Avoid 'Orange Peel' in Your Finish

Bad Axe D-8 Handsaws

POPULAR WOODWORKING MAGAZINE

February 2018 ■ #237

Mix Leather & Wood for a Folding Stool

page 24

Cut Arches Of Any Size

A Router & 'Spoil Board' Make Quick Work of Curves

page 33

17th-Century Desk Box

Peg Your Work for Projects that Last page 40

Multi-Use Shop Supports

Learn 3 Solid Joints in This Handy Build page 48

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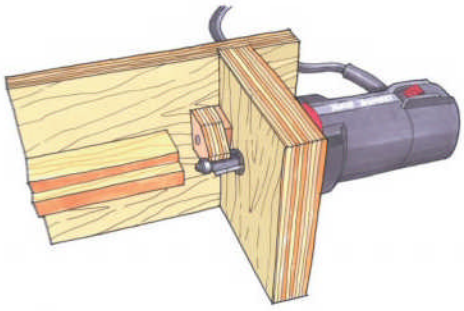
CONTENTS

FEATURES

BEAUMONT PHOTO BY ASA CHRISTIANA; ROUTER ARCH PHOTO BY GREGG HOMSTAD; DESK BOX & STOOL PHOTOS BY AL PARRISH

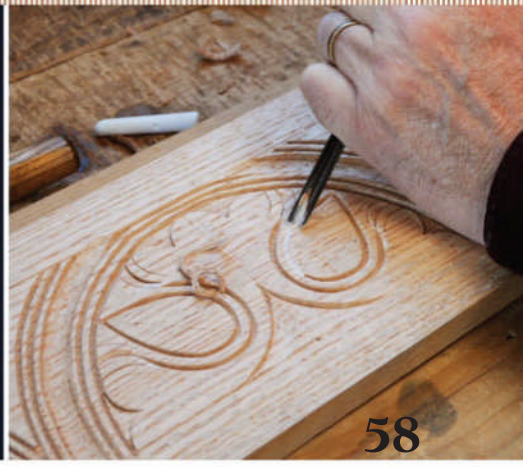
CONTENTS

FEBRUARY 2018



12

18



58

REGULARS

14

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Woodworking Idioms

I'm not generally a superstitious person, but whenever I say something that I hope will come to fruition (e.g. "I hope we get 30,000 more subscribers in 2018" or "One day, my home renovations will be complete"), I knock on the closest thing made of wood (or on my head, if there's no actual wood in sight). The action is an apotropaic vestige of Druidism and other tree-worshipping religions – supposedly, one laid one's hands on a tree when praying to the gods. Here, we "knock on wood"; in Great Britain, I've most often heard it as "touch wood."

"Fade into the woodwork" and "Crawl out of the woodwork" sound like two sides of the same baseboard. In the former, the woodwork must not be very noticeable. The latter implies there are many holes and crevices in which wee beasties can burrow. In both cases, the woodwork seems an excellent place to hide.

In Shakepeare's "Hamlet," we find "I am but mad north-north-west: when the wind is southerly I know a hawk from a handsaw" (Act 2, Scene 2). So, former literature student that I am, I sometimes say "I can tell a hawk from a handsaw" to mean "Nope, I'm not crazy." There are two problems, though: 1. It causes some people to look at me as if I'm crazier than they initially thought, and 2. That phrase has been explicated to mean that Hamlet is saying he can distinguish between a plasterer's square platform for mortar and a carpenter's tool for cutting stuff, but it's more likely a corruption of "hawk from a heronshaw" or "henshaw," meaning he can tell the difference between two species of birds. In which case, it's not woodworking related. And I, for one, cannot identify a heronshaw.

Then there's "veneer of respectability" – I hope I have at least that, and preferably shop-made (it's thicker).

The above got me asking my coworkers about other idioms and aphorisms that seemingly have their roots in wood and woodworking, but have made their way into everyday language (some more than others). Here are the ones we were able to unearth from our sawdust-addled pates (and I admit that some are a stretch):

- Whittle away at
- Heart of oak
- Rule of thumb
- Unvarnished truth
- Against the grain
- To dovetail with
- Out of the woods
- Up a tree
- Hard/tough as nails
- Axe to grind
- Out of one's tree
- Deadwood
- Measure up
- Fair and square
- Hit the nail on the head
- Can't see the forest for the trees
- Barking up the wrong tree (OK – that one has more to do with dogs)
- Take someone down a peg
- Nailed it!
- Little strokes fell great oaks
- Not the sharpest tool in the shed
- Dumb as a post
- Dumb as a box of hammers
- Sharp as a tack
- Straight as a rail
- Final nail in the coffin
- Mad enough to spit nails.

And let us not forget "to go out on a limb" – from which the name of this column is derived. **PWM**

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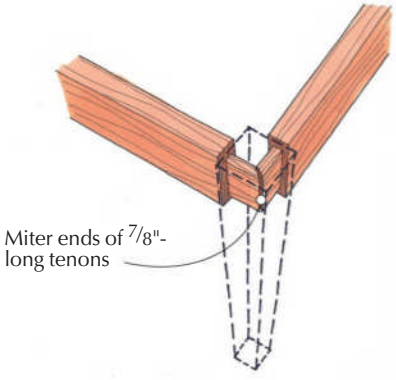
Mortises That Meet



The drawings for David Thiel's Prairie Spindle Chair (page 158, "Arts & Crafts Furniture Projects," second edition) do not indicate the placement of mortises on the legs. It appears they are centered. If they are 7/8" deep (and the tenons 7/8" long) as mentioned in the text, however, the mortises from one side break through the mortises on the adjoining side on the back legs.

Are the mortises supposed to be 3/4" deep, rather than 7/8"?

Alton Jelks,
via email

Alton,
The mortises on the legs should indeed be centered. And yes, at 7/8" long, both the mortises and the tenons intersect. So, I cut miters on the ends of the tenons so they meet at the inside corner.

It's your call if you'd prefer to size the mortises and tenons at 3/4" to avoid this (though the 7/8" size results in a stronger joint), but I find it easier to clean out the mortises with the intersection, because I can push waste through the mating hole.

David Thiel,
online content developer

Underhill Spring Pole Lathe

I am interested in building Roy Underhill's "Double Spring Pole Lathe" from the August 2016 issue (#226).

A difficulty we have in northern Alberta is sourcing Southern yellow pine, which I suspect Underhill used for his build. Construction lumber alternatives here are usually spruce or lodgepole pine. Neither of these are, in my opinion, stable enough for this project. Once they are brought indoors, they almost immediately resemble boomerangs or corkscrews (some exaggeration).

A reasonably priced alternative (although far more expensive than construction lumber) available in my area is yellow poplar. My concern is whether or not its relative softness would stand up to the rigors of being used for this lathe.

Jamie White,
Alberta, Canada

Jamie,
The yellow, or tulip, poplar would indeed be strong enough for the lathe, but, as you say, a lot more expensive. My first treadle lathe was made entirely of Douglas fir and has held up admirably after 40 years of treadle turning.

My only experience with lodgepole pine is in using it for actual lodge poles when we lived in a tepee in the Colorado Rockies, and I do recall it tended to have spiral grain.

Perhaps, however, if you were to carefully pick through a pile of pine or spruce 2x12s, you might find straight-grained timber that you could saw into the narrower stock for the lathe. You only need one good one!

Roy Underhill, contributor

Why Tapered Blades for the Voigt Coffin Smoother?

The November 2017 issue (#235) has an excellent, detailed article on how to build a traditional wooden smoothing plane, in which the author, Steve Voigt, is specific about using a tapered (wedged) blade.

I've built a lot of Krenov-style planes with blades from Hock Tools, which are parallel. They work beautifully. So why the tapered blade here? Is it really necessary?

Aram Schiffman,
Eugene, Oregon

Aram,
A tapered iron is nice, but it is not a deal breaker. If you have a suitable parallel iron, it will work. In the article, I specified a tapered iron because I was talking about finding and using a vintage double iron (a cutting iron and chipbreaker), and nearly all old double irons designed for wooden planes have tapered irons. Parallel irons were made in the 18th and 19th centuries, but they are rare.

More important than the taper is that the blade should have some length (around 7" is good), and the chipbreaker should be the old style, with a curved, claw-like bevel at the tip, and a substantial (1/32" to 1/16") gap just above the curved bevel, as in shown in the photo at the top of page 48.

The chipbreaker itself supplies about half a degree of taper, so if you have the right kind of chipbreaker, the tapered iron is less important than it would be in a single-iron plane.

A few people have mentioned to me that a tapered iron resists pull out and slippage, which is true. Another benefit is that a tapered iron seems to adjust more smoothly.

Steve Voigt, contributor

CONTINUED ON PAGE 10

ILLUSTRATION BY MARTHA GARSTANG HILL

CONTINUED FROM PAGE 8

Research Everything

As another literature major turned woodworker, I read Megan Fitzpatrick's November 2017 "Out on a Limb" editorial (issue #235) with sympathetic eyes. Along the way, I spent some years working as an insurance claims professional. I saw plenty of egregious lawsuits in those days, but the "hot coffee" case noted was not one of them.

The plaintiff in that suit was served near-boiling coffee, which, when the flimsy cup fell apart, caused second-degree burns. Her recovery required multiple skin graft surgeries and cost thousands of dollars. Initially, she only sought help from McDonald's for her medical bills, but her request was rebuffed.

Sure, the jury's award was over the top, but they were looking to send a message.

Not everyone knows the details of this case, but I found it ironic that the facts in your article weren't researched before you chided newcomers "unfamiliar with lumber…who can't be bothered to learn."

Steve Seebart,
via email

Steve,

Mea culpa. I went for the cheap laugh rather than checking out the facts on the coffee case. No doubt there are plenty of more appropriate and relevant references I could (and should) have made.

Megan Fitzpatrick, editor

Loose Router Collet Fix

In the November 2017 issue Letters column, a reader asked how to prevent his router bit slipping in the collet and ruining his project. The answer Christopher Schwarz gave was good, but it did not go far enough.

Years ago I was using my dovetail jig and the router bit kept creeping out. I tightened the collet clamping nut a couple of times to an excessive point, but it happened again. After thinking about it for a minute, I came up with a possible cause, and a solution.

What is happening is that the metal collet is not going into the taper of the router spindle all the way, in order to fully clamp the router bit. The reason is that the two metal surfaces (the outside of the collet and the spindle taper) are dry. So I wiped a small amount of lightweight grease in the spindle taper of the router. Now, when the nut is tightened, it lets the collet fully compress and therefore clamp on the router bit.

I have never had the problem since – and neither have my woodworking club members, with whom I shared my experience.

Dan Martin,
Galena, Ohio

Tool & Toy Chest Lid

Regarding the toy chest pictured in the Letters column in the November 2017 issue (#235): Instead of using a chain on the lid to keep it from opening too far, install a safety lid closure. Too many young fingers have been squashed already by not using those devices.

Keith Whitmore,
via email

Keith,

I should have recalled that we had several people mention the same when that article was published (February 2007, issue #160), and tailored my response accordingly. A soft-close safety hinge would indeed be appropriate, particularly for a toy box. **PWM**

Megan Fitzpatrick, editor

ONLINE EXTRAS

Letters & Comments

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PHOTO BY BRENDAN GAFFNEY

Highly Recommended

We were introduced to Veritas Pencils by Larry Barrett during a greenwood chairmaking class Brendan Gaffney and I took in October 2017 (Barrett called them "ink pencils"). They mark a distinct, easy-to-see line on wet wood without applying much pressure; they are a godsend for marking out green stock.

The pencils are available in packages of 10 in both red and purple (the purple reads as black on wet red oak) for $11.90, and are made in the U.S. I put in an order almost immediately.

— Megan Fitzpatrick

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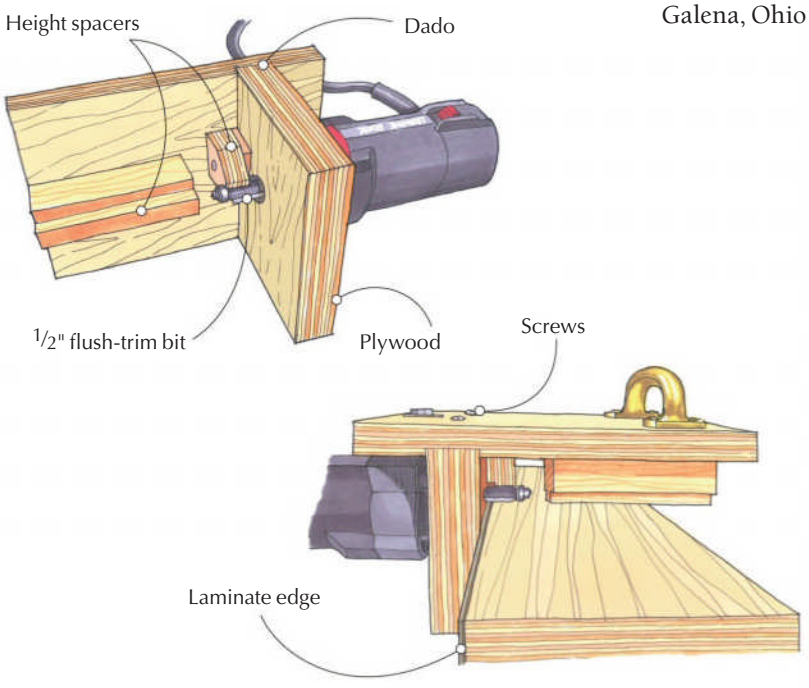
I made this fixture from two pieces of plywood dadoed and screwed together for strength. It makes the job of holding the router at the correct angle for trimming laminate a lot easier and negates the usual balancing act.

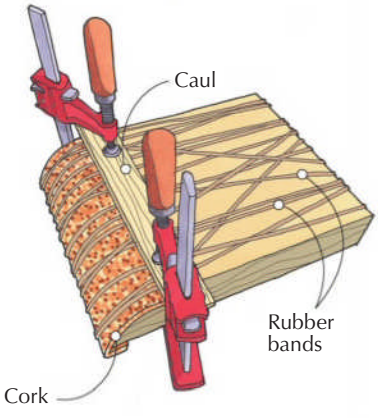
Dan Martin,
Galena, Ohio



Use Rubber Bands for Clamping More Than Veneer

I was looking for a way to secure cork on a curved vise chop while the glue dried. Then I remembered the venerable rubber band method for clamping veneer. So, I used a bunch of rubber bands over the bend, and added a caul to the flat area of the chop. The rubber bands worked on the thin, flexible cork just as well as they do for veneer.

Derek Olson,
LaCrosse, Wisconsin

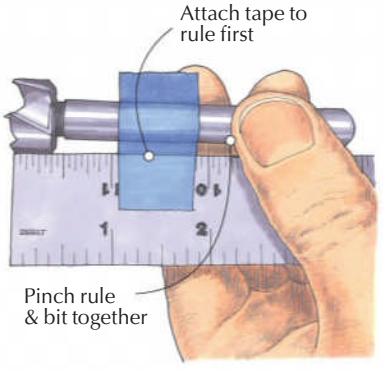


Place Tape Perfectly

When applying tape to a drill bit to act as a "depth suggester," it can be tricky to get the tape exactly where you want it while holding the bit, the tape and a rule. The solution is to apply the tape to the rule exactly at the depth you desire. Then pinch the rule and the bit with one hand and wrap the tape around the shank with the other.

This trick allows you to apply tape with great precision (here I am putting it at 1 1/16") and it helps keep the tape square as you wrap it around as well.

Christopher Schwarz,
Covington, Kentucky



Raise a Spindle Sander Table

I recently had a project that required a slight modification to my oscillating spindle sander. The spindle was too long to work in the area I needed it to reach, so I raised the table with an auxiliary table in order to shorten the spindle. I also made sure to maintain dust collection by enclosing the area that covers the existing hole and using the table inserts. The auxiliary table is held in place with a couple of clamps.

The top is 3/4" plywood, cut to match the size of my sander's top. I ripped the cross pieces to a width that gave me 1 1/2" of exposed spindle while at the top of the stroke, and attached them with glue and countersunk screws from the top. The feet are attached with glue and countersunk screws up from the bottom into the cross pieces. I positioned

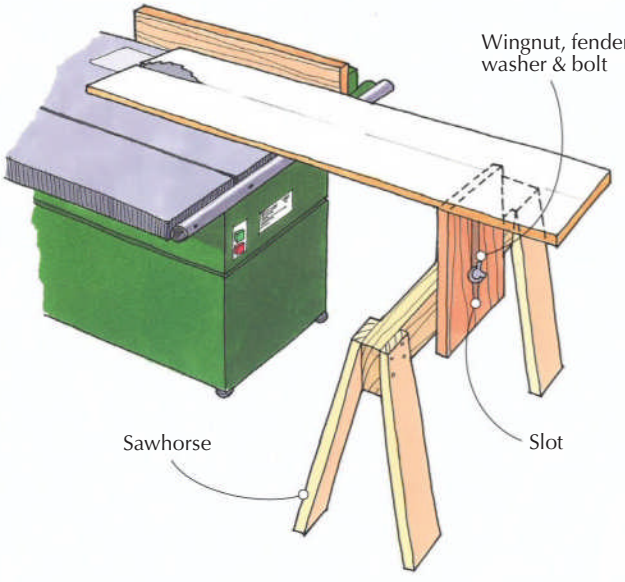
ILLUSTRATIONS BY MARTHA GARSTANG HILL

Make a Quick Infeed Table

I needed to cut long boards on the table saw, but had only a small table for the outfeed and none for the infeed. So I built this handy infeed table using scrap plywood and a sawhorse, both of which I already had on hand.

I drilled a hole in the center of the sawhorse crossbar and cut a slot in the plywood. The ply is fastened to the horse with a carriage bolt, fender washer and wingnut. Voilà – adjustable infeed support. And it's easy to take to plywood off to put the horse back in use for its original purpose.

Paul Donohue,
Denver, Colorado



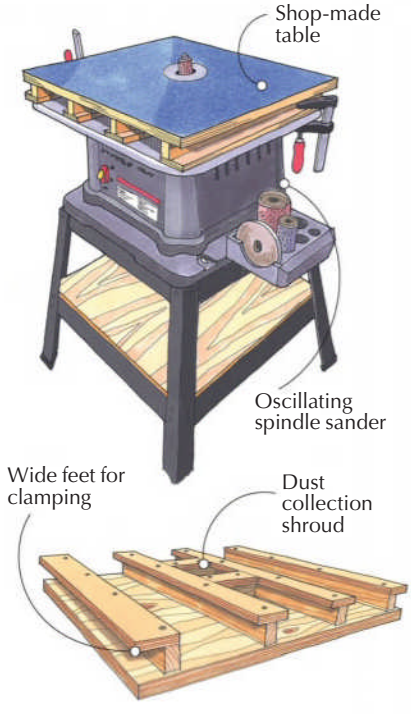
the feet and cross pieces to give me a larger clamping surface to attach the table to the existing top.

I used a hole saw at the drill press to cut the hole in the center to match the existing hole, then screwed and glued on more cross pieces around it to enclose the dust collection area.

I then filled the top as needed with spackling (I used some pretty rough plywood) and sanded it smooth.

I cut some laminate to size and attached it with contact cement, then drilled the hole in the center and used a flush-trim bit in my router to clean up all the edges. Then I switched to a rabbeting bit to cut a shallow recess for the inserts. **PWM**

Dave Howerton,
Post Falls, Idaho



You Probably Have Stain Blocker Already at Hand

I had to strip some woodwork in my house before repainting it. The paint I chose combined primer and pigment, so I didn't pick up a gallon of Kilz or other stain-blocking primer.

But after two coats of paint, I was still getting bleed-through. So, I grabbed some shellac I'd mixed up a couple months back, and brushed it on. Just minutes later, it was dry, so I applied another coat of paint. It worked like a charm – and at no additional cost.

Megan Fitzpatrick,
Cincinnati, Ohio

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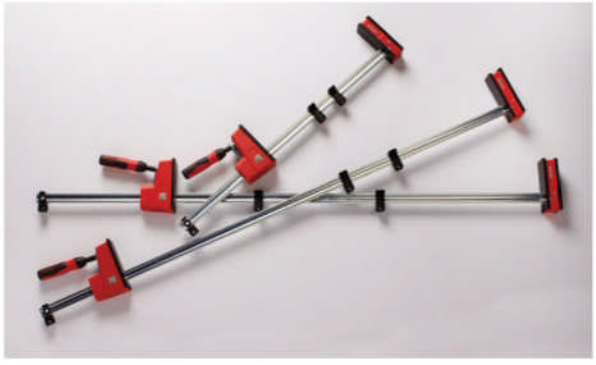
Each issue we publish woodworking tips from our readers. Next issue's winner receives a $250 gift certificate from Lee Valley Tools, good for any item in the catalog or on the website (leevalley.com). (The tools pictured below are for illustration only and are not part of the prize.)

Runners-up each receive a check for $50 to $100. When submitting a trick, include your mailing address and phone number. All accepted entries become the property of *Popular Woodworking Magazine*. Send your trick by email to popwoodtricks@fwmedia.com, or mail it to Tricks of the Trade, *Popular Woodworking Magazine*, 8469 Blue Ash Road, Suite 100, Cincinnati, OH 45236.

Next-generation Bessey REVO Clamps

We love the original wooden-handled Bessey K Body clamps. But they became unavailable in 2008 when Bessey released the Revo clamps, which had a larger clamping surface (of about 30 percent) than the K Bodies and a soft-grip handle that allowed for easier and more comfortable tightening – but we found the clamps often slipped under heavy pressure, particularly if the bars got wet (say, when you're cleaning up glue). Plus, the plastic on the clamp heads broke easily when dropped.



Bessey is about to release the next generation of Revos (they'll be available in the first quarter of 2018), so we got a handful of them in for testing, and I talked with Karl Kish in Bessey's product development group about the changes.

The company got complaints, he said, that the moveable head slipped too easily when not under pressure, and could slide back on the bar to smack the hand of the person holding it. Bessey improved that slippage issue by adding more play in how you disengage the head from the rail – you have to lift it higher to loosen it. Well, that seems to have also taken care of the slippage issue when the clamps are under heavy pressure, even after a misting of water. No slippage.

Plus, the plastic has changed. I dropped a clamp from chest height and it bounced, but didn't crack.

The new clamps will be available in 12"-98" lengths, can be used for spreading by toolless reversal of the head, have a throat depth of 3½", a clamping force of 1,700 pounds and a load limit of 2,200 pounds – far more than is necessary in most situations. — *Megan Fitzpatrick*

Bessey Revo Clamp

Bessey ▪ besseytools.com or 519-621-7240

Street price ▪ To come

▪ READ *Learn about clamps of all sorts at popularwoodworking.com.*

Prices not available at time of publication.

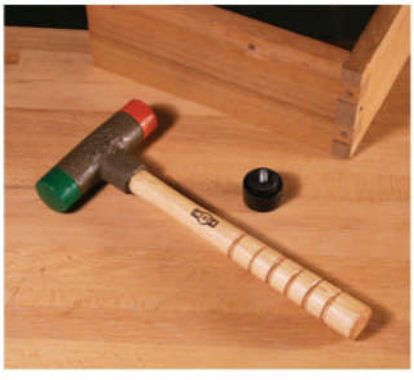
Lixie Dead Blow Mallet

Well-fit joinery (not too loose, not too tight) and well-planned glue-ups rarely need much persuasion – but I am not always lucky enough to find myself with either of those. In the past, I've used big rubber mallets, small sledges and framing hammers (with a block of wood, of course) to bring home tight joints or break apart a glue joint.

During a recent glue-up, I slipped and ended up with a hammerhead-shaped ding in a workpiece from a glue-up gone wrong. I've seen a number of recommended rubber and dead-blow mallets, but I remembered one we had at College of the Redwoods (now the Krenov School) – the Lixie Dead Blow Mallet. This messy glue-up was what I needed to finally get around to ordering one.

Lixie makes a wide range of mallets, from a small 10 ounce to a massive 110 ounce "Mjölnir" of sorts. I went with a comfortable size, a 30-ounce mallet with 1½"-diameter heads. I've found find this to be a comfortable weight for general furniture assembly.

What I like most about the Lixie mallets is the various types of replaceable heads. The standard mallet ships with black (hard) and green (medium) heads, but I ordered the orange-red (soft) head as well (for an additional $10.95). The orange head can be swung with serious force without leaving a trace of the blow (even in pine) – no more wooden block to miss when swinging the mallet. All of the heads are very durable, as well.



The grooved hickory handle is novel and the grooves help with the grip, but I felt I still needed to rough up the slick finish a bit with some coarse sandpaper to get a really solid grip on it.

The hammers are made in the U.S., and the steel shot in the head means there is little to no rebound, even when swinging for the fences. I'll show those cranky joints who's boss, now!

— *Brendan Gaffney*

CONTINUED ON PAGE 16

Lixie Dead Blow Mallet

Lixie ▪ lixiehammers.com

Street price ▪ $54.95

▪ VIDEO *Watch a short video where we test the different heads on various woods.*

Prices correct at time of publication.

PHOTOS BY AL PARRISH

CONTINUED FROM PAGE 14

Bad Axe Tool Works D-8 Handsaws

Making a good handsaw is difficult; making great handsaws at a production level seems darned near impossible. The new D-8 handsaws (based on the Disston D8 and Simonds No. 72) from Bad Axe Tool Works somehow invoke all of the best things about the golden age of sawmaking in America while setting a new benchmark for quality.

Bad Axe offers the D-8 in 24" and 26" plate sizes in dedicated rip or crosscut configurations, and I had the pleasure of testing a 26" ripsaw (5.5 ppi) and a 24" crosscut saw (9 ppi). I put them straight to work breaking down 50' of 6/4 Southern yellow pine and the ripsaw powered through 10'-long cuts with ease while the crosscut performed with precision and speed. Both tracked impeccably in both hard and softwoods.

These saws are taper ground, which means there is less metal in the plate toward the spine; this keeps the saw from binding in the cut. Heat introduced to metal during taper grinding can lead to a floppy saw plate, but thanks to a proprietary wet-grinding process, the Bad Axe saw plates feel as substantial and well-tensioned as my favorite vintage Disstons.

Starting at $375 each ($435 to $445 as shown), there are plenty of options to customize handles and hardware for an additional cost.

Let's face it, at these prices, these saws aren't for everyone. Unless you're a committed hand tool user the cost may feel prohibitive. On the other hand they're a bargain compared to a quality table saw, and with a little care you'll be able to pass them down to your grandchildren. These saws are an investment, but for a hand-tool centered shop, they're a good one.

— James McConnell

Bad Axe D-8 Handsaws

Bad Axe ▪ badaxetoolworks.com or 888-489-9665

Street price ▪ from $375

▪ READ *Discover some old-school tricks for handsaw use.*

Prices correct at time of publication.

Texas Heritage Woodworks Saddle Bag

I'm a fan of having my tools out and at hand in the workshop. It's easy enough to mount the saws to the wall, whip up a chisel rack and tuck the planes on a shelf, but the small items rarely have a good spot to sit – so they end up on every horizontal surface, in the way and subject to being knocked around or, even worse, onto the floor.

When Jason Thigpen over at Texas Heritage Woodworks was building his Dutch tool chest, he was looking for a good way to solve the same problem. With his skill on the sewing machine and savvy in creating tool storage solutions, he came up with the Saddle Bag, a small footprint tool organizer that's at home in a tool chest, on the wall or even attached to the side of the bench.

With 12 pockets of various sizes (from 1"-3" in width and 3"-4" in depth, including two pass-through pockets for longer tools such as combination squares) it easily handles miscellaneous items such as pencils, rulers, screwdrivers and squares, with plenty of room for tools that I use less often, including nail sets and countersinks. The leather-reinforced eyelets along the top of the Saddle Bag allow it to be mounted with four #6 screws. The double stitching and hand-peened copper rivets in the 14.7 ounce canvas (available in a range of colors) ensure its longevity.

At $70 it's not an inexpensive item, but the quality of construction and durability make it a lifetime solution to the clutter of small tools. As with any storage solution, you may not find an item for every pocket, or vise-versa, but in my case, I found a home for the dozen or so small items that always bounce around the shop. **PWM**

— Brendan Gaffney

Texas Heritage Saddle Bag

Texas Heritage ▪ txheritage.net

Street price ▪ $70

▪ READ *See what the author keeps in his saddle bag, and how it's hung in the shop.*

Price correct at time of publication.

SAW PHOTO BY THE AUTHOR; SADDLE BAG PHOTO BY AL PARRISH

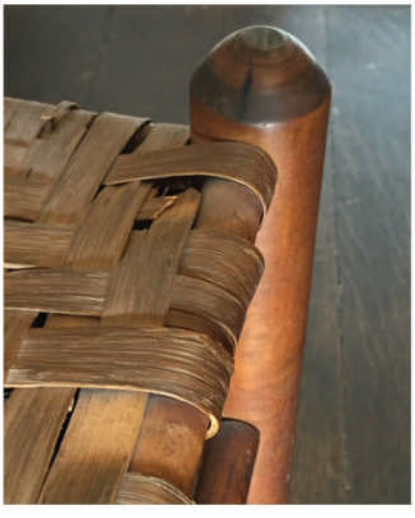
Local Hidden Treasure

You might drive by one every day, tucked away from the main road.

I drove right by it for years, never suspecting there was a time capsule of American furniture right under my nose. The Spring Hill Historic Home is tucked away out of sight up a long tree-lined gravel road in Massillon, Ohio. The original land grant for the property is dated 1813, when this state was a wilderness, but even then it was quickly changing from one big woods to one big farm.

Its green meadows gave way to urban sprawl, and now the rambling farmhouse is an island. One would hardly guess from its plain white exterior that it's chock-full of simple furniture pieces from when the land was opening up for settlement. The families that called it home prospered and, over time, added rooms and a menagerie of furniture, mostly spanning the 19th century, from high-style Regency to Victorian, Arts & Crafts, Eastlake and a handful of mongrels of unknown pedigree. The only common denominator is that much of the furniture is hand-made, and even the later factory-made pieces were from shops that employed skilled furniture makers.

Simple & sweet. *Though plain in style, this walnut country clock's tall case has a glow that needs no gilding or carving.*



A worn warmth. *This stool reflects both the harshness of its environment on the frontier and the comfort it brought its owners.*

Close to Home

As much as I like museums in large cities with collections of iconic furniture from America and around the globe, I have a soft spot for local house museums. There is often an opportunity to see the collection up close and more in depth than in an art gallery setting. Usually the big museums have sensors with alarms to keep you at bay, even if all you are doing is bending down for a closer look with your reading glasses on.

Maybe it's only me, but I find that security guards in the decorative arts sections of large museums are particularly suspicious of woodworkers lingering over a piece of furniture a bit too long.

In contrast, I've learned that if I show a genuine interest in the history of a house museum, I'm often granted permission to look closer, even at the undersides and guts of a furniture piece. Yes, I want to look at the exterior of a table or chest, but as a woodworker, I really want to see the maker's marks. I want to inspect the joinery, see what worked or, often, what joinery didn't work.

I also like house museums because they frequently have examples of early furniture that was crafted locally, meeting a need but also bringing a bit of comfort to the harsh existence on the frontier. There is an honesty in it that I'm drawn to, even if the proportions are a bit off or the joinery is primitive. In fact, it's often that homespun quality that attracts me to it. It may be loosely based on high-style furniture, but it's stripped down and without the refinement that larger urban markets demanded. I have to admit, in a wide-ranging collection like here at Spring Hill, there is quite a bit of furniture in the house I don't care for.

CONTINUED ON PAGE 20

CLOCK PHOTO BY LES TROYER; MUSEUM PHOTOS BY THE AUTHOR

CONTINUED FROM PAGE 18

The little things. *Crown moulding details such as this are just asking to be stolen and re-imagined.*

I've found over the years that as my building and design skills have improved, my opinions about furniture are more pronounced. Furniture that speaks to my taste holds more delight for me, and furniture I dislike seems to grate on me even more. I can also look back and realize that furniture I once swooned over decades ago no longer holds my attention. We furniture makers are a fickle lot. But that doesn't mean that there aren't hidden design lessons, even in the furniture we dislike.

Hidden Lessons

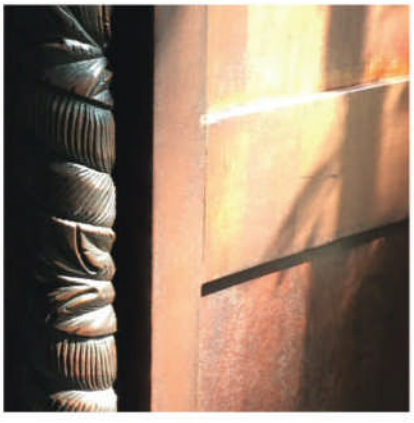
Tossing my opinions aside, I'll share a secret with you if you don't tell anyone you heard it from me. Often the furniture you don't like can be filled with ideas and inspiration – if you slow down and pay attention.

I've always made a practice of listening to people I disagree with. Though it's not always easy, this has served me well – seeing things from another perspective can be eye opening. Also, from a purely human standpoint, it's more difficult to dismiss another person while you are talking over a cup of coffee, looking in the other's eye.

The same goes for furniture. Experience has shown me time and again that gems are hidden away in almost every furniture style, with few exceptions. The key is to resist the urge to dismiss it. Look at the details, examine it closely and try to ignore the surface noise that turns you away. You just might spot that small patch that glimmers. Take time to really look at the curves. Do they flow or flounder? Look closely at the carving and try to imagine whether it adds to the piece or detracts from it. Would it look better if the carving was cut more deeply or could it benefit by toning it back? Did the selection and placement of veneers enhance the piece?

Try to ignore your prejudices and see it for the first time. You may find it's easier to find ideas in a room full of furniture you don't like, rather than that with which you are more familiar.

All show? *Was this turner just trying to show off, or is there something fun underneath these bold shapes?*



Light sensitive. *This carving disappears in shadow but sparkles under a shaft of sunlight.*

Unfamiliar vignettes. *Curves that sing show up in unexpected places, such as in this teapot or other non-furniture forms.*

Vignette

One practice that helps me really see these details is taking snapshots of small details. Instead of trying to capture that broad portrait that includes a room setting, I focus on small cropped details that might show how a carving reflects the sunlight shining in the window. If you focus on the small, you can often see the hand of the builder and notice the tool and wear marks that are part of the story a piece has to tell. Look closely at the textures, especially the wear of furniture left outside where the elements carved their signature.

I find when I get into that up-close mode I even notice some fun design elements in non-furniture items. A graceful curve on some crockery can be exciting and might just be the spark that sets your imagination in a new direction. So just forget that some of this furniture reminds you of your cranky in-laws, and let your eyes look beyond. **PWM**

George is the co-author of three design books and writer of the By Hand & Eye blog (with Jim Tolpin).

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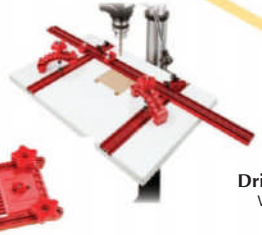

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Folding Stool

BY CHRISTOPHER SCHWARZ WITH DAVID LYELL

For camping, conquering and contemplating, these stools have a long history among artists, soldiers and rugged individualists.

There are few things that British military officers and plein air painters of the 19th century would agree upon. But this stool is at the top of that (quite) short list.

Three-legged folding stools were a popular way to carry a comfortable place to sit during the 1800s and early 1900s, whether you were trying to (unsuccessfully) subdue the Zulu or capture the way the light reflected off the River Thames at sunset. As a result of the stools' light weight and portability, they also became popular among campers, hunters and anyone else who needed to squat comfortably outside.

The key to the design's success is its three legs. Three legs sit on any terrain without wobbling. The stool is folded easily into a small bundle and tucked under your arm or into a rucksack.

Plus, they are remarkably easy to build, no matter the tools you own or

PHOTOS BY THE AUTHOR

> "If they don't give you a seat at the table, bring a folding chair."
>
> —*Shirley Chisolm (1924-2005), American politician & author*

the wood you have on hand. You can make one of these stools using old broom handles, cheap hardware and pieces of your leather jacket from college. Or you can go full "officer" and use fancy woods, fancy harness leather and hardware that is machined like a clock.

Finally, the stools are quick to construct. The stools shown in this article each took about two hours to build, start to finish. You can begin building one after breakfast and sit on the finished stool to eat your lunch. So let's start with the "squeegee stool."

Sorry squeegee. *The handle of this tool was the perfect diameter for a folding stool. So the first order of business was to saw off the squeegee part.*

The Thick Stick

During the last five years I've built a lot of these stools. I began making them, as always, by building copies of historical examples. These, however, presented a problem. They broke under standard North American Buttock Pressure.

After much experimentation, I determined that beefing up the stools' legs to $1\frac{1}{4}$" in diameter made them strong enough for most body types. So when I began to make basic, hardware-store versions of these stools I looked for sticks that were $1\frac{1}{4}$" in diameter.

Most of the broom handles at my hardware store are about $\frac{7}{8}$" diameter or a touch more, but some are thicker. During one trip to my local store we found handles that are $1\frac{1}{4}$" in diameter attached to a squeegee tool (about $23). We snatched that plus a replacement handle (about $6) and headed back to the shop to make some quick stools.

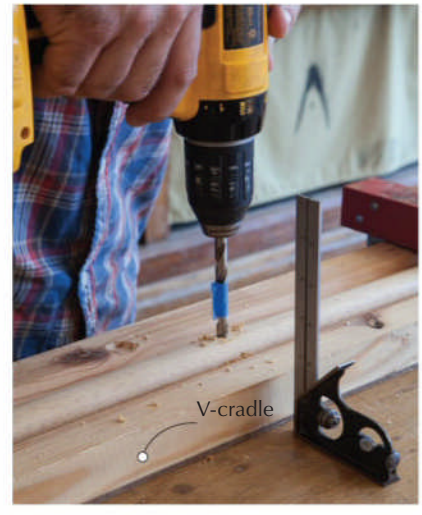
Sawn, Rasped & Bored

Cut the three legs to $23\frac{3}{4}$" long. This will result in the seat being about 17" off the floor. Use a rasp to round over the sharp corners on both ends of the three sticks. This will make the stool look nicer and make the seat last longer.

Remove the stickers and finish from the handles using a cabinet scraper or sandpaper. Then bore a $\frac{5}{16}$"-diameter hole through the diameter of the handle. The hole should be exactly at the middle of the stick, both its length and diameter. Put a piece of tape on the drill bit at the correct depth so you will stop boring right when the tip of your brad-point bit pokes through the other side of the leg.

Drill the hole from one side of the leg. Flip it and finish the job. While your drill is out, drill the pilot holes in the tops of the legs to accept the #10 x $1\frac{1}{4}$" screws that will attach the seat to the legs. Depending on your particular #10 screw, the pilot might be $\frac{7}{64}$", $\frac{1}{8}$" or a little bigger (screws are not all the same).

Mr. Pushy. *Rasps and files cut only on the push stroke. Don't drag the teeth back over the work or you'll shorten the life of the tool.*



Square off. *Use a square to help you keep your bit perpendicular to the leg and in line with its diameter. Don't trust your lying eyes.*

Go deep. *To prevent your screw from bottoming out, drill the pilot hole to $1\frac{1}{2}$" deep.*

Bolt from the internet. *I got the idea for this tri-bolt from a tutorial on the internet. I'm so glad it's useful for more than just cat videos.*

Homemade Tri-bolt

The hardware that makes the stool work – the tri-bolt – can be cobbled together from the hardware store or you can buy a beautiful version from Lee Valley Tools (see the Supplies list). If you are using the hardware store stuff, here's your shopping list:

- One 5/16" x 3" hex-head bolt
- One 5/16" x 2 1/2" eye bolt
- Three 5/16" washers
- Two 5/16" acorn-headed nuts

There's about a 100-percent chance that the hardware will be zinc plated. I dislike shiny zinc bits so I remove the plating with the help of citric acid. Put the hardware in a coffee cup, fill it with warm water and put a couple tablespoons of citric acid in the water. In a couple hours, the zinc will be gone. Remove the hardware and oil it.

Before installing the hardware, add a finish to the legs. We used a coat of beeswax for the squeegee stool. Thread the legs and hardware together and use a little bit of a thread-locking fluid to keep the two acorn nuts in place.

Leather Seat

A piece of thick leather is ideal for the seat. Look for something 8 oz. (1/8" thick) or thicker. Be aware that how the leather was tanned can affect its pliability and strength. So trust your gut when looking at the animal's gut. ("Would this leather hold me?") You'll need a piece of leather that is about 17 1/4" square – see the drawings on the next page.

Use the drawings to create a pattern for the seat. I use hardboard (sometimes called Masonite) for the pattern. Place the pattern on your leather, hold it firmly and use a sharp utility knife to cut the seat to shape. Tip: For cleaner cuts, strop your utility knife like a straight razor.

Now punch three holes in the seat that are big enough to thread your #10 screws through. A leather punch makes clean holes (unlike a drill bit). Punches are available at most craft stores.

Screw the seat to the legs. I recommend using a brass screw cup (available at any hardware store) under the head of each screw. The cups will hold the leather tighter and prevent it from getting easily damaged.

Now take your stool for a nice squat. Want to make it fancier? Read on.

Different Legs

There are lots of ways you can improve the look of the legs. If you have a lathe, you can turn them. My only advice is to not turn any section of the leg thinner than 7/8" in diameter. The turned leg shown in the drawings has a small foot with chamfers at top and bottom. Another traditional shape is to turn the foot so it resembles a teardrop.

If you don't have a lathe, consider tapered octagonal legs, as shown in the photo at the beginning of this article. These legs are 1 1/4" at the top and 1" at the foot. Rasp the corners at the top and bottom like shown for the broomstick stool.

The remainder of the operations on the legs are the same as for the broomstick stool. Boring 5/16" holes will allow you to use either the hardware-store hardware or the Lee Valley stuff. Also, instead of using a wax finish, I used super blonde shellac followed by a coat of wax.

Upgrade the Seat

Instead of a plain triangular seat, you can improve the strength and appearance of the seat by adding "pockets" to the three seat corners. These are attached with 15 #9 copper rivets. Make a hardboard template of the pockets using the drawings and use the template to cut out three pockets for the seat.

SUPPLIES

In addition to local leather stores, check out Tandy Leather (tandyleather.com) and Brettuns Village (brettunsvillage.com) for hides. Leather tools can be found at Tandy.

Tandy Leather
tandyleather.com or 877-532-8437

1 ■ 3/16" punch
#3777-06, $12.99

50 ■ # 9 copper rivets
#11280-00, $19.99 pkg/50

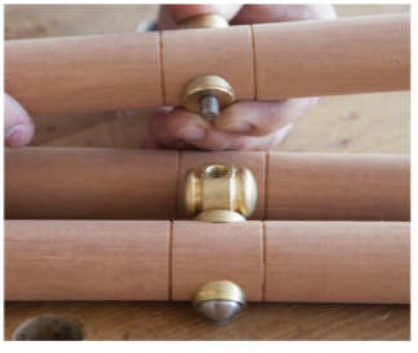
1 ■ # 9 rivet setter
#8110-00, $14.99

Lee Valley Tools
leevalley.com or 800-871-8158

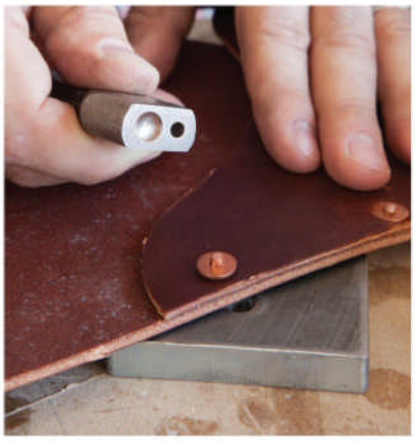
1 ■ Lee Valley Campaign Stool Hardware
#05H40.01, $39.50

Prices correct at time of publication.

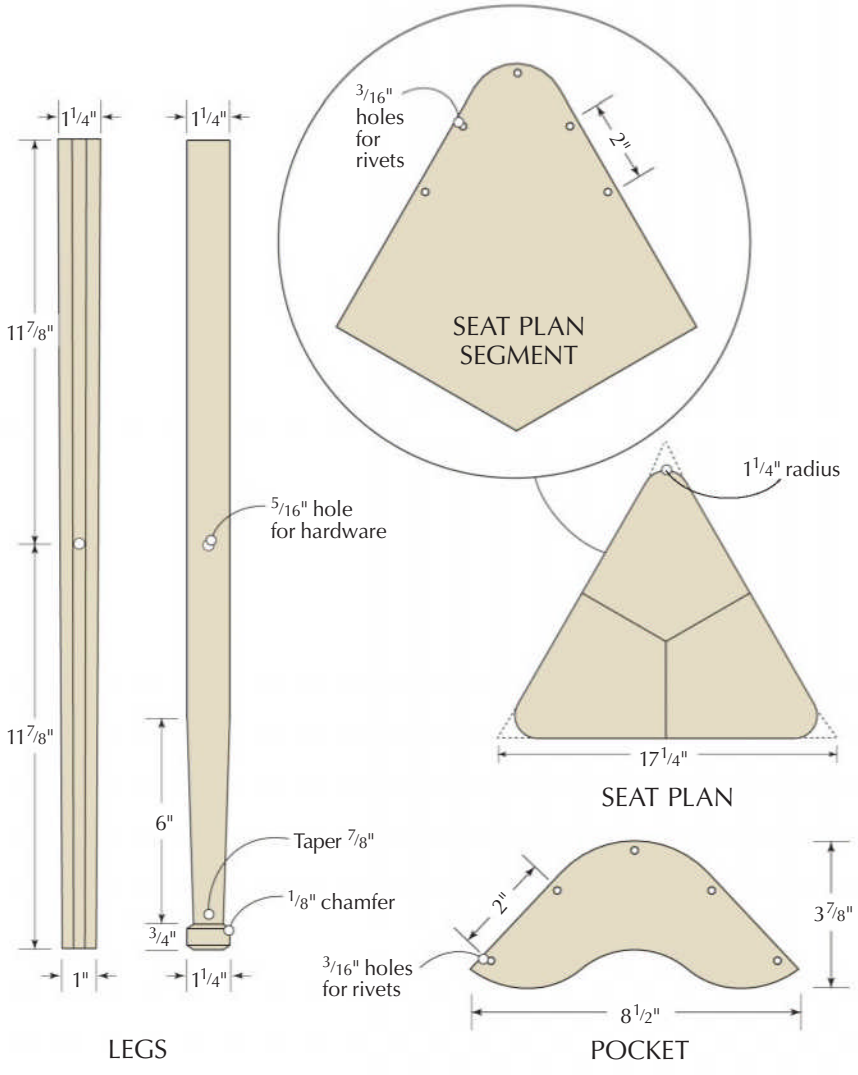
A punch in the gut. *This rotary punch makes several sizes of holes. A 3/16" hole works fine with #10 screws.*



A better bolt. *The Lee Valley hardware for this stool is quite nice. It costs more than the hardware-store bolts but is worth the investment.*



Set rivets. *This handy tool (top) sets the burr. After setting the burr, nail snips can remove the excess (bottom). Then use the rivet setter or a hammer to peen the rivet. Note the metal plate under the leather; it helps when setting the burr and peening the rivet.*



Use the drawings to mark out the 30 holes needed for the rivets in the seat and pockets. A 3/16" hole is correct for a #9 rivet. Thread the rivet through the matching holes in the seat and the pocket (the flat head of the rivet should face your buttocks). Now place the "burr" on the shaft of the rivet and use a rivet-setting tool to drive the burr onto the rivet. Place the rivet on a block of metal, snip away the waste above the burr and peen the rivet with the rivet setter or a hammer.

Now punch the 3/16" holes in each of the pockets for the screws and screw cups. Attach the seat to the legs with the #10 screws and screw cups.

You can also add a leather carrying strap to the stool. Rivet a metal D-ring (from any leather store) to one end of the strap. Loop the strap through the D-ring and put the stool's legs inside the loop. Fasten the other end of the strap near the top of one of the legs. Use brass screws and screw cups as before.

These stools are so quick to build you'll find they make great gifts – I think I've made almost 20 of them and have given them to so many people that some people have received two.

One last thing: I beg you to note that I wrote this entire article without a single "stool" pun. See, I can act like a grown-up. **PWM**

Christopher is the editor at Lost Art Press, a furniture maker and the author of "Campaign Furniture" (Lost Art Press).

Folding Stool

NO.	ITEM	DIMENSIONS (INCHES) T	W	L	MATERIAL
❑ 3	Legs	1 1/4	1 1/4	23 3/4	Straight-grained hardwood
❑ 1	Seat	1/8	17 1/4	17 1/4	Leather
❑ 3	Pockets	1/8	3 7/8	8 1/2	Leather

ONLINE EXTRAS

For links to all online extras, go to:

■ **popularwoodworking.com/feb18**

PLAN: *Download patterns for the leather seat and pocket.*

WEBSITE: *Visit the author's personal website.*

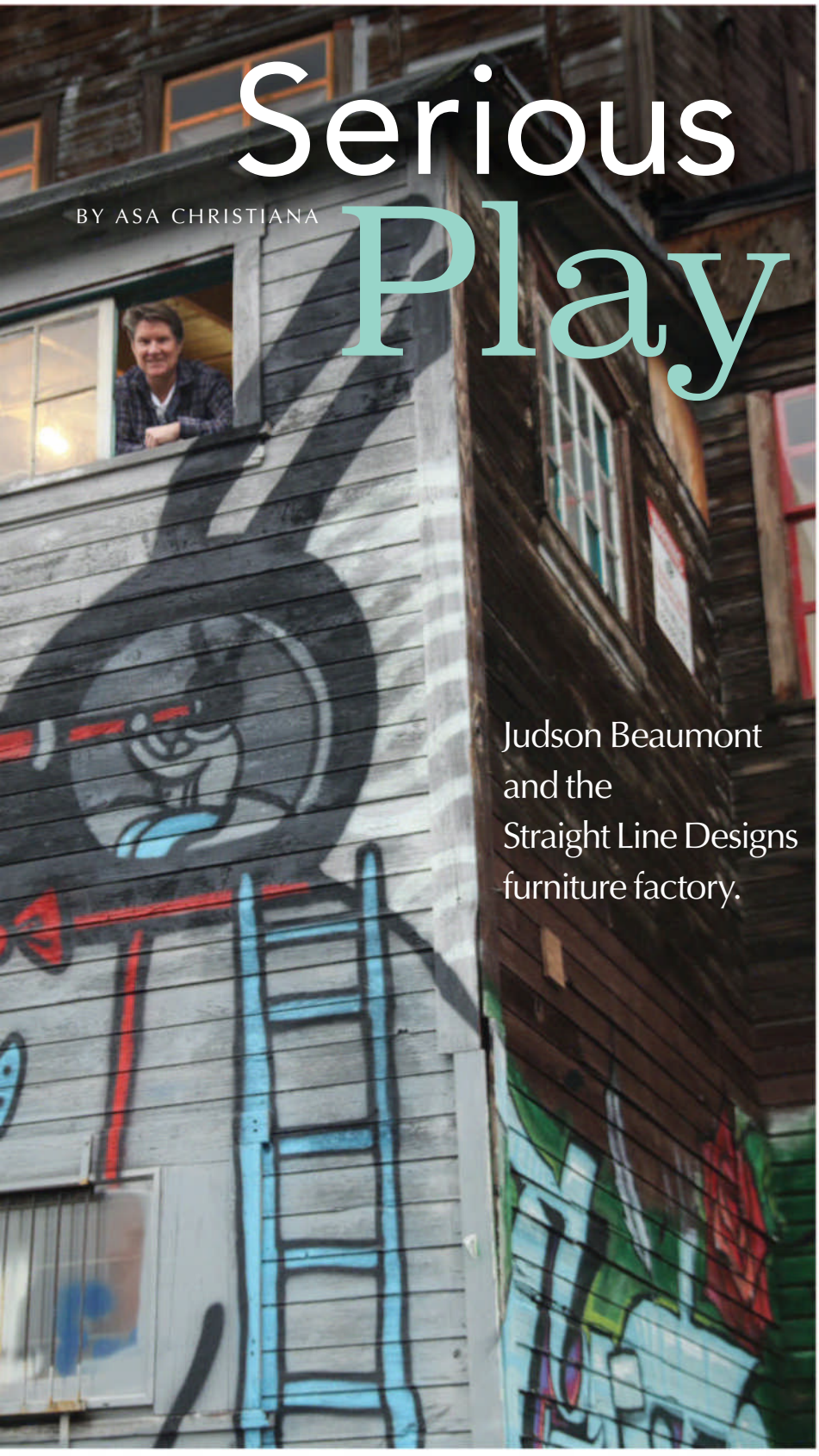
IN OUR STORE: *"Build a Campaign Chair with Christopher Schwarz" available as a download or DVD.*

Our products are available online at:

■ **ShopWoodworking.com**

Serious Play

BY ASA CHRISTIANA



Judson Beaumont and the Straight Line Designs furniture factory.

Lucky spot. *The first to answer an ad for "artists' space" 30 years ago, Judson Beaumont found a broken-down factory building and chalked out his square footage on the second floor. Now the big building is filled with artists and artisans who have decorated the exterior with playful artwork reflective of the creative work happening inside.*

When I think of Judson Beaumont I can't help thinking of Willie Wonka – the original Wonka, from Roald Dahl's matchless tales. Small in stature with boundless energy, both inhabit a magical factory with a small army of dedicated helpers. Endlessly curious and constantly creating, they whip up whimsical confections that delight kids (and kids at heart) worldwide.

Where Wonka has the Whipple Scrumptious Fudgemallow Delight, Beaumont has furniture that comes alive – clocks with attitude, cabinets that melt and explode, tables that lift a leg and pee (sort of).

Some pieces are expressly for kids, such as the airport play zones he designs or the entire children's library he created for Princeton University, which includes no tables or chairs. Others, like his iconic Little Black (or Red) Dresser, a dress-shaped chest of drawers that hangs on an closet rod, are for the rest of us. A staggering amount of work has emerged from the loading dock of his graffiti-covered factory building in Vancouver, B.C. – plenty of repeats and command performances to be sure, but just as many one-offs and weird experiments.

Unlike the fictional chocolatier, however, Beaumont is happy to venture past the walls of his compound. Invited to a Hong Kong mall for a 2013 tribute, he sat for TV interviews and a performance by dancing children dressed like his furniture. He travels widely as a guest speaker and works long hours in faraway places to supervise installations, including the 200'-long wall mural he hung inside a Disney cruise ship, dry-docked in Spain.

Although his work is beloved as far away as Japan and Dubai, success was far from inevitable.

Stumbling Into Art School

At 18, the youngest Beaumont boy was floundering. High school had been a struggle, and he found himself delivering pizzas with no ideas for the future. His dad, a suit-and-tie businessman, had seen enough. Remembering his son drawing and making go-karts

SHOP PHOTOS BY THE AUTHOR; OTHER PHOTOS COURTESY OF STRAIGHT LINE DESIGNS

and skate ramps while growing up, Beaumont's father signed him up for art school without asking, mid-term.

"Classes had already started and I felt stupid," Beaumont says. "I walked into my first class, and there was a nude woman standing in the middle, as a model. She saw me come in and winked at me, and I thought, 'I'm gonna give this art-school thing a try.'"

His initial motivation aside, Beaumont flourished in the art department at Capilano University in Vancouver, soaking up every mode and media. In painting class, though, he hit a roadblock. "I couldn't do lifelike – those paintings where you feel like you are looking through a window," he says. "So I started sticking wood pieces on the canvas."

"I don't think painting is for you," his teacher said. "You're a sculptor."

In the basement of the school Beaumont found the sculpture shop and his calling. "They said, 'You can do anything you want down here – carving, fiberglass, bronze casting, woodworking (there was a full woodshop) – just call it art.'"

That freedom was essential to his development. "I had wild ideas, I made sketches and sketches – a lot of them horrible – but all the time I was learning how to conceptualize pieces and figure out how to build them," he says.

Beaumont's strong first year at Capilano got him into a dedicated college of art and design, Emily Carr, also in Vancouver. After a couple years he was done with the required assignments and free to do his own thing. "I went crazy," he says. "I was the last one in the workshop every night."

The Magic Cube

Beaumont's artistic breakthrough came while he was still in school, in the form of a cube. "I made hundreds of these things, out of every material. I didn't know about building so the insides looked like junk at first. But I made them look perfect on the outside."

When there were 30 cool-looking cubes lying around the shop, each a little world unto itself, a professor suggested Beaumont have a show, open to the public. "My stuff was on the floor;

GREATEST HITS

An endless stream of inventive pieces flows out of Beaumont's workshop in Vancouver – playful pieces for kids and kids-at-heart. But functionality is never sacrificed for flair.

Little Red Dresser

Bad Table

Boom Cabinet

Hollow Chair

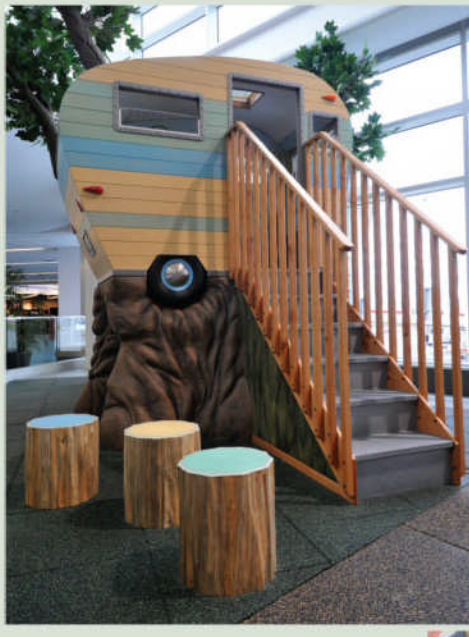
Tear Away Bench

Oops Cabinet

Not-So-Live Edge

PERFECT OUTSIDE, PRACTICAL INSIDE

Beaumont's art-school background taught him to design first and engineer second. His furniture is polished and unique while his construction methods are eminently practical.



Fun in the airport. *This colorful camper gives kids a safe place to climb and play at the Vancouver International Airport. The log seats are stave construction, finished impeccably.*

A Little Red Dresser takes shape. *Cabinet fronts and backs are routed from a single template. Panels and ribs are glued and nailed in to connect the flat parts and create the curvy sides, which are then covered with bending plywood. Drawers are then hung on the interior ribs using commercial slides, and a pro paint job brings the piece together.*

CNC is a new weapon. *It takes piles of precisely cut plywood parts to make one Hollow Chair.*

other students' paintings were on the wall," he says.

With no expectations, he was shocked when people started walking up to him with offers for his "coffee tables." "I went up to my teacher and said, 'They're going to give me $300 for this!'"

"Good!" he said.

"They're going to use it as furniture."

"Bad," the teacher said. "It's art."

But the cold cash spoke loudly, too, and Beaumont began to wonder why his pieces couldn't be considered "functional art." Soon after, he discovered the work of studio furniture makers such as Wendell Castle, and realized he wasn't alone. Emily Carr didn't offer a furniture program (today it does), but they grudgingly let him focus on furniture in his fourth year. He built clocks and other furniture and called it art. "I knew in my gut I was onto something. I didn't need approval. It felt good, and fun."

After college Beaumont took an unfulfilling job making props for commercials and movies, but quit after nine months. "I didn't want to be just another prop guy," he says.

While art school gave him the time and freedom to find his voice and passion, it was a broken-down factory building that allowed him to pursue his dream.

The Chocolate Factory

Following an ad for "artists' studios for rent," Beaumont walked into a "decrepit, ratty, horrible" building with no windows, lights or heat in an industrial section of the city. With the first floor occupied mostly by drug deals and prostitution, Beaumont marked his 500-square-foot space on the second floor in chalk, becoming the building's first paying tenant. His monthly rent was just $300, leaving him enough cash to close off his spot with 2x4s and drywall.

A year later, the building was full of creative types like him. "It was like a greenhouse for working artists," he says. "We never went home."

Another key to his success was taking cabinetry jobs at first to pay the bills. "The goal was to finance my art career."

His first tools were as humble as his

"Life is more fun if you play games."

—Roald Dahl (1919-1990), British novelist & poet

surroundings. "I used a circ saw and a straightedge – no table saw!" he says. "I can't believe the things I made with a jigsaw. I wasn't in a hurry to be successful, but I was relentless. My buddies in the building would sit and drink beer and watch me hustling to make money. I had hard work and blind faith."

After hours Beaumont built his funky cubes and boxes, putting them wherever he could around Vancouver – consignment stores, art galleries, in shoe stores as pedestals. He only asked to put his name on them. When he made them for store displays, "people liked the boxes better than the products on them," Beaumont remembers.

"Because I didn't even know how to put in a drawer in yet, I needed a confidence builder," he says. "Boxes were something I could do. As they got more and more complex, I developed many of the ideas I use today."

The young artist was making it work, and he began to expand his space, uncovering the old window openings in the walls and inspiring others to do the same. "Suddenly the building had a real pulse and was a nice place to be."

Today Beaumont and his five-person staff occupy 3,500 square feet in that same second-floor corner, with lofty ceilings, a flood of natural light and a rooftop patio he built outside his windows, perfect for taking breaks in the occasional Vancouver sun.

FACTORY WAS A LUCKY FIND

The first to answer an ad for "artists' space" in an old factory, Beaumont walked into a broken-down building, occupied mostly by criminal activity. He chalked out a second-floor spot and has stayed for 30 years.

Room for creativity. *The interior is flooded with natural light, with all the space Beaumont and his staff need to spread out and create, with a sun porch just outside the windows.*

A Not-so-straight Line

The name of the business, Straight Line Designs, is ironic now – but wasn't at first, in those days of cabinetry and cubes. Like any artist, Beaumont wanted to move on and keep exploring. He started doing curvy fiberglass shapes, like a big carrot with drawers in it.

He put his kids next to the big carrot, to give a sense of scale, and shot a picture for his first business card.

"Everyone loved that postcard," he said. "I gave it to everyone I met and it landed me a big project at a ski resort."

Just about that time, Beaumont saw the film, "Who Framed Roger Rabbit." It was another critical moment in his development.

"I watched the Toontown scene again and again," he says. "Buildings were bending, there were eyes in windows – I thought, that's what I want to do."

He made his next cabinet curvy, skinned with Wilsonart plastic laminate, which meant he didn't have to spray or sand. "Everybody in the building said, 'No one will buy that.'"

They were wrong. Photographed

KIDS SELL FURNITURE

Universally appealing work, great photos and the power of the internet helped Beaumont find clients around the world. From the beginning he put kids (his own at first) in the photos to interact with the pieces and give a sense of scale.

Beaver Cabinet

Sullivan Clock

beautifully, often with children interacting with them, Beaumont's curvy cabinets and cartoonish installations were unique and well-suited to a worldwide market. "The internet was exploding," Beaumont remembers, which brought him clients from around the globe and encouraged him to design weirder and wilder things.

Beaumont's art-school background was an advantage in a number of ways. Free from the notion that things have to be difficult, or built with traditional joinery, he focused on design and making his furniture unique.

"Everyone knows how to make furniture the 'right' way," Beaumont says. "I didn't want competition."

His practical construction techniques not only saved time, but could also be duplicated by his young assistants. Expert finishing brought each piece to life just as it did with his first cubes in art school, harmonizing the combination of materials.

The finished furniture is sturdy and functional, but the real appeal has always been the joyful design. At its biggest, around 2010, Straight Line Designs had 17 to 25 employees and occupied 7,000 square feet of space. It was way too big, Beaumont says. "It got crazy, the quality went down, I was losing money." So he sized the operation back to its current manageable size, with a small, skilled staff, mostly young would-be designers and makers. They come and eventually go, and keep the place young.

The Secret

Like Wonka, Beaumont knows that failures are part of the recipe. Where Wonka had his "Inventing Room," Beaumont has his Saturdays alone in the shop—a time he sets aside for sketching, making models, fooling around with tools and techniques. It's a space for his inner child to play, to explore dead ends and remember the pure joy of inventing that set him on this path.

With his staff gone, production halted and the big shop to himself, Saturdays are therapy, but also critical to his success. "You have to try and fail," he says. "This bugged me when I was younger, but now I know that everything doesn't just pop up."

For Beaumont (and many other studio furniture makers), it takes dozens of sketches, experiments and full-on attempts to yield pieces customers might ask for again, which the workshop can repeat amid the piles of one-offs.

Some pieces are hits but prove too time-consuming to be made profitably. Still they are worth building, paying dividends in other ways. "People love miniatures," he says. His camping-trailer doghouses and adult dollhouses that hang on walls are perfect examples. Both have already acted as important calling cards, bringing in much bigger jobs.

At the end of the month, after rent and payroll and plywood and molding compound and a pile of other supplies are paid for, Beaumont often wonders where the money has gone. But he still relishes the challenge of his job. At 56, after 31 years in business, that's what keeps him showing up at 7:30 a.m., beating his employees to the shop every day.

"My rule is: if you can draw and design it, you can build it," he says. "I love it when someone tells me, 'You can't build that' or 'No one would want that.' These words only encourage me more." **PWM**

Asa is the former editor of Fine Woodworking.

MISSES CAN BE HITS, TOO

Even pieces that don't make money or go into production can be powerful marketing tools, drawing bigger jobs.

Doggy campers. *It's hard to turn a profit on these quirky doghouses, but they are in high demand.*

Adult dollhouses. *After a trip to Palm Springs for Modernism Week, Beaumont was inspired to build these wall-hung house models. The idea is to make them DIY kits that can be flat-packed for shipping.*

ONLINE EXTRAS

For links to all online extras, go to:

- **popularwoodworking.com/feb18**

WEBSITE: *Visit Beaumont's website to see more of his playful work and read about his process at straightlinedesigns.com.*

VIDEO: *Watch interviews with other woodworking greats, including Frank Klausz, Wendell Castle, Toshio Odate and Garry Knox Bennett.*

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Rout Arches of Any Size

BY BEN BRUNICK

This millwork technique can be used to make curved parts with accuracy and ease.

Much of my recent work has been making period-appropriate arch-top sash windows for an historic building. They are 6½' tall, with a 5'-diameter arch. In other words, they're a bit larger than what you'd likely need for a furniture piece with an arched door or opening.

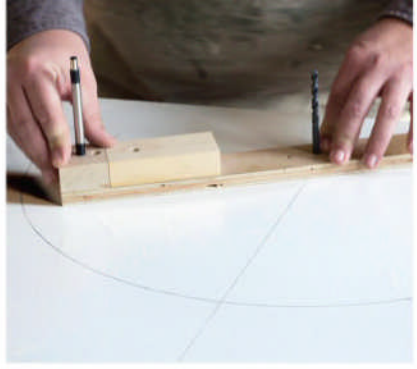
But no matter what your arch needs, the same techniques apply – so although I include dimensions in this article for a small, arched cabinet door, you can apply these techniques to arches of any size.

Always begin with a drawing and a given dimension – in this case, the wood is a frame for a stained glass panel I designed and made to add some visual interest to my cabinet door.

My first step is to get a ¾"-thick sheet of melamine large enough on which to draw the arch. On it, I mark an X and Y axis, then drill a 5/16" hole at their intersection. The hole accepts a bronze bushing with a ¼" inside diameter; the bushing helps to protect the much-used center pivot hole from wear.

The exterior radius of the panel is 9", and it has ¼"-wide lead caming around it, so I want a 5/16" rabbet to house the panel – that gives me 1/16" of wiggle room for hiding the caming.

LEAD PHOTO BY AL PARRISH; STEP PHOTOS BY GREGG HOMSTAD & THE AUTHOR



Draw the arch. *Here, I'm using my shop-made trammel jig to scribe the interior and exterior arches onto 3/4"-thick melamine. Note the axes – where they cross, I've drilled a 5/16" hole to accept a 1/4" inside-diameter bushing. The bushing keeps the pivot point from distorting during use.*

Part selection. *I draw a line on one edge of the board to designate the interior edge of the parts. I also offset it closer to one face, which also indicates my show surface. You can use your own method of denoting orientation, such as marriage marks or a cabinetmaker's triangle.*

So, I drill my shop-made trammel marking jig for an 8 3/4" radius to scribe the internal arch on the melamine. Next, knowing that I want a 2 1/4"-wide frame, I drill the trammel to an 11" radius for drawing the external arch.

With the internal and external arches drawn, shift your focus to drawing out the individual mitered components that will make up the arch. See "Arch Components" on the next page for step-by-step instructions on how to determine the number of pieces and angles.

With the arch component dimensions determined the fun part – the woodworking – begins.

Wood Selection & Layout

To go with the Arts & Crafts design of the stained glass panel, I've chosen quartersawn white oak for the frame. Ideally, I'll get all the wood – in this case, three arch segments, two stiles and the bottom rail – from the same long board. As long as I'm careful with layout and marking, that will result in continuous grain up the stiles and over the arch to help accentuate the form.

I selected a relatively quiet, quartersawn board. In this situation, I'm after straight grain, not showy ray flakes, to frame the glass rather than compete with it for attention.

I begin the layout of the rough oversized parts with the left-hand stile followed by the three components that will make up the arch (joined with loose tenons, so I don't add length for tenons; your needs may vary), then the right-hand stile. Cut the material for the bottom rail from what remains.

Next, cut free from your board the parts that will produce the stiles and rail, but leave the three arch components connected together in their single rough piece.

As you make the cuts, continue your line onto the freshly cut end grain to keep track of which ends go together. I also use numbers to help me quickly know which parts meet where, and I use an arrow on the edge to mark the interior face; if I mark on the face itself, it will get milled off. Do what works for you – just be sure you can keep track of what goes where throughout the process.

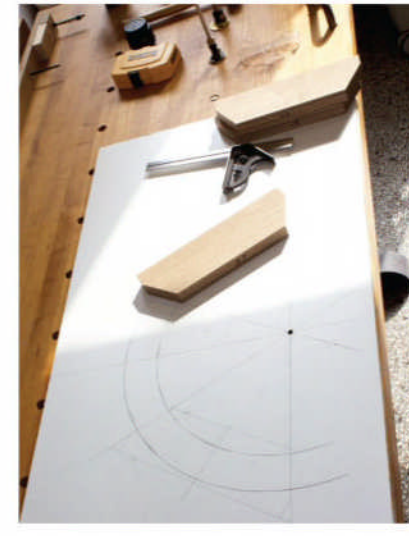
I started with 5/4 stock and milled it to 1" thick, then cut the arch blanks (still on one board) to 3 7/8" wide, the stiles to 2 1/4" wide and the bottom rail to 3 1/4" wide.

With the stock milled to thickness and width, cut the three arch components to length, which, using the process detailed in "Arch Components," I've determined is 11 1/2". As you make these cuts, mark each piece in its correct order.

Now you'll clip off the 30° angles using your preferred method.

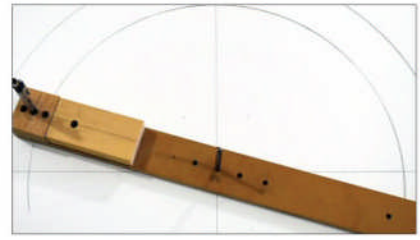
Tightness of the joint is critical. Don't stress too much, however, if the two 30° cuts don't come together in a perfect 60° angle; just get close. After they're glued up, any slight inaccuracies will be taken care of by shooting

Angle cuts. *I use a miter saw with a stop system to make the 30° cuts for the arch pieces. You might choose a table saw with a mitering jig or sled, or cut them by hand and shoot the edges (if you're into that kind of thing). Regardless of how you choose to cut them, just make sure they come together tight where they'll be joined.*

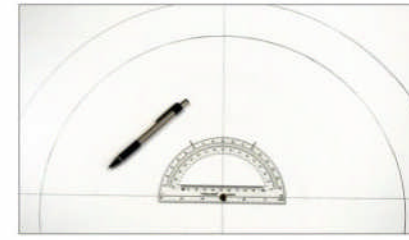


Confirmation. *After making the cuts on the first arch component, I check it against the drawing to confirm my saw settings are correct before cutting the angles on the other two arch components (again, I mark the angle on the interior faces first).*

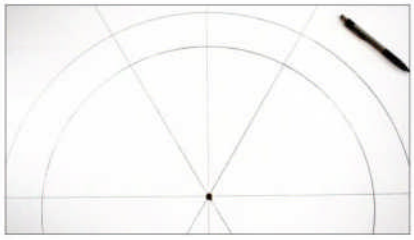
1 *Draw vertical and horizontal axes on a sheet of melamine, then drill a 5/16" pivot hole where they cross, and insert a 1/4" inside-diameter bushing.*



2 *Make a simple trammel to draw the interior and exterior radii of your arc. A 1/4"-diameter drill bit makes a nice pivot.*

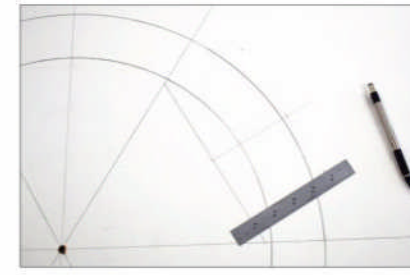


3 *Mark 60° and 120° increments with a protractor to both sides of the pivot point.*



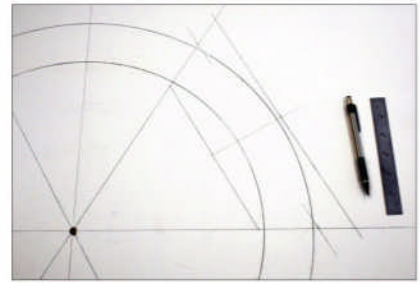
4 *Divide the arch into three equal segments by connecting and extending the 60° and 120° marks from the pivot point.*

5 *Measure 1/4" from the interior radius on the horizontal and adjacent angle line, and connect the dots. This line is the interior extent of the rough frame segment.*

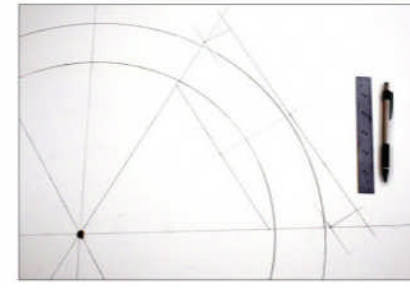


6 *Mark the center point on this line, then extend a line 90° through the exterior arc. Mark 1/4" beyond the exterior arc on that line, then measure and mark equidistant to either side of that line from the interior extent.*

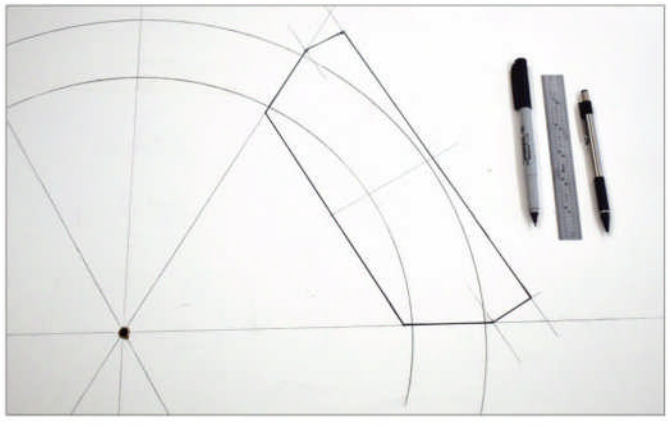
7 *Connect the points to determine the exterior extent of the frame segment, parallel to the interior extent. You've now defined the overall segment width of the workpiece.*



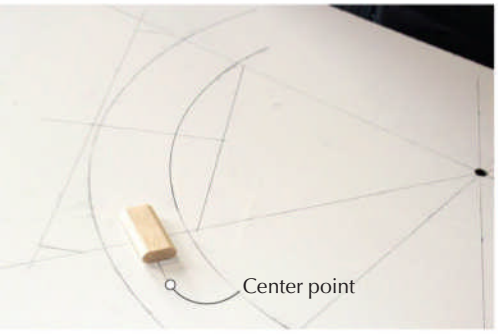
8 *Now mark at 1/4" again, this time beyond the exterior radius on the horizontal axis and 60° angle line.*



9 *Draw perpendicular lines from those marks to the exterior extent line. From line to line is the overall segment length of the workpiece. Note that I use a Festool Domino for the joinery; if you prefer to use traditional tenons, you'll extend the length accordingly (for a tenon at both ends of the center piece and at the ends that mate with the stile on the two outside arch pieces).*



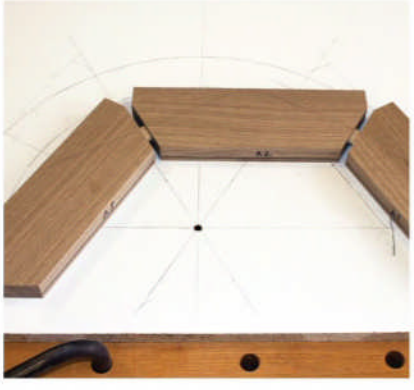
10 *Three of these segments joined together, outlined here in bold marker for clarity, will make up your arch.*



Location, location. *Mark the centerpoint of the joint, and choose a tenon size that leaves plenty of meat.*

Plunge. *Align the machine to your mark, then cut the mortises (one on each end of each piece).*

Mark from the piece. *Use the already-marked arch component to transfer the mortise location to the remaining two pieces, then carry those marks around with the square, perpendicular to the miter angle.*



Check. *I like to insert the loose tenons partially, and check the dry-fit against the drawing. It never hurts to be sure!*

the two ends of the 180° arch.

To begin the layout, mark the 30° angles on the interior side of the first arch component so that they match the arch component drawing.

I set a stop at my miter saw so the angled blade just kisses the layout line, then make the first cut. It gets flipped end for end, then I butt it against the stop and make the second cut. Then repeat twice for the other two arch components.

Save the offcuts; they'll play an important role when it comes time to clamp the joints together.

I use a Festool Domino to create the joinery. I apologize for advocating an expensive dedicated tool, but joining together parts like these is the very reason I went through the torturous pain of purchasing one. So, I'm not going to not use it. You can, of course, employ other loose tenon methods, or calculate the extra length needs during layout for traditional mortise-and-tenon joints.

With that out of the way, let's lay out the joinery.

For that, it's back to the drawing to mark the center point between the interior and exterior arches of the angled miter.

Next, you need to make sure you know which is the face side of each piece. (Remember my offset Sharpie lines? Those denote my faces.) For the rest of the build the "face" side will face down—except when cutting the rabbets on the stiles and rail.

Place the first arch component face down on the drawing and mark its mortise location from the mortise center point on the drawing.

Use a square to transfer that mark across the faces.

The remaining arch components can now be registered against this first one, again face down, to transfer the mortising marks.

The marks have a twofold purpose. The first, of course, is to reference the Domino's cutter. The second is to align the offcut clamping blocks during glue-up.

Joinery & Glue-up

First, cut the mortises. Then it's time for those "magical "offcuts. What makes them magical is that no matter the angle of the miter, the offcut from it will always work as its clamping block, due to some geometric law that is best explained by someone above my pay grade.

Anyway, back to the matter at hand.

Clamping blocks. *Glue the blocks in place with thick viscosity cyanoacrylate glue and apply relatively heavy clamping pressure by placing the jaw at the apex.*

Center block. *After slicing the two offcuts where they overlap, glue them together and simultaneously glue and clamp them to the center arch component.*

Clamp the joints*. Apply glue to the ends of the loose tenons and in their mortises, then slip the joints together and clamp.*

Flatten. *Put some waxed paper above and below the glued-up arch, then place a caul on top and clamp that to a flat surface. It may not be necessary, but it doesn't hurt to ensure you've not introduced twist from clamping pressure.*

The short side of the triangular offcut is the side against which the clamp will bear. Mark it at the halfway point then carry that mark around perpendicular across the top. These get aligned (then glued) with the mortise lines on the workpieces to center the clamping pressure with the mortises and their loose tenons.

On the center arch component, the two clamping blocks overlap each other. The fix is to cut each one where it intersects the middle of the arch component.

This glue joint is mostly an end-grain-to-long-grain joint, which just feels wrong – but it only needs to hold long enough for clamping the miters. The thick viscosity of the cyanoacrylate glue helps to prevent end-grain absorption and the heavy clamping pressure seems to help with the bond. Don't try to use just accelerant and hand pressure – trust me.

The clamping blocks need only about 10 to 15 minutes in the clamps. Use this time to get the liquid hide glue out of your fridge and warm it up as you gather clamps, waxed paper and other accessories for the glue-up.

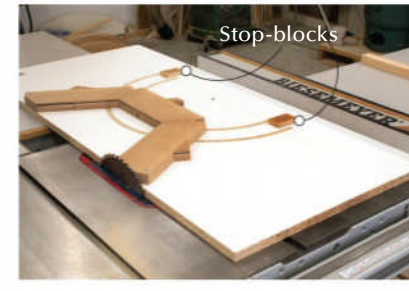
Once the clamping blocks are out of the clamps, use them (and those clamps!) to clamp up the miter joints.

You'll need two clamps – one with a deeper throat – to clamp both miters at the same time because they overlap.

That's a good excuse to buy a deep throated clamp…or just glue the arch up in two sessions. Either way, get the miters clamped up tight. Then clean up the excess glue before throwing some waxed paper above and below it so it can be clamped down flat with a caul on top and a piece of melamine underneath.

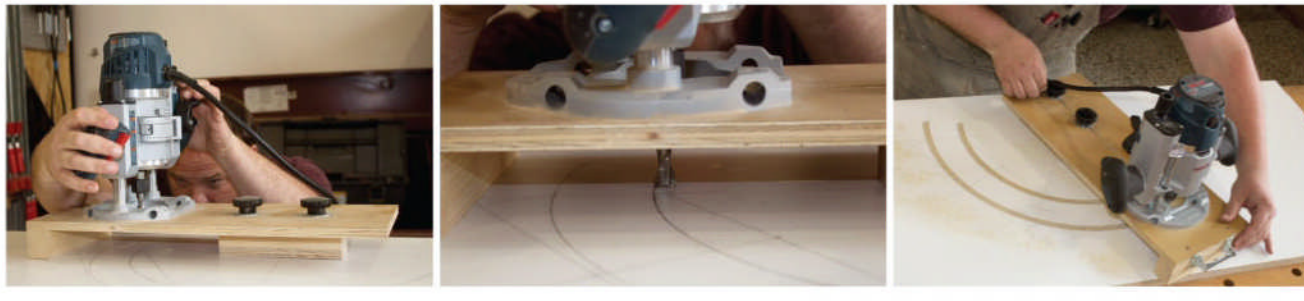
While the glue dries (you should leave the arch clamped at least overnight), turn your focus back to the melamine. You'll use an adjustable trammel router jig to shape the arch with a 1/2" upcut spiral bit. But first, use it to cut two shallow grooves through the melamine's top layer to create a "spoil board" (a sacrificial worksurface). Make the cuts on the waste side of both the interior and exterior arch radii.

Check the arch. *Take the arch out of the clamps and stand it on end on a flat surface. It is almost inevitable that it won't meet the surface at a perfect 90° – so don't despair. You'll clean up the ends as shown below.*

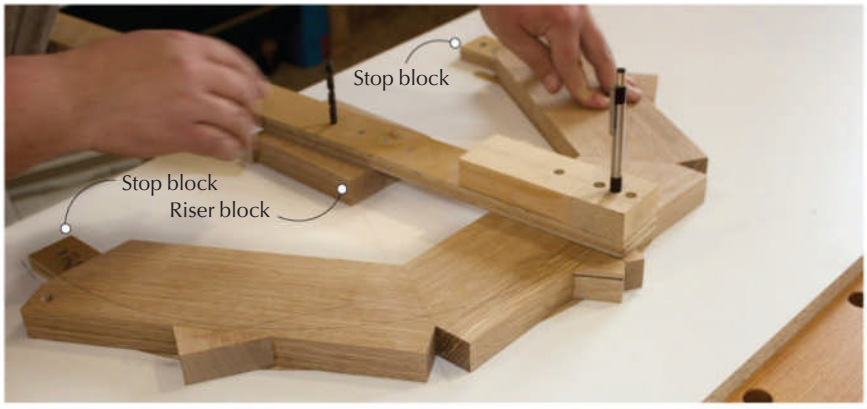


Nip it. *Screw the arch to the melamine with the ends hanging just over the edge, then run it over the table saw to create co-planar flats.*

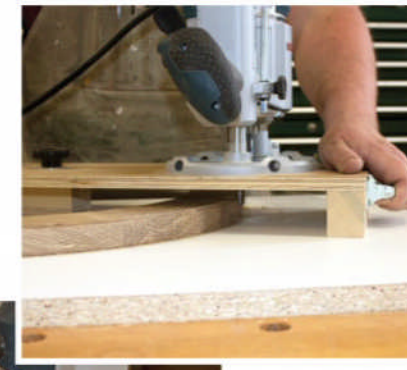
SPOIL BOARD



Spoil board. *Cut shallow grooves on the interior radii of both arcs. The two locking knobs on my jig allow me to easily move it in or out to match the radius; the plunge router provides the necessary depth of cut.*



Re-mark. *Use a 1"-thick riser block (to match the thickness of your workpiece) to draw the interior and exterior radii onto the arch.*



Now screw two stop-blocks along the X axis to allow for registration of the arch. (They're shown in the photo above.)

Get Ready to Rout

Take the arch out of the clamps, then drill a clearance hole through the waste at each end. Hang the ends of the arch just off the edge of the melamine spoil board, opposite the layout. Secure it through the holes with screws, then pass the board through the saw to just nip its edge, and bring the two arch ends into the same plane.

The freshly nipped ends can now be registered and centered up against the X axis stop-blocks on the spoil board. Use the drawing trammel to mark the arch on the workpiece.

Rough out the arch at the band saw, then secure it between the grooves on the spoil board, face-side down. I use double-sided tape for this, applying heavy pressure as I push it in place, along with a few mallet taps (delivered through thin scrap to protect the workpiece).

Outside first. *Take a series of shallow cuts to shape the outside edge first, then do the same on the inner edge, as shown at left.*

Now you're ready to rout. The depth of cut and one of the radii should still be set from cutting the spoil board grooves. Make a series of progressively deeper climb cuts, about 1/8" deep per pass, to shape the arch. The combination of the shear cut of the spiral cutter and shallow climb-cutting passes helps to prevent tear-out on uphill grain sections of the arch.

With the first radius cut, reset the cutter to the other groove in the spoil board. Again, make a series a progressively deeper cuts to shape the arch.

It's rabbet time – but instead of just jumping in and cutting one on the arch, I find it's better to first cut the rabbets on the straight pieces.

Straight rabbets. *Before routing the rabbet in the arch, I cut the rabbets on the stiles and lower rail at the table saw with a dado stack and sacrificial fence.*

Rabbet transfer. *Align the stiles with the bottom of the arch and transfer the rabbet to the end of the arch on both sides. You'll of course have to reset both the depth of cut for the rabbet and the router location for the rabbet radius – which you can do off the marks you transferred from the stiles. After dialing in the settings, a few passes and the curved work is complete.*

Matched up. *After routing the rabbet in the arch, check it against the stiles – just in case.*

Mortise locations. *With the glass in place, butt the rail into position and mark the mortise locations. I'm using a triangular plastic piece with a 90° corner to ensure the rail is square.*

This is straightforward work, but be sure cut the rabbets on the interior edges..

Now unscrew the stop-blocks on the spoil board so that you can align the straight pieces to the arch to transfer the rabbet.

Reinstall the stop blocks on the spoil board, then confirm that your glass panel fits inside the arch's rabbet. If all is well, remove the arch from the spoil board.

Cut the lower rail to length, marked from the bottom of the arch.

We're running downhill now!

Tenon the two stiles to the arch's ends (I again used Dominos for this). Drop the glass into its rabbet, slide the lower rail into position against the panel's bottom edge, then mark the mortise locations.

Glue the loose tenons in place, then clamp across the rail and where the arch meets the stiles. Then clamp from top to bottom.

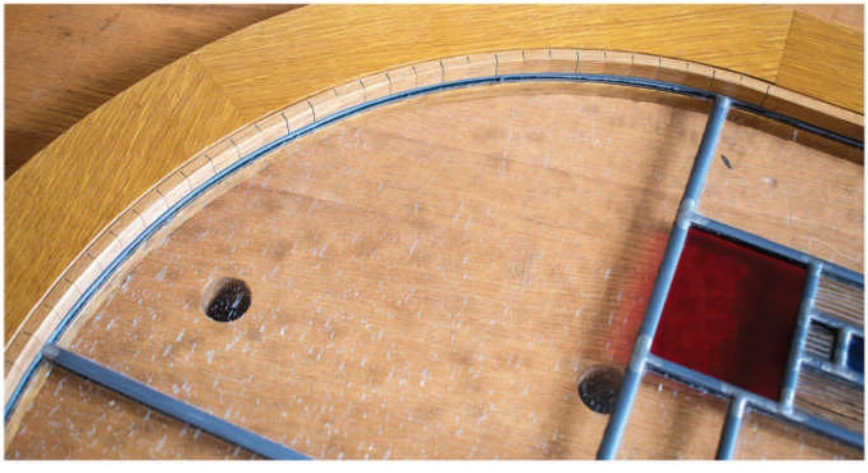
Clean off any excess glue, then clamp the assembly flat just like before, using cauls and waxed paper to hold everything down flat onto a sheet of melamine.

Now Just Add Glass

Only a few tasks remain once the glue is dry: finish planing (or sanding) and applying a finish.

If you assembled your frame from continuous grain, congratulations – you get to handplane. Otherwise, get out the sander.

I don't know what's going to happen to this door (stay tuned!) so I just used a couple coats of amber shellac as the finish. It can be topcoated with a future finish, or be easily stripped with alcohol.



Trapped glass. *Here, you can see the relief cuts in the white oak strip that is pinned in the rabbet to secure the glass panel in place.*

Final clamp-up. *Clamps across the rail pull the joint together side-to-side, while a single clamp at the apex of the arch pulls the rail into place vertically. A clamp across the intersection of the stiles and arch keeps the joints in the arch together under this pressure.*

Finally, it's time to for the glass panel. I use white oak retaining strips to trap it in place. Thin relief cuts every 1/2" allow it to bend to conform to the radius. I use a thin-plate Japanese saw and a bench hook to cut these.

The strips are secured with a (carefully aimed) 23-gauge pin nailer. **PWM**

Ben is a woodworker based in Yankton, S.D., where he's just built many arch-top windows for the restoration of the historic Mead Building.

ONLINE EXTRAS

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17th-century ‘Desk Box’

Simple joinery will keep this piece together for centuries.

BY PETER FOLLANSBEE

LEAD PHOTOS BY AL PARRISH; STEP PHOTOS BY THE AUTHOR

Books, papers, lamps, candlesticks, spoons, Legos, clothing, electronics and more all end up on top of any flat surfaces in our house. As a joiner, I have made lots of carved boxes over the years. My family has between four and eight at any given time in our house; I haven't seen the insides of some of them in years. That's because of the stuff that gets piled on top of them.

So I decided to make myself a box with no tempting flat surface on its lid.

In the early 1990s, I studied a large group of 17th-century joiners' work that was made in Braintree, Mass., and among this grouping was a piece perhaps known in the period as a "desk box." But don't think lap desk – this thing is so heavy and bulky that it would cut off your circulation if you placed it in your lap.

This oak and pine box is outfitted on the interior with a narrow open tray behind two tills, with four small drawers above. Between the tills is an open box area.

The joinery is simple; it's rabbets at the corners that are fastened with glue and square wooden pins (or "trenails"). The bottom is nailed up to the carcase, and this captures the dividers that define the spaces inside. These are fitted into dados in the sides, front and rear. The hinges on the till lids are pintles.

Weighty matters. *The weight and mass of a large framing chisel help to keep it lying flat as I pare across the rabbet.*

Green Start

For me, the work starts with riving and planing all the stock from green oak. You can forgo the riving, hewing and planing and use sawn stock instead if you like. Quartersawn is best, but use what you have.

My desk features carved decoration based on the original; I do this work first, before cutting the joinery. (See "Lunette & Floral Carving," page 58.)

Begin by shaping the sides. The shape of these boards determines the slant of your lid, as well as the height and depth of your box. Mine is about 11" tall overall, slanting down to about 5½" at the front. All this happens over a depth front-to-back of about 14½" to 15". There's a narrow flat area at the back of the box. This is where the hinges fasten the slant lid to the box.

Leave scratches, not graphite. *I use an awl and square for striking the layout lines. I abhor pencils in furniture work, but a pencil line sure is easier to see – it's just harder to remove afterward. The boxes I've studied show layout lines remaining after all these years.*

Carcase Work

Once the carving is done, I cut the rabbets on the ends of the front and back boards. I lay the front board face down on the bench, then stand each end board in place to scribe its thickness on the front board's inside face. I use a marking gauge to determine the rabbet's depth, set to about half the thickness of the board. Then I saw the shoulder down to that depth line.

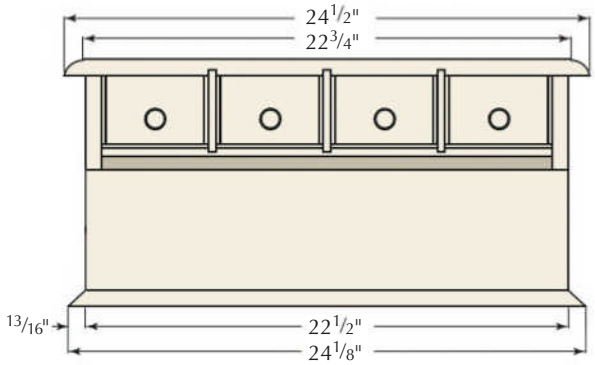
Because my stock is perfectly clear, straight grain, I split the next part of the rabbet joint. Saw the cheeks if you're using sawn stock. Once I've cut both rabbets, I set winding sticks across them to check that these joints are in the same plane.

Many period boxes are nailed at the corners; this box uses square wooden pins and glue to secure these joints.

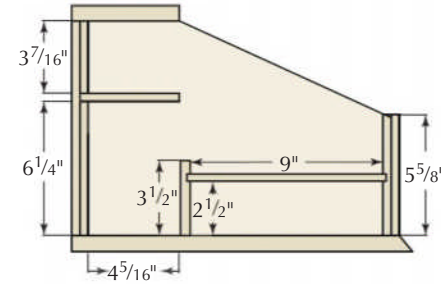
I bore the holes for these pins while I'm working on the rabbets – three holes in each, about ¼" in diameter. Bore from inside the rabbet, which allows you to easily eyeball their location. Keep the holes away from the edges and try to center them in the rabbet's width. I bore them separately in the front and back, then line these boards up one at a time against the end grain of the side. From there, I scribe where the holes fall on the side's end grain, remove the front (or back) and bore the end grain. You could clamp the whole carcase together and bore the test-fitted joint, too.

Dividers, Tills & Pintles

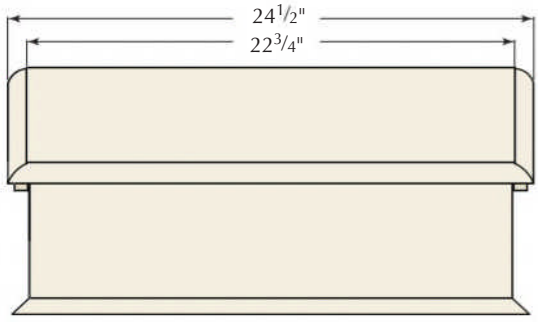
After those holes are bored, lay out the dados for the back of the tills and the shelf under the drawers. These cuts are done on the inside faces of the side



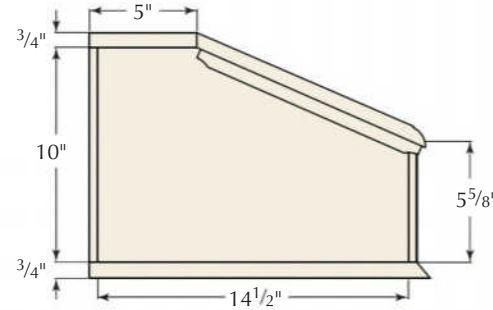
ELEVATION (LID REMOVED)



PROFILE SECTION (LID REMOVED)



ELEVATION



PROFILE

Editor's note: Peter works almost entirely without measuring; the illustrations should be viewed only as rough guides for this sort of work.

Saw then chisel. *You can use a saw only to start the notches. After I've gone as far as I can with the saw, I get out the chisel and mallet to chop the end. Then, I use a paring chisel to take it to finished depth as shown.*

boards. I lay a square from the bottom edge of the box side, and scribe a line up to the point where the flat top begins its slant toward the front.

This one scribed line becomes the back of the dado for the tills' backboard and the front edge of the drawers' shelf. I make these dividers from stock planed to about 3/8", so for the tills' back, I come forward by that amount to scribe the line that marks the front of this notch. The height of this notch in my box is about 3 1/2".

Locating the height of drawers' shelf can be worked out a few ways. One thing to consider is that if it reaches too low, there's little room to get your hand in under it to reach the rear tray behind the tills. If it's too high, the drawers will be pretty shallow.

Here, use the marking gauge from the top flat edge of the box's sides. Once these notches are laid out I use a backsaw and chisels to chop them.

I tend to go back and forth, through

"**pintle** n. a pin or bolt upon which some other part pivots or turns."

—"Webster's New World College Dictionary"

Pintle & till locations. *Here's one end of the till backboard, showing the notch for the till side and the round mortise bored for the till lid's pintle hinge.*

Backtracking saviour. *Forgetting to bore this hole before rabbeting means you must clamp some stock in the rabbet so the bit doesn't slip down in there. It's clumsy but manageable.*

many test-assemblies in making something like this box. Next, I test-fit the whole carcase together so I can determine the length of the drawers' shelf, and the backboard to the tills. I usually use a folding rule to measure these inside figures, from the bottom of one notch across the box's width to the bottom of the corresponding notch on the other end. Another way is to use two narrow sticks, each longer than half the box's width. Shove a stick into each notch, and pinch them together where they overlap. Then tilt them out of the box, without losing that pinched grip. This is the length you need to cut your boards. It should be the same for both the tills' back and the drawers' shelf, or very close to the same.

Plane this stock to 3/8" thick, then work it to finished width to match the notch. Finally, trim it to length, then try to knock the carcase together with these pieces in place.

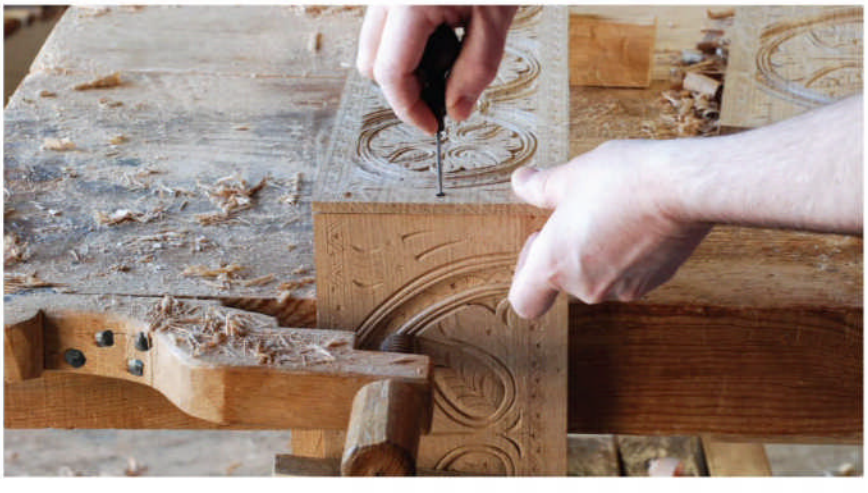
My notch-cutting and planing always leaves room for adjustment; a final trim on the ends usually gets these things so they will fit, and the box's joints will close. Once I'm satisfied that everything fits as it should, I scribe a line across the tills' back, right where the board fits into the carcase. This will help locate the holes for the till lids' pintle hinges.

Both of these boards need some work. The shelf has notches for the drawer dividers; the till back gets notches for two till sides, and holes for the pintle hinges. It doesn't matter which one you do first. The drawer dividers are a bit thinner than the shelf and till back, 5/16" this time. I laid out the dividers so the drawers were close to equal sizes. Mine has three dividers and four drawers, based on the format of the original. These notches are cut all the way across this board, so they're easy to saw and chisel.

On the till backboard, mark out the pintle hole and the notches for the tills' sides. The pintle hole needs to be dropped down from the top edge, so there's wood above the hole. My oak till lids are 5/16" thick, so I come down that much again before the hole. I scribe a line 5/8" down from the top edge. This line marks the top of the till sides' notch, and the bottom of the pintle hole. The till lids overhang the till sides, so you can slip your finger under the lid and lift it up. Thus the till lid's width determines the placement of the notch for the sides.

To lay out the till sides' notch, use the till lid width from the scribe line on the tills' back, minus about 1/4" for the

Pintle shoulder. *Form a shoulder for shaping the pintle hinge round by pressing a chisel into the corner of the square pintle.*



Pin locations. *Here I'm working on a standard box (no slanted lid), but the method is the same for marking the bored holes for the square wooden pins.*

Shave while driving. *I love when I've sized the pins just right; the corners of the pin are shaved as I drive it into the joint. That's a perfect fit.*

Same sequence. *In this version of a desk box, I'm nailing the joints – but the sequence of assembly is the same. The shelf for the drawers must be in place before nailing or pinning the rear joints.*

overhang. That's the outer edge of the notch. I make it about 5/16" wide. It's a stopped notch like the first ones, so that means more saw and chisel work. There are related notches in the box front's inside face for the other end of the tills' sides. You can locate these any number of ways; I find the simplest is to lay the tills back and the box front with their bottom edges butted together, and scribe the marks from the back to the front.

Bore the mortise for the pintles right against the box sides. Because I've already cut the rabbet, the bit will wander into the joint, making a mess of things. To resist the bit's tendency to wander, I clamp a piece of scrap in the rabbet. This is only an issue on the box front, not on the tills' backboard. The mortise in the back can go all the way through; that depth in the front is only about 3/8".

Another test-fit gets the length of the till sides and the lids. Planing and fitting the sides is easy; get the length and cut the piece to fit. They can slip up from below quite easily. The till lids need an extension at each end – the pintle or hinge.

After scraping a moulded edge on the till lids with a scratch stock, I mark the length of the lid with enough excess at each end. I mark the pintles' width using a marking gauge, aiming for about 3/8", then saw this out, leaving square extensions at each end. Then, using a chisel, round the pintle by chamfering it bit by bit.

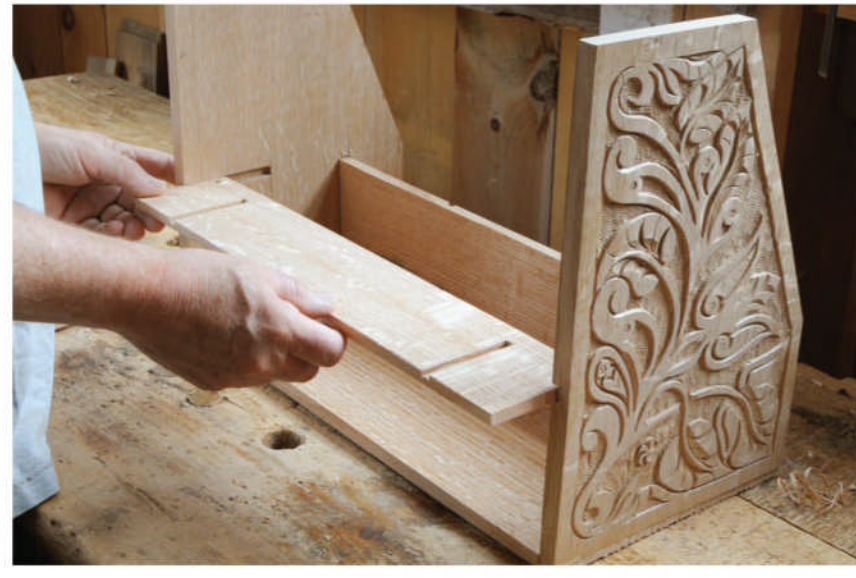
I press the chisel into the wood to make a hint of a shoulder, then pare toward this cut. It's good to have a test hole to try your progress as you go. Aim for an easy fit; this lid wants to swing open freely. I also chamfer the whole length of the till lids' hinge edges. Rounding this over, top and bottom, helps it swing open.

I mark the pin holes on the sides' end grain by testing the joint, then marking the location on the end grain. Mark each joint, then bore the holes. I use square, untapered wooden pins to secure this glue joint. Most period boxes are nailed at the corners, in which case the glue is not necessary.

The pins are shaved from dry, riven stock. It's worth taking the time to test this joint if you've not pegged this sort of thing before; you don't want any surprises once you've spread the glue. And the last thing you want to do is split the box parts during assembly.

I glue and peg the back and sides together, with the drawers' shelf fitted in place first. Glue the rabbets and the end grain, then drive the pegs. Then trim them flush.

Lay this sub-assembly on its back and slide the till backboard up in its notches. Slip the till lids in place (the till sides can go in afterward) then drop the box front onto the till lids and the box



Check the direction. *As you slide the till backboard in place, make sure the notches for the till sides are facing in the right direction.*

Put a lid on it. *Drop the till lids into place before installing the box front. I never trust that they are interchangeable, so I keep track of right and left.*

Payoff. *All the test-fitting now pays off – there should be no excitement during final assembly.*

sides. Glue and peg as you did before.

When everything is pegged and trimmed, check that the box is square.

The till sides slide in from below, and the bottom will keep them in place. So make them slide in easily, but tight enough to not rattle around.

Add the Bottom

I make the bottom from a single white pine board. Plane it to about 5/8" to 3/4" thick, leaving it longer and wider than necessary.

Once it's ready, set the box on the board, lining up the rear edge of the bottom flush with the back of the box. Then mark the position of the box on this face, with an overhang of about 3/4" side to side and at the front. I tend to scribe both the inside and outside of the box's "footprint" so I can readily see where the nails go to fasten the bottom to the box.

Remove the box, lay out this overhang from the box's outer perimeter, then cut the board to size.

Plane a chamfer on the ends and front, from the box's edge to just about the edges of the bottom. Then bore pilot holes for the nails that will fasten the bottom in place. I use two nails in the short ends, three in the front and back. Replace the box in position on the bottom and, with a fine awl, prick marks into the box's bottom edge for these nails. Bore a smaller pilot hole partway into the oak box parts. Then use a gouge to cut a small countersink on the underside of the bottom for the nail heads.

Put everything in position, then nail the bottom to the box. Make sure the till sides are in place, and that the overhang is on the front, not the back!

Hole-y. *Be sure to bore pilot holes for the nails that attach the bottom to the carcase; otherwise one or both of the parts could split.*

Scoop. *Use a gouge to cut countersinks for the nail heads on the underside of the box bottom.*

Top & Lid

Now turn to the piece I call the top – the flat section that is fixed to the top edges of the box sides and back. The lid is the slanted piece that is hinged to the top. Size the top so there's an overhang on the back edge and the ends. For the first step, it's even better to have it extra long. I either clamp or temporarily peg it in place to scribe the placement of the notches for the drawers' dividers.

Line the top up so its front edge is in the same plane as the front edge of the drawers' shelf. While you have this board in place, bore the holes for square wooden pins that will secure it in place. Then use a square and awl to transfer the notches in the shelf to the top. Mark the finished length, too, allowing for about a 7/8" overhang on each side. Remove the board and cut these notches with a saw and chisels. You can cut a thumbnail moulding on the short ends, too.

Before pegging this top in place, attach the dovetail hinges. It's easier to clinch the nails on the underside when it's a loose board.

The hinges shown here were made by blacksmith Mark Atchison. You can buy manufactured dovetail hinges, but I encourage you to get to know your local blacksmith.

Chop a slight recess for the thicker part of the hinge's leaf, making sure

Transfer marks. *After assembling the carcase, transfer the locations for the drawer dividers to the flat top of the box.*

Only temporary. *A nail temporarily holds the top in place as I drive the wooden pins to secure it.*

to align the barrel or pin of the hinge along the arris of the top board. Then bore pilot holes and drive and clinch the nails through the hinges.

I usually clinch the nails by placing one of my steel bench dogs under the place I'm nailing. When things go right, the nail bends as it exits and hits the bench dog. Or you can drive the nails through, turn the piece over, and back up the head of the nail and hammer the tips back into the oak.

Peg the top in place with square untapered pins, much like you did the rabbet joints. I use two pins in each short end, three in the long edge.

The lid is a wide oak board, beveled on one edge to meet the top at an angle. I start with the board wider than I need, and work the bevel first. Then I trim it to length and width, leaving an overhang on the ends and front edge. You can figure out the angle with an adjustable bevel or just wing it.

I cut a thumbnail moulding on the ends to match the top board, and nail cleats to the lid's underside to help stiffen it and keep it flat. The nails securing these come from below and are clinched on the top of the lid.

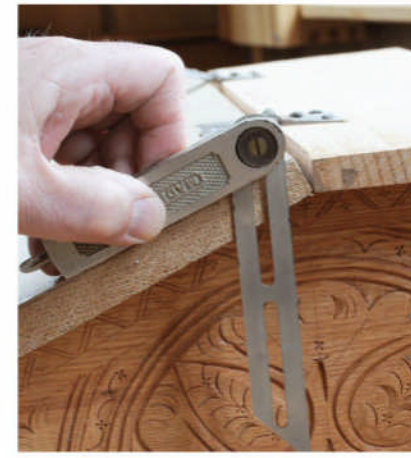
Place the box lid in place and scribe the location of the hinges. Cut a recess just like before and bore pilot holes for the nails.

Driving these nails and clinching them is tricky business, because now there's a large bulky box in the way. Patience.

Fit & Make the Drawers

All that's left now are the drawers. I based mine on some from a cabinet made in the 1680s. These drawers are made from very thin stock, maybe 3/16", and are nailed together with headless wire brads. The bottoms are nailed up to the bottom edges of the drawer.

Planing the thin stock can be a challenge; I made a planing board for just this purpose. It's a long piece of pine with a thin oak slat glued across it. The slat serves as a planing stop for the oak stock. I jam the whole thing against the planing stop on my bench, then carefully work the thin oak boards.



In my sights. *I sometimes use an adjustable bevel gauge to sight the angle I need to plane onto the lid's edge. Sometimes I eyeball it.*

Flat helps. *Planing thin stock is in some ways the most challenging part of this project. It helps to have dead-flat radial stock.*

Size to fit. *Fit each drawer bottom into its opening first. Here, I'm scribing the length.*

Hair-raising woodworking! *These thin parts are easily split. I have a scrap of oak under the drawer front to keep from breaking it to pieces as I clinch the wire tails that fasten the pull.*

The drawers' sequence is: bottom, sides, front and back. The bottom board fills the drawer opening, so I scribe its width and length according to the opening. Then I cut this, fit it in place and make the sides to sit on top of the bottom, and slip into the openings. Everything is scribed, not measured. It might be (probably is) that each drawer is a different size. They are quite close, but my work is never exact.

Once I've cut the sides to size, the fronts and backs, which are the same height, are scribed and cut to fit between the sides.

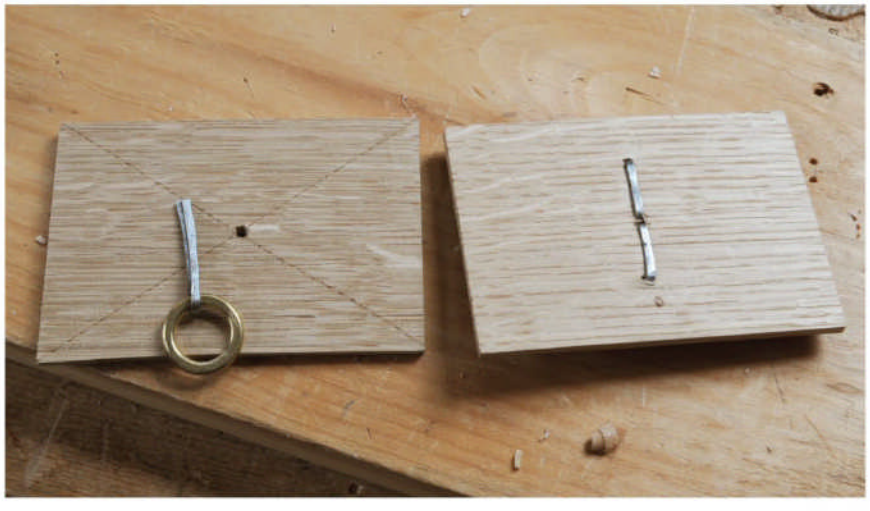
Then come the drawer pulls. Install these before assembling the drawers. I use brass curtain rings for the pulls, and they are held in place with wire wrapped around them and driven through the front, then clinched inside.

Scribe an "X" on each drawer front, or otherwise mark the centers. Bore holes for the wire. Fold the wire through the curtain ring and drive both tails through the hole. Then bend them over, and drive them into the oak.

I use thin wire brads to assemble these drawers. Bore a pilot hole using an eggbeater drill and a bit made by snipping the head off one of the wire brads. These pilot holes are way out near the edges of each board, and there is little tolerance for error. Drive the brads in, leaving about 1/4" standing proud. Snip the heads off, then bend them over and drive them into oak's grain. Done.

The finish (on the outside only) is linseed oil thinned with turpentine. You could choose to paint the entire outside or use paint just to highlight your carvings. **PWM**

Peter specializes in 17th-century tools, techniques and furniture forms. He's currently working on a book on joined chests, tentatively titled "Joiner's Work."



Nailed it. *Clinch the wire brads down into the grain of the oak drawer parts. This is what I get for copying period work.*

ONLINE EXTRAS

For links to all online extras, go to:

- **popularwoodworking.com/feb18**

WEBSITE: *Read more from the author at pfollansbee.wordpress.com.*

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Shop Supports

BY WILLARD ANDERSON

Learn to cut three joints by hand as you make these handy shop appliances.

I have used what I call "shop supports" for many years. These are not sawhorses, and they are not outfeed tables – they're somewhere in between, and I find them indispensable.

I use them to temporarily store and sort lumber that I get in for workshops I teach at the Woodwright's School. And when I process stock, the shop supports are tall enough that I do not have to do a lot of bending over.

The shop supports are just high enough that I can comfortably crosscut or rip stock by either clamping it or holding it with my off hand.

Two supports provide stock support; one provides offcut support. I also find that the three supports, when overlaid with a panel, make a useful temporary bench.

Recently I made new shop supports, primarily because the feet had rotted away on my old ones, but also to eliminate the nails and screws and instead rely on strong joinery.

I used 2x6 pine from the home center. For three shop supports, I needed three 10' boards (for the tops and stretchers) and one 12' board (for the legs). I planed and trimmed it straight, square and flat, to a common width and thickness. The lengths on my pieces are 42" for the tops, 24" for the legs, about 31" for the stretchers and 18" for the feet.

I used three joints for assembly. The feet are joined to the legs by half-laps; the stretcher is joined to the legs by wedged through mortise-and-tenons; the top is joined to the legs by through sliding-tapered dovetails.

My final shop supports' 26½" height is not a magic number – it's the dimension that fell close to 2', which is a good compromise between bench height and sawbench height. The 42" length of the tops is primarily because when I was cutting 4' x 8' plywood, this left 3" all the way around for clamping straightedges to the sheet goods when sawing it.

Before moving on past dimensioning your stock, mark the reference face and edge (a flat, straight face and flat straight edge that meet at 90°) on each workpiece. You'll do all the layout referencing your tools off of these surfaces.

Tapered Sliding Dovetail

I constructed these shop supports by starting at the top and working down. The sliding dovetails have to be fit first, because the width between the legs determines the length of the stretcher.

In general, I make the wide part of the tapered joint on the backside (if there is one) so that if I have to whack on the joint to drive it home (not ideal), any damage is not so visible.

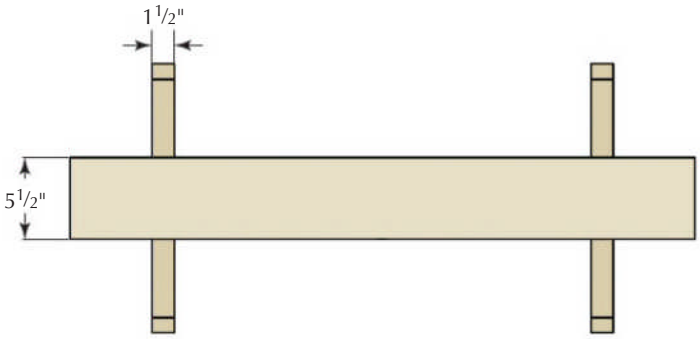
The sliding tapered dovetail is a straightforward joint, requiring no measurements other than using simple layout tools adjusted by eye, with some consideration taken for proportioning.

There are two rules for these joints: the "Rule of Halves" and the "Rule of Eighths."

The Rule of Halves states that whatever degree of taper you choose to use translates as a gap in the joint just before you begin the assemblage; for each halfway assembly of the joint, you reduce the gap by one-half.

So how many halfway steps do you need to reduce the gap to an acceptable amount? A slight taper means that the joint closes up quickly (not many half

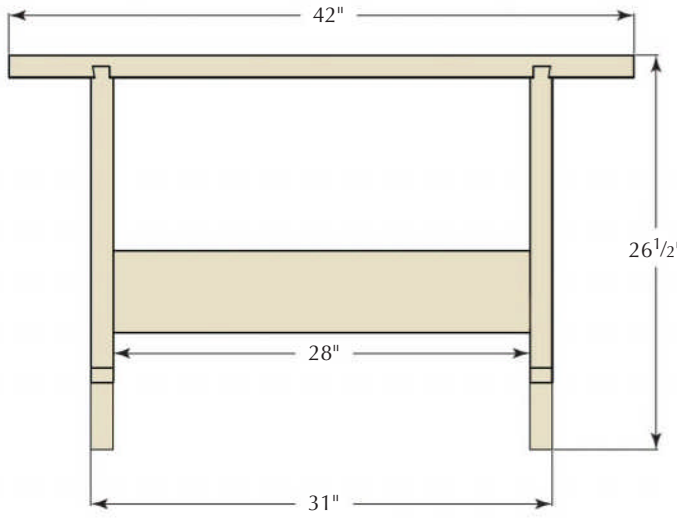
PHOTOS BY THE AUTHOR



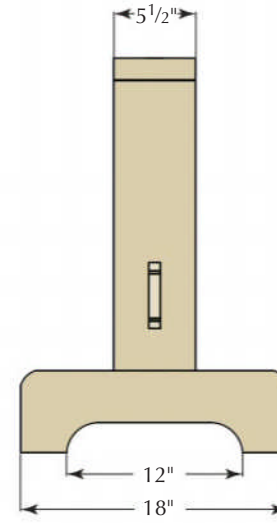
PLAN

Shop Supplies

NO.	ITEM	DIMENSIONS (INCHES) T	W	L	MATERIAL
❑ 1	Top	1 1/2	5 1/2	42	Pine
❑ 1	Stretcher	1 1/2	5 1/2	31	Pine
❑ 2	Legs	1 1/2	5 1/2	24	Pine
❑ 2	Feet	1 1/2	5 1/2	18	Pine



ELEVATION



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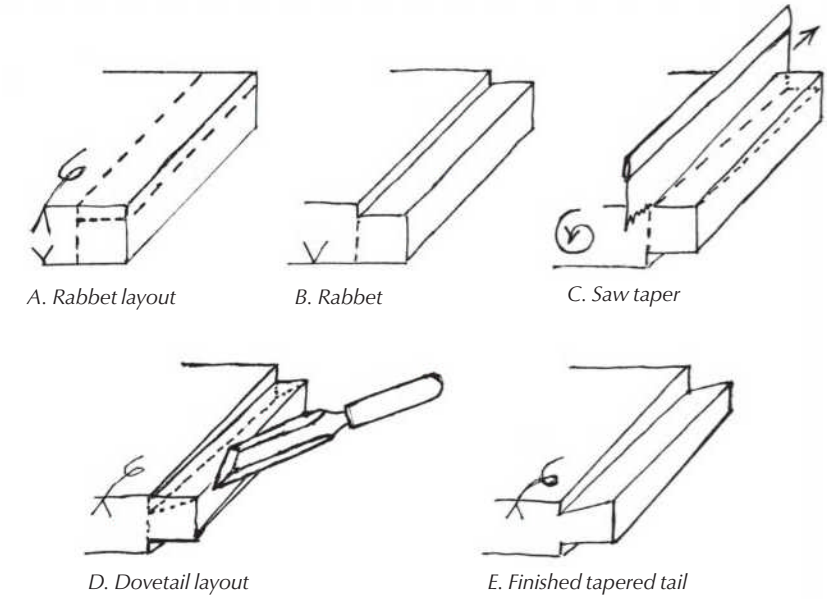
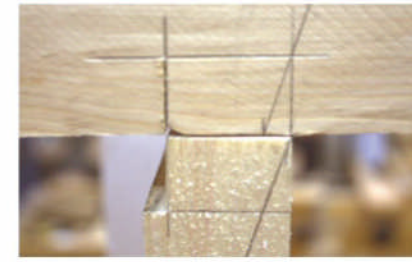


A. Rabbet layout *B. Rabbet* *C. Saw taper*

D. Dovetail layout *E. Finished tapered tail*

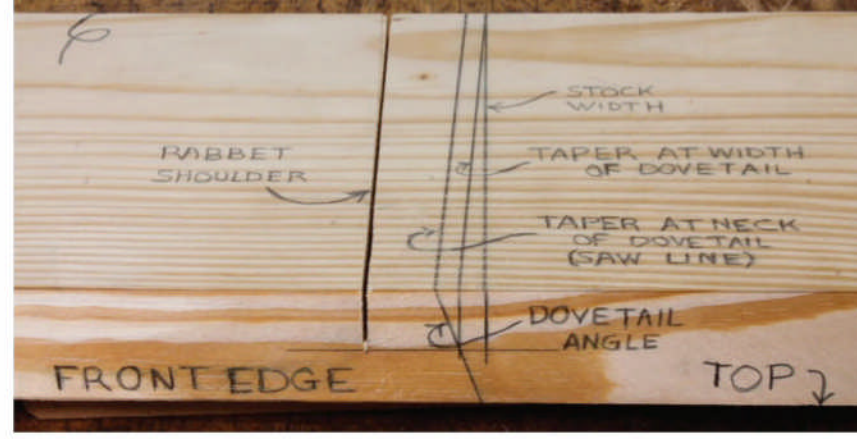
TAPERED SLIDING DOVETAIL – TAIL STEPS

Now cut. *Using a moving fillister, plane to your rabbet lines on the leg. Then saw the shoulder line on the top.*

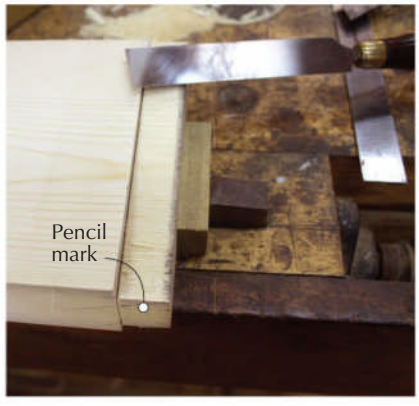


Bevel gauge. *I use a bevel gauge to mark the angle of the dovetail on the leg, then transfer the same angle to the socket.*

Square taper. *Here's the layout for the square taper. Cut this with a backsaw, just nipping the narrow end of the shoulder, cutting down to about 1/8" by eye at the other.*



View from beneath. *Here's a look at the sliding tapered dovetail socket layout on the underside of the top. Note that here I've already cut the straight side of the slot, which matched the rabbeted shoulder of the tail.*



Dovetail angle. *Here, I've sawn the shoulder deeper (about 1/8") to create the neck of the dovetail, and am paring from the end to the bottom of the saw cut. Note the pencil mark along the outside edge; this is to ensure I don't narrow the base of the tail.*

steps), and you might need a sledgehammer to knock it home. A heavy taper means that the joint closes up slowly, and it could be too loose and pass all the way through.

The Rule of Eighths states that a taper of 1/8" over a width of 8" means that three halfway steps will reduce the gap by a factor of eight (2^3, to 1/64" in this example), and one more halfway step will close the joint (in the last eighth-width of the stock). You can apply this rule to any width of stock, adjusting the taper proportionately.

First, lay out the tail portion of the joints on the top of the legs, then transfer your marks to lay out the socket on the underside of the top, about 6" in from the ends. The reference edge of the top is the one you look at and the reference face is the underside of the stock. The tail height should be more than one-half and less than two-thirds the thickness of the stock into which it will slide.

Also mark the sockets on two edges of the top, referencing from the underside. I like the joint to have two shoulders to rest on. One shoulder is a rabbet, the other is the dovetail. This helps to square up the joint during assembly because there are two shoulders for it to bear on.

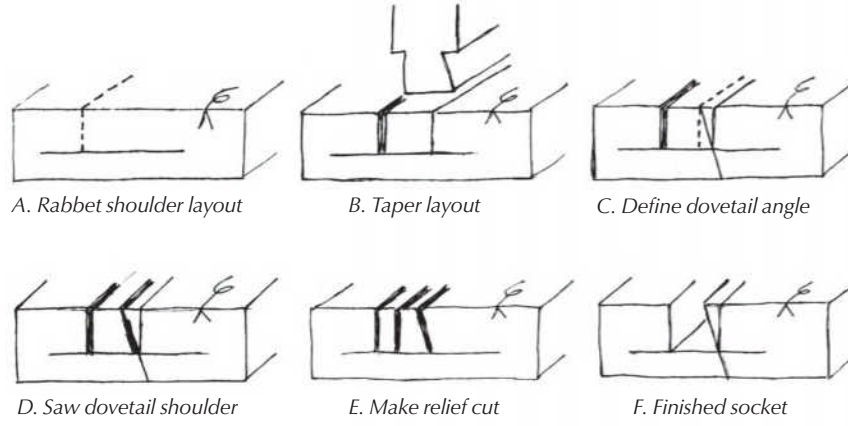
I make the tapered dovetail shoulder on the leg in several steps. First, I cut a square ramp with a saw at the baseline and on the end grain (and clean it up as needed to square and straight with a chisel and shoulder plane). Then, I saw the shoulder deeper to create the dovetail shape, and remove the waste with a chisel to clean up the angle.

You'll note in the pictures that I laid out and cut the straight shoulder for the socket as I did the tail. But if you've not already done so, lay out the square lines to define the rabbet shoulders, then saw these shoulders.

Turn the top upside down, and place the leg upside down with the rabbet on the leg set flush to the shoulder cut on the underside of the top. With a pencil, mark the tapered edge along its length. Remember, this will be the full width of the tail. Knife in a second line 1/8" inside this line (the same offset you sawed into the leg). This denotes the width of the neck (the narrow part) of the dovetail. On the two edges of the top, draw in the dovetail angles by connecting the knife line to the pencil line, using a bevel gauge.

Saw the knifed shoulder line down to the gauge line. Remember to saw in the waste side, up to this knife line. This is important and the only absolutely critical aspect of this joint.

To remove the waste, make a saw cut straight down the middle of the two shoulders for relief, then pare out the majority of the waste with a long, thin paring chisel. Clean up the bottom using a router plane with a narrow



A. Rabbet shoulder layout *B. Taper layout* *C. Define dovetail angle*

D. Saw dovetail shoulder *E. Make relief cut* *F. Finished socket*

TAPERED SLIDING DOVETAIL – SOCKET STEPS

Mark the tenon. *I use a mortise gauge (which has two pins) to mark the tenon width in one go. The gauge is used off the reference face (of course!).*

Mark the mortises. *With the legs paired up and aligned with the dovetail shoulders even, square a line across where you want the mortises. I gauged by eye about 12" down from the top (two-thirds the length of the feet).*

spear-point blade (set to your baseline).

The joint should assemble easily seven-eighths of the way in – but don't push it all the way together yet. If the joint is too tight, either the neck is thick, the tail is wide or the taper is not even. If the joint does not bottom out, it is likely a neck problem. If the visible gap during assembly is not even top-to-bottom, then the angles do not match and the tail is probably too wide. Use a small straightedge to ensure that the taper is even and flat along its length, and to check for high spots, then adjust as necessary.

Saw the tenons. *I make small chisel notches at the start of the cuts to help guide my saw, then tilt the tenon away from me in the vise as I saw to my baseline. Then I reverse the stock in the vise to angle it away from me, and saw to the other end of the baseline. Finally, I clamp the stock at 90° in my vise, and saw straight down to remove the triangle of waste that remains. The already-cut kerfs serve as guides to keep my saw on the correct trajectory.*

Wedged Mortise & Tenon

With the sliding dovetails partially assembled, place the stretcher against the legs to mark the shoulder-to-shoulder inside length for the stretcher (in my case, that's about 28").

Knife in these lines around the two ends of the stretcher stock.

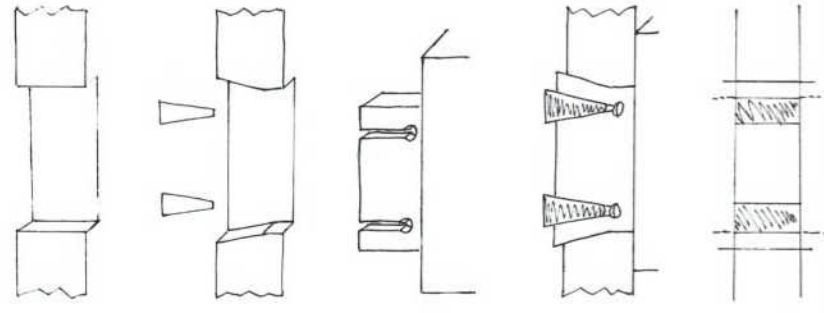
To lay out the stretcher tenons, set a mortise gauge to mark tenons that are more than one-third but less than one-half the thickness of the stretcher stock. In my case, the tenons are about 1/2"-5/8" thick. Again, the exact dimensions don't matter.

Center the gauge on the stretcher stock by eye, then scribe the tenon shoulders all the way around.

To lay out the mortise position on the legs, pair up two legs on edge with the reference edges up with the reference faces touching and the dovetail shoulders even. Make a tick mark in pencil across the edges where the top of the mortise will be, about halfway down the length of the leg. Don't mark the other mortise endwall at this time.

Now is a good time to make sure the final height of the support will be what you would like it to be. So, while you are at it, mark the position of the half-lap shoulders (which will join the legs to the feet). Note that the legs do not go to the floor. The relief on the underside of the feet is in the range of 2". The final height of the support will thus be about one-half the thickness of the top, plus the length of the leg, plus 2". Cut the legs to length.

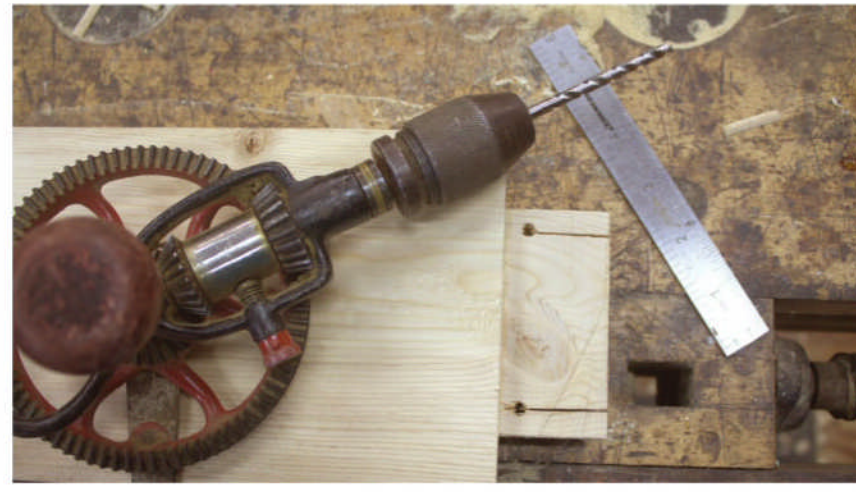
Square the mortise tick marks around each leg in pencil. Reset the fence of your mortise gauge by eye to about half the width of the leg stock, then scribe mortise cheek lines on both faces of the legs.



A. Through-mortise *B. Tapered mortise* *C. Stretcher tenon, kerfed & drilled.* *D. Side view, assembled* *E. End-grain view*

WEDGED MORTISE & TENON

Chop chop. *Ideally, your chisel perfectly matches the width of your mortise; it makes for less work. Chop halfway through one side, then flip the work and chop again. This leaves clean shoulders on the workpiece surfaces.*



Wedge slots. *Sawn slots, with small holes at the bottom, reduce the chance that the thin tenon ends will split off as you drive wedges into them.*

Loose fit. *Here's the dry-fit after I've chiseled the slopes (and with the kerfs cut for the wedges in the end of the tenon).*

Now saw the tenons with a rip-filed backsaw. I wanted the tenon shoulders to be long to help prevent racking; I decided on 1".

Use a square balanced against the tenon shoulders, and pencil the tenon shoulders in. Saw down to these lines, then cut the shoulders off slightly proud with a crosscut backsaw before paring them square and flat. Use these tenon dimensions to lay out the second end-wall of the mortises on the legs.

Now chop the mortise out halfway through from each side and clean up your cuts as necessary.

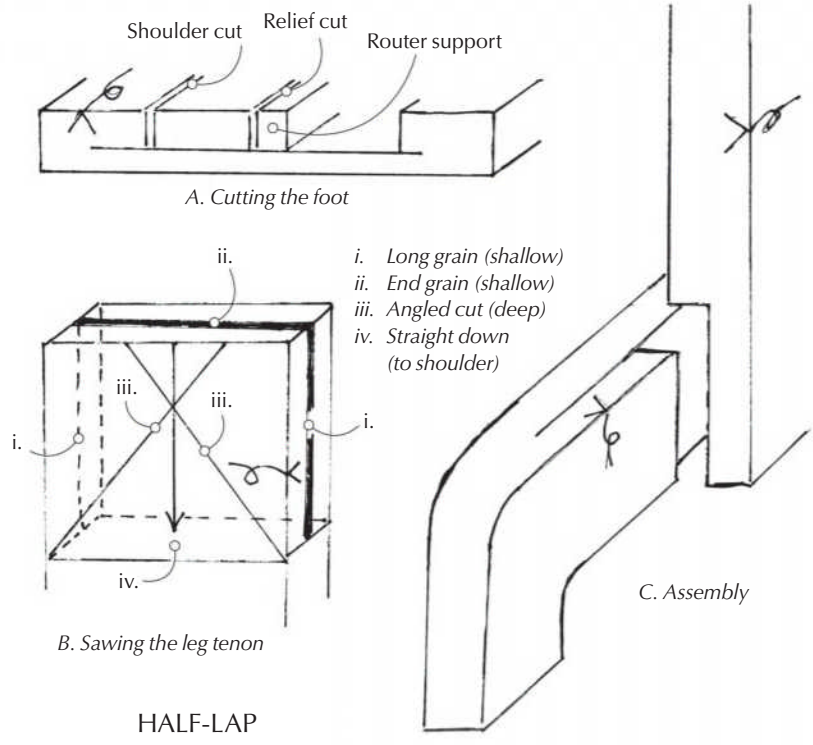
With a square, draw a line about 1/16" proud of the two mortise endwalls on the outside face. From that line, chisel a slope that goes about halfway into the mortise. Your tenons will soon fill this intentional gap.

Now on each tenon, drill a pair of holes slightly proud of the shoulders and about 1/4" in from each end, then saw straight down to these holes to create wedge slots.

But don't reach for the glue and wedges just yet; first, you need to cut the half-lap joints that join the feet to the legs.

Half-lap

You could consider a half-lap joint to be a combination of a very wide dado, and a single-shouldered tenon. What you remove from one reference face of the joint, you leave on the other reference face. So, no matter where you scribe the



Feet. *Here's the feet, with the dado side of the half-lap marked in pencil.*

Half-lap tenon. *Here's what the finished tenon part of the joint looks like on the ends of the legs.*

centerline for the joint, the two halves will always assemble flush.

Before laying out the joint, I cut a relief on the underside of the foot stock, about 2" deep, to leave 3"-long foot pads. Then, I round the inside and outside corners of the feet. The rounding is aesthetic, but the cutout helps to allow the shop supports to fit firmly on the ground

I chose to lay out the half-lap joint from the inside face so that the feet look continuous from the outside face; this, too, is purely aesthetic.

Use a marking gauge set to about half the thickness of the leg and foot stock to mark a centerline down both long edges of each leg and across the top and bottom of the feet. Remember to mark the layout off of the reference edge and face.

You'll remove the waste from the non-reference side of the "tenon" part of the half lap and from the reference side of the "dado" side of the half-lap.

To cut the "tenon" on the legs, follow the same sawing procedures as for the stretcher's tenons, this time with a rip-filed panel saw. Saw the cheek off with a long crosscut backsaw, tilted slightly to undercut the joint to ensure the joint is flush at the shoulder line. Finally, clean up the sawn face with a wide paring chisel.

To lay out the "dado" part of the joint, arrange the feet with the reference faces up and reference edges touching. Center a leg on top of the feet and make one pencil mark to define the first shoulder of the joint on each board. Square this tick mark down each face and down each edge to the centerline with a knife. Chop a V-groove on the scribe line and saw down to the midline with a crosscut backsaw.

> "Beauty is the purgation of superfluities."
>
> —*Michelangelo Buonarroti (1475-1564), Sculptor, painter, architect & poet*

Once this shoulder is established, lay the leg stock back on the feet, flush to the sawn shoulder line (just so you cannot see it) and knife a tick at the other shoulder. Carry this mark down the face with a square and pencil, then saw the second shoulder. If you are careful with this layout and saw into the waste, you will get a tight joint.

Make two more saw cuts in the middle portion of the joint, again to the midline and about 1/2" apart. This creates an island to provide support for your router plane as you clean up the bottoms; you'll remove it afterward.

Chop out the majority of waste using chisels, leaving the raised central section untouched.

Use a router plane to clean up the surface, then use a paring chisel to knock out the island and flush it to the rest of the dado cheek.

Assembly Time

The joinery is now complete, and it's time to assemble your supports.

The through-mortises need to be assembled first, but loosely. Put the stretcher in place through the leg mortises, with glue on the tenon faces – but don't insert the wedges yet.

Place the loose assembly on your benchtop, then put the top in place and tap the sliding dovetails together, working both of those joints at the same time.

This joint is (or should be) tight, so you don't need to apply glue. If you do use glue, move quickly because any swelling of the joint surfaces will impede your assembly. The joints should go in most of the way with no major resistance. The last 1/2" to 1" should

Chop the waste. *After chopping out the waste, set a router plane blade to your baseline, then use it to clean up the floor of the joint. One end of the plane registers on the island of waste in the center. After both sides are planes flat, remove the remaining waste with a chisel.*

Wedges. *The hardwood wedges spread the tenon and close up the gaps, making the joint almost unbreakable.*

bring the joint tight. Use a rubber mallet and a piece of waste stock as you knock the joints home to keep from damaging them.

With the sliding dovetails assembled, put a clamp across the mortise joints to close them. Squeeze glue into the ramps on the ends of the mortises, coat hardwood wedges with glue, then tap them into the saw kerfs.

When the glue is dry saw the wedges and tenons flush with the leg. Plane the joints smooth.

Now place the assembly upside down and glue the feet to the legs, making sure the shoulder joints are tight.

After the glue is dry, trim any overhanging leg stock from the bottom edge of the joint and rasp this smooth

The final step before painting is to relieve all of the sharp edges.

Finally, I painted my new shop supports with two coats of white exterior latex primer (any exterior finish would do, but paint offers the best protection against the elements).

With solid joinery, combined with a finish that will resist weather, my new shop supports should last for years to come. **PWM**

Bill is a retired scientist who lives and works in central North Carolina, where he teaches at Roy Underhill's Woodwright's School.

Add feet. *Clamps help to pull the half-lap joints together tightly.*

Tenons & tails. *The tenon is basically floating in its mortise here, as the top gets slid in place on the dovetails.*

ONLINE EXTRAS

For links to all online extras, go to:

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Drug Companies Fear Release of the New AloeCure

Big Pharma stands to lose billions as doctors' recommend drug-free "health cocktail" that adjusts and corrects your body's health conditions.

by David Waxman
Seattle Washington:

Drug company execs are nervous. That's because the greatest health advance in decades has hit the streets. And analysts expect it to put a huge crimp in "Big Pharma" profits.

So what's all the fuss about? It's about a new ingredient that's changing the lives of people who use it. Some call it "the greatest discovery since penicillin"!

The name of the product is the AloeCure. It's not a drug. It's something completely different. And the product is available to anyone who wants it, at a reasonable price. But demands may force future prices to rise.

TOP DOC WARNS: DIGESTION DRUGS CAN CRIPPLE YOU!

Company spokesperson, Dr. Liza Leal; a leading integrative health specialist recommends AloeCure before she decides to prescribe any digestion drug. Especially after the FDA's stern warning about long-term use of drugs classified as proton pump inhibitors like **Prilosec®, Nexium®, and Prevacid®**. In a nutshell, the FDA statement warned people should avoid taking these digestion drugs for longer than three 14-day treatment periods because there is an increased risk of bone fractures. Many people take them daily and for decades.

Dr. Leal should know. Many patients come to her with bone and joint complaints and she does everything she can to help them. One way for digestion sufferers to help avoid possible risk of tragic joint and bone problems caused by overuse of digestion drugs is to take the AloeCure.

Analysts expect the AloeCure to put a huge crimp in "Big Pharma" profits.

The secret to AloeCure's "health adjusting" formula is scientifically tested Acemannan, a polysaccharide extracted from Aloe Vera. But not the same aloe vera that mom used to apply to your cuts, scrapes and burns. This is a perfect strain of aloe that is organically grown under very strict conditions. AloeCure is so powerful it begins to benefit your health the instant you take it. It soothes intestinal discomfort and you can avoid the possibility of bone and health damage caused by overuse of digestion drugs. We all know how well aloe works externally on cuts, scrapes and burns. But did you know Acemannan has many of other health benefits?...

HELPS THE IMMUNE SYSTEM TO CALM INFLAMMATION

According to a leading aloe research, when correctly processed for digesting, the Aloe plant has a powerful component for regulating your immune system called Acemannan. So whether it's damage that is physical, bacterial, chemical or autoimmune; the natural plant helps the body stay healthy.

RAPID ACID AND HEARTBURN NEUTRALIZER

Aloe has proved to have an astonishing effect on users who suffer with digestion problems like bouts of acid reflux, heartburn, cramping, gas and constipation because it acts as a natural acid buffer and soothes the digestive system. But new studies prove it does a whole lot more.

SIDE-STEP HEART CONCERNS

So you've been taking proton pump inhibitors (PPI's) for years and you feel just fine. In June of 2015 a major study shows that chronic PPI use increases the risk of heart attack in general population.

UNLEASH YOUR MEMORY

Studies show that your brain needs the healthy bacteria from your gut in order function at its best. Both low and high dosages of digestion drugs are proven to destroy that healthy bacteria and get in the way of brain function. So you're left with a sluggish, slow-to-react brain without a lot of room to store information. The acemannan used in AloeCure actually makes your gut healthier, so healthy bacteria flows freely to your brain so you think better, faster and with a larger capacity for memory.

Doctors call it "The greatest health discovery in decades!"

SLEEP LIKE A BABY

A night without sleep really damages your body. And continued lost sleep can lead to all sorts of health problems. But what you may not realize is the reason why you're not sleeping. Some call it "Ghost Reflux". A low-intensity form of acid reflux discomfort that quietly keeps you awake in the background. AloeCure helps digestion so you may find yourself sleeping through the night.

CELEBRITY HAIR, SKIN & NAILS

Certain antacids may greatly reduce your body's ability to break down and absorb calcium. Aloe delivers calcium as it aids in balancing your stomach acidity. The result? Thicker, healthier looking hair…more youthful looking skin… And nails so strong they may never break again.

SAVE YOUR KIDNEY

National and local news outlets are reporting Kidney Failure linked to PPI's. Your Kidney extracts waste from blood, balance body fluids, form urine, and aid in other important functions of the body. Without it your body would be overrun by deadly toxins. Aloe helps your kidney function properly. Studies suggest, if you started taking aloe today; you'd see a big difference in the way you feel.

GUARANTEED RESULTS OR DOUBLE YOUR MONEY BACK

Due to the incredible results people are reporting, AloeCure is being sold with an equally incredible guarantee.

"We can only offer this incredible guarantee because we are 100% certain this product will work for those who use it," Says Dr. Leal.

Here's how it works: Take the pill exactly as directed. You must see and feel remarkable improvements in your digestive health, your mental health, in your physical appearance, the amount inflammation you have throughout your body – even in your ability to fall asleep at night!

Otherwise, simply return the empty bottles with a short note about how you took the pills and followed the simple instructions and the company will send you...Double your money back!

HOW TO GET ALOECURE

This is the official nationwide release of the new AloeCure pill in the United States. And so, the company is offering our readers up to 3 FREE bottles with their order.

This special give-away is available for readers of this publication only. All you have to do is call TOLL-FREE **1-800-746-2951** and provide the operator with the Free Bottle Approval Code: JC025. The company will do the rest.

Important: Due to AloeCure's recent media exposure, phone lines are often busy. If you call and do not immediately get through, please be patient and call back.

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Lunette & Floral Carving

This traditional pattern can dress up any panel.

I've carved so many oak boxes that I lost track of their number long ago. I'll sometimes bump into one, or a photograph, and say, "Oh, I forgot I did that one…" But one design I come back to over and over again is the first pattern I learned, which I did three decades ago by studying museum examples. The carvings on my finished desk box (page 40) are from a family of joiners who worked in Braintree, Mass., between 1640 and 1700. The half-circular pattern is called a "lunette" in art history terms; the full circle could be called a rosette. It's easiest to learn the lunette first. There's a bit of geometry and a lot of V-tool work. So once you've practiced with the V-tool a bit, you're ready for this design.

First, draw it out on paper, following the steps below.

1. Scribe a margin top and bottom with a marking gauge. Mine are 4" apart.

2. Strike a centerline for each lunette with a square and awl.

3. Set your compass from the bottom of this square line to the top margin. Then swing this arc so you scribe a half-circle between the margins.

4. Make two more arcs from this same center point, inside the first arc. Space these about 1/8" apart.

Box front. *Featured in this carvings are two lunettes with floral motifs. All it takes is some basic geometry, four carving tools and a punch. And practice.*

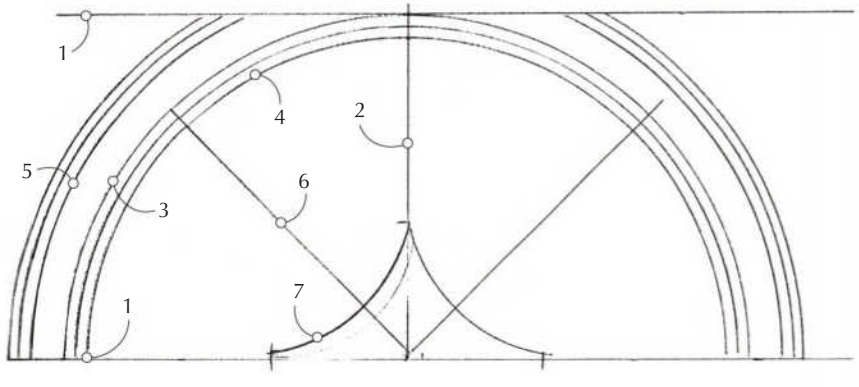
5. Now open the compass about halfway past your first half-circle and strike partial arcs that hit the bottom margin, but don't reach up to the 12 o'clock position on the top margin. Again, space three of these about 1/8" apart.

6. Strike 45° diagonal lines from the center point out to the first arc.

7. Then use the compass one last time to strike two short arcs from the bottom margin to the centerline. I think of these as an inverted V, with curved lines. I want the top of it a little more than one-third of the way up the centerline. The center point for these arcs is somewhere on the diagonal line. Some tinkering with the compass will get you there.

After stumbling around on paper, it's time to repeat the process on the board. I scribe all these marks. Most of them get cut away, but strong light often shows some remaining scribe marks on period carvings. I like mine to have the same effect – so for me, no pencil.

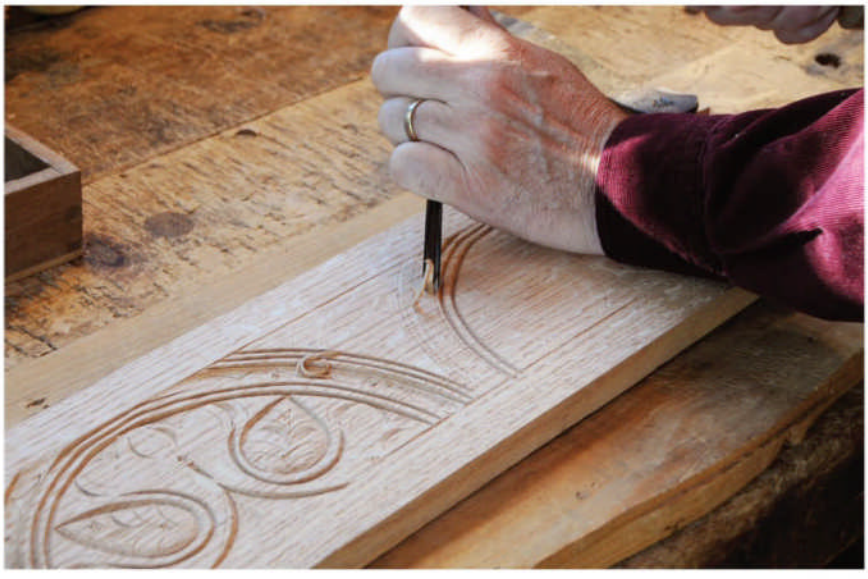
The photos that follow lead you step by step through the carving. Note that almost all of it is done with mallet in hand. The photos are tight to show details, but the mallet is almost always just out of view. **PWM**



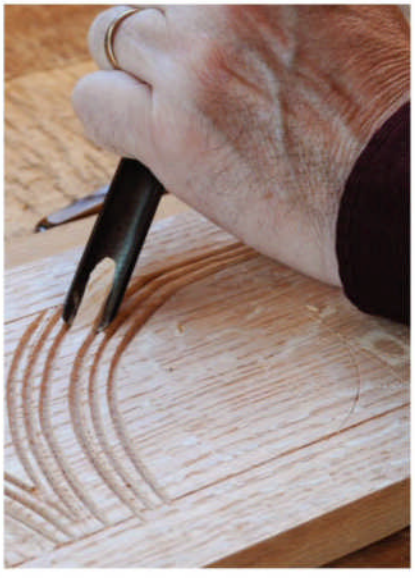
LUNETTE PATTERN

Peter has been involved in traditional craft since 1980. Read more from him on spoon carving, period tools and more at pfollansbee.wordpress.com.

PHOTOS & ILLUSTRATION BY THE AUTHOR



1 One down. *Here, I have one lunette all carved so you can see where I'm headed. In practice, I start by carving all the V-tool work. I cut all the lines in one direction, then shift my position around and cut all the lines the other way.*



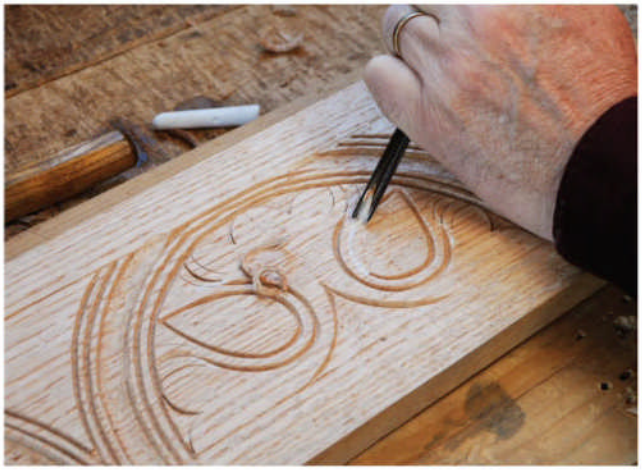
2 Hollow. *Using a 1/2"-wide, deeply curved gouge, hollow the area outside the full half-circle. A couple of passes will create a nice smooth concave shape between the sets of outlines. My colleague Jennie Alexander calls this section the "marble run."*

3 Lunette. *With the hollow done, turn your attention to inside the lunette. I use a 3/4" #7 gouge to strike an outline of petals around the arc. Think of it as one very small petal at the top, one very wide petal just on each side of that, then half a small petal again right and left to reach the bottom margin. These strikes reach into the V-tool outline. When marking the top petal, position the gouge so the petal is not too narrow across its bottom. If those gouge strikes are too close to each other, the next step can pop the petal right off the board.*

4 Shadow cuts. *Now tilt the gouge's handle down and, coming from behind those first incised cuts, remove the wood between the incised cuts and the V-tool outlines. Then do the same at the bottom. These background cuts don't need to be flat; they just need to have some depth to create shadows.*

5 Add flowers. *The tulip motif is centered on the diagonal line. It is outlined with a V-tool, and has an echo of a V-tool line around it. The echoed outline doesn't reach all the way to the full circle. I use chalk to sketch this, rather than pencil. It's easier to remove.*

6 Echo lines. *Here's what those echoes don't connect. The 3/4" #7 connects them. Make three or four incised cuts that reach from the echo line to the outer circle. Remove a chip behind the one closest to what will be the V-tool echoed outline.*



7 ***Tulip cuts.*** *Now cut the tulip and its outline with the V-tool.*

8 ***Add gentle domes.*** *I use a 1/2" #5 gouge, held bevel-up, to cut a slight dome on the tulips. Read the grain and cut down the fibers. The tool's handle is tilted way down low to do this shaping work.*

9 ***Chipped out.*** *There are a bunch of fussy chip cuts here and there, mostly to fill blank spaces. I use a 3/4" #7 for these. Some are incised cuts to highlight the blank areas, some have a chip removed behind them. Think crescent-moon shapes.*

10 ***Punch-uation.*** *I have a punch that forms a Maltese cross, filed from a cut nail. The original carvings have these punched highlights spaced around the pattern. Inside the hollowed marble run are alternating incised cuts that look like children's drawings of flying birds. The punch is between each set of these, and scattered elsewhere around the design.*

ONLINE EXTRAS

For links to all online extras, go to:

- **popularwoodworking.com/feb18**

BLOG: *Read Peter Follansbee's blog.*

ARTICLE: *"The Best Oak Money Can't Buy."*

About this Column

ARTS & Mysteries

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Causes of Orange Peel

Understand and avoid this common spraying flaw.

Orange peel is the most universal defect in a sprayed finish. It is a bumpiness on the surface that resembles the skin of an orange – hence the name.

No matter what brand or quality of spray gun you're using, or how well you clean and tune the gun, or what you're spraying, you can still get orange peel. You want to avoid it if possible.

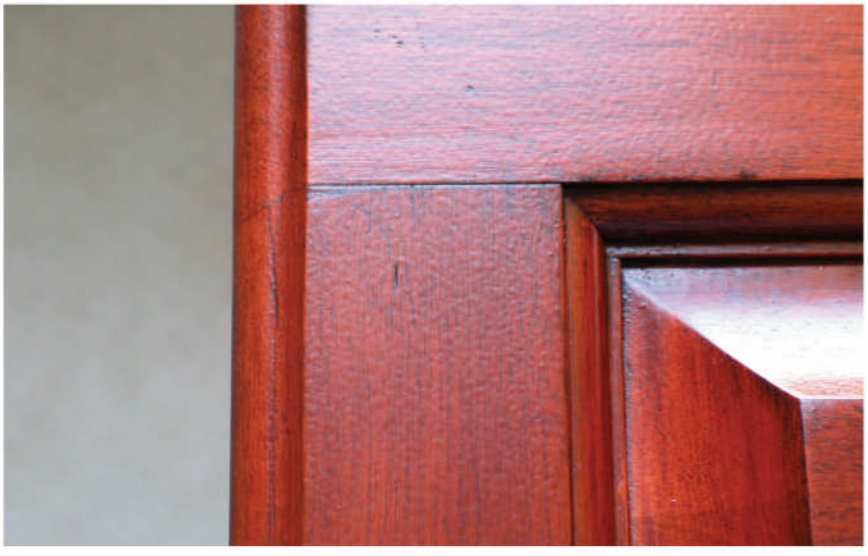
The problem is that there are so many causes (and thus so many solutions) that eliminating the problem can become very confusing.

Here's one manufacturer's list of causes:

- Liquid material is too thick
- Failure to deposit a wet coat
- Spray gun is moving too rapidly
- Insufficient air volume
- Insufficient air pressure
- Incorrect fluid nozzle
- Incorrect air cap
- Holding spray gun too far away
- Holding spray gun too close
- Thinner evaporates too fast
- Too much draft
- Temperature too high
- Temperature too low
- Humidity too low.

That's a lot of causes. All can be correct, but there are so many that I'll bet you stopped reading after the first two or three and skipped to this paragraph. The trick is to compress these causes into just three or four so you can keep them in your head. This can be done as follows:

- The liquid is too thick for the amount of air
- The gun is being moved too fast over the surface or being held too far from it
- The liquid is drying too fast
- The gun is being held too close to the surface.



Orange peel. *Once you become aware of orange peel and learn to recognize it, you'll see it everywhere. Try to avoid it, as explained in this article; the only way to get rid of it is to sand and polish it out.*

These four can be reduced to three by eliminating the last one. Holding the gun so close that it causes the finish to ripple is so obvious and rare that you don't need a separate instruction pointing out not to do it. Let's take each of the three remaining causes in turn.

Viscosity cup. *Finish manufacturers sometimes supply you with timing guidelines for measuring viscosity, typically using a Zahn #2 or Ford #4 cup. I've never used these cups because the manufacturer is assuming perfect temperature and humidity conditions, which I seldom have. Nevertheless, I'm not saying not to use them.*

Viscosity & Air

The most common cause of orange peel is an imbalance between the viscosity of the finish and the amount of air atomizing the liquid as it exits the gun. The thicker the liquid, the more air required; the thinner, the less air needed.

So the obvious fix is to increase the air pressure or thin the material.

Increasing air pressure is the most efficient way because there's no solvent waste or loss of finish build. Both compressors and turbines produce enough air to atomize most finishes in normal conditions. But turbines are limited on the topside if you need more than the usual amount of air. Compressors are not limited. You can increase the air pressure well beyond that obtained by a turbine.

Thinning is often the easier method of reducing orange peel, however. But the price is reduced build, which may cause you to have to apply more coats.

There are two additional possible solutions: Warm the finish before

PHOTOS BY THE AUTHOR

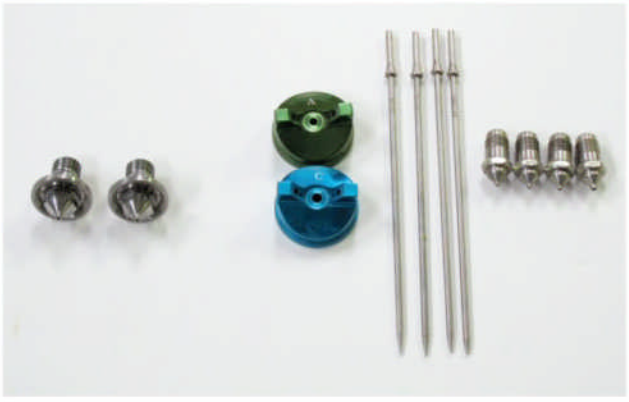
Warming a finish. *You can reduce the viscosity of a finish by warming it, as I'm doing here with a bucket of warm water. A thick finish, possibly caused by cold temperatures, then requires less thinning and less air pressure to be sprayed with no orange peel.*

spraying, or use a smaller-diameter fluid nozzle and corresponding needle.

Liquids are more viscous – that is, thicker – in colder temperatures and less viscous in warmer temperatures. Keep this in mind because in cold weather, your finish will likely be thicker in the morning unless you keep the thermostat up all night.

There are a number of methods of warming a finish. These include putting the container of finish in a larger container of hot water or using a bucket warmer or even an electric blanket (if you're careful) wrapped around the container of finish. You can even use an oven or microwave if the amount of finish is small.

Dry spray. *The next level up from orange peel caused by the finish drying too fast to flow out well is dry spray. Some of the spray actually dries before it hits the target. The result is that the finish feels rough and loses transparency because of random light reflection.*



Needle nozzle sets. *Some brands of spray guns come with, or have available, a choice of fluid nozzle sizes and even entire sets of needles, nozzles and air caps. On the left are alternative sizes of fluid nozzles supplied for compressed-air DeVilbiss guns. On the right are air caps, needles and nozzles supplied for Apollo turbine systems.*

Smaller-diameter needle/nozzle sets spray less fluid material, so less air is required to achieve good atomization. There are two problems, however. These sets are usually fairly expensive and may not even be available for your spray gun. And more importantly, they will cause your spray pattern to be narrowed and slow your production.

Speed & Distance

The second most common cause of orange peel is moving the gun too fast over the surface or holding it too far from the surface. The result is that you don't fully wet the surface so the finish can't level out. There is no proper speed or distance because there are too many variables: how fast the finish dries, what volume of finish is exiting the spray gun, whether the pattern is narrow or wide, etc.

The goal is to spray a wet-enough coat so the finish flows out and levels well, but not so wet that it puddles or sags. The only way you can know the correct speed and distance is to watch what is happening in a reflected light.

Doing this is more difficult when spraying vertical and complex surfaces. It's also harder to arrange enough lighting. But working with reflected lights is probably the single-most important rule in finishing, whether spraying or brushing, and it is rarely mentioned.

To get the best results, arrange your position and lighting so you can see how the finish is behaving at all times. A reflection is always necessary to see orange peel developing.

Drying Rate

A finish needs time to level before it begins setting up. If the balance between the temperature and the evaporation rate of the solvent (or solvents) isn't right, there may not be enough time for leveling. You will need to either lower the temperature in the spray area or add a slower evaporating solvent.

Lowering the temperature, usually with air conditioning, can be quite expensive because the cooler air is being exhausted so quickly. Thinning with a slower solvent, or retarder, is usually the easier way. But this, of course, could cause you to have to apply more coats.

One step past orange peel caused by the finish drying too fast is "dry spray," which has a sandy texture. The fix for dry spray is to thin the finish with retarder or hold the gun closer to the work. **PWM**

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

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Patience Learned, Not Taught

Youthful energy sparks the experience, but careful work takes time.

Recently, the young boy a few houses down the street wanted to make some things out of wood. His father told him that Mr. Bill (that's me) would be the obvious choice, because "he has made quite a few nice things out of wood, and seems to know all there is about woodworking."

Having been approached politely, I asked the elementary school-age fellow if he knew what it was that he wanted to make. I was pleased to hear that he did not – he just wanted to learn how to make things, "like you do."

His father warned me that the child has a short attention span, and he thought it was a hopeless cause. But I took the challenge, and after a short conversation, told the boy to come back on a Sunday afternoon when I would begin to teach him a bit about woodworking. I figured I would show him how to saw some wood, drive some nails and maybe plane a board.

He showed up. He had on a baggy long-sleeved shirt – we would not use any power tools because, I told him, the sleeves were a potential hazard to get caught in moving bits and blades. (I never intended to have power tools in the first lesson, but I was making a point.)

I showed him my tool cabinet, named the various tools while giving a short explanation of how they are used and, for some of my older tools, a history. I doubt he remembers any of it.

The next task at hand was to saw some wood. It's a centuries-old skill that we sometimes forget we had to learn. I learned on a low sawbench my grandfather had used. He had patience. He let me saw until I was tired. He let me cut trees, then showed me why I should have chosen a felling axe instead of a splitting axe. He had me drilling holes with a brace, and when I was exhausted from trying to speed through and had slowed to a normal pace, he remarked on how much easier it was at a slower speed.

Watching that boy try to be a human Sawzall brought back the memories. I showed him twice and told him four times, but he was going to need to get there on his own. After a large quantity of his youthful energy was expended, I pulled out some planes and a fresh scrap and had him watch me run a rabbet, round an edge and plow a groove. Clamping a fresh scrap in the vise, I handed the plane over to him. Seeing him struggle, I showed him how to adjust the plane to take a lighter cut. I reminded him again about using body weight and his big muscles to shoot through the boards.

We chopped a mortise, then I carved his initials in the chuck of mangled wood. By anybody's standards, the board was a display of failed attempts at every basic skill. But he wants to come back. That's a success.

He reminded me of so many things: My time with my grandfather; of having to be patient with a young lad; how some things can be frustrating; and mostly, that nothing worth having is easy. I'm willing to bet this kid will be pretty darn good one day. It might take him 30 or 40 years, but what the heck – maybe he will remember me. **PWM**

Bill is a former firefighter, currently in the fire and life safety field dealing with commercial properties.

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ULTRA-SHEAR

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