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APRIL 2010 ■ #182

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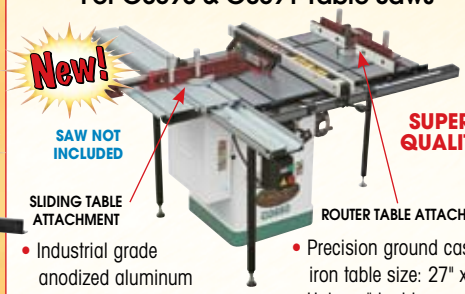

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Scraping Plane* (5)
***Best New Tool* 2004** Low-Angle Jack Plane* (6)
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Bevel-Up Planes* Smoother (8)
& Jointer (9)
***Best New Tool* 2006** Pullshave* (10)
***Best New Tool* 2007** Right-Hand Small Plow Plane* (11)
***Best New Tool* 2008** Skew Rabbet Planes* (RH & LH) (12)
***Best New Tool* 2009** Dovetail Saw** (13)
NX60 Premium Block Plane** (14)
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because by then, we'll have unveiled several innovations from Veritas® Tools. Those shown above have appeared in *Popular Woodworking's* annual *Best New Tools* feature. These are tools that the magazine's associates would be proud to own and recommend to fellow woodworkers, tools that have stood up to real shop-time use by amateur woodworkers (not just professionals). Since Veritas® Tools is devoted to designing and manufacturing innovative and practical hand tools that meet the needs of discerning woodworkers, it is no wonder that it has consistently made the list since 2001. Of course, you can always have a sneak peek at our latest innovations by checking out "What's New" in Woodworking on our website.

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Features

26 Shaker Stepback

Detective work and educated guesses helped us recreate this poplar cupboard from the White Water Shaker community, a forgotten and unrestored community in southwest Ohio.

BY GLEN D. HUEY

ONLINE ▸ **Tapered Backboards**

The backboards of this Shaker cupboard are unusual: They taper in width, are quite thin and are joined by tongue-and-groove. Find out how to tackle the unique back on our blog.

tinyurl.com/y9egbwe

34 Clark & Williams, Plane Makers

A slip on the ice launched the toolmaking company called Clark & Williams, one of the few makers of wooden handplanes in the West. We explore their shop and their unusual business.

BY CHRISTOPHER SCHWARZ

ONLINE ▸ **Plane Overload?**

If you want to get started in handplanes, check out five years of stories on our web site. Free.

tinyurl.com/ybslux7

40 How Tables Work

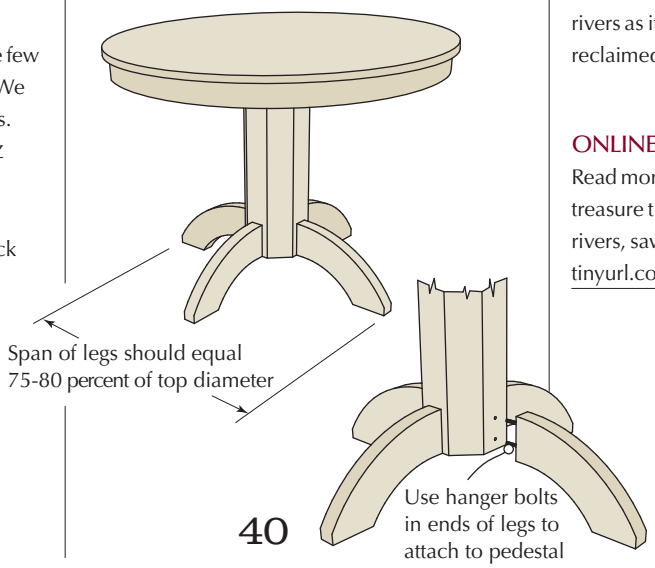
To build a table that is strong and looks good you must tap into both the engineering and artistic sides of your brain. We show you how – and how to avoid some common table-making pitfalls.

BY ROBERT W. LANG

ONLINE ▸ **Dining Room Design**

A dining table must balance surface area with user comfort and room size. With this free PDF, you'll discover how to work within practical parameters to build the ideal table for your lifestyle, family and home.

tinyurl.com/ybhanum



46 William & Mary

This late 17th-century style ushered in a radical shift in furniture design and construction.

BY CHARLES BENDER

ONLINE ▸ **Federal-style Cuffbanding**

A few decades after William & Mary, the Federal style became all the rage. In this video, you'll discover how to make cuffbanding – one of the quintessential elements of Federal design.

tinyurl.com/ylx957b

50 Sunken Treasure

As much as 750 million board feet of ancient Honduran mahogany sank to the bottom of rivers as it headed to sawmills. Today, it is being reclaimed, cut, dried and sold to woodworkers.

BY KARI HULTMAN

ONLINE ▸ **Water Logged**

Read more details about this underwater treasure trove and how it is reclaimed from the rivers, sawn, shipped and dried.

tinyurl.com/yzhmr7c

PLANES PHOTO BY CHRISTOPHER SCHWARZ; WILLIAM & MARY DESK PHOTO COURTESY OF CHARLES BENDER; MAHOGANY LOG SEARCH PHOTO BY ZEV BEN-YOSEF; ILLUSTRATIONS BY ROBERT W. LANG

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POPULAR WOODWORKING MAGAZINE

Number 182, April 2010. *Popular Woodworking Magazine* (ISSN 0884-8823, USPS 752-250) is published 7 times a year, which may include an occasional special, combined or expanded issue that may count as two issues, by F+W Media, Inc. Editorial and advertising offices are located at 4700 E. Galbraith Road, Cincinnati, Ohio 45236. Unsolicited manuscripts, photographs and artwork should include ample postage on a self-addressed, stamped envelope (SASE); otherwise they will not be returned. Subscription rates: A year's subscription (7 issues) is $19.96; outside of the U.S. add $7/year • Canada Publications Mail Agreement No. 40025316. Canadian return address: 2835 Kew Drive, Windsor, ON N8T 3B7 •

Periodicals postage paid at Cincinnati, Ohio, and additional mailing offices. Postmaster: Send all address changes to *Popular Woodworking Magazine*, P.O. Box 420235, Palm Coast, FL 32142-0235 Canada GST Reg. #R122594716 • Produced and printed in the U.S.A.

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CONTRIBUTORS

Kari Hultman
"Sunken Treasure," page 50.

Kari owns a graphic design agency in Pennsylvania, which supports her lumber and tool addiction. She started her woodworking journey as a Normite, but influences from classes and mentors directed her toward the path of hand-tool use.

An avid woodworking hobbyist for more than 18 years, Kari makes her own handplanes (including the blades), builds furniture (her current love is Pennsylvania German), has taught classes in lettercarving and hand-cut dovetails, and lives to learn all things woodworking including carving in the round, marquetry and inlay. Kari manages the Village Carpenter blog at villagecarpenter.blogspot.com, where she writes about projects, techniques, trips to historic sites and woodworking events, and her two fashion-conscious shop dogs. She also edits our Tricks of the Trade column.

To read more about Kari and to link to her blog, visit popularwoodworking.com/karihultman.

Jerome Bias
"Thomas Day," page 22.

Jerome, who lives and works on a dairy farm in Orange County, N.C., has developed a passion for building period reproductions of furniture pieces from Eastern North Carolina and Southern Virginia, inspired in large part by the work of Thomas Day. Jerome uses only tools and techniques from the time period in which he's building to produce pieces that not only look like the original, but exhibit the building processes the original maker would have experienced. He is also a quilter and upholsterer.

Jerome has given talks and woodworking demonstrations for the Chapel Hill Preservation Society and the Thomas Day Educational Foundation, and he serves as a consultant with the North Carolina Museum of History.

This is his first article for this magazine.

To read more about Jerome and to link to his web site, visit popularwoodworking.com/jeromebias.

Charles Bender
"William & Mary," page 46.

Chuck began woodworking at the age of 12. In his teens he studied under a German Master who taught him the value and proper use of hand tools. After his formal training, he worked with two Chester County master furniture makers. Throughout his apprenticeship Chuck studied period furniture design and construction. For more than 30 years, he's created masterpieces for clients throughout the country.

Since starting his own period-furniture business in 1991, Chuck has been recognized as one of America's top traditional craftsmen. His work can be seen in private collections, museums and some of the best juried craft shows in the country.

Chuck opened The Acanthus Workshop (acanthus.com) in 2007, a Philadelphia area-based school that provides woodworking instruction to students of all skill levels.

To read more about Chuck and to link to his web site, visit popularwoodworking.com/charlesbender.

POPULAR WOODWORKING MAGAZINE

APRIL 2010, VOL. 30, NO. 2
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SUBSCRIPTION SERVICES: Subscription inquiries, orders and address changes can be made at popularwoodworking.com (click on "Customer Service"). Or by mail: *Popular Woodworking Magazine*, P.O. Box 420235, Palm Coast, FL 32142-0235. Or call 386-246-3369. Include your address with all inquiries. Allow 6 to 8 weeks for delivery.

NEWSSTAND DISTRIBUTION: Curtis Circulation Co., 730 River Road, New Milford, NJ 07646.

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BY CHRISTOPHER SCHWARZ, EDITOR

Two Magazines, One Mission

In my 13 years with this magazine, I've never written about the magazine itself. You've never had to hear about how we tweaked the fonts, leading and kerning to spiff up our look. All that rubbish is inside baseball in my book. This is a woodworking magazine, and you pay me to write about woodworking.

But this issue features changes that are so radical that I'd like to take a few minutes to explain them. If you'd like to turn the page and get to the woodworking stuff, I totally understand.

For those of you still with us, here's the deal: Starting this issue we've combined *Popular Woodworking* and *Woodworking Magazine* into the publication you are holding. It might look like we've just closed one magazine, but that's not right. Read on.

We've taken the best parts of each and combined them into *Popular Woodworking Magazine*, which will be published seven times a year. (The details of what this means for your subscription are addressed on the cover wrap around this issue.) We took the best writers from *Popular Woodworking*, including Adam Cherubini, George R. Walker, Bob Flexner, Mike Dunbar and David Charlesworth for this new magazine. From *Woodworking Magazine*, we took a lot of the physical appearance and no-crap reporting. Plus, this new magazine has bigger, thicker and brighter paper.

You might wonder if this is a desperate act to stay in business. Hardly. Both magazines posted solid profits year after year and are some of the best-performing publications for our parent company. Instead, it was the staff of the magazines who decided to make this change to ensure we will be profitable next year and in 10 years. In short, we will branch out even more into the Internet, DVDs, podcasts, social media and book publishing.

The magazine is still the heart of the business – my veins are filled with ink and sawdust. But we know we need to adapt to grow.

I won't kid you – some changes might unsettle you at first. *Woodworking Magazine* readers might be shocked to see ads and color photos. *Popular Woodworking* readers might stumble when they encounter our willingness to trash conventional wisdom.

But rest assured, I think you'll like the result. This magazine is put out by the same staff who produced *Woodworking Magazine* and *Popular Woodworking*. There have been no staff changes or reductions. I'm still the editor. Steve, Glen, Bob, Megan, Linda and Drew are all sitting at the same desks and doing their damndest to inform you.

So take a close look at this issue. Read the stories. Check out the boxes at the end of each article that point you to the vast amount of woodworking knowledge we've dug up on the Internet for you. And let us know what you think. It's easy. That's because there's one thing about us that will never change – our willingness to answer every e-mail and phone call.

When it comes down to it, we're just passionate woodworkers who want to continue writing, building and reading about woodworking for the rest of our lives. And with your support, we'll all get to do that until they scrap the printing presses for good. PWM

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.

Highly Recommended

When buying handplanes, there once were only two good choices: Buy vintage and rehab it or buy a premium tool. But now Steve Nisbett of Illinois offers a third excellent option. Nisbett is a machinist who rehabs old planes until they are better than factory fresh.

We bought one of his Dunlap 3DBB smoothing planes and were impressed with how true all the critical surfaces were. And his prices are lower than what you'd pay from a premium maker.

Visit his eBay store at stores.ebay.com/flatwood-tools-and-more.

— Christopher Schwarz

PHOTO BY CHRISTOPHER SCHWARZ

For more information, go to PWFREEINFO.COM.

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Recommended Auger Bits

After reading your blog article "The Essential Brace & Bit" (tinyurl.com/yauz7lr), I have ordered a Stanley/North Bros. 2101A 10" brace that looks to be in almost-new condition.

However, I'm now thinking that my paltry few (and very beaten up) auger bits will not do it justice so I've started looking at options for a set.

I'm hoping you can provide a bit of advice here, as there seem to be quite a few choices. Do I go for single or double spur? Screw point or spur point? Jennings pattern or Irwin pattern? Coarse auger screw pitch or finer? Who made the better quality bits – Irwin, Jennings, Forrest City, Mephisto …? I suspect that many of these bits were designed for construction rather than cabinetry, so I wanted to understand the characteristics to look for when the use is in furniture making.

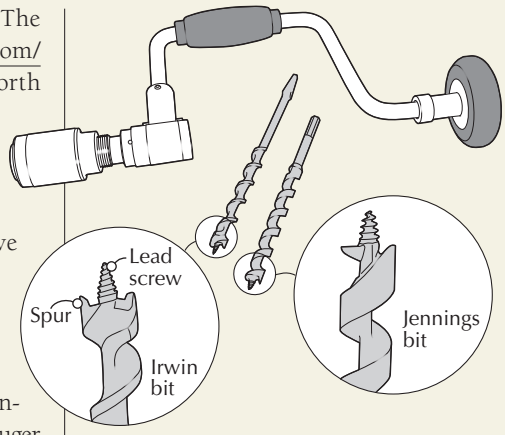
Ross Manning
Church Point, Australia

Ross,

I'm not much of an expert in auger bits – I wish I were. I know enough to do a good job. Here are my thoughts; take them with a grain of salt.

I prefer the Irwin-pattern bits with a medium-thread lead screw. These work for both hardwoods and softwoods, and the screw-feed tip doesn't clog as often as it does on a bit with a fine-thread screw.

The reason I prefer the Irwins is that the flutes don't clog as readily as they do on the Jennings bits. The Jennings-pattern bits are easier (in my opinion) to keep straight because they have more flute surface guiding you. But the price is that they jam with shavings.



The Irwin brand is so ubiquitous that I almost never stumble on a lot of other brands. So I don't have a lot of experience in comparing brands. The way I judge a used bit is visually – is the fit and finish nice? How much of the spurs remain? Is the cutting lip damaged? Are the flutes rusted (which impedes chip clearance). Those factors are more important (to me) than the brand on the bit.

Finally, if you haven't already, download the free old Irwin manual at tinyurl.com/yc7ozvl. It's great. It explains a lot about augers and how to care for them.

Christopher Schwarz, editor

How to Avoid Router Burns

Despite my efforts to the contrary, I still inflict router burns, most recently with a roundover bit on cherry stock. Besides some heroic sanding, might there be an easier and/or better way to remove the burns?

Eric Bolen
via e-mail

Eric,

Burned surfaces while using the router is commonplace, especially when working with cherry. Router burn is usually due to one (or more) issues, all of which need to be watched for and addressed.

First, if your router bits are dull, the chances of burn are much greater. So make sure your bits are sharp. This is also a great reason to have a variable-speed router – if you reduce the router's revolutions per minute, you reduce the opportunity for the bit to burn. Second, the speed at which you move along the edge is important. If you move too slowly, you'll burn the edge due to the router bit (which is spinning at up to 20,000 or more rpm) working a single area too long. Again, lower the router's rpm if possible – or speed up your work pace. Third, when you stop or hesitate while routing, I can almost guarantee there will be some burn as a result, so make sure you pull the bit away from the edge if you need to stop.

If you employ these remedies and continue to have burn issues, I do have a trick to make the burn go away. When I cut profiled edges with my router, I set the depth of the cut at slightly less than what is optimal. If I run through the cut and everything looks great, I'm done. If, however, I develop that nasty browning at any place along the edge, I simply lower the bit depth setting a minute amount and run a second pass. The second pass should not cause any burn due to the small amount of material I'm removing.

Glen D. Huey, senior editor

Liquid Hide Glue Formula

I was very interested in the liquid hide glue recipe in the Winter 2009 issue of *Woodworking Magazine* (Issue #16). I mixed up a batch, and just finished it this morning. I'm wondering if the proportions of ingredients in the article are correct.

I can't get one part of salt to dissolve into three parts of water plus two parts of glue granules, so I'm left with a pile of salt crystals at the end of the two-day cooking process.

The cooked mixture is definitely a liquid in my 55° Fahrenheit shop and seems to work OK in my single test.

It has been too long since college chemistry for me, but unless the goal is to have a saturated solution of sodium chloride, the amount of salt seems a bit high.

Ken Whitney
Rocklin, California

Ken,

I rechecked the information to make sure we had things right, and we do. The mixture is one part salt, two parts hide glue and three parts water.

I pulled out our experimental mix to take another look at it as well. The mixture is a bit opaque and not near as clear as fresh-cooked hide glue, but it is still liquid. I assume the salt is suspended in the mixture as you suggest, but the glue worked fine. I spread a small amount on a piece of wood and the glue hardened just fine.

The key is to make sure your salt is table salt and

CONTINUED ON PAGE 12

ILLUSTRATIONS BY MARY JANE FAVORITE

CONTINUED FROM PAGE 10

that it doesn't have any additives. Be sure to follow the cooking instructions to the letter – something that shouldn't prove difficult for woodworkers.

Glen D. Huey, senior editor

Among High-end Chisels, Are There Differences in Use?

Compare Lie-Nielsen, Ashley Iles and Blue Spruce chisels. They're all pretty, but in terms of pure function, can you make a claim that "X" dollars gets you "X" more functionality?

Tom Doran
Tucson, Arizona

Tom,

At that level, there is no difference in basic function or edge retention. None. I've used them all.

What's different is the handle and the balance. The Lie-Nielsen 750 pattern is my favorite shape. And I like the short blade. But others prefer a longer blade and a different pattern. The best thing to do would be to order a 1/2" chisel from each. Use them a bit. Send back the ones you don't like.

I know that's not the answer you were looking for, but I'm afraid it's the best I have.

Christopher Schwarz, editor

Softening End Grain for Planing

I've read more than once that you apply denatured alcohol when working end grain with planes. You've stated, "it works better."

What does the alcohol do to the end grain that makes it easier to work? Does it toughen the wood? Soften the wood? Make it more flexible?

If it softens it, I'd think one could use any liquid. So does alcohol also do something to the mechanical properties of the wood?

As far as traditional solutions, the author of the 1839 book "The Joiner and Cabinet Maker" doesn't soften his end grain with linseed oil before planing, does he?

Andre Ridder
Farmsum, Netherlands

Andre,

Alcohol softens the wood, making the end grain cut more like face grain. End grain is so tough, especially in ring-porous woods, that you need all the help you can get.

And you're right; any liquid will work (water, mineral spirits, etc.). I use alcohol because it doesn't rust tools and is low on the VOC scale.

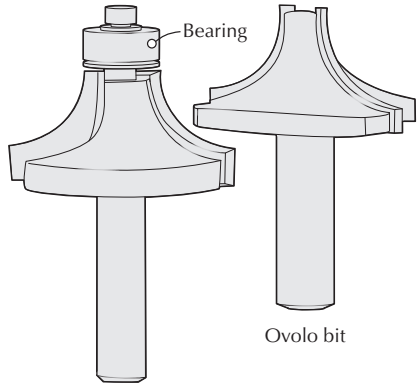
I've even used mineral oil and other oils. These are excellent solutions because they don't evaporate quickly and they lubricate the plane's sole. Traditional solutions include raw linseed oil and tallow. Yup. Fat.

The oils are a bit messy.

As to the exact mechanical properties of the wood that are affected, I'd have to do some research. I imagine the liquid lowers the beam strength (E-value) of the fibers, but that's just a guess.

You're right; there's nothing in "The Joiner and Cabinet Maker" about this practice. However, in his landmark 18th-century, five-volume "L'Art Du Menuisier," André Roubo specifies keeping a pot of linseed oil by the bench for lubricating purposes. And vintage American tools that haven't been cleaned are typically covered in mutton tallow.

Christopher Schwarz, editor



'Roundover' vs. 'Ovolo' Bits

Is there a difference between "roundover" and "ovolo" bits and if so, what is it?

Randall Nelson
Jefferson, North Carolina

Randall,

There is a difference.

Roundover bits, sometimes called beading bits (although I like to think of a beading bit as a router bit that will form a full bead with a single pass), are used to round over an edge and are bearing guided. An ovolo router bit has the same profile as a roundover bit, but there is no bearing.

In furniture construction, ovolo bits are used to divide a drawer front to make it appear to be two or more drawer fronts when, in fact, it's a single drawer. These bits also are used in plunge operations for some cabinet door front designs.

Glen D. Huey, senior editor

"A home workshop can be a cheap psychiatrist, especially if we let go of our grim purposefulness and just enjoy what we are doing."

— Gene Schnaser
from "The Home Workshop Planner"

A Food-safe (and Nice) Finish

I've read vague statements on the Internet about walnut oil as a food-safe finish – but will it behave like true tung oil if applied in multiple coats, as you detailed in the Winter 2009 *Woodworking Magazine* (Issue 16)? I want both food-safe and nice looking, even if it takes a month of daily buildup.

Brian Cribbin
Albuquerque, New Mexico

Brian,

I've not worked with walnut oil, so I referred to Bob Flexner's "Understanding Wood Finishing." He says the reason most woodworkers think some oils are not food safe is due to metallic dryers, such as lead. In the 1970s, lead was removed from everything, including oil driers. Bob states that all oils are food safe as long as they are dry – 30 days or less, depending on the temperature.

My thought is that walnut oil could be used just as you would tung oil, and the build should be about the same as well. PWM

Glen D. Huey, senior editor

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EDITED BY KARI HULTMAN

THE WINNER:

Mortising Jig for Hinges

Faced with a looming deadline, I needed to find a way to quickly and accurately make hinge mortises for five boxes. My solution involved a jig that referenced the side and back of the box and lid, a palm router and a shallow flush-cutting router bit. The half-hour I spent making the jig saved me hours of work and produced the most accurate hinge mortises I've ever cut.

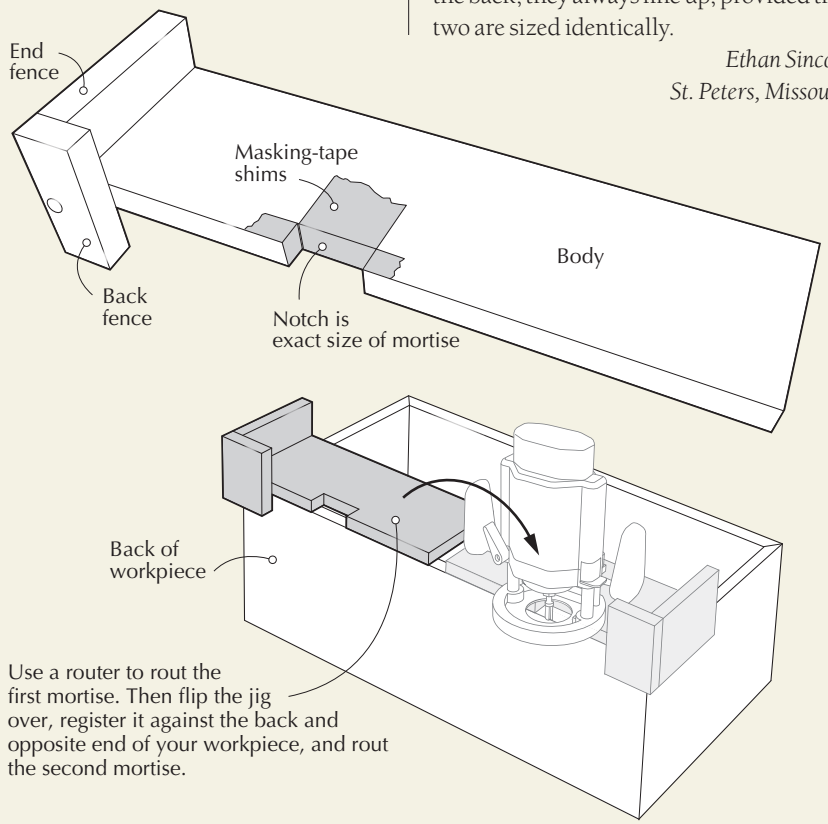
To make the jig, I measured and marked how far from the end I wanted to place my hinges. Going off that mark, I used the table saw to remove a section the exact length and width of the intended mortise. Next, I checked the fit by slipping the hinge into the notch to be sure it held with a friction fit (a loose fit can be shimmed with tape).

After cutting the notch, I attached the side fence and the back fence with glue, making sure to maintain 90° angles. Once the glue was dry, I secured the fences with square-drive screws in pre-drilled and countersunk holes. Finally, I labeled the jig with the brand and size of the hinge and the distance of the mortise from the side.

Using the jig is a snap. Place it along the back side of the box and register the fences tightly to the back edge and the adjoining side. The notch determines the exact location of the mortise. Clamp the jig in place, set the depth of the router bit and rout the mortise.

Unclamp the jig, flip it over to register against the other end of the box and rout the second mortise. Do the same thing for the lid. Chisel out the mortise corners. Because the corresponding box and lid mortises use the same jig and reference the same side and the back, they always line up, provided the two are sized identically.

Ethan Sincox
St. Peters, Missouri



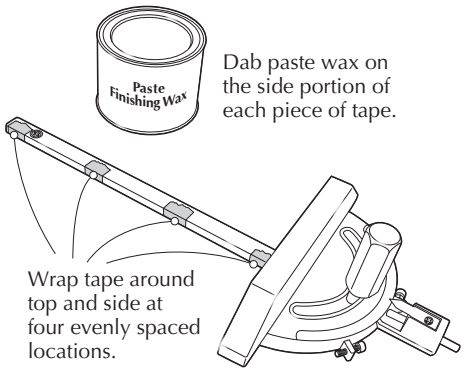
Remove Play From Miter Gauge

The basic miter gauge that came with my table saw had some minor play when used in the miter slot. Expensive aftermarket miter gauges solve this problem with set screws on the sliding bar.

Instead of going the more expensive route, I simply wrapped masking tape around the top and one side of the sliding component at four evenly spaced locations, being careful to avoid putting tape on the bottom surface.

I added a second layer of masking tape where needed and finished by putting a dab of paste wax on each piece. This created a perfect fit for the miter gauge.

Brad Hall
Bernville, Pennsylvania



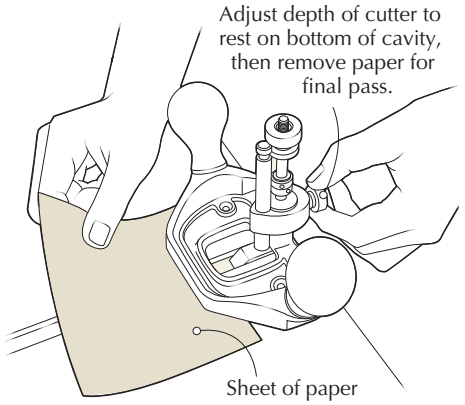
Multi-use Skewers

Bamboo skewers are for more than just shish kabob. I use them to stir things and to apply glue in holes and mortises. Also, one or more can be packed into a stripped screw hole with some epoxy. After the epoxy sets, trim the excess skewers, drill a pilot hole and the screw will hold again.

I use them as mini pegs by drilling a hole slightly smaller than the skewer and driving them in. This works well for nailing on small drawer bottoms because you won't hit a metal nail with your plane later on. I also have used them as hinge pins for wooden hinges, to open the end of a plugged glue bottle, as a replacement stylus for a cell phone and – when grasping a bunch of them – to demonstrate to students how wood fibers look.

Mike Siemsen
Chisago City, Minnesota

ILLUSTRATIONS BY MARY JANE FAVORITE



Router Plane Final Pass

I use my router planes quite a bit for rabbets, dados, inlays and tenons. The final pass didn't always produce the surface that I wanted, and making the adjustment for it was a challenge. Often, the final pass was too deep.

Here is what I have been doing for some time: With the router plane in the cavity (such as a rabbet), I put a sheet of paper under the front of the router plane, making sure that the cutter rests on the bottom of the cavity, then I lock the setting. Then I remove the paper and make a final, light pass. Depending on how close to or away from the iron I move the sheet of paper, I can refine the cut further.

I have noticed that even for a larger router plane with adjustment screws, the same method of using a sheet of paper is more accurate than using the screw adjustment. Registering this tool against the actual piece of work is more accurate than using measurements.

Alfred Kraemer
Menomonee Falls, Wisconsin

Unstick Sticky Nozzles

Although spray cans can be handy, I've always hated them when I try to reuse an older can. Holding it upside down while spraying in order to unclog the nozzle doesn't always work.

A trick I found that works pretty well is to spray upside down first, then take the nozzle off and place it on an aerosol can of WD-40. Spray a few shots, and return it to the spray can for storage.

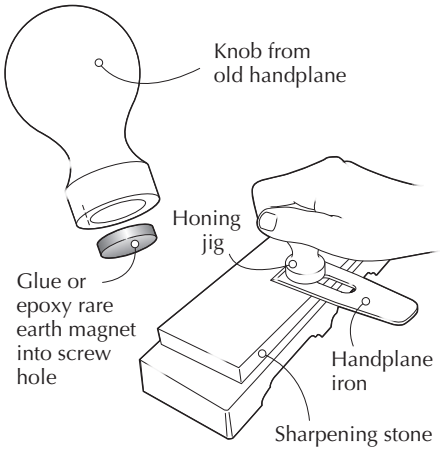
I had a can that wouldn't spray, so I soaked the nozzle in lacquer thinner to no avail. I tried to blow the thinner through it with my air compressor, but no luck. I finally placed the nozzle on a can of WD-40, and it started to work.

Rog Mickelson
West Burlington, Iowa

Get a Grip

When using a sharpening stone to hone the flat side of handplane irons or scraper plane blades, it can be difficult to grip the metal. Take an old knob off a handplane and glue or epoxy a rare earth magnet into the bottom screw hole. The magnet grabs the iron, and the comfort of the plane knob lets you hone away without issue – simple but effective.

Tom Fidgen
Toronto, Ontario



Pitch Remover

Working in a shop that makes trusses, I cut resinous yellow pine all day. After letting pitch build up for more than a year on our radial arm saw, I decided it was time to clean the blade. After trying a few things, I saw a spray can of decal and adhesive remover. Thinking, "Why not?" I sprayed it on the blade. In three minutes and with a very light scrubbing, the blade was completely clean. The product is available at auto parts stores.

Daniel Freeman,
Dardanelle, Arkansas

Adding Age to Screws

I really dislike the look of most modern hardware and common fasteners with their brightly finished zinc coating. So when I need to use these screws and hardware on a project, I like to make them look older by removing the zinc plating.

To remove the zinc plating, I use vinegar found in any grocery store. Red, white or cider makes no difference (just don't waste good balsamic!). I simply place the screws in a small jelly jar or plastic cup, cover them with vinegar, then allow them to soak for a day or so. The acid in the vinegar removes the zinc plating and leaves the screws with a dull, steel gray color – allowing them to age and take on a nice patina that looks much more authentic on a piece of furniture.

It works on hinges and other zinc-plated hardware too, though sometimes you need to let the larger items soak longer, depending on the thickness of the plating. The best part is, it's safe. I wouldn't put the used vinegar on a salad, but I can pour it down the drain. **PWM**

Bob Rozaieski
Swedesboro, New Jersey

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Tricks-in-Action shows you how tricks work for real. To see how "Pitch Remover" works in our shop, go to popularwoodworking.com/tricks and watch the video.

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BY THE EDITORS

Rob Cosman Dovetail Saw

This saw is different in almost every way, from its handle to its teeth.

Looks different – is different. *The Rob Cosman dovetail saw uses a solid-surface handle, a thick brass back and an unusual tooth filing. We take the saw for a test drive.*

The new dovetail saw from craftsman Rob Cosman pushes the limits on saws that are designed to cut woodworking's signature joint. Cosman developed the saw after teaching thousands of woodworkers to cut dovetails and having one bright idea while talking with his wife in bed.

What's different about this saw? Everything. Cosman's saw is the heaviest and longest dovetail saw I've ever used. Tipping the scales at 1.16 lbs., the saw's weight comes from a heavy 1/4"-thick x 7/8"-wide brass back and 1"-thick Swanstone handle.

Swanstone is a solid-surface material like Corian, but it is reinforced with glass to be more durable. Cosman added weight to the saw's toe to make the tool start easily and cut smoothly. The weight from the Swanstone handle helps balance the tool.

The tote's shape is traditional, except for three indents cut into its grip to remind you to grasp it with three fingers – an improper four-finger grip is almost impossible.

Rob Cosman Dovetail Saw

Rob Cosman ▪ robcosman.com
or 877-967-5966

Street price ▪ $295 (Canadian)

Go Online *to read Christopher Schwarz's blog entries on handsaws.*

▸ tinyurl.com/yb2plne

The blade of the saw is also different. While the .02"-thick sawplate is typical, the saw has unusual rip teeth. The first 2" of the plate are filed with 23 points per inch (ppi) – this was the idea Cosman had in bed one night. The remainder of the blade is 16 ppi. The fine teeth are used for two or three short strokes to start your kerf. Then you switch to the aggressive teeth. The saw has a fine set – about .002" per side.

My personal dovetail saw is different in almost every way, so we purchased one of Cosman's saws and I built a small dovetailed chest with it to see if we could become friends.

The tote is the most shocking aspect of the tool, especially in the white Swanstone. Every visitor to our shop comments on it. The version with a dark handle, which Cosman sells as "ebony resin," looks more traditional, though it is flecked with some color.

The tote itself is comfortable. And I was surprised by how quickly the Swanstone warmed to my touch – it actually warmed up faster than my wooden saws. And the saw is indeed balanced, but it felt too heavy in my hand at first.

When I put the saw to work I initially found the brass back to be a challenge. The tool would tend to tip left or right while cutting tails, which made my slope more pronounced than I planned. This isn't a big deal if you cut your tails first. And after a few joints, my problems with tipping disappeared and I was able to follow my line.

The fine starter teeth work well. This saw is perhaps the easiest-starting Western saw I've ever used. And it is fast – the extra weight turbocharges the tool. After one project (about 28 tails) the saw and I had made friends and I didn't notice its weight.

The tool itself is well-made – the tote has crisp lines and the brass back fits nicely into the tote. The teeth are sharp and properly formed.

Cosman ships the saw with a nice finger-jointed box and a short DVD that instructs you on how to use the tool and offers advice on how to practice sawing. If you are one of the thousands of woodworkers who cut dovetails using Cosman's time-tested techniques, this saw reinforces his methods and will make a fine addition to your tool chest. The saw is $295 (in Canadian dollars).

— Christopher Schwarz

CONTINUED ON PAGE 18

COSMAN & FESTOOL PHOTOS BY AL PARRISH; ROCKLER PHOTO BY CHRISTOPHER SCHWARZ

CONTINUED FROM PAGE 16

Festool's Five-in-one Drill-driver

Festool markets the new T 12 + 3 Lithium-ion cordless drill set as a five-in-one drill. The set includes an eccentric chuck, a 1/2" keyless drill chuck, a quick-change "Centrotec" chuck and a right-angle chuck (the fifth in the set is a depth-stop chuck; it's optional), but that's not all this drill is about.

At 9 1/4" tall and with a 7 1/2"-long body, this drill sits squarely in the compact category. It has a two-speed gearbox (0-450 and 0-1,500 rpm) and switches between gears with ease. It also has a drill/drive mode selector switch that, when set in drill mode, overrides the clutch to provide the maximum power and torque.

When the T 12 + 3 drill is in driver mode, the clutch is activated and there are 25 torque settings from which to choose. The clutch is not the normal mechanical clutch. This tool has an electronic clutch that the company says is superior and more sophisticated than the standard fare.

Additionally, and this is a big difference in compact drills, the Festool drill has a brushless motor. Brushless motors have several advantages over brush-type motors, the most important of which are reduced noise and extended service life.

The kit includes the aforementioned chucks, two batteries and a charger, all packaged in a Festool Systainer. The batteries recharge in 70 minutes and the charger works with all Festool batteries, past and present.

This might be the only drill you need. However, it's a Festool and while that name says great-quality tools, it does require a larger cash outlay than most drills require.

— Glen D. Huey

Festool Five-in-one Drill

Festool ▪ festoolusa.com or 888-337-8600

Street price ▪ $525

Go Online *to read our 12-volt, Lithium-ion powered drill-driver review.*

▸ tinyurl.com/y8emkrm

Rockler's Answer to Clamp Storage

Rockler's mobile clamp rack, the Pack Rack Clamp & Storage System, is a sturdy and customizable rolling unit.

The shining feature of this rack is mobility. And Rockler did not skimp when it added the high-quality polyurethane casters.

Carriage bolts assemble the frame, so you'll need only one wrench to ratchet things tight. Plus, the square portion of the bolts assist in keeping the frame aligned during assembly.

Along the rack's steel A-frame are 13 mounting holes in which you position eight included steel rods for clamp hanging. With the rods in position, your clamps rest along multiple points, so when you roll the unit around your shop, you'll never have to worry about a clamp falling off.

The rack kit comes with shelf hooks so you can add a center shelf for additional clamp storage. Plus, you can purchase accessories such as longer steel rods on which to hang additional clamps off the side.

In our shop we stocked the rack with more than 30 parallel-jaw clamps in varying sizes, and there's still space available. We also attached a portable dust collector to the side of our unit. With the additional weight of the dust collector and brimming with numerous clamps, this rack still glides across the floor.

This unit's mobility and sturdiness allow you to fully customize the system to fit your shop's needs.

Complete assembly instructions are included, but if you have problems, there's an expanded set of instructions with step-by-step photos at rockler.com.

If you're looking for a new clamp-storage solution, the Pack Rack Clamp & Storage System is a good choice. PWM

— Drew DePenning

Rockler Pack Rack Clamp & Storage System

Rockler ▪ rockler.com or 800-279-4441

Street price ▪ $150

Go Online *for a shop-made solution to clamp storage.*

▸ tinyurl.com/clamprack

BY GEORGE R. WALKER

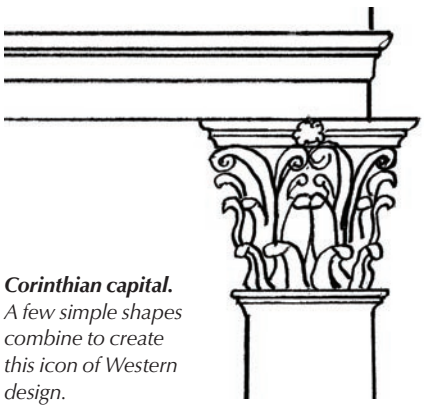
Making Sense of Forms

Train your eye to see the layers in a great design.

Eye-catching. *The form of a piece is what usually captures your attention from across a room.*

Early 20th-century filmmakers used time-lapse photography to dazzle audiences with never-before-seen images of flowers emerging and bursting into bloom. Critics with Victorian sensibilities objected that something so intimate should best be left hidden. Sometimes a well-designed piece of furniture can feel like it holds on to its secrets. We sense there are many hidden design lessons if we could only see them. A good place to start is to learn how to recognize and visualize forms.

A form is a combination of simple shapes that together make up a composition. A form is what catches your eye from a distance; it's the "bones," or what some refer to as the "lines of a piece." When I study a design I start by looking at it from across the room and take in the overall form. A Corinthian capital is a form. Underneath all those leaves and volutes is a simple vase shape, or you might imagine it as an inverted bell. Can you visualize that simple shape underneath all those leaves? Ancient legend holds that the form is inspired by a basket left at a graveside. An acanthus plant grew up around the basket providing the germ of an idea for this form.



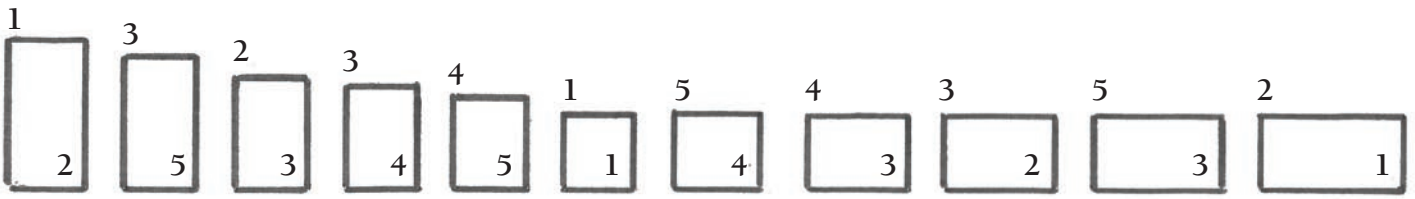
Corinthian capital. *A few simple shapes combine to create this icon of Western design.*

Simple Shapes as Building Blocks

Many furniture forms are based on simple squares, circles, rectangles or, by extension, ovals. Those simple shapes become a form when divided up and organized into useful or decorative parts such as doors, drawers or open spaces. A square can be extended horizontally or vertically to produce an infinite number of possible rectangles. However, artisans tend to favor a small handful of simple rectangles based on whole-number ratios. The graphic atop the next page shows the most common shapes. In the center is a square with a ratio of 1:1. Flanking it on both sides are rectangles with a ratio of 4:5. They continue marching out to the ends where we have 2:1 rectangles.

This little handful of simple rectangles found favor for several reasons. First, the simple ratios were thought to be linked to the ideal human form and music. For millennia, artists and sculptors used simple whole-number

LEAD PHOTO BY AL PARRISH; OTHER PHOTOS AND ILLUSTRATIONS BY THE AUTHOR



Symmetrical rectangles. *Each rectangle has a twin on the opposite side of the square.*

ratios to proportion the human figure. Additionally, they are user-friendly and lend themselves to simple tools such as dividers, and require little or no math. Best of all, they are easy to visualize in your mind. A rectangle with a ratio of 1:2 is two squares; a rectangle with a ratio of 2:3 is a square and a half square. All these simple whole-number rectangles can be expressed in simple multiples or divisions of squares. Just close your eyes and try to visualize a rectangle made up of two squares. Can you picture it?

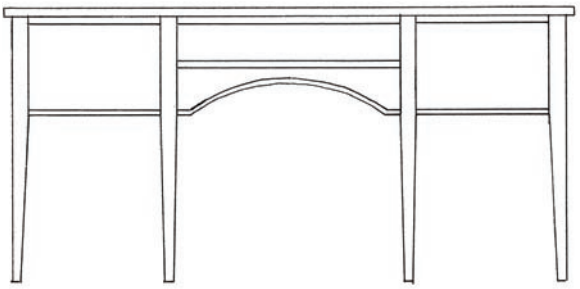
Many tall cabinets such as chests on chests, bookcases and highboys are built around a rectangle with a 1:2 vertical ratio. At the other end of the spectrum are long pieces such as sideboards, which often are built around a 1:2 horizontal rectangle. In between, you find desks, chests, dressers and even small document boxes composed out of simple rectangle ratios such as 2:3, 4:5, 3:5. This does not mean that all this work is confined to rigid, straight shapes. Overtop this skeleton you have many possibilities just as with that Corinthian capital. A simple shape can be the basis for a powerful creative form. Another advantage these simple shapes offer is a way to adapt a furniture design to your needs.

Practical Application

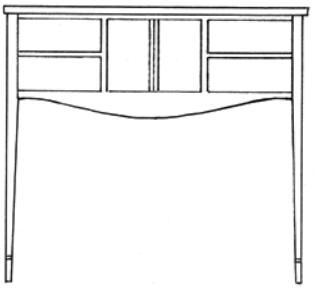
Many of the original sideboard designs are from the Federal era (circa 1790-1810) and are quite massive. Often the form is built around a 2:1 rectangle that is approximately 40" tall and 80" long. It's a comfortable height at which to set down a large, heavy tray of piping-hot food straight from the kitchen.

The drawing above is a typical example of the form, a piece made in Baltimore around 1810. You can see readily that the large 2:1 rectangle is subdivided into smaller rectangles, with a square in the center section.

But what if we don't have room or wall space for such a large piece? The smaller drawing above is a rough sketch I drew for a small sideboard based around a single square. To the untrained eye the square shape is not apparent because it's broken up by the open space below and the case above. Perhaps we want something in between these two. Just retain the height, but rough in a rectangle that's 2:3 or 3:5. This offers a good starting point to begin sketching in doors, drawers, etc.



Simple elegance. *This elegant form (a Baltimore sideboard) is a combination of simple shapes.*



Elegance writ small. *This smaller version of a sideboard also is composed of simple shapes.*

Some may feel limited at the thought of building around a small number of simple shapes. It may help to think of them as primary shapes just like we have primary colors. Instead of restricting our creativity, they offer a framework to begin building upon. Once the form is roughed in we can add curvature to the case front or top. We also can change up the legs and frames making them organic, curved, turned or carved. Still, from across the room it will have those solid bones – a form that captures our eye and makes us want to step over for a closer look.

Natural inspiration. *Forms can be seen in the unfolding springtime blossoms of the bluet.*

Make it a practice when looking at furniture to visualize the simple shapes that make up the form. Try to pick out not only the overall shape that defines the envelope but also the smaller shapes that work together to make up the bones of the design. You'll be pleasantly surprised to see that the masterpiece you've admired can open up like a spring wildflower before your eyes. **PWM**

George is the author of the DVDs "Unlocking the Secrets of Traditional Design" and "Unlocking the Secrets of Design: Moldings" both from Lie-Nielsen Toolworks (lie-nielsen.com).

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About This Column

If you have a thirst to hone your creative skills, Design Matters will dive into the basics of proportions, forms, contrast and composition to give you the skill to tackle furniture design challenges with confidence.

BY JEROME BIAS

Thomas Day

This antebellum free black man was the most successful cabinetmaker in North Carolina.

Sitting pretty. *Day built all forms of custom furniture. Here, we see a settee with rolled and carved arms.*

My introduction to Thomas Day came in 1998 on a shopping trip to High Point, N.C., for a bed. I stumbled across a reproduction of an antique piece that had soaring mahogany posts supporting a tester that authoritatively defined the space that the bed occupied. This effect was counterbalanced by a floating headboard. I was awestruck.

The description of the piece indicated that it was made by Thomas Day, a free black cabinetmaker from North Carolina who worked during the time of slavery and had the largest cabinetshop in the state. I was intrigued.

Life-changing inspiration*. This reproduction bed, built by the author from recycled pine, was based on a piece by 19th-century Master Cabinetmaker Thomas Day.*

A Touchstone in Black History

I had always dreamed of doing 18th-century woodworking, but I didn't know the trade was one in which African-Americans were traditionally involved. Later study revealed I was wrong, and Thomas Day's work serves as a case in point. My world expanded that day, though I didn't buy the bed. Instead, I made a copy of it – my first woodworking project – and I began to research the original craftsman.

Thomas Day was born near Petersburg, Va., around 1801. Both of his parents were free, and both of their families had been free for multiple generations. Thomas and his brother, John Day Jr., were educated by Quakers, and both of them apprenticed under their father, who was a master cabinetmaker.

Thomas Day's story can't be told without also looking at the life of his brother – also an accomplished cabinetmaker. However, as the racial climate of the country declined and the racist legal statutes aimed at free blacks became increasingly oppressive, John Day Jr. became disillusioned with the prospect of receiving fair treatment. He decided to leave the United States, a country that he dearly loved. Following his religious convictions, John Day became a Baptist, and went to Liberia as a Baptist missionary and eventually became the first chief justice of Liberia's supreme court.

Careful Positioning in Society

Thomas Day chose a quite different route. He sought security and safety for himself and his family through his strength of character, creative genius and careful positioning of himself in white society. By 1827, he had a prosperous business in Milton, N.C., where he made and sold bespoke furniture, and offered ready-made pieces.

Day made a point of covering as much of the market as he could, and kept up with the latest styles. He produced work in Gothic revival, Louis XV and vernacular styles, among others. He made mahogany and walnut furniture that was coveted by the governor and members of

Southern charm. *Day added one of his signature scrolled motifs to this ladies bureau that was made for the governor's wife.*

SETTEE & BUREAU PHOTOS COURTESY OF THE NORTH CAROLINA MUSEUM OF HISTORY; BED PHOTO BY THE AUTHOR

elite society throughout the state. For them, he designed house interiors. To date, more than 80 interiors have been identified as Day's work, in large part due to his distinctive newel posts and mantels. But Day also worked in stained poplar, pine and oak for the lower end of the market, and he made coffins, then provided transportation to the graveyard as well.

By 1838, Day had 21 men working in his shop, including white master cabinetmakers, free blacks and slaves that he owned. In 1850, his shop made one-sixth of all the furniture built in North Carolina, which made him the most prolific cabinetmaker in the state. And by 1855, he had a credit rating of $40,000.

To help alleviate the legal restrictions to his rights as a citizen, Day forged judicious relationships with white society. He specialized in providing the most fashionable furniture to the most powerful members of white society. He attended the Milton Presbyterian Church and made the pews for the church with the stipulation that he be allowed to sit with the white congregation. And most notably, Day owned slaves, which garnered him trust and acceptance from his white patrons.

Day's ownership of slaves is a thorny issue, and there is conflicting evidence about what he believed. We know that the slave labor in his shop enabled him to keep his prices competitive. We also know that Day was educated by Quakers who engaged in apprenticing slaves with the idea of their being eventually freed and prepared to earn a living. Were the slaves in Day's shop laborers, apprentices or master cabinetmakers? Were they allowed to buy their freedom? We simply don't know, but perhaps further research will provide answers.

To further muddy the picture, we know that Day sent his three children to what was considered a "flaming abolitionist" boarding school. And, scholars are now reviewing

Simple elegance. *This simple cradle by Day has none of the distinctive carving of much of his work, but the elegant lines and curves appeal.*

A distinctive look. *In addition to building furniture, Day built interior woodwork pieces for the homes of important clients. More than 80 examples of his interior work have been identified, in part due to his distinctive mantels.*

evidence that Day attended an abolitionist meeting in Philadelphia – no small action. If he did and word of it reached Milton, Day's life, his family member's lives and their livelihood would have been in grave danger.

Day's efforts to provide a level of personal freedom for his family succeeded on some fronts. In 1830, he married Aquilla Wilson, who lived in Virginia. State laws barred free blacks from moving into North Carolina, but the citizens of Milton successfully petitioned the state legislature to allow her to move to Milton. In addition, Day was allowed to travel, both in the state and around the country, at will. His children lived outside of North Carolina for extended periods of time while they were in school. All of this was outside the bounds of the law.

A Sad Ending

Despite his personal and professional success, Day's business ended on a sad note. A national bank crisis in early 1857 caused one in three businesses to fail, and Day had trouble collecting on money he was owed – money he needed to pay off debt from a new steam engine he'd purchased for his business.

In addition, his health was failing, which made it impossible for him to keep up with the number of orders necessary to stay afloat. In 1859, his business was declared insolvent. Though his son was able to pay off the debt by 1864, we believe Day died in 1861, so he didn't live to see the business he'd built recover.

A Legacy in Wood

The works that Day left behind range from the mundane to the avant-garde. He took standard popular forms and patterns, and transformed them with his own motifs. His work is made distinct by its undulating lines, flowing shapes and decisive use of negative space.

Some suggest that Day's creative genius was the result of his using woodworking as an outlet to express the isolation and frustration he felt living in the antebellum South. Others have suggested that it is his African heritage expressing itself. Still others say that until we further explore the African-American artistic aesthetic, we won't know. I suspect they are all correct.

An Education and Inspiration

A decade after my discovery of Day and his work, he's become an integral part of my life. I now interpret the maker and his work for the Thomas Day Education Project and various museums and historic sites.

I appreciate Day because he challenged many of my preconceptions and has caused me to stretch my knowledge base. Because of Day, my definition of what a cabinetmaker looks like has changed. Because of Day, my definition of "good furniture" has changed. Because of Day, I was inspired to follow my dream of doing period woodworking with a focus on Southern pieces.

The lives of every cabinetmaker whose furniture we copy are written all over their pieces. Pay attention to those stories; they have much to offer. And their stories just may help you revise your own. **PWM**

The exhibit "Behind The Veneer: Thomas Day, Master Cabinetmaker" will open May 22, 2010, at the North Carolina Museum of History in Raleigh, N.C . Concurrent with the exhibit opening will be the release of "Thomas Day: Master Craftsman and Free Man of Color," by Patricia Marshall and Jo Leimenstoll, a book that takes an in-depth look into 160 pieces of furniture and architectural woodwork produced by Thomas Day.

Jerome is a historic interpreter, furniture maker, dairy farmer, quilter and upholsterer who lives in Mebane, N.C.

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MANTEL & CRADLE PHOTOS BY THE AUTHOR

BY CHRISTOPHER SCHWARZ

Skansen Bench

Based on a Swedish antique, this bench uses through-tenons made with just a jigsaw.

Jah, it's solid. *Thanks to massive tenons and a thick seat, this bench will withstand both children and time.*

I've always liked things that are Swedish, impossibly overbuilt and yet somehow graceful. For example, my beloved Volvo 240DL, a certain foreign exchange student in high school and this bench from the Skansen living history museum in Stockholm.

This bench is from the Älvros Farmstead, a group of buildings from the 16th and 17th centuries that were moved to Skansen. I first spied this bench in the book "Making Swedish Country Furniture & Household Things" (Hartley & Marks). For this version I proportioned the parts so it could be built with dimensional pine – one 12'-long 2x12 and one 8'-long 2x8. Total cost: About $22.

At first glance, this might not look like an "I Can Do That" project, with its laminated top and wedged through-tenons in the seat. But I assure you, it can be built with basic tools.

How the Joinery Works

The heart of the bench is the four through-tenons that connect the legs to the seat. The tenons are cut while you're shaping the legs. They don't have face shoulders, so they're cut easily with a jigsaw. The mortises are also easy. You just drill a hole for each mortise, then shape the mortise with a jigsaw.

Of course, it's the details that determine how easy all this will be, especially with the mortises. Let's begin there.

The seat is made of two 2x12s glued face to face. But it's best to cut the mortises before gluing up the seat plank – you'll get less deflection of your jigsaw's blade. Lay out the locations of the mortises on the two boards and drill a 3/4"-diameter hole at each mortise location.

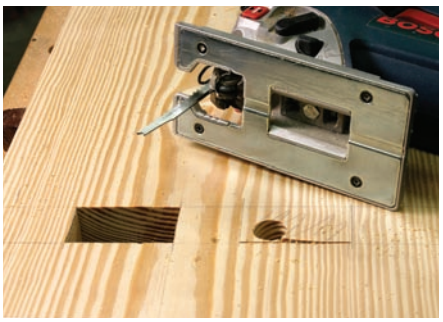
With your jigsaw, square up the mortises. After experimenting with several blades, I got the best results from a Bosch T744D blade, a 7"-long blade designed for cutting wood rapidly. It is a shade thicker than typical blades and has deep gullets. This helped prevent the blade from deflecting.

The only downside to this blade is that it will tear up the surface of your wood. Set the jigsaw's orbital action to "0" and take your time. When the jigsawing is complete, straighten up the mortises with a coarse rasp.

Don't glue up the seat yet – we'll do that after everything is dry-fit.

Get Those Legs in Shape

The legs are shaped with a jigsaw and a rasp. Lay out the pattern on one leg (you can download a SketchUp drawing of this bench from our web site). Then jigsaw the shape and clean up your cuts with a rasp and sandpaper. Use that leg as a template for the other three.



No mortiser required. *With large through-tenons you can simply drill a starter hole for your jigsaw's blade then square things up. Don't rush the cut or the blade will deflect.*

All in the jigsaw. *The shape of and joinery on the legs is made entirely with a jigsaw. Follow close to the line and you won't have much cleanup work to do here.*

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

After you have the four legs in shape, fit them to the mortises. Use a block plane to thin the faces of the tenons; use a rasp to thin the edges. Go for a tight fit, though the wedges will help fill little gaps. Fit the bottom seat plank over the tenons. Then fit the top seat plank on that.

Now you can glue up the seat plank using the tenons to keep the mortises aligned. Remove the top seat plank and coat the bottom seat plank with glue (avoid the tenons). Drive the top seat plank onto the tenons.

To clamp the two planks together, I recommend using 2"-long screws that you drive through the underside of the bench through clearance holes. Screws cinch the planks together without clamps. After the two planks are screwed together, knock the legs out of their tenons. After the glue dries, you can remove the screws if you're a cheapskate.

A Self-made Wedgie

Wedging the tenons is simple. You're going to wedge them diagonally, from corner to corner. This will expand each tenon in four directions. The first step is to cut a kerf in the tenons to receive the wedges. I used a handsaw. Any saw will do. Saw from the top to the shoulder of the tenon.

For the wedges, you can use builder's shims or make your own. I made mine from leftover oak. I split out the wedges using a pocketknife and a hammer. The wedges are 3/16" thick at the top, 2 3/4" wide, 2 1/2" long and taper to a point.

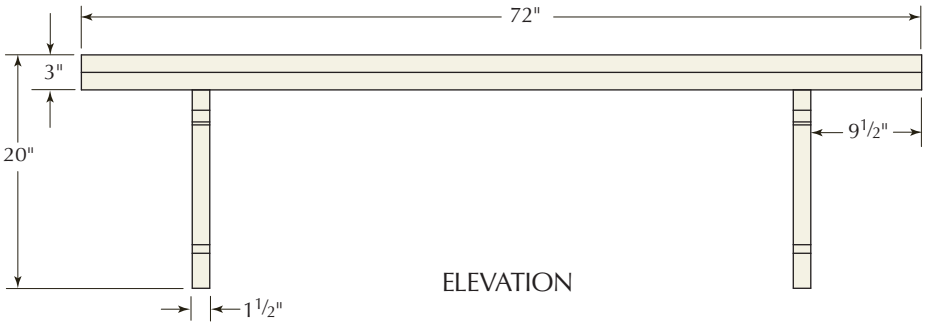
To assemble the bench, brush glue on the mortises and tenons and drive the legs home. Paint glue on the wedges and drive them into the kerfs in the tenons. Wait for the glue to dry, then trim the wedges.

To lighten the look of the top I chamfered all the edges with a block plane. The finish is a few coats of an oil/varnish blend. You could use paint – red is a traditional Swedish color.

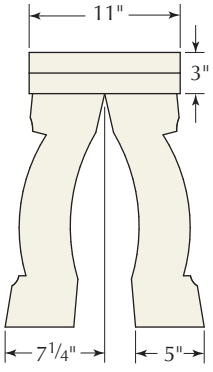
When the bench was complete, I jumped up and down on it – it's solid. Heck, I think I could have parked my 240DL on it. PWM

Christopher is the editor of this magazine, the author of "Handplane Essentials" and likely in trouble with his wife for talking about Swedish exchange students.

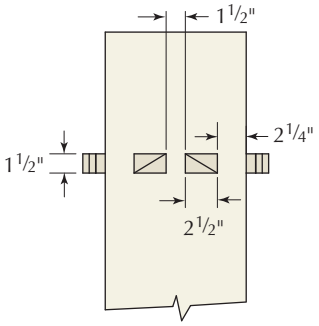
Cheap clamps. *With the seat planks glued together, drive 2" screws through the underside to clamp things up. Place a screw wherever you see a gap between the planks.*



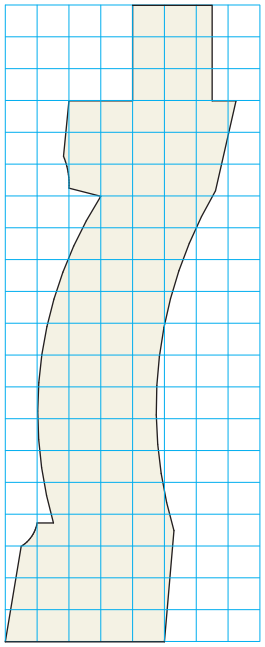
ELEVATION



PROFILE



PLAN



1 grid square = 1"

LEG PATTERN

Skansen Bench

	NO.	ITEM	DIMENSIONS (INCHES) T	W	L	MATERIAL
❑	2	Top slabs	1 1/2	11	72	Pine
❑	4	Legs	1 1/2	7 1/4	20	Pine

Go Online FOR MORE ...

Download the "I Can Do That" manual:
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About This Column

Our "I Can Do That" column features projects that can be completed by any woodworker with a modest (but decent) kit of tools in less than two days of shop time, and using raw materials that are available at any home center. We offer a free online manual in PDF format that explains all the tools and shows you how to perform the basic operations in a step-by-step format. Visit ICanDoThatExtras.com to download the free manual.

Shaker Cupboard: Rejuvenated

BY GLEN D. HUEY

A White Water Shaker stepback is sprinkled with water from the fountain of youth.

Shaker stepback cupboards aren't abundant. In fact, there are only a few examples in the many published books on Shaker furniture. Unless you have a sharp eye for Shaker furniture, or are excited about painted furniture with a heavily worn surface, I doubt you would give a second look to the original cupboard on which this project is based. However, the fact that the original is part of the White Water Shaker Village collection propels this piece, in my opinion, toward the top of Shaker cupboards. A reproduction of this cupboard is a must. And in the process, we can turn the clock back to see the cupboard in its earlier days.

Inspiration From the Original

The original Shaker stepback, with its missing crown moulding and other absent features, required detective work before construction began. As we move through the project, we'll examine some missing features and try to reach conclusions that bring this piece back to an earlier day.

The first question is: What about feet? The cupboard at White Water has a three-sided frame that rests on the floor. Was that the original design? Or were the feet worn away or removed?

Also, what happened to the crown moulding? It's obvious there was a moulding, but it is long since gone. What was the profile?

Other features to look at are the unique drawer construction and the use of a half-dovetail sliding joint to secure the shelves to the case sides – even with this complex but strong joint, the builder nailed in the shelves.

Shaker serenity. *Inspired by an original cupboard at the White Water Shaker community, our revitalized Shaker stepback blends nicely into the surroundings of the North Family dwelling.*

LEAD PHOTO BY AL PARRISH; STEP PHOTOS BY THE AUTHOR; ILLUSTRATIONS BY ROBERT W. LANG

Face (Frame) Facts

Before we get to the detective work, we need to build the cases and face frames. The frames for both sections use mortise-and-tenon joints. Mill your parts to size according to the materials schedule, but leave an extra 1/8" in width on the stiles. After the frames are fit to the cases you'll use a router and flush-trim bit for a perfect fit.

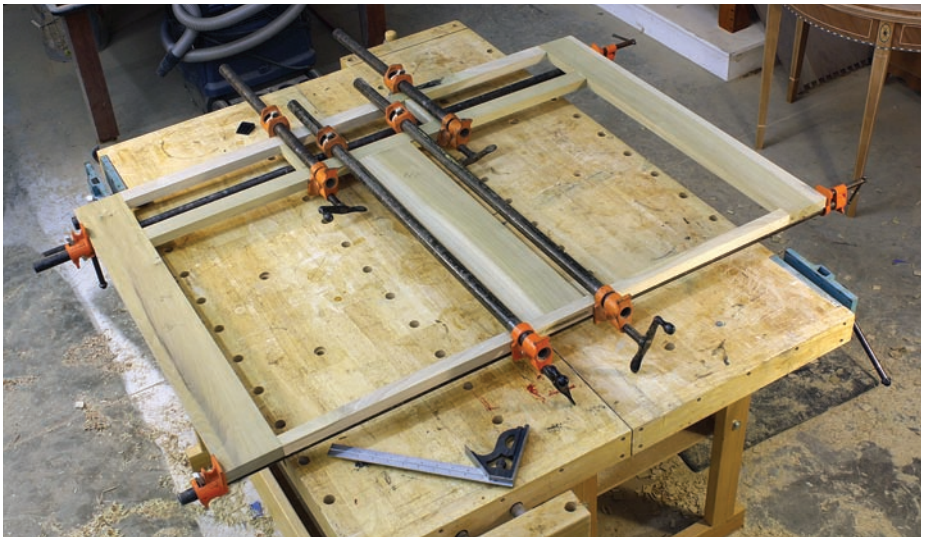
Locate and mark the mortise locations for 1/4"-thick tenons. Wherever possible, each joint should have a 1 1/4"-long tenon. With the face-frame material at 7/8" in thickness, a 5/16" face shoulder produces a centered tenon. An edge shoulder of a matching size ensures a stout joint.

There are two frame joints where the matching edge shoulder is not used: on the bottom rail of the lower section where the tenon would end up 3/8" wide, and on the bottom rail of the upper section where the tenon would be 5/8" in width.

As always, cut your mortises first then cut your tenons to fit the mortises. Set up and cut all the mortises on your face-frame parts. It's best to cut the mortise then reverse the position of the workpiece and make a second pass at each mortise. Yes, the resulting mortise may be wider than 1/4", but the joint will be centered on the stock, and that's most important.

Cut your tenons using your favorite method, then test-fit all your joints. When your tenons fit snug and can be slid together with a little muscle, it's time to assemble the face frames. Work methodically through the assembly. Apply glue to both the mortises and the tenons to achieve the most strength. Clamp the frames and allow the glue to dry.

Missing features. *The original cupboard, on which our piece is based, has lost its crown moulding. And no one is sure there were ever any feet to lift the cupboard base off the floor.*



Work methodically. *To assemble the face frames correctly, you'll need to work in a specific order. Plan the steps and have plenty of clamps handy.*

Freaky Dovetail Joints

Dovetails abound in the carcases. Both sections have half-blind dovetailed corners and shelves attached with half-dovetailed sliding joints.

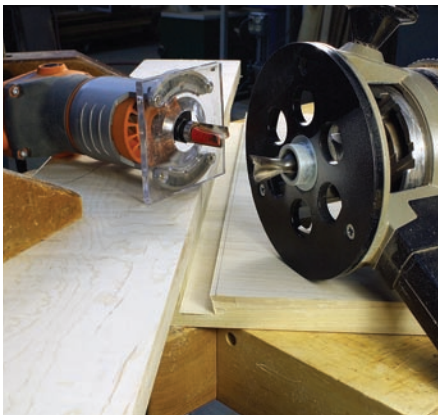
On the upper section the case top is dovetailed to the sides; on the lower section, the case bottom has the dovetails. The pins of the half-blind dovetails are positioned in the sides with the tails in the mating pieces. Also, there is a 3/4" difference in widths between the upper case sides and the top, and the lower case sides and the bottom. Those offsets capture the backboards.

The half-dovetail sliding joint is easy with two router setups. You can work with a single router, but you'll need to change the bits multiple times or position the fence in the exact same location each time.

The setups are this: One router has a 3/4"-diameter, 14°-dovetail bit coupled with a 51/64" outside-diameter template guide bushing. The second router has a 5/8"-diameter pattern bit with a top-mount bearing.

Begin by marking lines across the sides at both the top and bottom edges of the dados. Position and clamp a 3/4" fence at the top edge of a shelf location. Always work with the fence set to the left of the area to be routed. If these guidelines aren't followed, you can form the half-dovetail on the wrong edge.

Strong joinery. *The bottom of the lower section is joined to the sides with half-blind dovetails, as is the top of the upper section.*



Double-teamed. *Two routers, two bits and a guide bushing take the guesswork out of creating the half-dovetailed sliding joints.*

Begin with the dovetail router bit setup. Set the bit to cut 1/2" deep into the case side, then hold the guide bushing tight to your fence as you make a pass. The cut should be close to, but not beyond, the lower shelf layout line.

Grab your second router, set up with the bit tweaked to cut at the same depth, then make a second pass making sure to hold the bearing tight to your fence. This cut completes the socket. Move to the next shelf location and repeat the process.

Before moving on, cut the grooves in the side pieces for the backboards. The grooves are 3/8" in from the back edge of the case sides; each is 3/8" wide and 1/2" deep. A dado stack makes this quick work.

Jig Up the Slide

Now it's time to cut the mating shape on the horizontal shelves. To hoist these large panels onto your router table is quite a task. But with a simple shop-made jig, you won't need to. Instead of taking the panel to the router, you'll take the router to the work.

Build a jig to create the sliding half-dovetail with two straight pieces of 2 1/2"-wide and 3/4"-thick scrap that are 24" long. Screw the pieces together to form a "T" with one leg of the top piece set at 7/8".

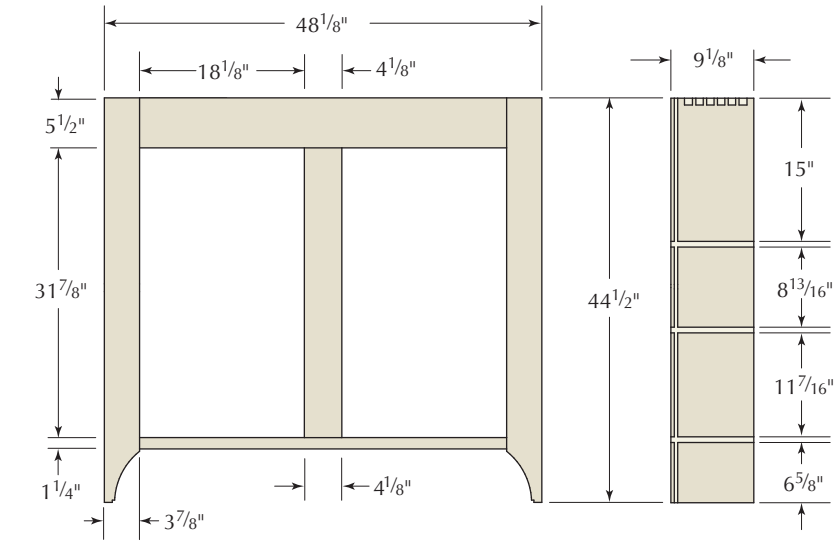
For the jig to work, you'll have to size that top leg according to your router setup. This time use a 3/4" outside-diameter template guide bushing with the same dovetail router bit. (The matching diameters allow the router bit to cut where the bushing rubs.) Clamp the jig on a test piece, then make a pass to create the half-dovetail profile as shown below.

Check the test piece in a socket. If the test piece is too wide, take a light table saw cut off the working edge of the jig, make another test cut and check the fit. Continue to take light passes off the jig to sneak up on the correct fit.

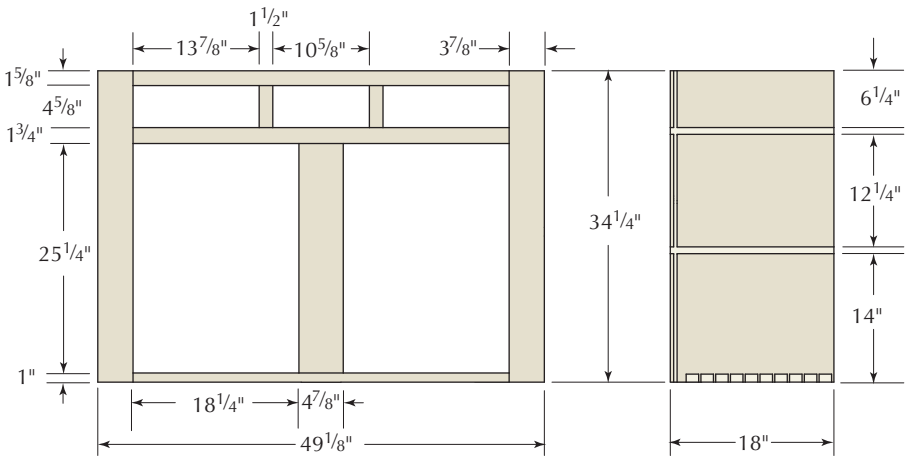
If your test piece is too narrow to fill the half-dovetailed slot, you'll have to remove thickness from the bottom piece of the jig, or remove and replace the top piece at a new location. Once the fit is correct – the workpiece slides into the slot without slop – the jig is ready to go.

Clamp the jig in position, then run the router bit to shape the profile on both ends of each shelf. (Use the jig and clamps to pull out any warp in your shelves.)

Each shelf in the upper case receives two plate grooves on the top face (the lower section's shelf is not grooved). The grooves are 2" and 4 1/4" from the back edge of the shelf and extend from end to end. Use a router and a core box router bit.



UPPER FACE FRAME & CABINET DETAIL



LOWER FACE FRAME & CABINET DETAIL

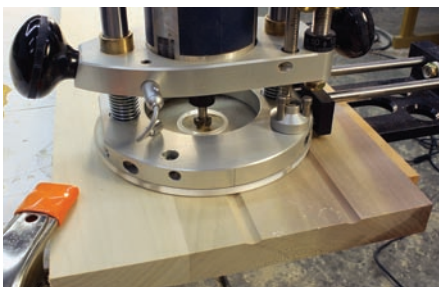
Build the Boxes and Peg the Frames

Assemble the boxes by swabbing glue in the sockets (and a small amount on the shelf ends), then slide the pieces together.

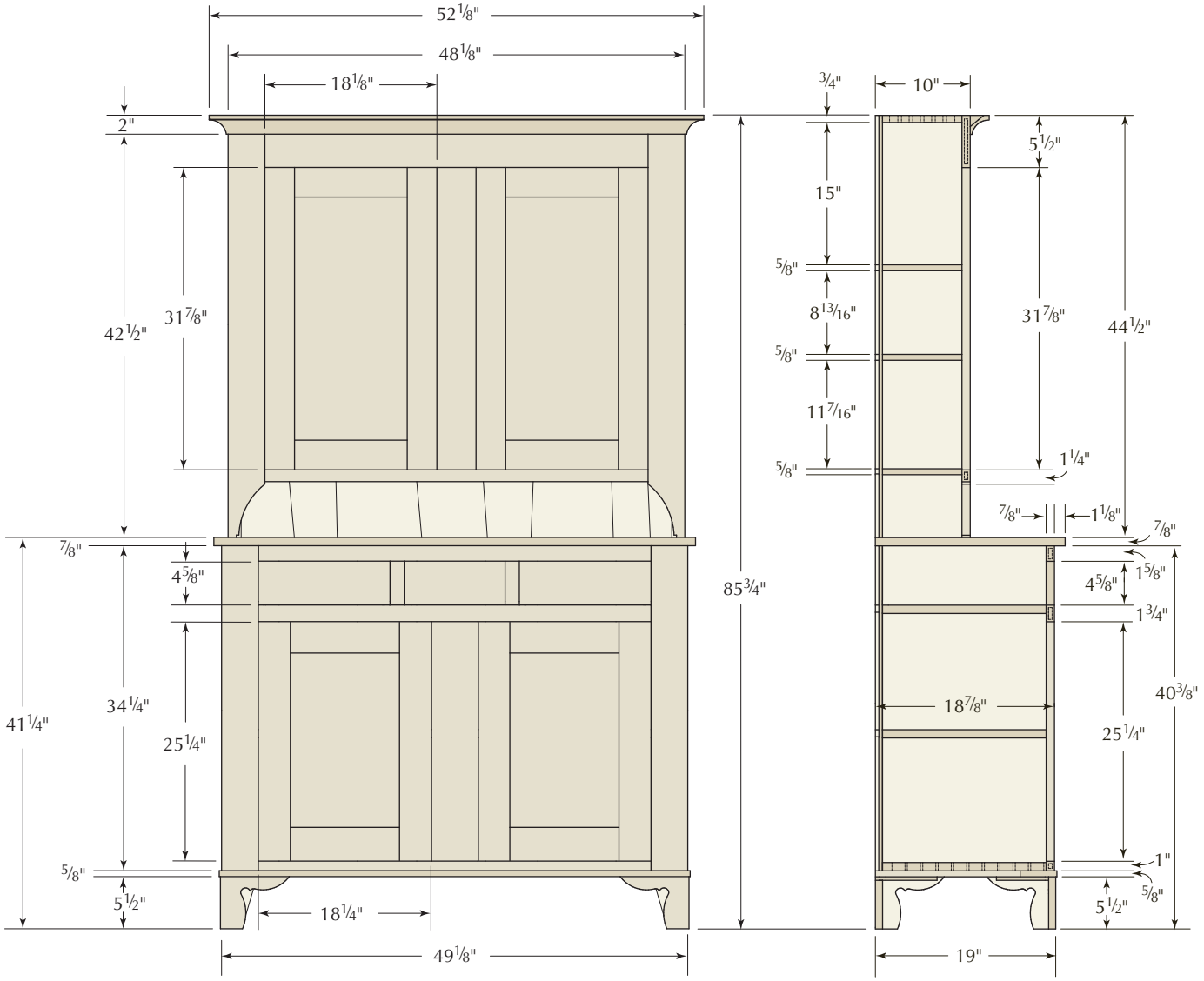
After the shelves are installed, butter the dovetail pins with glue, then tap those joints together.

When the glue is dry, fit the face frames to their boxes. It's important to align the middle rail of the lower section with the drawer sup-

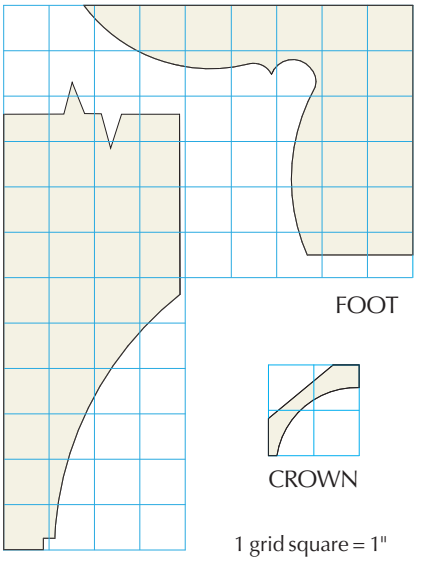
Double duty. *This shop-made jig not only dials-in a perfect sliding dovetail, it allows you to pull any warp out of your shelves.*



It's odd, but true. *It's not often you find plate grooves behind blind doors. It's a bigger wonder as to why two different grooves were plowed. Maybe it's for plates and bowls?*



A tight fit. *The glue swells the wood and makes the joint fit more tightly than before, so light taps with your mallet might be needed.*



PATTERNS

port. A thin bead of glue secures the frame to the boxes. Position the frames, add clamps then allow the glue to dry.

Drive square pegs into the face frames. Doing this after the glue sets provides additional strength so there is less of a chance to split the frame pieces. To match the original cupboard, evenly space four pegs in each rail and outside stile.

Before adding the pegs, trim the stiles to the case with a flush-trim router bit with a bottom-mount bearing. The uppermost stile's peg is located behind the cove moulding. As is done on the original cupboard, don't forget to drive a couple nails into the shelves.

The detail work on the upper section face-frame stiles is router work. To create the design, make a plywood pattern of the curve – the pattern keeps the look consistent from side to side – then make the cut using a router with a pattern bit. Square the inside corner with a chisel.

"Why can you not see, in your mind, what I see so clearly in mine?"

— Walter Darr
Continental Airlines scheduling supervisor

Through-tenon Doors

Construction of the four doors is identical, so after you mill the parts to size, gather your stiles and mark them for 1/4"-thick tenons with 1/2" edge shoulders.

With through-mortises, work from both edges of your stile as you mortise so you don't blow out the exit edge. Transfer your layout lines to both edges of the stiles and make sure you work within those confines.

Work past the halfway point of each mortise, then flip the stile edge for edge to clear the mortise.

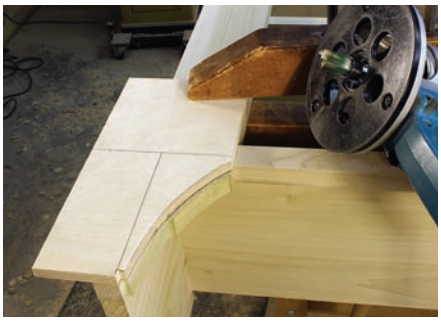
Most 10" table saws have a maximum 3 1/8" depth of cut. The door stiles on this piece are 3 1/4" in width. Because the through-mortise joinery on the doors exceeds the maximum cut, it's best to install your dado stack and sharpen your shoulder plane or bullnose plane.

Set a dado stack to its widest cut, raise the blade to just less than 5/16", position your fence to create a 3 1/4"-long tenon, then make the passes needed to clean away the waste.

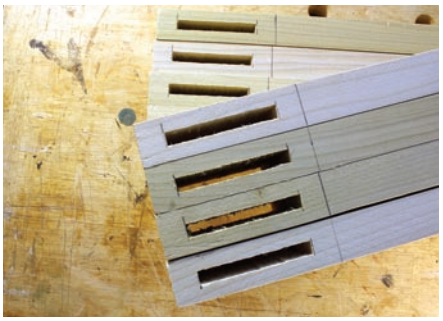
The door's flat panels fit into a 3/8"-deep x 1/4"-wide groove in the rails and stiles. Plow the grooves through the entire length of the stiles. (Doing so requires haunched tenons to fill in the small lengths of groove beyond the edge of the mortise. The haunches are formed with the dado stack as well.)

Fit each joint so the tenon fit is snug, but doesn't require a mallet to assemble.

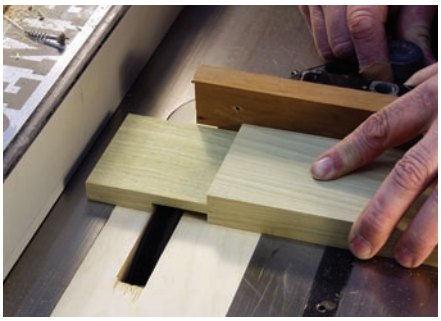
Dry-assemble the frames, then measure the openings for the panels. Measure across the opening, then add 5/8" (this builds in 1/8" of space for panel movement). Mill the four panels to size. Finish-sand the panels and knock off



Work after the fact. *You could complete the face frame stile detail before the frame is attached to the box, but there's added stability afterward. Here, a plywood pattern ensures a perfect match.*



See right through it. *The door mortises are best accomplished by working down from both edges of the stiles. And be sure to keep the slot centered for the best results.*



It's an acceptable setup. *Because this dado cut is not a through cut, it's OK to use your fence as a stop when using the miter gauge, too.*

Take a break, old friend. *I usually grab my Shinto rasp to fine-tune my tenon fit, but with the amount of work left to do, I found a bullnose plane did the work that much more quickly.*

Make a preemptive strike. *With #120-grit sandpaper, knock off the sharp edges around the panel area. This area is difficult to sand after the panels are in place, and the softened edges help age the cupboard's appearance.*

Just for looks. *Achieving a tight top-to-bottom fit of your tenons takes time and wastes time. The holding power of the joint is the flat-grain connection – and that's not found on the edge shoulders. A small wedge can tighten up the appearance.*

It's traditional with a twist. *Drawer construction for the cupboard is in typical 18th-century fashion, but the drawer backs are below the sides by a 1/4". Is this a boon or bust?*

The keeper of guides. *Small profiled pieces of wood hold the drawer guides from side-to-side movement while glue at the guide fronts and a few brads keep things tight to the dust board.*

the sharp inside edges around the panel area before assembling the doors.

When ready, add a thin layer of glue to the tenons and in the mortises, then slip the joints together. Add clamps (keep clear of the through-tenons) and let the glue dry.

Chances are you'll have small top-to-bottom gaps in the tenon fit. If so, cut thin wedges milled to the same width as your mortise to fill them. This cleans up the look.

Fit and hang your doors.

A Drawer Build – D'oh!

I can't count the number of antique drawers I've studied, or the number of drawers I've built. I don't think I have ever seen drawers built as they are on the original White Water cupboard. The drawers use typical 18th-century construction methods, but the drawer backs are different – the backs are square at the top and bottom and are held a 1/4" below the top edge of the drawer sides. At first glance, this looks odd, but there is a nice benefit to it.

The cupboard drawers are flush fitting with minimal gaps between the drawer fronts and the case. If you build with tight reveals, and the wood expands, you have stuck drawers. Drawer sides, stepped down from the fronts, allow the drawers to function, but this says "less-than-perfect craftsmanship" to me.

If you step down the drawer back in relation to the sides, you can fit the drawer front tight to the opening and slightly taper the top edge of the sides from front to back, all without any interference from the drawer back. I like it.

Build and fit your drawers. To keep the drawers traveling straight, you need drawer guides. To locate the guides, hold the drawer in position and mark along its edge.

Installation of the guides is easy. Spread glue on the first 5" of the guides (cross-grain construction precludes fully gluing the guides), place the pieces tight to the back face of the face frame, then tack each in position with brads. Also, add a couple brads near the back of the guide to keep it tight to the dust panel until the glue dries. (Don't use screws; unlike nails, they won't move with the seasons.)

Restriction of side-to-side movement is another interesting detail found on the original cupboard. The furniture maker added small keepers cut from pieces of 1/2"-thick stock to both sides of each guide. Create a small bevel on the end of your board, crosscut the length to 3/4", then rip pieces to width. (These are small pieces. Use a zero-clearance insert and a push stick, or cut them with a handsaw.) I couldn't tell how the pieces were attached. I used glue and tacked the pieces with a 23-gauge pin.

Swept Off Its Feet

The feet on the original are a mystery. There is no known photo showing any feet. The three-sided frame that today sits on the floor has no noticeable remnants of feet – no glue blocks or nail holes. In fact, nothing shows that feet were ever on this stepback. But the piece doesn't look right without something to stand on.

If you're a purist, skip the feet. If you look at the cupboard and think there's something missing, make the feet. Undecided? Make the feet separate and attach them with screws. If you change your mind, remove the feet.

Trace the foot pattern onto your stock, cut the profiles and sand the edges with a spindle sander. Arrange the feet into pairs. At the table saw, cut a 45° miter onto two sets of the pairs. Your miter gauge, with a short wooden fence attached, is the tool to use. Place the top of the foot (the long side) against the fence, then push the foot through the blade to bevel one half of your pair. To cut the opposing foot, reverse your miter gauge in the slot. Again, keep the top edge of the foot tight to the auxiliary fence, then push the piece through the blade while using a push stick to hold the stock tight to the tabletop and fence as shown below.

Works in reverse. *If you flip the position of your miter gauge in the slot, you can guide one half of the foot pairing for its 45°-bevel cut. It's similar to using a panel-cutting sled.*

Supplies

Horton Brasses Inc.
horton-brasses.com or 800-754-9127

4 ■ door catches
#SL-3

4 ■ solid brass butt hinge
#PB-409

Call for pricing.

Woodcraft
woodcraft.com or 800-225-1153

3 ■ Shaker knobs
#125433, $7.50 (10 pack)

Prices correct at time of publication.

A 45° cut into a 45° angle forms a perfect slot for a spline to hold the pairs as one. Leave your table saw blade set at 45°, add an extension to your saw's fence and slide the fence into position. Make a cut into the bevel of each foot. Reposition the fence to make a second pass to increase the slot width to match a piece of 1/4" plywood. Plywood is a great choice for splines because of its strength and stability.

Slip the front feet and splines together with glue. While the glue dries, dovetail the other profiled feet to the rear feet. Place the pins in the shaped feet with the tails in the rear feet.

Each foot unit receives a plate that's set in a 3/8"-deep rabbet at the top edge. Make that cut at a router table using a rabbet bit. The operation leaves a rounded corner. Square the corners or round the plates to fit. Afterward, glue and nail the plates to the feet.

The base frame's top edge is profiled with a 3/8"-roundover bit set to a 1/4" depth of cut. The corners are mitered. I recommend a mitered half-lap. When complete, nail the frame to the case. The feet are then attached to the frame using screws through the top plates.

Tops, Mouldings and Backs

The lower section top is a simple plank of 3/4"-thick stock. Cut a stop-rabbet on the underside of the back edge where the backboards attach. Align the top's rabbet with the grooves in both case sides.

The crown moulding is designed from examples found on other Ohio Shaker pieces. The moulding is made using a table saw. Cut the cove while pushing the stock at an angle over the blade. (Raise the blade incrementally with each pass and make multiple passes.)

Shaker Cupboard

	NO.	ITEM	DIMENSIONS (INCHES) T	W	L	MATERIAL	COMMENTS
BASE							
❑	2	Sides	7/8	18	34 1/4	Poplar	
❑	1	Bottom	7/8	17 1/4	48 3/8	Poplar	Dovetailed to sides
❑	2	Shelves	7/8	17 1/4	48 3/8	Poplar	Sliding dovetail ends
❑	1	Top	7/8	20	50 3/4	Poplar	
❑	1	Base frame front	5/8	3 7/8	49 5/8	Poplar	Miter both ends
❑	2	Base frame ends	5/8	3 7/8	19 1/8	Poplar	Miter one end
❑	6	Drawer guides	5/8	1 1/2	17	Poplar	
❑	1	Back	1/2	48 3/8	34 1/4	Poplar	Tongue-and-groove
❑	6	Profiled feet	3/4	5 1/2	7 1/4	Poplar	
❑	2	Rear feet	3/4	5 1/2	3 1/2	Poplar	
❑	4	Foot plates	3/8	5	5	Oak	
BASE FACE FRAME							
❑	2	Stiles	7/8	3 7/8	34 1/4	Poplar	
❑	1	Top rail	7/8	1 5/8	43 7/8	Poplar	1 1/4" TBE*
❑	1	Middle rail	7/8	1 3/4	43 7/8	Poplar	1 1/4" TBE
❑	1	Bottom rail	7/8	1	43 7/8	Poplar	1 1/4" TBE
❑	1	Vertical divider	7/8	4 7/8	27 3/8	Poplar	1" TBE
❑	2	Drawer dividers	7/8	1 1/2	7 1/8	Poplar	1 1/4" TBE
BASE DOOR PARTS							
❑	4	Stiles	7/8	3 1/4	25 1/4	Poplar	
❑	2	Top rails	7/8	3 1/4	18 1/4	Poplar	Through-tenons
❑	2	Bottom rails	7/8	3 1/2	18 1/4	Poplar	Through-tenons
❑	2	Panels	1/4	12 3/8	19 1/8	Poplar	
BASE DRAWER BOXES							
❑	2	Outside fronts	7/8	13 3/4	17	Poplar	
❑	1	Center front	7/8	10 5/8	17	Poplar	
TOP							
❑	2	Sides	7/8	9 1/8	44 1/2	Poplar	
❑	1	Top	7/8	8 3/8	47 3/8	Poplar	Dovetailed to sides
❑	3	Shelves	7/8	8 3/8	47 3/8	Poplar	Sliding dovetail ends
❑	1	Back	1/2	47 3/8	44 1/2	Poplar	Tongue-and-groove
❑	1	Crown front	3/4	3	55	Poplar	
❑	1	Crown end	3/4	3	24	Poplar	
TOP FACE FRAME							
❑	2	Stiles	7/8	3 7/8	44 1/2	Poplar	
❑	1	Top rail	7/8	5 1/2	42 7/8	Poplar	1 1/4" TBE
❑	1	Bottom rail	7/8	1 1/4	42 7/8	Poplar	1 1/4" TBE
❑	1	Vertical divider	7/8	4 1/8	33 7/8	Poplar	1" TBE
TOP DOOR PARTS							
❑	4	Stiles	7/8	3 1/4	31 7/8	Poplar	
❑	4	Rails	7/8	3 1/4	18 1/8	Poplar	Through-tenons
❑	2	Panels	1/4	12 1/4	26	Poplar	

* TBE = tenon both ends

It takes two. *Make two passes with your blade set at 45° to form the slots for the splines. Add a fence extension and use a push stick to guide your foot through the blade.*

A simple alternative. *One of the easiest ways to join feet to furniture is with a plate added to the top edge of your foot pairs. Screw the plates down then add a single block at the miter for extra support.*

Something different. *The treatment of the backboards on the Shaker cupboard is unusual. The thin boards have tongue-and-groove joinery and the end boards are beveled into dados in the case sides. To be true to the original, not one of the top section's backboards is rectangular.*

The remaining cuts are made with the blade angled at 45° and the fence maneuvered to appropriate positions.

Miter the moulding at the corners and fit it in position. Use brads to attach the pieces and make sure to add glue to the short grain of the miters for a better hold.

The backboards on the original cupboard are unusual. Not only is the thickness 1/2" (rather than the usual 5/8"), the pieces are tongue-and-grooved together. The joint is thin and fragile until installed.

Additionally, the upper section's back is comprised of non-rectangular pieces. It is an interesting assembly, but one that is difficult to copy without increasing the workload.

An Updated Finish

The finish schedule for the cupboard is involved, but easy to replicate. Sand the piece to #180-grit. Dye the piece with a water-based cherry aniline dye. A couple coats of 1 1/2-pound shellac, sanded between coats with #400-grit sandpaper, allow the top coat of acrylic latex paint to be manipulated. Apply the paint, then rub through the paint at appropriate areas to simulate age. My mantra for aging paint is "less is best." Overdoing it is easy.

It's obvious that we've pulled our Shaker Cupboard back to an earlier day in its history. But the big question is: Did the detective work pay dividends? The feet are of a Shaker design and accurately scaled for this size cupboard. The moulding is in balance with the new base and the overall design is proportionally pleasing. Job done. There's no way you could walk past this cupboard without giving it a look-see. PWM

A correct time and location. *It's best to attach the top after dye and shellac, but just before adding the paint to the cupboard.*

Glen is a senior editor of Popular Woodworking Magazine, *a published author, and teaches woodworking classes and seminars. Contact him at 513-531-2690 x11293 or glen.huey@fwmedia.com.*

White Water: A Lesser-known Shaker Village

White Water is one of four Ohio villages founded between 1787 and 1824 by the United Society of Believers in Christ's Second Appearing – also known as "Shakers" due to their spirited movements during religious meetings. The village is 22 miles west-northwest of Cincinnati and is the only substantially intact Ohio village.

White Water was established in 1822 when a group of Shakers traveled from Lebanon, Ohio, to share their religion with area settlers. The first brick building, and the only extant brick Shaker meeting house (shown in the photo), was constructed in 1827, followed by dwelling, smoke and milk houses, barns, workshops and other buildings – 22 structures in all.

The community prospered with the sale of seeds, fruit, wheat and livestock as well as brooms made from broom corn grown at the village. After the Civil War, the village population diminished as Shaker religious ways lost appeal. Handmade goods fell out of favor and the seed market declined.

After a fire destroyed the largest dwelling house in 1907 followed by the Shaker school closing, the parent ministry in Canterbury, N.H., sold the property and the final two Shakers moved away.

Today, the Friends of White Water Shaker Village (FWWSV), along with the Hamilton County Park District, have developed preservation, conservation and restoration strategies. They know the importance of the village, and work to restore and reopen the community as part of our American cultural heritage. (For information about, or to become a member of FWWSV, visit whitewatervillage.org.) — GH

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Watch a video on making cove moulding on the table saw:
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Read Glen's blog entry on making the unique backboard found on the original stepback cupboard:
▶ tinyurl.com/y9egbwe

Read more about the White Water Shaker Village:
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Clark & Williams, Plane Makers

BY CHRISTOPHER SCHWARZ

In an Arkansas basement, this somewhat unusual three-man company turns out extraordinary wooden handplanes.

Built for builders. *Clark & Williams planes might appear simple, but they are actually extraordinarily refined tools that require machinery, hand tools and incredible skill to build.*

The married couple wanted a custom gazebo. So Larry Williams, a successful carpenter, fetched his camera and was getting ready to photograph gazebos around town to show his clients. Right outside his door, Williams took a wrong step, slipped on an ice patch and became a full-time toolmaker.

Williams had broken an arm. To be more precise, he had ruined his arm and needed surgery and bone grafts. With one slip, his carpentry career disappeared.

"No one needs a one-armed carpenter," Williams says. "God I love carpentry. The kind of work I got to do … ." His voice trails off.

Today Williams and his business partners, Bill Clark and Don McConnell, run Clark & Williams planemakers in Eureka Springs, Ark. This three-man business is one of the few in the Western world that makes traditional wooden-bodied planes.

The company uses modern and traditional tools to make planes that represent, in their eyes, the pinnacle of tool development – 18th-century British moulding, bench and joinery planes. Planes of this era look simple – some woodworking authors have described tools of this period as "primitive." Yet once you see these planes through the eyes of their makers, later handplanes look and feel awkward.

The problem here is that even with modern woodworking and metalworking machines, building these tools is time-consuming. All the important details are made by hand. So Clark & Williams has an immense backlog. How long? Williams won't even take a guess.

"We're always adding steps," Wiliams says. "Any time we think we've figured out how to make McDonald's wages at this, we add extra steps to the process."

This problem weighs heavy on Williams, who has survived two serious health problems during the last two years. There is concern hanging in the air of this cozy basement shop in Arkansas that health problems, which launched the company into full-time production, could also be the end of it.

LEAD PHOTO BY AL PARRISH; STEP PHOTOS BY THE AUTHOR AND KELLY MEHLER

No small taper. *Here you can see the bevel and the tang of two unfinished irons for snipes bills planes. The irons start thicker at the bevel and taper 1/16" along their length. That's a lot of metal work.*

A steady hand. *The swooping gouge cuts on the shoulders of the moulding planes require sharp tools and skill.*

Mortises for wedges. *"We've been careful not to design our tools around our machines."*
— Larry Williams

After Disaster, Floats

Clark & Williams was born as a side gig of Williams and Clark, who were partners in a finishing subcontracting firm. The two had been using hand tools on the job for years, but they wanted to be able to make small amounts of custom or reproduction moulding.

Williams says they realized that hand planes would be the best way to do that. The problem was that Clark and Williams couldn't find planes that were in good enough shape to use, so they decided to make the tools.

That led to the second problem: They needed planemaker's floats.

These fascinating, useful and rare tools are a cross between a rasp and a saw. They cut wood aggressively, true the surface and leave a nice finish behind. Floats are key to making many parts of wooden planes, including the bed for the iron.

While vintage floats used by joiners showed up for sale occasionally, floats for the plane-making trade were rare. So in 1996 Williams and Clark bought the machinery to make floats; they helped pay for these machines by offering the floats for sale on the "oldtools" Internet discussion group. That led them to making 18th-century style planes and unlocking a key secret to handplanes without chip-breakers: a high cutting pitch solves most of the problems with tear-out.

For a while, they were splitting their time between finish carpentry and toolmaking. Clark built the bench planes (jointer, try, fore and smoothing planes) and Williams made the moulding planes (hollows and rounds plus complex moulders).

Then Williams broke his arm in 2000, ending his carpentry career and beginning his life as a full-time toolmaker.

Since day one, simply figuring out how to make these tools has taken an immense amount of thought and labor.

"Basically, we've had to re-create an entire industry," McConnell says. "In the 19th century, there were beech suppliers and (companies) who made the right tapered irons. When we started, tapered irons weren't even available. So we've had to make the tools to make the tools."

Unlike modern plane irons, many 18th-century irons tapered in thickness, which is key to their performance. So Clark & Williams had to figure out how to do this using metal milling machines. Then they had to heat-treat their own cutters as well.

Even getting the right wood is a constant fight. They visit small custom sawmills all over the country to find beech that is thick enough to make their planes; they never glue up thinner stock to make their plane bodies. While beech is an important tree in Europe, it isn't prized in the United States by sawmills – it moves a lot in service when it is flat-sawn. So the three guys find themselves scrambling for the 9/4 stock they need for moulding planes, the 16/4 for bench planes and the 4/4 for plane totes.

In fact, almost all their components are a struggle. For joinery planes with depth stops, Williams has to make them from scratch on a metal milling machine using a set of complex fixtures he built. So they make every single part of their planes, with the exception of a single cut nail that fastens the tote to the body of some of the company's bench planes.

Clark & Williams (and McConnell). *Bill Clark with one of his jack planes, Don McConnell with a pair of snipes bills and Larry Williams with a try plane.*

A Shop of All Trades

As a result, the main shop for Clark & Williams is an unusual combination of woodworking machinery, all forms of milling machines (including a metal lathe), heat-treating ovens and nice European workbenches.

Adding to the atmosphere is a large wood-burning stove. Several times during the day Williams steps outside the shop to split some wood and feed the stove. With a bundle of wood under his arm, Williams enters the shop in the company's woodworking area.

This room would look like home to any furniture maker. There's a vintage Powermatic 66 table saw, a large Grizzly band saw, an older Makita floor model planer, a sander, drill press and small Craftsman band saw. Here they break down the beech into usable stock, usually 24" lengths, then they reduce those to 11"-long billets, which become the 10"-long planes. They also cut the shoulders, grips and some chamfers on the planes using the table saw.

From there the billets pass into the next room, which houses a Bridgeport-like milling machine, the metal lathe, some grinding equipment and a Grizzly wood mill. The wood mill is a favorite of Williams, who has developed a whole rolling cart of ingenious fixtures that hold the parts in position.

Today Williams is working on some moving fillister planes and is sinking the mortise for the wedge on the wood mill. From there the billets will go to the adjacent bench area where things will get cleaned up with floats and planes and sandpaper.

"Eighty percent of the work is with hand tools at the bench," Williams says. "We tweak them until we're happy."

Meanwhile, work begins on the irons of the planes. These come into the shop as $\frac{1}{8}$" x $2\frac{1}{2}$" bars of oil-hardened steel. The steel is cut to shape on the band saw then tapered on a metal mill – the irons have to taper $\frac{1}{16}$" along their length. Then the irons are hardened.

After that it's back and forth to the stations around the shop to prepare the planes for finish. Some operations, such as cutting them to final length and planing the tops, don't happen until the end so that the work is as crisp as possible.

Machines help the hands. *Here the Grizzly wood mill is milling out the hole for a depth stop on a moving fillister plane. While machines handle some of the operations, about 80 percent of the work is by hand.*

The woodshop. *Williams is a big fan of his vintage Powermatic 66 and its simple fence. He never switched to the popular Biesemeyer system.*

The Clark & Williams legacy. *"If I drop dead tomorrow I'll have left a good legacy. I can look back at our books and see the names of the people I sent planes to. Those people now have a capability that I only dreamed of when I was a carpenter. That's pretty neat." — Larry Williams*

Each plane is tuned and sharpened so it is ready to work right out of the box. You read that right. Clark & Williams are one of the very few makers who hone their tools so that your first swipe with the tool is an amazing one.

As you can imagine, that is a lot of work. And if you're wondering how long it takes to make a typical half set of hollows and rounds, you can keep on wondering.

"The honest answer is: We don't know how long it takes to make a set," Williams says.

"The truth," McConnell adds, "is that we really don't want to know."

Unusual Company

If you're in business yourself, you're probably wondering how a company like Clark & Williams can survive with such a huge backlog, an incredible amount of handwork and a constant struggle just to get raw materials.

Wait, it gets crazier.

I've heard Williams gently discourage customers from ordering tools at times. The company doesn't advertise, seek publicity or actively try to expand its work force. But the most amazing thing is that in 2007, the company basically gave away all its trade secrets in a series of two DVDs produced by Lie-Nielsen Toolworks, a friendly competitor.

In the DVD set, titled "Making Traditional Side Escapement Planes," Williams shows

Where to begin? *"When I became a furniture maker, I decided I wanted to go back and start at the beginning, 18th-century furniture. It turned out to be a good instinct. It was a very good foundation."* — *Don McConnell*

every step to making the company's moulding planes using simple machines and tools. And in a follow-up video released in 2009, "Sharpening Profiled Hand Tools," Williams shows anyone how to sharpen the contoured irons – shortening the learning curve for both users and competitors.

"Sometimes we run into people who have watched the video and made some planes," Williams says. "They're real hesitant to say they're thinking of making them to sell. They don't know that we'd like to pat them on the back and buy them a drink. We put this information out to be used. We'd be thrilled to see others get into it."

That, right now, is one of the unusual goals of Clark & Williams – to train people to compete against them in the marketplace. In part to make it easier for people to compete, Clark & Williams raised its prices significantly in the fall of 2009 and is planning future videos on making and using planes that they will give away free on the Internet.

They hope that the DVDs will encourage people like Matt Bickford to make planes to sell.

Bickford, a derivatives trader in Connecticut, bought the DVD and has made three half-sets of hollows and rounds in cherry.

"This is certainly a project that any hobbyist can do," Bickford says. "It is one of the most thorough DVDs – it was the only source I needed." The only part of the construction process that concerned him was heat-treating the irons, but even that was straightforward.

"The irons are certainly holding an edge," he says.

Bickford has traded away his extra sets to fellow craftsmen and – in the back of his mind – says he's considering making tools for sale some day. But first he wants to get some feedback from craftsmen now using his tools.

In the fall of 2009, Bickford showed one of his planes to Williams during the Woodworking in America conference held in Valley Forge, Pa.

"Matt did a fine job," Williams says.

"I felt bad," Bickford says. "I felt like I was plagiarizing Larry's work."

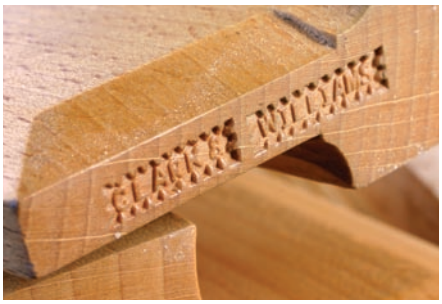
The Learning Curve

The other major challenge facing Clark & Williams is training its customers to actually use the tools. While barrels of ink have been spilled on teaching people to use garden-variety bench planes, chisels and other basic hand tools, there is little written about moulding planes that is useful.

This lack of information hasn't stopped some craftsmen from diving headfirst into the world of moulding planes. Chicago furniture maker Jeff Miller owns a half-set of hollows and rounds and uses them in his work, which is decidedly contemporary.

The first time he used them, Miller says he was making a fancy Roman-style chair that had ornate arms, for a Catholic church.

"The arms had a rolled-over detail that you couldn't rout," he says. "These planes were perfect."



Their mark. *Though McConnell is deeply involved in the production of the moulding planes, the company opted to keep its original name. "I wish Don's name were stamped on each plane," Williams says.*

Planing planes. *McConnell finishes up a set of hollows and rounds at his bench last fall. Dressing the beech right before finishing is what gives the tools their crisp appearance.*

Clark & Williams Planes at Colonial Williamsburg

For most woodworkers, the Anthony Hay Shop at Colonial Williamsburg is the Tabernacle of Hand Work in the United States. The reconstructed cabinet shop in Virginia embodies the methods and style of work that were typical in the Tidewater area of the state in the mid-18th century.

The interpreters who work in the small but neat space use period-appropriate tools and techniques to build furniture and harpsichords. And on their benches and in their toolboxes are 125 planes from Clark & Williams.

Mack Headley Jr., the master and supervisor at the shop, says they first became aware of Clark & Williams through a friend of the shop.

At the time the Hay shop was using mostly 19th-century moulding planes. After receiving a donation, the shop purchased one full set of hollow and round planes – 36 planes in sizes from 1/16" up to 1 1/2". After working with that set, Headley says they purchased a second full set of the planes. While most craftsmen of the period would have had only a half set of the tools, Headley says they purchased full sets in case they wanted to alter the curvature of any of the tools – that would allow them to have one unmodified set at hand.

In addition to the hollows and rounds, Headley says the shop also has snipes bills and complex moulders, such as ogees, astragals and beading planes.

Because the shop makes only short runs of mouldings, they work mostly using hollows and rounds, which are more flexible than complex moulders, but can be slower to use.

The shop also has 14 rabbet planes, two toothing planes, a compass plane and four tongue-and-groove planes from Clark & Williams.

Several years ago there was an effort at Williamsburg to make bench planes for the shop. The blacksmith made blades. Other artisans made the bodies. But there were still some holes in the collection that needed to be filled in, so Williamsburg purchased four bench planes from Clark & Williams.

Though the Hay shop is in the United States and the Clark & Williams planes are decidedly British in appearance, Headley says the tools are appropriate for the shop and time period – toolmaking on this continent was still in its infancy so many woodworking tools were imported. Read more about the Hay shop at history.org. — CS

Reclaiming a lost art. *McConnell explains the inner workings of historic moulding plane profiles to students in a planemaking class at Kelly Mehler's School of Woodworking.*

In fact, Miller wants to develop a series of contemporary details using the hollows and rounds for his chairs and table edges.

"They are so useful for shaping and give you so much control," he says. "You might have this router bit and that router bit, but that's so limiting. These tools free you up to do work that is difficult to (cut with a) machine."

However, Miller's confidence might be the exception. Many Clark & Williams customers are looking to make traditional mouldings and are looking for good step-by-step instruction.

On making planes. *"It's fun seeing them come to life, setting them up and sharpening them."*
— Don McConnell

Here, take this secret. *Williams shows students at Kelly Mehler's School of Woodworking how to make a hollow and a round plane during a 2008 class.*

But you won't find that in modern woodworking magazines or books. Even finding a class in moulding planes can be a challenge.

And so the guys at Clark & Williams also spend hours poring over nearly forgotten books to recreate the lost techniques for making mouldings efficiently. Before joining Clark & Williams in 2005, McConnell was already one of the country's leading authorities on preindustrial woodworking. Not only is he a professional hand-tool furniture maker and gifted carver, McConnell has also spent his adult life digging into the history of steel, measurement systems and early tool development.

And now his research is guided by his day job as a plane maker. McConnell has always shared his knowledge freely on the Internet, and now he also is hosting DVDs produced by Lie-Nielsen that show woodworkers how to unlock their tools to make mouldings that

Supplies

Clark & Williams
planemaker.com or 479-981-1313

Lie-Nielsen Toolworks
lie-nielsen.com or 800-327-2520

"Things men have made with wakened hands, and put soft life into are awake through years with transferred touch and go on glowing for long years. And for this reason, some old things are lovely warm still with the life of forgotten men who made them."

— D.H. Lawrence (1885 – 1930)
English writer

no electric router could easily accomplish.

So six days a week McConnell and Williams meet at the shop, which is in the basement of the house where McConnell lives (Clark, the third guy in the company, works from his shop at home). They start at 9 a.m., talking history, working and drinking the discolored water that Williams calls coffee.

They finish at 5 p.m. or so and go home to answer e-mails, troll the Internet a bit and read, read, read.

"This," McConnell says, "is our lives."

All this hard work has earned them recognition. In 2006, Williams was named a Living Treasure by the Arkansas Arts Council. Various shops at Colonial Williamsburg own and use many of the company's planes. And the men are in high demand from woodworking schools all over the country to teach.

But in talking to them, it's clear that what drives them are the chunks of beech and steel they fashion each day. Each plane is like a wooden jewel. It withstands the closest scrutiny. Even the freehand cuts made with a gouge on the shoulders of each plane are perfect.

This display of bravado would be remarkable for any craftsman, but it's especially so for Williams, who has survived cancer and a heart attack and still doesn't have the full use of the arm he ruined. Yet he is still as steady and sure as a young man at the bench.

With a plane, chisel or brace in his hand, it's clear that Williams is simply driven and possessed to build the set of moulding planes he always wanted when he was that carpenter working on amazing jobs, carving linenfold panels from English oak.

And by his own measure, he's just about made it there.

"There is very little in this world I'd be willing to steal," Williams says, looking at a half-set of hollows and rounds that McConnell is finishing up. "Fifteen years ago if I had seen a set of planes like this, I would have been willing to steal it. That's really scary that I would be willing to say that. But it's true."

McConnell looks down at the planes and, in his own way, agrees.

"My test of a set of planes that I've made is whether I secretly wish I could keep it," he says. "That's when I know they're ready to be shipped." PWM

Christopher is the editor of this magazine and the author of the books "Handplane Essentials" and "Workbenches: From Design & Theory to Construction & Use."

A new plane maker. *One of the students at Kelly Mehler's School of Woodworking takes one of his moulding planes for a spin. One of the goals of Clark & Williams is to teach the art to budding plane makers.*

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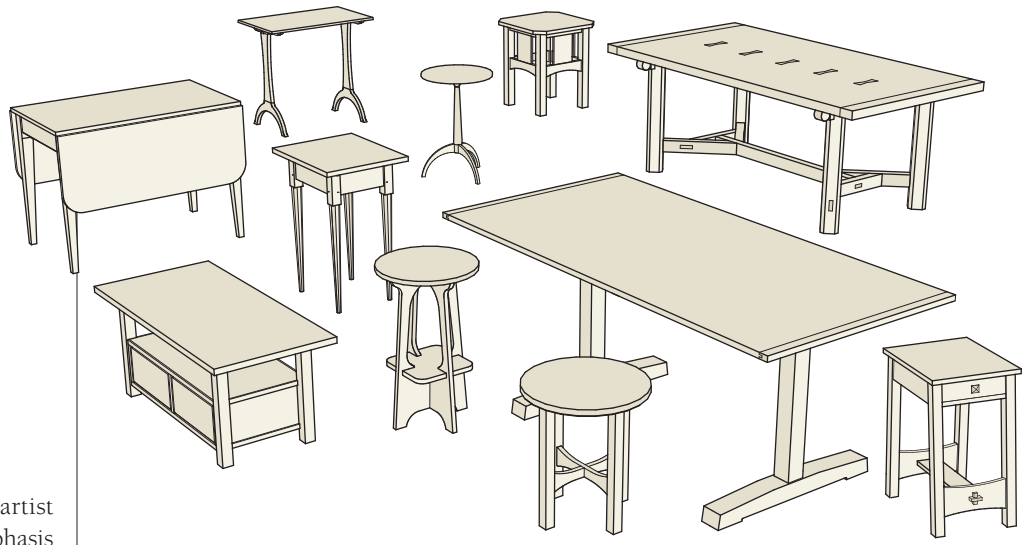
How Tables Work

BY ROBERT W. LANG

Numerous shapes, forms and functions share a common set of issues.



Form follows function. *Tables of different sizes, made for different uses, share a common set of engineering problems.*

A good furniture maker is part artist and part engineer. An overemphasis on either side of this equation leads to furniture that is ugly, impractical or both. Tables are especially vulnerable in this regard. Tables serve many purposes and are simpler than cabinets or chairs. But this simplicity calls for a thorough knowledge of how wood works when in the form of a large flat surface and an underlying structure.

Regardless of style, there are many mistakes lying in wait to spoil the plans of the would-be table maker. Whether you are new to the craft and getting ready to make your first occasional table or are more experienced and aiming to build a showpiece for your dining room, there are many aspects of table design that you need to consider.

Shape and Size

The design process begins with establishing practical parameters. A dining table needs to accommodate a certain number of people on a regular basis, and more on special occasions. An end table provides space for a lamp and a beverage, and an entry table may hold a vase, the mail or your keys.

In addition to being the right size for its use, a table must also fit in the available space. Seating 12 for Thanksgiving dinner is a worthy goal, but not at the expense of daily navigation through the dining room.

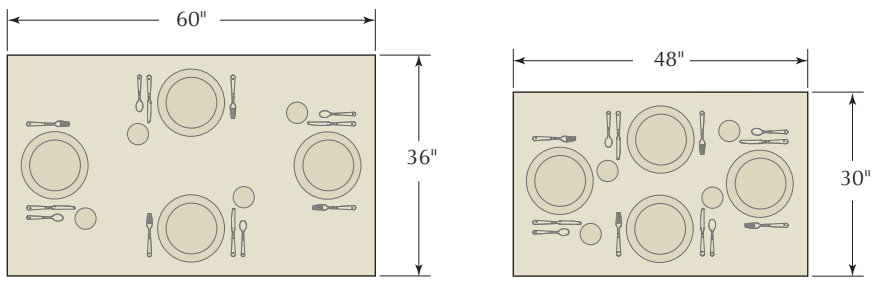
At this early stage of the process, a scale drawing of the room or a 3D model in SketchUp will allow you to consider alternatives. Changing your mind at this stage is much easier than it is after you start cutting wood.

If you find it difficult to visualize things on paper or on the computer screen, you can mock up sizes and shapes with cardboard. Put your idea together with packing tape, place it in the room and live with it for a day or two. You don't want to invest the effort to build the real thing only to hear, "I didn't realize it would be like that" from someone you love when you're done.

Consider also how shapes play a role. Rectangles are easy shapes to make, but sharp corners are painful reminders of too much table in too little space. Rounded shapes are more adaptable if you need to squeeze in an extra diner or two, but will be more demanding to build. Clipping square corners will protect your hips or shins if you need to make the most of a tight space.

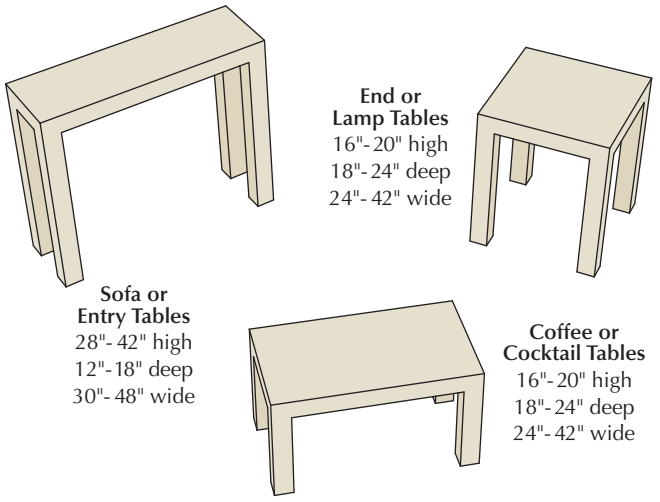
For dining tables, a simple ratio of human body to perimeter space rarely works. Consider the available space at corners or across the table, and how that affects the table's function. The drawings below give some examples, and an article adapted from my book "Drafting & Design for Woodworkers" (Popular Woodworking Books), gives many more (see "Go Online" at the end of the story).

Perfect the plan first, then work on establishing the proper height for the structural elements. Standard heights have evolved over the years for the distance from floor to tabletop for different types of tables. You may want to

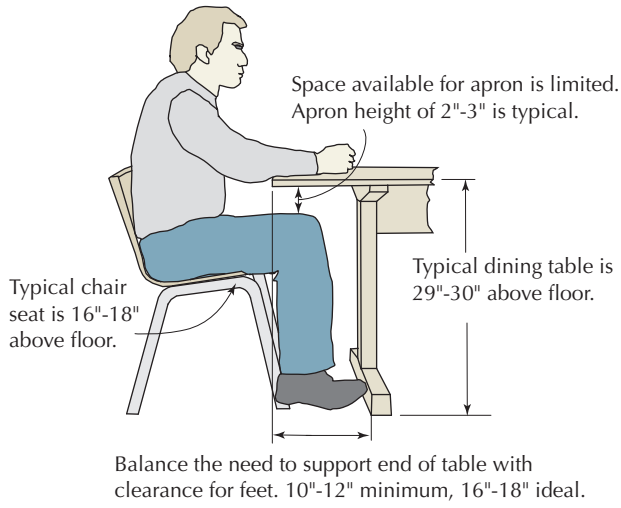


How many for dinner? *A rule of thumb for seating is to allow 24"-30" per person around the perimeter of the table. But you also must consider the shape and overall size of the table. Extra space is needed at each corner, and while a narrow table may accommodate two settings across from each other, there may not be room for serving dishes in between. There is no substitute for a scaled layout. More examples are online at popularwoodworking.com/apr10.*

ILLUSTRATIONS BY THE AUTHOR



Standard is a range. *This range of sizes for occasional tables is only a guideline; there are no laws in furniture design.*



Tight squeeze. *Dining tables and desks don't leave much room for experimentation. If in doubt, pull up a chair and grab a yardstick.*

vary the height to suit your needs, but consider the consequences. Restaurants often provide tables an odd height to make people uncomfortable so they won't linger.

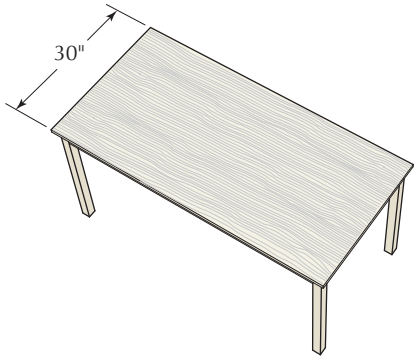
Desks and dining tables must also be able to accommodate a chair, and the person on the chair, with enough room between the table and wall to get in and out. Compare what you are considering to existing designs, and spend a few minutes with a yardstick, a folding chair and a card table and you'll find out if the dimensions you're considering will work in real life.

Start on Top

With the overall parameters of size and shape established, stylistic and structural details are next in line. Here is where the balance between structure and style is most important. As you develop your plan, consider the forces that will be working against you. Considerations one and two are movement of the top, and leverage on the ends of the legs.

A solid-wood top will move across the grain as the seasons change. Moisture (or the lack of it) in the air will migrate to (or from) the top and it will change in width. The number of variables involved makes predicting how much change will take place a guessing game, but it will happen. This is a force that you can't control, but you can design around it.

In most table designs, the top and the base are individual units that work together. The connection between the two must be strong, with some provision for the top to shrink and swell. Cabinetmaker's buttons and figure-8 fasteners are time-tested solutions. If someone suggests a method to you that includes the phrase, "that will keep it from moving," be aware that you are listening to a fool.

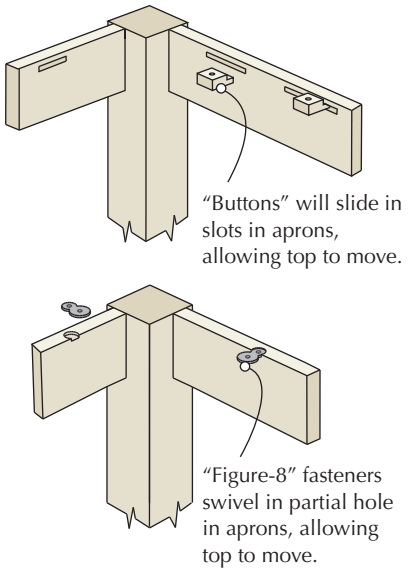


Irresistible force. *Wood movement can't be stopped, but it can be accommodated. When attaching a top to a base, use fasteners that will slide or swivel.*

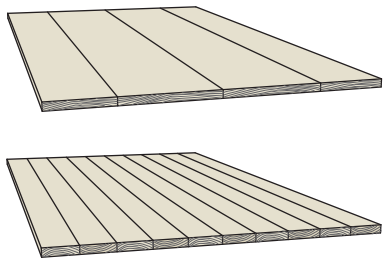
Wood movement can't be controlled, but it can be directed. In a dining table you can screw the top to the base in the center and use sliding fasteners on the perimeter to let the top move equally toward each long edge. On a desk, you can use a solid connection at the front edge to maintain appearances and force the results of the movement to the back.

In most tables, the wood grain will be in line with the longest dimension of the table. If you want an attractive table, use the widest material you can find and arrange the individual boards for the most attractive appearance. Historically, tables were made this way without suffering any dire results.

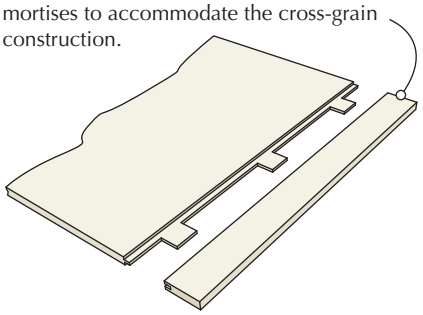
The common advice to use narrow strips and to alternate the direction of growth rings may have some merit if you're operating a large



Go with the flow. *Attach the top to the base structure with a method that allows the top to expand and contract with fluctuations in humidity.*



No advantage to ugly. *If you want an attractive top, use the widest boards available and arrange them for appearance (top). Gluing tops from many thin strips with alternating end grain is often presented as good technique. In reality, it is more work, with more opportunities for failure- and it makes an ugly top (bottom).*



Looks good, what do they do? *Breadboard ends might help keep a top from warping; they also might keep elephants away. If you use them, take care to attach them solidly.*

factory, using suspect material and a finish that will take the life out of the wood. If you're carefully making one table at a time, this procedure will lead you to do more work than necessary to produce an ugly table.

Use the best material you can find for the top. It will be the prominent visual feature of your table, and bad decisions during construction will haunt you forever. I make tops first so I can pick the best material from what I have available, and I usually spend more time finding the right pieces to put together than I spend in actual fabrication.

Match the color and grain patterns, and arrange the boards for appearance. You can overcome surfacing problems by adjusting tools and techniques, but you won't be able to change ugly. Let the wood acclimate to your shop and carefully mill each piece as flat and as straight as you can. Establish a flat surface for gluing to minimize the work you need to do on the assembled top.

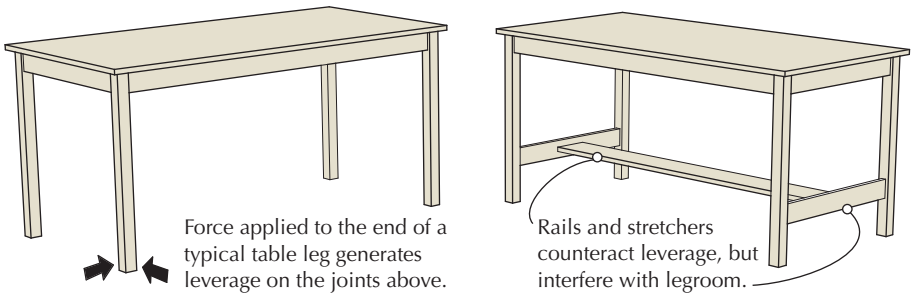
Breadboard ends look nice, but their ability to keep a top flat is overstated. You won't be able to straighten out a large warped piece of wood with a skinny straight one. In addition to attaching the breadboard to the top with a tongue and groove, add three or five tenons. The tenon in the center is the only one that should be glued. Allow room for movement in the outer mortises, and use pegs to hold the joint tight. Get used to the fact that the only time you will see the end of the breadboard flush with the edge of the top will be the day you make it.

A Sound Structure

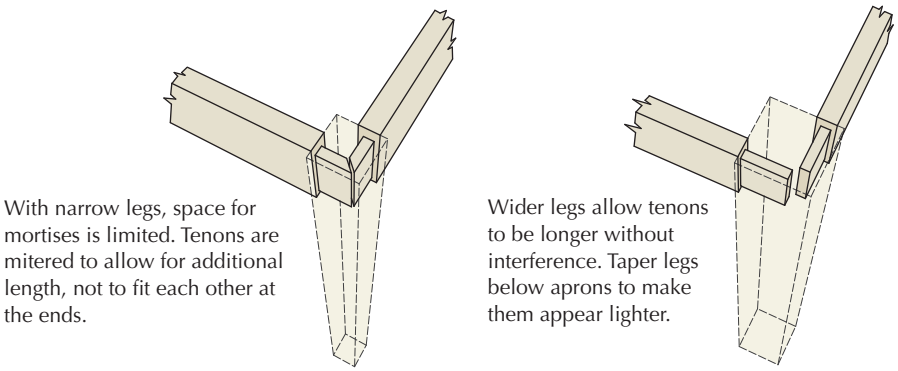
The most common type of support structure is four legs connected by aprons. This design has been used for centuries, but there are weak points. As long as a table is sitting still, skinny legs and aprons are fine. Put some pressure on the bottom of the leg, however (think of dragging a heavy table or kicking a leg as you pass by), and there is enough leverage to break apart the joints or the wood around them.

Mortise-and-tenon joints offer the strongest connection, but two aprons intersecting a leg at a right angle introduce complications, especially if the legs are narrow. Rules based on making a framed panel won't apply for the size and location of the tenons.

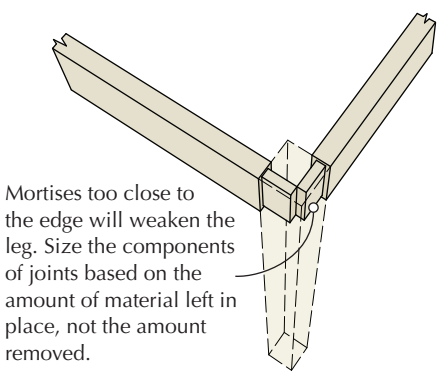
Size the elements of the joints so that plenty of material remains around the mortises. Tenons don't have to be centered on an apron's



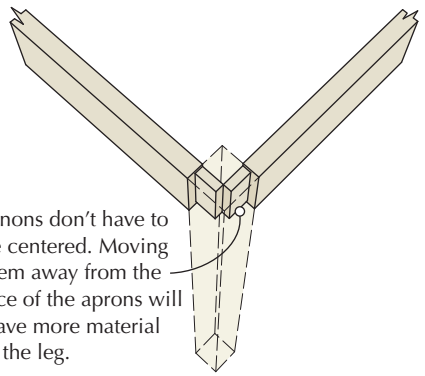
The force may be against you. *Table legs make excellent levers if there is no supporting structure near the bottom end.*



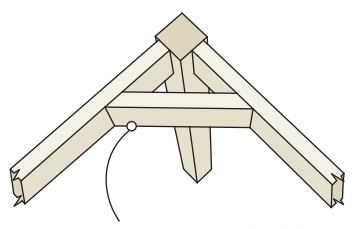
Two joints, one space. *Narrow legs leave little room for joinery. Mitering the ends increases the length of the tenons; there should be a gap between them where they meet.*



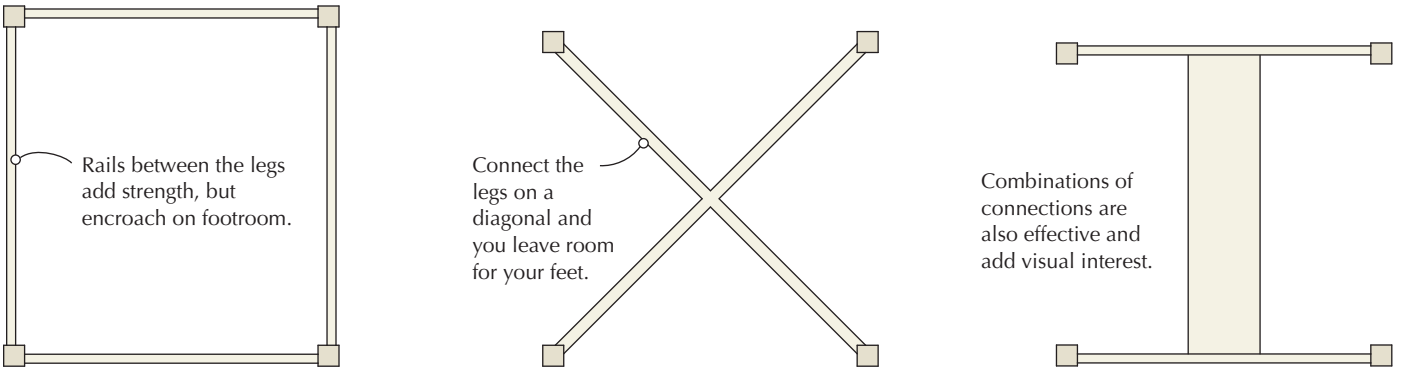
Size and location matter. *How much material is left around a joint is just as important as the size of the joint. Don't put strong tenons in weak legs.*



Justifiable bias. *Moving tenons to the back face of a rail is one method to avoid a weak area around a tenon.*



This has your back. *No one that matters will ever look behind the legs and under the top. Add a wood or metal brace behind the corner if you need to.*



Many ways to make a connection. *Look for a way to secure the legs without interfering with your feet.*

thickness; they can be offset if need be. The longer the tenon the better, and mitering the ends of tenons that would otherwise intersect gains additional length.

Dominos, dowels and biscuits are easy alternatives for mortises and tenons, but won't be as strong or last as long. Of the three, Dominos are the most durable alternative as they most closely approximate a mortise-and-tenon joint. Biscuits should be used in pairs to maximize the meat of the joint. Dowels may seem strong enough in the short term, but over time either the dowels or the holes for them will move out of round and the joints will fail.

A brace at a 45° angle between the aprons and behind the leg will not be seen and will add support to smaller pieces. These braces can be made of wood as seen in the drawing on the previous page at bottom right, and held in place with screws or other joinery. There are also a variety of metal brackets available that serve the same purpose.

Even the best joinery won't eliminate the effects of leverage. The addition of rails and stretchers near the bottom of the legs will form a stronger base, but the trade-off is in both appearance and in use. More structure equals a heavier appearance and interferes with legroom.

On a desk or worktable, rails and stretchers may not be a problem, but in dining tables this can be an issue. Horizontal parts near the floor make inviting footrests and are areas where wear will quickly show.

Connecting rails can be like aprons running from leg to leg, or they can connect pairs of legs. These rails are then connected to each other by a stretcher running the length of the table. A third method is to join the legs from corner to corner, with the cross pieces joined to each other in the center.

The best joint to use is a mortise-and-tenon, but there are alternatives. A single dovetail is effective for rails that join legs at the top of the leg. This allows the rail to be thin, and the wedge shape of the dovetail resists the outward movement of the legs. Sliding dovetails are traditionally used on small stands to join legs to a central pedestal.

On a Pedestal

There are alternatives to placing a leg on each corner. Tables that are square or circular can be supported by legs attached to a central post. Keep the footprint as large as is practical to prevent the table from tipping if weight is placed on one end. Imagine the ends of the feet to be vertical legs to get an idea of how they will act in their supporting role.

"You can use an eraser on the drafting table or a sledge hammer on the construction site."

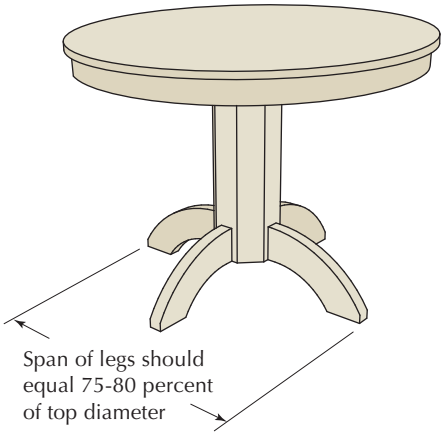
– Frank Lloyd Wright (1867 - 1959)
American architect, interior designer & educator

In small pedestal tables, such as the iconic Shaker candlestand, the legs attach to the pedestal with sliding dovetails. In commercially made dining tables, the typical connection is with hanger bolts in the ends of the feet, held firm with nuts on the inside of a hollow post.

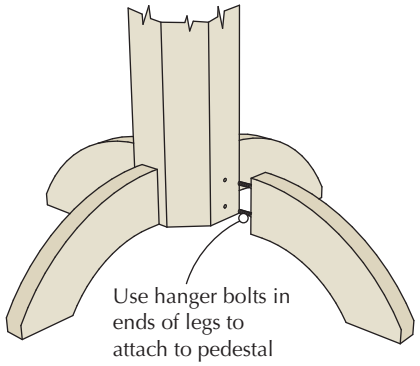
At the top of a pedestal table, a plate wider than the column is used as an intermediate connection for the top. With small tables the connection to the column can be a permanent joint. For larger tables, it's better to use screws or hanger bolts, down to the column and up to the tabletop.

To make a dining table extend, leave a few inches of space between the base and the top for an extension-slide mechanism. In most extension tables, the grain direction is rotated 90° to run across the table. This avoids making an end-to-end match where the two halves join. A side-to-side match will be less obvious when the table is closed.

While you could make your own slides, buying manufactured ones has advantages.



Put it on a pedestal. *A central column with three or four feet is often a good solution in a limited space.*



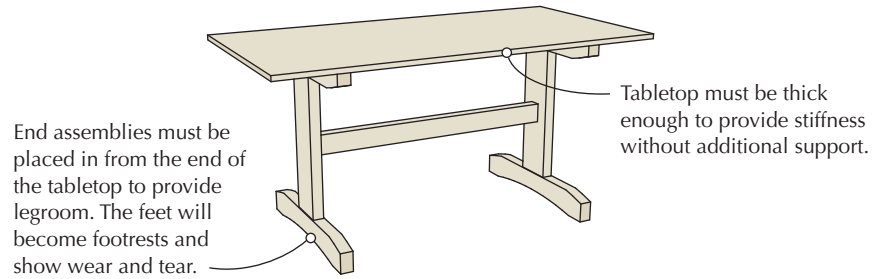
Opportunity to over-think. *In factory-made tables, legs bolt on to a hollow pedestal. Small pedestals often connect the legs to the post with sliding dovetails.*

There is a lot of engineering and fitting involved in making a slide that will work predictably for an extensive period of time.

Two types of slides are available: one for pedestal tables and one for tables with legs. The type for pedestal tables includes a gear mechanism that equalizes the movement from the center outward. The two types are also crowned in opposite directions to compensate for sagging as the table is opened. Equalized slides raise slightly at each end in the open position, and the other raises slightly in the center. When the leaves are in place, the surface will be level.

Get the hardware (or at least the actual sizes) first and engineer the table around it, with the appropriate space between the base and the top. Attach the slides with screws to the top and to the structure below. If your extension design incorporates an apron, attach the apron to the top. The joint in the apron will likely open as the top moves seasonally. A small piece of trim to cover the gap, attached to one apron only, is a common fix.

The aggregate width of the leaves should be a couple inches less than the opening range of the slides. Short dowels with dome-shaped ends will fit the leaves to each other, and to the tabletop.



On the beam. *Trestle tables are another alternative to four legs. Trestles provide a strong structure with a small amount of wood.*

On the Beam

Feet can also be placed laterally, and connected by posts and beams to make a trestle table. This time-tested alternative to four legs can simplify joinery and make maximum use of minimal amounts of material. Trestle tables are essentially a series of connected I-beams.

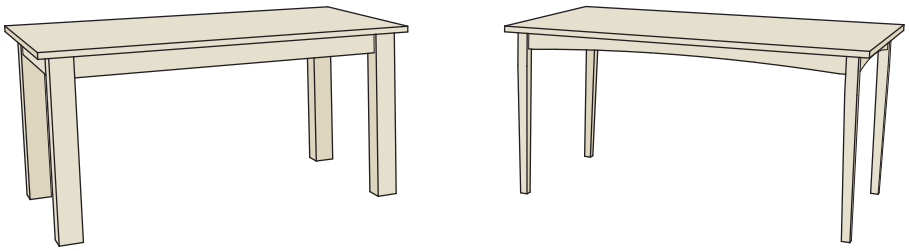
Each end has an obvious "I" shape, but looking down on the structure in plan view reveals that the two ends connected by central rails also form an "I." The top in this scheme often plays a structural role, connecting the outer ends of the upper beams, thus keeping the post-and-beam assemblies at each end from twisting or racking.

Hybrid structures are often seen, and are a good creative outlet. You can have a trestle form at the base and conventional aprons at the top. Whatever the form, keep an eye on the structural elements. You want the table to be strong and attractive, and you don't want wood movement of the top causing problems.

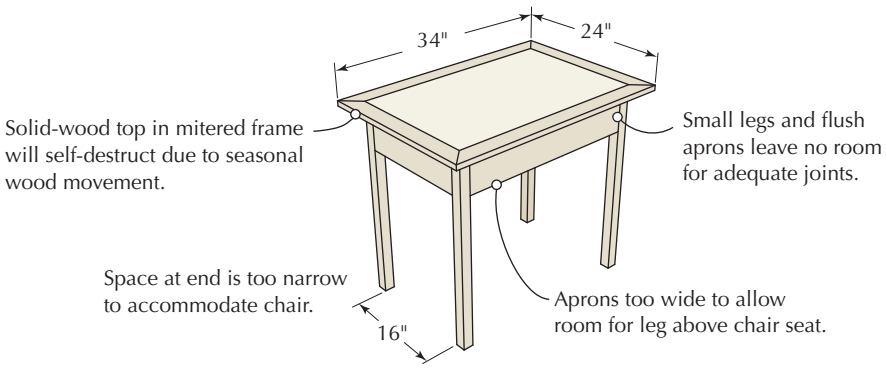
Structural elements will have an impact on the appearance of the table. Elements associated with specific styles can look odd if placed inappropriately. The proportions of the elements will also impact the overall proportions and appearance of the final design. Tapers, bevels and curves can make parts appear smaller or thinner than they really are.

The last illustration shows an unfortunate, but common combination of design mistakes. For a design to look good, it has to make sense, and ignoring hundreds of years of techniques isn't wise. Learn the basics and build on a firm foundation – then get creative. **PWM**

Bob is senior editor of this magazine, and the author of "Drafting & Design for Woodworkers" and several other books. Visit his web site, craftmanplans.com.



Appearance can be deceiving. *Proportions of individual components have an impact on the overall perception of a design. These two tables are the same size, shape and basic structure, but make wholly different design statements.*



Beginner's bad luck. *Table design isn't always intuitive. The drawing above shows several mistakes that beginning table builders tend to make.*

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3D models of the tables in the opening illustration are available for free download at:
▸ popularwoodworking.com/sketchup

For an article excerpt from "Drafting and Design for Woodworkers" on dining table shapes and sizes, visit:
▸ tinyurl.com/ybhanum

For a catalog of manufactured solid wood table legs and kits, visit:
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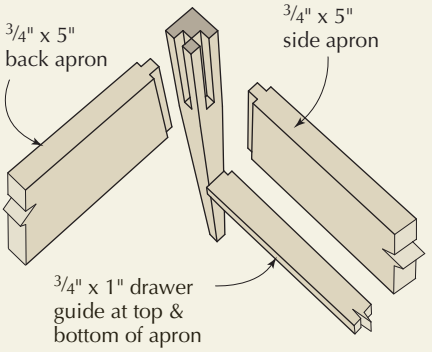
A Good Example

If you've never made a table before, or if you just need to exercise your table-building muscles, this small Shaker side table, featured in Issue 2 of *Woodworking Magazine* (Autumn 2004), is a good practice piece. The proportions are excellent, the joinery is sound and it won't require a large investment in materials or time. When you're done you will have an attractive end table or nightstand.

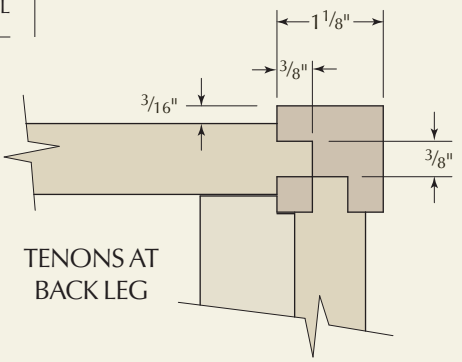
The top is 18" square, and connects to the frame with screws in oversized holes in the upper drawer guides. If you choose not to include the drawer, simply repeat the joints from the back aprons at the front and attach the top to the top edge of the aprons.

Starting with a good example is also a good way to practice developing your own designs. One secret to becoming a good designer is to study many different existing forms and experiment with them. Design is a skill that can be learned through practice; it isn't a gift that some of us have and some of us don't.

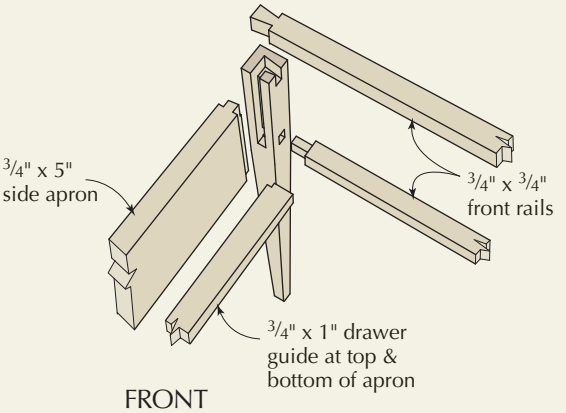
A SketchUp model of this table is available as a free download at popularwoodworking.com/sketchup. If you have SketchUp installed on your computer, you can download the model and view it in three dimensions to see how it goes together, or you can use the model as a starting point for designing a similar table of a different size. – RL



BACK LEG JOINT DETAILS



TENONS AT
BACK LEG



FRONT
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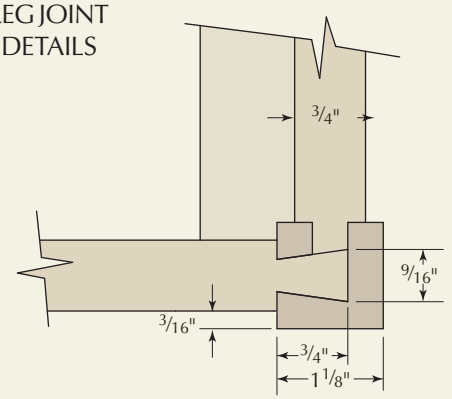
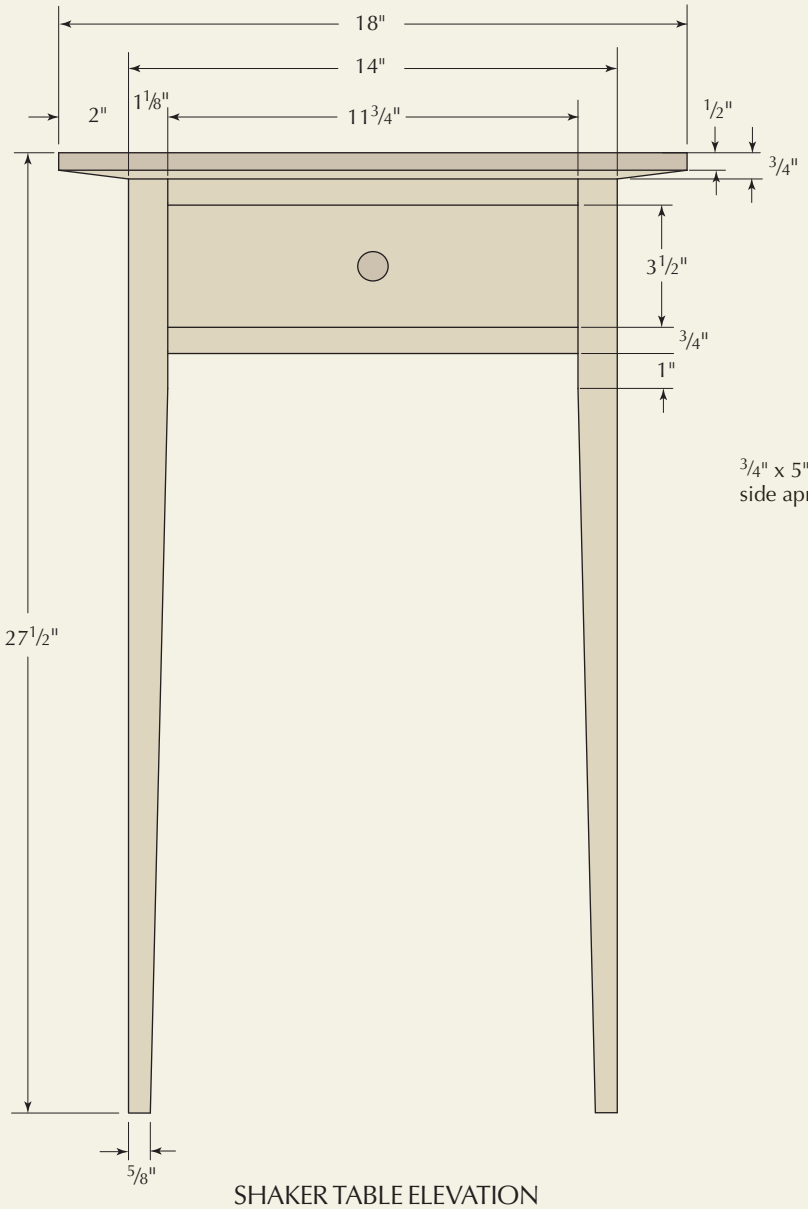
DETAILS



DOVETAIL AT
FRONT LEG & RAIL



SHAKER TABLE ELEVATION

The William & Mary Style

BY CHARLES BENDER

This period ushered in a radical shift in furniture design and construction.

Enduring design. *The high chest, or highboy, was a form introduced during the William & Mary period that has retained its appeal to this day.*

If you ask most people what they know about period furniture, many will shrug and say something like, "Oh, you mean that Colonial-style furniture." Most woodworkers tend to gravitate to Queen Anne, Chippendale, Federal or Arts & Crafts pieces. Sure, those names represent different styles of furniture but, until you really begin to study them, you may not realize that the periods flow from one into another. As you study the different styles you begin to see how each period builds on the one before it. And as you move backward through the periods, studying the design and construction changes that took place, you'll eventually come to the one style that kicked off a furniture revolution: William & Mary.

Prior to the William & Mary period (in this country, at least) most furniture was boxy, massive and simply decorated. Chests were simply boxes that sat on the ground or were on stump legs that were an integral part of the construction of the box. Frame-and-panel construction was rampant in this early form of furniture. Decoration was in the form of applied bulbous half turnings or shallow relief carving. To top it all off, much of the furniture was made from that most plentiful of woods, oak.

When William of Orange and Mary II were welcomed into England in 1688 from Holland, they brought with them lots of Dutch craftsmen. They also brought with them a new sensibility in furniture design. In general, furniture became a bit lighter in feel. The ornamentation began to change from the low-relief carving and applied half turnings to turned structural elements, pierced carvings and caning. The choice of primary wood began to shift from oak to a wood that already had a deep, rich, dark color: walnut.

For you fans of Jacobean furniture, I'm not disparaging pieces from that period. I have a healthy respect for them. I've even been known to make one from time to time. But even the most devout fan of Jacobean furniture has to admit that the pieces made during the William & Mary period shifted design emphasis from a stiff, ecclesiastical design architecture to one that was much more inviting and gracious.

William & Mary furniture is identifiable by its bun feet, symmetry in design, the use of bold mouldings with architectural propor-

PHOTOS COURTESY OF THE AUTHOR

tioning and chairs with canted backs. One of the period's greatest contributions to English furniture was the highboy. In this country, the form held favor long after it had faded in England. If we look at the design changes in chairs, tables and case pieces during this period, we can easily see how William & Mary furniture took major steps away from the Jacobean style and ran headlong toward the Queen Anne.

The United States began life as a British colony, so naturally we took our decorating cues from the mother country. And though we may hate to admit it, we looked to England even after the American Revolution to find out how our homes should look.

Why do we now favor Queen Anne and Chippendale? Perhaps because the furniture of those two periods was the furniture of our Founding Fathers. And, while we took cues from England, the furniture from both periods had a distinctly American flair. It deviated from its English counterparts in so many ways that it's sometimes difficult to associate the two in the same context.

So why does William & Mary furniture get ignored by most folks these days? Frankly, the furniture was long out of style by the time of the American Revolution. And, although we added our own flair to the style, it still had a very distinct "English" look to it.

By 1695, the official "starting" date for the William & Mary period, we were no longer a group of ragtag settlers. We had established "civilized" colonies populated with craftsmen who were eager for new settlers to come and buy wares. Because most of the settlers were coming from England and other parts of Europe, they wanted to own things that were familiar to them, yet they wanted to distinguish themselves as Americans.

The presence of a growing number of professional craftsmen changed both the design and construction of furniture in a great number of ways during this period. One such change was drawer construction. We began the period with the side-hung drawers left over from earlier days and moved rapidly toward the paneled bottoms and bottom runners of the Queen Anne period.

Seating Pieces

If we begin by looking at how seating designs changed in America from the Jacobean to the William & Mary period, we can see some radical things happening. While the joint stool remained popular throughout the Colonial period, chairs saw the greatest changes. Chairs from the Jacobean (or Pilgrim) period primarily fell into two groups: turner chairs and joiner chairs. The turner chairs had rush or splint seats and were typically of ladder-back construction. They tended to be rather straight-backed in nature. Most Shaker chairs emulate the turner chairs of this period.

Change in runners. *In the Jacobean period, drawers were usually on side-hung runners (left). In the William & Mary period, runners slipped beneath the drawers.*

Jacobean joiner chairs were of frame-and-panel construction with plank seats. They, too, tended to be rather straight-backed in nature. With the shift to the William & Mary design sense, we see the joiners' chair backs become canted for comfort. The backs were at a distinct angle to the seats. We also begin to see how the chairs shifted from having parts that were cut out to emulate turnings to incorporating turnings into the frame-and-panel construction. The back construction changed in that the panels began to lift off the seat, giving the chair a lighter appearance. Once the back rail lifted off the seat, chair backs began to shift from frame-and-panel construction to slatted backs with carved crest rails. This also led to frame construction with the use of caning and leather for the seats and backs of chairs.

The turners' chairs of the William & Mary period also saw shifts in design and construc-

Curved back. *As the William & Mary period progressed, chairs began to change in design. Here you can see the beginnings of the Queen Anne period with the reversing curve of the back. These chairs were mass-produced in Boston and shipped throughout the colonies due to their popular design.*

Comfortable and showy. *The wing chair (or easy chair) became popular in the William & Mary period. With settlements and trade routes firmly established, the wealthy had access to imported fabrics, which could be shown off on this type of chair.*

tion techniques. We begin to see canted backs on them as well. This meant cutting the rear legs out of a larger plank of wood, then offset turning them to create the decoration for the chair. We can see a shift from the ladder-back style to frame construction with slatted, caned and upholstered backs. We even see fully upholstered easy chairs come into vogue. Comfort was being firmly ushered into the world of chairs.

The design aspect of William & Mary chairs also deserves some consideration. For the first time, chairs became something more than a stool with a back (and possibly arms). Chairs began to take on more than merely a function. They began to become visually pleasing, and to make a statement about the owner's decorating taste. In essence, chairs became, for the very first time, works of functional art.

Casework Pieces

If we look at case furniture, we see the same radical changes occurring. Instead of utilitarian boxes that sat on the floor or ground (depending on whether your home had a floor or not), we began to see chests gracefully suspended in the air by sinuous legs. We also began to see the use of highly figured and sometimes exotic woods, and veneers being used as "decoration" instead of relying on turned or low-relief carved elements.

"Design is everything! Without good design, the greatest craftsmanship is wasted. Not all great museum pieces are of the best craftsmanship. It was design that made them a treasure."

— Wally Kunkel (a.k.a. Mr. Sawdust)
from "How to Master the Radial Saw"

Another area of refinement in case furniture was the growing use of brass hardware. This brass hardware wasn't merely a utilitarian addition. Pulls and escutcheons were made in decorative forms or had pictorial chasing; that added interest to the overall piece. These brasses were set against the background of polished wood. Again, for the first time, hardware became more than a functional method of opening and closing doors and drawers. It became an integral part of the design of the piece of furniture. It added to the artwork's function.

A drop of style. *Hardware became more of a decorative element during this period. With the growing popularity of lace in clothing, brasses often were pierced and chased to mimic the interlacing designs.*

Fancy feet. *Feet became decorative elements during the William & Mary period. Instead of being merely part of the side panel construction, turned ball or bun feet added a new element of design.*

Quintessential William & Mary

As noted earlier, the biggest contribution to furniture design from the William & Mary period is the highboy, or high chest. If you've ever looked at a Philadelphia Chippendale or a New England Queen Anne highboy and thought, "There's a masterful balance of joinery and ornamentation" (c'mon, I think that stuff all the time), you have William & Mary to thank. If not for them, the highboy might never have been introduced into our vernacular. And it all began with those crazy bun feet.

When builders began to raise chests off the ground, the first method was to extend the corner posts of the frame-and-panel construction to create a space between the floor and the box. It wasn't long before the turners got hold of the design and began adding Dutch-influenced bun feet to chests. Why can't you make something both beautiful and functional? The stuff in the chest really needed to be up off the dirt floor, and those stump feet are fairly plain. So, why not add a bit of style and flash? (That's 17th-century "bling," for you younger readers.)

From there, it didn't take long to stretch those bun feet into legs. Adding legs to support the chest gave the piece a much lighter look while adding practicality. A chest on legs made it easier to get into the drawers. It also put the chest squarely in your line of sight, making it the perfect showcase for those polished, figured veneers and shiny brass hardware. Again, William & Mary added form to function.

Additionally, there was a clear shift in construction methods. High chests, or highboys, were essentially dovetailed boxes set on legs. Prior to this period, chests were primarily of frame-and-panel construction. By shifting to the dovetailed box method of construction, larger flat surfaces were created that facilitated the use of the figured veneers.

Table Design

Tables also saw a radical change in function and design. Prior to the William & Mary period, tables tended to be four legs with stretchers and aprons, and a fixed top. During the William & Mary period we saw a shift to adaptable furniture. Tables began to have moving parts. The

Smaller appeal. *With the advent of the high chest, or highboy, dressing tables also came into fashion.*

Room for more. *Gateleg tables became the rage because they could be closed into a much smaller piece. This allowed the table to be placed against the wall leaving the room open for other uses.*

collapsible table was introduced, and the gateleg began yet another design revolution.

Until late in the 18th century, rooms in houses tended to be multi-functional. In the earliest homes a table of fixed size was often an obstruction. By adding the design features of a swing leg and drop leaves to tables, we could finally fold a table up to a small enough size that it was out of the way. Even with the leaves in the down position, one could still use the table. You could work or entertain on the center section. If you had more work or more company, you could extend one or both leaves. This was a design innovation that would change the furniture world as we knew it.

Another addition to the design culture of the late 17th and early 18th centuries is the dressing table, sometimes referred to as a lowboy. It's hard to tell whether this form should be discussed as a piece of case furniture or as a table. Clearly, they were in use as tables yet they relate to highboys, or high chests. They were not overly useful as storage pieces, nor were they intended to be used as work or entertaining tables. Their size was perfect for storing one's personal effects and giving just enough workspace for applying wigs and makeup. Constructed using the same methods as the highboys, dressing tables were usually smaller versions of the base of the matching high chest. Design and decoration usually followed that of the highboy.

Enduring Influence

With all these radical design and construction innovations, is it any wonder Americans were reluctant to give them up easily? If we look at the highboys and lowboys built by the Goddards and Townsends in Newport during the latter part of the 18th century, we see the same construction techniques are held over from the William & Mary period. These masterpieces of American furniture are constructed using the same techniques as their predecessors – dovetailed boxes atop legs. While the construction methodology changed in most of the country during the Queen Anne period to the now familiar mortise-and-tenon construction, in Newport they saw fit to continue the earlier method.

We see the gateleg table shift and change throughout the Queen Anne and Chippendale periods, becoming even lighter in appearance and incorporating the new design elements of the cabriole leg. Chairs also continued their change in construction and design, first by adding the cyma, or reversing curve, to the shape of the back then eventually adding the same shape to the seat.

Over time, the William & Mary penchant for pierced and carved crest rails would find its way into the pierced and carved splats of Chippendale-period chairs. The bun foot on chests would eventually be replaced with the bracket foot. But without that first bun foot, we might never have known the graceful curve of the ogee foot.

Throughout furniture history, styles and construction methods have built upon everything that came before. Chippendale built upon the foundation of Queen Anne by expanding the Chinese and French influences in design and construction. Hepplewhite and Shaker furniture shifted to a less ornate sensibility. Sheraton and the Neo-Classical furniture makers hearkened back to the Chippendale period with a nod to Egyptian, Roman and Greek architecture. Stickley and the Greenes took their cues from the pre-Queen Anne days.

So the next time you're wandering in an antique shop or your favorite museum, take a moment to look over that piece of William & Mary furniture. Even if you're not a fan, you might just begin to appreciate that the "Glorious Revolution" that began in 1688 had more influence on your favorite furniture style than you may have imagined. **PWM**

Charles is a period furniture maker and the lead instructor at The Acanthus Workshop. To learn more about his furniture and the school, visit acanthus.com.

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Sunken Treasure

BY KARI HULTMAN

How to buy mahogany that 18th-century furniture masterpieces (and dreams) are made of.

Remember when Honduran mahogany (*Swietenia macrophylla*) was the most fashionable wood used in fine furniture, had 40 to 60 growth rings per inch, and was readily available in 20"-wide boards?

If you were an 18th-century woodworker you would.

That was the norm back then, but things are different now. Honduran mahogany is protected (as is *Swietenia mahagoni* – known as West Indian or Cuban mahogany, the "original" mahogany) due to harvesting to near extinction by the 20th century. Wide boards are difficult to find, and 25 growth rings per inch is considered dense.

But thanks to a few frogmen and entrepreneurs, we can turn back the clock a couple hundred years and work with some of this legendary timber. To understand how this is possible, we have to start in 1638.

Bottom feeders. *Divers in Belize pull from the bottom of a river one of the thousands of logs that has been waiting to be harvested.*

Up from the bank. *Tractors pull the waterlogged logs up from the riverbank where workers await with eager chainsaws.*

Early Discovery

In that year, shipwrecked British sailors-turned-loggers (known as Baymen) began harvesting timbers in Belize and exporting lumber to Europe. By 1724, mahogany was being put to use by cabinetmakers in England, and by 1771 it became the primary source of income for the country of Belize. The rich, dark, reddish-brown, durable, rot-resistant, dense wood with superior workability so enamored 18th- and 19th-century fine furniture makers, that forests were significantly diminished in a matter of 200 years – this after surviving two millennia of Mayan inhabitants and yearly hurricanes.

Mahogany was first logged in northern Belize, where harvesting was limited to the nearby rivers and streams that served as the principal transportation routes. After 1800, oxen were imported to do the heavy transporting, and logging advanced farther south along the rivers, but not inland. Railroads, tractors, roads and heavy logging equipment in the early part of the 20th century made inland cutting possible.

Traditionally, trees were cut above the roots and logs were bucked – the process of sawing a felled tree into sections – by two men using 8' saws. Timbers were then loaded onto wagons or dragged to wharfs where they were stored along the shoreline until the rivers had swelled enough to float the logs. The felled logs were collected in "booms" (river bends where iron chains were drawn across the river), then released when a ship arrived for loading.

Lost Lumber

Historical records indicate that as much as 50 percent of the estimated 1.5 billion board feet of timber never reached its destination, having become waterlogged and sufficiently heavy to sink to the bottom of rivers. That's 750 million board feet! What a waste of a precious

"If you have to cut a tree down for it, it's worth doing your best."

— Guy Clark (1941-)
songwriter and country musician

PHOTOS BY ZEV BEN-YOSEF

commodity, never to be worked by furniture makers and luthiers.

But what if you could get your hands on some of that long-forgotten Honduran mahogany – the same wood that was used by 18th- and 19th-century cabinetmakers, the logs from primeval rain forests? What if your reproduction period furniture that you so painstakingly replicate in every detail, down to the joinery and hardware, could even more closely resemble the original? What if your musical instruments could emit the soft, warm tones that can come from old-growth hardwood? What if a company of divers, wood experts and businessmen was willing to retrieve the sunken treasure that was lost to loggers 100-200 years ago and make it available to you?

You're about to find out.

Greener Logs Limited set up operations in Belize in 2007 and has been salvaging exotic tropical hardwood from rivers, creeks and lakes in Belize and other parts of Central America ever since. Divers connect ropes to the logs that are then lifted and towed by boats back to the banks where a tractor or log skidder pulls the logs onto dry land.

Greener Lumber LLC (573-685-2301 or info@greenerlumber.com), established in July 2009 and located in central Missouri, is working with the recovery team of Greener Logs Ltd. to bring the wood to the United States for drying and distribution. The lumber is sliced from logs, then dried in vacuum kilns at River City Hardwoods in Muscatine, Iowa. Drying takes about 10 to 14 days to reach 8-percent moisture content with a few additional days to stabilize – no small feat considering the wood starts with a nearly 60-percent moisture reading.

From rivers to riches. *An estimated 750 million board feet of lumber is waiting at the bottom of rivers. Companies are now hauling it up and bringing it to market.*

At first the stock was cut into mostly 4/4 thickness, but some 6/6, 8/4 and 12/4 boards were available. That all changed once production was in full swing. As the supply increased, Greener Lumber began cutting all manner of thicknesses. Boards measuring 10' to 14' long and 10" to 20" wide are in stock, but wider boards are available with the importation of larger-diameter logs, some as large as 5½'. With 200 years worth of sunken logs, divers will uncover layers of subsequently more ancient timber that's older, denser and wider. Within the next two years, the company expects to find some of the legendary 80-100 growth rings per inch.

So what's the price of 200-year-old wood? Straight-grained lumber is $25 per board foot for 4/4 stock, and the price grows in increments of $2.50 per board foot with each ¼" of added thickness. Figured stock, such as fiddleback mahogany is available at $45 per board foot while a quantity of "plum pudding" material is available at $30 per board foot.

To ensure satisfied customers, Greener Logs Lumber photographs each piece and lists the pieces on its web site. Patrons are able

Cut down to size. *The long logs are cut down into lengths that can be easily transported out of the country for cutting and drying.*

Yeah, that's wide enough. *Need some 20"-wide boards? No problem. Suddenly, one-board tops look possible.*

to buy rough-sawn material in lengths that equal widths. For example, if a board were 20" in width, the minimum purchase would be 20" of length or 2.8 board feet. Of course, longer lengths are OK, too. And credit cards are accepted.

Not Just Mahogany

Other species are being discovered along with Honduran mahogany. Bullet tree is a wood that is virtually unknown in the United States and has stunning figure and color, along with exceptional hardness and strength. It makes great turning projects and dent-resistant tabletops. Sapodilla, another salvaged wood, has wonderful interlocked grain, and is the color of dark chocolate with reddish ribbons running through it. Another species, Santa Maria, is a dense and straight-grained wood, the color of dark pecan.

Caches of cocobolo and Honduran rosewood have also been discovered. "You just never know what you're going to get when you start bringing logs to the surface," says Rich Petty, the owner of Greener Lumber. And like opening a real treasure chest, once the logs are sawn, some jaw-dropping figure is revealed such as fiddleback mahogany, which is gold to woodworkers.

As if finding this ancient and exotic lumber isn't enough good fortune, there are also environmental benefits. Salvaging logs is a viable alternative to cutting young timber. Once the supply of recoverable wood has been exhausted – while present forests have been able to catch up in size and density to their majestic ancestors – effective management for sustainable forestry in the tropical regions of Central America can be developed. The trees can be harvested systematically so that a source for wide, dense mahogany will be available for future generations of woodworkers.

Flaming red. *The deep red color of this mahogany is unlike the modern stuff. How does it finish? Beautifully. Hint: You'll find out in our next issue.*

Working With Old-growth Lumber

So, how does this recently discovered treasure compare to new-growth mahogany? Senior Editor Glen D. Huey and Editor Christopher Schwarz spent some time in the shop working with it – Glen with power tools and Chris with hand tools.

"From a power-tool perspective, this material handles like most other good-quality mahogany lumber when it comes to milling and material preparation," Huey says. But he did notice a pungent odor arose as the material passed through the saw and sander. According to Huey, the smell is similar to a marsh at low tide or a freshly plowed pasture.

When he applied aniline dye, boiled linseed oil and shellac, however, he found a few differences.

As Glen wiped the workpiece with a wet cloth to raise the grain, he noticed the #180-grit sanding dust was a bit redder than what he was used to. It was almost bloody in appearance. The biggest difference was that the grain

Other good woods. *Take a look at this recently slabbed sapodilla log. Other exotic species are mixed in with the mahogany.*

Squared and ready. *Even with the rough surface left by the chainsaws, these mahogany logs inspire a hearty lust.*

was raised only the tiniest bit, even though the piece was highly figured.

As the dye was added, there was minimal soaking in, but the dye colored the piece just as it should.

Next up was the linseed oil. This was amazing. After five minutes, there were no dry spots. Normally, you'll see spots where the oil soaks in and you have to spread the oil a couple times to keep everything wet. The oil sat on top of the wood like a bar-top finish.

This lumber has such tight growth rings that the wood is nowhere near as porous as the woods we usually work today. It is possible to reduce the number of topcoats used in a normal finish schedule. What does that mean to most woodworkers? Probably not much, except for an easier, smoother finish with less sanding and rubbing.

Hand Tool Workability

According to Schwarz, the old mahogany is incredibly dense, but it cuts relatively easily with hand tools. "The problem came when I was trying to get a good finished surface on the curly stuff. You can really see why 18th-century craftsmen developed high-angle planes. One really wild board I worked just laughed at my efforts to plane it with a 45°-pitch tool. Only when I got above a 60° effective pitch did I start to get a surface that I like. And even then, there was still some tearing."

Aside from giving new-growth mahogany a chance to mature and having access to wider boards, is there a good reason why woodworkers should buy the old-growth mahogany over the new stuff?

"It looks like nothing else I've worked," Schwarz says. "The grain is intense and complex. Modern mahogany looks like a stringy, misshapen weed compared to this stuff. I'm not a wood hoarder at all. My lumber racks are always bare. But this stuff inflames my latent lignum lust."

So there you have it: the same lumber our forefathers used, environmental benefits, supply for future woodworkers, smoother finish and exotic lumber-lust ignited. What more could you ask for from a treasure trove like this? PWM

Kari is a woodworker, graphic designer and runs the blog The Village Carpenter at villagecarpenter.blogspot.com.

Dang that's dense. *After 30 minutes covered with oil, very little soaked into the mahogany. And the next morning? Nope. This stuff is dense.*

Off to you. *With the logs cut into manageable chunks, they are loaded into containers to head off to the mills and kilns north.*

Coming in June: Killer Wood

Of course, the first question running through your head should be: "Sounds cool. But how does the wood look?"

You can find out in the next issue. Senior Editor Glen D. Huey is building an 18th-century Philadelphia lowboy using some of the wood from Greener Lumber. The lowboy features trifid feet, an unusual corner detail on the top and drawer slips in the interior. The wood he picked out for the top and drawer fronts is highly figured.

"It's what we call 'screaming' mahogany," Glen says. "It's a technical term."

If you don't want to wait until June to own this lowboy, which is 29" high, 19" deep and 33" wide, you can pick up the original at H.L. Chalfant Antiques in West Chester, Pa. Price: $40,000.

— Christopher Schwarz

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BY BOB FLEXNER

An Array of Lacquers

Many finishes are known by this one name.

Color. *When poured into glass jars, it's easy to see the different colors of lacquers. On the left is nitrocellulose, which is made with fairly orange modifying resins. In the middle is water-white lacquer, which is made with fairly colorless modifying resins. The color that exists is supplied mostly by the nitrocellulose. On the right is CAB-acrylic lacquer, which is totally colorless.*

In common speech and among those in the professional finishing trade, the term "lacquer" usually refers to nitrocellulose lacquer. But there are many other finishes that go by that name.

When referring to one of these, it's best to use a modifying word, or words, to distinguish it from nitrocellulose.

These other lacquers include water-white lacquer, urethane-modified lacquer, vinyl lacquer, brushing lacquer, CAB-acrylic lacquer, crackle lacquer, pre-catalyzed lacquer, post-catalyzed lacquer, padding lacquer, water-based (or waterborne) lacquer and Oriental (Japan or Chinese) lacquer.

Here's an explanation of these lacquers, all of which, except padding and Oriental lacquer, are available in various sheens ranging from gloss to flat.

Nitrocellulose Lacquer

Nitrocellulose is the first modern lacquer. It was used as a plastic as early as the late 19th century (for example: movie film and brush handles). After World War I it came into wide use as a finish.

The impetus was the growth of the automobile industry and the large stocks of gunpowder (cellulose nitrate) left over from the war.

The automobile industry had been using varnish, which dries very slowly, to finish cars. The introduction of fast-drying, pigmented nitrocellulose lacquer removed the bottleneck at the finishing stage of production.

By 1930 most furniture manufacturers had shifted to lacquer from shellac.

Nitrocellulose lacquer is made with cellulose nitrate and a modifying resin (usually alkyd or maleic) that improves build, flexibility and adhesion. An oil-like plasticizer (modified castor oil was used originally) is added for further flexibility.

The raw ingredients are dissolved in lacquer thinner, which is unique among finish solvents because it is composed of half-a-dozen or more individual solvents that evaporate at different rates. The manufacturer controls the drying speed of the lacquer by its choice of solvents.

Spraying. *Because lacquer thinner is made up of individual solvents that evaporate at different rates, it's possible to spray heavy coats of any finish thinned with lacquer thinner onto a vertical surface with no chance of runs or sags. This is one reason finishers love spraying lacquer.*

The most unique characteristic provided by lacquer thinner is resistance to runs and sags on vertical surfaces. The individual solvents are chosen to evaporate quickly one after another immediately after the lacquer is propelled from the spray gun – so that by the time the finish settles on the surface it is already beginning to thicken.

No other finish solvent or thinner provides this characteristic.

Closely Related Lacquers

Water-white, urethane-modified, vinyl and brushing lacquers are all made with cellulose nitrate and are closely related to nitrocellulose lacquer.

Water-white lacquer is made with a lighter-colored modifying resin, usually more expensive coconut alkyd or acrylic. So this lacquer yellows less and costs more.

Urethane-modified lacquer uses urethane alkyd to add a little more heat, scratch and alcohol resistance. This lacquer isn't widely available or used.

Vinyl lacquer is made with a modifying vinyl resin to improve adhesion and water resistance. This finish doesn't harden as well as other lacquers, but it performs well under

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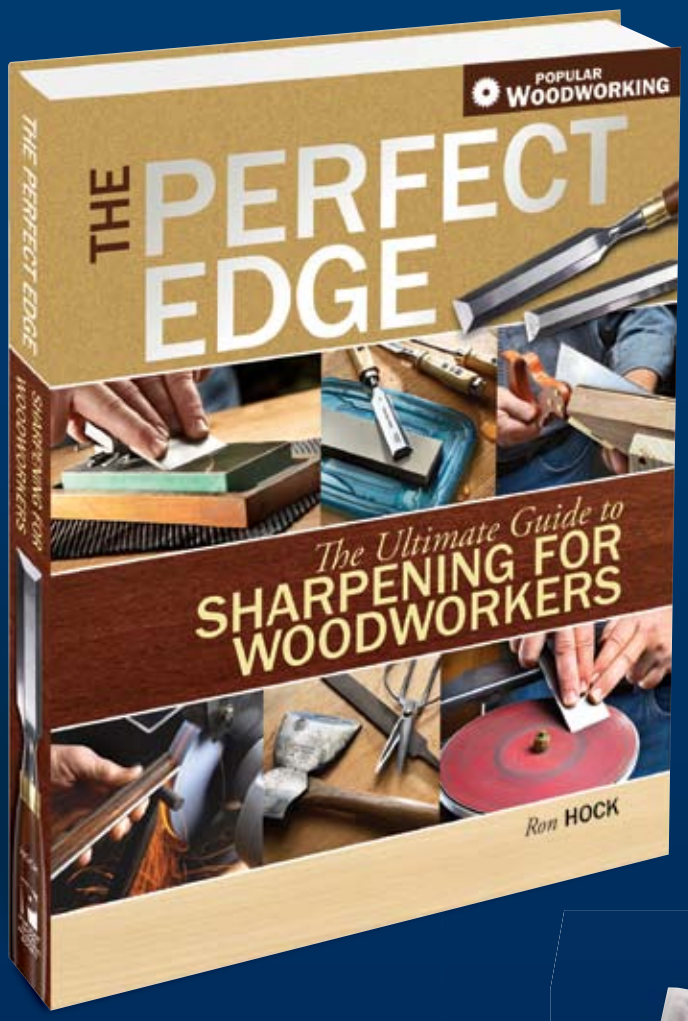
PHOTOS BY THE AUTHOR

GET SHARP AND STAY SHARP!



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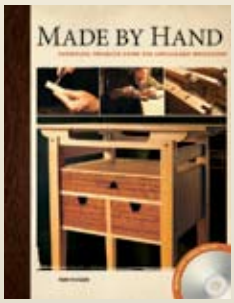

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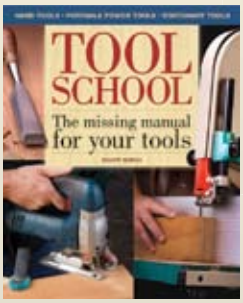

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catalyzed finishes, so it is usually sold as "vinyl sealer."

Brushing lacquer is nitrocellulose lacquer made with slower evaporating lacquer-thinner solvents. The finish dries slowly enough to be brushed, but the non-sagging characteristic common with spray lacquers is lost.

CAB-acrylic Lacquer

Cellulose/acetate/butryrate and acrylic resins dissolve in lacquer thinner and are considerably more expensive than cellulose nitrate. But they are non-yellowing, so they are used to make a totally colorless lacquer.

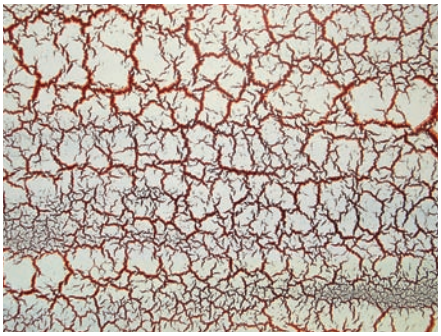
The usual reason for choosing CAB-acrylic is to finish light-colored woods such as maple, or to finish over white pickling stain.

Crackle Lacquer

Crackle lacquer is nitrocellulose lacquer made with more pigment than there is finish to bind all the pigment particles together. As the finish dries and shrinks, it cracks and separates, revealing the layer below.

To create this finish, apply a coat of colored nitrocellulose lacquer and follow with a different-colored crackle lacquer. You can control the size of the cracks and the "islands" in between by varying the amount of thinner, and the speed and spray distance of the gun, as well as the amount of finish that's sprayed on the piece –but no more than one coat.

Because the crackle layer is crumbly, you should always apply a clear coat on top.



Crackle. *Crackle lacquer contains more pigment than the lacquer can bind together. So when the finish dries and shrinks, it cracks and separates to reveal the layer below. You can create very interesting and attractive effects by varying the amount of thinner, the speed you move the spray gun and the distance you hold the gun from the surface.*

Brushing. *By dissolving lacquer finish in slower evaporating lacquer-thinner solvents, manufacturers make a lacquer that dries slowly enough to be brushed. But the slow drying cancels out the benefit of reduced runs and sags on vertical surfaces. So on these you need to stretch the finish out with your brush so the build isn't too thick.*

Pre- and Post-catalyzed Lacquers

Catalyzed lacquer is made with only a small percentage of cellulose nitrate. The bulk of the finish is another resin entirely – melamine or urea formaldehyde. These resins are combined with alkyd resin to cure very hard and scratch-resistant when an acid catalyst is added.

The cellulose nitrate is added to make the finish more user-friendly. Without it, the product is called conversion or catalyzed varnish.

The defining difference between pre- and post-catalyzed lacquer is that the manufacturer adds the catalyst to the pre-; you add it to the post-. Pre-catalyzed lacquer is therefore more user friendly, but it often cures more slowly and has a shelf life of six months to a year or two.

Padding Lacquer

Padding lacquer is not lacquer at all but shellac thinned in solvents that dissolve lacquer. The name causes a lot of confusion.

When furniture manufacturers shifted from shellac to lacquer in the 1920s, they found that touching up nicks and rubs using shellac and the French polishing method wasn't as successful as it had been when shellac was the finish. Shellac dissolved in alcohol doesn't bite as well into a lacquer finish.

So manufacturers added some lacquer solvents to shellac and changed the name to padding lacquer to distinguish the product.

Water-based Lacquer

Water-based finish is entirely different from any of the lacquers discussed above. It's related more closely to latex paint and white and yellow glue. Unfortunately, some manufacturers insist on calling their water-based finishes lacquer (or varnish or polyurethane), which creates confusion among consumers.

A water-based finish is an emulsion of acrylic and sometimes acrylic/polyurethane resin. The finish dries initially by water evaporation and then forms a hard film when the droplets of emulsified resin stick together as the very slow solvent evaporates.

Besides the water raising the grain of the wood and slowing the drying, the most important difference between water-based finishes and true lacquers is in application. Water-based finishes don't contain lacquer thinner so they run and sag easily on vertical surfaces.

Oriental Lacquer

The original lacquer is a natural resin harvested from trees in east Asia, primarily Japan and China. So this lacquer is commonly called Japan or Chinese lacquer. It is totally unrelated to any of the lacquers discussed above.

When exposed to very high humidity, Oriental lacquer crosslinks to form a hard, durable film. The natural reddish color is often enhanced with pigments.

Oriental lacquer has been used since before recorded history. Beginning in the 15th century, furniture and other objects with this highly decorative finish were imported to Europe, and European craftsmen tried with varying degrees of success to imitate it with the resins they had available. Their efforts are often called "japanning." **PWM**

Bob is author of "Understanding Wood Finishing" and contributing editor to Popular Woodworking Magazine.

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GLOSSARY

Woodworking's lexicon can be overwhelming for beginners. The following is a list of terms used in this issue that may be unfamiliar to you.

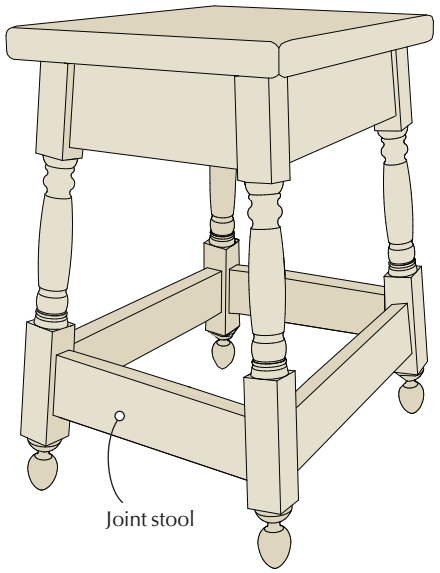
bun foot (n)
Instead of a plinth or bracket base, some casework sits on roundish blocks of wood that can be in a variety of shapes, from acorns to squashed spheres.

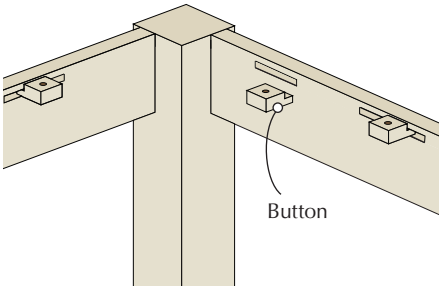
button (n)
An L-shaped bit of wood that fastens a tabletop to its base. The tongue of the button fits into a mortise or groove in the table's apron. The remainder of the button is screwed to the underside of the tabletop. Buttons are positioned to keep the tabletop secure but allow for seasonal swells.

crest rail (n)
The topmost rail of a chair.

cyma (n)
An "S"-shaped curve used as a moulding profile, sometimes also called an "ogee." When the shape looks like a proper capital "S" (in profile), it's a cyma curve. Turn the "S" upside down and it's a "cyma reversa" or "reverse ogee."

escutcheon (n)
A small metal plate or band of furniture hardware that can define or surround a hole. Typical examples define a keyhole or surround a door knob.





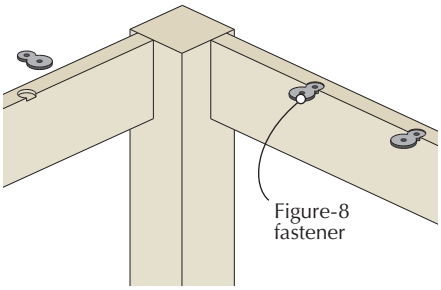


figure-8 fastener (n)
A small piece of 8-shaped metallic hardware used for attaching tabletops to their aprons. One of the holes through the 8 is screwed to the underside of the tabletop. The other hole through the 8 sits in a notch in the apron (or leg) and is screwed to the table's base. Like buttons, these fasteners allow for seasonal wood movement.

frame-and-panel construction (n)
A way of controlling wood movement by surrounding a wide panel of solid wood by a joined framework of vertical pieces (called stiles) and horizontal ones (called rails). The panels float in grooves in the framework without glue.

gateleg table (n)
A table with a pivoting leg to support a hinged top leaf that, when not in use, can hang vertically to reduce the table's footprint.

joint stool (n)
Ubiquitous in Renaissance households, this four-legged stool is characterized by turned legs that are often splayed for stability and connected by stretchers. The name reflects the form's makers – joint stools were made by joiners rather than turners, who were precluded by guild rules from making mortise-and-tenon joints.

moulding plane (n)
A type of handplane – typically with a wooden body – used to make decorative mouldings. Typical examples include hollows and rounds, which create convex and concave segments of a circle; and complex moulders, which cut one profile only, such as an ogee.

planemaker's float (n)
A cutting tool that consists of a flat piece of steel that has triangular teeth cut into one face or edge. These teeth work much like a saw or rasp and are used for truing surfaces when making planes. They are also used in joinery, typically for cleaning out mortises.

snipes bills (n)
A pair of wooden planes that works with the moulding planes to produce shapes. The snipes bills can sink a small depression in the work (using only a gauge line for guidance) that then clears a path for other moulding planes to follow.

"Words are only postage stamps delivering the object for you to unwrap."

— George Bernard Shaw (1856 - 1950)
Irish playwright, 1925 Nobel Prize for Literature

wood acclimation (n)
Wood readily exchanges moisture with water vapor in the surrounding atmosphere. In high relative humidity, wood will swell; in low relative humidity, it will shrink. To avoid problems, relative humidity of 25-55 percent is recommended. Allow stock to acclimate to your shop before using it, but bear in mind that your shop environment may not match the environment for which the piece is destined. **PWM**

Go Online FOR MORE ...

For access to our online Glossary:
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More on joint stools:
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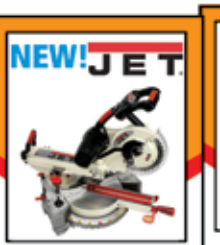

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BY ROY UNDERHILL

'Put Yer Ass Into It'

A boring task turns into a history lesson.

One day in Williamsburg, a message reached me at the carpenter's yard that the cabinet shop was shorthanded and needed help. I figured it was some high-end task like dovetailing a chest or shaving cabriole legs, so I dropped my adze and headed to the cabinet shop across the creek.

I eased into the visitor-crowded shop and waited for a couple of Japanese honeymooners to get their photograph. Along the wall, I spied the work ahead – a great stack of heavy walnut spindle blanks, waiting by the lathe.

Well, I'm a pretty good turner, so I happily worked my way through the visitors toward the rack of polished gouges. Then I noticed that David, one of the shop's journeymen, was already at the lathe, nodding toward the great wheel that drove it.

Oh, fair enough, I thought. I stepped over the rope, set my hands on the drive handle of the 6'-diameter wheel and began to crank. Slowly I worked it up to speed. The first 10 minutes were fine. I watched the leather drive belt pour from the top of the wheel over my head, run along the wall to the headstock pulley, and then rush back toward my feet. I counted the spindles in the stack. I watched the faint drift of brown shavings feathering to the floor.

I was craning my neck to see if there was any water in a mug on the windowsill when I felt a rap on my shoulder. I turned around to see a visitor ducking under the rope barrier. This was easy for him, because he was a little guy, old as my dad, but moving fast. I tried to form the words explaining that the ropes were for his protection, but I got only as far as taking in air before he pushed me away and grabbed the crank of the great wheel.

"Outta the way, kid," he said in some New York accent. "Here's d'way ya do it!"

I reached to direct him back across the rope into visitor world, but the room was transforming. I pulled back. Gone was the clattering roll of the wheel and the lazy cut of the turning. The great wheel was flying, and the floor was humming at a high-energy harmonic. David struggled to hang on to the gouge as a ribbon of sheared walnut hosed over his shoulder.

"Dat's how ya do it kid; ya gotta put yer ass into it!" he shouted.

I knew this couldn't last, but he kept it up, grinning and shaking his head, never flagging. He was still grinning as I reached out to him again. He grabbed me first and now had me turning the wheel as he ducked back under the rope. He stood there grinning.

"Dat's it! Just put yer ass into it!"

I had no idea what he meant, but I then felt the belt slacken as David parted off the finished walnut spindle. I let the wheel slow.

"Never thought I'd do that again!" the guy said.

"What …?" was all I got out.

"I was in the ball turret of a B-17 durin' the war. Two-six-two got us and next thing I know I'm in a parachute. I wake up with some Austrian farmer pokin' me with his pitchfork. Marches me to his farm and puts me to work. For six months, 'til the end of the war, I'm turning this wheel for this farmer." He rapped my shoulder hard in the way only old guys know. "The one thing I learned was, ya gotta put yer ass into it."

As he faded back into the shuffling stream, I tried to re-establish boundaries by cranking up my historical interpretation. "The great wheel you see here …" Across the room I saw his head poke around to listen. I stopped short. Here's this guy – one minute he's flying along, next minute a jet shoots him down, next minute he's cranking a great wheel on some Alpine farm in a scene out of the Middle Ages …

And I'm trying to teach him history. PWM

Roy is the host of the PBS show "The Woodwright's Shop," and author of many books, including "The Woodwright's Guide: Working Wood with Edge & Wedge" (UNC Press) from which this story is excerpted.

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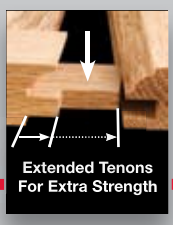

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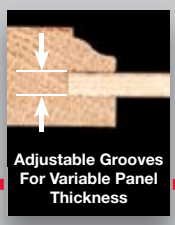

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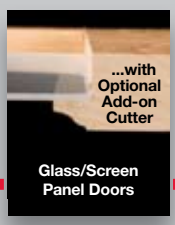

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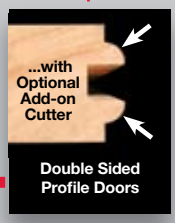

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