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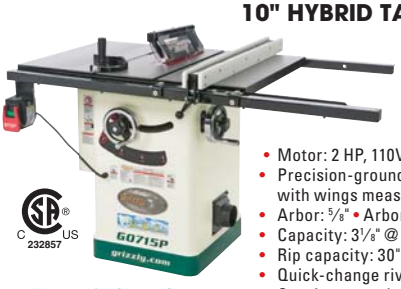

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- Minimum stock length: 8"
- Maximum cutting depth: ⅛"
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- Cutterhead diameter: 3⅛"
- Cutterhead speed: 4800 RPM
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COFFEE TABLE PHOTO BY MARIO RODRIGUEZ;
MOULDING & PRESS VISE PHOTOS BY AL PARRISH

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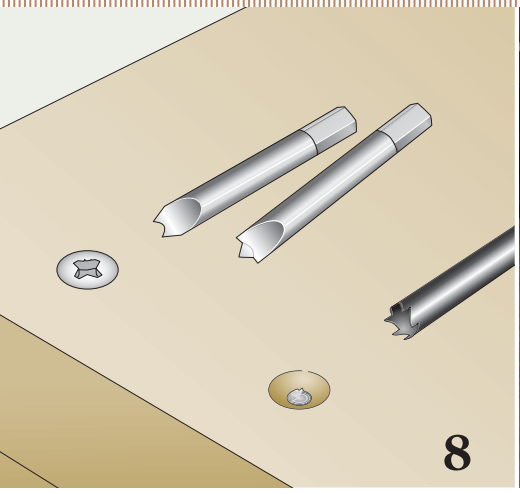
AUGUST 2014



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Most-requested 'Class'

While chatting amongst ourselves early in the year about sessions we wanted to teach at Woodworking in America 2014 (Sept. 12-14, in Winston-Salem, N.C.), Chuck Bender mentioned that the most-often requested class at his former school, Acanthus Workshop, was "How to Finish a Project" – and perhaps we could offer that session at this year's conference.

The potential session's title, however, didn't refer how to color your wood or protect it; it was a suggestion from the spouses of his students to – allow me to paraphrase here – "Teach my woodworker spouse how to follow through and complete the &*%$ projects he/she starts!"

Sorry; in this matter, we can be of no assistance. We are all, in fact, part of the problem.

Around my desk there are parts stashed from three projects that have languished for years; two of them (a Shaker hanging cabinet and an inlaid Bible box) moved here from my cubicle at our former location. That was three years ago. And they had cluttered my old cubicle for a while, too.

At home, I have several partially finished carving projects that my grandfather began more than a decade before he died. (To be fair, my favorite is one I asked him to not finish. It's a carved duck on which he'd completed the knife work; I liked it in the raw, without the fancy paint job he was planning. So that one is on me.)

In my ersatz home shop (also known as the study) is my English tool chest, on which I completed the case late in 2012. I feel certain it would be far more functional were I to finish the three sliding tills...and really, I've no excuse other than that life has gotten in the way. The pieces for said tills are already cut to size and the dovetails are laid out (and half of the joints on one till are even cut). The pieces have been on the shelf under my bench since January 2013.

Chuck Bender has the same problem – but on a far more grand scale. Among the many things he moved to Cincinnati from his shop in Pennsylvania upon joining the magazine staff last year is a Philadelphia highboy on which he began work in 1989. The casework was completed a decade ago. The carving? Not so much. And he has other exemplars of lack of follow-through.

And then there's Robert Lang, who among us is by far the worst offender (sorry Bob). He's moved several times since I've known him, and every move has included the box full of parts for hand mirrors and clocks he was selling on the craft-show circuit...in which he last participated in 1985.

At work, Bob still has several partially finished "Chinese Stools" kicking around (from a 2009 article), several half-built Stickley book racks (he was cajoled into completing one of them for the August 2012 issue) as well as bits and pieces for a couple Stickley tabletop book racks and several tabourets.

So I'm afraid we are poor examples when it comes to seeing all of our projects through to completion. It's instruction we're unqualified to offer…and to be frank, I don't know any woodworkers who are qualified. Sorry, spouses. **PWM**

PHOTO BY THE AUTHOR

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Methods to Remove Broken Screws

I am looking for a special tool to remove a broken screw. I used to have one, but I loaned it to a friend and he lost it.

It recall that it comes in several sizes, is hollow and cuts around a screw in wood. Then you remove the tool and break off the plug, fill the hole with a dowel and drill a new hole of the proper size and length.

Calvin Lepp,
via e-mail

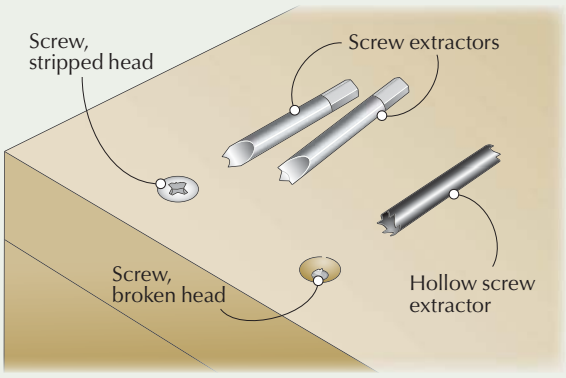
Calvin,
There are a couple of options for removing broken and stripped screws. First is a "screw extractor," which works best when there's a bit of the screw head remaining. The benefit to this approach is "saving" the screw hole – that is, once the stripped screw is removed, you can often just insert a new one in its place.

Depending on how deeply the broken part is recessed, you can also use a rotary tool (such as a Dremel) to cut a new slot in the steel (or whatever material the screw is), then use a regular driver to remove it. Again, this approach "saves" the hole.

Or, there's a "hollow screw extractor," which is the type you reference. As you note, it drills a larger hole around the broken screw and cores out the wood/broken screw. You then have to plug the hole and drill a new pilot hole once the repair is complete.

An online search using "screw extractor" and "hollow screw extractor" will return several sources.

Megan Fitzpatrick, editor



Chipbreaker Grind Angle

I was interested to see the "Chipbreaker Theory & Use" article in the April 2014 issue (#210), but there are two things I do not understand.

1. In the photo of chipbreaker preparation on page 34, it is clearly being held at about 70° to 80° to the stone. This is the sort of angle that Yasunori Kawai and Chutaro Kato recommend. It is clearly not 45°, as stated in the caption.

2. In the text, an angle of 45° is suggested.

I don't know precisely how important the "correct" angle is, but the article departs significantly from Kawai and Kato's research findings. But I have used 70° for my experiments, and this definitely works very well.

David Charlesworth,
Hartland, Devon

David,
I do hope that you enjoyed the article. Your books were among the very first that I bought when I started woodworking, and they are fantastic. So to call this "a reader question" is sort of like having Michael Jordan comment on my jump shot and saying that it's an observation from "a sports fan."

The variables that the woodworker can control in setting up the chipbreaker are the distance from the edge and the leading angle. In practice, I've found that the distance of the chipbreaker from the cutting edge is by far the more important variable. This is why I and Kees van der Heiden spent more space in the article on the placement of the chipbreaker. And again, my experience is that the leading angle of the chipbreaker is not that critical.

In addition, if you are using a standard Stanley plane, the curved front edge of the chipbreaker effectively gives you a leading angle of about 45º, and the shape of that chipbreaker makes it hard to manipulate that angle. It is true that if you have a more modern chipbreaker (such as one from Lie-Nielsen Toolworks, Veritas or Hock Tools) that the angle can be more easily manipulated, but we wanted to make it clear that woodworkers with vintage Stanleys could achieve excellent results.

Since the translation of the video came out, I've read multiple comments along the line of "Kawai and Kato recommend an angle of 80º for the leading edge of the chipbreaker." I think this is a bit of an over-extrapolation of their results. Keep in mind that in their setup, they are deliberately planing against the grain over an extended distance with a "plane" that has no mouth (it's just the cutting edge of a blade with a chipbreaker) and a bed angle of 40º.

With that in mind, it is perfectly conceivable that under more usual circumstances (using a plane with a relatively tight mouth and a 45º bed angle, and paying attention to the overall grain direction of a board when planing) such an angle may not be necessary. The first photo in the article shows a cherry board planed with a Stanley plane against the grain that is clean of tear-out with the chipbreaker is set properly; the leading edge of that chipbreaker is nowhere near 70°-80º.

I'm not saying that manipulating the leading angle won't affect your results. That can be clearly seen in the video. And

CONTINUED ON PAGE 10

ILLUSTRATION BY MARY JANE FAVORITE

CONTINUED FROM PAGE 8

I'm not saying that you don't get excellent results with an angle of 70°. But if I were not getting the results I want from my chipbreaker, making such a change would be the very last thing I would try.

Regarding the photo, it's true that the angle doesn't really match the caption. We do state in our article that the exact angle is not critical. But I think that the recommendation in the caption and in the article to aim for an angle of about 45° for the leading edge of the chipbreaker is a reasonable one.

Wilbur Pan, contributor

David

I have tested everything between 30° and 90°, and somewhere in the middle suits me best. They all work; you just have to adjust the distance accordingly. With very high angles it is easy to get too much compression of the shaving, and with very low angles the edge becomes quite fragile.

I agree, the picture is a bit misleading.

Kees van der Heiden, contributor

Anti-fatigue Mats

Years ago on the Editors' Blog you recommended using horse stall mats for workshops with concrete floors. I purchased one of those for my shop and have been using it for about three months. It is very durable, but it seems hard compared to foam mats. Do you still recommend these mats after you and the other editors have used them for an extended period of time?

Jerry Rhoades,
via e-mail

Jerry,

Chuck Bender, senior editor, has a much cushier anti-fatigue mat – the Hog Heaven, by Andersen – that he's used for years with good results. It costs a bit more than a horse stall mat, but he reports that the Hog Heaven is heavy enough to stay in place, and it still looks and performs like new.

I, however, prefer the horse stall mat in front of my bench – and, minus the sawdust, it still looks like new. But I am the only one among us who seems to like the harder, heavier (and thicker) surface. Perhaps it's because my work boots have heels (small ones), and the hard mat keeps them from sinking into the floor.

Megan Fitzpatrick, editor

How to Find Online Extras

I've received my first issue of *Popular Woodworking Magazine* (April 2014). On the table of contents there are several online references that I have not been able to find at popularwoodworking.com/apr14, specifically the "First Workbench?" mentioned. Could you help me find the article?

Brian Mills,
via e-mail

Brian,

Several people have asked this same question, so here's a primer:

All the extras for that issue are at popularwoodworking.com/apr14; once on the page, click on the headline for each article. That will take you to a longer description of the article, at the bottom of which you'll find all the extras.

We follow the same naming protocol for every issue, so, for example, extras from the December 2013 issue are found at popularwoodworking.com/dec13, June's are at popularwoodworking.com/jun13, and so on, then the links for each article are within the longer description of each.

But here's a direct link to the one about which you inquired:

http://www.popularwoodworking.com/projects/175_workbench **PWM**

Megan Fitzpatrick, editor

ONLINE EXTRAS

Letters & Comments

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Send your questions and comments via e-mail to popwood@fwmedia.com, or by mail to 8469 Blue Ash Road, Suite 100, Cincinnati, OH 45236.

PHOTO BY MEGAN FITZPATRICK

Highly Recommended

Sure, the packaging on this box says waxed paper is for the "microwave, baking, storing," but it's also a handy product to keep around the workshop. Use it between clamp jaws and your workpiece to keep glue off the clamp pads and bars, and spread it over your benchtop to protect it from the sticky stuff, too. In a pinch, it works well as tracing paper.

Plus, it's inexpensive and readily available (unless you're fancy and want the heavy-duty stuff…but why?).

— Megan Fitzpatrick

POPULAR WOODWORKING MAGAZINE

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Safety Note

Safety is your responsibility. Manufacturers place safety devices on their equipment for a reason. In many photos you see in *Popular Woodworking Magazine*, these have been removed to provide clarity. In some cases we'll use an awkward body position so you can better see what's being demonstrated. Don't copy us. Think about each procedure you're going to perform beforehand.

THE WINNER:

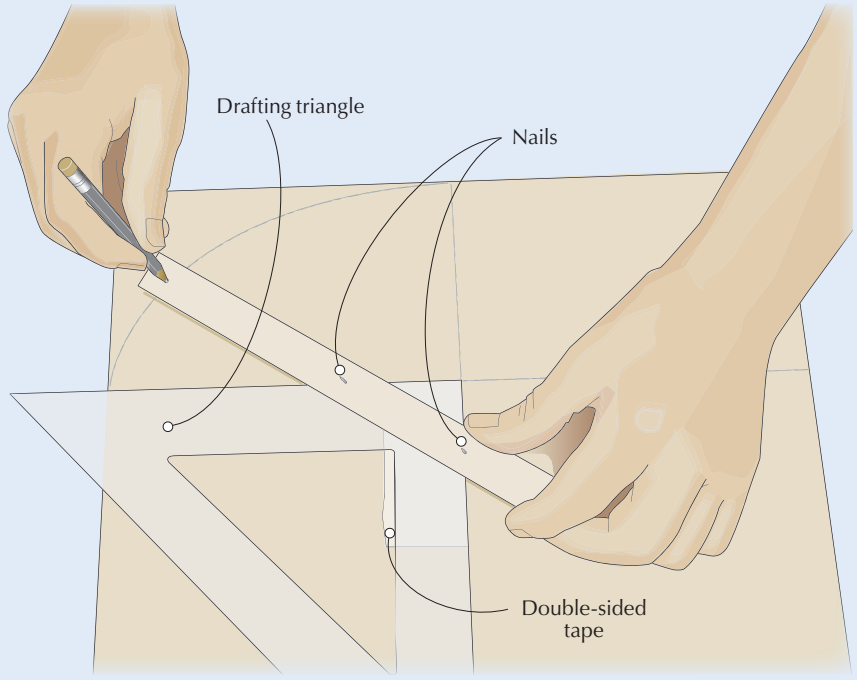
An Easy Way to Draw Any Ellipse

On my most recent project I needed an elliptical arc. Although my arc conforms to the Golden Ratio (1:1.62), the method I use works for an ellipse of any proportion.

Determine the overall size of the ellipse you need and cut a piece of pattern material large enough to encompass it. Next, draw vertical and horizontal lines that bisect the pattern stock. This divides the material into quarters; the arc is drawn in one quarter at a time.

Now make a simple scribing tool that allows you to draw the arc. Start with a thin strip of wood that is a little longer than half the longest dimension of the ellipse. Drill a hole near one end for a pencil point. From the pencil point, at a distance equal to half the height of the ellipse, drive a finish nail. Then drive another at a distance of half the width of the ellipse. Make sure to drive the nails so only about 1/16" protrudes below your wooden strip.

Use double-sided tape to attach a 45° drafting triangle to the pattern; the 90° legs should line up with the vertical and horizontal lines, and the corner of the triangle should be placed exactly at the intersection of the two lines. Make sure the triangle is firmly in place before proceeding.

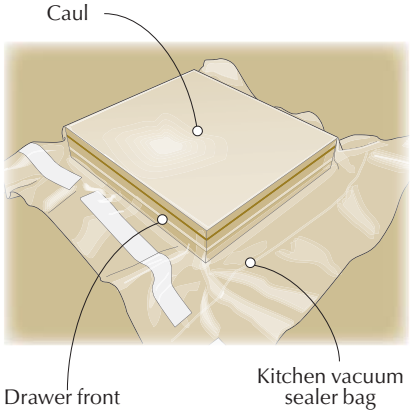


Hold the nail heads of the scribing tool against the edges of the triangle, and slide the nails along the edges as you mark the arc with the pencil. Flip the triangle into an adjacent quadrant to draw an arc, or into all the other quadrants for a complete ellipse.

This method works quickly and easily for ellipses of any size – though you might have to purchase a fairly large drafting triangle if your ellipse gets too big (of course, you can always substitute a piece of plywood if necessary).

Once you get the method down, you'll be able to draw elliptical arcs of any size in a snap.

Bill Wells,
Olympia, Washington



Kitchen Vacuum Press

While working on a project some years ago, I needed to veneer some small drawer fronts, but I had no vacuum press. Looking around for an alternative, I decided to give my wife's vacuum-seal food saver a try. It worked well and I've been using it ever since.

The great thing is you can make a bag to fit each drawer size you have. Usually I cut an extra piece of wood the same size as the drawer front to act as a caul, then I sandwich the veneer between the front and caul with a sheet of waxed paper in between.

Provided you don't run out of bag material, you can glue up all your drawer fronts at once without the use of a single clamp. Let them sit overnight and you're good to go.

I think you'll be hard-pressed to find a more versatile and economical way to glue your veneered drawer fronts and panels.

Leonard Harrison,
Browns Mills, New Jersey

ILLUSTRATIONS BY MARY JANE FAVORITE

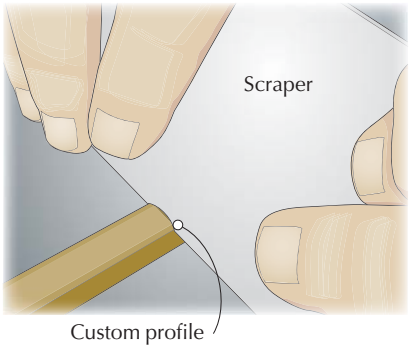
Pillow Scraper

While working on a recent furniture project, I challenged myself to do as much hand work as possible – so when it came to making Greene & Greene pegs and spline plugs, I had to find an alternative to the power-tool method I learned in a woodworking class to achieve a consistent, soft pillow profile.

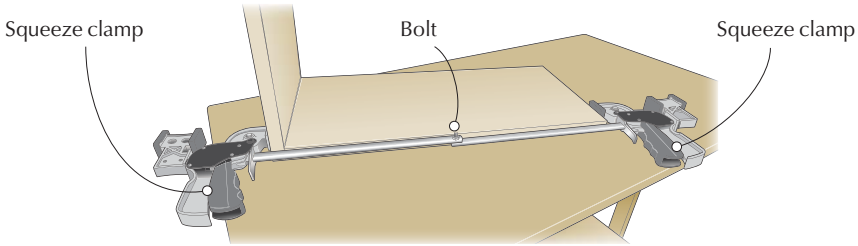
After sanding and filing the pieces by hand, I was unhappy with the results. Then it occurred to me that a scraper with a custom profile might just be the solution.

I used diamond files to shape the edge of a scraper until I got the profile I wanted. Then I chucked a 12"-long piece of ebony stock in my lathe to hold it in place, and scraped one side. I rotated the piece 180° then scraped the opposite side with the same profile. With the profile scraped, I took a polisher to the blank and brought the surface to the appropriate shine.

Splitting the piece along its length gave me two identical strips from which to make plugs and splines. I just rounded the ends by hand with sandpaper, gave the pieces one more polish, then glued them in place.



Steve Boudreau,
Coldwater, Ohio



Clamp Extension

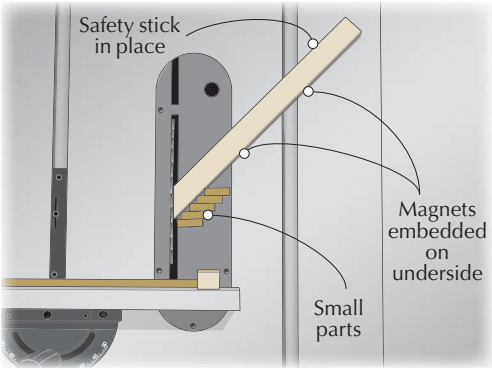
When gluing large cases or extremely wide panels, I often do not have enough long clamps to ensure a proper glue-up. This is a trick I use that works quite well.

I take two squeeze clamps and remove a jaw from each. At the end of the clamp rod there is a hole into which I slide a bolt to join the clamps. In a matter of seconds, I can create just about any size clamp I need.

Alejandro Balbis,
Longueuil, Quebec

Cut Small Parts Safely at the Table Saw with a Simple Stick

Cutting small pieces using a miter gauge at the table saw continuously runs the risk of blade vibration causing the pieces to kick back.



To safely cut small, identical pieces, I've made a wooden strip about 1" wide and 10" long with a mitered end and two magnets recessed on the underside. I place the strip on the saw table with the mitered end just a hair away from the blade and behind the rotating teeth. When I push the miter gauge and stock past the saw blade, the small pieces are pushed away from the spinning blade. PWM

Charles Mak,
Calgary, Alberta

ONLINE EXTRAS

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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 web site (leevalley.com). (The tools pictured below are for illustration only, and are not part of the prize.)

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SuperMax 19-38 Drum Sander

Attention to detail makes this machine a top-quality addition to any shop.

The first thing that comes to mind upon seeing the SuperMax 19-38 drum sander is the company's focus on quality. It's evident in everything from the castings to the precision-milled drum to the thoughtful placement of the controls and adjustments.

Though Warren Weber and Bill Schroeder founded SuperMax Tools in 2005, they've had their hands in drum sanders for more than two decades. Both worked with and helped to develop sanders for Performax before Jet purchased the company. When the two decided to venture on their own, they wanted to build better machines. The 19-38 demonstrates that we all benefit from their experience.

This open-ended sander provides versatility while maintaining accuracy. Stepping up to a 19" single-width (38" double-pass) sander comes with some inherent problems; the foremost is how to keep the head and feed table parallel. SuperMax overcomes this with beefy head castings and a single-point adjustment on the table. The fact that you can make quick, accurate adjustments to the table by turning a single nut is reason enough to own one.

The attention to detail continues with the extended-width feed table. Most sanders have tables that end at the same point as the head. The SuperMax extends 3" past the head to provide extra support to wide boards (it does, of course, take up a little extra shop space).

SuperMax Drum Sander

SuperMax Tools ▪ supermaxtools.com or 888-454-3401

Street price ▪ from $1,399

▪ **BLOG** *Learn more about the SuperMax story on the Editors' Blog.*

Prices correct at time of publication.

Versatility & quality. *The SuperMax 19-38 drum sander accurately smooths boards up to 38" wide, and quick-release clamps make grit changes a snap. (The extended infeed and outfeed tables pictured at left are optional.)*

Tracking the feed belt on machines of this type can often be problematic, but this sander has adjustment wrenches permanently attached for quick and easy changes. And for sanding that extra-wide material, there's a "Fast Lever" that adjusts the table and eliminates any overlap sanding ridge.

The height adjustment is also impressive. A quarter turn of the knob moves the head in accurate 1/64" increments, and there's no backlash.

Dust collection is always a major concern with sanders. The 19-38 performed nearly dust-free when attached directly to a small collector (about 500 cubic feet per minute, though 600 CFM is recommended).

My one complaint about the 19-38 is the dust-port placement. The 4" port is exactly in the center on top of the head. Unless your hose is connected from above, it will be in the way. This makes the optional casters less of an option in my book; the sander needs to be stationary for effective and convenient dust collection. (Among other available options are a closed base, digital depth gauge and infeed and outfeed tables.)

All of these details are important – but not as important as how the sander performs. The cherry and sugar pine I ran through the machine came out perfectly flat after each grit in my progression (#80, #100, #150 and #180), and was as smooth as expected with each.

The machine is powerful; my tests didn't bog it down – and should you end up taking too thick a pass, the "Intellisand" system slows the feed rate to avoid burning the belt or the wood's surface. It works so well that I didn't scorch the surface of a cherry board while taking off 3/64" in a single pass at the highest feed rate (note: this is not recommended).

Being able to smooth tabletop-width boards is the primary reason you would want this sander in your shop. With spring-loaded clamps on the head that make paper changes a snap, you can take a couple of glued-up rough boards to finish-ready in very little time.

— Chuck Bender

CONTINUED ON PAGE 16

PHOTOS BY AL PARRISH

CONTINUED FROM PAGE 14

Arbortech TurboPlane & Mini-Turbo

If you are into sculpting wood or forming sculpted furniture parts, the Arbortech TurboPlane and Mini-Turbo are two tools that could make your work much easier. Although they are sold separately, they work well as a team.

The TurboPlane is an easy-to-handle, relatively safe 4"-diameter power carver that fits on most standard angle grinders. It can be used freehand to create flowing contours or with a rub pattern to make repetitive shapes. Unlike many power carvers, this one works with the carbide teeth safely beneath the tool rather than along the edge. This gives the tool a more natural feel when removing waste, and it allows for extremely fine cuts because you can use the grinder itself as a fulcrum to adjust the depth of cut.

The Mini-Turbo is just a smaller (2") version of the TurboPlane that gets you into tighter places. The sanding disks that come with it are a tremendous boon to the operator because they quickly smooth out any bumps left by the power carver.

Both tools quickly gobble up wood regardless of species. In testing, I found both tended to grab less than other power carvers, but were still aggressive enough to quickly waste away material. I experienced it grabbing only on startup; the more I practiced with the tool, the less of a problem it became.

The larger carver has permanently affixed teeth that can be resharpened with a few strokes on a diamond hone. On the mini, the teeth are replaceable. A couple of quick turns with an Allen wrench and you're up and running with fresh teeth.

If you're looking for an affordable way to get into power carving, these Arbortech tools are worth considering.

— CB

TurboPlane & Mini-Turbo

Arbortech ▪ arbortechusa.com or 866-517-7869

Street price ▪ from $139 to $159

▪ **ARTICLE** *Read how The Wood Whisperer uses power tools to sculpt his pieces.*

Prices correct at time of publication.

Diablo General Purpose & Crosscut Finish Blades

In recent years, Freud's Diablo brand has become synonymous with high quality, high tech, reasonably priced circular saw blades; these new blades should only enhance that reputation.

The D1040X (general purpose) and D1090X (fine crosscut) blades feature unique grind angles on the teeth. Both are alternating-top-bevel blades, but they sport a 30° bevel rather than the standard 15°. They cut using a shearing action that produces a smoother surface with less tear-out.

The D1090X (which Freud calls its "Ultimate Flawless Finish" blade) also has the faces of the teeth ground at an angle. Freud calls this the Axial Shear Face Grind (ASFG), which accentuates the shearing action and produces a glassy-smooth surface with no tear-out. This blade works well in hard and soft woods, but shines when cutting veneered surfaces.

Its kerf is only .084", so you'll squeeze more pieces out of that stick of moulding. And the ASFG produces a flawless finish cut that needs no touching up. You can easily cut finished moulding without fear of tearing out.

The D1040X is a general-purpose blade with a .097" kerf that leaves a surprisingly smooth crosscut surface, given that it only has 40 teeth. For general hardwood and softwood work, this blade is a winner.

I tested the blades on two different table saws and a compound miter saw. Each left behind relatively flat surfaces on crosscuts and rips. Even with thin kerfs, they run true. I did notice a slight deflection with the 40-tooth blade while crosscutting, but it was minor.

If it's time to upgrade your saws, you can grab both blades for less than $100. **PWM**

— CB

Freud Diablo Saw Blades

Diablo Tool ▪ diablotools.com or 800-334-4107

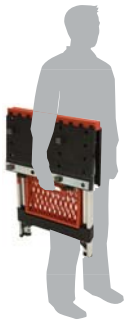
Street price ▪ from $29 to $53

▪ **IN OUR STORE** *Protect your new blades with this table saw blade box.*

Prices correct at time of publication.

QuikBENCH™ Portable Workbench

The portable QuikBENCH™ is a lightweight, easy to set up workbench capable of holding up to 300 lbs. Convert two QuikBENCHES to sawhorses, and together they will hold up to 2,000 lbs. Two benches can be connected together to form a workstation; in fact, you can connect as many benches as necessary to create a bench sized to your specific needs. The QuikBENCH work surface measures 30" x 24" and is 32" in height. Each bench has a 24"-wide by 3½" opening vise and a 15-amp, circuit protected, three-outlet power strip, plus four plastic bench dogs.



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Improvisation

Modifying a design means more than simply scaling.

"Art begins when an observer's sensibilities engage with the understatements of a calculating craftsman."
— Sara Genn, artist and musician

Design matters at any scale. *Even tweaking a tool handle a tad longer can be a challenge. These marking knives by Czeck Edge are nice examples of modifying a design.*

How do you modify a design without making a hash of it? It's a common question that dogs even the experienced woodworker. Any good cook knows that simply doubling ingredients is asking for trouble. Somehow those flavors that danced together in a recipe for six go flat when combined for 12. Scaling an adult-sized chair to a child-sized version is more than just making everything 40 percent smaller. Anatomically it might fit, but it just looks off.

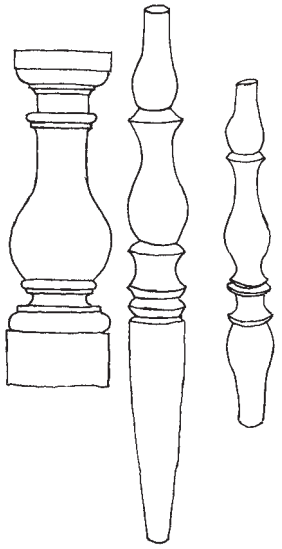
In furniture design, this plays out in a variety of problems, from scaling a cabinet to fit an odd corner of a room, to integrating a seashell into a carving, to something as deceptively simple as lengthening a turned handle on a marking knife. And then there's the adventuresome soul who might want to grab inspiration from a pleasing form and make a major detour, while still echoing something from the original.

In all these scenarios, it's helpful to take a closer look at the original inspiration and discover what lies beneath the surface. This knowledge is the raw material that informs judgment and makes it possible to move ahead without stumbling completely in the dark.

Unpack a Turned Spindle

Turned-spindle designs are a good place to learn how to dig beneath the surface to get at the heart of a composition. Experienced wood turners with a good eye can make design adjustments effortlessly, perhaps because over time they gain a feel for how elements combine to create a pleasing composition. That's the goal of unpacking a design: to give the inner eye a stronger sense for when something feels right.

This is not about decoding some formula to be cloned, but more like listening to good music or tasting good food and allowing it to inform our judgment. Once you see how the parts of a design mesh, it's easier to make confident design choices. To do this, it's necessary to unpack the original design.



Design echoes. *This Windsor chair leg and arm support both contain an echo from the original inspiration – the stone architectural baluster on the left.*

It's also important to understand there's an order to this madness. Start with the larger parts that reveal themselves from a distance, then work down through smaller elements that become readable as you move closer.

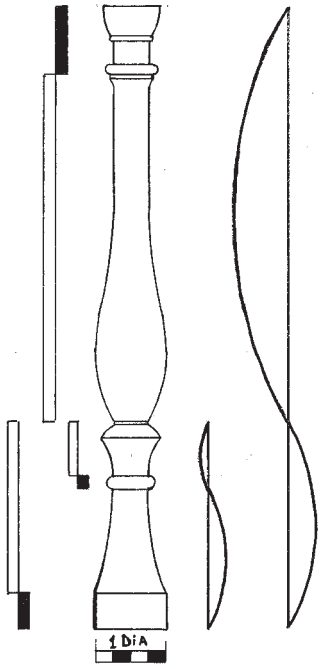
This also applies to making adjustments on a design. The first ones to tackle are usually the ones that stand out from across the room. Get those out of whack and no amount of fiddling with details will right the ship.

Solve the Puzzle

The design on the next page looks simple, but it contains several layers of interwoven proportions. Grab a pair of dividers and see if you can uncover them yourself. Don't get hung up on extreme accuracy trying to determine proportional relationships. The goal is to get a sense for the flavor behind the design. This isn't astrophysics. If you find a simple ratio that seems close to, say, 3:5, it probably is.

Begin by looking at the most apparent feature – the overall heft of the composition. This is the length and how it relates to the major diameter

PHOTO & ILLUSTRATIONS BY THE AUTHOR



Divide it up. *Learn more by digging out the secrets of this design yourself. Use a pair of dividers to unpack this turned-spindle design.*

that dominates the design. Traditional designers often linked the height of a column or spindle to a base diameter.

A hefty spindle may be five diameters high while a slender stair baluster might be 20 diameters high. This recognizes that there is a proportional linkage between diameter and length.

That doesn't mean that to alter a spindle you must rigidly copy the original diameter vs. length ratio. To the contrary, your eye may call for you to make it more slender or robust. The key is to bump it, keeping this relationship in mind. You may find that your eye requires you to bump that 10-diameter length up to a more slender 12.

While you are at it, poke around and note how many sub-elements within this design are simple fractions or multiples of that base diameter.

Identify Contrast in a Design

Next look at how the length is divided into major and minor parts that play off or contrast with one another. Keys on the right side of the drawing (above) hint at contrasting elements. There's a hierarchy at work with major and minor groupings playing complementary roles. Probe to discover how the major and minor relate proportionally with each other as well as how they relate to the whole.

Traditional designers often used simple whole-number ratios – 1:2, 2:3, 3:4, 3:5 or 4:5 – to create a harmony between these major and minor pairings. Often these parts can contain smaller sub-elements that create additional layers of contrast.

This principle of contrast also applies to curves. Curves can complement in several ways including concave/convex, faster/slower (steep vs. gradual), and smaller arcs complementing larger arcs. Take a closer look at the curved sections and note how they employ contrast.

Punctuation & Borders

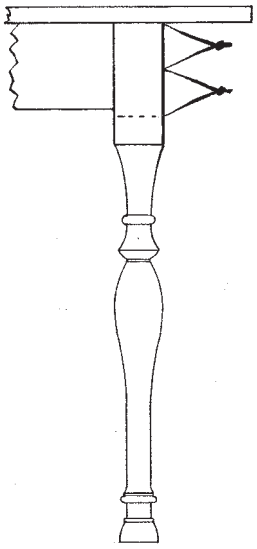
While major and minor elements complement each other in pairings, punctuating elements create borders or transitions between parts. Keys on the left side of the drawing highlight punctuation. They are smaller elements that highlight the termination of a larger part.

While contrast uses proportional ratios such as 1:2 or 3:5 to create harmony, a punctuating element is a small fraction of the part with which it engages, often one part in five or even one part in 12. Just as with major/minor pairings, these punctuating elements can work on the larger parts down to the micro level with small punctuation on sub-elements.

Now stop right here, go grab your dividers and try this out for yourself. Then, come back and read the rest of this article to discover how I used this spindle design as inspiration for a kitchen table leg.

Application

This composition was originally a design for a stair spindle but I thought I might make it into a kitchen table leg. I flipped it upside down and established the overall heft by determining the major diameter. I used a thumbnail sketch of the table with an apron and used trial and error, stepping off the height with dividers before finally settling on a leg 11 diameters high. I needed room for the apron joinery so I extended the section at the top by two diameters. I may still choose to add or subtract details from the original design but the underlying proportions are still intact. **PWM**



In practice. *The dashed line indicates the top of the original design. I extended the top section by two diameters to make room for the apron joinery.*

George is the host of two design DVDs (Lie-Nielsen Toolworks) and co-author (with Jim Tolpin) of "By Hand & Eye" (Lost Art Press).

ONLINE EXTRAS

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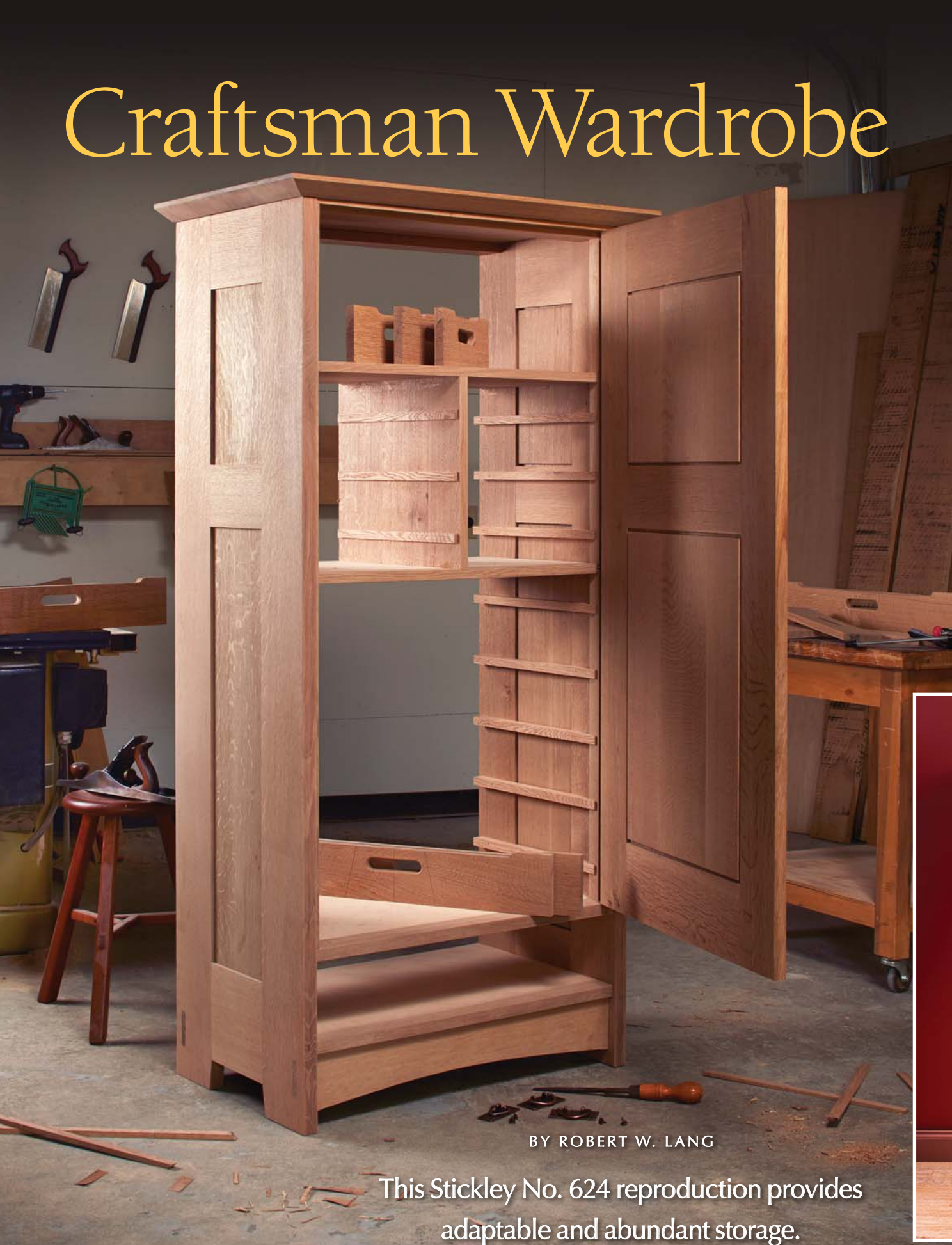
About This Column

Design Matters

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

Craftsman Wardrobe



BY ROBERT W. LANG

This Stickley No. 624 reproduction provides adaptable and abundant storage.

The lack of closet space is a common problem in older homes. In the early 1900s Gustav Stickley offered this wardrobe as a solution. He used a shorter version in his own home, and in his retirement experimented with finish formulas on the bottoms of the drawers.

I've taken a few liberties with the original details. In photos of original pieces there appears to be an inner case that contains the drawers. I think this allowed the factory to produce outer carcases in a standard configuration, then slide in variations of inner cases. I eliminated the inner case to save time and reduce the overall weight of the finished piece.

I used plywood for the carcase dividers that are out of sight and modified the way the drawer slides attach to compensate for no inner case. The outer case is quite strong on its own and the overall form is adaptable to a number of modern uses. The inner drawers could be replaced with shelves and this would make a great media cabinet, or you could leave out the upper bank of drawers and install a rod for hanging storage.

Four at one go. *To make layout easier and more exact, group the stiles together and mark them all at once.*

Get in the groove. *Your already-cut 3/8" groove provides an excellent alignment guide as you cut the mortises.*

First Things First

Casework is all about boxes; one big box contains a number of smaller ones. In this piece, the case sides need to be assembled first.

There are two 3/4"-thick panels in each side assembly. The upper ones are 9" wide x 15" long ; the lower ones are 9" wide x 36" long. If you don't have single panels of this size, go ahead and glue those up and set them aside to dry before moving on to the side frames.

All of the frame parts for the side assemblies are 1 1/4" thick. This provides a solid structure and eliminates the need for a face frame. After selecting the material and milling the stiles and rails to size, I grouped the stiles together to lay out the joinery.

The faces of the panels sit back 1/4" from the faces of the stiles and rails. The first step is to cut a 3/8"-wide x 1/2"-deep groove from the top of each stile down to the location of the lower rails on one edge of each stile. It doesn't matter exactly where the grooves stop, as long as each terminates inside your layout lines for the 3/8"-wide mortise.

With the four parts clamped together on edge on the workbench, I used a plunge router with a fence to cut the grooves. The clamped-up pieces serve as support for the router base. Rout the groove in the two outside pieces first, then swap those two to the middle and re-clamp them. This way, the same fence setting works for each of the grooves.

The 1 1/2"-deep mortises are in line with the grooves, and again there are a number of ways to make them. I used the hollow-chisel mortiser. Setup is straightforward; the fence is set to drop the chisel into the groove.

The top and bottom rails have a groove on one long edge and the middle rail gets a groove on both edges. Because these pieces are shorter and of different widths, I set up the table saw with a 3/8"-wide dado stack and made these grooves by running the parts on edge.

Time for Tenons

At the table saw, I swapped the dado stack for a combination blade and made the shoulder cuts on the rails first, using

Tenon jig. *A jig with a toggle clamp holds workpieces securely on end to safely cut tenon cheeks at the table saw.*

LEAD PHOTO BY AL PARRISH; STEP PHOTOS& ILLUSTRATIONS BY THE AUTHOR

Dead-on. *Raise the blade to the bottom of the groove to set the depth of the shoulder cuts. Set the edge of the blade to the edge of the groove to cut the cheeks.*

Drill & pare. *The size and location of these mortises in the stiles makes it awkward to use the mortiser. So I use a Forstner bit to cut the mortises, then pare the ends square.*

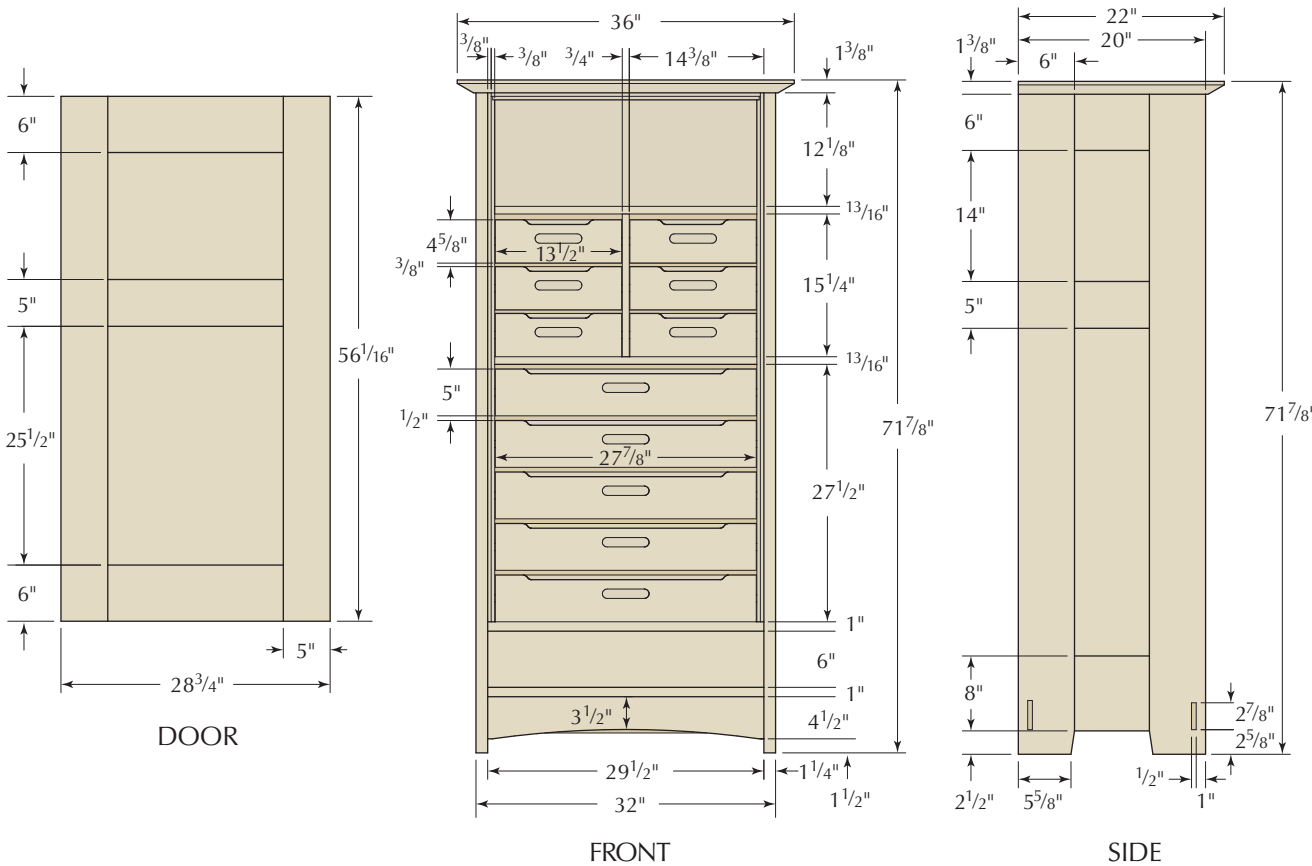
our sliding table with a stop to control the length of the tenons.

The tenon cheeks were cut using a jig that rides on the saw fence and holds the parts vertically. Because the tenons are off center, the cuts require a slightly different setup for each cheek and each shoulder cut. Aligning the cuts directly with the blade minimizes the set-up time and makes for more accurate work.

I aim to make tenons with a good fit – but I aim a little wide on the table saw and fit each joint by hand. I dry-fit the side assembly frames, clamped them together and planed the joints flush.

Before making and fitting the panels, I made the through-mortises for the lower rails at the bottom of each stile. These are ½" wide and, rather than change the setup on the mortiser, I headed to the drill press where I removed the waste with a ½"-diameter Forstner bit. I cleaned up the sides with a wide paring chisel and squared off the corners with a ½" mortise chisel.

Then, I cut a ⅝"-wide rabbet around the perimeter of the inside on each of the four panels to leave a ⅜"-thick tongue.



With the mortises cut and the panels cleaned up, I sanded the inner edges of the stiles and rails to #150 grit.

At some point before glue-up, cut small tapers for the feet at the bottom of each stile. I cut these with a jigsaw, removed the saw marks with a plane, then glued the side assemblies together.

Side-to-Side Joinery

The front and back rails at the bottom of the case are solidly connected with through-tenons. I cut the tenons on the rails at the table saw, but left the cheeks at the full width of the board until I had them fitting nicely in width from the inside of the panel (see the photos on page 24).

Then I cut the top and bottom shoulders. For fitting, these tenons are cut about 1/4" too long and are trimmed flush to the outside of the panel after assembly. Before assembly, though, mark then cut the gentle curve on the lower front rail; for this, I used a band saw, then cleaned up my cut with rasps followed by sandpaper.

I dry-assembled the sides and bottom rails, and clamped them together.

Tapered foot. *Before gluing the side assemblies together, use a sliding bevel gauge to mark tapers at the bottom of all four stiles. The tapers start 3/8" in from the inside edge and terminate slightly below the bottom rails.*

SUPPLIES

Lee Valley
leevalley.com or 800-871-8158

3 ▪ brass door hinges
#00D05.01, $37.80 per pair

1 ▪ brass double ball catch
#00W12.04, $4.50

2 ▪ cast brass mission pulls. 3 3/4" x 2"
#01W29.51, $4.50 each

1 ▪ cast brass mission pull, 1 1/2" x 4"
#01W29.55, $9.80

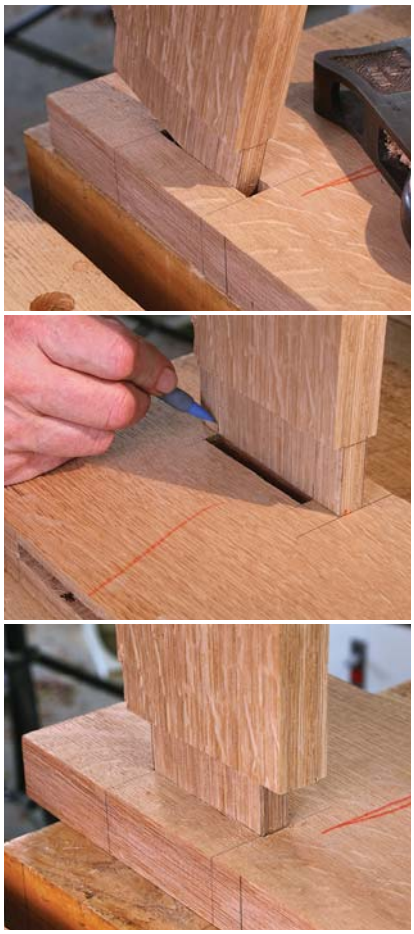
1 ▪ aniline water stain, Fumed Light Oak
#56Z04.01, $9.95

Prices correct at time of publication.

Craftsman Wardrobe

NO.	ITEM	DIMENSIONS (INCHES) T	W	L	MATERIAL	COMMENTS
❑ 4	Case stiles	1 1/4	6	70 1/2	QSWO*	
❑ 2	Case lower rails	1 1/4	8	11	QSWO	1 1/2 TBE**
❑ 2	Case mid rails	1 1/4	5	11	QSWO	1 1/2 TBE
❑ 2	Case top rails	1 1/4	6	11	QSWO	1 1/2 TBE
❑ 2	Case lower panels	3/4	9	36	QSWO	
❑ 2	Case upper panels	3/4	9	15	QSWO	
❑ 2	Top cross rails	13/16	4	31	QSWO	3/4 DBE†
❑ 1	Lower front rail	1	4 1/2	32‡	QSWO	1 1/4 TBE
❑ 1	Lower back rail	1	4 1/8	32‡	QSWO	1 1/4 TBE
❑ 1	Top	1 3/8	22	36	QSWO	
❑ 2	Lower div. & bottom edges	1	2 9/16	29 1/2	QSWO	
❑ 2	Lower divider & bottom	3/4	16 9/16	30	Plywood	
❑ 1	Mid-divider edge	13/16	1 1/4	29 1/2	QSWO	
❑ 1	Mid divider	3/4	16 9/16	30	Plywood	
❑ 1	Shelf	13/16	17 13/16	30	QSWO	
❑ 1	Vertical divider	13/16	17 13/16	30	QSWO	
❑ 2	Vertical door trim	3/4	2 7/16	56 9/16	QSWO	
❑ 1	Top door trim	13/16	1 3/8	28 3/4	QSWO	
❑ 1	Back	1/2	30 1/2	64 1/4	QSWO or plywood	
DOOR						
❑ 2	Stiles	1	5	56 1/16	QSWO	
❑ 2	Top & bottom rails	1	6	22 1/4	QSWO	1 3/4 TBE
❑ 1	Mid rail	1	5	22 1/4	QSWO	1 3/4 TBE
❑ 1	Lower panel	3/4	19 1/2	26 1/4	QSWO	
❑ 1	Upper panel	3/4	19 1/2	14 3/8	QSWO	
DRAWERS						
❑ 10	Lower drawer fronts/backs	3/4	5	27 7/8	QSWO	
❑ 10	Lower drawer sides	3/4	5	16 13/16	QSWO	
❑ 5	Lower drawer bottoms	1/2	16 5/16	26 7/8	Plywood	
❑ 12	Upper drawer fronts/backs	3/4	4 5/8	13 1/2	QSWO	
❑ 12	Upper drawer sides	3/4	4 5/8	16 13/16	QSWO	
❑ 6	Upper drawer bottoms	1/4	16 5/16	12 1/2	Plywood	
❑ 16	Outer drawer guides	3/4	1	17 1/16	QSWO	
❑ 6	Inner drawer guides	1/4	3/4	17 1/16	QSWO	
❑ 2	Bottom drawer fronts/backs	3/4	6	29 1/2	QSWO	
❑ 2	Bottom drawer sides	3/4	6	18 3/16	QSWO	
❑ 1	Bottom drawer bottom	1/4	17 15/16	28 1/2	Plywood	

*quartersawn white oak; **TBE = tenon both ends; †DBE = dovetail both ends; ‡cut longer and trim flush after assembly



Thickness first. *Get the tenon fitting in the mortise side to side, then mark from the work to get the perfect tenon width.*

Tail transfer. *With the case dry-assembled and clamped, it's simple to mark the sockets for the top rail's dovetails.*

Waste removal. *A small router with a fence makes quick work of removing the bulk of the waste in the large dovetail sockets.*

At the top of the case I used a pair of dovetailed rails at the front and back to connect the side panels. The top gets screwed to them at the end of the project.

I cut a rabbet on the bottom of the ends of the top rails, leaving about 5/8" of thickness. Then I cut the tails and put the rails in position between the dry-fit carcase. The rabbet allowed me to register the pieces to the side assemblies and clamp them in position while I transferred the tails to the ends of the stiles to mark the sockets.

Rather than take the case completely apart to complete the joint, I removed the rails and made angled saw cuts at the ends of the sockets. I removed most of the waste with a small router before paring to my layout lines with a chisel.

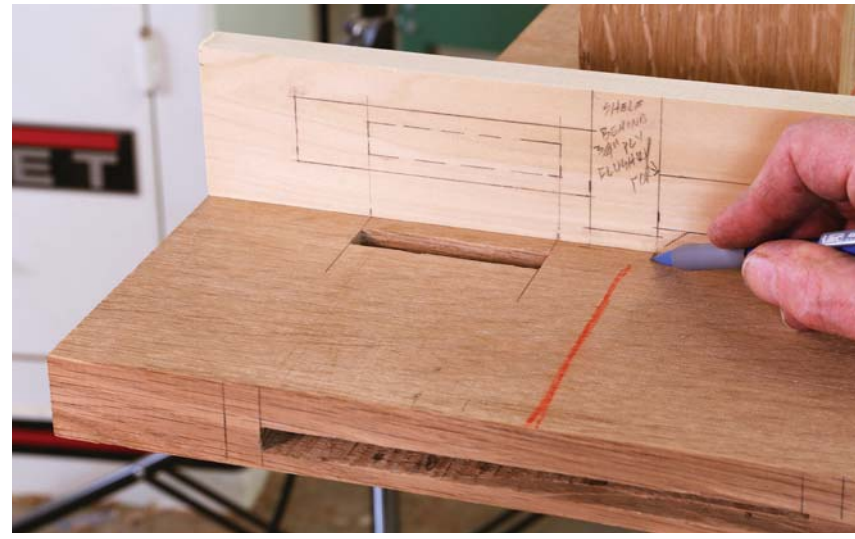
Storage Galore

Inside the case are the bottom and a horizontal divider above the bottom drawer, horizontal dividers between the full-width and half-width inner drawers and a vertical divider between the half-width drawers. There's also a shelf above the smaller drawers that supports open storage at the top of the case.

The bottom and bottom divider are set back 1/4" from the case front; the remaining dividers and the shelf are set back 1 1/2". I made a story stick that indicated the locations of these parts vertically along with their distance from the front edge.

The shelf is solid wood, as is the vertical divider between the upper drawers. I chose solid for these pieces because they can be seen when the door is open. The bottom and the horizontal dividers are 3/4"-thick birch plywood with a solid piece of oak glued to the front edge.

The horizontal dividers and shelf



Story stick. *With many shelf locations to lay out, a detailed story stick is an excellent tool.*

Trusty guide. *This dado jig supports the router on both sides of the cut. The slot in the jig is the exact width of the dado. When I make the jig I clamp the two sides with a scrap from the shelf in between to match the slot to the material.*

sit in 1/4"-deep stopped dados that stop even with the plywood-solid juncture (17 3/16" from the back edge of the case, which includes 5/8" for the backboards). That allows the solid front edges to be thicker than the plywood for appearance's sake. I cut the edges to length with the other case parts temporarily clamped together to get a nice fit; these are simply glued to the edge of the plywood when the case is assembled. The solid oak shelf is notched at the front to fit the dado.

The vertical divider runs in two 16 9/16" dados; one centered in the underside of the shelf and another on the top of the top divider. The divider is notched at the front.

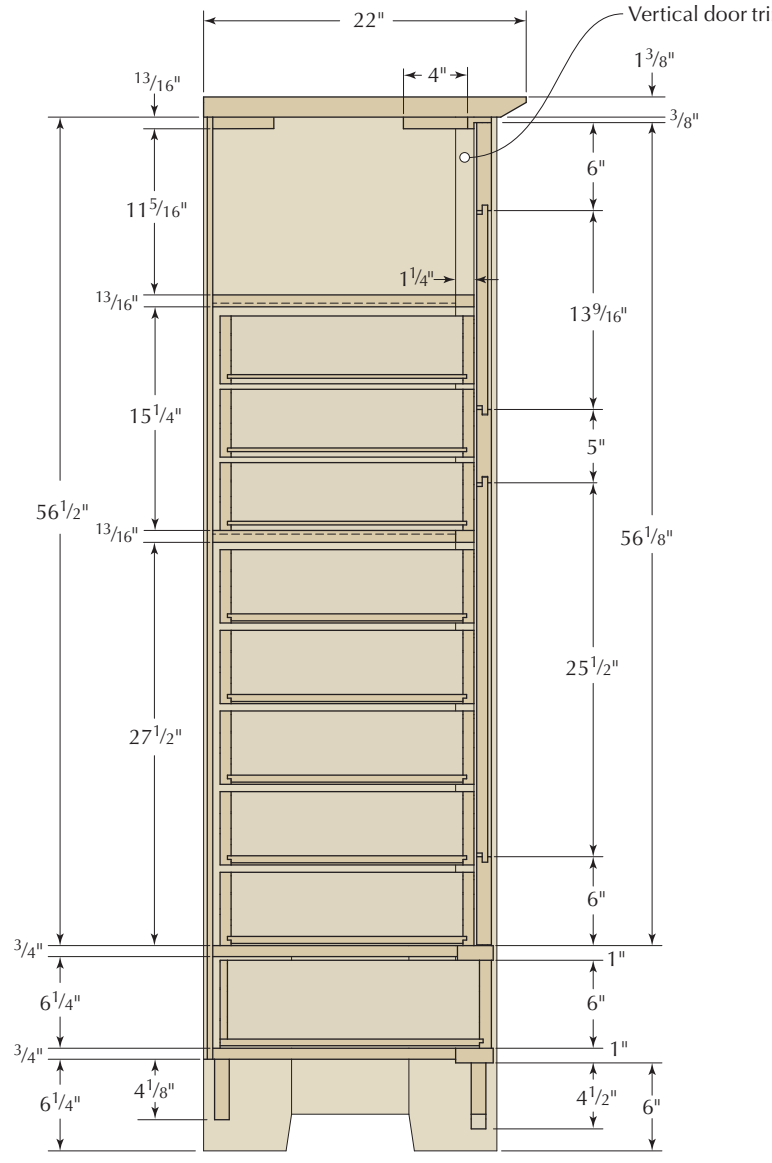
The dados were all cut with a router, using a 5/8"-diameter mortising bit with a short cutting length and a bearing above the cutter. I cobbled together a simple jig to guide the router and match the thickness of the shelves.

The final bit of joinery on the carcase is the 1/2" x 5/8" rabbet along the back edge of the sides to accept the back. It runs from the top of the back stile to the bottom edge of the carcase bottom.

After a final dry-assembly to make sure everything fit as it should, I took the carcase back apart to plane the stiles and rails smooth, and sanded the visible parts of the case interior to #150 grit.

"The impulse of the true craftsman is to love and properly treat the materials which lie nearest to his hand since they possess for him the endearing qualities of old and familiar acquaintanceship."

—Gustav Stickley, from The Craftsman



SECTION

Glue-up on a carcase this large and heavy requires some planning. With one of the side assemblies inside-up on some beams across low horses, I began with the through-tenoned lower rails. I got the tenons started in the mortises then brushed glue on the tenons only. This prevents glue from squeezing out and making a mess on the outside of the case.

Then I applied glue to the dados and the ends of the dividers and shelf before putting them in place.

It is a two-person job to lift the second side assembly into place. I applied glue to the tenons and the shelves and in the dados in that assembly, then Chuck Bender and I lifted the panel and flipped it into position.

When everything was lined up, we tapped the joints home and clamped the case together. The last pieces of the carcase were the two top rails. These can be nailed or screwed on from the top to hold the tails in the sockets while the glue sets. Before moving on to the door, I glued on the hardwood divider edges.

Half the Battle

The door is made similarly to the side assemblies, except for the panel groove; on the door it is 3/8" deep. The 1"-thick stiles and rails are joined with mortises and tenons; the two glued-up panels are the same thickness and configuration as the side panels. If you look at the illustration on page 22, you'll note that the door is smaller than the current opening. That's because there are trim pieces around the opening to form a dust seal between the inside and outside of the cabinet, and to create the necessary clearance for the barrels on the hinges and to allow the door to swing fully open.

On both sides and the top there is 3/8" between the door and the case. This gap is filled with a strip of wood that carries the hinges on one side. At the top there is a smaller strip with its back edge butted against the front of the top rail.

On the sides, the trim pieces are 3/4" x 2 7/16" x 56 9/16", with a 1 1/8"-wide x 3/8"-deep rabbet; the top trim is 13/16" x 1 3/8" x 28 3/4", with a 1 1/8"-wide x 7/16"-deep rabbet. These rabbets form the dust seal. I made and fit these parts, then built the door to fit the opening with a slight reveal all around (I shoot for 1/16").

Below the door is a single drawer with half-blind dovetails at the front; it's the only drawer front that is visible from the case exterior. It is fit to the opening, and runs on the carcase bottom.

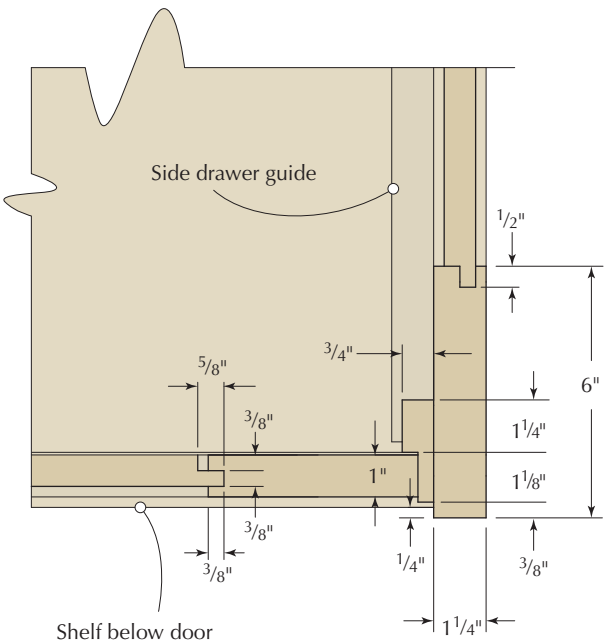
While it's unusual, the remaining 11 drawers were constructed with half-blind dovetails at all corners. That's because the drawers can be removed from the case to serve as trays to carry about your socks or what have you; half-blinds at all corners make the trays look good from any angle.

Drawers or Trays? *Handle cutouts on the fronts and back, and a plywood bottom fully captured in grooves on all four sides, allow the drawers to be pulled out to function as trays – so finish all show surfaces.*

These drawers all run on guides that match up to 3/4"-wide x 1/4"-deep grooves centered on the sides of each drawer.

I through-cut the groove from front to back on the sides; the drawer front acts as a stop when the drawers are pushed in. The drawer bottoms are all plywood pieces that float in 1/4" grooves in all four drawers pieces. I

Drawer guides. *The drawer guides are simply nailed in place to the case sides and center divider; on the sides, they are rabbeted around the trim strip at the front. Note the spacer that holds the guides level as they're nailed.*

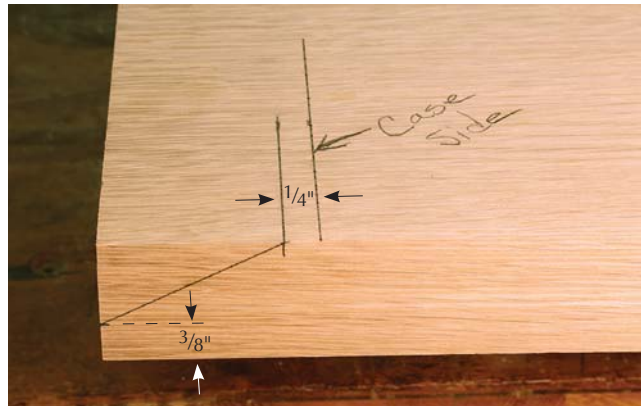


FRONT CORNER DETAIL

Replication. *A pattern makes it simple to mark all the drawers for the handles and profiled edge – and you can use it for pattern routing after cutting the shapes with a jigsaw or band saw.*

Sample for safety. *Before deciding on your finish schedule, always do a test piece on an offcut of your actual stock.*

Top detail. *The bevel begins 3/8" down from the top edge and terminates 1/4" away from the side of the case. Mark it with a bevel gauge, then use that same bevel gauge setting to set the angle on the table saw blade, then make the cuts.*



used 1/4"-thick plywood for the smaller drawer bottoms. In the lower pieces, I used 1/2"-thick plywood rabbeted at the edges to fit the 1/4" grooves.

The drawer guides were simply nailed to the insides of the case. In the bottom section, the bottom guide was attached 2 1/8" up from the lower divider; the remaining lower guides were spaced 4 3/4" apart. In the upper section, the bottom guide was attached 2" up from the divider; the remaining upper guides were spaced 4 3/16" apart. I made two plywood spacers for each section to make the layout consistent and easy.

Those attached to the side panels have a notch cut in the front to bring the edge of the guides about 1/4" past the trim on the edges of the door. The guides on the vertical divider are thinner and have no notch.

I made a pattern for the drawer fronts and backs, and used spray adhesive to attach that to a piece of 1/2"-thick plywood. After cutting the shape and smoothing the edges, I used these patterns to mark the parts. The plywood is so the pattern is sturdy and wide enough to double as a template for pattern-routing with a flush-cut bit, after cutting slightly beyond the lines.

The handles were made by drilling out the ends with a 1" Forstner bit at the drill press and connecting the holes with a jigsaw. I cut the shaped edges at the band saw, then clean up the cuts as needed with a spindle sander.

Before the drawers are assembled, rout an 1/8" roundover on the handle cutouts. After assembly, chisel a notch in the back to continue the groove.

The top is 1 3/8" thick and overhangs the cabinet by 2" at the sides and front, with a bevel on those edges. I attached it from underneath with screws through the two dovetailed cross rails.

The door hangs on three 3" x 2" brass butt hinges and it is held closed by a brass roller catch installed at the bottom-left corner. The drawer and door pulls are cast reproductions of Stickley pulls.

For the back, you have choices: solid oak backboards with tongue-and-groove or shiplapped joints, or a piece of white oak-veneered plywood.

The appropriate color is similar to that achieved by fuming white oak with ammonia. On a large piece getting even color chemically isn't likely, so I decided on aniline dye in a "Fumed Light Oak" color to mimic the traditional process. The dye was brushed on and allowed to dry overnight.

Then, to warm up the dark brown dye a bit, I brushed on two coats of amber shellac, sanding to #400 grit in between coats. I followed the amber shellac with one coat of clear shellac for a little more build, then applied a topcoat of brown wax to keep the finish looking good for years to come. **PWM**

Bob is executive editor of this magazine. Contact him at 513-531-2690 x11327 or robert.lang@fwmedia.com.

ONLINE EXTRAS

For links to all online extras, go to:

- **popularwoodworking.com/aug14**

VIDEO: *Construct and use a jig to cut dados the exact width of shelves.*

BLOG: *Learn three techniques to achieve an authentic Arts & Crafts finish.*

ARTICLE: *Build the Stickley No. 802 sideboard with the help of this free article.*

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Improve a Coping Saw

BY CHRISTOPHER SCHWARZ

Your saw can work better by adding washers or by changing the way you saw.

Around the bend. *If your coping saw doesn't work how you think it should, it could be the saw.*

When I was a kid, the first saw I bought was a Craftsman coping saw with a chrome frame and red-stained handle. For years I did everything with that saw – crosscuts, rips, curves and even joints. But I made none of those cuts particularly well.

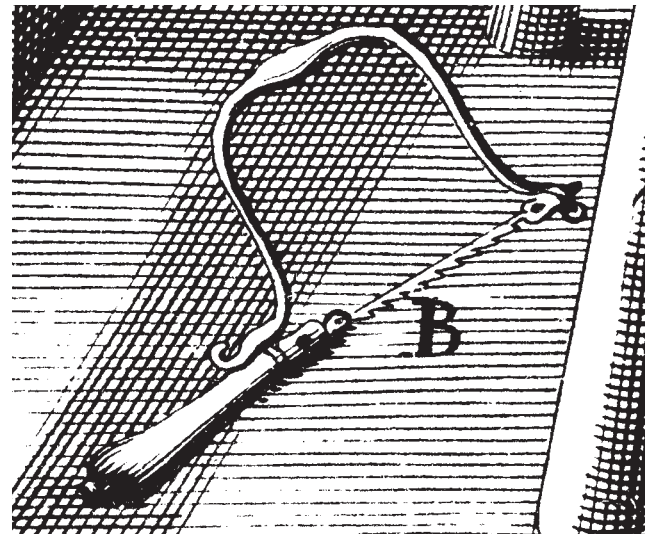
Part of the problem was that I was 11 years old. But part of it was the saw. I still own that saw – it's sitting in front of me now – and it simply will not tension a blade enough to prevent it from twisting. A good coping saw will keep the blade fixed at one position when fully tensioned and it will allow the blade to move freely for scrollwork when the tension is backed off.

If you've bought a coping saw sometime in the last 40 years, you probably have encountered the same problems that I did. While cutting, the blade at the toe rotates, while the blade at the heel stays stationary. This results in a poor cut and broken blades.

It wasn't always this way. Coping saws (and their ancestors) have a 500-year track record in woodworking. And after buying and using dozens of vintage coping saws, I have come to the conclusion that most of the modern ones aren't worth much. They don't tension the blade enough and their frames

PHOTOS BY THE AUTHOR; ILLUSTRATION BY DANIEL T. PESSELL
BASED ON THE AUTHOR'S MODEL

Twisted. *The toe of my old coping saw tends to slip when I want it locked, even when the saw is fully tensioned. This makes the saw wander and produces an out-of-square cut.*



From le Home Depot? *This small frame saw from marquetry was shown in a 1676 French text on woodworking and architecture. It looks only slightly fancier than coping saws from today's home center.*

are weak at best. I know of three solutions: 1. Buy a Knew Concepts coping saw, which costs $149 and tensions the blade brilliantly. 2. Hunt down a well-made vintage coping saw with a stiff and well-tensioned frame. 3. Improve a $12 coping saw with 50 cents' worth of hardware-store washers.

All three approaches are valid. But before diving into the nitty-gritty, I think it's important to understand where this ubiquitous woodworking saw came from. It has noble roots.

From Throne Rooms to Toys

While frame saws likely were invented by either the Romans or the Greeks, it wasn't until the Golden Age of veneered marquetry in the 16th century that the delicate bowsaws required for the intricate work appeared. Several woodworking historians think marquetry saws developed from the jeweler's saw, a small metal-framed saw used to cut precious materials.

In 1676, André Félibien published a drawing of a *petite sie de marqueterie* that looks for all the world like a modern coping saw – you can even see that the teeth point away from the handle. Furniture covered in marquetry was a favorite of royalty in Europe and (by the 17th century) in England.

By the 18th century, these sorts of saws were sometimes called "Morris saws" – perhaps it was a bastardization of the word "Moorish," or it relates to the inlaid game board for an old game called "Nine Men's Morris." These saws were used for all sorts of intricate cuts, both by cabinetmakers and jewelers. And the saws had blades designed to cut not only wood, but tortoiseshell, brass and other semi-precious materials.

In the 19th century, the saws were commonly called "bracket saws," and during the middle part of the century a fretwork craze developed – you find advertisements for the saws and plans in publications that have nothing to do with woodwork, such as *The Pacific Tourist* and *Beautiful Homes* magazines.

Soon the saws spread to the schools, where 19th-century craft-based schools using the Sloyd system taught handwork that was based around using a knife, a "frame compass saw" and other simple tools to make toys. By the early 20th century, the saw had acquired its modern name, "coping saw," as carpenters found the tool handy for coping inside corners when cutting moulding.

Historical purists might not agree that the coping saw is a descendant of the early marquetry saw, but from a user's perspective these saws are functional equivalents: a metal frame that tensions a thin blade that is used for curved and intricate cuts.

3 Ways to Fix the Blade

While researching coping saws, I found three primary ways of keeping the blade aligned at both the toe and heel of the tool.

1. Tension alone. A lot of coping saws – good and bad – use the frame alone to tension the blade and fix it in one position. The two arms of the frame spread out so the opening for the blade is too big. You push the arms together to get the blade into the frame, which tensions the blade somewhat. And you can then increase the tension by turning the handle clockwise, which pulls the

Tighten it. *The Olson, and many saws like it, rely on the frame alone to fix the blade in one position. Over time, the frame can become slack.*

Stop it. *These saws – a Crary Machine Works (right) and a Knew Concepts – have detents that keep the blade fixed at a certain number of positions.*

arms of the frame even closer together.

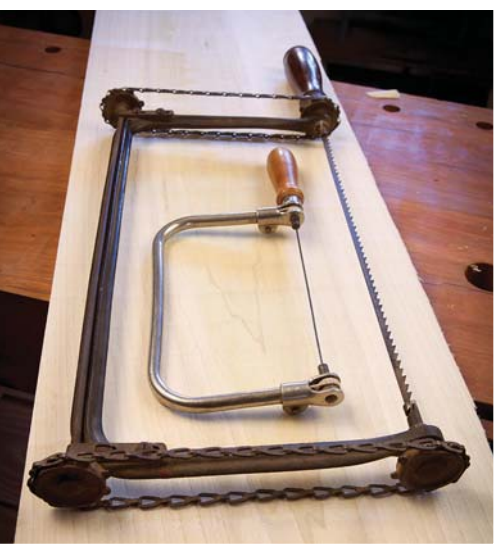
This works fine if the frame is rigid and keeps its original shape. Many coping saws with lightweight frames lose their shape after a few months. The arms bend in and stay bent. I have old saws from the early part of the 20th century that still tension the blade beautifully. So some key metallurgical point has been forgotten or ignored.

2. Stops. Some saws have fixed detents or stops in the frame that help the blade stay aligned at the toe and heel. This solution can work brilliantly or not at all. Some modern coping saws have detents that are too shallow to hold anything – so you are back to relying on the frame alone to keep the blade fixed.

A downside to a saw with stops is that they don't always work well when you want the blade to rotate as you cut, such as when you are cutting curvaceous fretwork in thin materials. The stops are actually too aggressive. If you don't use your coping saw for fretwork, however, one of these saws is likely for you.

3. Pulleys. Some older coping saws that were designed for fretwork use an ingenious system of pulleys or rollers to keep the blade aligned at the toe and heel. The Jones Patent saw made by E.C. Atkins uses a string that passes through the saw's frame to keep the blade aligned. The Fenner Patent saw uses a chain. (Both are shown below.)

These saws excel at coping fretwork. The Jones Patent saw works almost like magic. When using these to saw out dovetail waste, however, you need to pinch the handle and saw frame with your fingers to lock the blade's position.



Spin it. *Coping saws with pulleys keep the blade aligned no matter what sort of cutting you do. Sometimes they spin too much for waste removal, but you learn to control them.*

A Bargain Solution

Now you might be thinking that I'm going to send you on a wild goose chase for one of the aforementioned saws, which can be expensive, rare or both. And that is certainly an option for people who like vintage or well-made tools.

But what if you just want a dang coping saw that works? For the last five years (at least), I've been fooling around with this idea, trying to find the best inexpensive coping saw and the simplest way to modify it to make it work well.

Here's the scoop: Buy an Olson Deluxe Coping Saw – they are available for about $12 from many woodworking suppliers. Right from the box (actually the plastic bag) the Olson is a good saw. It's unique in that it has a locking mechanism at both the toe and heel. So you can get the blade to stay fairly aligned if you don't get too aggressive with it when cutting.

But with the addition of two pieces of 25-cent hardware from any hardware store, you can turn this saw into a blade-clamping monster. What you need are two $5/16$" split washers, sometimes called "spring lock washers."

I have experimented with a lot of different kinds of washers, including wave washers and serrated-tooth washers. While these improve the saw, the wave washers wear out too quickly for my taste, and the serrated-tooth washers prevent the blade from rotating in one direction only.

Feel free to experiment with more exotic washers – I hear the conical Belleville washers are the cat's pajamas – or just get it done with the cheap-o split washers.

With the washers in place (see pictures above at right), your saw is ready to go. You should be able to lock the

> "The coping saw is the easiest saw to sharpen."
>
> *—Charimaker Michael Dunbar, as he threw a dull blade into the trash*

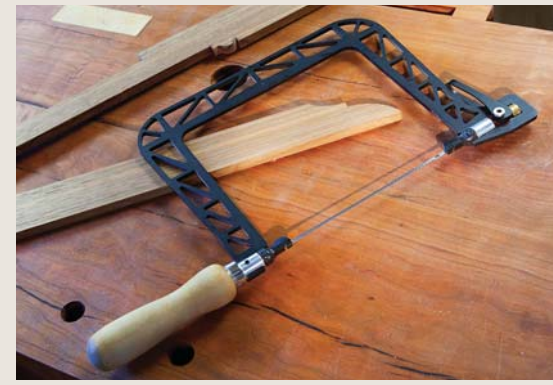
KNEW CONCEPTS – THE ALUMINUM CADILLAC

For those woodworkers who have prime-rib tastes, I recommend the Knew Concepts coping saw. It is astonishingly lightweight (8 ounces), tensions the blade to a high note and can lock the blade in eight positions.

Except for the wooden handle, the tool's makers redesigned the tool from scratch. I've been using one for about 18 months and have zero complaints, except for the color. The factory red was just too much for me. So I painted it black to match my planes and my tool chest.

At $149, it is the most expensive coping saw on the market, but it also has no equal.

For more information, contact Knew Concepts at 831-234-4652 or knewconcepts.com. — CS



Modern technology. *The Knew Concepts saw is different than traditional coping saws on almost every point.*

Not that. *The current crop of Olson saws come with a plain washer between the handle and the saw frame. Remove it and replace it with a 5/16" split washer (left). Then add a split washer between the screw at the toe and the frame (right).*

Simple & cheap is best. *The simple split steel washer works better in a coping saw than the fancier serrated-tooth washers or bronze cut washers.*

blade so it might require pliers to move. That's great for cleaning out dovetail waste. Remove the washers, and the blade will rotate easily for scrollwork.

One last note: Good blades help. The hardware-store varieties are usually overset and break easily. A good-quality blade, such as those made by Olson or Pegas, lasts longer and makes sawing smoother. And just like with your band saw, your saw and your blade will last longer if you relax the tension when you are done for the day.

Choosing Blades

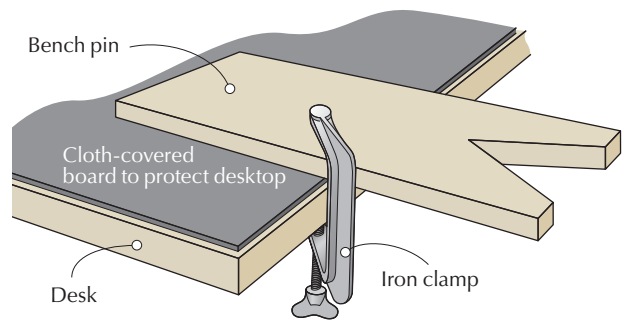
Coping saws come in a variety of tooth configurations. You can get them with different teeth per inch (tpi). The typical range is 10 tpi up to 20 tpi. I use the 10-tpi blades for waste removal and usually a 15- or 18-tpi blade for scrollwork. If the material is thick, consider a skip-tooth blade. The wide spaces between the teeth prevent the blade's gullets from filling with sawdust.

I wish that coping saws didn't have so much set to the teeth, but there is little you can do about that with typical workshop equipment.

One last detail on blades: I have found that the length of coping saw blades isn't consistent. Some blades are longer than others. If your saw suddenly stops tensioning properly, it might be that your blades are a little too long.

How to Cut

There is a lot of debate about whether you should set up the saw to cut on the pull or the push stroke. I think the answer is obvious: Orient the blade so the tearing or splintering from the blade is where you want it.



Cut anywhere. *The V-shaped board, called a bench pin, acts as a sawing platform. With the blade cutting near the point of the V, thin materials won't vibrate during the cut.*

COPING DOVETAIL WASTE IS AN OLD TECHNIQUE

I cope out the waste between my dovetails because that's how I learned to do it, and I am fast at it. When I demonstrate that technique, a common gripe from the peanut gallery is that it's an unnecessary modern complication to dovetailing.

It's actually not modern. In "Turning and Mechanical Manipulation…" (1856), Charles Holtzapffel wrote:

"The wood between the dovetail pins is generally cut out with the bow or turning saw, leaving the space as at b, fig. 694; and the spaces are then pared out with the firmer chisel from opposite sides, as at c, the chisel being placed exactly on the gage lines, but slightly overhanging, so that the insides are cut hollow rather than square, to insure the exact contact at the inner and outer edges of the dovetails."

Unless you're a geologist, I consider 158 years to be a good long run for a woodworking technique. — CS

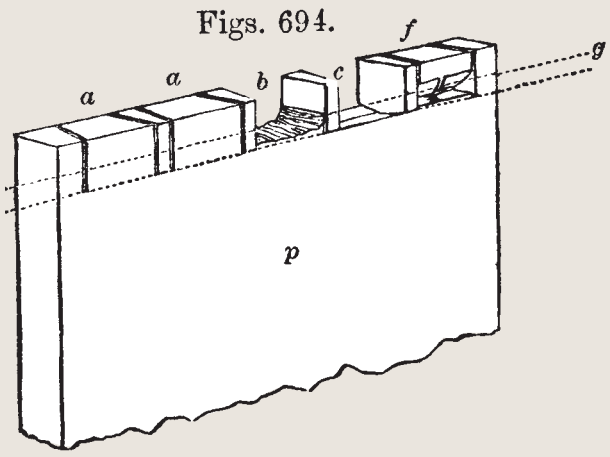


Figure that. *Sawing out your dovetail waste is a technique that dates back to 1856 at least.*

When your work is vertical in a vise or sawing donkey, the teeth should point away from the handle so the splintering is on the backside, which you cannot see while standing at the bench.

When sawing material held horizontally (more on that in a bit), orient the teeth so they point toward the handle. Then the splintering will be on the backside of the work facing the floor, which you cannot see while sawing.

Of course, if you are just removing dovetail waste with the saw, the tearing will be chopped away. So do whatever you like.

When you set up your work to saw it, many woodworkers prefer to saw the work while it's held vertically in a vise. And in some cases, such as when you are sawing dovetail waste, this is the best approach.

But when you look at 19th-century photos of schoolchildren sawing out a "Dinky Bird" or squirrel shape, they're holding the work horizontal on a table or a platform with a V-shaped cutout for support below (see the illustration on page 31). With small pieces of work, you can hold the work with your off-hand and saw with your dominant hand, holding the saw vertical.

With big pieces of work, clamp the work to the bench (you can use your face vise or tail vise for outboard support) and hold the handle of the coping saw with both hands. Try it, and I think you will be shocked how easy it is to follow a line and keep your cut square to your face. Gravity is lending a hand.

When you saw with the work horizontal, try not to get too aggressive. You should feel like you are moving smoothly – not quickly – through the work. Speed will come in time with this method because gravity helps pull the saw down and into the cut, and it helps clear the kerf of dust as well.

Like with most things in handwork, it's more about finesse than force. And practice always helps. But there are times when the tool really is the culprit, and I'm afraid that is definitely the case with many coping saws. So fix your saw and learn to cope. **PWM**

Christopher is the editor at Lost Art Press and the author of "Campaign Furniture."

Sit & saw. *When I cut scrollwork, I clamp the work flat on the bench and sit on a sawbench. Keep your chin right above the work and both hands on the saw if possible.*

ONLINE EXTRAS

For links to all online extras, go to:

- **popularwoodworking.com/aug14**

BLOG: *Read dozens of free online articles on the coping saw.*

ONLINE: *Test your coping skills with five free Arts & Crafts letter opener patterns.*

TO BUY: *The book "Handsaw Essentials," by Christopher Schwarz.*

IN OUR STORE: *The DVD "Build a Custom Backsaw with Matt Cianci."*

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Mid-century Coffee Table

BY MARIO RODRIGUEZ

Top this sleek design with patterned veneer – it's much easier than it looks.

All over the country, mid-century designs, with their sleek surfaces and clean lines, are turning up in high-style interiors. Here's a simple table that's perfect for any modern interior setting. It employs loose-tenon joinery and a veneering technique I introduced years ago that uses yellow glue and a common household iron.

The base is made up of square legs that are joined to rails of the same dimension. Then the construction is reinforced by a second set of slightly narrower rails. The rectangle formed by the legs and top rail is visually divided and reinforced by a second, slightly narrower, rail. This simple arrangement of the rectangle creates a nicely divided space that is both strong and pleasing to the eye.

Simple Joints for a Clean Look

The key to this design is a base that doesn't distract the viewer from the intricate top – so I kept the rails and legs at $1^1/_2$" square. Working with such slender members presented a problem: How could I maintain the dimensions of the parts yet join them soundly?

I decided to use loose mortise-and-tenon construction for the base. Loose tenons provide the necessary strength and allow me to speed up and simplify construction.

To cut the mortises, use a jig made from scrap plywood that supports and

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

This equals that. *The jig platform is assembled around the bushing to ensure a snug fit. The narrow strips in the middle are equal in width to the diameter of the bushing.*

Double duty. *Mortises are cut into both the legs and aprons with the same jig and at the same settings.*

One good turn. *With the jig fence re-set, mortises for the lower rail (which run across the leg) are also cut.*

No interference. *The ends of the tenons are mitered for a stronger joint.*

secures the parts, and provides precise registration and uniform results. The key to the jig is a platform that controls the travel of a 3/4" outside-diameter router bushing to set the length of the mortise. The mortises are 3/8" wide and cut with a upcut-spiral router bit. The space between the router bit and the router bushing provides adequate clearance for chips and debris generated by the cut.

The distance between the outside of the bushing and the bit is figured into the length of the slot on the router jig. The jig platform is mounted onto a fence that centers the mortise on the wood thickness and a stop is attached to the fence. This setup controls perfectly both the position and dimensions of the mortises for both the legs and the rails.

> "Rules are mostly made to be broken and are too often for the lazy to hide behind."
>
> —Douglas MacArthur (1880-1964), American General

In one configuration, the jig is set to cut the top mortises in the direction of the leg. With the fence re-set at 90° to the slot, I cut the mortises for the lower rail, which run across the leg.

To make the tenons, dimension oak stock to a precise 3/8" thickness and rip it to a fat 1" to match the length of the mortise. Then set the table saw blade at 45° and cut off the corners of the tenon stock to produce tenons that fit neatly into the rounded mortises without any play or slop.

Finally, cut the tenon stock to length on the band saw. Because the legs are only 1 1/2" square, the mortises are a little shallow. But by mitering the protruding ends to 45°, the tenons more fully engage the mortises for increased strength.

Two Steps for the Base

Carefully clean and sand the legs and rails, removing all mill marks before the glue-up. Then join the legs to the longer rails, checking for square and for tight joints. After allowing the longer frames to set up, join the frames to the shorter rails and again check for square.

When the base is completely glued up and set, I glue and nail 1/8"-thick x 1 1/4"-wide strips flush with the inside top of the table base with mitered corners. These strips create an attractive

Thin & pinned. *Thin strips applied flush with the inside edges create a 1/8" reveal between the upper edge of the rails and the tabletop.*

Solid addition. *Corner blocks are glued and screwed into place. They strengthen the corner and provide a way to attach the top.*

reveal between the top and base when the table is assembled. Next, I screw and glue reinforcing blocks at each corner to strengthen the base assembly and provide a means of attaching the top to the base later.

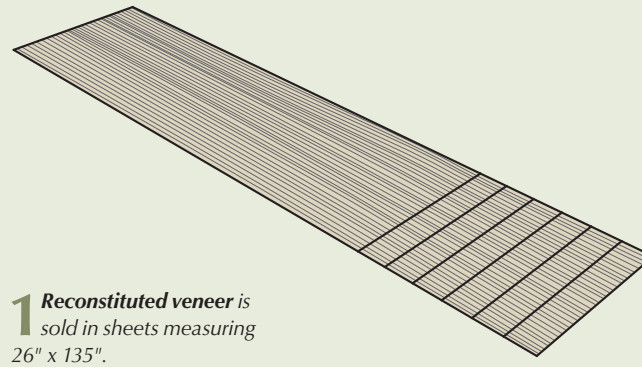
Weave the Top

I use 3/4"-thick shop-grade plywood for the top, "beefed up" to a 1" thickness with 1/4"-thick strips glued and nailed to the underside of the thicker plywood. When the glue is dry, use a block plane to plane the edges flush.

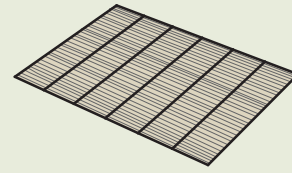
The veneered top is arranged in a pattern of squares, with each square's grain running perpendicular to those surrounding it. This easy arrangement achieves an attractive design that resembles a basket-weave pattern that's made even more striking by the strong linear grain pattern of the teak veneer I used.

In the thick of it. *Thin strips added to the perimeter make the plywood top appear thicker. A block plane is used to trim and flush the substrate edges.*

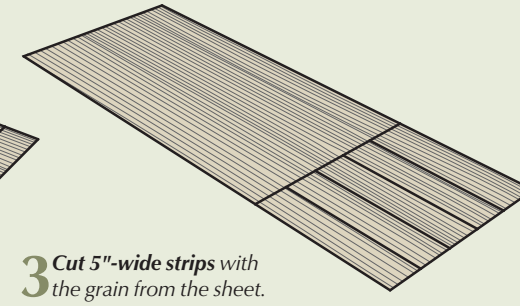
BASKET WEAVE BY THE NUMBERS



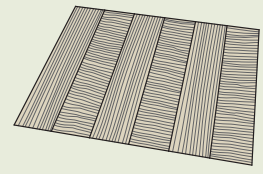
1 ***Reconstituted veneer*** *is sold in sheets measuring 26" x 135".*



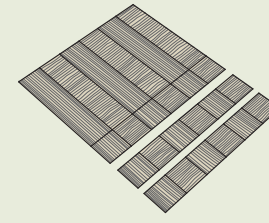
2 ***Cut 5"-wide cross-grain*** *strips from the sheet.*



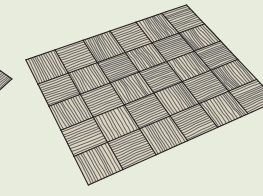
3 ***Cut 5"-wide strips*** *with the grain from the sheet.*



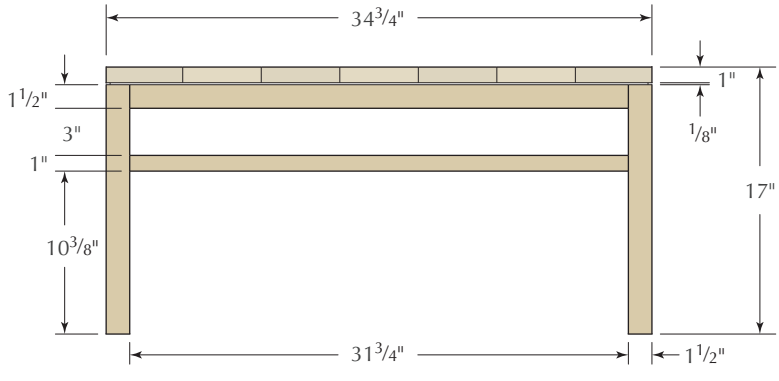
4 ***Tape alternating strips*** *together. Begin with a long-grain strip and end with a cross-grain strip.*



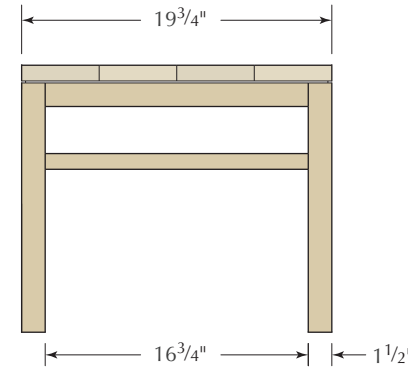
5 ***Cut 5"-wide strips*** *from the composite sheet.*



6 ***Flip every other strip*** *end over end to achieve a basket-weave pattern and tape the strips together. Edging strips are cut from this basket-weave sheet.*



FRONT



END

This way. *The reconstituted veneer sheet is cut across the grain into 5"-wide strips.*

Then that way. *After pinning the strips into place, dampened veneer tape is applied along the entire seam.*

Rolling along. *A roller secures the veneer tape and ensures a strong bond and a tight seam.*

The thought of working with veneer usually strikes terror in the hearts of most woodworkers. Veneering can be messy, difficult and unpredictable – but on this project, it's a piece of cake; many of the problems commonly associated with veneering are easily avoided.

I chose reconstituted teak veneer for its straight grain and strong contrast. Unlike conventional veneer, reconstituted veneer is made up of sliced veneer that is re-glued into a distinctive yet uniform color and pattern, then sliced into sheets. This produces an unusually stable and well-behaved material, well-suited to this veneering technique and perfect for this project.

The veneer is sold in sheets measuring 26" x 135" and is available in several wood species. Because of its unique constitution, the veneer is fairly easy to handle and not prone to cracking or tearing as easily as conventional veneer.

After reducing the large sheet to smaller, easier to handle sections, cut several 5"-wide strips across the grain and a number of 5"-wide strips along the grain. Then tape these strips together, alternating long-grain with cross-grain strips.

Next, cut this reconfigured sheet into 5"-wide strips, producing strips with alternating grain squares. Finally, flip every other strip end over end to achieve the basket-weave design and tape this arrangement together. (As a precaution, I applied tape along the perimeter to prevent any damage.)

From offcuts and leftovers, form enough edging to cover the tabletop's edges, then generously apply tape to these strips.

Modern Method

To better protect the edges and corners of the table, I decided to glue down the top first then snug the edging up against it. This critical gluing sequence protects the more vulnerable edging from being easily damaged or pulled away later.

Use a 4" foam roller to apply yellow glue to both the plywood substrate and the veneer. The initial application of glue to the veneer causes it to buckle slightly because of the water contained in the glue. That inevitable movement can be minimized by lightly wetting the face (taped) side of the veneer. Be careful though – too much water can loosen

Mid-century Coffee Table

NO.	ITEM	DIMENSIONS (INCHES) T	W	L	MATERIAL
❑ 4	Legs	1 1/2	1 1/2	15 7/8	Walnut
❑ 2	Long top rails	1 1/2	1 1/2	31 3/4	Walnut
❑ 2	Short top rails	1 1/2	1 1/2	16 3/4	Walnut
❑ 2	Long mid rails	1	1 1/2	31 3/4	Walnut
❑ 2	Short mid rails	1	1 1/2	16 3/4	Walnut
❑ 2	Long reveal strips	1/8	1 1/4	34 1/4	Walnut
❑ 2	Short reveal strips	1/8	1 1/4	19 1/4	Walnut
❑ 1	Top*	1	19 3/4	34 3/4	Plywood

*Top substrate 3/4" plywood with 1/4"-thick strips along bottom edges.

Down under. *Yellow glue is applied with a foam roller to the back of the veneer and to the substrate.*

Bench press. *The iron heats the veneer and the glue, adhering it to the substrate.*

the tape. Let the glue dry thoroughly before applying a light second coat.

After about four hours, when everything is dry, carefully place the basketweave sheet onto the substrate. Align the edges with the substrate but include about 1/4" of overhang all around.

With a common household iron set at medium-high, start at the center of the panel and work slowly toward the edges. After covering the entire sheet, let it cool for about an hour.

With the larger basket weave down and secure to the substrate, carefully apply yellow glue to the edging and the substrate edges with a small brush and let this dry thoroughly. Once it's dry, use a warm iron to carefully press the edging into place, making sure it is tight up against the veneer of the top. Then leave everything to set up and cure properly. This curing or drying period will stiffen the veneer, making it easier to clean up and trim later.

Get unstuck. *After wetting down the tabletop, gently remove the tape with a scraper.*

Clean-up Time

The tape is applied with water, and I remove it the same way. Once yellow glue is completely dry, it isn't affected by a light application of moisture. So I spray a small amount of water onto the tabletop, wait a few minutes for the tape to soften, then gently scrape and peel off the tape.

With the glue dry and all the tape removed, use various files (I like a 10" second-cut file and a Grobet detail file), a card scraper and a sanding block to trim and flush the edges.

Once you've finished cleaning up the top, apply denatured alcohol to the surface and edges to make sure the veneer is securely applied. The alcohol raises the grain and swells the veneer, which causes it to rise off the substrate surface at any spots where the two didn't fully bond. If you do have any areas that require attention, small bubbles are easily glued down by going over those areas with a warm iron.

After waiting a couple of days for the veneer to dry completely, sand the top and edges to #220 grit, then apply four coats of a wipe-on varnish. (I used a satin finish wipe-on urethane from General Finishes), sanding between the first and second coats. The last two coats are rubbed out with a fine aluminum oxide 3M Rubbing Pad.

The base is stained with a dark walnut dye that is rubbed out and allowed to dry before applying the same wipe-on varnish used for the top. **PWM**

Mario builds furniture and teaches classes at the Philadelphia Furniture Workshop.

Finishing touch. *After trimming, a detail file cleans up and softens the edges.*

ONLINE EXTRAS

For links to all online extras, go to:
- **popularwoodworking.com/aug14**

ARTICLE: *Discover how Mario Rodriguez tunes up his veneer saw.*

CLASS: *Sign up to take a class with Mario at the Philadelphia Furniture Workshops.*

VENEER: *Purchase reconstituted teak veneer from Certainly Wood.*

PLAN: *Download a free SketchUp model of this project.*

IN OUR STORE: *Purchase the author's video, "Make an Elegant Writing Desk."*

Our products are available online at:
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Massive Mouldings

No limits. *With a router and core-box bits, a table saw, a few basic hand tools and some creativity, you can make mouldings of just about any size and shape.*

BY CHUCK BENDER

Add a few hand tools to a mostly machined process, and it's simple to make any profile.

When it comes to making mouldings, size should not be a limiting factor. Using tools you probably already own – combined with a little creative thinking – you can make just about any moulding profile you desire, regardless of size.

Owning a half-set of hollow and round planes is a goal I've finally achieved after decades of building furniture; they are tools I wouldn't trade for anything. But the fact that it took me so long to acquire them should be your first clue that they aren't a necessity. Nearly every moulding I've ever made has been primarily done with a router or shaper (which is essentially just a big router), a table saw and a few basic hand tools.

That doesn't mean hand tools were not an important part of the process – or that a set or half-set of hollows and rounds won't make it easier. It just means that basic hand and power tools can work together to achieve almost anything in woodworking. This is a philosophy I've held since I began in the craft.

What You Need

At least one router should be in every woodworker's arsenal. It doesn't have to be huge, but it certainly needs to be larger than a palm, or trim, router. I've successfully used 1½-horsepower routers throughout my career. The router should be equipped with an edge-guide and a router table – both can be homemade.

You'll also need an assortment of core-box and straight router bits as well as a shoulder plane and a block plane. And throw a table saw into the

LEAD PHOTO BY AL PARRISH, STEP PHOTOS BY THE AUTHOR; ILLUSTRATIONS BY ROBERT W. LANG FROM THE AUTHOR'S MODELS.

mix; if you don't, it's going to be tough ripping the angles on the blanks. Plus, while you certainly can cut large coves in a series of successive passes with a large core-box bit at the router table, it's a lot faster and more efficient to use a table saw.

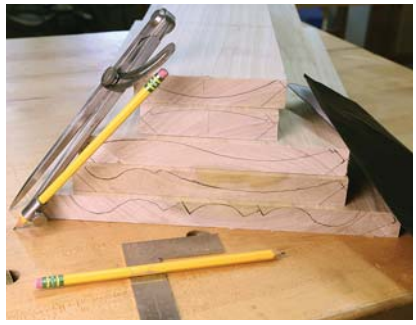
Where to Start

Usually when making mouldings, the process begins with general proportioning. In order to make a piece look balanced, the mouldings can't be too large or small. Often the right size moulding doesn't have corresponding router-bit profiles commercially available.

But you're not limited to specific sizes and shapes, so the next step is to draw the exact moulding profile you want. You can trace an existing moulding if you are copying something, or proportion it from a photo. You can even make it up.

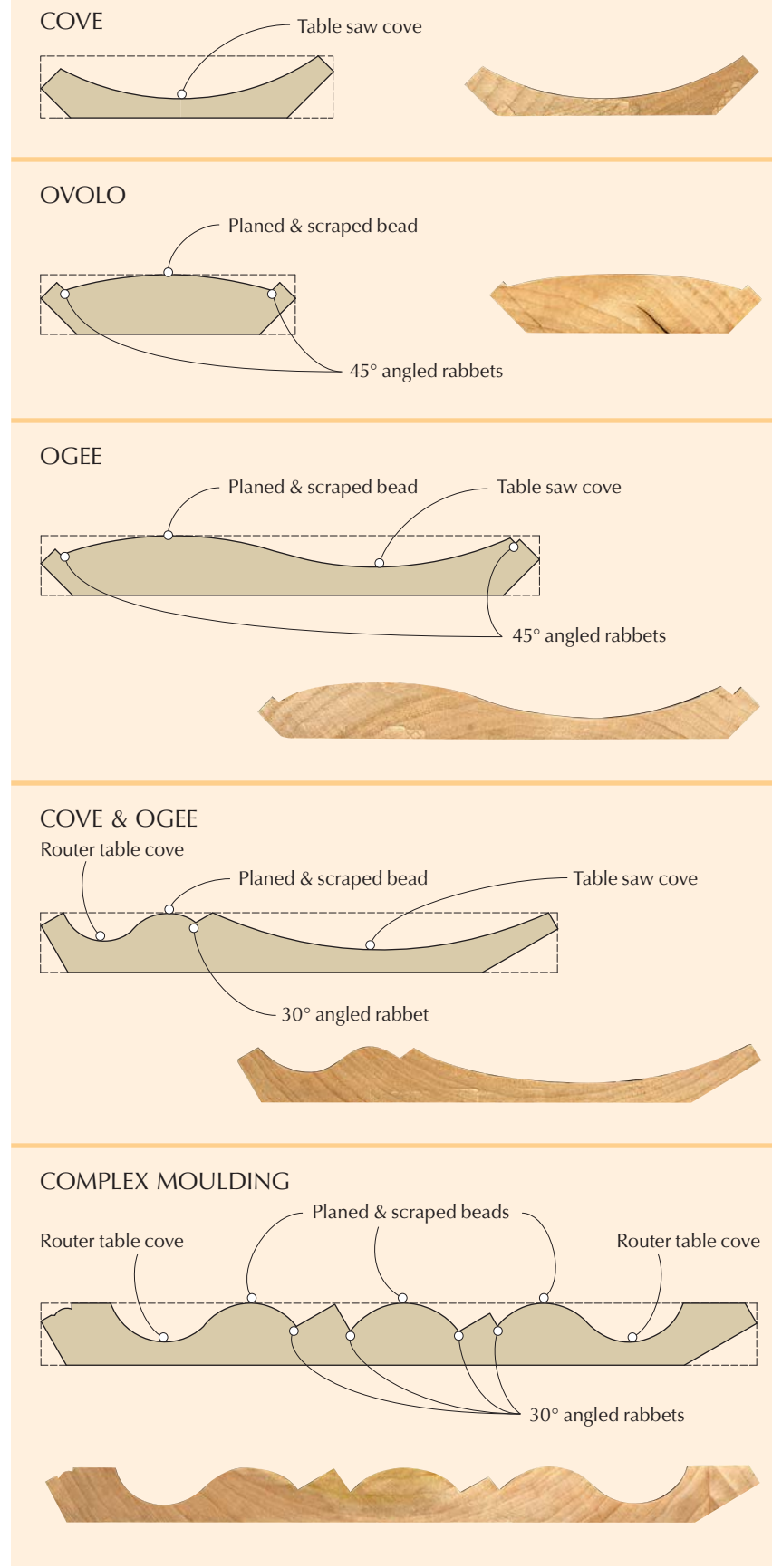
Most mouldings have several things in common. First, they are made up of coves, beads and flats. These elements may be used singly or in combination, such as half a bead and half a cove combined to form an ogee, or a two fillets and a bead to form an ovolo.

Additionally, larger mouldings are often made from wider, thinner stock that is set at an angle to the piece of furniture. When the board is tilted at an angle, the orientation of the individual elements needs to be considered – but we'll address that later on.



Stack 'em up. *Whether you use traditional drafting methods or carbon paper and full-sized printouts of mouldings, the ends of the blanks need to have the profiles drawn on them. This helps to guide the location of rabbets and dados for rough stock removal, and your planes as you finesse the curves. It's good practice to draw the profiles on both ends of the blanks.*

FROM PAPER TO PROFILE



Once you have the profile nailed down, the fun begins. When making large complex mouldings, planning is key. You have to figure out which parts to cut first and how to make the subsequent cuts without removing reference surfaces. The hand tools clean up the transitions between the router and saw cuts and form curves your bits cannot.

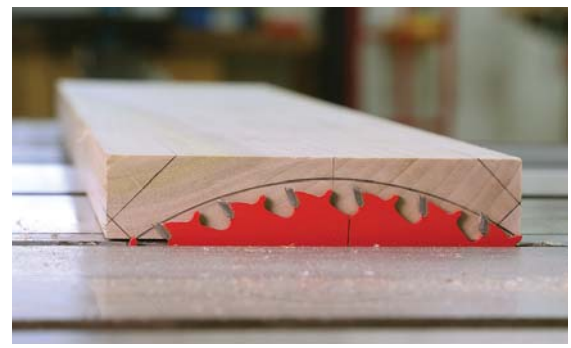
Coves

Before you jump into making a big crown moulding for that highboy you have under construction, practice by making some smaller samples. Create a few large single elements, then combine them to create an even larger, more complex moulding.

Making coves is a great place to start. Depending on just how large a cove is needed, either the table saw or a core-box router bit can be employed. If you don't like the notion of pushing stock diagonally over a blade at the table saw (see "From Rectangle to Round" below), make sure to have a wide variety of large-diameter core-box bits available. They can be used in successive, overlapping cuts to create coves of nearly any size – the overlap can be scraped or sanded later to smooth the surface.

For the samples, begin with two moulding blanks (each 1" x 4¾" x 18" to 24"). The coves for both samples have 4" radii and the angles are all 45° to the faces. Draw the moulding profile on the ends of the blanks. One will be profiled entirely at the table saw – the other will use a combination of the table saw and router table.

The first moulding begins by setting a fence at the proper angle on the table saw. Taking successively deeper cuts, continue until the cut matches the profile. You may need to tweak the fence angle to achieve the exact shape. For most of the mouldings I make, somewhere close to the profile will do. If it's critical to exactly match a profile, the cove can be adjusted slightly by hand during the surface preparation stage.



Considerable coves. *Align the cove blank with the saw blade and it's obvious that, when set to cut the proper depth, the blank would need to move perpendicular to the blade to create the proper radius cove. To lessen strain on the blade (and make the operation safe), set your fence at the correct angle, then make a series of cuts, raising the blade incrementally with each pass.*

FROM RECTANGLE TO ROUND

Making cove moulding on the table saw is easy and safe if you set things up properly and take your time. It's done by setting an auxiliary fence at an angle to the blade then making successive passes, raising the blade slightly between each, until the proper depth is reached. The question is, how to set the angle of the fence.

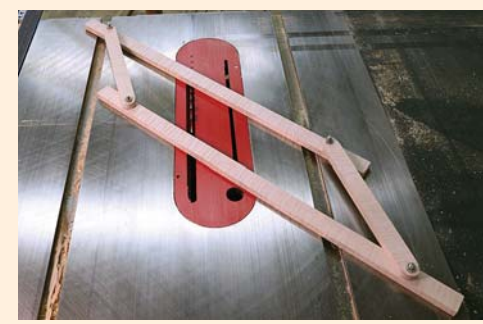
One method that takes a lot of the guesswork out of the process is to use a shop-made parallelogram jig. For my jig I used some scrap that I milled to ⅜" thick x ¾" wide. I cut two pieces about 18" long and two more at about 7". These four pieces form the entire jig once they're joined together with bolts.

Find the center of the width of the pieces and set a marking gauge. On the short pieces, make a mark about 1" in from each end at that centerline; mark the long pieces 2" or 3" inches in from the end. What matters in this process is that you are consistent with your marks – otherwise you'll have a trapezoid but it won't necessarily be a parallelogram. Drill holes through the parts at the marks and assemble the jig with small bolts (wingnuts make tightening the jig easier). Round over the ends of the short pieces so they don't protrude beyond the outer edge of the long pieces when the jig is assembled.

To use the jig, set the space between the long sticks to the final width of the desired cove. Set the table saw blade to the height of the deepest part of the cove and place the jig on the table so it surrounds the blade. Adjust the jig until the blade's teeth just touch the jig on both the front and back of the blade. The angle of the long parts to the blade is the proper angle for your fence.

— CB

Scrap it. *Careful layout and some scrap is all you need to make a jig to help set up the table saw to make cove moulding. Oh – and some small bolts, too.*



Angle it. *With the jig set to the proper width, rotate it around the blade until the teeth just touch at the front and back. This is the angle at which you will set your fence to guide the workpiece at a diagonal across the blade as you cut the cove.*

The second version uses the largest core-box cutter you own. Set up the bit in a router table so that, when the bit is raised to full height, the cutter engages the profile layout at the back of the blank. In this way you can continue to rout using the forward half of the bit (allowing you to push the material in a right-to-left motion) while making any necessary height adjustments (see photos on page 43). Don't worry about leaving small peaks in the cove where the router cuts overlap; you're about to take care of that problem.

A gooseneck scraper is your best friend when it comes to making large mouldings. Spend some time learning how to get a sharp edge on the tool and you'll find a plethora of places it can be used. For large cove mouldings, with overlapping table saw or router cuts, you'll find it makes short work of smoothing the profile. For extremely large coves, you can either purchase a card scraper with a curved edge or make one from a rectangular scraper. Either way, grind it to fit the radius of the moulding profile.

Once the surface is scraped you may still need to sand. Many woodworkers like to use some kind of backer for their sandpaper, but I prefer just using my fingers. As I sand the surface I can feel any irregularities transfer through the paper. A dowel or other backer might help level the surface better, but you can't beat feeling the small bumps and surface changes. I like to prep the moulding surfaces to the same degree as the case on which they will reside.

Beads

Making convex mouldings usually involves a bit more handwork. Power tools still play an important role in preparing the blank for its final shape, but the cuts made are guidelines rather than finished profiles.

Use a router or table saw (or both) to create rabbets that help to define the outermost points of the curve as well as bevels that help remove the bulk of the waste. This provides two edges on which to ride a shoulder plane and a block plane for the final finessing of the curve.

Rabbet it. *To make large convex shapes, start by defining the outermost points of the curve with rabbets. They will act as guides for your handplanes.*

For the sample moulding, begin with a blank that's 1" x 4 3/8" X 24" and draw the profile on the ends, just as you did for the cove. The angles for this moulding are also 45° to the face. Begin at the table saw with the blade tilted to 45°. Make the cuts needed for the fillets at the top and bottom of the bead, or ovolo, moulding. By using the same setting on the saw, you keep the surfaces of the two fillets perpendicular to one another. This is probably the single-most important concept to maintain regardless of the profile you are making: Keep your fillets plumb or parallel with the ground and perpendicular to one another.

With the fillets run, head to the bench and grab your shoulder and block planes. The idea is to use the largest plane possible to create a series of flat, angled surfaces that are at a tangent to the final arc. In this way the intersection of those surfaces can then be removed in the same manner until the moulding profile consists of a series of small, uniform flat segments. In other words, we're making an arc out of a bunch of small flats. The goal is to create flats that are so small that they are imperceptible.

> "A creative man is motivated by the desire to achieve, not by the desire to beat others."
>
> *— Ayn Rand*
> *(1905-1982) Novelist*

When creating the initial bevel, I use the fillet created at the table saw as a guide for my plane. For this reason I like to begin with my block plane (unless the bead is so small that the plane won't fit). It also helps if you mentally divide the arc into left and right halves. Begin on one half, use the fillet to catch and guide the edge of the block plane, then remove the bulk of the waste to create a flat surface that just touches the arc profile. Where that surface exits the blank, use your plane to create two more flats that are at relatively the same angle to the initial flat. You should now have, on one half of the arc profile, three flats and two peaks. Continued planing produces five flats and four peaks and so on, until you eventually have a quarter-round arc.

Coves & Beads Together

Once you have the individual coves and beads down to a science, it's time to bring them together to create more complex mouldings. Much like turning, mouldings are composed primarily of convex and concave arcs in combination with fillets to create a variety of shapes. You're either using quarter-rounds with quarter-hollows and one or more fillets to create various separate shapes, or you are flowing a quarter round directly into a quarter hollow to

Faceted flats. *To get to round, start by beveling the waste then knock those corners off to create more flats. Eventually you'll have so many facets it'll be easy to make it round. I use a block plane for this operation.*

Colossal concavity. *On extremely large coves, whether using the table saw or router table to create them, make your first pass at the back of the cove; as you move forward to make cuts for the remainder of the profile, you'll always be cutting in the proper direction.*

Ridged coves. *A little pencil shading shows the overlap between two passes on the table saw. These ridges are easily removed with a scraper and sandpaper.*

SHARPEN A GOOSENECK SCRAPER

Card scrapers are tremendous tools; a gooseneck scraper functions exactly the same way. It is incredibly useful for smoothing the surface of small and large coves created at the table saw or router table – provided you get the scraper sharp.

Sharpening gooseneck scrapers seems harder than it is. The process is exactly the same as with a card scraper. The first step is jointing the edge with a file or at a stationary sander (an edge sander is preferable but a disc sander will do). Remove any trace of the previous hook while maintaining the curve of the scraper – less is more.

Scrape it. *A gooseneck scraper makes short work of the peaks left while making large cove mouldings.*

I like to slide the edge of the scraper over a waterstone to remove the file or sander marks, making sure to keep it square to the stone. Slipstones also work for this operation if you're not practiced at using a flat stone on a curve. — CB

Hone it. *Hold a slip or stone against the edge of your bench to make it easy to hone the scraper square.*

Turn it. *Lay the scraper flat on the bench and it's easy to turn a burr.*

create an ogee or cyma curve.

Flowing one element into another isn't hard, but it does take some planning and practice. The ogee is probably the simpler of the two to create. Start with a blank 1" thick x 8½" wide by 24" long that has the profile drawn on the end as in the previous examples. The concave portion is offset from the center of the blank; it is the first element to make. On some mouldings I like to start with the rabbets that define the convex portions or the fillets, but for large ogee mouldings, beginning with the cove gives me the most wiggle room for flowing in the bead and placing the fillets.

With the cove cut (at the table saw or router table), set your table saw blade to 45° to cut the rabbets and back bevels for the moulding. Head to the bench and make the bead portion with your handplanes just as in the last example.

Take care at the transition points to not gouge the hollow of the cove with the corner of your plane. If you have trouble making the transition cuts, leave a bit of a ridge between and scrape or sand the profile so it flows smoothly. Small successful steps are better than a large one that leaves you trying to figure out how to replace material mistakenly removed.

Adding a fillet between elements is a bit more difficult, but by this point I'm sure you're up to the challenge. You might think to create the separating flat all you need to do is run an angled rabbet in the proper place and, in essence, you'd be correct. The main concern is not in running the fillet but in maintaining its integrity.

While I'm not a big fan of woodworking "rules" I'm going to give you one now: Never monkey with the fillet. Don't touch it, play with it or even look at it (OK, looking at it might not be that bad) until you're ready for final prep of the entire blank. The minute you get close to it and start scraping or planing the adjacent surface is when you're most likely to end up with a fillet that wavers or tapers as it traverses the moulding. Stay off the fillet as much as possible once you have it created and looking uniform.

Angles Other than 45°

For the sample moulding with a fillet separating the elements, you'll need a blank 1" thick x 8¾" wide x 24" long. By this point you know the drill: Draw the profile on the ends. Start with the coves for all the reasons previously mentioned. Because this moulding is essentially a large cove and a smaller ogee, you'll have two completely different setups for the coves. I made the sample using the table saw to cut the large cove; the concave part of the ogee was made on the router table.

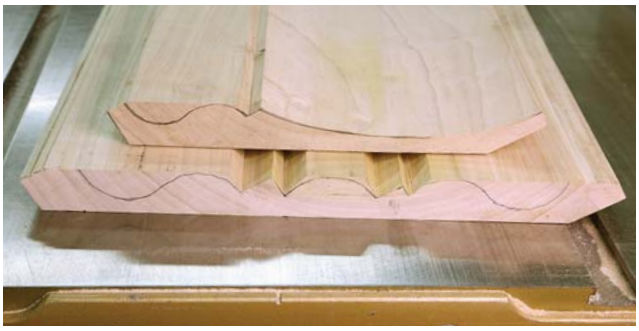
The big twist for this moulding is the angle at which the fillets and back angles are cut. For this profile, two different angles are employed. Every bevel is either at 30° or 60°; the trick is how to make them at the table saw. Most saws don't tilt past 45°, which means you'll end up tilting to 30° then modifying the position of the blank to keep the various parts perpendicular to one another.

With the moulded face down, cut the fillet and top front angle. Flip the blank onto its back and cut the bottom front angle and the top back angle. The last step is to add a tall auxiliary fence to the saw, stand the moulding up on edge with the moulded face to the fence and cut the bottom back angle. Head to the bench and shape the round portion of the ogee, prep the surface and you have successfully created your first massive compound moulding.

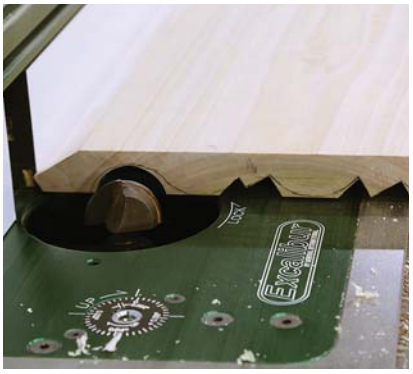
The final profile in the series simply steps up the complexity. It's composed of two ogees, multiple fillets and a large and small bead. I've also thrown in a 30°/60° twist. The blank is 1" thick x 11⅝" x 24" just to keep things interesting, and again, the profile should be laid out on the end. Start at the table saw and cut the coves for the large ogees then cut the rabbets for the fillets. Then head to the router table, and with an appropriate core-box bit installed, cut the smaller coves. Next is bench work with handplanes and scrapers for the rounding process.

Making large mouldings isn't something you'll likely do every day, but it isn't something that should scare you, either. The process isn't complex when you break the mouldings down into individual elements. It might take a little creative thinking on your part to figure out how to cut the back angles or combine the various elements in ways that suit your aesthetic, but the results can be impressive and beautiful; they'll certainly add a sense of mass to any piece to which they are applied. **PWM**

Chuck is senior editor of this magazine and can be reached at chuck.bender@fwmedia.com.



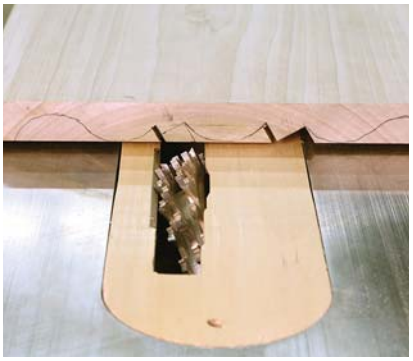
Rabbets run. *All the table saw work is done on these mouldings so it's time to head to the router table to make the smaller cove cuts. (By grouping operations, you'll get more consistent results and increase your efficiency.)*



One fence. *Set the router table's fence to guide your first pass to cut the part of the cove closest to the fence with a core-box bit.*

Two fence. *For successive passes that widen the cove, adjust the router table's fence back from the cutter to make the second pass in the correct, safe direction.*

Extreme angle. *With the saw set at 30° and a tall auxiliary fence, cutting a 60° back angle on mouldings is a breeze.*



Stacked rabbets. *Some profiles just don't cooperate with your saw's cutting capacity; tilt a stack dado and run the rabbets to beat the machine.*

ONLINE EXTRAS

For links to all online extras, go to:

- popularwoodworking.com/aug14

BLOG: *Learn how to use hand and power tools to prepare your cove moulding for finish.*

IN OUR STORE: *See how Glen D. Huey makes cove moulding at the table saw.*

TO BUY: *Tod Herrli shows you how to make your own hollow and round planes on this step-by-step DVD.*

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Roubo's Press Vise

BY DEREK OLSON

This centuries-old device is effective in use and simple to make.

In my early years as a woodworker I was prejudiced against veneer – but experience has mellowed my opinion; I've realized building the period furniture pieces on my bucket list requires skills working with veneer and inlay.

My burgeoning interest in traditional techniques made me want to build a veneer press, but I couldn't find one I liked until I read "To Make as Perfectly as Possible: Roubo On Marquetry" (Lost Art Press), a translation of the marquetry section of André-Jacob Roubo's 18th-century tome "L'Art du menuisier." The engravings of Plate 280 held the inspiration I needed.

After building several incarnations of this vise, I decided to build a version fairly faithful in scale and dimension – though your primary consideration should be making a press that suits your needs, so adjust the dimensions as required. Roubo blesses this experimentation writing, "These types of vises are of different sizes…and serve for gluing as much for solid wood as for veneer work."

Roubo identifies three components: The "screws," the upright threaded dowels; the "beams," the jaws of the press; and the "frames" that act as nuts, twisting around the screws and tightening the beams together.

I used a length of reclaimed Southern yellow pine for the beams, though hardwoods are also a good choice.

18th-century vise. *This traditional device can be used for pressing veneer and solid glue-ups.*

The Screws

For the screws, I ordered 1½"x 36" maple dowel online. I bought more than I needed to ensure at least a couple of keepers with straight grain and little to no run-out.

At first blush the decorative ball at the top of the screws seems like delightful conceit, but in use I've found it nicer to handle the ball than wrap my palm around the sharper threads when moving the vise around and tightening down the frames.

To turn the balls, crosscut a dowel in half and mark the centers for mounting on the lathe; use a roughing gouge to true 1⅞" on the end for the ball.

Mark for ⅜" of waste at the tailstock, then use a parting tool and skew chisel to bring the ball shape to life. I don't shoot for a perfect sphere – I'm not that good of a turner. I just shoot for some-

LEAD PHOTO BY AL PARRISH; STEP PHOTOS BY THE AUTHOR; ILLUSTRATION FROM "L'ART DU MENUISIER"

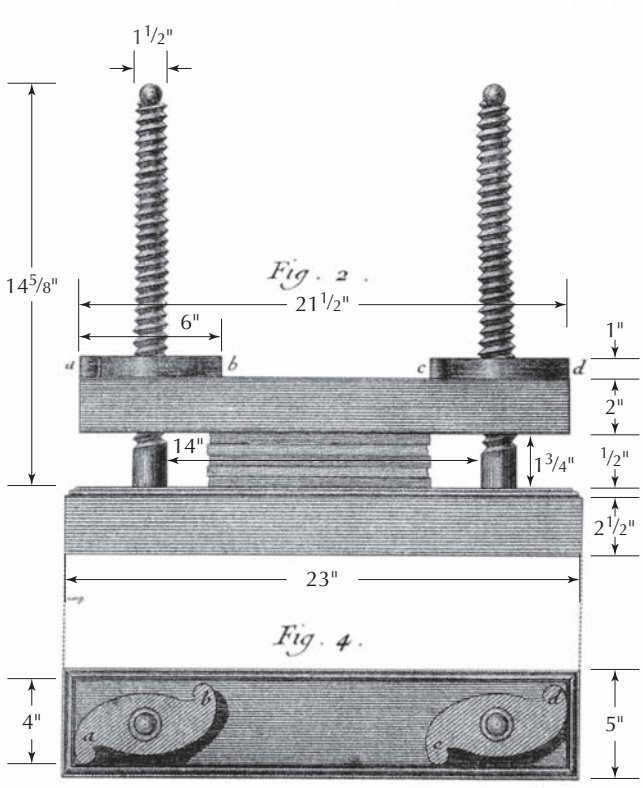

Plate 280. *Roubo's text provides only rough guidelines for the build, so I used dividers to step off measurements for a vise suited to my needs.*

On the ball. *The balls on the ends of the screws makes them easier to grab and create the clearance to get your threadbox started.*

Saddle up. *Two pieces of scrap with notches secure the round piece in the vise. The leather strap keeps them together.*

thing that looks right to my eye, then try to stop before I push it too far.

Sand the ball to #120 grit and attack the remainder of the dowel with #80 grit. Don't try to remove any real meat; you just want to reduce the dowel's diameter by a few thousandths of an inch to reduce friction and binding while cutting the threads.

Saw off the tailstock "crown" and sand those saw marks away.

There are several ways to cut threads. I've found a hand-powered threadbox to be sufficient for my occasional needs. If you're a thread-cutting virgin, experiment first on offcuts to ensure that your threadbox is correctly adjusted and that the cutter is sharp (an important point), and that you know what to expect when you approach the good stock. A little practice goes a long way.

Soak the dowels in WD-40, keeping them wet for a half-hour. Use the downtime to rough out the stock for the rest of the vise. Once the dowels are well lubricated, wipe them off and chuck them into a bench vise. I use a holding jig (based on a pair of joiner's saddles) with a piece of leather nailed across the ends that acts as a flexible hinge; that keeps me from having to juggle three things at once.

If you skip turning the ball, cut a slight chamfer on the starting end to make it easier to fit the threadbox over the dowel's end. Drive the threadbox in a steady, continuous motion; don't force your way through. If you get hung up, back up a bit and renew your momentum.

You'll probably have some grain failure and chip-out along the peaks of the threads. However, I've never found this to hurt the function of the screw in use. (The threads act in aggregate, and like soldiers in formation, the army is not affected because a few men fall.)

The Beams

The top beam on my vise is undersized to the base by 3/4" on the ends and 1/2" on the sides. Roubo shows a nice moulding around the edges of the bottom beam, so I cut one, too. You can skip the moulding if you must, but keep the overhang on the ends. It's a great landing place for the pad of a holdfast.

Cut the beam stock to rough dimensions and select inside faces that are clear and free of defects. After squaring and surfacing the two pieces, return to pay particular attention to the inside faces. Check them carefully both with winding sticks and against one another to ensure they mate and are smooth. Once they are flat, go over each with a finely set smoothing plane or scraper. You want to eliminate any defects that could telegraph to your veneers.

Now find the longitudinal center of the top beam and mark in 3" from the each end. These points will be the centers for the screws. Line up the beams, inside faces together, and clamp them together. Chuck an extra long 1/8" drill bit into the drill press, make sure everything is lined up and square, then

> "After benches, vises are the greatest tools of the cabinetmaker."
>
> *—André -Jacob Roubo, French craftsman & author (1739-1791)*

drill through the top beam into the base. This pilot hole marks the center alignment for the screws in both beams.

Separate the beams and drill the screw holes using Forstner bits. Following the pilot hole, drill a 1⅜" hole in the base beam and a 1⅝" hole in the top. The 1⅜" hole is appropriate for the threading tap; the larger holes in the top beam allow that piece to pass over the screw threads. Take your time and drill in from both sides to prevent blow-out.

Get it straight. *Clamp the two beams together and drill a small hole through both to ensure that the holes are on the same centers.*

On the beam. *The lower beam is tapped for the ends of the screws. Another option is to leave the ends unthreaded and simply glue and peg the screws into the holes.*

When tapping holes, accuracy and lubrication are your friends. Prep the tap by rubbing the threads with canning wax, soak the hole in the beam with WD-40 and take special care to make sure you are starting the tap perfectly plumb.

Any slight variance will translate through the length of the screw and will impede the travel of the top beam. You can chuck the tap into an unplugged drill press and rotate it into the cut by hand. If your holes do not tap square, you can enlarge the holes drilled in the top beam to accommodate the slope, but this allows more play in the beams when they meet.

The Frames

The S-shaped frames are the one part of the vise that should be made from hardwood. I used some hickory from my offcut bin and prepared two blocks of 1" x 3" x 6".

Find the center of one block, then sandwich the two together. Drill a hole at the center point and connect the two with a temporary screw.

Trace around a quarter to define the round ends in opposite corners, then draw the curved lines between them freehand. I roughed out the shape on the band saw and cleaned up the cuts with rasps and a scraper. Remove the temporary screw and separate the matched frames. The screw hole becomes the guide to drill a 1⅜" hole. Follow by tapping the holes in the same manner as the beam.

All Together Now

To assemble, brush glue into the threads of the base beam and insert the screws, turning and pushing them down until they bottom out. Now drill and glue in a ⅜"-diameter dowel from the side to fix the screws in place. Fit the top beam over the screws and thread on the frames.

This press is pure simplicity and versatility. It's cheap to build, and the only special tool required is a 1½" threadbox and tap. It's more traditional than vacuum bags and doesn't use any oddball clamps or hardware. Dismiss the pleasantries like the ball turning and the moulding, and it's easy to build one in a single day or a half dozen in a weekend. Multiples of this vise would help in pressing larger surfaces. **PWM**

Lock it in. *When the screws are in position in the lower beam, drill through the beam and into the screw. A dowel in the hole will keep the screw from turning.*

Take it for a spin. *After the frames are shaped the holes are tapped. Turning the frames on the screws applies pressure to the top beam.*

Derek is a husband and father, and a woodworker with a deep fascination with history. Visit his blog at insidetheworkshop.blogspot.com.

ONLINE EXTRAS

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BLOG: *Read more from Derek Olson.*

IN OUR STORE: *Roy Underhill translates (and channels) André-Jacob Roubo while building a folding bookstand for the February 2011 issue (#188).*

TO BUY: *A poster of Plate 11 from "L'art du menuisier," suitable for framing.*

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- ShopWoodworking.com

Danish Modern

BY LINDA ROSENGARTEN

Enthusiasm and people skills are the keys to Ejler Hjorth-Westh's success.

'Dannebrog' armchair. *This Oregon ash chair is upholstered in velvet that's the same color as the red of the Danish flag. Ejler Hjorth-Westh says it's a social commentary on who is allowed to sit on what.*

Coffee first. *Ejler greets just about every day in his shop the same way: with a large mug of coffee in hand.*

On California's Mendocino coast, you really never know who you are talking to by looking. Institutional "costume" doesn't fly around here, so it is not always easy to tell who belongs into which socially recognizable box. So, when you first look at Ejler Hjorth-Westh, with his aw-shucks overalls and his outsized signature beard, you can be pretty sure that his appearance is deceiving.

Ejler was raised on a farm in Denmark, and still considers himself a farm boy at heart. He studied religion (to Ejler, a study in religion was a study in philosophy) and biology in college, has a teaching degree in biology, is a boatbuilder who fishes the chilly Pacific waters near his home in Elk, Calif., a dedicated vegetable gardener, a big reader, an interpreter of post-modernism, a well-recognized furniture maker and an instructor in fine woodworking at the College of the Redwoods in Fort Bragg, Calif.

Although Ejler readily shares his passion for woodworking and for living life both fully and with intention, he is slow to reveal his depth of thought. Furniture making is not only work and craft, it is for Ejler a pursuit in bringing together his delight in nature and kinship with history and philosophy into usable forms.

Like many professional woodworkers and artisans, his is a home-based business, a little cottage industry. Ejler actually lives in a house a few feet away from his shop with his wife, Karen.

The shop is populated with just about everything a busy woodworker could ever want, including a good feel and a place for building boats. This shop is like a TARDIS structure from "Doctor Who" – seemingly larger on the inside than out.

The shop looks like a regular barn from the outside: big doors, tools for yard work and supplies stacked and leaning against it. Inside, though, this outbuilding expands into a two-wing split level, a haven for woodworkers, postulants and guests.

Wood is stacked everywhere. Jigs and patterns for chair arms and other shapes hang from beams and rafters. There is a tool for everything, including a wood encased circa 1883 Silver band saw, as well as a sturdy, rotund wood-burning stove and pieces of furniture on various benches and hanging from the walls. How does all this fit in there? Who knows – perhaps it's magic.

Be Lazy

Ejler works routinely on commissioned furniture, and does so with remarkable efficiency. While you can go to school to learn his techniques, the secret to Ejler's success is how he produces so many fine pieces so quickly.

'Event Horizon.' *The intricate front panel of this kwilla, zebrano, redwood burl and ebony cabinet protects a reserve of fine wine.*

You might think there is something remarkable, some type of secret technique, a special genius that powers his prolific production; Ejler says otherwise. "I'm quite lazy. But I do go out of my way to get the kind of work I really want to do, that I can't wait to sink my teeth into," he says. "If I do a big cabinet with lots of drawers and endless dovetail work, I may want to do chairs next, or vice versa. I try to mix up my work, so I don't run out of steam."

There you have it: Be lazy. That said, there is wisdom to taking on the jobs that motivate you. True, Ejler is beyond taking every job that comes along. He's an established furniture maker at the top of his form, an artisan who's paid his dues. Furthermore, he's done so in study of history as well as hands-on, hands-on and more hands-on. Hav-

'Doussie.' *This 16" x 16" x 53" English sycamore tall chest was built to the specifications of a customer who needed it to house the same content and occupy the same space as a tired piece from Ikea.*

LEAD PHOTO BY KEVIN SHEA PHOTOGRAPHY; HJORTH-WESTH & WORKSHOP PHOTOS BY THE AUTHOR; FIR BED PHOTO BY EJLER HJORTH-WESTH; ALL OTHER FURNITURE PHOTOS BY JOHN BIRCHARD

Barn door. *A red barn door, just steps away from his house, leads to Ejler's shop in Elk, Calif., a small village on the Mendocino coast.*

A look inside. *Work stations are surrounded by seeming chaos, with the tools of the trade lining every wall and window.*

ing taught for many years also means helping others find solutions to a lot of different problems. So Ejler is well-schooled in addressing various technical challenges.

Plus, he has one other important strategy: "I don't think I'm afraid of anything; I always want to try something new, something different and challenging," he says.

He recently worked on a king-sized bed in Douglas fir that provided just such an opportunity.

"I enjoy the change, the shift in gears as it relates to my skills, tools, patience and focus. I like the liberation of such a piece as the fir bed," he says. "It still has got to be good but it is not nitpicky, it's free and a bit careless. It's liberating."

The bed also met his standard for working together with clients. "I have to bring in my patron's needs, their ideas and their words in order to channel my inspiration, to bring it focus," he says.

Some makers who take commissions tire, even to the point of exasperation, of the fancies and half-knowledge of their clients. It's not always easy to answer the same question over and over again, deal with someone else's schedule, and negotiate price or a changing landscape of costs, he explains. Artisan-client reciprocity factors large in return business and turns one-time clients into patrons.

Ejler says his job – any artisan's job – is to work with a client as a team to deliver on expectations. But in the end, maker and client are looking at a piece through a different lens. For Ejler, that lens is the craft itself.

So he invites clients into his shop, and works to make customers feel good. "I want people to feel my shop is a place

Antique. *This circa 1883 Silver band saw sees significant use in Ejler's shop.*

'Pin Cushion.' *This afzelia and bubinga piece, which functions as a bench or low table, features an intricate top (right).*

where good things happen, that it's a place where a client wants to be," he says. "And for the client to know it is where I want to be."

And who wouldn't want to be in Ejler's shop? It is cozy and filled with woodworking tools. The chairs are elegant and comfortable. He has stations for work and for socializing; a sharpening station is next to a hot plate and kettle, his shop has an office station with computer, printer and the stuff of business, as well as a television where other woodworkers and pals come to watch sports events.

You go there to be part of it, to be part of the tradition and craft of artisan woodworking (and maybe to catch some football on TV).

Ejler's enthusiasm for building furniture carries from the shop to his patrons' homes. Yes, he's done his best on his work – but the job doesn't rest there. He is eager for a good reception of his work and relies on his clients' happiness and their enjoyment of the commission process for him to consider the job complete and successful.

Happy patrons are inseparable from his estimation of what makes a good artisan.

"Once you experience the rejection of a piece by a customer, you do not want to experience that rejection ever again," he says. "I see it as my obligation to the craft to create a successful piece, both for me and for the buyer. We're not just woodworkers, we're artisans building what people want, not what they need. If you learn to value a client's gratitude, that's part of the skills of being an artisan – the people skills."

Teaching the Craft

Ejler brings that teamwork approach to the classroom, too, by offering attention, focus and respect for his student's aspirations, coupled with top-notch instruction.

> "Learn to value a client's gratitude; that's part of the skills of being an artisan...."
>
> —Ejler Hjorth-Westh
> Woodworker & teacher

Big tails. *Ejler is in the midst of building a king-sized bed from construction-grade Douglas fir. To match the size of the piece, he chose massive dovetails for a strong, functional joint. To cut them, he uses a full-size ripsaw.*

Two of Ejler's beliefs as a woodworking instructor are that he must recognize talent in a student, and that when he is teaching he must be at his best. His students can expect him to pull out of them their very best, too.

It's also worth noting that Ejler's education is European, and although that bears some resemblance to what Americans learn, when it comes to furniture, his viewpoint was born from scholarship related to the deconstruction of the European aristocracy (those big patrons of furniture, their own names and eras all over styles and schools, not the maker's) up to the Modernist era.

When you talk with Ejler, you realize that he recognizes and appreciates the fact that furniture crafted in wood offers an opportunity to confer a complex of meanings into its making, both structural and social – and it comes through in his work.

Otherwise, it is all about the wood, jigs and handwork. **PWM**

Linda lives in Fort Bragg, Calif. Among other endeavors she has owned a small, independent bookstore for many years and, with her husband, Ron Hock, owns and runs Hock Tools.

'Victoria' chair. *While taking cues from Victorian chair design, this Italian walnut and leather chair does away with much of the stuff and fuss of the period inspiration.*

ONLINE EXTRAS

For links to all online extras, go to:

- **popularwoodworking.com/aug14**

WEB SITE: *Find out more about the College of the Redwoods, where Ejler Hjorst-Westh teaches woodworking.*

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Painted Bucket Bench

BY CATHARINE C. KENNEDY

A simple project from home-center wood is transformed with faux graining.

Faux graining is the art of illusion. Use this technique, and your choices aren't constrained by what woods are available or what's shown in the veneering catalogs (or your bank account); you are limited only by your imagination. With the use of simple tools and materials you can transform a modest piece of inexpensive furniture, such as this pine bucket bench, into a showpiece. It's simple and fun – a great combination.

The Build

For this exercise, I built a traditional bucket bench using dimensional lumber purchased from a home center and a basic set of tools. (In fact, this project fits into the "I Can Do That" philosophy and tool set – see online extras for more on ICDT).

I got all the wood needed out of two 12' 1x12s (which are, of course, 3/4" thick and 11 1/4" wide). All but the back piece and the lower rail are used at full width; the back piece and rail are ripped from a 1x12, which I did at the table saw. You could use a jigsaw for the rip, and run the shoe of the tool along a straightedge for a more-perfect cut. But no matter how you cut it, use a block plane to clean up the new-sawn edges.

For this project – with the exception of the sides – you can go ahead and cut all the parts to size per the cutlist.

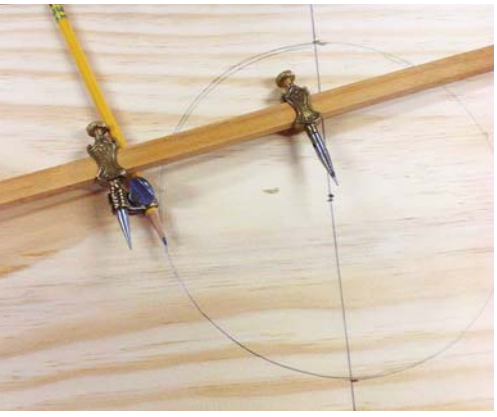
For the sides, which are each 38" in length, crosscut a 76" piece of 1x12 and mark across it at 38". That's where you'll lay out the curve cutouts for the

Kitchen display. *A "bucket bench" is an historic form meant for holding stoneware and buckets. It's a simple project to make, and traditionally it is painted.*

LEAD PHOTO BY AL PARRISH; STEP PHOTOS BY THE AUTHOR

"An artist cannot fail; it is a success to be one."

—Charles Horton Cooley (1864-1929) American sociologist



Draw. *Trammel points make quick work of marking the cutouts for the half-round feet.*

Cut. *I used a frame saw to cut the half-rounds; note the relief cut in the center. You could also use a coping saw or, of course, a band saw to make these cuts.*

feet, which is easier to do while the two halves are connected.

Set a compass or trammel points for a 3¾" radius and, starting from the center of your marked centerline, draw a circle.

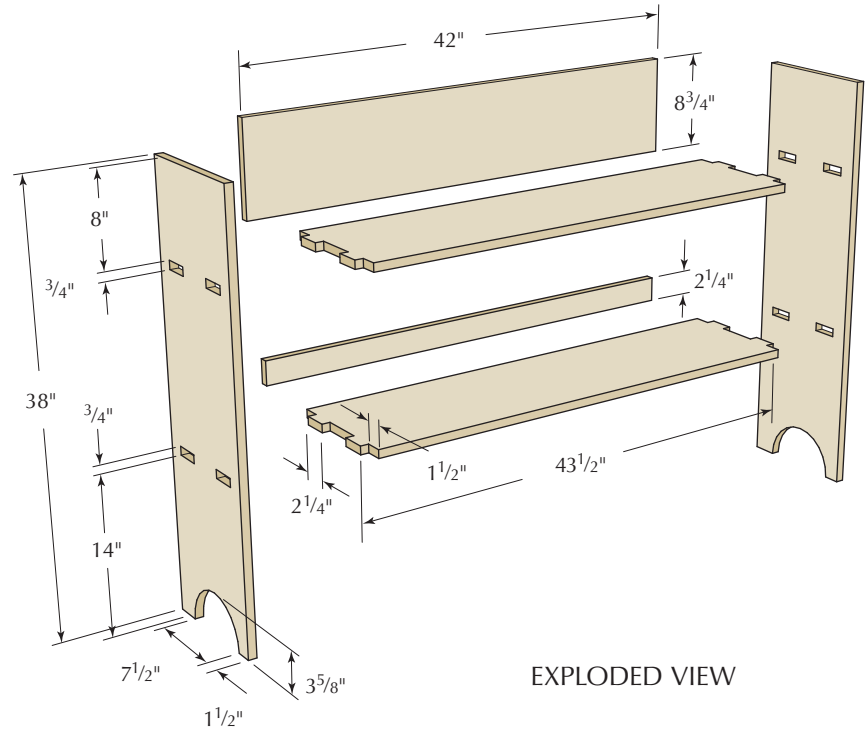
Cut the piece in half on the centerline, butt the boards together and clean up the bottom surfaces as needed with a handplane or sandpaper. Then clamp them together and remove the waste.

You may have a little cleanup to do on the cutout surfaces with rasps, files or sandpaper. Once satisfied with the curves, it's time to move on to the mortises and tenons for the shelves.

Lay out and cut the mortises first (refer to the illustration for the mortise locations). There are only four on each side, so I used a chisel for this operation.

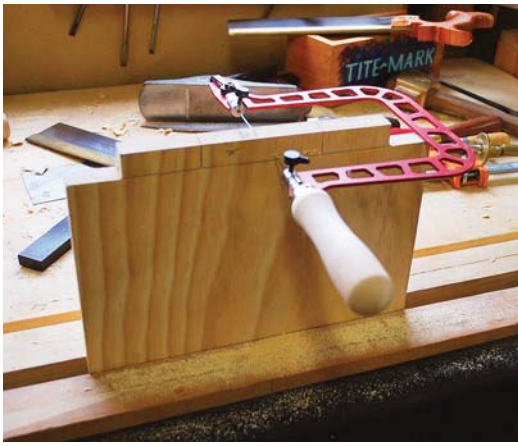
After the mortises are cut, show the two shelves to the side pieces and mark the tenon locations directly off the mortises. I used my dovetail saw to make the cheek cuts, and a coping saw to remove the bulk of the waste before chiseling to the layout lines.

Before moving on to the paint, do a



EXPLODED VIEW

Whack 'em. *With just four mortises to cut – and in soft pine, to boot – I used a chisel.*



Cut then cope. *A dovetail saw makes quick work of the cheek cuts, and a coping saw removes most of the shoulder waste. The rest is cleaned up with a chisel.*

dry-fit to ensure the pieces go together and the joints are fit well.

Prepare to Paint

Of the various methods available for wood graining – oils, acrylics or vinegar – I far prefer to use the vinegar recipe. It uses materials commonly found in the home: sugar, vinegar and water…as well as powdered pigments (everyone has those at home, right? If not, they're available at any decent art supply store). The formula is simple to use, very forgiving (it washes right off with a damp cloth) and non-toxic.

Here's the recipe:

- 1/4 cup of white vinegar
- 1/2 cup of water
- 1 teaspoon of sugar.

Stir the three ingredients until the sugar is dissolved, then put a small spoonful of pigment (for this project I used burnt umber, burnt sienna and raw sienna) into a separate, clean container. Add enough of the vinegar mixture to make a paste, stirring to remove all lumps, then add enough additional liquid to make the paste into the consistency of syrup. The thinner the mix, the more you can "work" it. Cap the container and put it aside for the moment.

Before you start grain-painting your bench, it's good practice to make a sample board to try different techniques and brush patterns. This paint dries very fast, so it's best to get familiar with it, and to work very quickly in small sections.

There are a variety of options for applying the graining. They can be as simple as wadded up paper toweling or plastic bags, progressing through brushes and tools specifically for graining. You know those old brushes you didn't get quite clean enough and they hardened up? As long as the very tips aren't caked with gunk, these crusties are really good for striations, as we will see.

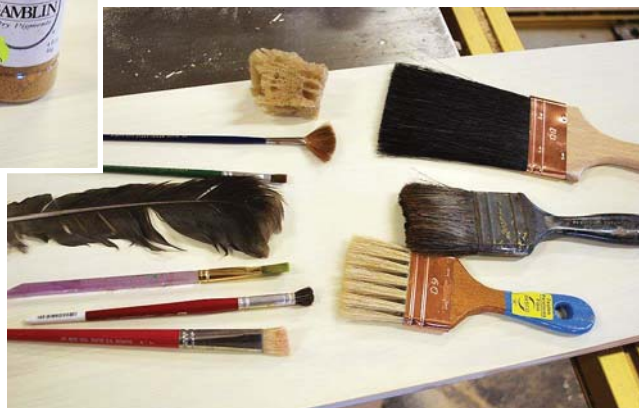
Now Paint

The raw wood needs to be painted with an undercoat of acrylic paint on all surfaces and allowed to dry. (It doesn't matter what color you choose – use your imagination while keeping in mind that it might show through in places.) Sand as necessary, and be sure to wipe off any dust. The standard painting practices of dropcloths or newspaper to protect your floor or bench apply here, as well as supporting the workpieces on sticks, blocks or cans.

If you're going to add edge-banding and a center diamond as shown here, mask off those areas with blue tape before picking up your brush.

I think this simple project calls for somewhat plain grain – and that's where I start. Using a very stiff brush to apply the stirred vinegar and burnt sienna pigment solution, I go the length of the board, in strokes about 6" wide. Vinegar graining is a removal process – we are leaving what we want to resemble grain, so by gently stroking the brush down, the pigmented area

Pigments. *I used three colors of pigment for this project: burnt umber, burnt sienna and raw sienna. Dry pigments are available at art-supply stores.*



Tools. *Feathers, sponges, brushes and even paper and plastic bags can be used for faux graining.*

Grain. *The bulk of the graining is applied with a very stiff, old brush to achieve a lined finish. Don't aim for straight strokes; variation adds a lifelike look.*

Bucket Bench

NO.	ITEM	DIMENSIONS (INCHES) T	W	L	MATERIAL
❑ 2	Sides	3/4	11 1/4	38	Pine
❑ 2	Shelves	3/4	11 1/4	43 1/2	Pine
❑ 1	Back	3/4	8 3/4	43 1/2	Pine
❑ 1	Rail	3/4	2 1/4	42	Pine

Stipple. *Move a flat brush up and down to the surface to mimic veneered edge-banding.*

"grain" is formed.

Absolutely straight brushing is not an asset here – you want to mimic the grain variation found in nature.

Next, coat over the adjoining section and repeat the graining until the board is complete. If you like the look of it, move on to the next piece; if you don't like it, simply remove the paint with a damp paper towel and reapply it.

When you are ready to move on to the edge-banded areas, reposition the tape so there is a scant bit of the grained board showing (rather than any undercoating.) It helps to use a flat brush the same width as the tape. On this piece, I stippled – that is, I moved a flat brush up and down – perpendicular to the edge, just as you would find on a veneered edge. For this, I used the vinegar paint with burnt umber pigment.

For the center of the inside back, I decided on an inlaid look. Here, blue tape is definitely your friend.

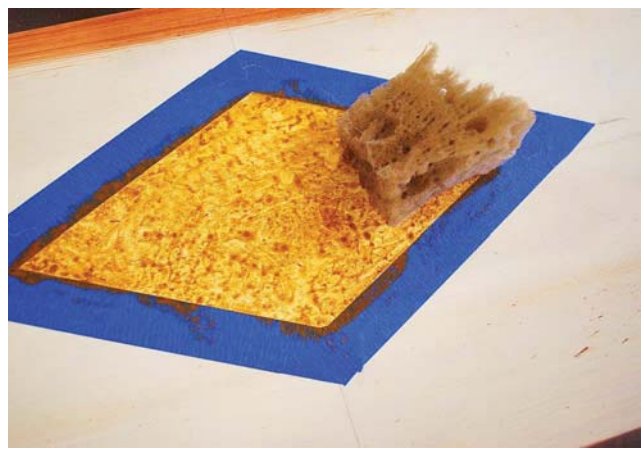
Use a pencil to lightly mark vertical and horizontal lines, and a diamond shape of a pleasant size. Run tape along the sides of the diamond and make sure the edges are down firmly. Once the tape is in place, use an eraser to remove your pencil lines, so they don't show through.

I mixed more of the vinegar paint with raw sienna pigment for the light area, and used just a touch of the burnt sienna there as well for contrast. Start with the medium to light shade for the center section in a more random all over pattern, using a dampened natural sea sponge in random motion.

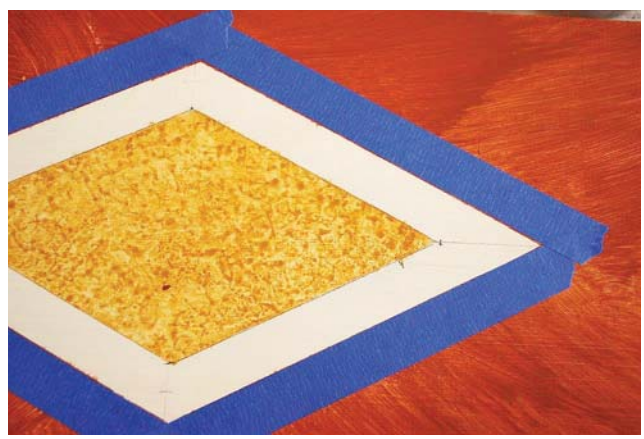
For the grain on this back piece, I wanted a quarter-matched look, so I had to keep in mind which way the graining should run to mimic that. Here, I used the same color and brush as I did for the bulk of the project.

After these sections are dry, remove the tape and apply new tape to the outsides of these lines, to isolate the now-unpainted line. I used the darkest color as an edge banding, and used a small flat brush to remove pigment perpendicularly from the line. Wipe your brush on a paper towel frequently for best results.

Once you've finished the faux painting, you might notice that all your hard work looks flat and dull – but once the project is assembled, apply a coat of polyurethane or varnish, and the colors and graining will pop. **PWM**



Sponge. *A natural sponge, lightly dampened, deposits just enough color to mimic a bird's-eye pattern if you touch it to the surface in a random pattern.*



Stipple again. *Use the same brush, color and technique as for the edge-banding to define the edges of the "inlay."*

Catharine graduated from the Carpenters' Union Apprenticeship program, built wooden boats, worked in cabinet shops and was the lead carpenter at Hancock Shaker Village in Pittsfield, Mass., for 12 years. See her engraving work at catharinekennedy.com.

ONLINE EXTRAS

For links to all online extras, go to:

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BLOG: *View a collection of antique grain-painted chests.*

VIDEO: *Learn more from Catharine Kennedy on vinegar paint and faux-graining.*

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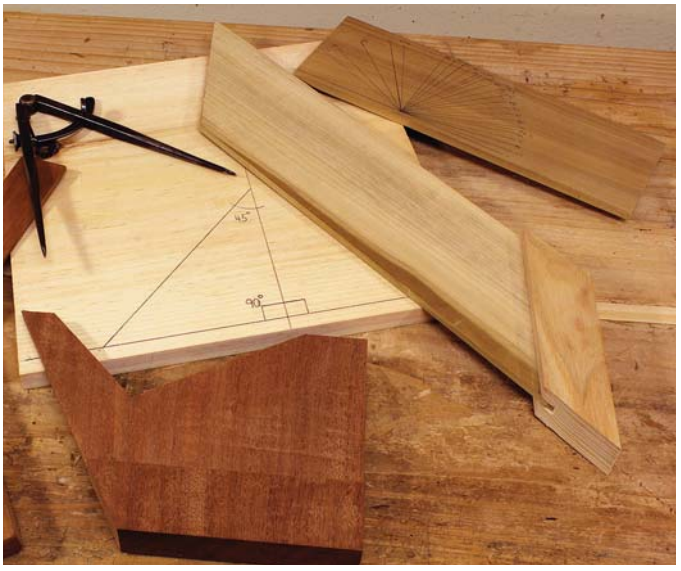
Don't be Such a Square

Make a 45° miter square with help from dividers and a straightedge.

The very first lesson any woodworker learns is that precise work requires square corners. We ensure that stock is square before cutting any joinery. We check to make sure that casework is square during assembly. Almost everything we do is dependant upon things being square. That is, until we need an angle other than square.

Throw in an angle other than 90° and panic sets in quickly. How do we cut, fit or adjust a joint that can't be confirmed with our try square? The secret is, of course, another tool. We can purchase the necessary tools. But making our own is a good lesson in simple techniques, and a low-risk way of stepping outside the square box.



Unsquare squares. *The angles for these tools are established with nothing more than a pair of dividers, a straightedge and some basic geometry.*

Geometry to the Rescue

Many period woodworking books include a section on geometry. Having an understanding of geometry allowed our forebears to work faster and more precisely. This was important, considering that their rulers were typically graduated down to only 1/8" increments, and often not very accurately so.

As Peter Nicholson stated in his book "The Mechanic's Companion," "The use of Geometry is not confined only to speculative truths in Mathematics, but the operations of mechanical arts owe their perfection to it; drawing and setting out every description of work are entirely dependant upon it."

The geometry used to establish the angles that we commonly use in woodworking shouldn't be unfamiliar to you. We don't need a calculator or complicated mathematical formulas. Using basic geometry, we can accurately draw the angles we need using only a pair of dividers and a straightedge. Even if you don't have a try square, you can draw 90° accurately using simple techniques. (Many building trades use the Pythagorean theorem, also known as the 3-4-5 rule, to define square on an almost daily basis.)

The Frustrating Miter

One of the most difficult joints to make well in woodworking is the four-corner miter joint such as one might use for a frame. Typically, the first two corners aren't a problem. That's my theory as to why most furniture cases are wrapped with mouldings only on three sides – there are but two miters to cut. (Also, it makes them easier to fit against a wall, and you needn't worry about the corners breaking apart from wood movement.) Fitting the third and fourth corners and getting all four miters to close tightly is magnitudes more difficult than fitting just two. Adjusting one corner just throws the other corners out and shortens one of the pieces, requiring similar adjustments to the parallel parts, which leads to days of frustration and choice language.

One helpful tool for making accurate miters is the 45° miter square. A combination square has a 45° leg on it, but it's kind of short and can be difficult to register accurately on a wide miter, such as those on a picture frame. Fortunately, these squares are not difficult to make accurately. The first step is drawing an accurate 45° line (see the photos at the top of the next page).

The easiest way to define a 45° line is using the hypotenuse (longest side) of a 45-45-90 right triangle. First plane the edge of a board so it is perfectly straight. Using a try square, draw a line perpendicular to the board's edge. I use a marking gauge to make a line parallel to the board's edge as well to give my divider's point a positive place to register.

Place one point of the dividers at the square intersection of the two legs. Then swing an arc that intersects the two legs. Draw the hypotenuse by connecting the points where the arc crosses each of the legs. The two legs will be of equal length and join at a right angle. Therefore, the hypotenuse is a 45° angle.

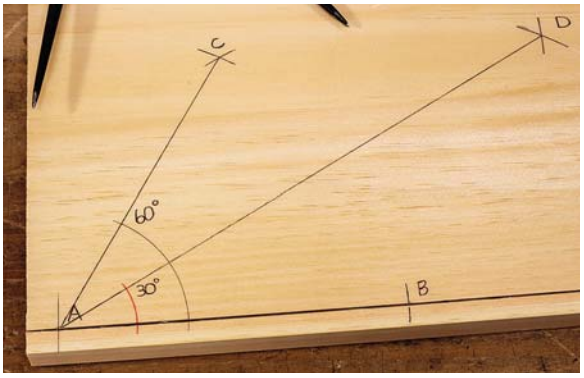
PHOTOS BY THE AUTHOR

Triangle. *Two equal legs joined by a square corner define the 45° right triangle.*

Test, adjust, repeat. *Use the 45° line drawn on the board as a reference to true up the miter square.*

Using this line, set the blade angle of an adjustable bevel, which is used to lay out the 45° cuts for the miter square. Plane the edges of a 1/4"-thick board perfectly parallel to one another. Using the adjustable bevel, lay out parallel 45° cuts on each end of the board and saw them off. Plane a 1/4" groove in a piece of 1" x 1 1/2" stock for a handle and glue the blade into it. A couple of pins or finish nails helps to hold the blade in place.

Test the assembled miter square against the 45° line you drew on the board. If the miter square does not line up with the line drawn on the board, plane the side of the blade until it does. Repeat with the other side of the blade. Other styles of miter squares are similarly constructed, but they require testing and adjustment in sequence in order to true all of their sides.



Equilateral triangle. *Split the angle of an equilateral triangle to find 30°.*

Other Angles

Other angles are determined similarly. Drawing a 60° angle can be accomplished by drawing an equilateral triangle. By splitting one of the angles, a 30° angle can be defined.

Again, I start by using a marking gauge to draw a line parallel to the straight planed edge of the board. Place the dividers at point "A" and swing a wide arc that crosses the line at "B" (see photo below). Without changing the setting of the dividers, move the point to "B" and swing a second arc that crosses the first arc at "C." These three points define an equilateral triangle, so line "AC" will be at 60° to line "AB."

To find the 30° angle, alternately place a point of the dividers at "B" and "C" and swing two arcs that cross at "D." Line "AD" will bisect the 60° angle, resulting in a 30° angle.

With a little imagination and experimentation with dividers and straightedge, the angles you can precisely draw are practically limitless. Play around with the concepts, and you can ditch your calculator once and for all. With a little patience, dividers and a straightedge, even making your own protractor is just a matter of swinging a few arcs. **PWM**

Bob has been building furniture for two decades and now works entirely by hand. Read his blog and listen to his podcast at logancabinetshoppe.com

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About This Column

ARTS & Mysteries

Bob Rozaieski of Logan Cabinet Shoppe ends his tenure as Arts & Mysteries columnist with this issue. Peter Follansbee takes the reins in October. "Arts & Mysteries" refers to the contract between an apprentice and master – the 18th-century master was contractually obligated to teach apprentices trade secrets of a given craft.

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Matching Colors

Use the method that allows you to keep trying until you get it right.

One of the most challenging tasks in wood finishing is matching the color of an existing object, color swatch or photo in a magazine. Most people try to accomplish this with just a stain, but it rarely works.

Most factory-finished objects, for example, are colored with more than one step to begin with, and even in cases where just a stain was used, or the wood has simply aged, it's still rarely possible to imitate exactly with a stain alone.

Toning is the technique most professionals who spray their finishes use to match color. This involves first using a stain to get the color close, then adjusting the color slowly to achieve a match by spraying highly thinned lacquer with a little pigment or dye added. The problem with this method is that it's unforgiving because the toner dissolves into the existing finish. If you get the color wrong or too dark, you have to strip off everything and start over.

So if you use a spray gun, here is a forgiving method of achieving the same thing. If you don't like what you've done, simply wash it off, make the adjustments, and try again.

To demonstrate, I'm matching very light-colored, maple-veneered plywood to the leg of a 1930s gumwood chair that was colored to look like mahogany.

The color to match. *This is a 1930s gumwood chair finished to look like mahogany. I'm using it for a practice color match on a light-colored piece of maple plywood. I suggest you also practice first.*

Background color. *The first step is to match the background color, which is the lightest color in the object or photo you're matching. Achieve this color by spraying an NGR dye stain, usually followed by a brownish oil-based pigment stain to add definition to the grain. Then apply a sealer coat to lock in this color.*

Background Color

The first step is to use a dye stain to match the background color. This is the lightest color you see in the sample you're matching. An exact match isn't necessary, just something close. Try to keep this color on the light side.

The best stain to use is an NGR or non-grain-raising stain, which is a dye thinned in acetone. You can also use TransTint dye from woodworking suppliers, which is the same thing, just in concentrated form. Thin it with a solvent other than water to avoid raising the grain.

Spray just the amount of color you want and leave it. Don't wipe it.

Then apply and wipe off an oil-based pigment stain, usually a shade of brown, that brings the color a little closer. Some of the pigment will lodge in the grain to give it definition. If this stain gets the color too dark, quickly lighten it by wiping with naphtha.

(There might be cases where the grain of the sample is so muted or nonexistent that you don't want to highlight it, but these cases are rare.)

When you're satisfied, apply a sealer to see the true color. This can be sanding sealer for easier sanding, vinyl sealer for better durability, shellac to block off a problem in the wood, or the finish itself. Don't sand this coat until after the next step because sanding deadens the color intensity.

CONTINUED ON PAGE 62

PHOTOS BY THE AUTHOR

Popular Woodworking Presents
Woodturning with Tim Yoder

— Tune in now. Shows airing each Saturday! —

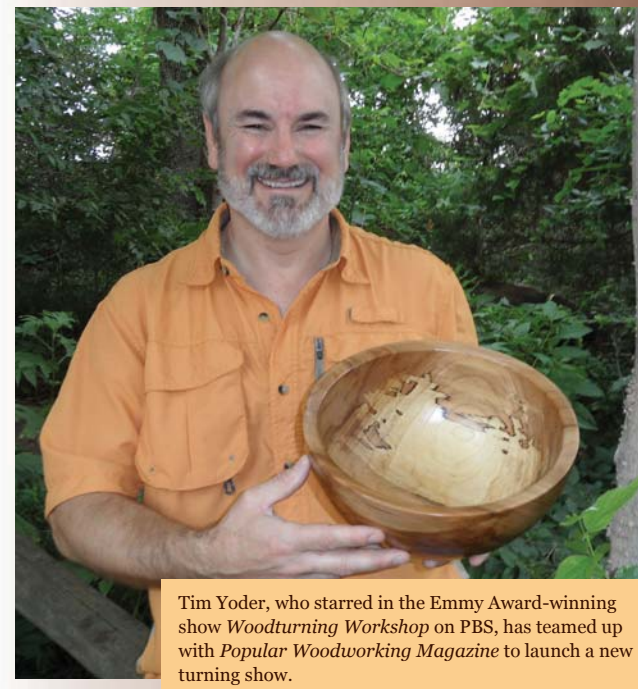
Popular Woodworking Magazine has teamed up with well-known PBS star Tim Yoder to launch a new online video show, filled with expert and friendly advice that will teach you how to become a better woodturner.

In each 30-minute episode, Tim takes you through the process of making beautiful woodturning projects, from wine stoppers and duck calls to platters and bowls. Along the way, you'll learn his favorite turning tips and techniques, and he'll offer reviews of the latest lathe tools, chucks and accessories to help you determine the best products to buy.

Whether you're an experienced woodturner who wants to improve your skills or you're new to the hobby and want to learn basic woodturning, *Woodturning with Tim Yoder* is a show you'll want to watch.

Visit **www.popularwoodturning.com** every Saturday for the latest episode of *Woodturning with Tim Yoder*.

This show is brought to you by: Easy Wood Tools, Robust Lathes, Titebond Glue, Thompson Lathe Tools, Woodworkers Emporium, Rikon Power Tools, Cook Woods and American Association of Woodturners.



Tim Yoder, who starred in the Emmy Award-winning show *Woodturning Workshop* on PBS, has teamed up with *Popular Woodworking Magazine* to launch a new turning show.

CONTINUED FROM PAGE 60

Making up the color. *After determining the direction you want to adjust the color, usually to the red, green, yellow or black side, add a very small amount of the color, or colors, to naphtha or mineral spirits and stir well. You want to build the color very slowly so you don't lose control.*

Checking Where You're At

With the true color now revealed, hold the object you're finishing and the object (or photograph) you're matching next to each other and decide on the direction you need to move the color. Compare with the grain running in the same direction for a more accurate view.

In almost all cases, you'll need to add red, yellow or green, or you'll need to reduce the intensity of the color using black (for example, to make red more brown). Because you can "green out" a color (meaning "kill" some of the red) by adding a combination of yellow and black, the only colors you really need on hand are red, yellow and black.

The easiest color medium to use is Japan color, which is pigment ground in varnish, though in a pinch you could dig the settled pigment out of the bottom of a can of stain or glaze and use it. You could also use universal tinting colors, available at most paint stores.

If you forget and sand the surface before you've done the comparison, you can restore the intensity temporarily by wiping with naphtha or mineral spirits. Naphtha evaporates very rapidly and is my preferred solvent for all these steps. Mineral spirits (paint thinner) dries considerably slower.

Adding the Color

Stir the color or colors you've chosen into naphtha or mineral spirits to a very weak consistency. As an example, in a pint of thinner begin with just the amount of color that sticks to the bottom two or three inches of a stirring stick as you pull it straight up out of the can. You want to build the color very slowly or you'll lose control and get it too dark too quickly.

Strain the mixture into your spray-gun cup to remove any lumps of pigment, and agitate often because the pigment settles quickly.

Begin spraying this mixture onto your work. Use a narrow fan width and hold the gun at a low angle to reduce dark overlaps. Move the gun faster and at a greater distance from your work than would be typical when spraying a finish. You want to apply the mixture so it just wets the surface, without wrinkles or runs.

Build the color very slowly, paying close attention to it while it's wet because the color will be inaccurate when dry. If you want to do some shading – darken some areas more than others – this is the time to do it.

If at any time in this step you decide the color you're adding isn't going in the right direction, or if you get the color too dark, simply wash it all off with a rag wetted with naphtha or mineral spirits and begin again with an adjusted color.

This is the great advantage of this color-matching technique compared to spraying a lacquer toner. You can try over and over without ever having to remove the base color or the sealer coat.

'Seal it In'

When you think you have the color very close to a match, apply a washcoat. This is the finish thinned to about 3- to 6-percent solids – just enough to produce an accurate "wet" look when dry, without any more build than necessary.

Check the objects against each other. If you don't quite have a match, continue spraying more color and follow with another washcoat. Each time you apply a washcoat, you're locking in the color, and you can't remove it without removing everything down to the dye.

When you're satisfied with the color match, apply your finish coats. **PWM**

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

Spray at a low angle. *To avoid the dark overlaps that can occur when spraying at a perpendicular angle, spray at a low angle with a narrow spray pattern. Build the color slowly and sneak up on the match with many passes. Judge your progress while the color is still wet.*

Color match. *Here's the final color match after applying a washcoat to reveal the true color.*

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Take Your Home to Work

A lunchtime woodworking break yields more than a nice saw handle.

Last summer, I took Matt Cianci's Build a Backsaw weekend class through my local woodworking guild. There is never enough time in a weekend class to finish the project; this was no exception. I'd roughed out the tote, set the saw plate into the back and sharpened the teeth (with impressive results), but it was far from done.

Knowing myself as I do, I figured I had a very short window of opportunity before my unfinished saw was relegated to the "I'll Finish This Later" pile.

Fortunately, a subsequent conversation with my wife sparked an idea. We were discussing some work she had to finish at home during the next weekend and I thought, "People take their work home with them all the time; maybe I should try taking my home to work, instead!"

I quickly made a list of what tools I needed and decided it would be possible. Later that night, I packed up a toolbox with rasps, files, sandpaper, a handscrew clamp and my unfinished saw, and loaded it all into my car.

On my lunch break the next day, I grabbed my toolbox, headed out to the covered patio behind our building and sat down at my new temporary workspace – a picnic table made from heavy-gauge mesh steel. Set on 23 acres of land, my work's campus is home to a field, a large number of trees and several walking trails, all visible from the back patio.

That view, along with the steady sound of water percolating from a retention pond fountain, was about as idyllic a setting as I could hope for in the middle of a work week.

Because I was shaping my tote with hand tools, I didn't have to worry about having electricity (or violating any policies against using power tools at work) and I had plenty of natural light.

Once I got set up, I realized I could wedge the threaded rods of my handscrew into the mesh of the picnic table bench several different ways, allowing me to adjust the tote's position according to whatever angle I needed. This was better than sitting at my workbench at home!

During the next two weeks, I shaped and refined my tote in 45-minute intervals. I was honestly a little sad the day the tote was ready for finish; I'd accomplished more than just completing the saw. I'd befriended several co-workers (and a broad-headed skink) who were all drawn to my outdoor undertaking. I breathed fresh air and enjoyed a bit of sunshine. I even managed a notable increase in my work productivity during those two weeks.

Ever since then, whenever I'm working on a project in the shop, I always ask myself if it is something I can easily take to work. The number of times I've said yes is surprising! You might consider asking yourself that same question. **PWM**

Ethan lives in the St. Louis area and is always looking for ways to fit woodworking into his busy schedule. Read more from him at thekiltedwoodworker.com.

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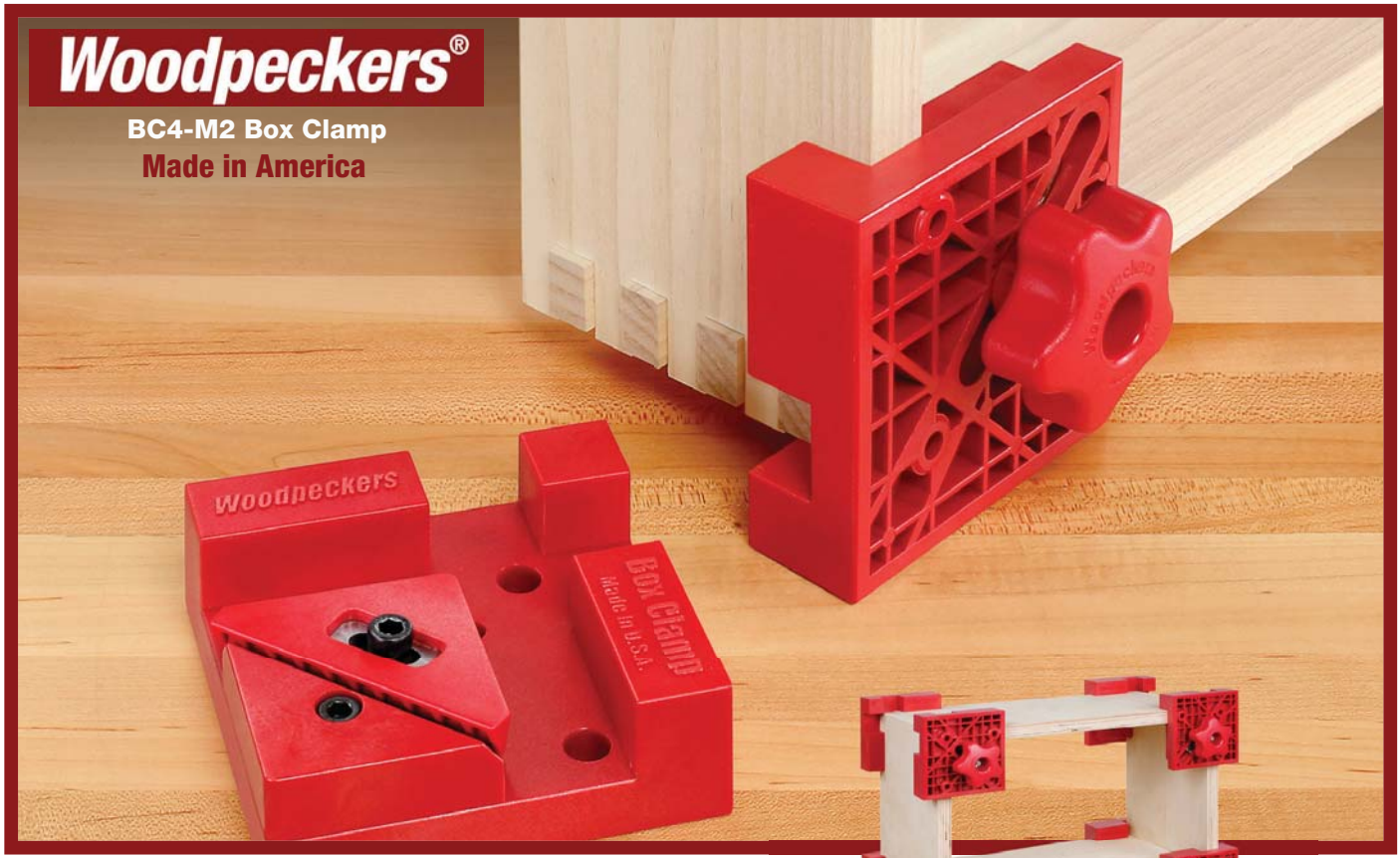

Like Having an Extra Pair of Hands. With our new M2 Box Clamps you can glue-up or dry-fit any 90° joint quickly and easily and know your joint is square. Just position the clamp in the corner of the joint, give the knob a twist and equal pressure is applied while instantly squaring the joint. It's that simple.

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