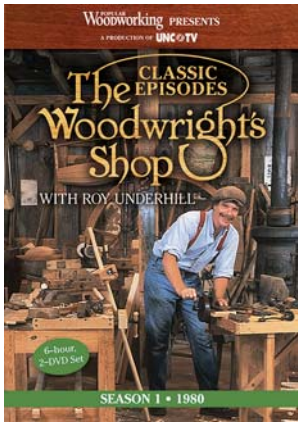
Always an Apprentice

I've got a lot to learn. But when it comes to woodworking, I wouldn't have it any other way. In fact, it's one of the things I like most about the craft. Whenever possible, I try to tackle a new skill or technique with every project I build. Figuring out exactly how to pull off the things that I draw or imagine keeps me up at night – in a good way – and pulls me out of bed in the morning. It's those small breakthroughs that got me hooked on woodworking in the first place. In this, I doubt that I'm alone.



It isn't always easy to replicate our early woodworking successes. I remember carving a whistle from a green hickory branch while sitting on a swing with my grandfather in a South Carolina mill town. Several years later I nailed together a blanket chest on the back porch with my father looking on. And just after college, I assembled my first hand-cut mortise-and-tenon joint in a sweltering Mississippi basement.

With each skill you pick up, you gain membership to a small society of men and women who have a need to understand something with both their heads and their hands – people who get that glint in their eyes when something finally comes together and makes sense.

I can think of no woodworker who more clearly gets that glint in his eye or does a better job of sharing that passion for woodworking than Roy Underhill, long-time host of the PBS show "The Woodwright's Shop." It worked on me: Between 30 years of Roy's shows and his many books, I've learned loads under his tutelage – mere mention of Roy reminds me of yet another basement shop where I cut mitered dovetails on a Jefferson bookcase using Roy's advice.

Like me, many others have long been clamoring for vintage episodes of "The Woodwright's Shop." So I am especially proud that we have partnered with Roy and UNC-TV to bring those old episodes back to life. Shows are now available as full-season DVDs and as streaming video on shopclass.popularwoodworking.com. Five seasons are currently available, and we will add a new season every month. Or, for a small taste, visit popularwoodworking.com. The episodes not only hold up, they improve with age.

While watching the first episode of Charles Brock's web TV show, "The Highland Woodworker," I noticed the same passion for the craft and a bit of the same glint that's seen in Roy's eyes. Which makes sense – Roy was featured on that first episode. And you can tell that the show strives to get to the heart of the matter – it's made by people who love the craft for people who love the craft.

So I am also proud to announce that we are now a sponsor of "The Highland Woodworker." Episode 2 features Brian Boggs (another of my woodworking heroes) as well as the first in a recurring segment from our editors. In the first, I walk through the steps for pegging mortise-and-tenon joints. I still remember the first time I pulled it off. A square peg in a round hole. It's simple and logical – yet somehow amazing. It's woodworking. PWM

Matthew Teague

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Period Pocket Screws

I've really enjoyed the Arts & Mysteries series on boarded furniture (an eye-opener to simple yet durable construction methods), but was left wondering how tops are attached in period examples.

Nailed on through the top seems a recipe for problems. Figure-8 clips are not period correct. And wedged mortise and tenons are not simple.

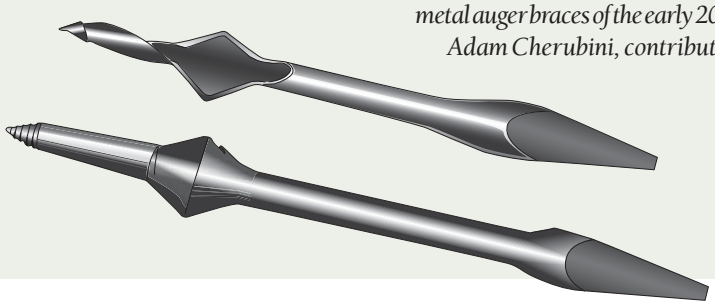
Something else must have been employed. I'm thinking some sort of glue block(s). Wood movement in these pieces should allow for rigid attachment. Who knows: There may have been 18th-century pocket-screw jigs.

Jeremy Wright
Monticello, Illinois

Jeremy,
Many pieces I have seen had nails through the top. I would expect they were always toenailed in, which would make them hold better. But you never know if this was the original builder's intention, or what someone did when the original builder's intention failed. Buttons (wooden clips) or glue blocks are excellent options.

But pocket holes easily date as far back as the 18th century, and there were specialized bits for the operation (or the pocket can be made with a few chisel cuts). I have a couple bits (though none from the 18th century). The upper bit shown here probably dates to the first half of the 19th century. It was made to fit Sheffield-style braces. The lower bit appears to have been made to fit the metal auger braces of the early 20th century.

Adam Cherubini, contributing editor



Saw Burn Removal Methods

Have you any suggestions for removing burn marks from cherry from a saw blade, both with and across the grain?

Harold W. Haft
via e-mail

Harold,
You can always sand away saw burns, but I usually reach for a scraper.

Cherry burns easily, but using a nice, sharp and clean saw blade helps. I also find that you can push cherry through a blade a little faster than you can oak and other especially hard hardwoods, and moving through the cut quickly and at a steady rate also helps minimize burning.

We all deal with it; I had to scrape some burn marks off the cherry legs for the table featured on page 26 in this issue.

Matthew Teague, editor

What is the Campaign Chest Time & Materials Cost?

How much did the campaign chest in the August 2012 issue (#198) cost to build with the hardware and finish? Also, how many hours did it take to build the project?

I know that my costs will be different, but I still would like to know what the author, Christopher Schwarz, spent, as well as the number of hours it took to build the pieces.

Wilson Stevens,
via e-mail

Wilson,
The materials costs for the chest totaled about $1,000 for the wood – I bought 16"-wide mahogany and used no secondary wood for the sake of authenticity.

The hardware shown is from Horton Brasses; it cost me about $700.

The project took about 80 hours of shop time.

I wrote several blog articles this spring on how to achieve the same result with less money, including this one:

popularwoodworking.com/woodworking-blogs/chris-schwarz-blog/campaign-chests-on-a-budget.

Christopher Schwarz, contributing editor

Inspiration for Young Women

I caught Megan Fitzpatrick and Peter Follansbee on "The Woodwright's Shop" rerun this weekend (episode #3107).

I pointed her out to my 7-year-old daughter as the lady who will help publish my story about my workbench. She exclaimed with great excitement, "Girls can do woodwork too?" She lit up like a lightbulb!

"Or course they can, honey!" It had never occurred to me that she might think woodworking was strictly a male thing.

She spent the rest of the day hammering and sawing all my scraps and she just had a blast in the shop – for the first time ever.

I want to let Megan know what a positive role model she is. I wonder how many other young girls she will inspire?

W. Paul Olsen
Wildwood, Missouri

Ed note: (Paul's End Grain about his workbench will appear in an upcoming issue of Popular Woodworking Magazine*).*

Any Suggestions for a Shiny Finish on Red Cedar?

I've turned a few pieces out of red cedar that I finished with Danish oil – but I've never been thrilled by the exterior appearance.

I like bright, shiny finishes. Do you have any suggestions on how to achieve this on cedar? It's about time to make something else because I still have a nice chunk of the wood.

Dale Larson
Slidell, Louisiana

CONTINUED ON PAGE 10

ILLUSTRATION BY MARY JANE FAVORITE

CONTINUED FROM PAGE 8

Dale,
Shellac would be your best option. It's glossy. You could also apply a first coat of shellac to seal in the aromatic oils that can cause a finish to not dry well, then coat over it with whatever finish you want.

You could do the same with the pieces you've already finished. Apply a coat of shellac, then more shellac, or whatever you want. It should work well, even though you're coating over the Danish oil.

Bob Flexner, contributing editor

Campaign Chest Gallery

The August 2012 (issue #198) article "Campaign Furniture" by Christopher Schwarz was fantastic and long overdue. I made my first campaign chest in 1976. I was an Air Force officer at the time, so the idea of portable furniture appealed to me. I had nothing much to guide me, so I made a few mistakes – but the piece has held together for 36 years and through several moves.

I completed a one-piece writing desk last year. The mechanism I used for it was sort of made up; as you pull out the supports, the writing top comes with it.

I didn't have the knowledge to build the kind of gallery arrangement as Christopher did – and I'm still a bit mystified as to how the gallery slides out. At any rate I hope this isn't the last article on this most intriguing, and I think elegant, style.

Randall Wright
Bemidji, Minnesota

Randall,
The gallery in Christopher's chest is a separate carcase sized to fit inside the top drawer of the upper chest, with just enough clearance to slide in and out (in fact, the gallery can be pulled out completely from the chest, should the top drawer ever need repurposing). You can make the gallery however your tools and skills allow, and can adopt construction methods from any piece that has a gallery (from nailed-together dividers to friction fits in V-grooves).

Be on the lookout for a book on campaign furniture from Christopher in the next year or so.

Megan Fitzpatrick, managing editor

Drawboring Workbenches

I am in the process of building my workbench. It is in the Roubo style, and I will be using drawbored pins through the legs and stretchers. I was wondering if I should do the same with the leg-to-benchtop joint. I plan on connecting the top to the base with a sliding dovetail and a tenon.

Also, I'm reading Eric Sloane's book "A Reverence for Wood," and he mentions using "nicked" pins for drawbores. I was wondering if this would make an even stronger mortise-and-tenon joint.

Tom Conover,
via Facebook

Tom,
A drawbored mortise-and-tenon joint (pin nicked or not) will absolutely be strong enough for the joints in the base.

I read the passage in Sloane to which you refer, and I've neither seen nor used a nicked pin (which sounds as if it simply has a slight barb cut into it, rather like a bee's stinger, so that it can't easily be pulled out). I asked Christopher about it, and he's not encountered it, either. He did say, however, that he's seen pins work their way out of a joint when there is little or no offset. So the key is to make sure your drawbore holes are sufficiently offset (on a workbench base, that's between 1/8" and 3/16", depending on pin size and the species of wood for your base).

You needn't pin the top – the weight will be more than enough hold it in place atop the tenon and tail. **PWM**

Megan Fitzpatrick, managing editor

ONLINE EXTRAS

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PHOTO BY CHRISTOPHER SCHWARZ

Highly Recommended

There are many good marking and cutting gauges available – but years from now, someone will have to pry my three Tite-Mark cutting gauges (Glen-Drake Toolworks) out of my cold, dead hands.

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— Megan Fitzpatrick

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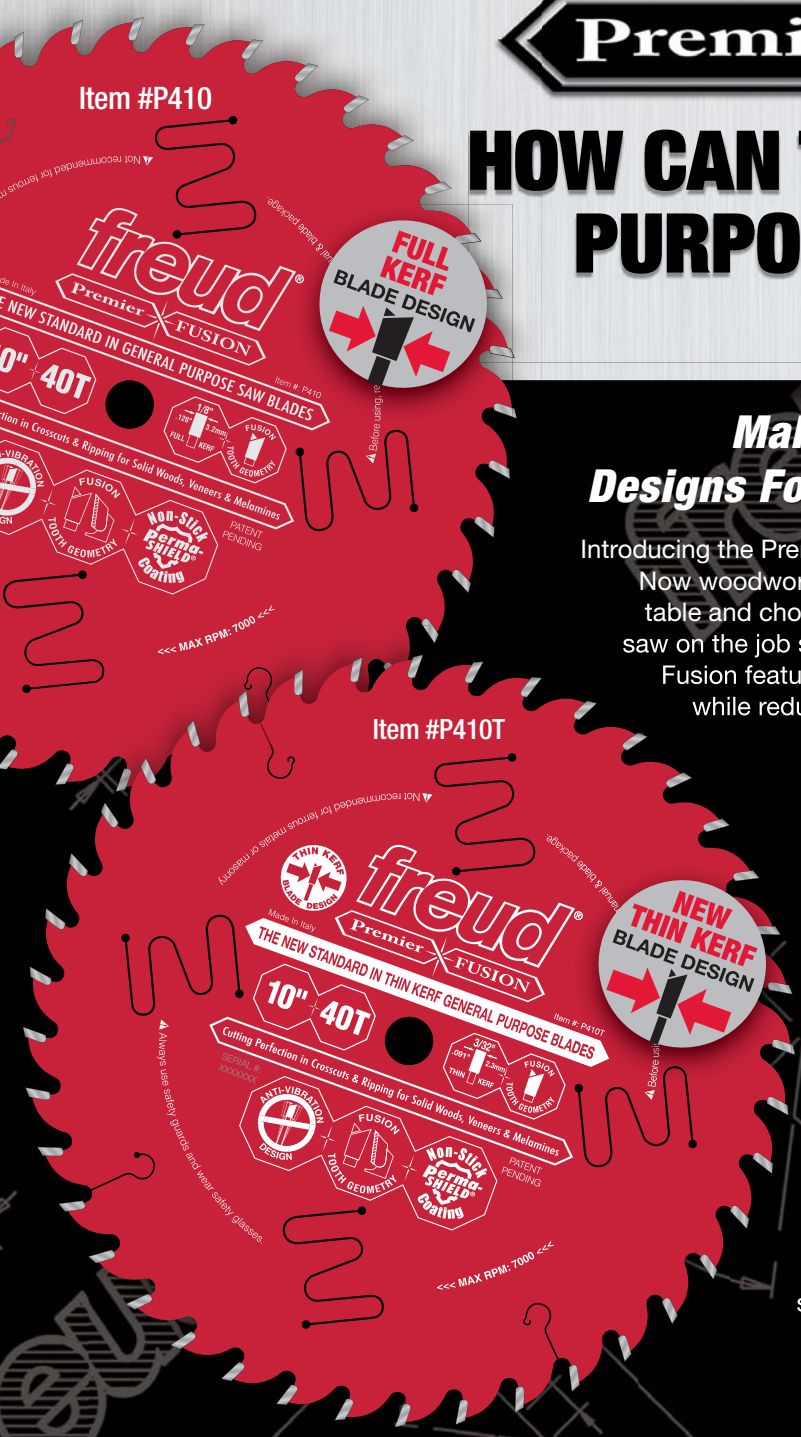
Premier FUSION

HOW CAN THE BEST GENERAL PURPOSE SAW BLADE GET EVEN BETTER?



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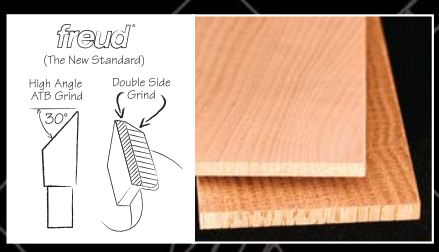
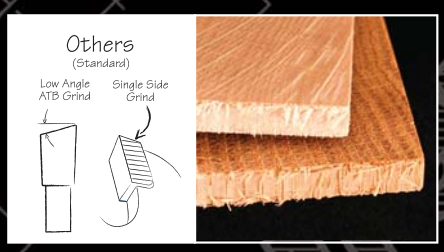
Freud's Fusion Tooth Design vs. Others





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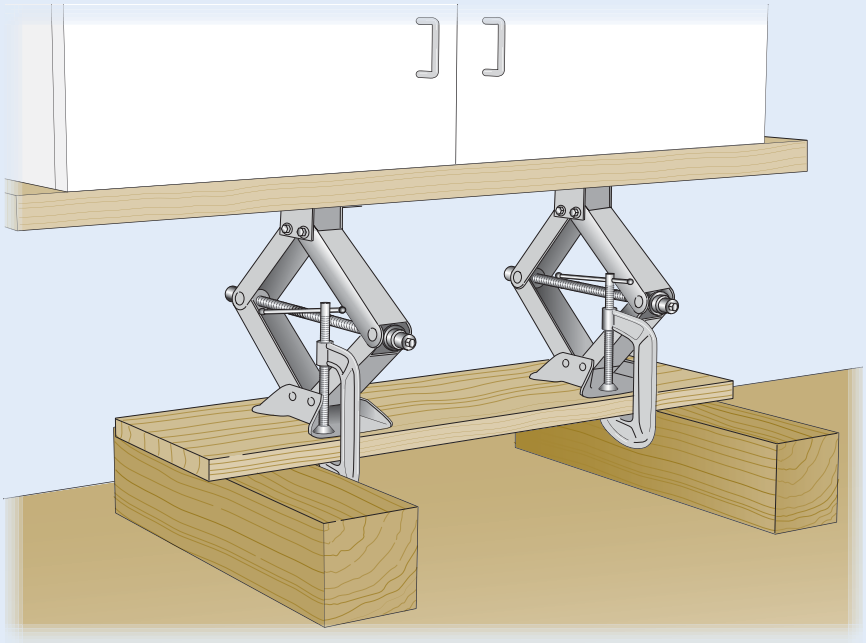


I have long used my car's scissor jack for house and shop projects including lifting a settled deck and leveling workbenches. And when I needed to install a new set of cabinets in my shop, I realized that a pair of these jacks would be perfect for positioning and leveling them.

I picked up a second scissor jack and clamped both to a scrap piece of 3/4" stock to provide stability. I also blocked them up so the scissor extension was sufficient to lift the cabinets into position. The arrangement at left shows the jacks on my workbench, securely holding the cabinets. I can easily raise and level the cabinets with just a few turns on the jacks. I now use these whenever I install cabinets.

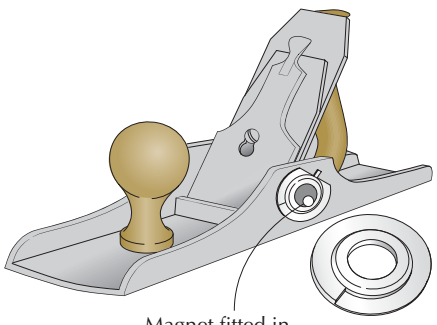
The benefit of a scissor jack is that it is strong, lifts smoothly and can be precisely adjusted. And you won't strain your back hefting heavy cabinets. You can pick up a used jack or two at an auto salvage yard for a very reasonable price.

Bill Wells
Olympia, Washington

Pocket Screwdriver on Board

I modified several of my Lee Valley pocket screwdrivers so I can use them to adjust the cap-iron screws as well as the lever cap screw on my handplanes. I jammed a magnet into the hole of the pocket screwdriver so I can attach one to each of my various planes.

Charles Mak
Calgary, Alberta



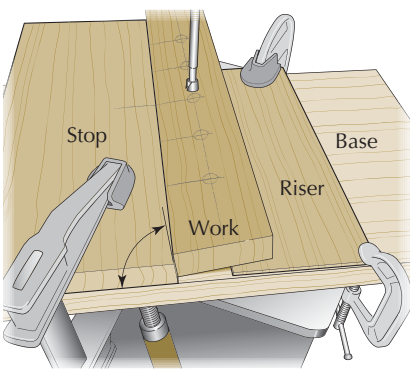
Magnet fitted in a pocket screwdriver

Shallow-angle Drilling Trick

I recently took on a project to organize our walk-in closet by making a wall rack to store belts and ties. It's a simple project: just a narrow (3/4" x 2" x 24") oak board with a routed edge and a row of 15 equally spaced pegs mounted at about a 7° angle.

To drill the holes for the 3/8"-diameter pegs at the angle I wanted, I came up with the idea shown here.

The stop is made by ripping a 7° bevel on one long edge. The stop is then fastened securely to a base. Next, set one long edge of the work against the beveled edge of the stop with the front (good) side facing up. Then, tilt the work until its edge is flush to the beveled edge of the stop. Slide a riser under the workpiece and parallel to the stop to hold the work edge flush to the stop bevel. Hold the riser in place with clamps or hot-melt glue.



Set the assembly on the drill press table and locate the centerline of the row of holes with the center of a Forstner bit in the drill chuck and clamp the base to the drill press table.

Drill the holes to the required depth then slide the work along to the next hole location.

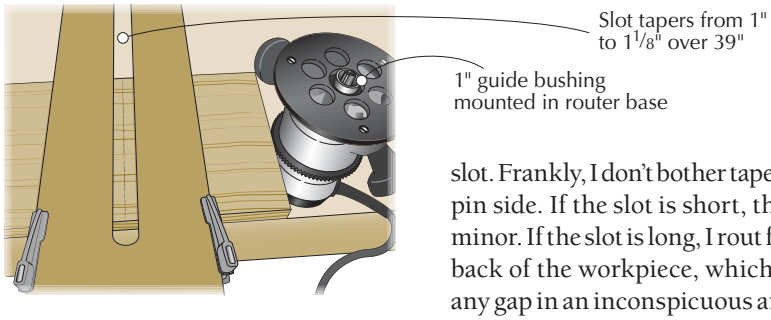
John Cusimano
Lansdale, Pennsylvania

ILLUSTRATIONS BY MARY JANE FAVORITE

Tapered Sliding Dovetail Jig

I finally solved an issue I've encountered many times with sliding dovetails. I used to make the sockets the same size as the pins but the longer the joint gets the more difficult it is to slide together. I made this jig that tapers the slot just a tiny bit (1/8" over 39") so the pin glides easily.

To make the jig, I used piece of laminate flooring that's about 44" long, but Baltic birch plywood would also work. After ripping off the tongue and groove on the board, drill a centered 1" hole about 3" from one end and a 1 1/8" hole about 3" from the other end. Clamp the board on a straightedge making sure the holes line up perfectly against the straightedge. Using a router outfitted with a flush-trim bit, rout along one side



between the holes, then spin the piece around and rout along the other side. I ended up with a 39"-long slot tapered from 1" to 1 1/8". Before breaking down the setup, make sure a 1" guide bushing fits perfectly in the 1" end.

To use the jig, clamp it to the workpiece where you want the slot and ride your router, outfitted with a 1" guide bushing, along both edges of the jig's slot to make a perfect tapered dovetail slot. Frankly, I don't bother tapering the pin side. If the slot is short, the gap is minor. If the slot is long, I rout from the back of the workpiece, which locates any gap in an inconspicuous area or in the back of the project. The 1" guide bushing will accommodate up to a 3/4"-wide sliding dovetail.

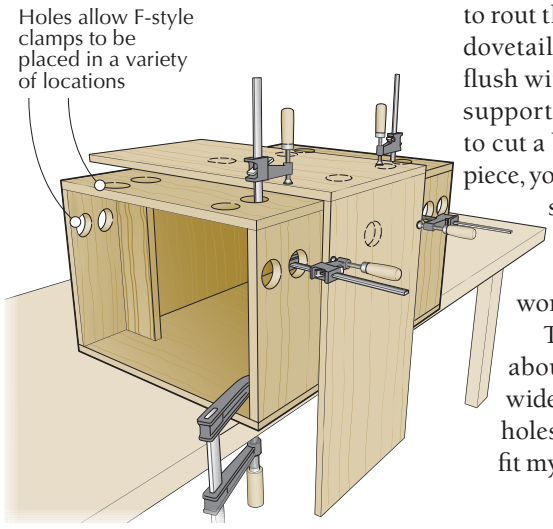
One more thing: Make sure your jig is wide enough for the router to clear the clamps.

Serge Duclos
Delson, Québec

The Moxon Quad-screw Vise

I built a couple dozen kitchen cabinet boxes at work and got frustrated with how finicky and time-consuming it was to clamp each corner, line it up, then flip it over to drill and screw. Things would often shift while flipping everything over or the clamps would just get in the way.

I had read the post on Christopher Schwarz's blog about building a Moxon double-screw vise with F-style clamps – and one day things clicked. I realized I could quickly build a Moxon quad-screw vise that would support both pieces, make them easy to align and keep the corner that needs to be drilled and screwed facing up.



After building the vise, I found it works for many other things. When cutting dovetails I can quickly transfer the tails onto the pin board with everything fully secured. If you have a less-than-ideal bench (too low, no vise or no bench at all) you can build it to be a comfortable working height and it isn't permanent. Any time you need to rout the end of a board for a sliding dovetail or a tenon, you can clamp it flush with the top and have plenty of support for your router. If you need to cut a biscuit or Domino in a small piece, you can clamp it and the top will support the tool. Overall, it's a pretty universal fixture that can be built to suit the size of work you do.

The quad-screw I built was about 18" tall, 24" deep and 32" wide. I used a 2 1/2" hole saw to drill holes for clamps in locations that fit my work. PWM

Jeremy Lindorff-Trnka
Minneapolis, Minnesota

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Veritas's New Top-secret Steel

Canadian company creates a steel combining the best of the old and new.

I've long been suspicious of the so-called "super steels" that promise long edge life between sharpenings. That has always meant that you have to spend a long time sharpening the tool on your stones or – even worse – you have to buy fancy equipment to even get a serviceable edge.

Plus, no new steel I've tried has ever had the feel of old-fashioned high-carbon steel. Until now.

Veritas is using a powdered steel (a closely guarded formula) that seems to defy many of the normal laws of high-carbon and alloy steels. Powdered metal is nothing new in woodworking. During the last decade, I've tried out several plane irons and chisels that were made using the sintering process.

In a nutshell, powdered metals are where you take your raw materials, combine them in liquid form and then atomize them to form a powder. The powder is sifted through a screen for consistency, put into a mould and then heated to form a solid billet. This sintering process allows you to make materials with remarkable consistency that can have properties that would be impossible to make by smelting.

For most of 2012, I've been testing a sample of Veritas's new metal, which is called PM-V11. I've been using it side-by-side with a Veritas A2 iron, swapping the irons back and forth in the same tool. Both irons were set up from scratch in my shop.

PM-V11 Steel

Veritas ▪ leevalley.com or 800-871-8158

Street price ▪ see leevalley.com

▪ **BLOG** *Read more about PM-V11: popularwoodworking.com/oct12.*

Price will vary depending on tool and size.

Feels old, looks new. *This new powdered metal from Veritas is as easy to sharpen as high-carbon steel and holds an edge like a alloy steel. In fact, you probably will think you are using old-fashioned steel.*

Both PM-V11 and A2 sharpen readily on waterstones and sandpaper. And the first surprise was how easy the PM-V11 was to polish. It polished up much faster than the A2 iron (and all other A2 irons I've used on waterstones).

In use, the PM-V11 held its edge longer than the A2. How long exactly I cannot say. I've been working in mahogany and oak exclusively since January, and it was obvious that I was getting more work from the PM-V11 iron between sharpenings.

But to be candid, edge life doesn't impress me terribly. As long as I'm not sharpening the tool every hour, I'm OK. What I really care about is sharpenability – how easy the tool is to sharpen – and how keen an edge it takes. On this front, the PM-V11 is a real champ.

In fact, the biggest surprise came when I tried sharpening the PM-V11 on my oilstones. It was exactly like sharpening high-carbon steel. The soft Arkansas bit right into the cutter and turned a burr with ease. The hard and translucent Arkansas stones did their jobs quickly and easily. Honestly, if I didn't know better, I would have sworn I was sharpening high-carbon steel.

The development of PM-V11 has required thousands of laboratory and real-world tests and more than $250,000 in development costs for Veritas, according to Robin Lee, president of Lee Valley Tools and Veritas. The company plans to offer it in many Veritas tools, plus replacement irons for Stanley blades. Blades using PM-V11 should cost about 30 percent more than an A2 or O1 blade, on average, Lee said.

PM-V11 is a big deal for traditional woodworkers like myself. It allows you to sharpen it with almost any medium – quickly – and enjoy a long time between sharpenings. It is the best of the old world and the new.

— Christopher Schwarz

CONTINUED ON PAGE 16

VERITAS PHOTOS BY CHRISTOPHER SCHWARZ, FESTOOL & M-POWER PHOTOS BY AL PARRISH

CONTINUED FROM PAGE 14

Festool Domino XL DF 700

Festool recently released the Domino XL DF 700, big brother to its revolutionary Domino DF 500, one of the most innovative tools of the last few decades. Aside from the size, the loose-tenon joints created by the XL are the same as with the earlier version. From a machine that resembles a biscuit joiner, a router-type bit both plunges and oscillates to cut mortises in mating parts. Into each mortise fits a loose tenon, or "Domino."

How's the fit? As good as I've seen, whether cut by hand or power. And lining up the joint couldn't be easier. Cut butt joints on square or angled parts, align the two mating pieces and mark the tenon location on both pieces with one quick swipe of your pencil. Line up the machine and make the plunge cuts. The XL also has an improved indexing system that allows for even less measuring.

For the combination of speed and strength, this joinery system is tough to beat.

While the original machine (7 lbs.) handles loose tenons in five thicknesses (from 4 to 10mm), the noticeably heavier XL (11.4 lbs.) handles Dominos 8,10, 12 and 14mm thick. But the more meaningful difference is that the Domino XL plunges much deeper than the original. Instead of maxing out at 28mm like the original, the XL cuts mortises from 15 to 70mm deep (which means loose tenons can be as long as 5 1/2").

If you often tackle large-scale projects such as doors, beds or hefty architectural elements, the Festool Domino XL deserves serious consideration.

The basic kit is $1,200 (it includes the tool and loose tenons). Pricey? Yes. But you'll be amazed by the time saved without sacrificing strength.

— Matthew Teague

Domino XL DF 700

Festool ▪ festoolusa.com or 888-337-8600

Street price ▪ $1,200

▪ **VIDEO** *See a collection of XL reviews: popularwoodworking.com/oct12.*

Price correct at time of publication.

M-Power CRB7 Combination Router Base

M-Power Tools offers an aftermarket router base that offers a number of features at the very reasonable price of about $90. It can be mounted to any router that has 5/16"-diameter edge-guide holes spaced between 3 5/64"and 5 1/8".

One key feature is an indexed micro-adjusting wheel that lets you dial in the router bit to a measurement or layout line – it's particularly useful when routing dados or grooves in combination with a guide rail or circle-cutting jig.

And speaking of cutting circles, the base comes with a pivot pin and pre-drilled holes for cutting circles as small as 3/4" and up to nearly 9" in diameter.

Of course, as a large surface router base the CRB7 provides a more stable platform when routing. The base is easily offset to put more surface on the work; a large knob quickly attaches to provide a good handle. It also comes with a height-adjustable stabilizing foot to help prevent the router from tilting on the outboard side.

The CRB7 can also be set up for routing mortises, either centered or offset. The mortising function is achieved by attaching two posts that extend below the base. These posts are rotated clockwise contacting the work and holding the router in position when making a forward cut. Adjustments to the router fence's guide rods provide the offset mortise capability.

An accessory edge-trim kit is also available. It attaches to the CBR7 base and will flush-trim edge banding. It uses a ball bearing riding against the outside edge of the banding to guide the router.

The CBR7 is available through Infinity Cutting Tools and delivers many features at an affordable price. **PWM**

— Steve Shanesy

CRB7 Router Base

M-Power ▪ m-powertools.com or 613-525-3328

Street price ▪ $90

▪ **VIDEO** *See the CRB7 in action at popularwoodworking.com/oct12.*

Price correct at time of publication.

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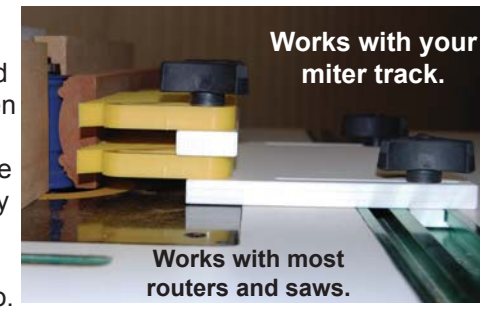

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Honing in on Proportions

Small changes can make a big design difference – and help train your eye.

How do you dial in the proportions on a furniture design? I used to pose that question a lot. Perhaps what makes this puzzling is the fact that small differences can have a dramatic effect. The line between the merely good and the dazzling is often blurry. Face it: Most of us aren't setting out to create a masterpiece; we'd just like to be able to make solid, confident design decisions and create furniture we're proud of.

For many years, whenever I'd spot an eye-catching bookcase or chair design, I'd question the maker about how he or she found that sweet spot. But even experienced builders often have difficulty answering that question. I often heard, "trust your gut." That's code for, "Build a lot of furniture and eventually your eye for proportions becomes second nature."

No doubt – there's no substitute for experience. But for many of us it sounds like a long journey. Even if you accept a long journey as part of the equation, a road map would be nice. I don't want to set out on a journey to Savannah, Ga., and end up in Newark, N.J. (no offense to the Garden State). The good news is that our woodworking tradition offers some helpful insight to help us cut through the fog. With a little practice you can begin to trust your gut and not have to wait until you've designed and built a lifetime's worth of furniture.

Tapping Into Your Sixth Sense

Regardless of any self-doubt you may harbor, you already have a strong sense of proportion. Leonardo da Vinci illustrated this vividly with a series of drawings called grotesques. He took a normal human face and exaggerated just one or two proportions out of kilter. Our natural reaction to those images is a testimony to our inherent sensitivity to proportions. The key, then, is learning how to tap into this proportional sixth sense, and learn to consciously unpack a design to begin to see proportional relationships.

Start small. *Learning how to make small adjustments to a design can actually help train your "designer's eye."*

Quite a difference. *Just pull one or two facial proportions out of what's considered average, and the effect is glaring.*

But before we tackle the subject of dialing in proportions on a furniture design, it's important to acknowledge that our individual sense of proportions is subjective. There are broad principles of design that most of us find compelling, but individuals have a range they find pleasing. It's similar to our preferences in music. We may enjoy different types of music – jazz, rock, bluegrass or classical – but underneath all it's held together with just a few simple notes. Just like we have an ear for musical notes, we can develop an eye for proportions.

Who's Related to Whom?

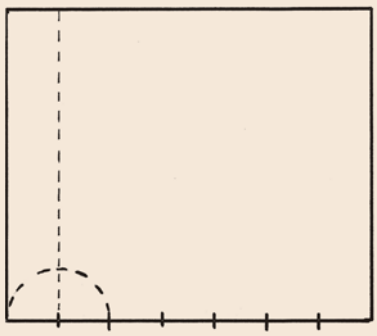
Design is largely about connections, and as a builder it's most important to learn how to find a way to connect with your inner eye. As you work through a design or a build, you may sense something is off. It may be a just a sense that the design is too heavy, or clunky.

Often it's a border element that looks a bit out of whack. By border, I mean any element that defines an internal space within a design. It can be a vertical border, such as the stiles that frame

PHOTO & PROPORTION ILLUSTRATIONS BY THE AUTHOR; FACE ILLUSTRATION BY LEONARDO DA VINCI, PUBLIC DOMAIN

A DASH OF SALT

Historic design books from the pre-industrial era had a thing about dividing an element or space into six equal parts and using a sixth to nudge a proportion one way or another. That may sound odd but actually has some solid logic behind it. If you tweak an element by something smaller than a sixth, it's hardly detectable to the eye. Conversely, if you adjust by a coarser proportion, it can be too large of a bump. Sort of like a bad haircut. Somehow a sixth is just like a dash of salt – enough that the eye picks up on it but not too far. — GW



Past proportions. *Frequently in historic work, a rectangle that defined a space (such as a small chest or table) was bumped by a sixth taken from the width. Here is a square that's bumped wider. Historic design books called this "a square and a sixth."*

Borders. *The heavy top, sides and base form the visual borders in this composition. These are exaggerated to show the effect that borders can have on a design.*

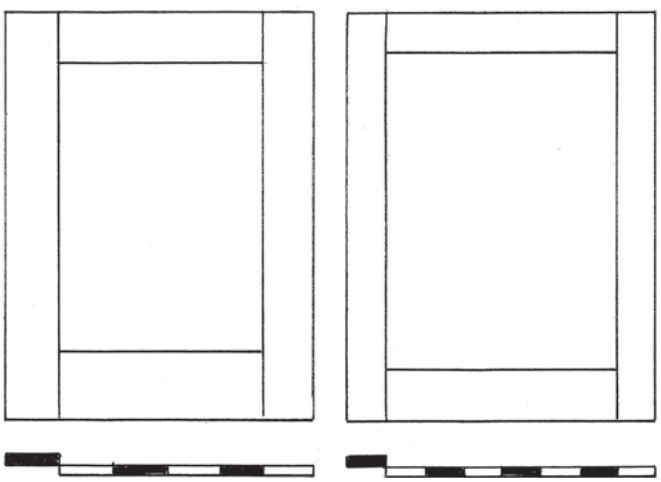
a raised-panel door or the legs at each corner of a table. Likewise, horizontal borders can be the rails on a door frame or the cornice at the top of a chest. If these border elements are off it's usually quite apparent.

Let's use an example of vertical stiles that appear too heavy flanking a door frame. Before you begin taking random stabs at it, start by picturing clearly what is related to what, proportionally.

Sometimes sorting out a design to make adjustments is like getting dragged to someone else's big family reunion. All those confusing aunts, uncles and cousins – who's related to whom? That stile may look a bit heavy, but in relation to what? Keep in mind that border elements always relate to the space they define.

A vertical border such as a door stile relates to the width of door space it frames. Just making that connection alone may free you to simply eyeball it and move on. But if you want to really cement a solid proportional image in your inner eye, pull out a set of dividers and take a moment to experiment with the proportions in that space. Divide the width of that door opening into five equal spaces and use one fifth to define the stile. That may be too heavy; that's OK. You can try dividing the space by six, seven, up to 12 equal spaces. This allows you to gradually creep up on the sweet spot for which your eye is searching. Also, by physically stepping off the space with dividers, your eye soaks in a powerful image of the proportional dynamic.

It's not really important what proportion you settle on; the key is that you begin to make the connection between the spaces. As you continue to tweak it down in proportional increments, at some point the width of the rail will cross a line and look weak – a signal you've shifted past where your eye (gut) wanted to take you. This same principle applies to horizontal borders, only they relate to the height of spaces they define. PWM



Is one better? *These door stiles and rails are related proportionally to the adjoining door opening space. Does one appear more pleasing?*

George is the author of two design DVDs (Lie-Nielsen Toolworks) and co-author (with Jim Tolpin) of a forthcoming book on design (Lost Art Press).

ONLINE EXTRAS

For links to all these online extras, go to:

- **popularwoodworking.com/oct12**

BLOG: *Read more from George R. Walker on his Design Matters blog.*

IN OUR STORE: *George R. Walker's DVDs.*

Our products are available online at:

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About This Column

Design Matters

Design Matters dives into the basics of proportions, forms, contrast and composition to give you the skill to tackle furniture design challenges with confidence.

The Right Wood in the Right Spot

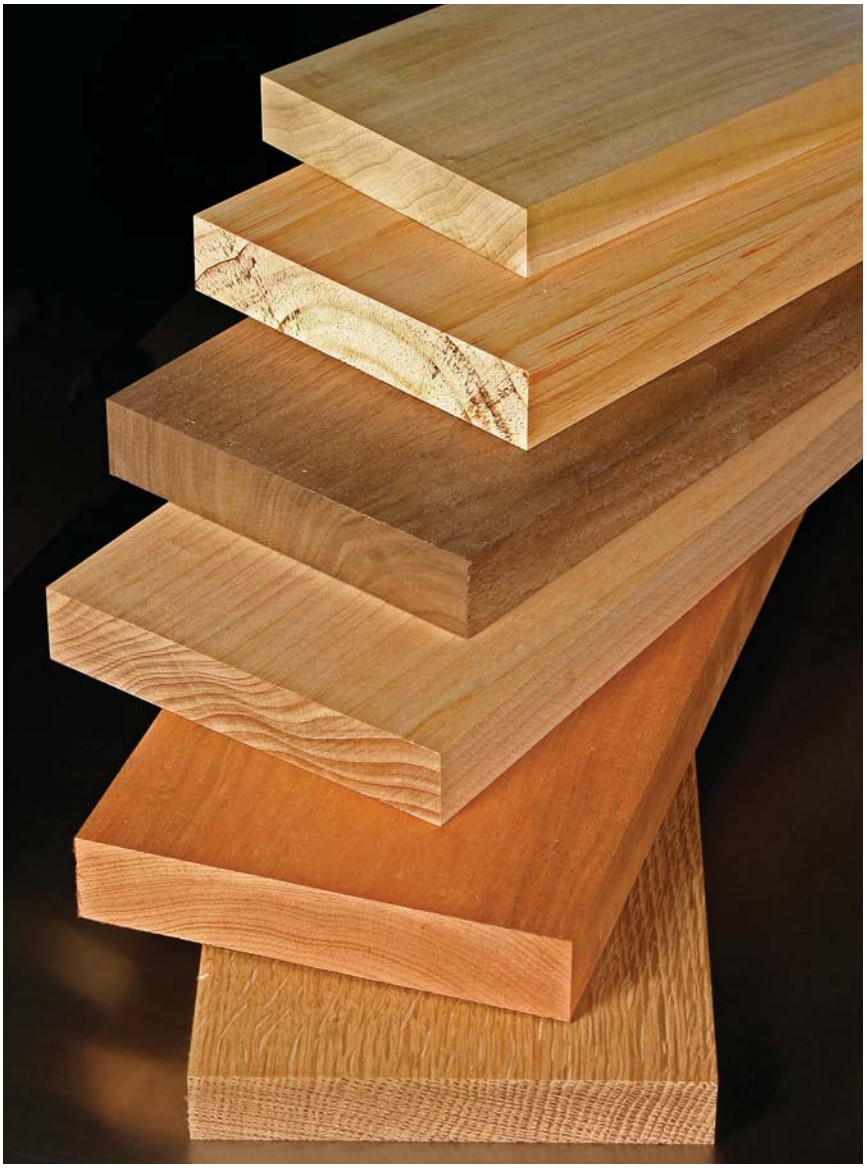
The end grain holds the secret to what stock to use where.

The single-most important factor in the appearance of any woodworking project is the selection of the material. This isn't what species to use or what color of finish; it is the choice of which board goes where. The wrong grain pattern in the wrong location can make even the most finely crafted piece look like junk.

While appearance is always subjective, there are traditional approaches to grain placement and orientation that are based on how wood behaves over time. In the grand scheme of things, these arrangements also appear harmonious to our eyes.

This is similar to music. You may want to write a non-traditional song, but the best-sounding notes and chords will be those that have evolved and been used for centuries. Good furniture design, regardless of style, calls for arranging the wood in ways that make sense both visually and structurally.

The key to understanding how any individual piece of wood will appear and function stems from where that piece of wood was when it was in the tree. It is rather simple to discover that by examining not the face, but the end of an individual board.



Character. *Every piece of wood is an individual, and its appearance is determined by where it was located in the log.*

Moisture Matters

A living tree contains a lot of water, and when it is cut down and made into lumber that water migrates into the atmosphere. As the water leaves, the cells shrink first as the water within the cells disperses. Then the cell walls lose their moisture, and in the process the cells get smaller and change shape.

This is what causes lumber to warp as it dries, and the vast majority of warpage occurs during the initial drying process. Wood will always be in the process of releasing or absorbing moisture in response to changes in the environment.

Properly dried and conditioned wood won't likely change shape after milling, unless it is subjected to extremes of humidity. The Architectural Woodworking Institute's "Quality Standards" recommends keeping relative humidity between 25 percent and 55 percent to avoid problems.

This includes the storage of lumber before milling, the conditions of the

CONTINUED ON PAGE 22

PHOTOS & ILLUSTRATIONS BY THE AUTHOR

CONTINUED FROM PAGE 20

shop during project fabrication and the environment where the finished piece will be placed. Extreme levels of relative humidity, less than 20 percent or higher than 80 percent, are likely to cause problems. If you work within these guidelines, problems related to wood movement aren't likely to occur.

Even so, it is essential to understand what direction any piece of wood you use will move, and the consequences of that movement. Tradition is here to help you out, and if you follow tradition the chances of your finished project looking good are greatly increased.

As Wide as You Can

Much of what is written about using wide pieces of lumber only applies if you're using material that is either not yet dry, or in the process of reaching equilibrium to a dramatic change in environment. If your wood is dry, at equilibrium with your shop environment, and conditions in the shop are close to those of your house, there is no good reason not to use wide boards for panels, case sides or tabletops.

Ripping wide boards and gluing them back together, with or without flipping them over (as you may have heard suggested), won't do a thing but waste your time and make your project uglier than it ought to be. That technique entered the literature as a way for factories to minimize the problems that come from using substandard and improperly dried material.

Wide pieces are often the most visible in a project, so you should take extra care in selecting the wood if you need to glue up a workpiece from narrower stock. The goal is to make the glued-up piece look as much as possible like a single board. Plan these glue-ups first as you select your material. Often you can use two rift-sawn (or partially rift-sawn) pieces on either side of a plain-sawn piece (see "Consider the Source," below).

Generally speaking, wood looks nicest if it is placed in furniture in the same orientation that it had in the tree. On plain-sawn pieces, orient the cathedrals so that they all point up, and arrange adjacent panels so that the upper peaks are at about the same level.

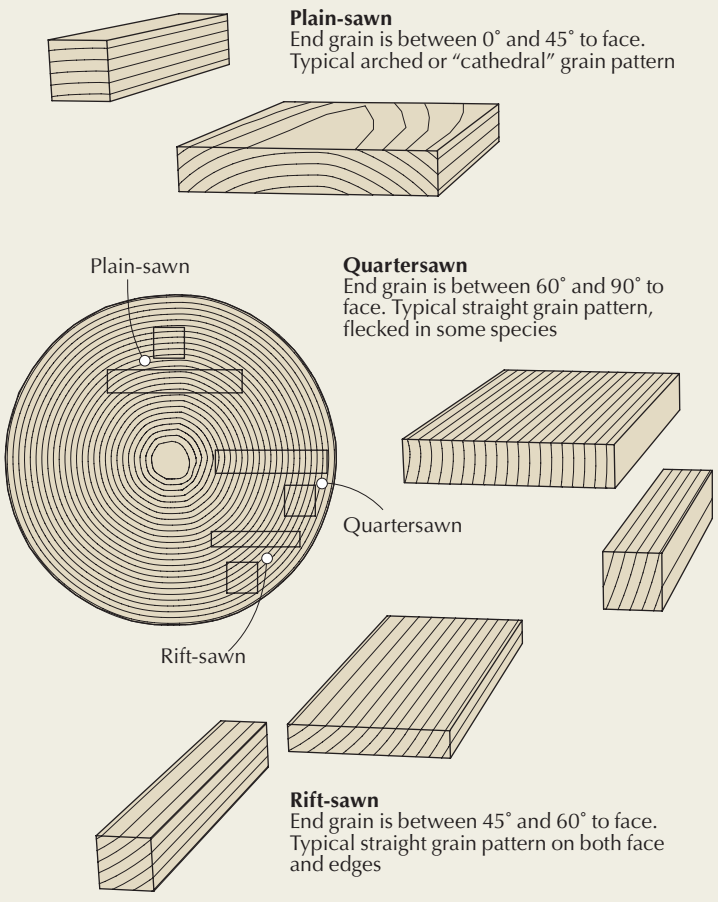
CONSIDER THE SOURCE

There are three main classifications of lumber, based on the pattern of the end grain on the board. These patterns are related to where the board was in the log. As wood dries, most of the shrinkage is in the circumference of the growth rings across the grain. Imagine the rings as elastic bands that have been stretched out. As they contract, each ring gets smaller, and longer rings in a board influence shorter rings adjacent to them.

Plain-sawn lumber is most likely to warp, twist and cup, because the concentric rings are disproportionately dispersed through the board. Trees are larger at the bottom than at the top, so the ring patterns taper along the length of a board. When the flat surface produced by milling crosses the tapered rings, it produces an arched pattern on the face, commonly called a "cathedral."

Quartersawn and rift-sawn lumber are more stable, both in initial drying and over time because the arrangement of the rings is more consistent throughout the board. The trade-off is in appearance; quartersawn and rift-sawn lumber exhibit straighter and tighter grain lines than plain-sawn material.

Most boards will have a combination of grain patterns. Plain-sawn faces show quarter sawn edges and vice versa. Rift-sawn boards will have straight grain on both the faces and edges. In many boards, the grain pattern will change across the width, with a rift-sawn pattern on one side and a plain-sawn pattern on the other. — RWL



For the outer elements of pieces, orient the grain with the widest spacing at the bottom; if the grain slants, make each side slope toward the middle. This will give your furniture a solid stance; it won't look as if it is leaning to one side.

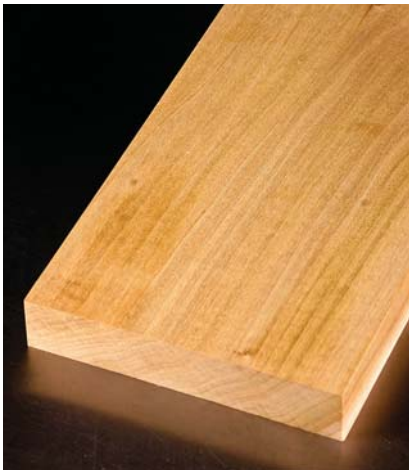
On the Straight & Narrow

Door frames and other frames are the ideal place to use quartersawn or riftsawn material. The narrower, straight grain won't detract visually from the panel, and the stability of this material is good insurance to keep things straight – regardless of what happens environmentally.

Rift-sawn material is also the best choice for legs or other square elements. The straight grain will look good from the front and the side. If you use quartersawn or plain-sawn material in this circumstance, you'll have to choose between a nice front or a nice side – you can't have both. This is especially important if the legs are carved or turned. The straight grain will make those tasks easier, and the finished appearance will be similar when viewed from any angle. **PWM**

Bob is the executive editor of this magazine. He can be reached at robert.lang@fwmedia.com.

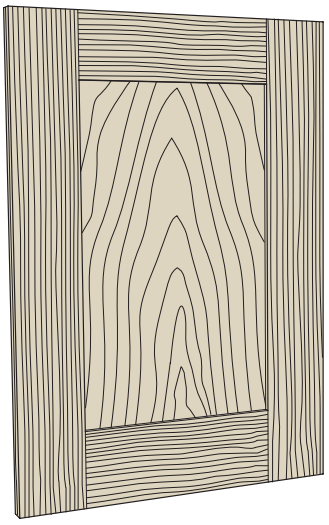
Plain-sawn. *Growth rings that arch across the end of a board create "cathedral" shapes on the face of the board. While attractive, plain-sawn lumber is most likely to cup or twist.*



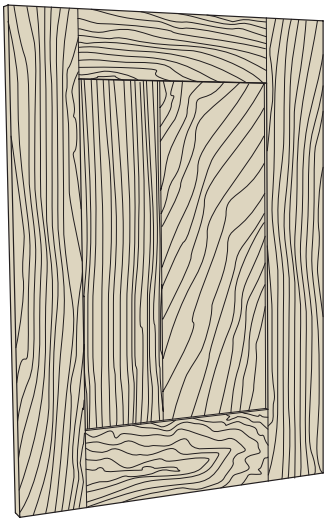
Rift-sawn. *The growth rings slant across the end of rift-sawn lumber. The grain pattern on the faces and edges is straight and this cut is stable.*

Quartersawn. *The growth rings in quarter-sawn lumber are vertical, or nearly so. This type of wood will move more in thickness than in width.*

Lumber can't read. *Most pieces of wood will have a combination of grain patterns, with a different appearance on one side of the face than the other.*



Harmonious composition. *Rift or quartered lumber for the stiles and rails and a plain-sawn panel make an attractive and stable door. Even if glued from more than one piece, panels look best with this grain pattern.*



Disturbing noise. *Wild grain, or grain running off the side of stiles and rails, detracts from the panel and the overall look. Mismatched panels should be avoided.*

ONLINE EXTRAS

For links to all online extras, go to:

- **popularwoodworking.com/oct12**

ARTICLE: *Read "Why Wood Warps," by Glen D. Huey, from the Summer 2009 issue of* Woodworking Magazine.

MAGAZINE: *For an in-depth look at "Composing With Wood Grain," read the Spring 2009 issue of* Woodworking Magazine.

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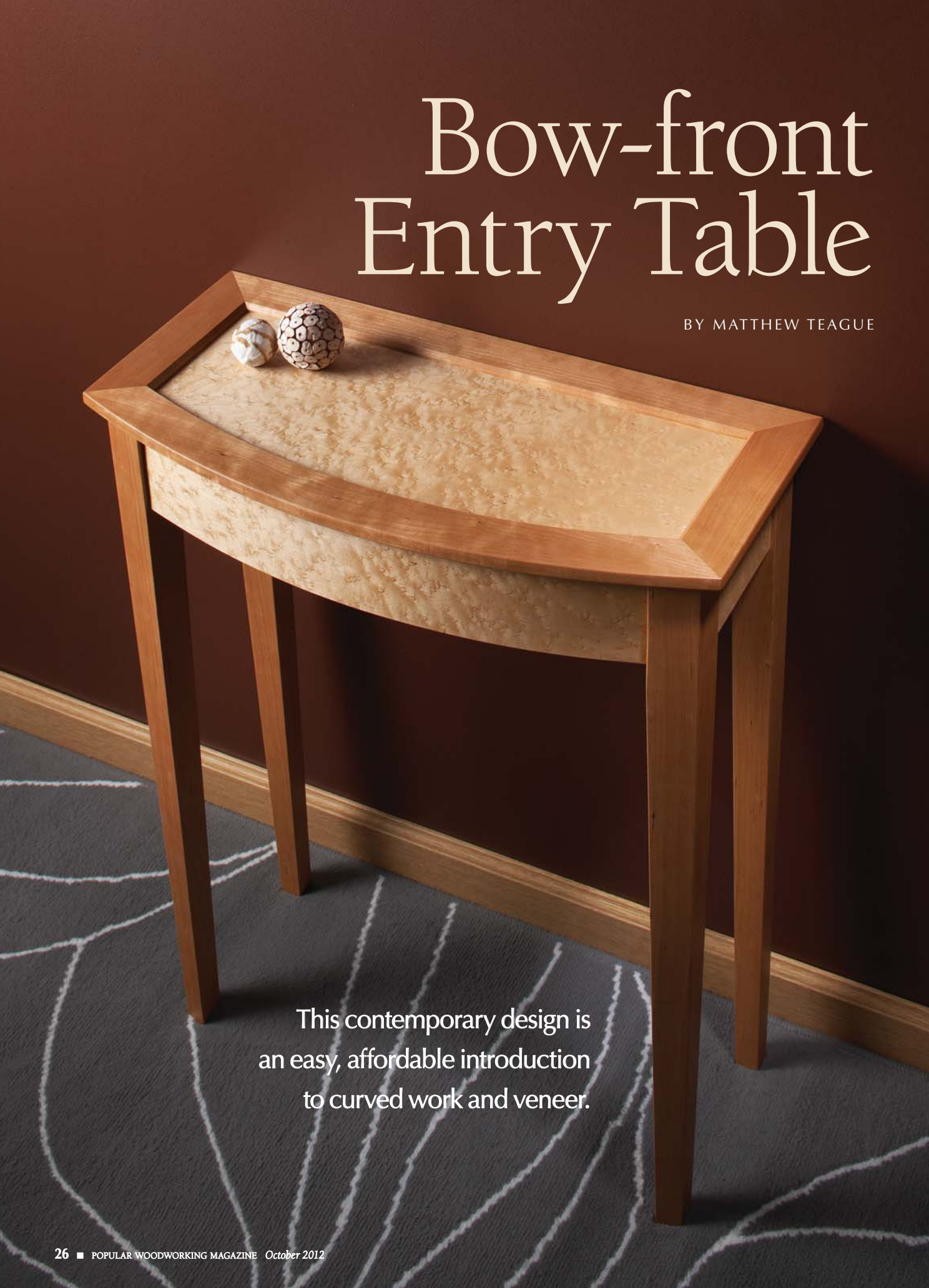
Bow-front Entry Table

BY MATTHEW TEAGUE



This contemporary design is an easy, affordable introduction to curved work and veneer.

Learning to work with veneers and curves enables you to design and build almost anything. This bow-front entry table serves as a good introduction to both – without costing a small fortune or requiring you to attempt an overly intimidating project. Veneer introduces to you to a world of beautiful grain patterns and species that are prohibitively expensive to buy in solid hardwoods. Having the confidence to add curved and veneered surfaces to your work also allows you to tackle a wide range of period, contemporary and original designs that were previously off limits.

This petite design teeters somewhere between a traditional bow-front table and a sleeker modern piece. The veneered bird's-eye maple top panel and aprons are framed and highlighted by the darker, contrasting solid cherry used for the legs and top frame. A subtle but graceful detail is that the front faces of the front legs are angled to visually extend the curve of the front apron. Like this little detail, which you may not notice at first, I think all furniture should have a few secrets to be discovered only on closer inspection. The hidden drawer on this table qualifies as well; its non-traditional placement on the side of the table is completely disguised by a drawer front that is piston-fit between the legs. Unless someone points it out, you'd never know it was there.

If you're new to veneering a curved surface or veneering altogether, this is a perfect project for expanding your skills. Thanks to a hand-pumped vacuum veneer press that costs only $60 for the complete setup, the veneering is easy, requiring no additional veneering tools. You could, of course, skip the veneer work completely and cut the curved apron from 10/4 stock. For that matter, you could even skip building and installing the drawer. But where would be the glory in that?

Start With the Curve

I stayed away from veneer work for years; I have a small shop and didn't want to spend hundreds of dollars on a vacuum veneer press that I don't have room for. When I needed to veneer the occasional panel, I borrowed a press.

A hidden drawer. *A false drawer front fits snugly between the legs so that when the drawer is closed you can't even tell it's there. A small cove routed on the underside of the drawer front allows you to pull it out from below.*

But lately I've admitted that it's difficult to regularly find solid stock that looks as good as fine veneers. And even if I could, I'd get better yield by sawing it into thick veneers. So I started looking around for an affordable solution.

There are many ways to veneer curved surfaces, any of which would work for this project: You could use a vacuum veneer press to attach veneer to an MDF substrate; hammer veneer over a brick-laid curve; or clamp up laminates or bending plywood between male and female forms. But I've been curious about the hand-pumped Roarockit veneer press system, originally designed to make skateboards, since it came out in 2002 (perhaps because much of my youth was well misspent on a skateboard). So I placed an order. For more on the process, which worked seamlessly for me, see "Hand-pumped Veneer Press" on page 29.

Whatever method you use to execute the curve, be sure to make the front apron first. Begin by drawing a full-sized version of the table base from above, as shown on page 28, but be prepared to alter the curve on the drawing if necessary. Laminates have a tendency to spring back after they are bent. Once the apron comes off the form and has a chance to acclimate, check to see if there was spring-back. If so, adjust your full-sized drawing. Otherwise, the curve of the top may not run coplanar to the curve of the apron.

Build the Form First

The first step in making the curved apron is to make a bending form with a curve matching the drawing. My form is made of 3/4" MDF, but plywood would work, too. On a scrap 5" wide x 28" long, draw out the arc as shown on page 28, bowing from 9 1/2" to 12" over 24" in length. Be sure to draw the arch an additional 2" long on either end. This extra length allows you to square and tenon the ends of the front apron. Once you've band sawn the arch, refine and fair the curve with a rasp or belt sander.

Making the form takes five layers of 3/4" material. Once you're happy with the fairness of the first, simply template-rout subsequent layers using a flush-trim bit on your router table. Then screw all the layers together.

It's easiest to add only one layer at a time, clamping it in place and getting the edges flush before you drive the screws. Once the form has reached full thickness, use a flexible sanding block (sandpaper glued to 1/4" plywood works well) to make sure the whole surface is smooth and fair. Laminate the apron as shown in "Hand-pumped Veneer Press."

OPENING PHOTO BY AL PARRISH; STEP PHOTOS BY THE AUTHOR; ILLUSTRATIONS BY ROBERT W. LANG FROM THE AUTHOR'S MODEL.

MAKE THE FORM

Draw the apron curve. *Bow a batten between finish nails driven into MDF and mark the curve. Remember to add length beyond the nails to allow for trimming and tenons.*

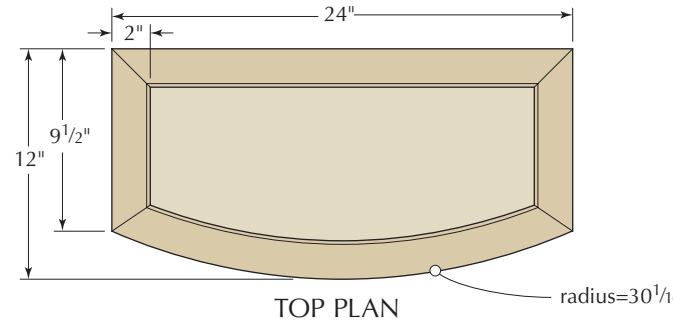
Build the form. *After band sawing the curves, template-rout multiple layers of MDF and screw them together. Once the form is assembled, make sure the face is smooth and fair.*

Seal it off. *Skip the finish or wax altogether – a layer of slick packing tape is all you need to make sure glue squeeze-out won't stick to the form.*

While the glue sets on the curved apron, mill the rest of the table parts to rough size and then focus on the legs. Because tenoning is the next step for the curved front apron, go ahead and cut all of the leg mortises before you taper the legs. I cut 5/16" mortises using my hollow-chisel mortiser and then cleaned up the walls with a chisel.

Tenon the Front Apron

Once the front apron comes off the form (you should let it sit overnight), check the curve against your initial full-sized drawing to make sure there isn't excessive spring-back. Using relatively thin veneers, I wound up with so little spring-back that I didn't need to adjust my drawing at all. (Spring-back may be an issue if you use thicker laminates and on more extreme curves.) If necessary, adjust the curve on your drawing and mark out the location, length and thickness of the front apron tenons on the drawing. Then mark the length, in-



TOP PLAN

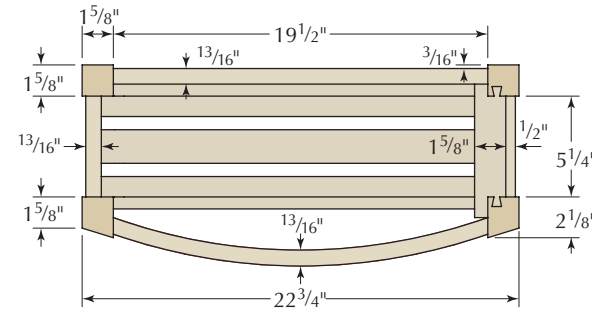
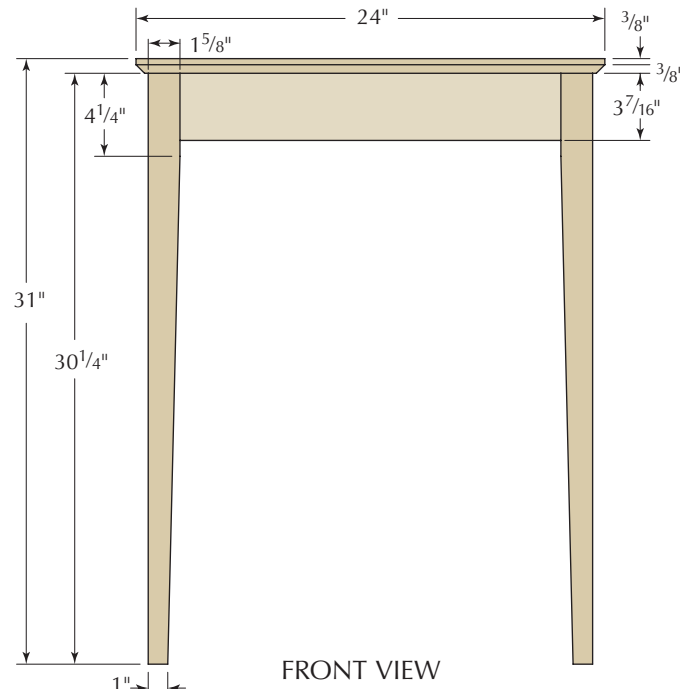


TABLE BASE PLAN



FRONT VIEW

SUPPLIES

Roarockit Skateboard Company
roarockit.com or 888-857-7790

1 ▪ Thin Air Press Kit 26" x 28"
#01301, $60
(The company also sells a variety of thick veneers that will work for your core and unseen face layers.)

Carlton McLendon, Inc.
Rare Woods and Veneers
rarewoodsandveneers.com or
866-727-3966

Bird's-eye and plain maple veneers, sizes and prices vary according to stock on hand.

Price correct at time of publication.

HAND-PUMPED VENEER PRESS

Originally designed to enable non-woodworking skateboarders to build their own boards, the Roarockit veneer press works almost exactly like a vacuum veneer press, but it's small enough to stow away in a drawer when not in use – a boon for those who have small shops. Also, if you're not sure veneering is something you'll do often, the setup costs only $60 – a fraction of the price of a traditional vacuum press. If you find it's not your thing (you won't), you haven't risked hundreds of dollars. The price covers everything you need, including a 26" x 28" vacuum bag. Roarockit offers bags of various sizes or will make whatever size you request.

Using the Roarockit is almost identical to using a traditional vacuum press. To make the table's front apron, simply follow the steps outlined in the photos here. As you work through the process, keep a few things in mind:

Though you could veneer over an MDF or brick-laid form using this press, I glued up the apron similar to the way a skateboard is glued up. I simply laid up multiple layers of 1/16" veneers until I reached the 13/16" thickness I was after. This process is similar to laminate bending where you cut multiple layers from a single board and then glue them back together over a form. Another option would be to put the face veneer over bending plywood and a bending form. Any of these methods would work, but because the system was designed for skateboards, I borrowed as much as I could from their methods.

The only downside to simply stacking up veneer is that you have to spread a lot of glue quickly. Using thicker laminates or bending plywood – either of which would work seamlessly with the Roarockit – speeds the process. That said, I had an extra set of hands in the shop on glue-up day. With my helper and I both spreading glue we had no trouble managing the clock. Another strategy would be to use a slow-setting glue, such as urea formaldehyde or epoxy.

While skateboards are typically glued up using PVA glues (Roarockit recommends Titebond II), I took the advice of Franklin International, maker of Titebond, and used its Cold Press Glue for Veneer. In brief, regular PVAs are less brittle, which is great for, say, a skateboard that gets banged around as a matter of course. But Cold Press Glue for Veneer is a little more rigid, a bonus for furniture. It's more prone to spring-back than urea formaldehyde resin glues or epoxies (both of which are common choices for veneering and laminate bending) but it is easy to use straight out of the bottle and spring-back has never been an issue for me, especially on mild bends such as this one.

Once your form is made, the glue-up process is pretty straightforward; mine went off without a hitch. Just remember to make your veneers and form a little oversized so that you can square the apron's edges and ends after it comes out of the form. This project was my first experience with the Roarockit veneer press, but I suspect it's the beginning of a long and fruitful relationship. — MT

1 ***Roll on the glue.*** *Spread a thin, even layer of glue on one face of the veneer. A 4" paint roller makes this work easy.*

2 ***Stack it up.*** *After your first unglued face is on the form, stack subsequent veneer layers in place with the glued face down.*

3 ***Roll again.*** *Spread glue on the opposing face (that way, if you miss a spot on one face the glue-up will still be OK).*

4 ***Line everything up.*** *Apply a flexible 1/8" Masonite or plywood platen over the top and tape the entire stack to the form.*

5 ***Slip it in.*** *With the glued bundle of veneer taped in place on the form, slide the assembly into the vacuum bag.*

6 ***Give air an escape route.*** *Netting over the top of the veneered stack provides a pathway for excess air to be sucked out of the bag once it's sealed.*

7 ***Take the easy way out.*** *Once the bag is sealed, a shop vacuum sucks the bulk of the air out of the bag.*

8 ***Pump out the balance.*** *Use the hand pump that comes with the veneer kit to remove the last of the air from the bag.*

cluding the tenons, on the actual front apron using your drawing as a guide.

Before tenoning, square one edge of the apron at the jointer, as shown in the photo below. Then trim the opposite edge to final width by running it through the planer.

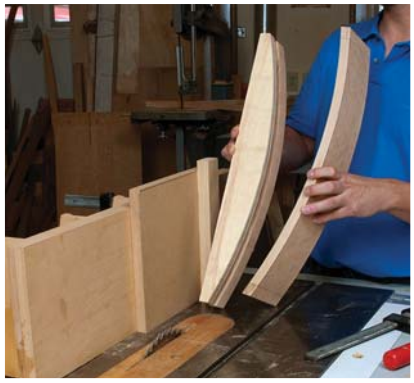
To help square and tenon the front apron, make a quick holding jig by screwing together a few pieces of scrap and band saw them to match the curve on the inside of the apron. At the table saw, position the jig against your miter gauge with your workpiece on top of the jig. Holding the assembly firmly together (with double-sided tape if necessary), align the cut and crosscut the ends of the apron square to the edges. Because you'll use this jig again, trim the jig at the same time you trim the apron, as show in "Square & Tenon the Curved Apron."

SQUARE & TENON THE CURVED APRON

Square an edge. *Joint one edge of the assembled front apron. Be sure one hand holds the apron flush to the fence as you square the edge to the face.*

Plane the opposite edge. *With the flattened edge facing down, guide the curved apron through the planer to square and bring the other edge parallel to the first.*

Square the apron with a jig. *Made of scrap band sawn to the shape of the inner curve and screwed in position, this simple jig positions the workpiece against a miter gauge to trim the ends square at the table saw.*



Use a stack of jigs. *With both the jig and apron cut to length, turn the jig upright against a right-angle guide and a tall fence to cut the tenon. Clamp the workpiece to the jig and the right-angle guide, align the blade to the tenon location and then cut the cheeks. The tenon shoulders are best sawn by hand.*

With the apron cut to length, mark out the location of the tenons, which you can transfer from the full-sized drawing. Attach a tall auxiliary fence to your stock table saw fence. Make a right-angle guide by attaching a guide fence flush to one edge of a 10" x 10" square of MDF or plywood. Orient the right-angle guide against the tall fence so that the guide fence allows you to hold the stock upright. Then position the curved jig you just used to cut the ends to length against the right-angle guide, and the workpiece against the jig and guide. Set the height of the table saw blade to match the length of your tenon and align the blade with the tenon location. Then make the cuts and test the fit of the tenon thickness in the leg mortises.

You could trim up the shoulders of the tenon at the table saw as well, but because it would take more extensive jigging up and there are only two of them, I used a backsaw to make the initial cuts and then fine-tuned the fit using a shoulder plane and a chisel.

Prepare the Legs

Note that the front legs of this table are cut from blanks that are wider front to back than side to side. Cutting an angle on the front of the front legs (shown on page 31) visually continues the curve of both the front apron and the tabletop. The process is simple but it lends refinement to the design. I then tapered the legs at the band saw and cleaned up the faces with a handplane.

Building the balance of the base is pretty straightforward. I veneered the side apron and the false drawer front (both to solid maple) at the same time using the same vacuum set-up I used to make the curved front apron. The side and rear apron were tenoned at the table saw, but you can use whatever method you prefer.

PREPARE THE LEGS

Rip an angle on the legs. *Set your table saw blade to match the curve of the front apron and then rip the faces along their full length.*

All in one plane. *After the tenons are fitted and the legs are ripped at an angle, the front faces of the front legs match the curve of the front apron.*

Taper the leg. *Use the band saw to rip tapers on the two inside faces of the legs. Then clean up the faces using a handplane. Make sure your tapers stop at least 1/4" below the aprons.*

READY THE TABLE FOR THE DRAWER

Mark the stretcher. *The stretcher above the drawer is marked to length, notched and dovetailed. The dovetail is then transferred to the top of the leg. The bulk of the dovetail slot is routed out, then chiseled to fit.*

Glue it up. *Clamp up the long aprons and add the drawer runners and kicker. Runners and the kicker are tenoned at both ends. The rear runner is also glued to the rear apron.*

How the drawer works. *The assembled base is outfitted with drawer runners, a kicker and guides. The false drawer front looks like an apron when the drawer is closed – you can't even tell it's there.*

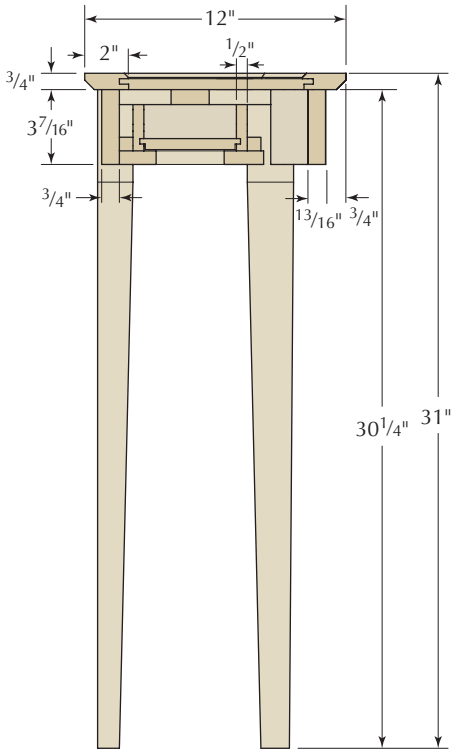
Assemble the Base

I've always thought that a table without a drawer, even if it has to be a small one, is a lost opportunity. Though drawers are traditionally placed at the front of a table, a drawer on the front of this table would be prone to racking and too short to find much use. That, plus the fact that I simply like the idea of a hidden drawer, led me to put a drawer on the end of this table. The drawer on my table is on the right end, but you could switch it to the left end if that makes more sense for the spot where your table will live.

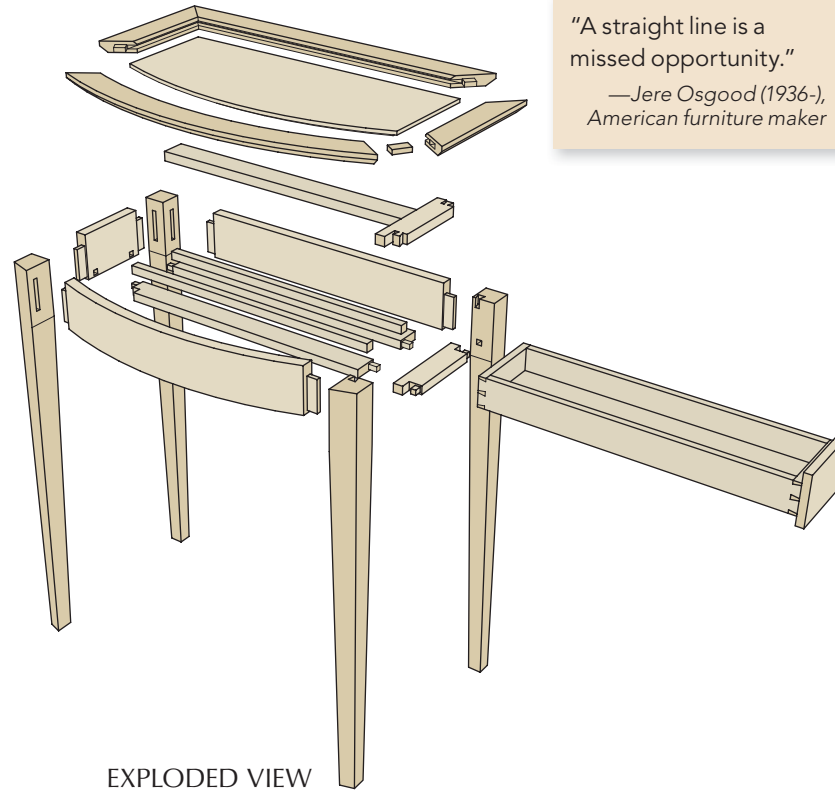
The drawer itself is set in a fairly traditional drawer opening – it's just sideways. A stretcher below the drawer is tenoned into the table legs and wraps around the legs. The stretcher above the drawer also wraps around the legs but is secured to the legs from above with a single dovetail. If you've never used this technique, it's much easier than you might imagine. Just cut the tails on the stretcher and then knife the outline of the dovetail directly onto the table leg. To get a flat bottom on the dovetailed slot in the legs I use a 1/8" straight bit to rout out the bulk of the waste. Then I fine-tune the dovetail slot with chisels.

Before assembling the base, cut small mortises (mine are 3/16" thick) on the upper and lower drawer stretchers, as well as on the side apron, to accept tenons cut on the ends of the drawer runners and kicker.

After a quick dry-fit, you're ready to glue up the sides. When the glue has had time to cure, do another thorough dry-fit to make sure that the joints on the front and back apron close up completely. Once you're satisfied with the fit, glue the front and rear apron, as



SECTION VIEW



EXPLODED VIEW

"A straight line is a missed opportunity."

—Jere Osgood (1936-), American furniture maker

Bow-front Entry Table

NO.	ITEM	DIMENSIONS (INCHES) T	W	L	MATERIAL
❑ 1	Front apron face	1/16	3 7/16	19 5/8	Bird's-eye maple veneer*
❑ 12	Front apron cores	1/16	3 7/16	21 3/8	Veneer*, 3/4" TBE**
❑ 1	Side apron core	3/4	3 7/16	6 3/4	Maple, VBS†, 3/4" TBE**
❑ 1	Rear apron	3/4	3 7/16	21	Maple, 3/4" TBE**
❑ 1	False drawer front	1/2	3 7/16	5 1/4	Maple, VBS†
❑ 2	Front legs	1 5/8	2 1/8	30 1/4	Cherry
❑ 2	Rear legs	1 5/8	1 5/8	30 1/4	Cherry
❑ 1	Upper drawer stretcher	5/8	1 5/8	6 5/8	Maple
❑ 1	Lower drawer stretcher	5/8	1 5/8	6 5/8	Maple
❑ 1	Tabletop panel	3/8	8 7/8	20 7/8	MDF*, VBS†, RBE‡
❑ 1	Tabletop frame rear	3/4	2	24	Cherry
❑ 2	Tabletop frame sides	3/4	2	9 1/2	Cherry
❑ 1	Tabletop frame front	3/4	4+	24	Cherry*
❑ 2	Drawer runners	5/8	1 1/2	20 5/8	Maple, TBE**
❑2	Drawer guides	5/8	5/8	19 1/2	Maple
❑ 1	Drawer kicker	5/8	1 1/2	20 5/8	Maple, TBE**
❑ 2	Drawer side	1/2	2 3/16	20 1/2	Maple
❑ 1	Drawer back	1/2	2 3/16	5 1/4	Maple
❑ 1	Drawer front	1/2	2 3/16	5 1/4	Maple
❑ 1	Drawer bottom	3/8	4 5/8	19 7/8	Cherry

* Cut oversize to match layout, trim to final dimensions ** TBE=Tenon both ends
† VBS=Veneer both sides ‡ RBE=Rabbet bottom edge to fit groove in frame

well as the runners and kicker, to the assembled sides.

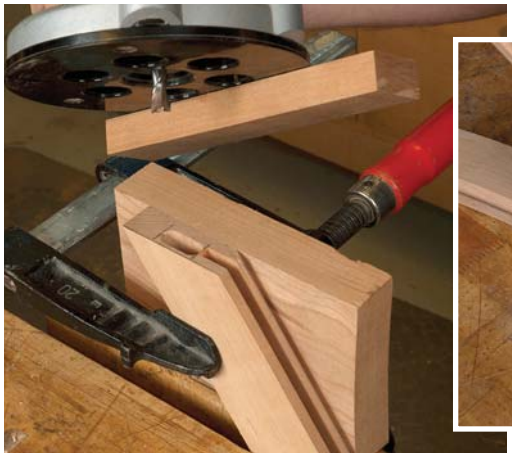
Build the Tabletop

I used a mitered frame on the perimeter of the tabletop because the look fits the contemporary feel of this design. I typically reinforce my miters with splines or keys, but for a sleeker, cleaner look I used loose tenons to join this frame. When choosing stock for the cherry frame, look for straight grain for the straight pieces and use a piece with arched grain to match the curve on the front piece of the frame. Start by cutting the three straight parts of the frame to size. Leave the front piece of the frame oversized and square at this point – it makes cutting the angle on the end much easier.

The joints at the back of the tabletop are mitered at 45°, which can be done at the table saw or on your miter saw. The angle on the front joints can be pulled off the full-sized drawing using a bevel gauge and transferring the angle to your table saw or miter saw.

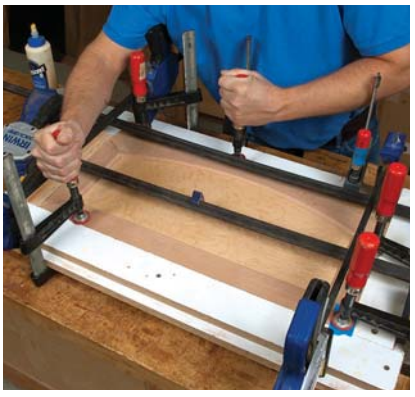
Before moving on, take time to test

MAKE THE TABLETOP



Mortised frame. *Clamp scrap stock flush to the ends of the frame members to steady the router and use double-sided tape to a guide fence on your router base. Then take plunge cuts until you reach full mortise depth.*

Loose tenons. *Plane and rip stock to fit the mortises in the frame members of the tabletop. Then round over the edges at the router table and trim the tenons to length.*



Tabletop glue-up. *To make sure the tabletop goes together square and flat, use a quickly made and self-squaring assembly jig that allows you to register two adjacent sides off of right-angle guides.*

the fit of all the joints and make sure they close completely. To tweak them for a perfect fit I use a piece of sandpaper glued to a flat scrap of wood. Once you're satisfied with the fit, band saw and fair the curve on the front piece.

To mortise for the loose tenons I used a plunge router outfitted with a straight bit and guide fence, as shown above. Place the mortises so that the joints won't poke through the edges of the frame or panel groove. Once the mortises are done, cut the loose tenons to thickness and width at the table saw. Then round over the edges and cut them to length. To house the bird's-eye maple panel in the tabletop, use the router table to mill a 1/4"-wide x 1/2"-deep groove centered on the inside edges of all four frame members. On the inner top edges of the frame pieces, mill a 3/16" x 3/16" chamfer.

Having glued up the curved front apron, veneering the flat panel is easy. I used the same vacuum bag set-up and used bird's-eye maple veneer on the top and plain maple veneer on the bottom. For the core of my panel, I used 3/8" MDF because I had it on hand, but a quality plywood would work, too.

Rabbet the bottom edge of the panel. Before you glue up the top, apply a few coats of finish to the panel. I like to glue up tabletops or any flat assembly on an assembly jig made from a piece of 3/4"-thick melamine to which I've screwed two guide boards at a right angle. After applying glue, I butt adjacent flat frame parts against the guide boards. For the curved front piece of the frame I cut a few scraps to match the curve. Once clamps are applied to close up the joint, make sure the tabletop is flat to the melamine. If it's not, add a few clamps to hold it down.

To give the table a lighter feel and a sense of lift. I routed a 3/8" x 3/8" chamfer on the bottom edge of the top.

Add a Drawer & Finish

The drawer can be made in whatever fashion you prefer. I dovetailed a simple maple box and installed a cherry drawer bottom just to add a little contrast. Once the drawer is built and fitted, using a false drawer front allows you to size it for a piston-tight fit between the legs.

I routed a cove on the inside edge at the bottom of the false drawer front so I can reach underneath and open it easily. A nice touch for the hidden drawer would be a hidden locking mechanism, such as one of those that Charles Bender wrote about in his article "It's a Secret" (*Popular Woodworking Magazine*, Nov. 2009, issue #179; you'll find a link to that article in Online Extras).

Though I finished the panel on the tabletop prior to assembly, I still sand the frame and lay on a few more coats of Waterlox before attaching it to the base. Additional coats simply build the sheen and lend a little more protection. The base of this table got three coats of finish, and the top got about six. Before the final coat, I wet-sand the entire piece with #600-grit wet-dry sandpaper, apply a thick coat and then wipe it nearly dry after a few minutes.

To attach the top to the base, I screwed directly through the drawer kicker and into both the top panel and the sides of the tabletop frame. To allow the front and back of the tabletop to expand and contract just a little, I used figure-8 tabletop fasteners to secure it in place and prevent warping.

It's a satisfying build and a handsome little table. The contrast of the cherry surrounding the bird's-eye maple panel and aprons serves to highlight the beauty of the veneer. And the drawer is a nice surprise – one you can keep to yourself or show off to your friends. **PWM**

Matthew is the editor of this magazine. He can be reached at matthew.teague@fwmedia.com.

ONLINE EXTRAS

For links to all online extras, go to:

- **popularwoodworking.com/oct12**

ARTICLE: *"It's a Secret," by Charles Bender.*

BLOG: *Learn a quick method for dovetailing the upper drawer stretcher.*

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Acanthus Leaf

BY MARY MAY

Learn how to carve this classic detail – follow a few rules, and it's simple.

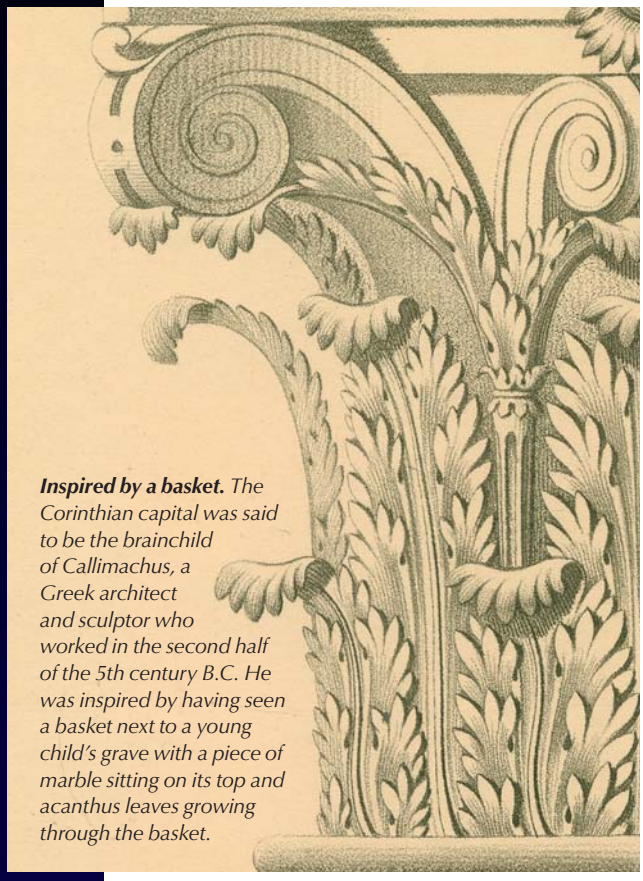
It's a real plant. *While the acanthus leaf is often a stylized decorative detail, it is based on a real plant native to Italy and Greece.*

The beauty and elegance of the acanthus leaf has inspired artists, architects and craftsmen for centuries. Among furniture makers, carving this classic detail is a rite of passage, much like making your first hand-cut dovetails. If you are interested in carving, the acanthus leaf should certainly be in your repertoire.

The acanthus plant, also known by the common name of "Bear's Breeches," is native to the Mediterranean. It has thick, spiny leaves with serrated edges and produces large 2'- to 3'-long spikes of white or purple flowers. The word acanthus comes from the Greek word *ake,* meaning a point or thorn, and *anthos,* meaning flower. The acanthus plant most resembles the dandelion, thistle and artichoke plants.

The acanthus first appears in the decorative and architectural arts of Greece around the 5th century B.C. The most

OPENING PHOTO BY AL PARRISH; STEP PHOTOS BY LAURA SPARROW; TEA TABLE PHOTO COURTESY OF MESDA



Inspired by a basket. *The Corinthian capital was said to be the brainchild of Callimachus, a Greek architect and sculptor who worked in the second half of the 5th century B.C. He was inspired by having seen a basket next to a young child's grave with a piece of marble sitting on its top and acanthus leaves growing through the basket.*

On the knee. *This acanthus leaf is a traditional style typically seen on the knees of cabriole legs.*

About face. *This green man (a traditional motif related to vegetative deities) was carved in white oak. Note how the acanthus leaves flow out from the face.*

Turned leaf. *This is an acanthus leaf detail on a turned post for a four-post mahogany bed. (The bedpost was turned by Greg Guenther, of Savannah, Ga., and features the author's carving.)*

familiar historical use for the acanthus on a curved or turned surface is on the capitals of Corinthian columns.

At first, the designs based on the acanthus leaf were accurately portrayed and extremely lifelike. As this motif grew popular, it became more stylized and has now evolved into an imaginary leaf of many uses. The acanthus design can be seen in everything from embroidery to architectural designs and furniture details.

Acanthus leaves in wooden, carved furniture became common in the 18th century. Many European-trained furniture makers settling in America brought different styles and techniques to this new furniture style. These craftsmen were able to achieve an amazingly high level of design during the Queen Anne and Chippendale periods. The acanthus leaf design was incorporated into furnishings such as table bases, chairs, highboys, tea tables and bed posts.

If you study the details of acanthus leaf designs, you will notice that no two are alike. There are some designs where the leaves are hollow, some are rounded and some have a combination of both rounded and hollow sections. They vary so greatly in style and shape that they are sometimes difficult to identify as an acanthus leaf.

One way I like to advise students on how to become familiar with the design of acanthus leaves is to start to draw examples that they see – whether from photographs or drawings, or actual examples of the carving on furniture.

"Carving is easy; you just go down to the skin and stop."

— Michelangelo Buonarrotti (1475-1564)

The more you understand how to draw the leaves, the more you will be able to recognize the subtleties of this versatile design. Carving the acanthus leaf is similar to drawing it. Because these leaves are often carved in shallow relief, you are virtually drawing with your chisels.

Step-by-step Process

Beginning on the next page, I show the step-by-step process of how to carve an acanthus leaf design; this particular design is based on the turned pedestal of a Charleston, S.C., tea table, dated 1755-1775. I'm carving the design onto a turned bedpost, which is part of a four-post bed made by Greg Guenther.

As you work through the carving, make sure you finish each step completely before going on. In many ways, each step you take prepares or sets you up for the next step. If you can keep to a structured process as shown, all the leaves around the bedpost should have a similar shape and appearance.

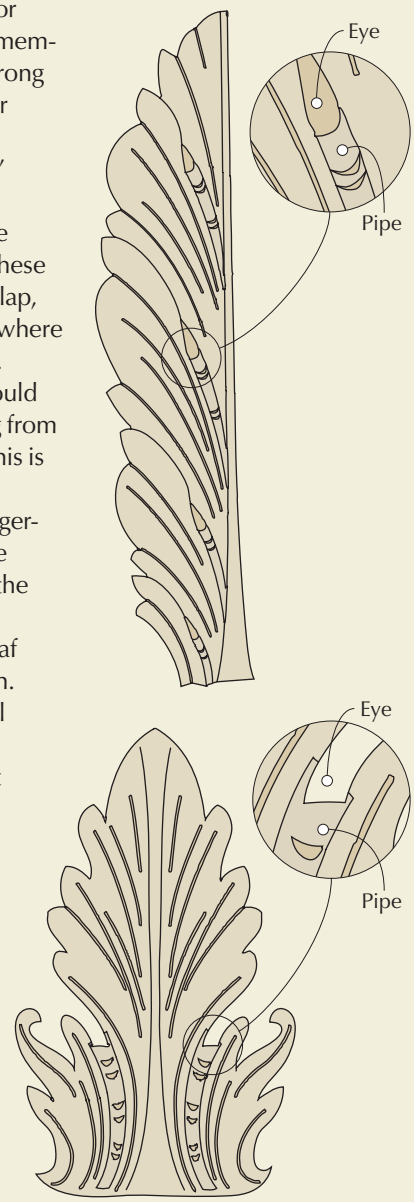
When I first began to carve, I was not even aware that these commonly seen decorative leaves were called "acanthus leaves," and the thought of carving one seemed pretty daunting. It took quite a few attempts at drawing and carving this leaf before I felt confident that I was on the right track. My advice in carving this beautiful and versatile design is to pick up a chisel and just make that first cut – and have fun doing it. **PWM**

Mary works in Charleston, S.C., and offers classes at her shop and in a variety of other locations. She also has instructional DVDs available and offers an online video school. Find out more at marymaycarving.com.

RULES FOR DRAWING

The simple way to tackle drawing or carving any acanthus leaf is to remember that there is no definite right or wrong way; there are just a few basic rules or guidelines to follow.

1. Most acanthus leaves have "eyes" which are teardrop-shaped holes where the separate sections of the leaves appear to overlap. When these sections of the leaves do not overlap, this "eye" is then simply the area where two parts of the leaf join together.
2. Where there are "eyes," there should be a raised section gently flowing from the eye toward the center vein. This is called the "pipe."
3. Quite often, there will be little fingernail-shaped notches cut out of the "pipe" that represent wrinkles in the leaf.
4. Make sure all detail lines in the leaf flow gently toward the center vein.
5. Try to make sure all of these detail lines have a slight curve. If any of the lines on the leaf are straight, it will cause the leaf to appear flat. The more curved the lines, the more shape to the leaf.
6. Try not to make any of these detail lines parallel to each other. They should all gently converge and eventually meet at the center vein.



Common details. *No matter what the style of an acanthus leaf, most have "eyes" and "pipes" with all detail lines gently flowing into the center vein.*

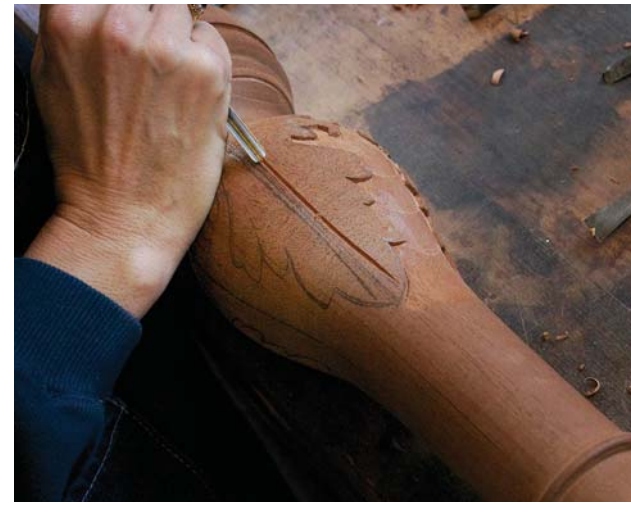
On a pedestal. *This Charleston tea table is dated 1755-1775 and is in the collection of the Museum of Early Southern Decorative Arts (MESDA) at Old Salem, in Winston-Salem, N.C.(MESDA Research File 9035).*

Detail look. *Here, we can see the details of the acanthus leaf on the tea table's pedastal.*

1 ***Outline the leaf.*** *With a 5mm V-chisel (60° angle), carve just outside the outline of the leaf edge 1/16" deep, leaving the line visible.*

2 ***Define the leaf edge.*** *With gouges that accurately fit the edge of the acanthus leaf design, make vertical stop cuts 1/16" deep along the entire edge of the leaf. I used a 12mm No. 4 gouge, and a 6mm No. 3 gouge. By removing the bulk of the wood with a V-chisel before defining the edge with vertical cuts, the small delicate leaf corners are protected from breaking.*

3 ***Lower the background.*** *With 3mm No. 3, 6mm No. 3 and 13mm No. 3 gouges, lower the background between the leaves. Try to make this surface as smooth as possible – as if it just came off the lathe with leaves placed on top of it. You can also use flat chisels for this process.*

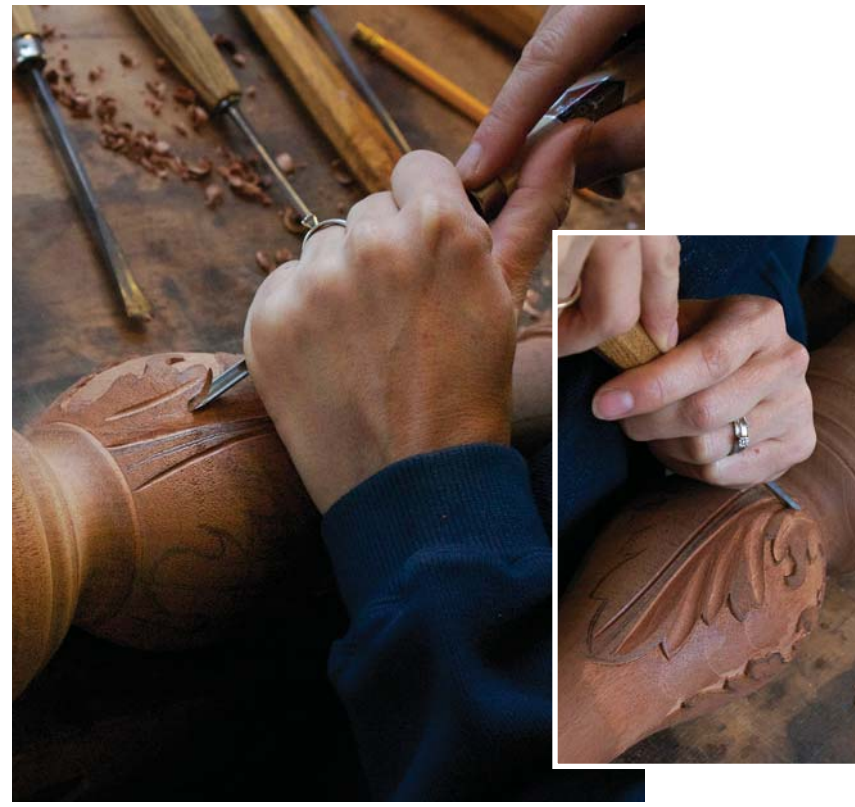


4 ***Carve the vein.*** *With a 5mm V-chisel, make two small 1/16-deep V-cuts up both sides of the center vein of the leaf.*

5 ***Lower the leaf.*** *With a 14mm No. 3 gouge, carve a gentle slope down to this V-cut from the main part of the leaf to give the appearance that the center vein is raised.*

6 ***Hollow the leaf.*** *With 8mm No. 7 and 14mm No. 7 gouges, hollow out the various lobes of the leaf. Make sure that the high ridge lines that are created by these hollow cuts gently flow into the center vein.*

7 ***Soften the ridge lines.*** *With a 6mm No. 3 gouge, soften or round over the ridge lines that were created in the previous step.*



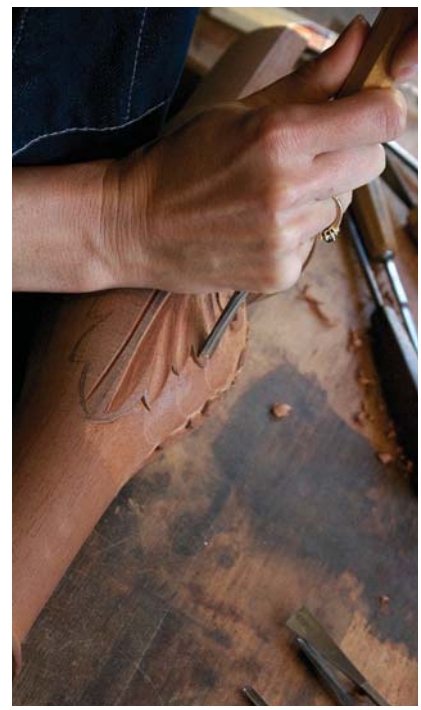
8 ***Carve a pipe.*** *With a 3 mm No. 11 gouge, carve a groove on both sides of the eye so that a long raised area is created. This area is called a pipe. This raised pipe flows gently into the center vein. With a 6mm No. 3 gouge, round over or soften the sharp corners of the pipe.*

THE TOOLS YOU NEED

German, Swiss and Austrian-made tools are generally quality examples. Long-handled gouges are safer to use and easier to control than palm gouges. Fishtail-shaped gouges are preferred over straight-shaped versions because their sharp corners help to get a cleaner cut in tight spots. The "No." in the tools below refers to the "sweep" – as the numbers increase, so does the blade curvature:

- 3mm to 5mm V-chisel (60° angle)
- 3mm No. 3 gouge
- 6mm No. 3 gouge
- 14mm No. 3 gouge
- 12mm No. 4 gouge
- 5mm No. 5 gouge
- 8mm No. 7 gouge
- 14mm No. 7 gouge
- 3mm No. 11 gouge
- Mallet (optional)

— MM



9 ***Leaf's end.*** *With an 8mm No. 7 gouge, make a small cut at the end of the leaf as shown. This creates a nice shadow and gives the leaf a little more shape.*

10 ***Draw vein lines.*** *Draw lines down all sections of the leaf where a vein line will be carved. Make sure these lines gently curve toward the center vein line.*

11 ***Carve vein lines.*** *With a 5mm V-chisel, carve all vein lines in the leaf. Let these cuts fade off before they reach the end of the leaf.*

12 ***Soften the edges.*** *With a 6mm No. 3 gouge, round over all the outside edges of the leaf.*

13 ***Carve a notch.*** *With a 6mm No. 3 gouge, make a little notch cut between each of the lobe sections. This really brings out the three-dimensional and slight overlapping appearance of the leaf.*

14 ***Make a "wrinkle."*** *With a 5mm No. 5 gouge, make several little cuts on the pipe that appear to be wrinkles. Make one cut vertical and make a second cut at a 45° angle to notch out a fingernail shape.*

15 ***Center vein.*** *With a 14mm No. 7 gouge, carve down the center vein line to create a slight concave shape.*

16 ***Finish.*** *To complete the carving, make several small notches with your V-chisel on the ends of certain leaves to give a little shadow effect. Lightly sanding the background to remove any facets created by the gouges should be done after all the carving is finished. You can also lightly sand the surface of the leaf, but be careful not to sand out the details. Caution: If you choose to carve more after sanding the surface, the grit deposited from the sandpaper will dull your gouges.*

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VIDEO: *Watch as Mary May shows you how to sharpen one of the essential tools for woodcarving – the V-chisel.*

IN OUR STORE: *Get DVD instruction from Mary May on carving the traditional acanthus leaf in relief (bonus: includes instruction for carving a leaf on both a cabriole leg and turned bed post).*

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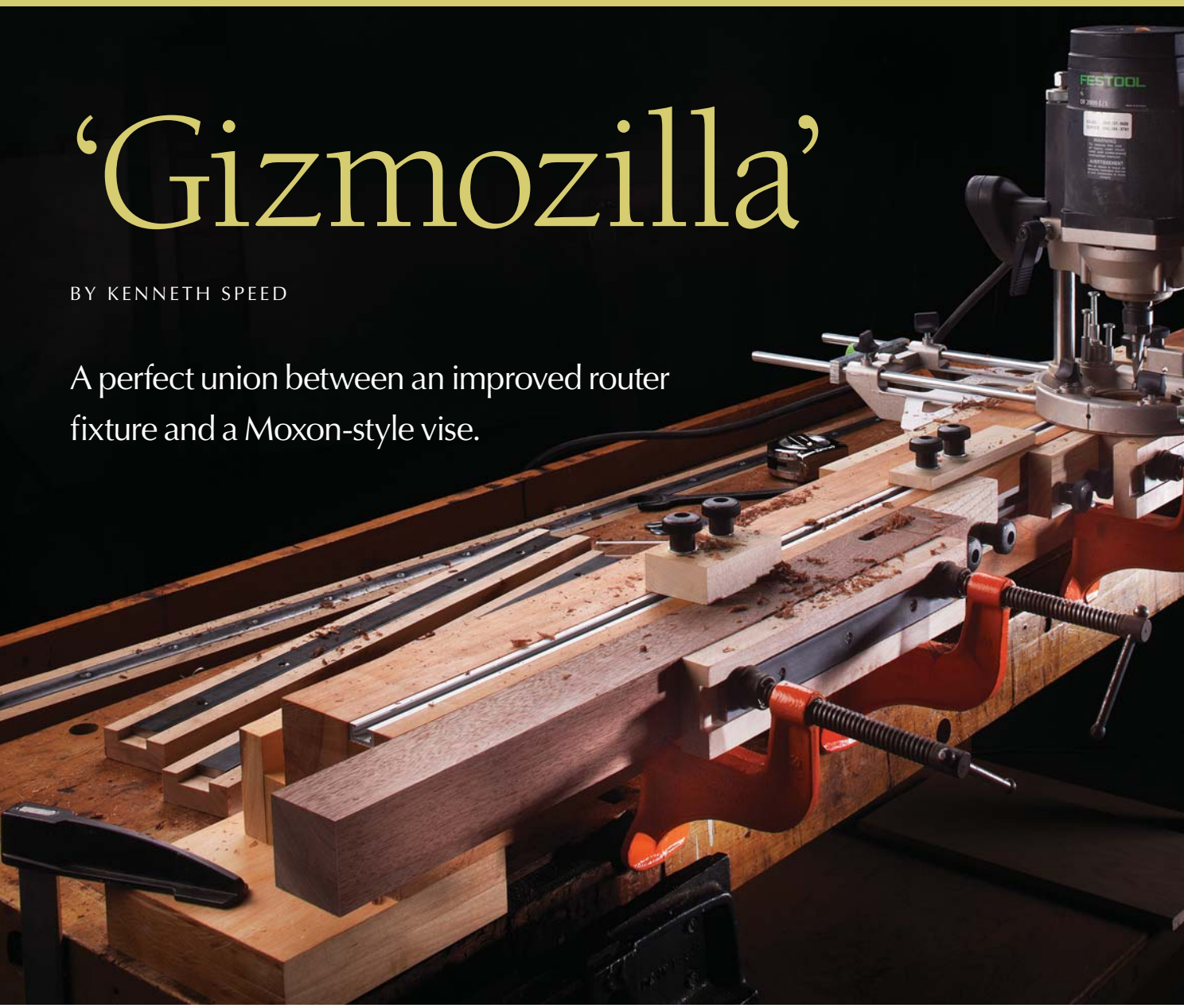
‘Gizmozilla’

BY KENNETH SPEED

A perfect union between an improved router fixture and a Moxon-style vise.



An evolving hybrid. *“Gizmozilla” started as an improved router mortising fixture but has numerous capabilities. It works well as a Moxon-style vise for holding hand work. In router-fixture mode it’s well-suited for making other joints and edge profiles. Above, it’s set up to mill mortises in identical locations on two different table legs.*

This fixture, which I’ve christened “Gizmozilla,” grew out of my general dissatisfaction with the methods available to small shops to cut mortises. At one time I used a small hollow-chisel mortiser but I never found the results satisfactory. I tried an open-sided box jig for router mortising, but by the time I had everything in position and clamped I was completely out of patience with the whole procedure. Finally, I resorted to drilling out mortises on my drill press and doing the final chopping out by hand. While I was generally happy with the resulting mortises, the process was far too slow.

Then I happened on an article in an old woodworking magazine that described a basic router mortising fixture. It was a wooden beam with an attached channel for the router edge guide; it used Jorgensen hold-down clamps to secure the workpiece. The author nailed stops to the beam to limit router travel. While the basic idea was sound, it seemed less than fully developed. Nailing stops to something I’d just worked hard to make smooth and square seemed a little crazy, so I added T-track and moveable stops.

I also added wooden clamping cauls of various lengths outfitted with steel bars and rare earth magnets to hold them to the clamps while allowing for some adjustment. The cauls and Gizmozilla’s 4' length adds to its flexibility.

I soon realized that by adding the lower feet I had a variant, and possibly an improvment on, a Joseph Moxon-style vise. The feet raised the fixture slightly and allowed me to position the face of the fixture forward of the edge of the bench.

PHOTOS BY AL PARRISH

Cuts Tenons

Every mortise needs a tenon. *The variety of setups using the clamping system and router fence makes cutting tenon cheeks a snap. For clean cuts, use an upcut-spiral bit and the plunge router's depth stops.*

Acts as a Vise

Look, it's a vise! *Want to cut some dovetails by hand? No problem. When used as a Moxon-style vise, Gizomilla's wide clamping capability even allows for holding case sides.*

Makes Stop Cuts

Just stop it. *Repetitive stop cuts, such as these drawer edge pulls, are simple to set up using the router stop blocks. A variety of other stopped cuts, such as mortises, are similarly done.*

SUPPLIES

Lee Valley
leevalley.com or 800-871-8158

2 ▪ 48"-long T-track, #12K79.28, $15.50

8 ▪ 1 1/2" T-bolts, #12K79.71, $3.70 (pack of 10)

2 ▪ 1" T-bolts, #12K79.70, $3.20 (pack of 10)

10 ▪ T-bolt knobs, #00M50.10, $1

4 ▪ 3/4" rare earth magnets, #99K32.11, $8.40

Woodworkers Supply
woodworker.com or 800-645-9292

4 ▪ Jorgensen 1623 3" hold-down clamps,#125.030, $14.69

Prices correct at time of publication.

Gizmozilla was born.

When the fixture is paired with a plunge router equipped with a guide fence, the adjustment features allow Gizmozilla to excel at numerous functions. It enables a woodworker to make repetitive mortises in precise locations on multiple parts such as table legs, or make multiple mortises on one part by setting additional router stops. Again, the adjustability of the router fence and depth of cut enables Gizmozilla to be used to cut tenons as shown above at top, or half-lap joints and bridle joints. I can also route edge profiles by clamping stock to the side of the fixture, as long as the cut is shorter than the fixture's overall length. Similarly, edge-routing doors and most tabletops and making stopped cuts, such as routing finger pulls in doors or drawer fronts, are all quickly accomplished. For many operations, Gizmozilla is easier and more intuitive to set up and even safer to use than a router table. I'm still discovering more uses for this fixture.

Gizmozilla also performs as a convenient and adaptable Moxon-style vise. The beam provides both a vertical and a horizontal surface at right angles to one another so marking out and cutting dovetails is quickly accomplished. The size of Gizmozilla enables me to clamp multiple pieces side by side (drawer sides for example) or to dovetail wide carcase sides. Pieces can be clamped down to the top of the fixture to make it easy to test-fit and adjust dovetailed components. The addition of T-track to a Moxon-style vise allows me to set angled stops for easier dovetailing.

TIPS ON USING GIZMOZILLA

Using Gizmozilla as a Moxon-style vise is probably self-explanatory, but using it as a router fixture isn't. Here are some tips on how to use it:

- The easiest way to position a piece for height is to simply butt the face of the piece to be worked to the bottom of the unplugged router when it is in position for mortising or tenoning operations.
- Set the travel stops to the router base so the bit aligns to layout marks on the workpiece. Alternatively, spacer blocks can be used to set the length of a mortise.
- Opposing pairs of mortises (such as on table legs) may be machined at the same time using multiple stop blocks. Care must be taken to maintain correct orientation of the two pieces.
- Multiple mortises may be machined using multiple stop blocks or positioning blocks.
- When cutting tenons or bridle joints, always position the workpiece so that the side being cut is away from the beam. When tenoning it may be best to cut the tenon a little heavy until the final length of the tenon is reached, then make a light full-length cut on each face to finish the tenon to thickness.
- Edging operations may require that the piece be clamped to the fixture with F-style clamps rather than with the Jorgensen hold-down clamps.
- Upcut-spiral bits work best for milling mortise-and-tenon joints; you should take light, multiple cuts using the plunge router's depth stops.
- If making light cuts doesn't prevent tear-out, place a waste block at the end of cuts. In most instances, for best results it easier to guide the router with one hand and hold the router fence with the other.
- A little beeswax or paraffin enables the edge-guide shoe to slide more easily in the trough.

— KS

Build the Fixture

This fixture is easy and affordable to build; many of the pieces can come from your scrap bin. To begin, glue up two pieces of 8/4 hard maple for the beam (any stable, close-grained hardwood will work.) The length isn't specific; it's simply what I had – but the size has proven to be very handy. While the glue dries, set the beam aside and make some other parts you'll need.

Go ahead and cut out the two pieces for the wooden trough at the back of the beam. Use ¾" stock the same length as the beam. Make the shoe that fastens to your router edge guide and fits into the trough. This piece will probably need to be fitted after the trough is attached to the beam so that it has no play but slides smoothly. You may need to make other adjustments to fit your particular router edge guide. Then go ahead and cut out the two feet for the beam.

When the beam is dry and out of the clamps, dress and square it to final size. Use a dado stack in the table saw or rout a channel for the T-track on the top of the beam about ⅝" from the front edge. The other channel is located about 1" down from the top of the beam on

GIZMOZILLA DETAILS

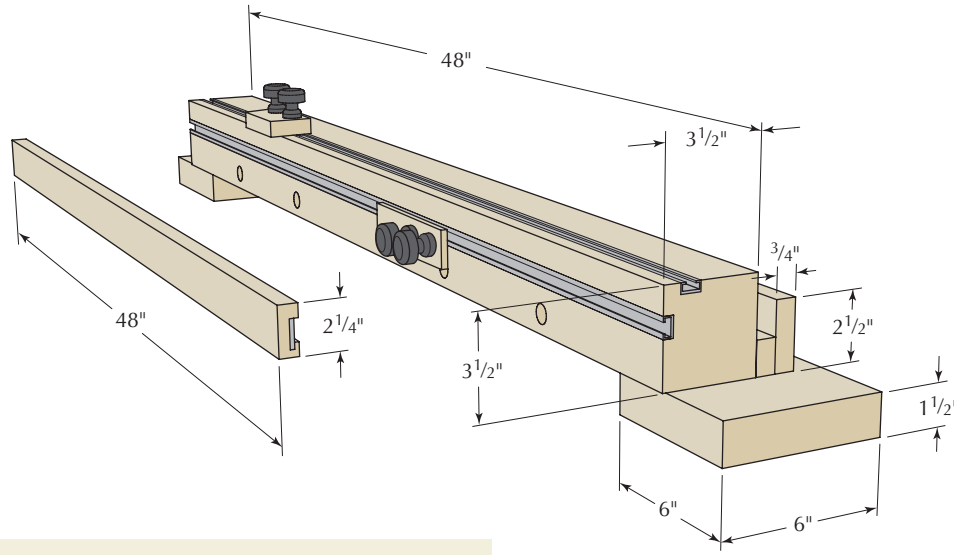
Hold it. *Jorgensen hold-down clamps are secured to the fixture with carriage bolts (with modified heads). The bolts pass through the fixture body to hold the clamps in place. Four holes allow for a variety of clamping set ups.*

Wood, steel & powerful magnets. *Because we aren't equipped with an extra set of arms and hands, Gizmozilla's wooden clamp cauls are outfitted with a steel strip and use rare earth magnets to hold them on the clamps.*

An end in sight. *The end of the beam tells it all. Note the trough on the rear face used to partially house the router fence, the feet locations, clamps, cauls and magnets, and the stop block in the T-track.*

"An idea is salvation by imagination."

— Frank Lloyd Wright (1867-1959) American architect



Gizmozilla

NO.	ITEM	DIMENSIONS (INCHES) T	W	L	MATERIAL	COMMENTS
❑ 1	Beam	3 1/2	3 1/2	48	Maple	
❑ 1	Trough side	3/4	2 1/2	48	Maple	
❑ 1	Trough bottom	3/4	1 1/4	48	Maple	
❑ 1	Router guide shoe	3/4	2 3/4	24	Maple	Fit to your router
❑ 2	Feet	1 1/2	6	6	Maple	
❑ 1	Clamp caul	7/8	2 1/4	48	Maple	
❑ 2	Clamp cauls	7/8	2 1/4	19	Maple	
❑ 2	Clamp cauls	7/8	2 1/4	11	Maple	
❑ 4	Router travel stops	3/4	2	3 1/2	Maple	
❑ 1	Positioning stop	1/4	1 1/2	6	Maple	

the front face. Be sure the grooves are just deep enough for the T-track to sit slightly below the fixture's surface. Next drill four 11/32" holes through the beam for the bolts that hold the Jorgensen clamps. I drilled my holes 8" and 16" from either end, and centered 3/4" up from the bottom edge of the beam. Drill additional holes if you wish.

Now take the trough bottom piece and clamp it in position on the back of the beam. The beam bolt holes must match up and continue through this piece so grab one of the bolts to mark the hole locations by tapping on it. Unclamp the trough piece and drill it, then use it as a guide to drill the trough side. When done, line up the inner and outer trough pieces using the carriage bolts and screw them to the back of the beam.

Prepare some clamping cauls and be sure to make one as long as the beam. Make shorter ones to fit the spacing between the Jorgensen clamps.

A Bit of Metal Work

As mentioned earlier, these cauls stick to the Jorgensen clamps using rare earth magnets. To stick the magnets to the cauls, it's necessary to attach a steel strip on the caul along its length. To make mine, I routed a 1"-wide x 3/16"-deep groove down the center of caul. In the groove I fastened pieces of 1"-wide x 3/16"-thick mild steel flat stock. Drill countersunk holes and use flathead screws to install the steel.

The carriage bolts require a slight modification to fit the recessed slot in the clamps. Grind or hacksaw them, then file the heads of the carriage bolts to fit the recess. When done, cut the T-track to length and drill countersunk holes in it before screwing the tracks into the channels in the beam.

Next screw the feet to the bottom of the fixture. The feet are flush on the front but protrude to each side and to the rear. This positioning allows the fixture to be clamped to a bench and the extra depth allows the fixture to protrude past the edge of the bench when necessary.

Travel stops for the router are simply 3/4"-thick rectangular blocks made from scrap. Drill two holes in them so they can be positioned on the top of the beam and square to the front face using T-bolts with knobs or wing nuts.

The positioning stops are 1/4" thick and long enough to reach past the workpiece and clamps, but are otherwise identical to the router travel stops. Angled or L-shaped positioning stops or other special stops may be made as required.

Gizmozilla grew and evolved as I built it. And as I continue working with it, the evolution carries on as I discover new and better ways to use it and expand the versatility of this fixture. **PWM**

Kenneth is a professional woodworker now semi-retired. He's been a shop foreman, purchaser, estimator, woodworking teacher and project manager and owned a cabinet business for many years. Ken continues to make furniture and cabinets in his semi-retirement.

ONLINE EXTRAS

For links to all online extras, go to:

- popularwoodworking.com/oct12

VIDEO: *Find out where the glue goes inside a mortise-and-tenon joint.*

TO BUY: *"Getting Started with Routers" DVD.*

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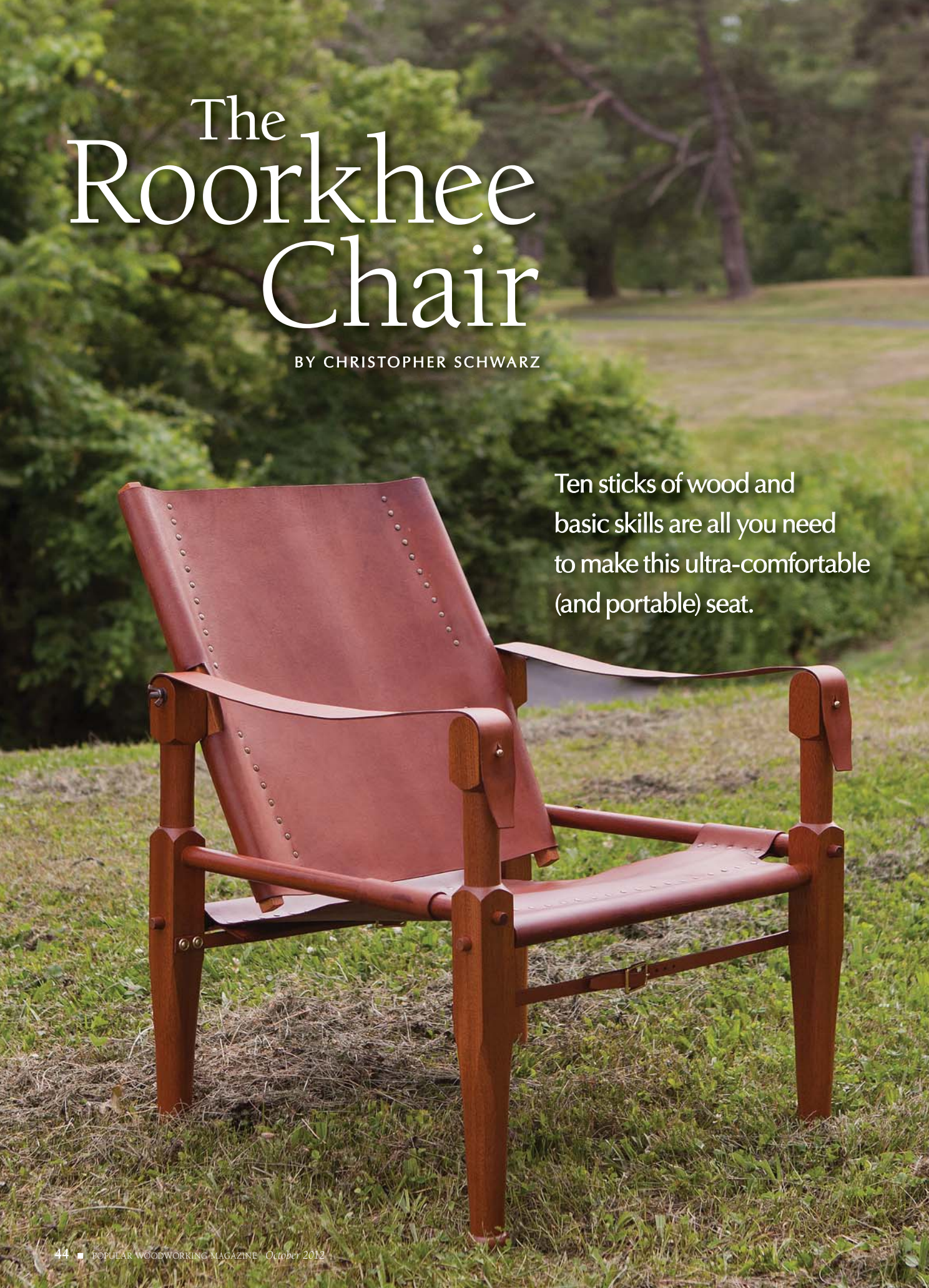
- ShopWoodworking.com

The Roorkhee Chair

BY CHRISTOPHER SCHWARZ

Ten sticks of wood and basic skills are all you need to make this ultra-comfortable (and portable) seat.



Furniture historians tend to paint the Arts & Crafts movement as a turning point for modern furniture design – where style turned its back on the ornate excesses of the Victorians to embrace the simple lines of what was to become the more utilitarian furniture of the 20th century.

I won't dispute that assessment, but it neglects a long-overlooked piece of furniture: the Roorkhee chair. Named after the British headquarters of the Indian Army Corps of Engineers in India, the Roorkhee chair was developed in the final years of the 19th century as the British military become more mobile following humiliations it suffered in South Africa during the Boer Wars (1880-81 and 1899-1902).

Weighing less than 13 pounds, the Roorkhee chair breaks down quickly, takes up little space and is shockingly comfortable. Because it has no fixed joinery, the legs and stretchers move to accommodate uneven terrain and any sitter.

It was a mainstay of the British army and navy up until World War II, according to Nicholas A. Brawer's book "British Campaign Furniture" (Abrams). And it also appears as a popular item for campers, adventurers and those on safari.

While all that is quite interesting, what is more fascinating is how the work-a-day Roorkhee chair directly influenced generations of modern furniture designers. Marcel Breuer's "Wassily" chair (1925), Le Corbusier's "Basculant" chair (1928), Wilhelm Bofinger's "Farmer Chair" (1966) and Vico Magistretti's "Armchair 905" (1964) all owe a tremendous debt to the Roorkhee chair.

This summer I built a run of these chairs for customers and for a book I'm writing about campaign-style furniture, and I selected one of the simpler forms of the Roorkhee to reproduce. To build it you need only 10 sticks of wood, a handful of tools and some upholstery. You can easily get the upholstery made in canvas by anyone with a sewing machine, or you can take the route I did and use cowhide, which is surprisingly simple work. Either material is historically correct.

Begin with the Legs

The 1¾"-square legs are beefier than modern examples of Roorkhee chairs, so resist the urge to skimp on material. The historical examples I've examined are made using mahogany or oak, so you can take the high road or the low one, depending on your budget.

Begin by shaping the legs. The cylinder at the top of each leg and the ankle at the floor are both 1¼" in diameter. So if you aren't confident in your lathe skills, you can waste away some of the material by using a dado stack in your table saw before chucking the work up between centers in your lathe.

Turn the round sections of the leg down to shape using a roughing gouge. Get the cylinder and ankle to size using a parting tool and skew. Use a skew to finish up the taper on the legs and the transitions, and a spindle gouge to create the ¾"-tall astragal that makes the foot. (Just FYI, I turned these legs with one tool from Easy Wood Tools. The full-size Easy Rougher will do all the operations on these legs with ease.)

Once you have the legs turned, make the ⅞"-radius curve on the top of each leg. Cut it to rough shape with a coping saw, then finish the job with a rasp or disc sander.

Tapered Joinery

Like a Windsor chair, Roorkhee chairs are assembled using tapered tenons and conical mortises. Unlike Windsor

TURN THE LEGS

Careful now. *Turn the cylinder at the top of the leg with care. If your tool catches the square section above or below, game over.*

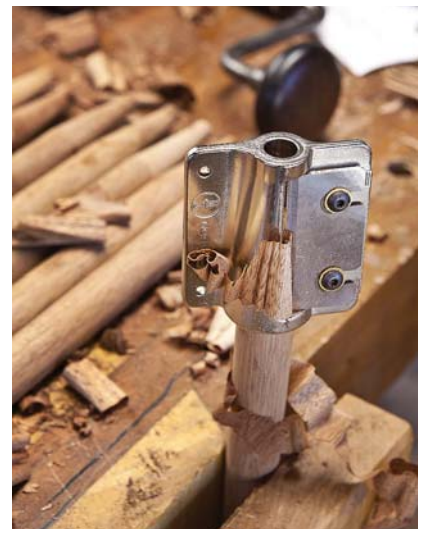
Angled & easy. *The transition between the cylinder and the square section is a snap if you ease into the cut slowly.*

Divide & divide again. *To make the astragal at the foot, turn 45° chamfers on the corners. Then turn chamfers on the arrises of the chamfers. Then turn arrises on those chamfers until you get an astragal.*

Round the top. *The top of the legs all have a ⅞"-radius curve for the leather armrests. Cut this a with saw and refine it with a rasp or sandpaper. If you are making a run of chairs, a disc sander is a huge help.*

PHOTOS BY THE AUTHOR;
ILLUSTRATIONS BY ROBERT W. LANG FROM THE AUTHOR'S DRAWINGS

Easy reamer. *A tapered reamer is the best practical solution to making the conical mortises. A sharp reamer is a joy. (A ground spade bit will also work.)*



Sharpen those dowels. *The Lee Valley Tools Tapered Tenon Cutter works like a high-quality pencil sharpener. It produces clean and crisp work.*

Check it. *After every reaming operation, confirm that your rails are 90° to the leg in both axes. Use your reamer to adjust the attitude of each leg.*

chairs, however, these joints are left loose – no glue and no wedges. Still, you want a good fit.

A Roorkhee chair has four 1"-diameter round rails, which you can make simply by using dowel stock (or turn them on your lathe). Original chairs would offer a seat that was about 16 1/2" wide and deep between the legs, which is skimpy for modern backsides. The sizes shown in this article will create a chair that has a seat that's 18" square between the legs. If you need more room, use longer dowels. But don't go overboard – longer dowels weaken the chair.

Begin by drilling a 1/2"-diameter hole for the dowels through your legs in the locations shown in the illustrations. All these holes are 90°; if you've ever built chairs, this should be a relief.

Now ream the holes into a cone. I used the Veritas Pro Reamer, which I chucked into a brace. You can also grind a cheap spade bit to the shape you desire, which will scrape the sides of the mortise to the correct taper.

With the mortises reamed, shape the tenons. Cut the dowels to finished length and then turn the ends to a cone shape on your lathe. Alternately, if you used the Veritas Pro Reamer, you can buy the 1/2" Tapered Tenon Cutter from Lee Valley Tools and shave the dowels as if you were using a pencil sharpener.

Roorkhee Chair

NO.	ITEM	DIMENSIONS (INCHES) T	W	L	MATERIAL	COMMENTS
WOOD						
❑ 4	Legs	1 3/4	1 3/4	21 1/2	Mahogany	
❑ 4	Rails	1 dia.		23 1/4	Mahogany	Over-long, trim to fit
❑ 2	Back braces	5/8	1 1/2	20 1/2	Mahogany	
LEATHER						
❑ 2	Leg straps	3 oz.	1/2	21 3/4	Leather	Overall joined length
❑ 1	Seat support	3 oz.	4 1/2	35	Leather	
❑ 1	Seat	3 oz.	17	33	Leather	
❑ 1	Back	3 oz.	20	27	Leather	3 1/2" w. x 4 1/4" notch

The Back Braces

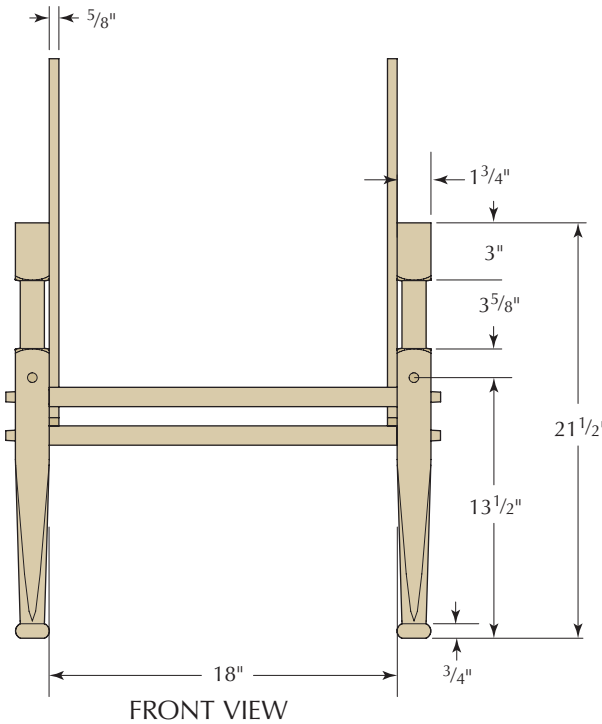
The back of a Roorkhee chair tilts to fit the user. The tilting occurs on 5/16"-diameter all-thread steel rods that pass through the back legs and the two back braces. The braces are secured to the legs using nuts, washers and wing nuts – all available at your local hardware store.

First drill holes through the legs to accept the 5/16" rod. The holes should be at the center of the 7/8" radius that defines the top curve of the legs. The holes should be just a smidge larger than 5/16" – whatever you have in your shop.

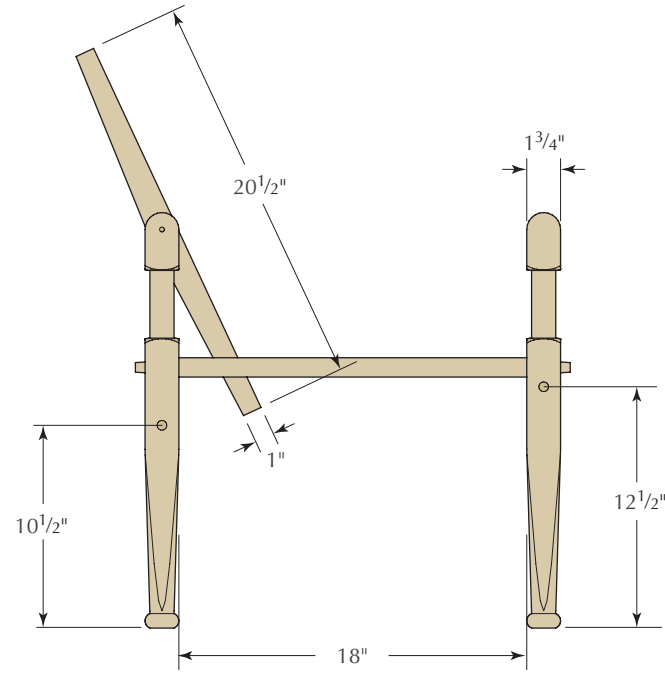
Now make the back braces. These two pieces taper from 1 1/2" wide at the center to 1" wide at the ends. Mark the taper on the braces and taper them with a handplane (or make the cut with a band saw). To complete the braces, drill a clearance hole for the steel rod through the braces in the center of the widest part of each brace.

Finish the Wood

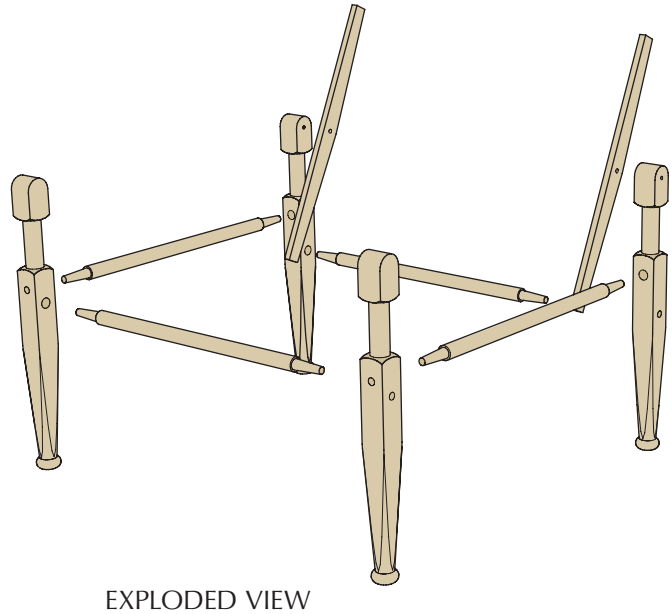
Remove all the tool marks from the parts, break the edges and finish all the wooden parts using three coats of garnet shellac. The wood is only one-half of this



FRONT VIEW



SIDE VIEW


EXPLODED VIEW

SUPPLIES

Tandy Leather
tandyleatherfactory.com or 877-532-8437

1 ▪ craftsman oak tooling leather side
#9157-35, $6.49 sq. ft. (need about 22 sq. ft.)

1 ▪ rapid rivets
#1271-15, $3.99/100 ct.

2 ▪ halter buckles, 3/4"
#1505-00, $3.99 ea.

1 ▪ 1/8" drive punch
#3777-02, $9.99

1 ▪ rivet setter
#8100-00, $3.99

1 ▪ Aussie leather conditioner
#2199-00, $14.99

4 ▪ button studs
#11310-01, $2.49 ea.

Prices correct at time of publication.

project. And you can choose to hand off the upholstery to a professional or do it yourself. (You can do it. It's easy.)

Leather & Hardware

The leather upholstery is stuff that is about 3-4 oz. cowhide – one typical skin should be more than enough for one chair. Begin by making the straps for the legs. These straps restrain the sides of the chair. Unbuckling them disassembles the chair. You can cut the straps using a straightedge and a sharp utility knife. Repeat: sharp utility knife.

Punch the holes for the buckles using a 1/8"-diameter drive punch, available at all leather-supply stores. To attach the straps to the buckle you'll need to rivet the leather into a loop. Riveting is simplicity itself. Punch two holes in the leather. Fold the leather over so the holes meet up – wet the leather if you want to make it more bendable.

Put the male end of the rivet through the hole and place it on a hard surface (such as your table saw). Place the rivet's cap on top. Strike the rivet three times or so using a hammer and a rivet-setter – a steel rod with a concave end. This makes a permanent join.

Screw the straps to the inside surfaces of the legs. Use #10 x 1 1/2" brass screws and brass finishing washers

RIVETED LEATHER – NOT CANVAS

Roorkhee chairs were covered in canvas, leather or leather-trimmed canvas. Of the three options, plain old leather is the simplest of the three solutions. However, if you prefer canvas but don't have sewing skills in your household, I recommend you outsource the job.

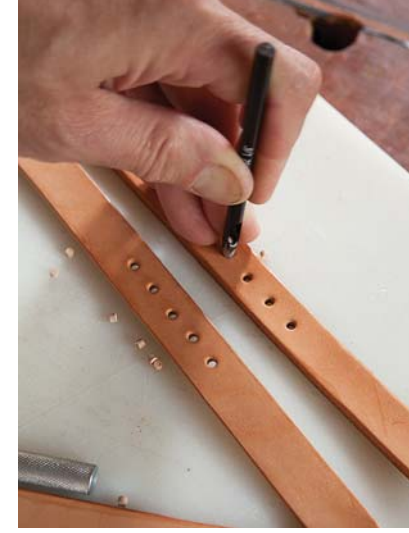
I think you'll be surprised how economical leather can be. I bought the skin, rivets, buckles and tools I needed for this chair for about $130.

I chose to rivet the leather pieces together for this chair. The other option is to sew them together. I decided against the sewing. Here's why.

To sew the leather together I'd either need a sewing machine that can pierce 3 oz. leather (I don't have one) or punch all the holes for the thread. I didn't want to buy or borrow a sewing machine so I decided on riveting, another traditional leatherworking joint. It requires only a punch, rivets and a rivet setter. Once you try riveting you'll be amazed how easy it is. In fact, punching and riveting leather is so easy that you might start making your own belts, suspenders or tool rolls. I'm making some chisel holders with my scraps (just be sure your leather is vegetable-tanned if you do this).

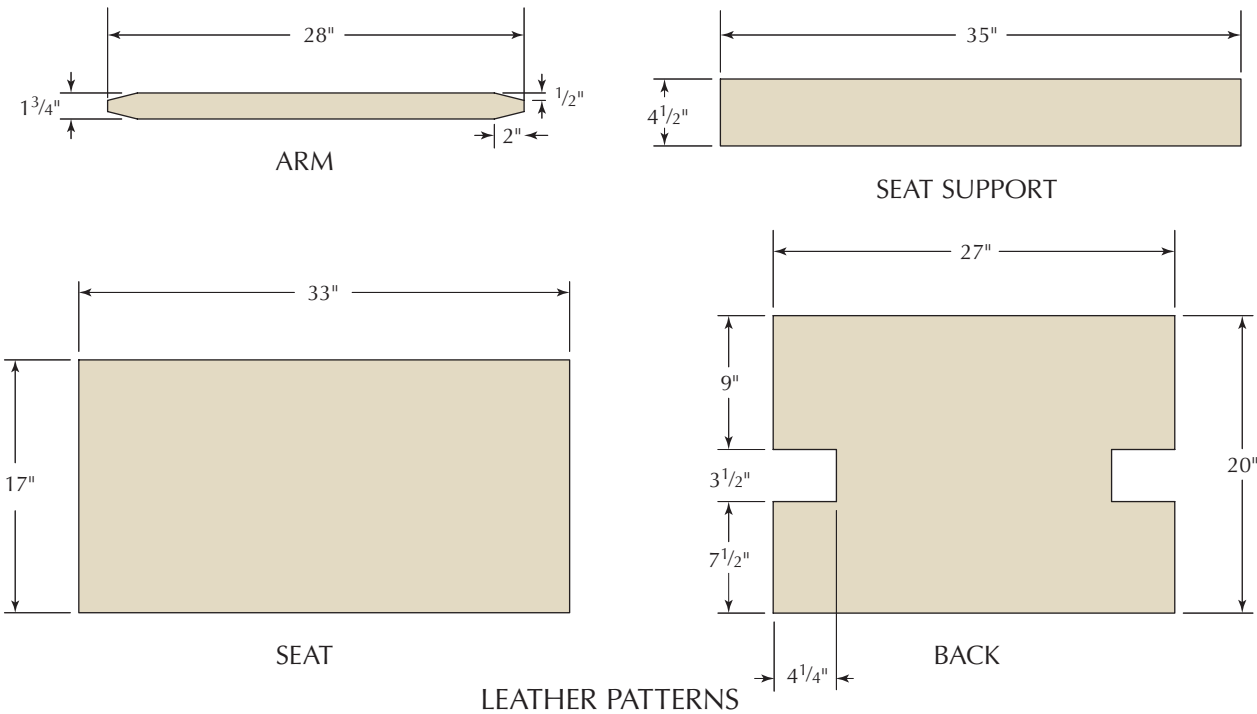
— CS

Rivet this. *Simple small rivets join all the leather in this project. A steel rivet-setter and mallet does all the leather joinery.*



Feeling punchy. *The 1/8"-diameter drive punch will do all the leather work on this chair. Keep it sharp and lubricated with beeswax or paraffin.*

Template work. *Make your templates for your leather using 1/2"-thick material – I used some MDF left over from another job.*



LEATHER PATTERNS

– two screws in each leg. Remember that the leather will stretch in use, so install it on the tight side.

The Seat Support, Seat & Back

Your bottom and your back are supported by three pieces of leather in the Roorkhee. The back is stretched and riveted around the back braces. The seat is two pieces of leather. There's a narrow seat strap that runs from side to side, plus the main seat that runs from front to back and sits on top of the seat strap.

These three pieces are all installed in the same way. Stretch the leather over the wood and mark where the line of rivets should go. This is mostly by eye, but space the rivets about 1" apart from one another. Punch all the holes for the rivets using your 1/8" drive punch.

Before you rivet the leather, it's best to finish it. You can burnish the edges and simply add a wax/oil solution, which is available at leatherworking stores. Or you can color the leather with a dye, finish it with an oil/leather solution and then rivet the flaps together. After you finish these leather pieces, thread everything together and pull the chair together. It should hold together and sit well. The only things left to add are the armrests.

> "The British Army is a social institution prepared for every emergency except that of war."
>
> — H.O. Arnold-Forester, Secretary of State for War, 1903

Armrests

The armrests were the biggest challenge to construct because the hardware to attach them to the chair isn't standard stuff. You can use 13mm ball socket studs, which are used to attach gas struts to car bodies – these are the struts that hold up the glass on the back of a pickup truck's camper top.

Or you can take the hard road and make your own. I used "Sam Browne" buttons from Tandy Leather. These are the stud shape you need, but instead of having a screw that goes into the wood, there's a threaded hole in the stud. I found a metric machine-screw fastener that screwed into this hole in the stud. This created a fastener that I could insert into the leg in a 7/64"-diameter hole.

Whew. Or just go to an auto parts store and get the 13mm ball socket stud. It's simpler. Screw these studs into the legs.

To attach the leather to the studs, make a slot at each end of each leather armrest. Use your 1/8" drive punch to define the extents of the slot, then use your utility knife to join the holes. This should make a hole that will button over the studs. Remember: Make the leather tighter than you think you should. It will loosen up.

OK, sit in the chair. Lean back and feel how it supports your lower back. Awesome, no? What? Don't fall asleep. I'm not done yet. There are still other leg profiles of Roorkhee chairs to discuss.

Oh, never mind. Enjoy your nap. Tomorrow you might have to fight. **PWM**

Christopher Schwarz is the editor of Lost Art Press LLC (lostartpress.com) and is working on a book about Roorkhee chairs and other pieces of campaign-style furniture to be released in 2013.

Assembled. *Here you can see the back braces bolted to the rear legs. The acorn nuts were later replaced with wing nuts.*

Leather options. *Here's the Roorkhee with brown leather, the steel 13mm ball studs and no straps on the legs. This arrangement is also historically correct.*

ONLINE EXTRAS

For links to all online extras, go to:

- **popularwoodworking.com/oct12**

BLOG: *See how the tapered tenons and conical mortises are cut.*

BLOG: *Learn how to age the steel hardware for this piece.*

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Spokeshaves

BY JAMES MURSELL

Learn how to choose and use these versatile shaping tools.

As a Windsor chairmaker and spokeshave maker, I use a spokeshave more than any other tool. I have three: two straight shaves (large and small) and, for hollowing wood, the curved specialty shave called a travisher.

My introduction to spokeshaves came at school where we had traditional wooden shaves with the blades held in place by friction. When they were sharp and set correctly they were great, but because they were old and well-used, the tangs often slipped in the body. That resulted in a sometimes unexpectedly thicker or finer shaving – not an endearing feature.

I've spoken with many people at woodworking shows, and I am amazed by how many still have their grandfathers' spokeshaves, but rarely use them because of the same problems I suffered during my training. This is a shame because spokeshaves are remarkably versatile tools for shaping wood.

The first spokeshave that I bought was an inexpensive metal shave. It worked after a fashion, but it was not a pleasure to use. Years after purchasing it, I read some of David Charlesworth's articles that explained all that should be done to make this type of shave function satisfactorily. In my opinion, tools

OPENING PHOTO BY AL PARRISH; STEP PHOTOS BY RAY FOXLEE; ILLUSTRATIONS BY ROBERT W. LANG FROM THE AUTHOR'S DRAWINGS

should work "out of the box" – and that one didn't. I am sure that similar experiences have put off so many potential spokeshave users.

I began to make and sell my own wooden spokeshaves about 15 years ago when I was unable to buy tools of the quality that I wanted.

Spokeshaves fall into two broad categories:

1. Low-angled, usually wooden-bodied
2. Higher-angled usually metal bodied

While there are today several metal-bodied shaves available that don't suffer from the same problems as the tools that I've encountered, I prefer wooden spokeshaves.

Metal (High-angle) Shaves

A fine example of a metal shave is Brian Boggs's spokeshave, available from Lie-Nielsen Toolworks. It is a beautifully made tool with a bronze body and a blade set at 40°. The blade is made of high-quality steel that holds a fine edge. The throat, or gap between the blade and the nose of the tool, is narrow to produce very fine shavings and a perfect finish, even on difficult woods. The sole of the tool, both in front of and behind the blade, is absolutely flat (a version with a curved sole is also available).

A few years ago I had a conversation with Boggs about our respective tools and we decided that we had designed them for quite different purposes. His tool is designed for finishing cuts, particularly on challenging woods, while mine are for removing wood quickly while leaving an excellent finish for most purposes – particularly on straight-grained wood.

The flat sole of the metal shave means that it is designed as a plane with handles to either side. The tool works best when the surface being shaved is flat or convex. Concave cuts are difficult to make with a tight-mouthed tool because the blade cannot touch the surface; it's held away from the wood by the front and back of the sole.

The alternative version with the curved sole is fine for concave work – but the curved tool is not ideal for straight or convex work. Thus, two spokeshaves are required.

Another limitation I see for most modern metal spokeshaves is the size of shaving that can be taken with the tools. If the goal is solely to produce a fine surface on wood that has already been shaped, then this is the tool for you. But if you wish to shape the wood to any extent first, I find a tight-mouthed metal shave to be problematic; with it, one just cannot remove enough wood quickly enough. This, of course, is the opinion of a professional chairmaker who operates in a world where time equals money. But even if I had all the time in the world, I would be frustrated by what I see as a limitation.

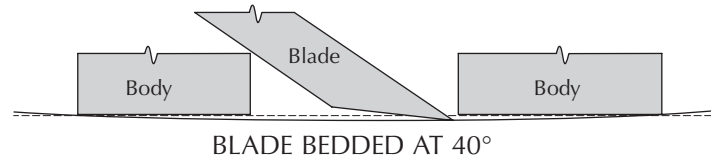
Wooden (Low-angle) Shaves

As I've inferred, low-angle spokeshaves are quite different from their (usually) metal, high-angle cousins. The biggest difference is in the geometry of their design. Unlike the metal shave, on the wooden shave there is nothing behind the blade to interfere with the workpiece; the blade is set bevel-up and the base of the blade is set at an angle to the wear plate (6° in my shaves), and the resulting cutting angle, between the blade and wear plate is around 33°.

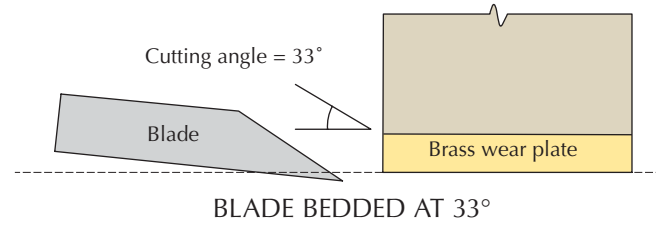
> "We shape our tools and afterwards our tools shape us."
>
> — *Marshall McLuhan (1911-1980) Canadian scholar*

The bodies of the low-angle tools are typically made of wood (though Veritas makes a metal-bodied low-angle version). As a result, they are warm to the touch and many experienced woodworkers consider them more comfortable to use.

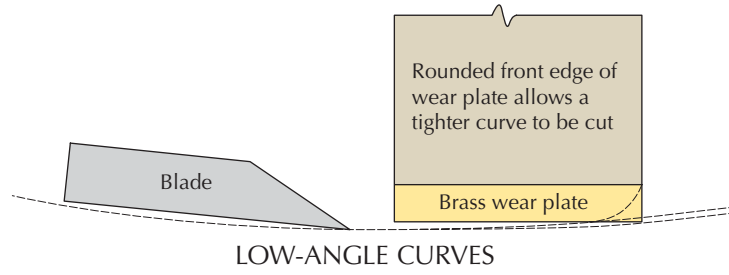
The spokeshaves I make have a solid wooden surface directly behind the blade (it does not project below the bottom of the blade and therefore doesn't interfere with concave cuts) and this



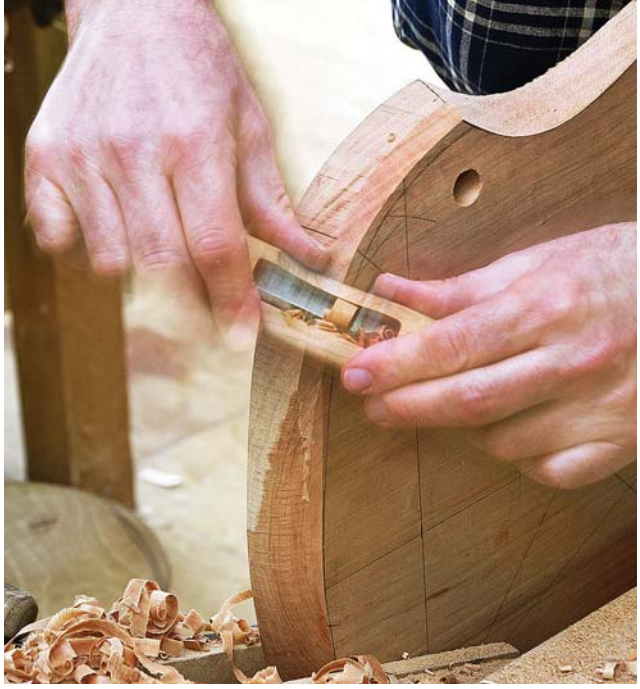
Metal spokeshave. *On most metal shaves, the blade is bedded at an angle of approximately 40°, the sole of the tool is flat and the mouth is tight. This makes deep concave cuts difficult to achieve.*



Wooden shave. *In a low-angle spokeshave, the blade is set at approximately 33° to the wear plate.*



Concave cuts. *Shallow concave cuts can be made with a low-angle spokeshave due to the angle between the base of the blade and the wear plate. Make the wear plate narrower, and a tighter curve can be cut.*



Thumb grip. *The sole on this shave allows you to put your thumbs directly behind the blade for excellent tool control, without causing interference with the cuts.*

Reverse grip. *A spokeshave can be used effectively with both a push and pull stroke. This is particularly useful when working on pieces such as spindles, where the grain often reverses. Notice the fingertip grip.*

allows the fingers or thumbs, depending on whether the tool is being pulled or pushed, to be directly behind the cutting edge. Apart from being comfortable, this minimizes any tendency for the tool to rotate in the hand as it is being used.

These tools are for removing wood quickly. On straight-grained wood and end grain they will leave an excellent quality surface. If, however, you are mainly working with wild-grained woods such as curly maple, then a fine-throated high-angle shave would be the better choice.

Adjusting the Cut

The position in which the blade is set relative to the wear plate is the first means of setting the depth of cut on both a wooden and metal spokeshave. Many woodworkers set the edge of the blade so that it is not parallel to the wear plate (when seen from the front). This means that there is a continuous range of cutting depths from fine to coarse across the blade. If a tool is used like this for even a short time, one gets used to the variation and can take advantage of it, depending on how much wood needs to be removed at that particular point.

I find this technique more effective with wooden shaves because the blades are usually longer. In my experience, the comparatively shorter blade of a metal shave means it can handle only a small variation in set. Setting a metal shave is more like setting a plane.

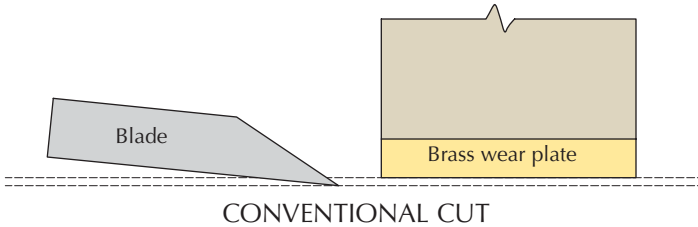
Anyone using a low-angled spokeshave for the first time may initially have trouble with the blade digging into the wood, especially if the blade is set coarsely, as I prefer. However, once the user learns to maintain contact between the wear plate and the workpiece, all problems evaporate.

Conventional cutting with both metal and wooden spokeshaves requires good contact between the surface of the wear plate and the wood being shaved. In this situation, the position of the blade sets the depth of cut. For cutting end grain, for example, set the blade finely and make sure the wear plate achieves good contact with the workpiece for long, continuous shavings.

I find that low-angle (typically wooden) spokeshaves come into their own when one gets away from this conventional mode of working – but too few people use them enough to develop a knack for the following techniques and to appreciate the flexibility the tools provide.

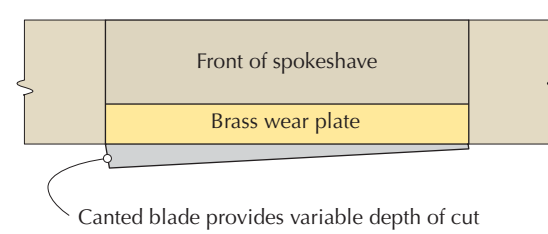
I mentioned that I favor a coarse setting for my shaves – not because I am always taking heavy cuts, but so that I can take the greatest range of cuts from very fine to coarse, without ever having to reset the tool.

To achieve a very fine cut (as I use to finish a shaved spindle in a Windsor



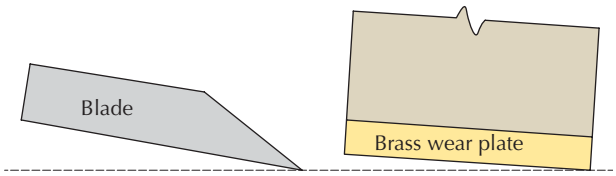
CONVENTIONAL CUT

Typical low-angle cut. *The conventional cut with a low-angle shave has the tool running on the wear plate; the depth of cut is set by adjusting the height of the blade.*



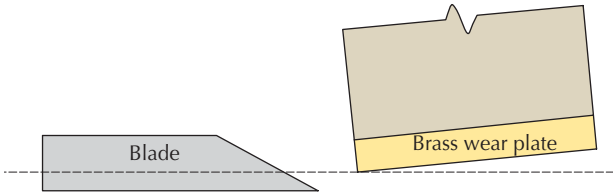
VARIABLE-DEPTH CUT

Out of parallel. *Set the blade at an angle to the tool's sole and one shave can make a variety of cuts.*



PRESSURE ON THE FRONT

Fine cuts. *To achieve the finest cut, run only the leading edge of the wear plate on the workpiece and trail the blade behind. Virtually all the downward pressure should be exerted on the front of the tool.*



PRESSURE ON THE BACK

Deep cuts. *Achieve the greatest possible depth of cut by running the back of the wear plate and the base of the blade on the workpiece, by applying pressure on the trailing edge of the tool.*

Rapid removal. *To remove a lot of stock quickly, ride on the base of the blade with the nose of the tool up in the air. Notice my grip on the tool: My fingers are pinching in front of and behind the blade*

chair), the contact with the wood is at only the leading edge of the wear plate. The blade skims over the wood taking the lightest possible cuts. When working in this manner, concentrate entirely on maintaining very light contact at the front of the tool and let the blade follow on behind. If you try to push or pull the blade it will begin to dig in and take more than desired.

I frequently demonstrate this technique using just two fingertips to hold the tool. While this is not a realistic way of handling the tool for real work, it serves to illustrate just how lightly one should hold it.

In order to take a slightly deeper cut when working in this way, simply add a little more pressure on the back of the tool.

But this is not the end of the tool's flexibility. Continue to apply more pressure to the back of the spokeshave until the sole of the blade runs on the wood, with the wear plate up in the air and touching the workpiece only at the very back. At this point you will be taking the maximum thickness of cut that is possible with that blade setting.

Although a little extreme, this is a useful technique when wood needs to be removed quickly. I use it, for example, when shaving spindles from green wood and when shaping seats along the grain in soft wood, such as tulip poplar.

Get a Grip

I have always emphasized that a spokeshave should be gripped with the fingertips directly in front of and behind the blade. Only this grip will provide the sensitivity of feel that is necessary to set the wear plate rubbing on either the front (minimum cut) or back (maximum cut) and anywhere in between.

Most people who are new to using spokeshaves grip the handles firmly with their fists. This usually leads to the tool running on the sole of the blade rather than on the wear plate, and results in an unexpectedly thick and uncontrollable cut. Control comes only when the tool is rotated forward onto the wear plate.

Rotating a tool with your fists is not as controllable as applying pressure with the fingers directly to the wear plate (front) or blade (back) to control the cut. This is the reason I emphasise the fingertip grip so continuously.

Parting Thoughts

Two other tips apply to all shaves: Keep the blade sharp; and skew the blade across the direction of travel. This lowers the blade angle, giving a slicing cut and producing a better finish on harder woods. Skewing also reduces the thickness of cut, giving yet another method for changing the cutting depth without changing the setting of the blade.

Finally, a plea to all woodworkers who don't currently use spokeshaves: Spokeshaves can do so much more than round over an edge or cut a bevel. They can create complex shapes that would be virtually impossible with a machine. So the next time you design a piece, why not shape the wood the way that you want, rather than be limited to the shapes a machine can achieve?

One last thought: Spokeshaves and rasps as a combination are absolutely unbeatable for shaping wood. **PWM**

James is the founder of The Windsor Workshop and a toolmaker in West Sussex, England. He can be reached at james@thewindsorworkshop.co.uk.

ONLINE EXTRAS

For links to all these online extras, go to:
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Drawers Date Furniture

BY BOB FLEXNER

Quick inspections reveal much about a piece's age and possible origin.

A while back, my wife and I were visiting friends who wanted to show us their collection of antique furniture. At one point we went into their bedroom and I headed directly for a very old-looking chest-of-drawers. I pulled the top drawer open about 3", looked at the side of the drawer and felt the exposed bottom.

The husband yelled out from behind me, "No! That's my wife's private drawer." Followed immediately by my wife's reassuring, "Don't worry. He doesn't even see what's inside the drawer."

And that was true. I just wanted to date the piece by how the drawer was made.

Over the years of working on hundreds of pieces of antique furniture, I've developed a quick and fairly accurate system for dating and determining the origin of any piece of furniture containing drawers. Here's how I do it.

Construction

Drawer construction has changed several times in the last 200 years. Because this construction is visible on the surface (unlike mortise-and-tenon and dowel joints, for example), it's usually easy and quick to determine the rough age of furniture, and its authenticity as a true antique, using drawers. Simply pull a drawer out a few inches, glance at the joinery on the side and feel the drawer bottom underneath – essentially a single motion.

In addition, the wood used for the drawer sides and bottoms helps deter-

Inspect the construction. *A simple glance at the drawer joints, combined with feeling the drawer bottom, provides a powerful clue as to when a piece of furniture was made.*

PHOTOS BY THE AUTHOR

CONSIDER THE JOINTS

Hand-cut dovetails. *Hand-cut dovetails indicate the furniture was made during the 19th century or before – as long as other clues don't point to a more recent time period.*

Pin-&-scallop joint. *The pin-and-scallop joint was used from the early 1870s to the end of the 19th century. It's easy to date furniture containing this joint.*

Machine-cut dovetail. *A machine-cut dovetail establishes that the furniture wasn't made before 1895 when the machine that cuts these dovetails was invented.*

mine whether the furniture is American or European.

How a drawer is constructed and the woods used is revealing, but there are two important caveats.

First, dating furniture is a fine art. Seldom does one clue provide confirmation of anything. Also important are style (including hardware), shrinkage, nails, screws, locks, the primary and secondary woods used, the type of finish, tell-tale tool marks, areas of wear and general appearance.

Second, many clues aid only in establishing that the furniture isn't older than a certain date. Any technique or machine that was once used could still be used, and often is used, for example, by many readers of this magazine who build reproduction furniture. So, for example, hand-cut dovetails alone can't be used to date furniture before the machine age. On the other hand, machine-cut dovetails definitely establish that the furniture is no older than about 1895, when the dovetail-cutting machine was invented.

Joinery

Three clearly distinct drawer joints have been used on quality furniture: hand-cut dovetails, pin-and-scallop joints and machine-cut dovetails.

Hand-cut dovetails are the oldest and are usually easy to identify. The size of the pins and tails is typically uneven, with the pins commonly narrower than the tails. Also, clearly visible scribe marks and saw or chisel overcuts frequently remain on the wood. If you're not sure by looking at the outside of the drawer, open it farther and look at the inside corner where overcuts are more likely to appear.

> "Every man at the bottom of his heart believes that he is a born detective."
>
> —*John Buchan, (1875-1940) Scottish Politician*

The pin-and-scallop was the first machine joint used on drawers. The machine was patented by Charles B. Knapp in 1867 (so the joint is sometimes called the "Knapp dovetail"), but the first factory installation didn't occur until 1871. So you can be sure that any drawer with a pin-and-scallop joint is not older than the early 1870s.

From the outside, this joint appears to be dowels inserted through a scalloped drawer side into the drawer front. But the "dowels" are actually pins cut into the drawer front. The pin-and-scallop joint is exceptionally strong and long lasting, a far better joint than machined dovetails because of the much greater glue surfaces.

Machine-cut dovetails are identifiable by their perfect symmetry. Pins and tails are the same size, the spacing is even and there are no saw or chisel overcuts. The machine that cuts these joints came into use in about 1895 and quickly spread throughout the furniture industry because dovetails were associated with quality. Today, router jigs are available for cutting the same joint.

Bottoms

Bottom panels in drawers have also changed as machinery has become available and more sophisticated. Five

EUROPEAN-MADE FURNITURE

The other drawers shown in this article use a white wood for the secondary wood which indicated they are likely American-made. The sides on this drawer (and also the bottom) are oak, which is a good clue that this furniture is not American. Most likely it is English because the wood is English brown oak.

distinct panels have been used: riven, handplaned, machine-sawn, machine-planed and plywood.

Handplaned panels, which were common before the mid-19th century, are about 1/2" thick. If the grooves cut into the drawer sides and drawer front to hold these panels were 1/2" wide, the likelihood of the wood splitting in this weak area would be greater than necessary. So bevels were handplaned on three edges of the panels to narrow them to about 1/4" to fit 1/4" grooves in the drawer sides and front. These bevels are easy to feel with your fingers.

By pulling the drawer out farther, you can often feel the ripples left by the handplane used to rough out the panel. These ripples were often left on the bottom side.

As large table saws and band saws were introduced into factories after the mid-19th century, panels for the bottoms were often sawn rather than handplaned. The bottom side was usually left rough with the saw marks clearly visible while the topside was handplaned smooth. The thickness of these panels was still more than desired so rabbets were usually cut into the edges to reduce the thickness for sliding them into grooves cut into the drawer sides and drawer front.

You can feel the rabbet on the drawer bottom just behind the drawer front.

By the late 19th century most factories had large planers, so drawer bottoms could be planed to the desired thickness (about 1/4") and no bevels or rabbets were necessary.

Before 1920, plywood became widely available, and drawer bottoms were cut from this material. A few factories were making their own plywood panels before this date, however, so you can't use the teens as an absolute date. But it serves as a good guide.

American vs. European

Generally speaking, machinery entered factories in Europe much later than in the United States, so all dates need to be pushed forward on European furniture. There is one significant difference in drawer construction that is at least helpful in determining if the furniture is American or European – the wood used for the secondary parts of the drawer.

Before the mid-20th century, oak was often used in Europe for drawer sides and bottoms, while pine, poplar, cottonwood or some other "white" wood was commonly used in America. Adding this factor to others can often aid in determining the origin of a piece of furniture. **PWM**

Bob Flexner is author of "Flexner on Finishing" and "Wood Finishing 101."

INSPECT THE BOTTOMS

Handplaned drawer bottom. *Drawer bottoms made before the machine age are typically thicker and are beveled on three edges to fit into narrow grooves cut into the drawer front and sides.*

Rabbeted drawer bottom. *Drawer bottoms made in the late 19th century after the introduction of band saws and large table saws are often rabbeted on three edges to fit narrow grooves cut into the drawer front and sides.*

Machine-planed drawer bottom. *With the introduction of planers in the late 19th century, drawer bottoms could be planed thin enough to fit into narrow grooves without the need for bevels or rabbets.*

Plywood drawer bottom. *By the 1910s manufactured plywood was available and it quickly replaced solid wood as the drawer bottom material of choice.*

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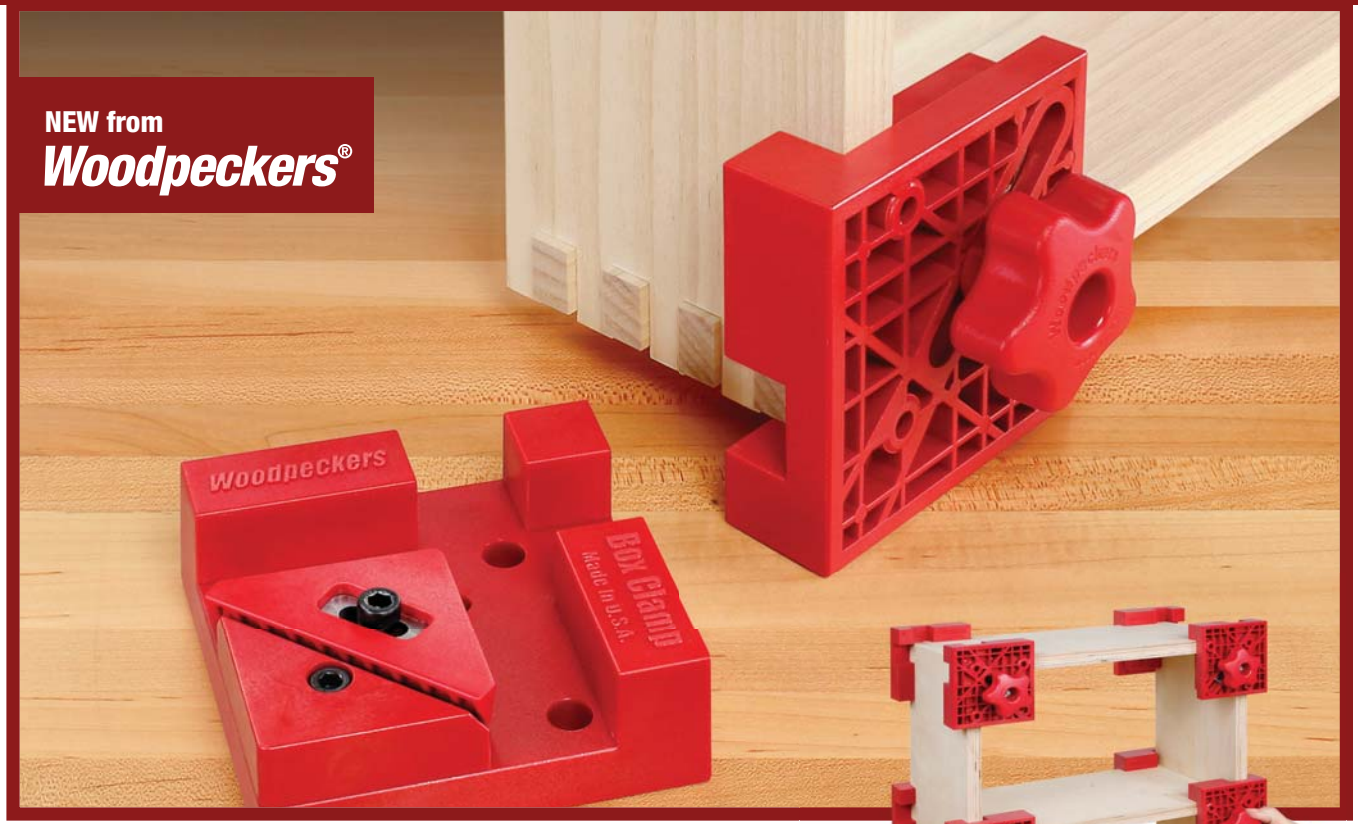

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Shaker Carry Box

Notched and nailed joints add visual interest to this simple project.

This form is typically called a Shaker silverware tray – but it comes in handy for ferrying all sorts of things hither and yon.

I got lucky at the big box store in finding some perfectly straight, flat and clear ½"-thick white pine with a bird's-eye-like pitch-pocket pattern.

At my home center, thin stock is available in nothing longer than 3' lengths. So to be sure I'd have plenty of that pretty "bird's-eye" for all my parts, I picked up three 3'-long and two 2'-long ½" x 6" boards.

A design note: The dovetailed piece that inspired this version (which can be found in the October 2007 issue of *Popular Woodworking Magazine*, #164) has half-pins at the bottom (and top) of the ends, which helps to support the sides as you lift. And for the notched construction shown here, it would arguably be a bit stronger to have the joints reversed so that notches on the ends support the front and back when you pick up the box.

But reversing the notches would mean two more shoulder cuts to bring the box ends flush with the outside faces of the front and back – technically, you would be cutting one box joint by hand at each corner (and a box joint is typically a machine joint). Those additional shoulders would make the pieces harder to fit well, and for our first handsaw cuts in the I Can Do That column, I elected to keep it simple. Besides, I'm not planning to put anything heavy in the piece; the nails will hold it together just fine.

You could also choose to simply reverse the joints and inset the ends so as to avoid a box joint – but I don't think that looks as clean (you'll find a bonus SketchUp drawing online for this approach).

Whichever approach you choose, the size of the workpieces remains constant; only the joint layout changes.

First Cuts

The ends are 5½" wide – which is the actual width of 6"-wide dimensional lumber – so those two pieces need only be cut to their final 9½" lengths, which I did at the miter saw.

The front and back are 16½" long but only 4" wide. So before cutting them to length, mark out the cutline and use a jigsaw to cut them to width. If you have a little practice under your belt, you don't really need to set up a straightedge for this rip cut. Yes, you need the cut to be straight – but you can arrange the factory edge at the top and turn your cut to the bottom (and of course, you can quickly clean up your cut if necessary using a block plane). Now cut the front and back to length.

Joinery Layout

Set your adjustable square to ½" – or for more precise work, set it to the actual thickness of your wood. Put your wood face-down (or up) on your Workmate, then set the square's stock on the wood and drop the rule down over the edge of your workpiece until it meets the table surface. Then tighten the thumbscrew to lock the rule in place.

Using that setting and a pencil, mark (or scribe with an X-Acto knife) a layout line on both faces and the top and bottom edges of both end pieces and the front and back. This is more easily accomplished with a marking gauge if you have one.

The notched cutouts are all 2" x ½". Reset your adjustable square for 2", then on each workpiece, mark a line from your first layout line to the edge

Pinch for precision. *Just shy of your cutline, pinch with your fingers to form a guide for the cut. Slight changes in finger pressure will micro-adjust where the sawplate falls.*

CONTINUED ON PAGE 62

LEAD PHOTO BY AL PARRISH; STEP PHOTOS BY THE AUTHOR; ILLUSTRATION BY ROBERT W. LANG FROM THE AUTHOR'S MODEL

CONTINUED FROM PAGE 60

of the piece on both faces, and across the end. It doesn't matter off which long edge you register the square for the front and back; the layout line is at the centerline of the board. On the end pieces, register off the bottom edge.

Time to Saw

We recommend a dozuki as your first handsaw, in large part because you can get a decent one at the home center. This Japanese saw cuts on the pull stroke, and the one in our kit has a back that stops short of the end of the sawplate, as you can see in the picture on the previous page. That's important, because the 2"-deep shoulder cuts can't be made if you don't have 2" of sawplate under the back – and this saw doesn't. So as I finish each long cut, I nibble away my cutline with the toe of the blade.

To make these cuts, pinch across the work with your off-hand using the pads of your fingers to align the sawplate with your cutline. With your index finger extended toward the end of the saw, grasp the handle just enough to keep it from flying out of your grasp.

To start the cut, "hover" just barely on the work and pull the saw toward you. Align your body so that you can pull the saw straight back (and push it forward) using your shoulder to supply a locomotive-like motion. Saw straight down to your baseline, then make the shorter cut – and on to the next one.

After all your notches are cut, dry-fit the pieces to ensure that you've sawn the mating surfaces on each one flat and straight. If necessary clean up your cuts with a sharp chisel.

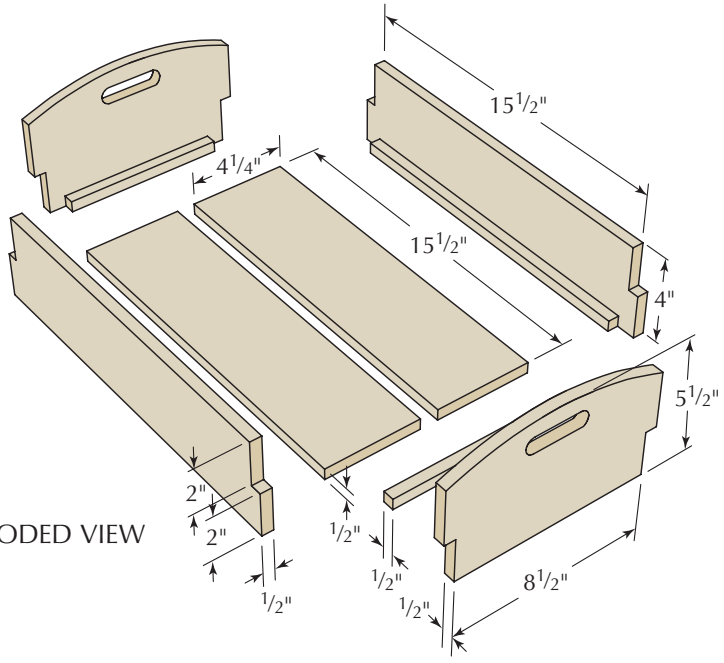
Once your joints are fit, lay out the curve across the top and the handle holes on the two end pieces. Cut the top curves with a jigsaw. Then drill a hole inside the handle waste on each end piece, into which you can insert your jigsaw blade, then cut those, too. If clean-up is required, use a rasp, file and/or sandpaper.

Trim for precision. *Hold your chisel at 90° to the work and gently pare toward the shoulder to create a flat mating surface for your joint. If you need to pare the end-grain surface, take lighter cuts – and use a sharp chisel.*

Hammer Time

It's almost time to nail everything together. But first, cut cleats to fit inside the joined pieces, and glue and clamp them in place aligned with the bottom edge of both sides and the front and back. The notches make it easy to properly align the workpieces while you clamp them square. Drill two pilot holes through the long grain and into the end grain of each joint, then sink 5*d* finish nails to secure it together. Rip your bottom boards and cut them to length then drop them in place. A coat or two of clear Watco, and you're done. **PWM**

Megan is the managing editor of this magazine. She can be reached at megan.fitzpatrick@fwmedia.com.



EXPLODED VIEW

Shaker Carry Box

NO.	ITEM	DIMENSIONS (INCHES) T	W	L	MATERIAL	COMMENTS
❑ 2	Ends	1/2	5 1/2	9 1/2	Pine	
❑ 2	Front/back	1/2	4	16 1/2	Pine	
❑ 2	Bottom boards	1/2	4 1/4	15 1/2	Pine	
❑ 4	Cleats	1/2	1/2		Pine	Cut to fit

ONLINE EXTRAS

For links to all online extras, go to:

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PLAN: *Download the two free SketchUp models for the "Shaker Carry Box."*

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About This Column

Our I Can Do That column features projects that can be completed by any woodworker with a modest (but decent) kit of tools in less than two days of shop time, using materials from any home center. Our free PDF manual explains how to use all the tools in the kit. Visit PopularWoodworking.com/ICanDoThat to download the free manual.

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SAVE $45

CENTRAL MACHINERY

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SAW BLADE INCLUDED

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A Chest for Every Woodworker

Design your tool storage from the inside out.

I currently store my woodworking tools in a traditional cabinetmaker's/joiner's tool chest. In building that chest, I leaned heavily on surviving period chests as well as images dating from the period. Over the years I've been an advocate for these sorts of chests. But I'm not convinced of their popularity with modern woodworkers.

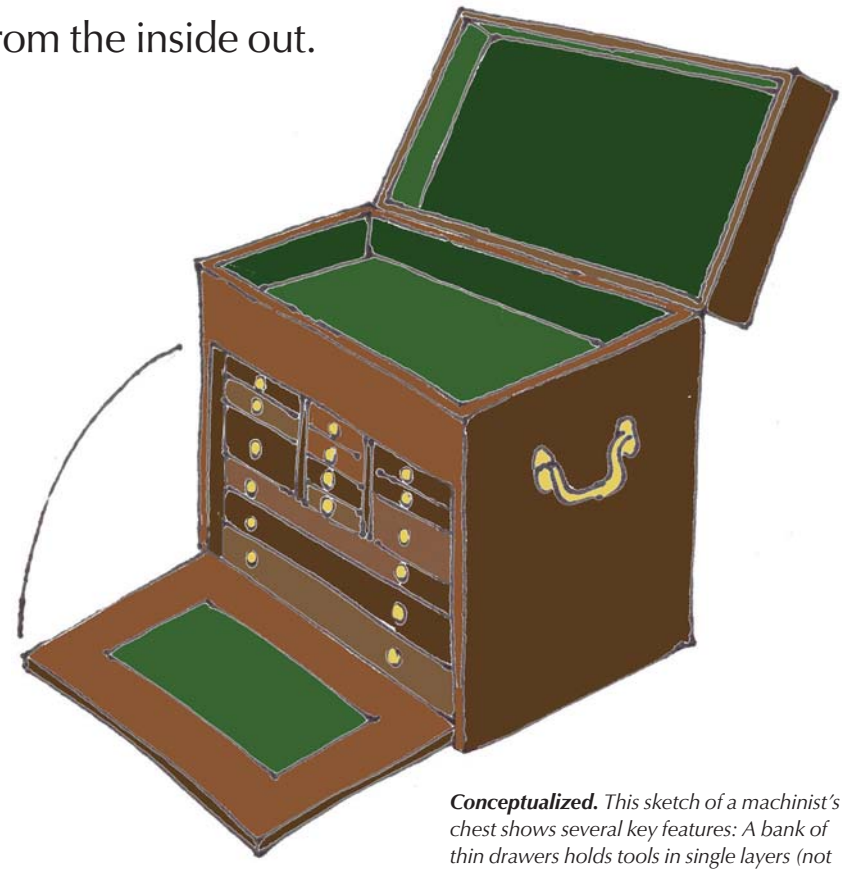
This year at the "Woodworking in the 18th Century" conference in Colonial Williamsburg, North Bennet Street School (NBSS) instructor Dan Faia showed images of chests made by the school's cabinetmaking students. NBSS focuses on traditional cabinetry and many students and graduates build reproduction furniture. So I was a bit surprised to see no chests resembling mine. The students' chests were more similar to Gerstner's machinist's chests than to 18th- or 19th-century-style cabinetmakers' chests. I pondered how such chests could hold any cabinetmaker's tools. Where would one store a half set of hollows and rounds? A ripsaw? A try plane? What are these students being taught?

It took me a minute to arrive at an answer: Most woodworkers don't have or use any of the tools I consider absolute necessities. These boxes probably held some tools familiar to me (such as chisels and dovetail saws), but they likely also contained hex keys, screwdrivers, dial indicators, combination squares, rulers and other things either I don't use or don't associate with woodworking.

What really attracted me to the NBSS chests was how unique each was. Sure, they are all based on machinist's chests, but each student arranged and sized the drawers to fit his or her own sensibilities.

Aesthetically, each chest was unique as well. Students experimented with veneers or different species of solid wood. As Dan explained it, the goal was to encourage each student to find his or her own way and style.

When I got home I looked afresh at my cluttered shop. My traditional tool chest does a great job of holding my cabinetmaker's tools, but what about everything else? A five-minute trip to Chris Vesper's booth at Woodworking in America 2011 left me with a sampling of his very fine layout tools. Since then I've collected a few other bits and pieces I felt necessary for toolmaking. These really deserve better storage than the cardboard and plastic storage boxes in which they currently reside. So I decided to build my own version of a mechanic's or machinist's chest. In keeping with the NBSS students' chests, I wanted my chest to serve my needs and reflect my sensibilities.



Conceptualized. *This sketch of a machinist's chest shows several key features: A bank of thin drawers holds tools in single layers (not in piles); the top lifts to reveal a large well; a flap resembling a writing slope slides under the bottom drawer, and can be pulled out for use (as shown) or folded up to conceal the felt-lined drawers.*

Design Survey

Just as I did on my cabinetmaker's chest, I began this project with a survey of existing chests. The standard machinist's chest has a few features I wanted to reproduce. These chests are characterized by a bank of small drawers. The uppers often flank a central door or drawer. In some chests this held a copy of "Machinery's Handbook," an invaluable reference for machinists. Another useful feature is the hideaway front panel that covers the drawers. The front piece is also lockable, providing after-hours security at the factory. The top typically hinges to reveal a well for bulky items.

CONTINUED ON PAGE 66

ILLUSTRATIONS BY THE AUTHOR

CONTINUED FROM PAGE 64

Aesthetically, most machinists' chests have features that suggest steamer trunks. They traditionally incorporate three-sided metal corners and have foot-locker style hasps, and many have leather handles on the lid. Perhaps these features recall a time when these chests were significantly smaller and realistically transportable.

I'm sure that once upon a time, machinist's chests were probably beautifully dovetailed cases with dovetailed drawers. I've not seen one, but I wouldn't be surprised if someone reading this has one. The early chests I've seen were all factory-made finger-jointed cases with machine cut dovetailed drawers. Modern chests primarily use tongue-and-groove joinery.

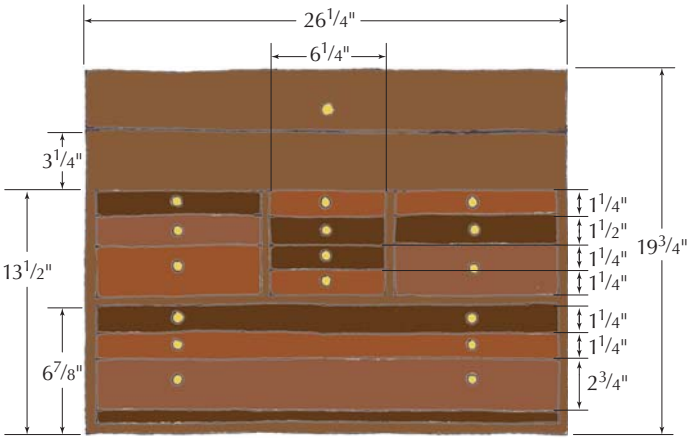
The chests I saw in many ways resembled 17th-century-style cases. I saw fastened cases, cross-grain joints and side-hung drawers. To some extent, being true to these chests means acknowledging their early roots and modern incarnations. I don't plan to copy factory joinery, but I won't use dovetails for everything either. As I see it, this is yet one more example of "boarded" joinery.

Sizing Your Chest

I'm an advocate of designing from the inside out. I arranged the tools I wanted to store in each drawer, then measured them to determine the size and depth I needed the drawers to be. I also photographed each drawer layout. With that done, I attempted to squeeze the desired drawers into a reasonably sized case. I held the width of the chest to 26 1/4" because there are steel-base cabinets (Kennedy, Craftsman etc.) available that I may some day wish to use as a base. The depth of the case was driven by a combination of the drawer volume and stock I had on hand.

The drawers on these chests are often not graduated as they would likely be on a piece of furniture.

Before you get cracking on this project, there are a few more details I'd like to share. It's best to have all the hardware on hand before you start construction (I'll write about the hardware I chose in my next column). Second, before you assemble the carcase, I recommend having all the drawer runners accurately installed. More information is coming on the drawers and drawer integration, but here's a spoiler: I used 1/2" x 1/4" ultra-high-molecular-weight (UHMW) plastic strips (the same stuff folks use to make table saw fences slippery) as drawer runners. I was nervous about how I would cut and work with this material. Turns out you can hand-plane it.

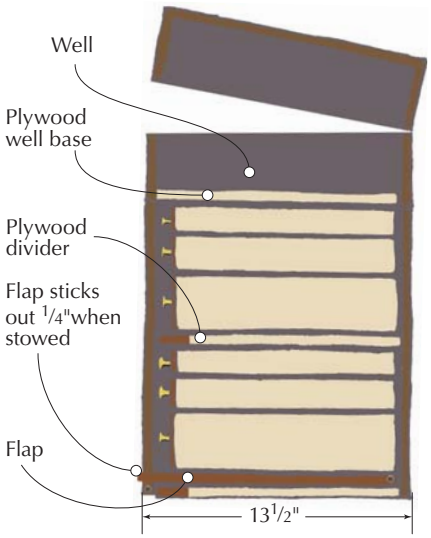


No graduation. *The drawers on these chests are very often not graduated as they might be on a fine piece of furniture. This plan assumes all stock to be 1/2" thick. Assume 1/8" gaps around the drawers and the flap.*

Conclusion

I see this project as a nod of respect to the vast majority of woodworkers who work with a mixture of hand and power tools. In the process, I recognize how limited my usefulness is to you. I hope you can laugh along with me as I apply 18th-century-style tools and techniques to modern work. In my next column, I'll be making brass hardware with simple hand tools and I'll saw plywood with handsaws. Of course we shouldn't lose sight of the point here: Everything we do as woodworkers presents us with the opportunity to grow, improve our skills and express our design sensibilities. **PWM**

Visit Adam's blog at artsandmysteries.com for more discussion of traditional tools and techniques.



Front flap. *The flap dimensions are 13 1/4" high (1/8" gaps top and bottom) and a hair under 25 1/2" wide. When stowed, the flap bumps against the backer boards and protrudes 1/4" at the front, which allows you to grab it from the sides to pull it out. The flap covers the drawers, which must be sized with hardware in mind. Ensure there is a gap between the center divider and the flap when closed. Also, the dado in which the flap runs should leave an 1/8" gap under the flap so you don't scratch it every time you pull it out.*

ONLINE EXTRAS

For links to all online extras, go to:

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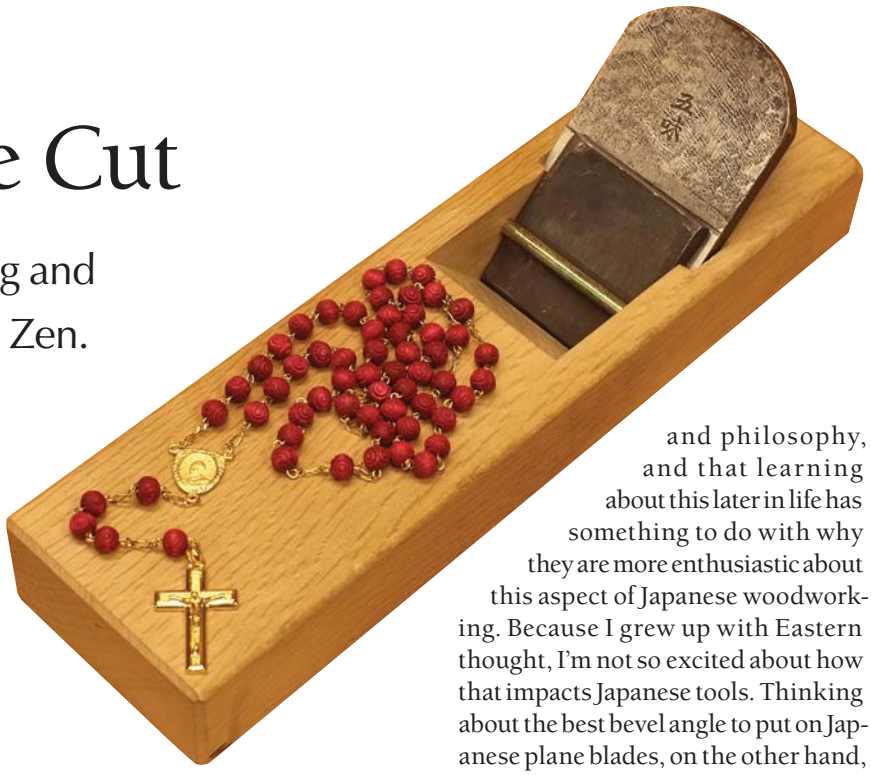
It Comes Down to the Cut

Thoughts on woodworking and the art of growing up with Zen.



Because I'm of Chinese descent, it's probably not a surprise that I found myself drawn to Japanese tools when I started woodworking, and that I wanted to learn how they worked and how they were used. At first this was frustrating. Part of the issue was that I don't speak or read Japanese at all. But a bigger hurdle for me was that many of the sources I found spent a lot of time talking about the Zen of using Japanese tools, and there was much talk about how this method of woodworking was shrouded by Eastern mysticism and philosophy.

I found it curious that there was so much talk about Zen and Japanese woodworking. After all, articles about 18th-century woodworking seem to avoid (for the most part) discussing Voltaire, Locke and Goethe. The thing is, despite the obvious interest of others in the Asian worldview and how it impacted the use of these tools, I wasn't interested in that aspect of Japanese woodworking at all. I just wanted to learn how Japanese tools worked, and my feeling was that despite the obvious differences between Japanese and Western woodworking tools, at the end of the day it all came down to sharp pieces of steel cutting through wood – and that was the level of understanding that I was trying to get to.

Although I'm a long way away from knowing all there is to know about Japanese tools, I think I now have a better understanding of why Eastern philosophy keeps coming up for discussion where Japanese woodworking is concerned, and my own family gave me insight into this. My wife is Catholic, went to Catholic school all the way through high school and was often called to read at Mass when she was growing up. I, on the other hand, am not. My religious upbringing consisted of hearing my parents talk about Confucian and Buddhist principles, and watching two local Sunday morning TV shows when I was a kid – one that showed the music of Baptist choirs from Chicago's South Side, and another show for Jewish kids that featured stories from the Torah.

When I attended Mass with my wife for the first time, I found it completely fascinating. I wanted to know about every aspect of the liturgy. The symbolism behind receiving Communion was something I thought about a lot. My wife, on the other hand, doesn't have the same degree of fascination, because she grew up with it. I think she finds it amusing that at times I'm the one who's more insistent that our kids perform the sign of the cross properly.

I'm sure that most of the woodworkers in the U.S. who use Japanese tools didn't grow up with Eastern religion and philosophy, and that learning about this later in life has something to do with why they are more enthusiastic about this aspect of Japanese woodworking. Because I grew up with Eastern thought, I'm not so excited about how that impacts Japanese tools. Thinking about the best bevel angle to put on Japanese plane blades, on the other hand, just rocks my world. I'm not immune to this type of enthusiasm, either. I know I am more enthusiastic about woodworking and hand tools than fellow woodworkers who grew up building things.

It's easy to focus on the differences between what Western and Japanese woodworkers do, just like it's easy to see the differences between Federal and Arts & Crafts furniture. But in this woodworking thing of ours, it's good to take a step back and look for common ground. I know I've learned a lot about how Japanese planes work from listening to Frank Klausz talk about Western planes, and overall, I've learned a lot more about woodworking by taking that approach. Because it really does come down to sharp pieces of steel cutting through wood. PWM

Wilbur lives in New Jersey and writes about woodworking on his blog at giantcypress.net.

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BLOG: *Visit Wilbur Pan's blog for more thoughts on Japanese tools.*

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