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FEBRUARY 2010 #181

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Turn Custom
Tool Handles

Toolbox that
Travels

5 Tricks to
See Better
In the Shop

Check out
George Walker's
New Design Column
on page 20





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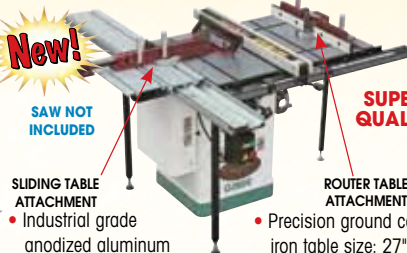
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Product Reviews & Awards ONLINE grizzly.com

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- Feed rate: 16 & 30 FPM
- Cutterhead dia.: 3"
- Number of knives: 3
- Knife size: 15" x 1" x 1/8"
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- Static pressure: 11"
- Bag capacity: 5.7 cu. ft.
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- Approx. shipping weight: 126 lbs.

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— FEBRUARY 2010 —

FEATURES



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30 Stickley Music Cabinet

The overall form of this small cabinet is appealing, but much of its charm is found in the joinery details.

BY ROBERT W. LANG

38 988 Chair

Provocative “upholstery” explores the tension between comfort and seeming discomfort in this unique showpiece of a chair.

BY JEFF MILLER

40 Turned Tool Handles

Take a turn on the lathe as you custom-fit your own tool handles.

BY KEVIN DRAKE

44 Milk Paint

This traditional paint looks great on any project, plus it's safe and easy to use.

BY MICHAEL DUNBAR

49 Cam Marking Gauge

This clever marking gauge (a reproduction of a late-19th-century tool) can be made in just a few hours, with stock from your scrap bin.

BY JIM CRAMMOND

52 Shoji Cabinet

Inspired by a Japanese shoji screen, this cabinet combines traditional and modern joinery and materials for a contemporary flair.

BY RYAN SHERVILL

58 One for The Road

Made entirely by hand, this cabinetmaker's toolbox holds all the hand tools you need on a jobsite. Plus, it looks great.

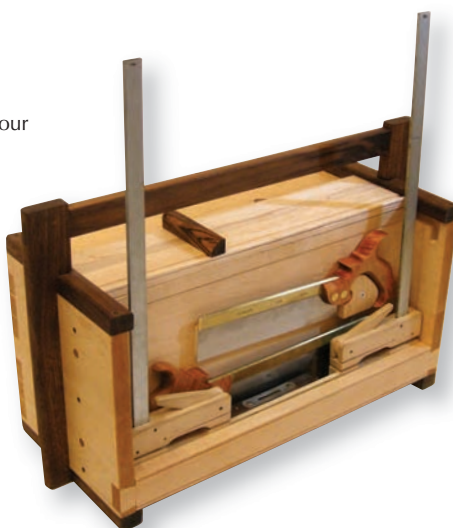
BY TOM FIDGEN

63 Better Vision In the Shop

Proper lighting and vision aids can make a world of difference in your woodworking.

BY ROB PORCARO

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BY CHRISTOPHER SCHWARZ

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BY CHRISTOPHER SCHWARZ

ON THE FEBRUARY COVER

In this issue, we debut "Design Matters," a column by George R. Walker that will give you the tools to tackle furniture design with skill and confidence. Page 20.

COVER PHOTO BY AL PARRISH



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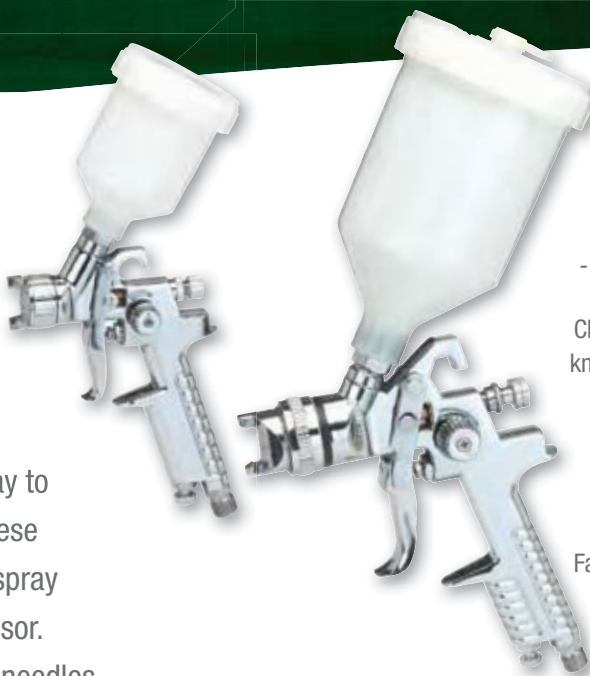
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Mini Pro 150cc Stainless Steel Cup 149393

Mini Pro 1.5mm Needle Kit 149395



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Charles Neil shares some of his knowledge about finishing spray guns using the economical WoodRiver® brand.

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Video



Blogs



Plans

Video Gallery

Delta Unisaw

Publisher Steve Shanesy came across an antique Delta Unisaw at a recent auction, and decided to bring it back to life. Watch along in a series of videos as he restores the 1944 Delta flagship table saw from start to finish (along with all the belts and bearings in between).

popularwoodworking.com/video

On the Blogs

I Can Do That Extras

On the top of the tapered-leg table (page 26 in this issue), Senior Editor Glen D. Huey painted a trompe l'oeil "inlay." On the blog, he provides step-by-step instruction to create this convincing illusion.

popularwoodworking.com/feb10

Project Plans

Stickley Music Cabinet

You can download a free SketchUp drawing of the Stickley Music Cabinet (page 30 in this issue), by visiting our February 2010 extras page. Once you have the plan on your desktop, you can take it apart to look at how the individual components are made (and how they go together) – or make design changes to suit your own sensibilities.

popularwoodworking.com/feb10

Try Square

Want to build the Roubo Try Square (page 20 in this issue) but prefer to work from full-size plans? You'll find links to purchase those plans on the February 2010 extras page.

popularwoodworking.com/feb10

New This Month

Design Matters

To supplement his new column (page 20 in this issue), George R. Walker is writing three times a week on his Design Matters blog, where he takes you along on his design journey and travels down a few rabbit holes along the way. Plus, he'll introduce you to a lot of creative artisans, both past and present.

<http://georgewalkerdesign.wordpress.com>

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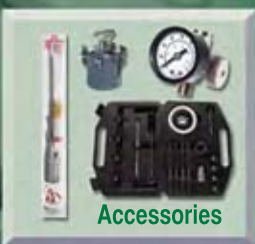
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Tom Fidgen is a hand-tools only craftsman who builds custom furniture; he's also an accomplished musician. He, his wife and two children recently moved to Toronto, Ontario, from Cape Breton Island in Nova Scotia (where they still spend their summers). Tom started his woodworking journey almost 15 years ago as a set designer and builder in television and soon began to build boats in a one-man shop; he then took up custom furniture work.

In this issue, we've excerpted "A Cabinetmaker's Tool Chest" from his new book, "Made by Hand: Furniture Projects from the Unplugged Workshop" (Popular Woodworking Books) (page 58).



Jeff Miller trained originally as a classical musician and his first foray into woodworking was making musical instruments. But his empty apartment needed furniture, and Jeff quickly found designing and making furniture to be far more satisfying than his attempts to build Renaissance cornettos, recorders and flutes.

He's been crafting award-winning furniture in his Chicago studio for 26 years now, and has participated in numerous juried shows in galleries and museums across the country. Although he makes a wide variety of furniture, his greatest interest is in designing and building chairs, and he has developed more than 30 different chair designs over the years. He writes about one of them, the "988 Chair," in this issue (page 38).



Jim Crammond is a civil engineer involved in railroad track construction and maintenance. His avocation is learning about and practicing hand-tool woodworking and Windsor chairmaking. He prefers to work in period styles, especially Federal and Queen Anne, but much of his recent output has been dictated by the domestic needs of his 20-something daughter. He is an active member of the Society of American Period Furniture Makers and the Mid-West Tool Collectors Association.

In this issue, Jim writes about building a vintage-style cam-lock marking gauge (page 49).



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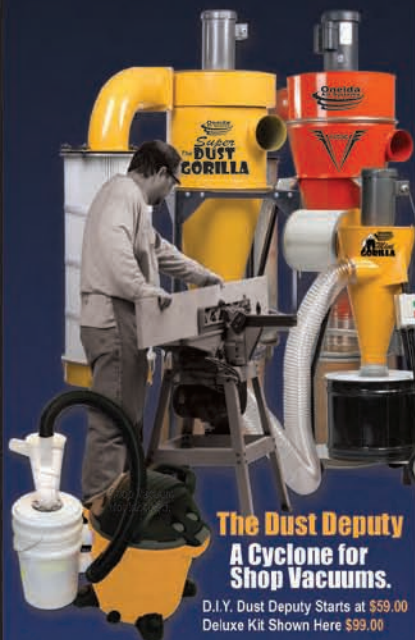
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There's a story—likely apocryphal—that the Gillette Razor Co. cryogenically treats the tooling it uses to manufacture razor blades so that the tooling lasts longer before it needs to be replaced.

The story goes that Gillette, however, doesn't use cryogenics on the actual razor blades it sells to its customers. Why? The razors would last too long and hurt the company's sales.

The same might be said about a woodworking magazine that teaches its readers how to design well-proportioned furniture.

After all, if you can design it yourself, what need will you have for the plans in this or any other woodworking magazine?

Let's find out together.

Starting this issue, *Popular Woodworking* is launching a new column on furniture design called "Design Matters." Written by George R. Walker, this column seeks to yank away the veil that shrouds this supposed black art of the trade.

This, I might add, is nothing new for us. This is what Bob Flexner does with finishing in every issue. It's what Adam Cherubini does with hand tools. And it's what the entire staff does with our "Jig Journal" column. (We don't think you have to spend your life building complex shop jigs just to build some furniture.)

All of the members of our staff are thrilled about bringing Walker into our pages. If you don't know Walker, he's the host of the game-changing DVD titled "Unlocking the Secrets of Traditional Design" (available from Lie-Nielsen Tool-

works). Walker's message, which is supported by historical research and practical experience, is that well-designed furniture is based on simple whole-number proportions, simple shapes and devices (such as punctuation) that anyone can learn.

Why hasn't anyone written about these topics before? Well, they have; we woodworkers just haven't been paying

close enough attention. All of the principles that Walker discusses are basically taken from the field of architecture. It turns out that good buildings and good furniture

share many of the same traits.

What's also important to know is that these ideas transcend the typical categories we put our furniture into—Arts & Crafts, Shaker, contemporary, rococo. In fact, though Walker personally enjoys building furniture from the 18th century, the principles he discusses in "Design Matters" can be applied to any furniture style.

If you like this column and want to get ahead of the class on the topic of design, I recommend you visit Walker's blog at georgewalkerdesign.com.

And one more thing: If you do eventually outgrow woodworking magazines with our help, then I consider that a job well done on our part. However, I do have one favor to ask: Be sure to tell the next beginning woodworker you meet how you got there. **PW**



Christopher Schwarz

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What's the Proper Height For a Hand-tool Bench?

On the blog, Christopher Schwarz stated that he has grown fond of Megan Fitzpatrick's 30" LVL workbench (November 2009, #179).

I just purchased a workbench that has an adjustable height, starting at 33". I am about 5'2" and certainly find this bench substantially better than any other bench I have worked on. However, the leveling feet could probably be removed to lower the bench more. So, how tall is Megan, and how does this translate to the height of her workbench? Short people tend to get ignored in many product designs.

Mitch Wilson,
Syracuse, New York



The general rule for measuring the ideal bench height for hand-tool use is to stand upright alongside the bench, with your arms hanging straight down. The top of the bench should be about level with the knuckle joint of your pinky finger. That height is a good compromise between using the bench for planing and using the bench for sawing dovetails and the like.

I'm just shy of 5'6", and technically, my 30" benchtop is too low for Chris, who is just shy of 6'4". But a lower bench is good for using handplanes because it allows you to get directly over the work. So, Chris has grown fond of my "short" bench for when he's handplaning. For cutting dovetails, he heads back over to his 34"-high bench.

— Megan Fitzpatrick, managing editor

Using Polyurethane Over Lacquer

I am a house painter and one of my customers wants me to repair the finish on some six-panel pine interior doors, which were stained and spray-lacquered in semigloss. I plan on touching up the nicks and scratches in the stain, but I don't feel comfortable brushing lacquer on such a large surface.

I was wondering if I could scuff sand the finish, clean it and brush a satin polyurethane on the doors.

I've had quite a bit of experience in finishing projects with polyurethane (bookcases, cabinets, etc.), so I know what I'm doing there. But I wasn't sure about the compatibility of poly over 14-year-old lacquer, which is about the age of the cured finish.

Rick Gayle
Florence, Kentucky

Bob Flexner always states that any finish can be layered over another finish that is fully cured. I trust that 14-year-old lacquer is fully cured. I would, however, test a small area, but I think you'll find that the polyurethane will hold to the lacquer so long as the old surface is clean and dulled – meaning scuffed to allow the new finish to grab.

— Glen D. Huey, senior editor

Finding an Angle

I thought Hunter Lang's knockdown desk (November 2009, #179) was a clever design and the article generally explained things well. I am, however, confused about one thing. And to my surprise, even experienced woodworkers I asked didn't seem to know the answer.

Is there a simple means to determine at what angle to set your table saw to create the appropriate bevels in the trim pieces for the bottom shelf? And perhaps an even more foolish question: This is not a compound angle, correct?

Ronald Becker
via e-mail

There are no compound angles. As we drew it, the mitered corner will be 30°. But here's an easy way to figure that out by drawing directly on the plywood shelf.

Lay a piece of the trim even with the front edge, and draw a pencil line along the back edge, giving you a line that is in from the edge by the thickness of the trim pieces. Make these lines all the way around the cutout in the shelf. Then connect the lines across the intersections from

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the front lines to the back lines. This will give you both the correct angle and the correct length of these pieces.

— Robert W. Lang, senior editor

What Kind of Wood and Finish?

I have two questions about projects from Glen D. Huey's book "Illustrated Guide to Building Period Furniture" (Popular Woodworking Books):

1) What was the primary wood for the Massachusetts high chest and the Pennsylvania chest on chest? The grain is incredible.

2) Glen mentions using a glaze in the finishing process. What color was the glaze and who makes it? It looks terrific.

Chris Kirk
Gainesville, Georgia

"Illustrated Guide to Building Period Furniture" is out of print, but those two projects, along with

18th-century projects from my other books, have been compiled in "Building 18th-Century American Furniture" (Popular Woodworking Books).

The Massachusetts high chest is striped mahogany and the Pennsylvania chest on chest is curly (or flame) birch. Both woods are available from Irion lumber (irionlumber.com). I should mention that finding curly birch wide enough for the lower drawers is not easy. That wood generally is found in widths of 5"-7".

As for glaze, I use two primary colors—Van Dyke Brown when I want to darken woods (for the most part, cherry and mahogany), and Burnt Umber for most of my maple and birch projects. I like the heavy-bodied glaze from Mohawk. You can find a distributor through the company's web site (mohawk-finishing.com).

— Glen D. Huey, senior editor

Rainbow Fish

Great magazine—I buy it all the time and do many of the projects at home for fun. I wanted to share with you a project I recently finished from the October 2009 issue (#178)—The "I Can Do That" Fish Sticks project.

Marvin Neff
Bastrop, Texas



Editor's Note: We love seeing pictures of magazine projects that you've completed—and we're especially gratified by the ongoing response to "I Can Do That." Please keep the pictures coming!

— Megan Fitzpatrick, managing editor

Countertop Slab Glue-up

I'm thinking about making a workbench, and I'm wondering about the feasibility of using pre-fabricated, butcher-block countertop. The cost is comparable (I'd buy two 1½" tops and glue them together for a total thickness of 3"), and the time savings would be huge. The downside would be the difficulty of gluing those panels together. I'd like to hear your thoughts.

Jonathan P. Szczepanski
via e-mail

Your plan is definitely feasible—and the countertops are easy to glue together face-to-face. Just screw them together from the underside. Screws make great clamps. Then remove the screws when the glue is dry.

I've done this many times when making plywood benches.

— Christopher Schwarz, editor

Fish Sticks Finish

I'm making the fish trivet (October 2009, #178) and am wondering what you finish them with. Is there a heat-resistant finish you recommend? My local hardware store had no recommendations.

Jerry Bell
via e-mail

We used no finish at all, because there is no finish that really stands up to high heat. The general rule is, if you can't hold a pot in your hands, don't put it on finished wood. But with no finish, it's not a problem to put hot dishes on the trivet. And if the surface gets a little charred, you can easily plane off any unsightly bits—or just call it blackened.

— Megan Fitzpatrick, managing editor

Metal Tool Maintenance in a Humid Climate

What do you use to wipe down your tools (planes, chisels, etc.). I live in humid Hawaii and have already tried camellia oil, but do not like it very much. It seemed to become too sticky if allowed to remain on the surface for several weeks.

Earl Koanui
Honolulu, Hawaii

When it comes to woodworking in tropical areas, rust is a tough thing to beat. Some readers in Florida will typically take all their portable tools (hand and power) in their air-conditioned house when they aren't in the shop. They report that approach works.

As far as a chemical to use, you might also try Boeshield T9 and Fluid Film. I have used both products and have found they do a good job—as long as you wipe down your tools after every use.

Other readers have reported success with desiccants, such as Bullfrog. I don't have experience with this product, but others who have like it for enclosed spaces, such as toolboxes. Also along those lines is a new product from WD-40, Rust-Shield.

In the end, it might be a combination of these approaches that works. **PW**

— Christopher Schwarz, editor

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Popular Woodworking welcomes comments from readers about the magazine or woodworking in general, as well as questions on all areas of woodworking. We are more than happy to share our woodworking experience with you by answering your questions or adding some clarity to whatever aspect of the craft you are unsure about, and if you have a complaint, we want to address it whenever possible.

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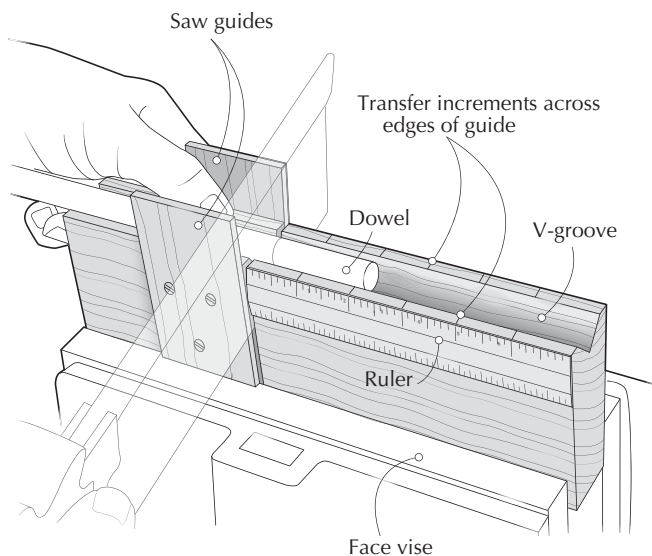
Dowel-cutting Cradle

I find cutting dowels on the band saw to be a hassle. For one thing, the blade can grab the round stock and twist it out of your hand if you're not using a support cradle guided by the miter gauge. And if you're cutting several dowels to the same length, you have to set up a stop of some sort. Even then, the cut dowels tend to fly to the floor afterward.

Instead, I use this simple fixture for most of my dowel-cutting chores. It's nothing more than a 10"-long pine 2x4 with a V-groove sawn into one edge. I attached a plastic 6" ruler to the right side's front face with double-sided tape and extended the inch marks across the flats on the top face. I cut a saw kerf at the zero end of the ruler, a bit deeper than the depth of the groove and screwed two 1/4"-thick plywood vertical guides on the left side of the saw kerf.

To use the jig, clamp it in a face vise, then feed the dowel stock from left to right. Line up the end of the dowel with the desired length on the ruler, and cut it off with a small backsaw. If I have a large number of dowels to cut, I put a bucket on the floor to catch them as they fall off the end of the jig.

— Craig Bentzley, Chalfont, Pennsylvania



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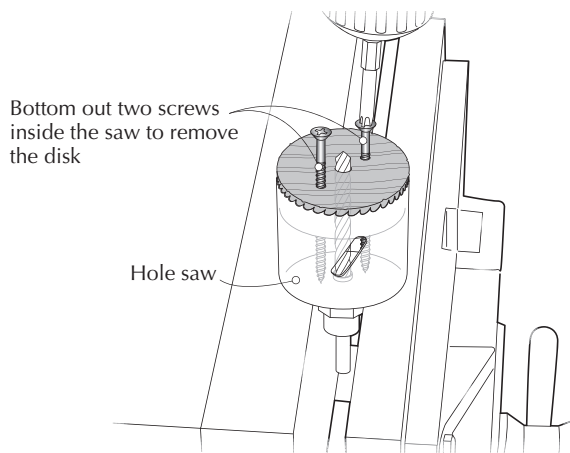
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Unjamming a Hole Saw

Hole saws provide an inexpensive way to bore large holes, but they have a maddening tendency to clutch the drilled disk afterward. I've found that the best approach for removing a stuck disk from the saw is to clamp it in a vise, then drive a couple long drywall screws into it at opposite sides of the bit. By driving the opposing screws in until they bottom out inside the saw, you can easily wrest the disk from the saw's grip.

— Andy Rae, Asheville, North Carolina



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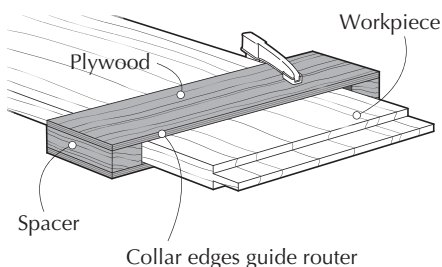
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Wide Tenons Made Easy

When making tenons for breadboard ends and other wide workpieces, the router is my tool of choice. Ensuring perfectly aligned rabbet shoulders on both sides of the board was a problem until I started using this shop-made collar jig. I just slip it over the end of the board and clamp it in place to serve as a double-sided router fence.

I make this jig from two strips of 1/4"-thick plywood about 5" wide and a few inches longer than the width of my workpiece. I nail or screw a couple spacers between the ends of the strips, using scrap that's just a bit thicker than my workpiece. The exact distance between the spacers is unimportant, but I keep them within an inch or so of the workpiece on each end for easy positioning. I don't worry about perfectly aligning the plywood pieces because I run the assembly



through my table saw afterward to ensure perfect alignment of the fence edges.

When setting up the jig, I locate it for the desired tenon length, then clamp the plywood to the workpiece at the end. To rout a centered tenon, I simply flip the jugged workpiece after each pass, and keep at it until the tenon reaches my desired thickness.

— Steve Gross, Hilo, Hawaii

Power Outage Protection

Last year, we suddenly lost power in our area due to windstorms. I don't know about you, but the thought of being in a windowless basement shop when the power goes out makes me nervous.

The power outage prompted a visit to the hardware store, where I purchased a couple rechargeable night light/power outage lights. These inexpensive units plug into a power outlet and activate when the A/C power fails. I mounted them in central spots in my shop, where they provide emergency light long enough for me to switch off machines and find my way out of the shop without tripping over equipment and materials.

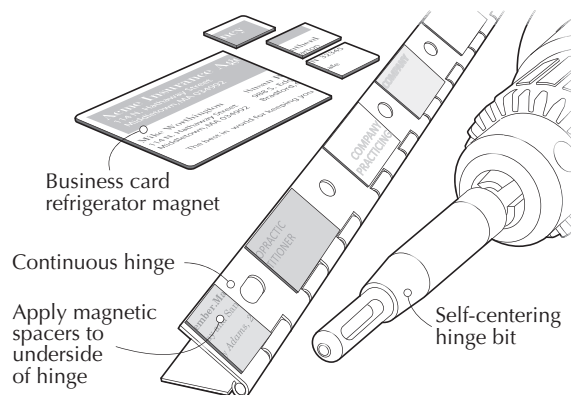
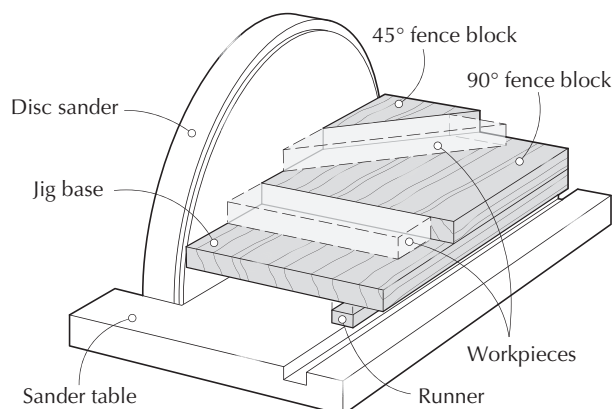
— Keith Mealy, Cincinnati, Ohio

Disc Sander Jig

I use my disc sander quite a bit for cleaning up the ends of squared or mitered workpieces. To increase speed and accuracy at the machine, I devised an inexpensive and easy-to-build fixture for the job. It consists of two 3/4"-thick "fence blocks" attached to a 3/4"-thick base that registers to the sander table via a runner fitted in the table slot. The plywood base and fence blocks abut the sanding disk to create a zero-clearance platform. This ensures that thin workpieces don't bend downward at their ends during sanding.

Make the base and runner first, locating the edge of the base against the sanding disk and carefully fitting the runner to the table slot so there's no slop. (I use acrylic to avoid seasonal movement experienced by wood runners.) After attaching the runner, cut the fence blocks, accurately sawing their 90° and 45° angles. Then place the 90° fence block on the base perfectly square to the disk, clamp it down and screw it to the base. Next, do the same for the 45° fence block. Done.

— Bil Mitchell, Riegelsville, Pennsylvania



Drilling for Continuous Hinges

Self-centering drill bits (also called "Vix bits") are great for quick, accurate drilling of hinge screw holes. Unfortunately, they don't work very well for many continuous, or "piano," hinges. That's because the leaves on continuous hinges often are too thin to allow the chamfered nose of the bit housing to fully seat in the hinge hole, which can throw the hole off-center.

When faced with installing about 10' of such hinges for some tool cabinet doors, I came up with a great solution. I went to my refrigerator door and pulled off a couple of business card magnets. I sliced them into spacer pieces that I then stuck on the underside of a hinge leaf, placing one spacer between every pair of screw holes.

After clamping the hinge to the cabinet, it was now raised about 1/32" above the surface, allowing the nose of the bit to seat fully in each hinge hole. When done with one hinge, I removed the magnets and attached them to the next hinge. It sure made the job go a lot faster and ensured perfect alignment of the hinges. **PW**

— Paul Anthony, PW Contributor

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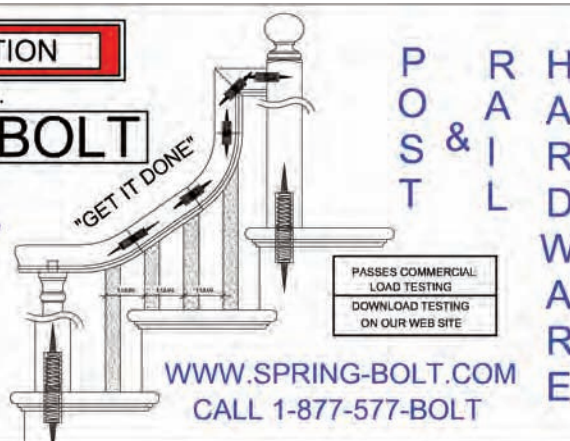
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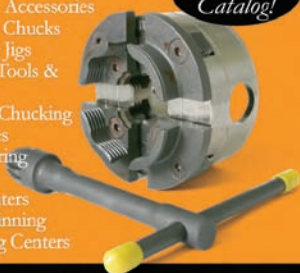
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'Good Eye'

Awaken your inner design sense with just a little practice.

Talk about design often leads back to the idea of developing a good eye. For a long time I wrestled with this; it seemed a bit like trying to lasso the wind. I knew I wasn't alone, either. Frequently I talk to woodworkers who struggle with making design judgments by eye.

I hear them say, "I look at a piece of furniture and I know in my gut something's a bit off, but I can't quite put my finger on it." It may be just a simple detail like sizing the rails on a frame-and-panel door. You know there's a fine line between sturdy and clunky – it's just not clear where that line is.

If that happens to you, your inner design sense, or eye, is telling you something. The good news is that you can train your eye. It's not something learned in a day, but just like mastering a skill like sharpening a chisel, your eye can be trained. You'll be able to tackle design problems with renewed confidence and even venture out creatively further than you thought possible.

Part of my difficulty was thinking that I needed to look closer, see more acutely. Now I know it's not so much about seeing keenly, it's about seeing differently. Often it's seeing the obvious but in a new light.

I remember one of the first times this happened to me. I had a good friend named Rudy as I was growing up. We both loved the outdoors and Rudy had an amazing knowledge about everything in the wild. It was through his eyes that I noticed the killdeer returning long before other songbirds, when the ground was still cased in snow and frozen hard as tundra. Or to look for the leaves sprouting on the shadblow twigs because it meant the smallmouth bass would start feeding in the deep pools on Beech Creek. I can remember clearly a day we stopped for lunch in the shade of an ancient hemlock.

Bookcase crown moulding. Training the eye helps to bridge that gap between your rough idea and reality.

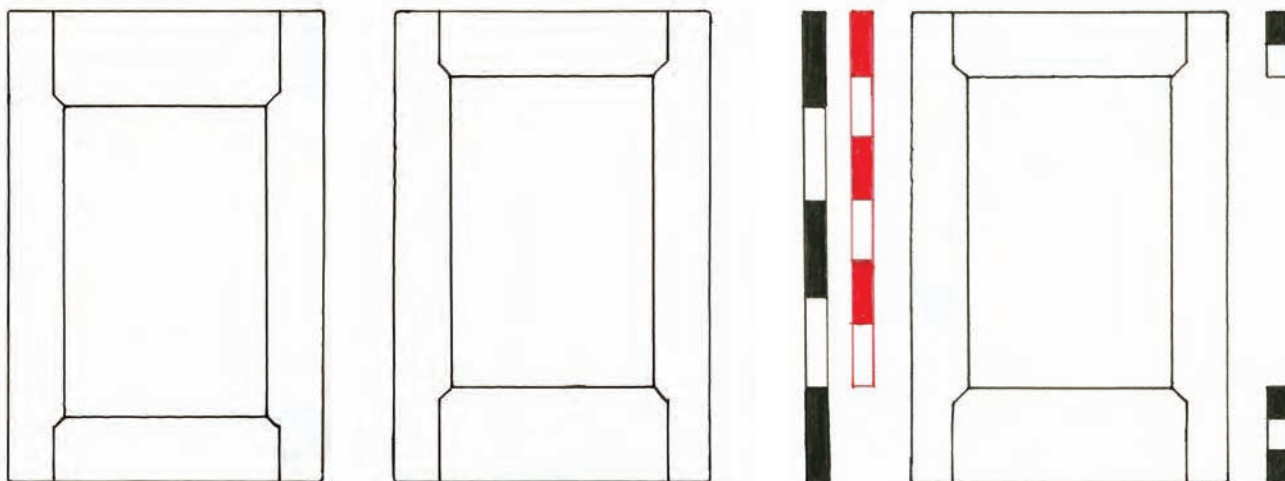
Rudy plucked a small patch of green, a sprig of lichen from the rotting log we sat on. He held it up to a shaft of sunlight and it sparkled with a flash of scarlet. "It's called a British soldier," he said. "See the red jacket?"

I blinked my eyes in wonder, and then looked again at the brown rotting wood and pine needles on the forest floor. A whole army of bright tiny redcoats stood in formation where a few moments before I'd seen nothing. I remember thinking they were so obvious and wondered why I couldn't see them until he pointed them out. Training your eye is a bit like discovering those redcoats.

Michelangelo had a proverb: "It is necessary to keep one's compass in one's eyes and not in the hand, for the hands execute, but the eye judges."

Some might argue that the whole idea of making judgments about what looks right is entirely subjective. Yet, we can't ignore the fact that as humans we are wired a certain way. How do we explain the pleasure we feel in hearing a wren sing its heart out in spring? Why are we dazzled by sunsets? Designers have been tapping into that hard wiring for thousands of years and some timeless design knowledge has grown out of that.





Frame-and-panel door frames. On these two examples, the top and bottom rails are weighted differently. At first impulse, which looks right?

Proportion the rails. Using simple divisions you can size top and bottom rails both to the opening and to each other.

Application

Let's illustrate with a simple example and go back to those rails mentioned earlier on a raised-panel door. Frame-and-panel construction is a solid solution to filling a door opening. Stiles and rails are joined together to provide a strong frame that holds a wide panel, allowing it to shrink and swell. Did you ever notice how the rails (horizontal frame elements) are sized on doors? If the goal is efficiency, just make all the rails and stiles of equal widths. This is an all-too-common approach today in cabinetwork.

To create some visual interest, another approach is to proportion the rails to the overall height of the opening and make one larger than the other. In the two examples shown above, one has the visual weight on the top rail, the other on the bottom. Which example does your eye judge as more appealing? Most would answer the one on the right—and with good reason. Examples in nature

abound where the visual weight is heaviest closest to the ground and becomes lighter as it rises, as with tree trunks and mountains, to name but a few examples. This is referred to as “pyramidal” and is often applied to elements such as rails, or drawer fronts on a chest.

A simple method to proportion rails is to divide the overall height into five equal spaces and use the bottom fifth to size the lower rail. Then take the remaining space above the lower rail and divide it again into five or six equal parts. Use the top unit as the height of the upper rail. This will also link the two rails proportionally.

If you divide by five, it will make the upper to lower rail a ratio of 4:5. If you choose to size the upper rail by dividing by six, the top rail will have a ratio of 2:3 with the height of the bottom rail. You may feel the rails still look a bit heavy to your eye. That's OK; this is meant as a starting point to get you in the

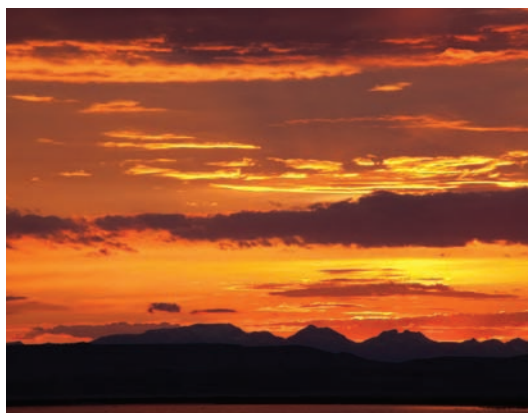
ballpark. It's perfectly fine to scale them back further. Just make sure the top rail is scaled back also, keeping that 4:5 or 2:3 ratio intact. Also, don't get hung up on the method. I happen to like this approach because it's simple and quick. The principle is more important than how you get there.

Ongoing Study

The focus of this Design Matters column will be exploring basic design principles or rules. Some folks are glad to have rules and welcome them as building blocks—sort



British soldier lichen. Sometimes our eye needs a little help to pick out the obvious.



Montana sunset. Who doesn't enjoy a great sunset? Learning design is about making connections we can relate to.



Mature oak. The spreading trunk echoes the pyramidal and anchors the tree both structurally and visually.

of a paint-by-number or connect-the-dots approach – but that’s not how it works. Design comes down to making judgments based on your eye, and no rule can make the final call. On the other end of the spectrum are those who want to learn the rules so they can break them. Our Western design heritage is rich, precisely because designers have always pushed the rules. But I’d like to suggest a third way to view rules. They can help us to see differently. Here’s how:

Understanding design basics can help you to recognize and appreciate great design in masterful work. Great furniture, art and architecture can become a tremendous source of inspiration and training. That

courthouse you’ve been driving by for years might be a textbook on proportions. Visits to a museum or historic site take on a whole new meaning as you understand more of what you see. It will change the way you see furniture. Your eye will reveal layers hidden within a great design – starting with the bones beneath the surface that define the form seen from a distance, to the subtle restraint that allows an inlay or carving to delight when seen up close.

A foundation in basic design principles also can give you the ability to see where you want to go with your design and have it come out the way you imagined it. This is often one of the hardest things to tackle. It’s difficult to clearly see how a design will look while it’s still just an idea rattling around in your head. Today we have wonderful technology to see an image in 3D on a computer screen, yet there is no substitute for developing that inner design sense and the ability to visualize.

Basic design knowledge can offer a starting point to begin roughing in your idea. Starting out with good bones makes a huge difference, and it’s amazing how much creative latitude you have. Many designers often compared the visual arts with music and for centuries saw a linkage between proportions and musical tones. A ratio of 2:1 equals an octave, 2:3 is a fifth, etc. The really exciting thing, if we think about design in that light, is that music can be expressed in so many ways. The same notes used to create a symphony by Bach find life in the music of John Lee Hooker or Bruce Springsteen. Don’t be afraid of the rules in a confining sense. View them as a key to unlock your creativity.

Finally, an important step in training the eye is to imprint the lesson by looking carefully at how it’s been applied skillfully or sometimes clumsily in other work. Take time to look at how the top and bottom rails are sized on older cabinet doors, entry doors, even old window sashes. If anyone asks what you are doing, tell them you’re looking for redcoats.

I’ll be discussing this and more design tips on my blog at georgewalkerdesign.com. You are welcome to join me there. **PW**

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



Stop and look. Buildings offer great learning opportunities. As your eye develops you’ll see more.

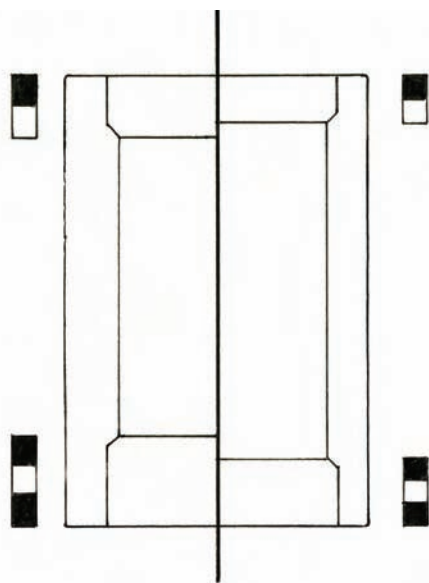
About This Column

If you have a thirst to hone your creative skills, Design Matters will provide tips, tools and much more. Designing your own furniture can be rewarding but also a bit scary. We’ll dive into the basics of proportions, forms, contrast and composition to give you the skill to tackle design problems with confidence. Good design is timeless, so pull up a chair as we explore great designs from antiquity, early American furniture and modern work as well. Together we’ll learn design secrets from the masters who gave us great furniture, art and architecture.

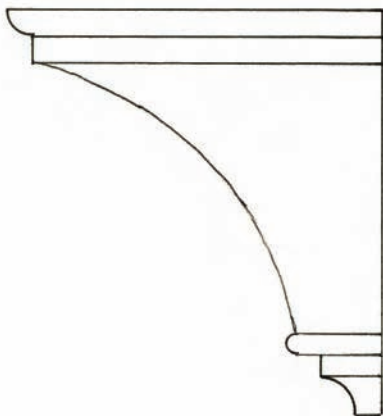
Designing warm and inviting furniture is not about specifications and tolerances, so set aside your ruler and calculator. Instead, grab a pair of dividers and a sketchbook. Bring along some sturdy hiking boots as nature always has and continues to be a wellspring of inspiration. We’ll also hike into the workshops of some talented designers and artisans, and learn what stokes their creative imagination.

In the first century, a Roman architect named Vitruvius wrote that a design should be functional, sturdy and beautiful. Some writers have interpreted his Latin word for beauty, *venustus*, as, “to give joy.” Even today, we all want that piece we’ve

been working on to look great and bring smiles. That’s the goal.



Still too heavy? Let your eye be the judge and scale the rails back, just retain the proportional link between top and bottom.



Idea sketch. Design skills can help you imagine how your idea will look at every step, from drawings to the completed work. See page 20 for the completed moulding.

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André Roubo's Try Square

The details of this 18th-century tool will both please and puzzle you.

One of the first tools I bought was a 9" steel try square with a brass and rosewood stock. Like a supermodel, it's nice to look at, but not so fun to deal with day-to-day.

Its blade is too short, it rusts when you look at it and it chews up the backs of my marking knives. It's too heavy, and the rosewood stock is difficult to hold – I can't get my fingers around the thing. But, I figured, that's what they sell in the stores so that must be as good as it gets.

Then my mother went through a phase where she collected antique measuring and marking tools, everything from log rules to T-squares.

Lucky for me, she outgrew this phase and foisted her small horde on me. Most of the tools were useless to a woodworker, but I started using one of her homemade wooden bevel gauges and what I thought was a framing square to lay out my work.

Impressed by the weight and accuracy of the wooden tools, I made wooden straightedges and put away my 24" Starrett.

And while browsing through André Roubo's masterwork "Des Arts Et Metiers: Le Menuisier En Bâtiment," I finally found the solution to my trying problem.

Plate 15, Figure 6

There among the other French layout tools was a nice wooden try square. And it was right below a square that looked like the framing square my mother gave me.

Online EXTRAS

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Built-in accuracy. Wooden try squares are more than accurate enough for woodworking. Plus they have other advantages – less weight and more reach.

Roubo called this square "le triangle," and offered specific dimensions. Here's a translation by Bjenk Ellefsen, a woodworking friend and native French speaker.

"The triangle is made of a handle and a blade; the handle ordinarily is 9 to 10 inches long by 1½ inch wide, and about 10 lines of thickness: the blade must have a foot to 15 inches long, by three to four lines thick, and 2 inches to 2½ wide. The blade must be mounted squarely in the middle of the handle's thickness with a corner bridge joint along its width and made to project by ½ inch at the top of the handle.... In general, the use of triangles of which I have just talked about, is to support or drive the marking knife to mark right angles on the wood."

Oh, about those unusual measurements: The French inch is a shade longer than the modern inch. And the French inch is divided into 12 "lines." With that information in hand, I designed a square after Roubo and began building six of them using quartersawn European steamed beech.

Meanwhile, Across the Channel

As I was building the French squares I dug up my notes on early try squares and was amused to discover that a well-known try square built by Benjamin Seaton in 1796 was similar to Roubo's – minus the attractive curves. His square had a 15"-long blade and an 11¾"-long stock. So I thought I was on the right track.

However, there was one detail about the

English squares in Seaton's mostly unused tool kit that made me raise an eyebrow. All three of his wooden try squares had blades that tapered in thickness. The blades were thickest at the stock and as much as $\frac{1}{32}$ " thinner at the tip.

What, I thought, is the advantage to a tapered blade? Roubo didn't mention it as far as I could tell. I decided to investigate.

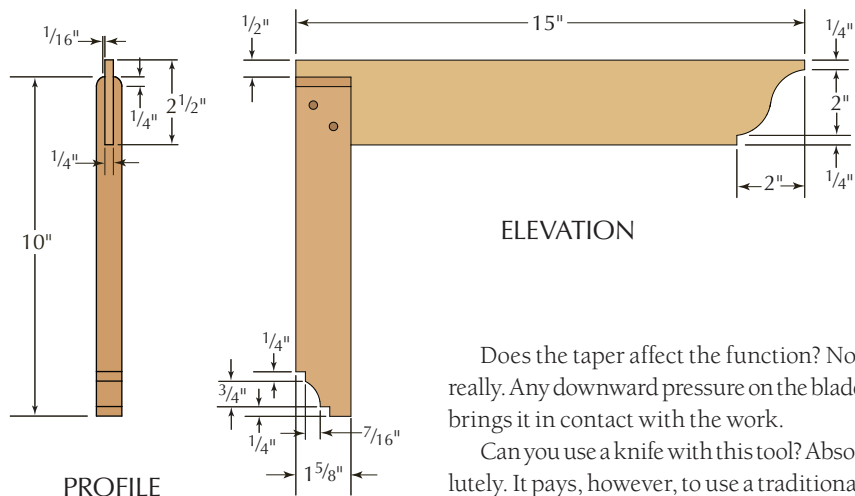
One working theory was that the slight taper improved the tool's accuracy over time. The taper exposes more end grain, allowing the blade to respond faster to changes in humidity (most of the moisture exchange in wood is via end grain). This same theory might explain why wooden smoothing planes are coffin-shaped and wooden straightedges are sometimes tapered on their top (non-functional) edge. There are other theories, by the way.

As I built Roubo's squares, I made a couple with tapered blades. Then I put all the squares to work on some small cabinets.

Au Revoir Rosewood

My rosewood square now needs to find a new home. The wooden square has a much longer reach, weighs half as much and is far easier to hold. Its stock has a familiar feel, like a saw handle. And because the handle is longer than on a traditional try square, it touches more area of my reference edge – a good thing.

Putting the tool to use answered a lot of questions I had about it.



Is it accurate? Using planes, files and a little sandpaper, it's easy to true these squares so they are more than accurate enough for woodworking.

Will they need a lot of maintenance? Likely no. When I build layout tools using wood I use dry, quartersawn stuff. My wooden straightedges, for example, have needed trueing once in the last five years.

And what about that taper? After a few days I forgot which squares I had tapered. So I measured them with calipers.

The funny thing was that most of my blades tapered. As I was fitting the blades in the stock, I imagine that I used more downward pressure while planing the ends of the blades – those areas weren't as critical as the ends that I had to fit in the handles.

Does the taper affect the function? Not really. Any downward pressure on the blade brings it in contact with the work.

Can you use a knife with this tool? Absolutely. It pays, however, to use a traditional striking knife instead of a spear-point knife. You have to be careful with the spear-point tool – it's easier to slice the reference edge of your square.

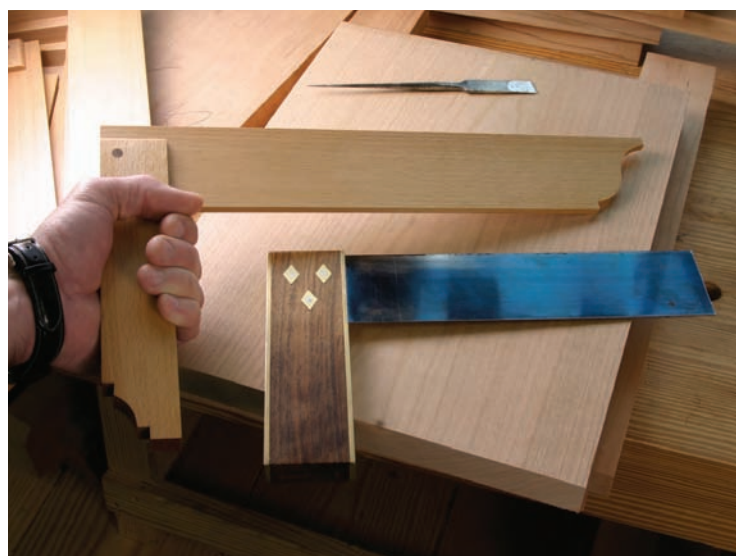
And finally, what about the curves on ends of the square? Do they have a purpose? Roubo doesn't mention the curves in his section on squares, though I imagine they could be used for laying out the occasional detail in a pinch. The curves are helpful to me in one way – they differentiate my squares from Senior Editor Robert W. Lang's.

I think the curves on a try square have the same use as the nib on the handsaw – to catch your eye and confound generations of future woodworkers. **PW**

Christopher is the editor of this magazine. Don't panic, he hasn't fired Adam Cherubini, our Arts & Mysteries columnist. Adam's day job has left him without a shop right now. He'll be back later this year. Promise. Next month, look for guest columnist Jerome Bias.



The right angle. The tip of my striking knife has an angle that suits a wooden square. A pointy-tipped knife would more easily slice the square.



A handle for hands. The narrower and longer stock of a wooden square makes it easier to hold and more accurate in use.

A Tapered-leg Table

Tapered legs lighten the look and add ‘spring’ to a table’s design.

Small tables are useful just about anywhere in the home. They can be easy to build, but a good design is important. To make the design more interesting, tapered legs (often part of Shaker, country and Federal furniture) are part of this design.

The taper begins below the aprons and continues on a slope until it reaches the floor. Tapering lightens the look and keeps the legs thick enough at the top to provide adequate joinery strength.

Additionally, this table’s base is slightly wider than it is deep, and the top overhangs the ends more than at the front or back – the increased work surface adds to the overall design.

Where to Begin

At the home center, pick up a piece of 1x8 red oak that’s 8' long (for the top), a piece of 1x6 poplar that’s 6' long and the stock for four legs—at my store I found 36"-long pieces of 2x2 poplar. Select the straightest, flattest boards you can find. And select the red oak with the best-looking grain.

At the miter saw, position a stop block to accurately cut the four legs to length. Next, cut the aprons from the 1x6 making sure to cut two each of the two different lengths. Adjust the stop block to cut the top material to length—three pieces make up the top and those three pieces need to be edge-glued.

The top has a clear finish, so it’s important to examine the pieces to find the best grain match. Flip and turn the boards for the best look, one that keeps the grain flowing across the panel. Draw lines across the joints so you can easily orient the pieces into position again.

On the back face of the middle board, add three pocket-screw holes along each

***Don’t limit yourself.** If you understand how the parts of a table come together, there’s no limit to size. Simply change the apron length, in pairs, and you can build whatever size table you like.*

edge—one hole 4" off each end and center the third hole. Add a thin layer of glue to the meeting edges, orient the boards as before and install the screws while keeping the ends aligned. When done, set the panel aside while the glue dries. After 20 minutes, scrape the excess glue from the panel.

Let’s Taper the Legs

The taper on tapered legs is on either two faces of the legs (as with this table), or on all four faces, which is more often seen on furniture of Federal design.

To keep things simple, work one face at a time. Move down from the top end of your legs to the width of the aprons. You could

begin your taper here, but to be safe—so your taper doesn’t extend up into where the apron attaches—move down another inch, then square a line across the face of the leg.

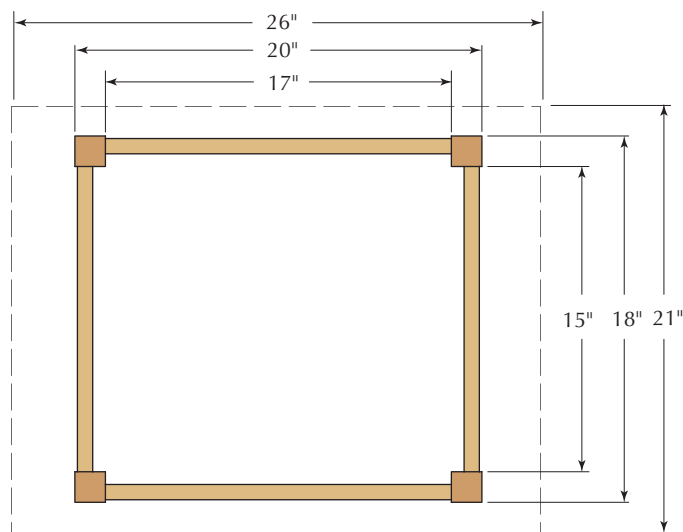
Rotate the leg 90° in either direction, slide down to the floor end of the leg and make a mark that’s 1/2" from the previously marked face. With the second face up, connect the end of the line with the mark set at 1/2" as shown.

Securely clamp the leg to the edge of a worktable with the waste area overhanging the edge. With a sharp blade in your jigsaw, and the blade set 90° to the saw’s base, carefully cut on the waste side of the line. Make the cut from the foot toward the top of the leg.

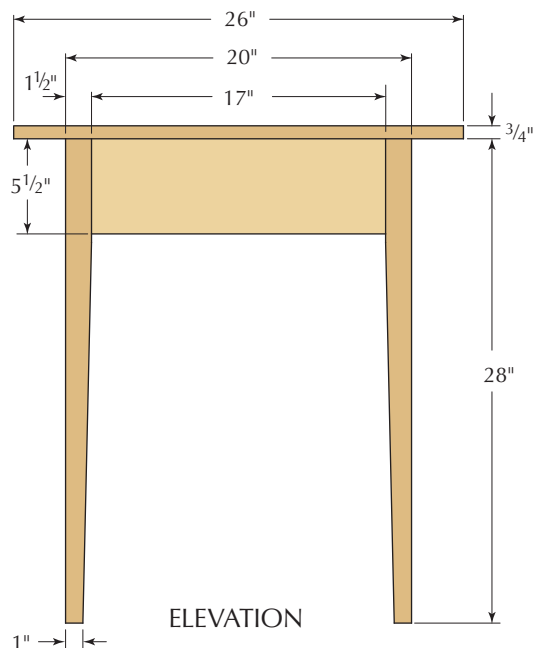
Keep the base of the saw flat to the face of the leg. The farther into the cut, as the jigsaw base fully settles on the leg, the easier it is to keep the jigsaw square to the leg. Also, if you have a variable-speed jigsaw, turn down the



***Connect the dots.** With the start of the taper drawn on one face, rotate the leg, mark the amount of the taper at the foot of the leg then connect the lines to show the total taper.*



PLAN



ELEVATION

speed a notch or two as you cut. This allows better control throughout the cut.

After the cut is complete, smooth the face to your layout line with a block plane. Work to maintain a 90° corner and don't worry if you plane a little bit beyond the line.

The second taper layout is made on that smoothed face. At the floor end of the leg, mark a point that's 1/2" from one edge. Connect from the 1/2" layout mark to the line where the taper begins on the edge nearest your 1/2" mark. That line is the second cut line. Use the jigsaw to cut just off the line on the waste side, then plane the face to the line. Repeat the steps on all four legs and you have completed a set of tapered legs.

On to the Aprons

Use your pocket-screw jig to install two screw holes at both ends of each apron piece. On the long apron pieces, add two pocket-screw holes along one long-grain edge,



Cut with a jigsaw. If you begin the taper cut at the foot, the task gets easier as you move up the leg. Just make sure to clamp the waste area off the side of your workbench.

Tapered-leg Table

NO.	ITEM	DIMENSIONS (INCHES)			MATERIAL
		T	W	L	
4	Legs	1 1/2	1 1/2	28	Poplar
2	Short aprons	3/4	5 1/2	15	Poplar
2	Long aprons	3/4	5 1/2	17	Poplar
1	Top	3/4	21	26	Red oak

spaced about 2" from the ends; on the short apron pieces install a single pocket-screw hole that's centered. These holes are used to secure the top, so oversize the pocket-screw holes along the top edge of the aprons with a slightly larger diameter bit to allow for seasonal wood movement.

Gather the legs in a square with the tapers facing inward. To check the arrangement, each pair should form an inverted V-shape. If your gathering does not, rotate whichever leg is out of sorts until the V-shape is found.

On the top of the legs – the area that remains square – label each leg where the apron pieces attach. This helps keep the orientation correct throughout the construction. Before you attach the legs and aprons, sand the aprons to #120 grit.

If you attach the aprons back from the face of the legs, you'll add a nice shadow line to the design. For this, slide a scrap of 1/8" hardboard under the apron before driving any screws. Clamp a leg to your worktable with the labeled face toward the apron, slide the elevated apron into position then add the screws. Next, position the second leg to the apron, clamp the leg then drive the screws.

Complete two matching assemblies, then add the remaining aprons to the base.

The Top and Finish

The top's length is correct, but you'll need to trim it to width. Level the joints with a plane, sand the panel through #150 grit, including the edges, then knock off the sharp corners with sandpaper. At the same time, smooth any sharp corners on the base.

Add two coats of your favorite paint to the base and a few coats of amber shellac to the top (sanding between coats). Attach the top when it's dry. As the final touch, I added a trompe l'oeil "inlay" with the same paint as I used on the base; see popularwoodworking.com/feb10 for step photos of that process. **PW**

Glen is a senior editor of this magazine. Contact him at 531-513-2690 x11293 or glen.huey@fwmedia.com.

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. You'll learn to rip with a jigsaw, crosscut with a miter saw and drill straight with the help of our manual.



Visit ICanDoThatExtras.com to download the free manual.

Delta's New Midi-lathe

Variable-speed portable lathe shifts into reverse to improve sanding.

If you need a lathe in a small shop and don't have the room or just don't want to wrestle with a full-size machine, benchtop lathes are a great solution.

Delta has introduced two benchtop lathes: one lathe has five speeds while the other lathe is a variable-speed model.

Interestingly, the variable-speed lathe has an extra feature that I think makes it the best choice. The #46-460 Midi-lathe is the only benchtop lathe with a reversing function, a feature found on some larger, more expensive machines.

Reversing the spin (without remounting the workpiece) allows for a better-sanded project. If you spin the workpiece in the opposite direction, you can smooth areas that would simply lay to one side with one-directional sanding—that translates into a better finish without as much variation or blotching. And when in reverse spin, you can



#46-460 Midi-lathe

Delta ■ 877-335-8219 or
deltaportercable.com

Street price ■ \$599

For more information, go to PWFREEINFO.COM.

aim sanding dust directly toward a dust collector to keep the cleanup at a minimum.

The #46-460 Midi-lathe has a 1-horsepower motor and a 3" faceplate for bowl turning; the faceplate has set screws that lock the plate to the spindle to safely work in reverse. Also included is a 6" tool rest to fit into small or tight areas and a 10" tool rest for maximum usage, a ball-bearing live center and a spur center, as well as the necessary adjustment tools.

The variable speeds are from 250 - 4,000 rpm. There are three pulley speed ranges (250 - 700, 600 - 1,800 and 1,350 - 4,000 rpm). These are adjusted with a patented belt-tensioning system that's accessible through a large door on the lathe's front. Flip the door up, release a small lever, move and adjust the six-groove belt (more grooves offer better power transfer and reduce slippage), then simply push the lever back to tighten things again.

The #46-460 lathe has a 24-position indexing pin to lock the headstock spindle for easier layout work with flutes or when carving at the lathe. The maximum turning on this lathe is a full 12½" in diameter (9½" over the tool rest support) and 16½" between centers. The lathe also features a self-ejecting tailstock.

A bed extension (#46-463, \$150) adds 25½" to your turning length to tackle almost any standard turning work. At 97 pounds, the lathe is light enough to move in and out of storage whenever you need to put it to work, but heavy enough to sit rock-solid as you turn. (The company suggests that you bolt the machine to a bench for maximum rigidity.)

—Glen D. Huey



Seals the deal. If you're a lathe devotee, you know the value of being able to reverse the spin as you work. This Delta midi-lathe is the only benchtop lathe to offer this function.

DeWalt's Compact Drill-driver: It's a Contender

If an 18-volt Lithium-ion drill-driver is in your sights, you just may want to take a look at the new DCD760 from DeWalt. This drill-driver is ready to take on the competition in the compact drill-driver tool category, and its rise to the top could be quick.

At a mere four pounds – including the battery – this tool has a 1/2" keyless, single-sleeve chuck, dual-range gearing and in the kit setup (DCD760KL), there's a 30-minute charger and two DeWalt compact Lithium-ion batteries. (These batteries are backward compatible with any DeWalt 18v tool produced since 1996.)

The speed selector switch allows you to choose a low-speed, high-torque option at 0-500 rpm, or there is a high-speed, low-torque gearing that spins at 0-1,700 rpm. A simple push/pull switch located on top of the tool allows easy changes.

The DCD760 has 17 torque settings for

driver tasks; the torque-adjustment ring is easily turned to select the appropriate setting to either seat screws flush to the surface or bury the head if you choose. Or you can set the tool to drill mode.

The DeWalt compact drill-driver stands 9 1/4" tall with the battery installed, and the body of the drill-driver is just less than 8 1/4" in length. These sizes allow access to areas into which full-size drills cannot get.

Also, this tool's body is set at a 90° angle to the handle. While different from other drill-drivers in the category that shift the body in an upward angle, the DCD760 saves wear on your wrist when used in normal operations – you don't have to cock your wrist down to drill straight into your work.

Over-molded rubber makes the tool comfortable in your hand while its light weight keeps fatigue at bay.

—GH



18v Compact Drill-driver

DeWalt ■ 800-433-9258 or
dewalt.com

Street price ■ \$224

For more information, go to PWFREEINFO.COM.

Veritas Surface Vise – the Instant Tail Vise

Tail-vise hardware for a workbench can be expensive, fussy or tricky to install. Now Veritas has invented a clever workbench accessory that allows you to add a tail-vise-like setup to any worksurface.

Called the Surface Vise, it's essentially a quick-release vise that drops into two 3/4"-diameter dog holes in your benchtop. One part of the Surface Vise locks into a dog hole and guides the vise's rod. The other part of the vise is a quick-release speed nut that engages the threaded part of the rod.

Here's how the Surface Vise works: You twist its speed nut slightly to disengage the rod so it slides free. Then you slide the head of the Surface Vise against your work. Twist the speed nut to lock it on the threads. Then turn the stainless swivel handle to squeeze your work.

It sounds more complicated than it really is. After a few uses, I found using the Surface Vise became second nature.

This is a great accessory if you don't have a tail vise on an existing bench, or if you want to clamp things to an assembly table. The vise has plenty of throw – about 8 1/2" – and it locks your work as tightly as necessary for planing or sanding.

The only real downside to the Surface Vise is a result of its advantages. Because



Veritas Surface Vise

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

Street price ■ \$75

For more information, go to PWFREEINFO.COM.

it mounts on the surface of your bench, it's going to stick up and could interfere with your tools, especially the soles of long hand-planes. You have to be careful when you clamp stock that is less than 7/8" thick. You either have to angle your tool a bit to avoid the metal posts, or add a tapered piece of wood to the head of the Surface Vise that will allow you to clamp thin materials. The vise's head is bored with two holes to make this easy to do.

My only other quibble is you need to lock the Surface Vise to your bench using a hex-

head wrench, a tool that can go missing.

Speaking as a workbench junkie, I think the Surface Vise is an outstanding retrofit for a bench. Lots of woodworkers discover how useful an end vise is after they neglect to put one on their workbench. This device fixes their error without having to build a new workbench or wreck an existing one. **PW**

—Christopher Schwarz



Stickley Music Cabinet

BY ROBERT W. LANG

A harmonious combination of details and materials.

One hundred years ago, when people wanted to listen to music at home, they cracked their knuckles and headed for the piano. This small cabinet was originally intended to store sheet music, and although times have changed, it is a nice, small-scale piece of furniture.

The overall form is appealing, and much of the charm is in the details. The exposed through-tenons in the cabinet often are seen in Gustav Stickley furniture, but the joinery in the door is unusual. The mitered intersections on the door are authentic to early Stickley pieces, but within a few years these joints disappeared from production.

I found three variations of the joinery at the outer stiles: full miters, partial miters and butt joints. I chose partial miters to maximize the holding power of the joints while retaining at least some of the look. I couldn't find an original example of this cabinet with that detail, but I included it in this project because it adds to the charm and presence of this piece. It was also an interesting and challenging exercise in joinery.

Making a Mitered Mullion Door

The obvious solution, mitering individual pieces, would have little strength and no built-in way to keep the parts aligned. The miters are for show; unseen joints provide strength and alignment. Mortises and tenons are used behind the miters at the intersections at the outer stiles.

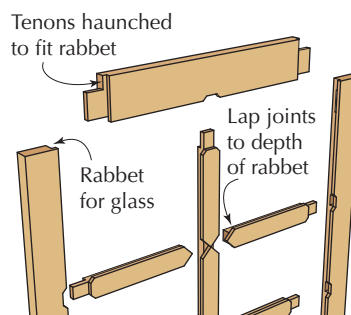
In the middle, there isn't enough room in the 1 1/4"-wide stile to include a practical mortise-and-tenon joint. My solution was a modified lap joint; the miters are cut down

to where the rabbet for the glass begins, and the back part of the short pieces simply butt against the center stile.

The matching cutouts in the center stile prevent the ends of the muntins from moving out of place and provide some face-grain-to-face-grain glue surface. It's stronger than you might think. The tricky part is getting the four points of each joint to meet neatly in the middle.

Careful layout is essential, and I began by clamping the three stiles together so I could mark them all at once. I set the vertical distance between the muntins on my combination square, and used the square to step off the spaces. After marking each space, I use a scrap of muntin stock held against the square to mark the width of those parts.

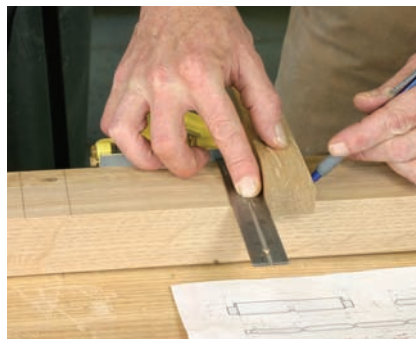
Before working on the miters, I cut a rabbet for the glass, leaving 1/4" of material at the face. I used the back of a chisel to clean the corners of the rabbets, then I made 1/4"-wide by 1 1/4"-deep mortises aligned with the rabbet at the muntin location on the outer stiles, and upper and lower rails.



DOOR DETAIL



Better than numbers. A combination square does an excellent job of laying out repeating spaces, in this case the openings in the door.



The real thing. A scrap of muntin stock is held against the square to mark the stiles. This speeds the process and ensures accuracy.



Run in reverse. The back of a chisel makes a great scraper, just the ticket for cleaning out the corner of rabbets.

The Fussy Part

I marked off the miters with my combination square on the vertical mullion, by drawing two pencil lines to form an "X." For the joints to look good, the end of the miters need to meet at a single point. To preserve the points,



Simple setup. Set the fence on the mortiser by lining up the chisel with the back of the rabbit.

I used my knife to mark just inside the pencil lines on each side of the mullion.

My first plan was to make a template and form the mitered cutouts with a router. After a couple test joints, I decided that the router alone would be too risky. Quartersawn white oak is tenacious stuff and tends to break off in big chunks when it's routed. In addition, the router would leave a rounded surface at the very point that would need to be chiseled to a sharp point.

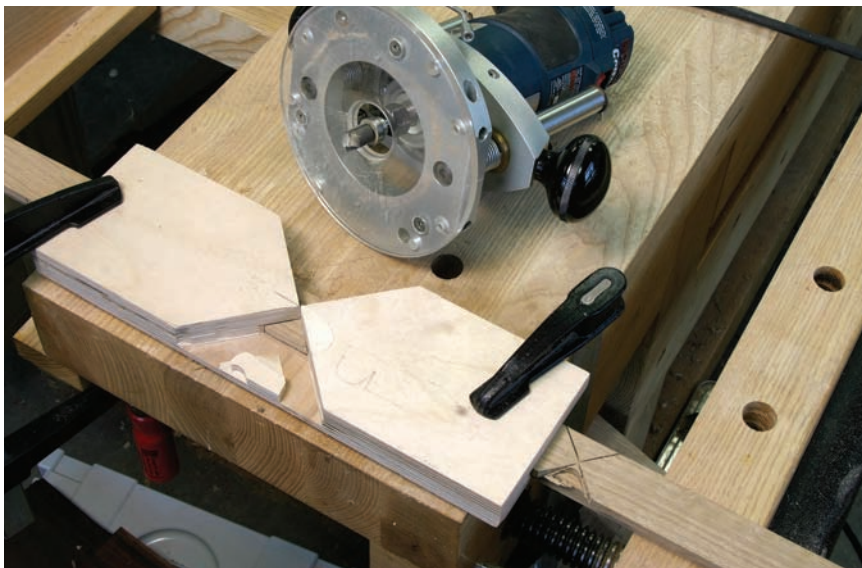
I used a fine toothed dovetail saw to establish straight, clean lines at the edges of the joints. I added a couple thicknesses of veneer to the fence of the template to move it out from the cut lines. The router, equipped with a bearing above the $\frac{9}{16}$ "-diameter straight cutter, left a flat surface at each joint; a chisel was used to trim back to the finished joint lines made by the saw.



X marks the spot. The joints in the central mullion meet in the exact center. A knife cut along the lines will help to guide the saw.



On the right side. For the points of the miters to meet, the saw cuts must be on opposite sides of the lines on each side of the mullion.



Step back and consider. The router jig is mainly to provide a flat bottom for the lap joint. Set the fence to keep the bit on the waste side of the saw cuts.

The mating pieces were made by first cutting a square shoulder on the back, with a $\frac{5}{8}$ "-long lap. I marked the miters from the intersection of the shoulder and lap, using my knife and combination square. I sawed outside the lines with a dovetail saw, the used a shooting board with my block plane to fit each joint.

This isn't as tedious as it sounds. It comes down to marking clean lines, cutting as close as possible to them, then testing the fit. Two pieces of wood against each other will tell you where to take another swipe or two on the shooting board. And with the number of joints in this door, there are plenty of opportunities to practice. By the time you get to the last joint, you'll know how to work these joints efficiently.

The Other End

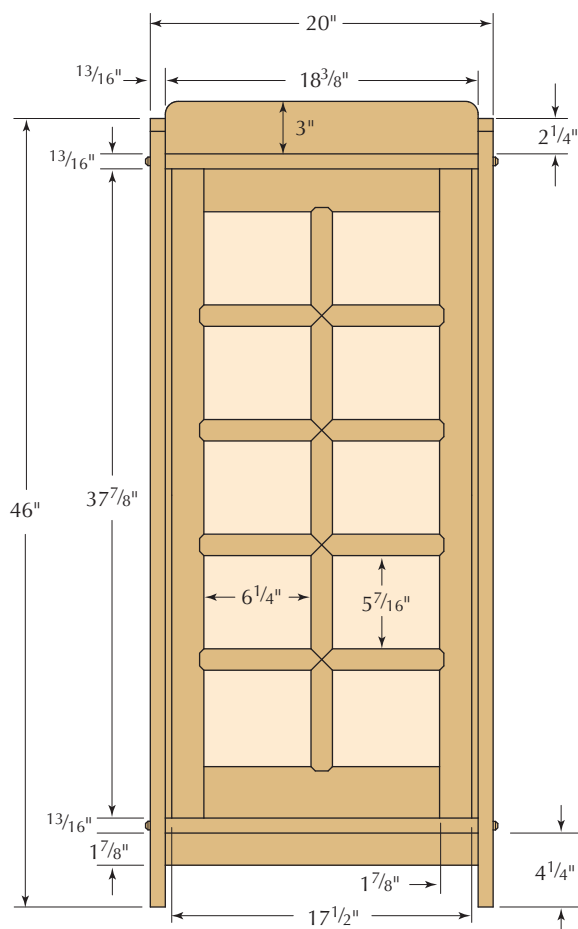
At the other end of the cross pieces, the mitered corners go back only to the edge of the rabbet, and a tenon is added. After marking the cuts in the stiles with a marking gauge and knife, I put together another simple router jig. I made the jig to fall inside the layout lines, and nibbled away at the thin part of the stile with a flush trim bit.

This jig served double duty. After routing, I reclamped the jig directly on the cut lines and used it to guide my chisel in paring the openings. The other half of the joint was made on the face of the muntin by first cutting the square shoulder by hand. Then I used the bandsaw to cut the tenon cheeks.

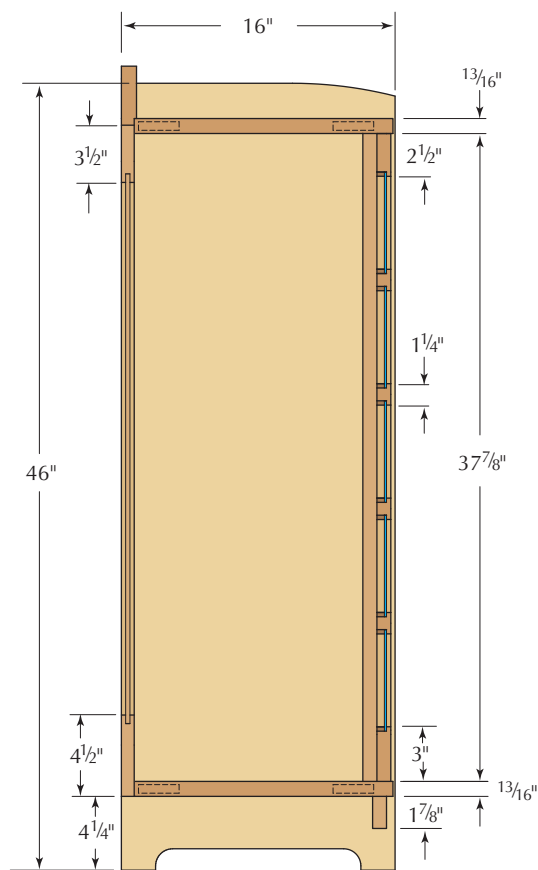
I carefully made a 45° cut in the fence of my bench hook, and used that to guide my saw for the short miter cuts. I left the mortises a bit wide so that I could move the muntins laterally if needed while fitting. After getting the cheeks to fit by filing them with a joinery float, I trimmed the mitered



Cutting corners. The router will leave material in the corner, which can be removed with a chisel. The finished edges of the joint have been established with the knife and saw.



ELEVATION



SECTION

edges with my shoulder plane until they matched the joints in the stiles.

After fitting each joint individually, I made a dry-run assembly of the entire door. There were a couple places that needed tweaking, and I gathered clamps and reviewed my strategy. A lot of joints needed to come together at once, and I didn't want to



Double duty. This jig guides the bearing on a flush-trim router bit, then is used to guide a chisel to pare into the mitered corners.

Stickley No. 70 Music Cabinet

NO.	ITEM	DIMENSIONS (INCHES)			MATERIAL	COMMENTS
		T	W	L		
❑ 2	Case side	13/16	16	46	QSWO*	
❑ 2	Case top & bottom	13/16	15	20 5/8	QSWO	
❑ 1	Backsplash	7/8	3 7/16	18 3/8	QSWO	
❑ 1	Toe rail	13/16	1 7/8	18 1/4	QSWO	
❑ 2	Door stiles	13/16	1 7/8	37 7/8	QSWO	
❑ 1	Door top rail	13/16	2 1/2	16 1/4	QSWO	1 1/4" TBE**
❑ 1	Door bottom rail	13/16	3	16 1/4	QSWO	1 1/4" TBE
❑ 1	Door mullion	13/16	1 1/4	34 7/8	QSWO	1" TBE
❑ 8	Door muntins	13/16	1 1/4	7 7/8	QSWO	1" TOE***
❑ 2	Hinge stiles	13/16	1 5/8	37 7/8	QSWO	Rabbet long edge
❑ 40	Glass stops	1/4	7/16	7	QSWO	Cut to fit openings
❑ 10	Glass	1/8	5 7/8	6 5/8	Glass	Cut to fit openings
❑ 4	Shelves	13/16	14 1/4	18 1/8	QSWO	
❑ 2	Back panel stiles	3/4	4 1/2	39 1/8	QSWO	
❑ 1	Back top rail	3/4	3 1/2	14 7/8	QSWO	1 1/4" TBE
❑ 1	Back bottom rail	3/4	4 1/2	14 7/8	QSWO	1 1/4" TBE
❑ 1	Back panel	1/4	11 1/4	32 7/8	QSWO	

* Quartersawn white oak; ** Tenon both ends; *** Tenon one end



Use the fence. Saw cuts in the fence of the bench hook guide the saw to make clean and accurate cuts.



Wasting away. The band saw fence is set to leave just a sliver of material as the tenon cheeks are cut.



Miters, too. 45° cuts in the fence guide the saw to cut the short miters. Preserve the line at this point, and work down to it while fitting.



Complex geometry. Test the fit often while fitting the miters. Trimming one edge will lengthen or shorten an adjacent edge as well.

set myself up to panic in the midst of it.

I gathered my clamps, made some battens to hold the joints flat, then got out an acid brush and a bottle of liquid hide glue. I brushed glue on all of the end-grain surfaces, and allowed the slow-setting glue to wick in. Then I went over the parts again, and brushed glue on the tenons.

I placed one of the outer stiles on its edge, and began placing the tenons of the cross pieces. With the four short muntins in place, I assembled the top and bottom rails to the central mullion, then placed the rail tenons in the mortises of the stile. With the door still on edge, the remaining muntins were placed, followed by the second stile.

I laid the assembly flat on some blocks on the bench and began clamping. The major joints, where the top and bottom rails connect were first. Then I clamped a packing-tape covered batten across each of the center miter joints and snugged the clamps. When all the battens were in place, I used bar clamps to bring the ends of the miters together.

I went over the assembly (grateful for the long open time of liquid hide glue) and checked each inside corner for square, and tightened the clamps. I left the door in the clamps overnight, and the following morning, I scraped off the excess glue then leveled the surfaces with my block plane.

There Is a Cabinet, Too

The cabinet assembly is simple, especially when compared to the door; it's just two sides and an identical top and bottom. After assembly, a backsplash is added behind and above the top, and a narrow toe rail is added below the bottom. The back is a framed panel that fits in a rabbet at the back of the sides. The back panel is flush with the bottom edge of the cabinet bottom, and ends at the midpoint of the top in thickness.

My first step was to cut the rabbets for the back in the sides. This differentiated the inside from the outside and the top from the bottom. The horizontal cabinet components join the sides with a pair of through-tenons at each intersection. I made a template from 1/2"-thick birch plywood to keep the mortises consistent in size and location.

The template locates the mortises and defines the shape at the top and bottom of the cabinet sides. I chose a piece as wide as the finished sides, and long enough to contain the mortises. To expedite making the template, I ripped some plywood

to 1/2", the width of the finished mortises. I marked the mortise locations on the template blank, then placed double-sided tape over the layout lines.

I stuck down the thin plywood strips at the end of the mortise locations, then placed wider pieces of plywood tight against the long edges. When all these pieces were in place, I tapped them with a mallet to set the adhesive on the tape, then drilled a 7/16"-diameter hole in each mortise location.

These holes are smaller than the mortise, but larger than the flush-trimming router bit I used to cut out the mortises. After routing all four mortises with a flush-trim bit, I popped off the thin plywood pieces, then cut and shaped the top and bottom edges of the template.

I laid out the mortise locations on the outer faces of the cabinet sides, marking the lines with a knife. The knife lines can't be rubbed off and are more precise and easier to see than pencil lines. More important, these lines are the finished edges of the through-mortises; cutting them first helps to keep



Sequence is everything. The parts of the door need to be assembled in order. Do yourself a favor by making a dry run, then use a slow-setting glue.



Above it all. Line up your shoulder over your hands so you can use your body weight to increase leverage as you pare the end grain.

half the difference of the measurements and check the fit by placing a corner in the mortise. When the corner can be placed in the mortise I stop. The tenon will be too tight at this point, but it will be close to fitting. The last little bit of thickness will be removed with a float in the next step.

The tenons can be cut at the table saw, but that introduces some risk, and it can be awkward to hold the work on end against a miter gauge or crosscut sled. Cutting the tenons by hand is as fast and accurate. After double-checking the layout and marking with a knife, I cut the long edges of the tenons, and the two outside edges by hand.

The waste in between the two tenons is another story. I cut most of it away with a jigsaw, then clamped a straightedge along the shoulder. With the straightedge in place, I cut a clean edge at the shoulder line with a flush-trim bit in the router.

Before testing the fit, I cut a slight chamfer around the inside edge of the mortise, and around the outermost end of the tenon. This helps to get the tenons started for fitting, and keeps the tenon from chipping out the grain on the outside of the mortise.

Fitting these joints is a bit like detective work. In theory, they should fit at this point, but in reality there will be a bit of wood somewhere that keeps the joint from going



Make your mark. Wait until the mortises are completed to lay out the tenons on the cabinet top and bottom. Mark the locations from existing edges.

home. When the joint sticks, these points need to be found and removed. If you guess and remove material in the wrong place, the result will be a gap in the finished joint.

Fit Without a Connoisseur Fit

I push the tenons in as far as I can, then tap on the end of the board a couple times with a dead-blow mallet. When I was younger and my eyes were better, I could see the shiny spots on the tenon where the joint is too tight. These days, I pull out a pencil and draw cross-hatched lines on the tenon and try the fit again. The graphite smears where the joint rubs, showing the high spots. These can be removed with a shoulder plane, but it's easy to tilt or go too far. A float is almost as fast, and allows more controlled removal.

As the size of the tenon gets closer to the size of the mortise, I slow down and remove material carefully. The difference between a joint that almost goes together and one that is sloppy can be a matter of a stroke or two.

When I'm satisfied with the fit, I run a pencil around the outer edge of the joint, marking where the tenon pokes through the cabinet side. Then I use a rasp to bevel the ends of the tenons, stopping the bevel about $\frac{1}{16}$ " from the line. Before assembly, I plane and/or finish-sand the cabinet parts.

It's likely that I will need to refine the surfaces once more after assembly, but the areas around the mortises are difficult to work. This is a point where the desire to see an assembled box tries to take over, but it pays to wait. After sanding, I brush glue inside the mortises and on the end of



Under control. Cut the tenon shoulders first, using a straightedge and a bearing-guided router bit. Adjust the depth of cut in small increments to achieve the proper thickness.



First things first. Test the thickness of the tenon by placing a corner of the shelf in the mortise. Aim for a tight fit at this point.

the shelves, and let it wick in for about 10 minutes. Then I put glue on the tenons and assemble the carcass.

After clamping, I remove any excess glue and check for square. I've never liked measuring diagonals, so I place corner clamps or square blocks and check each corner with a reliable square. Then I let the assembly dry overnight.

Details at the End

In most furniture the front is in a single plane, and visual interest comes from applied mouldings. Craftsman furniture does without the trim, and the front of the case is enhanced by setting each element back from its neighbor. The top and bottom are $\frac{1}{8}$ " back from the sides, the hinges strips are $\frac{1}{16}$ " in from the top, and the door is back another $\frac{1}{16}$ ".

The hinge stiles sit inside the door opening, and are $1\frac{1}{2}$ " wide with a $\frac{7}{8}$ " deep rabbet, leaving a $\frac{3}{8}$ " wide edge beside the door.

Supplies

Arts & Crafts Hardware
586-772-7279 or
arts-n-craftshardware.com

1 ■ Gustav Stickley V-door pull
\$37

Price correct at time of publication.



Begin at the end. Cut the ends of the tenons first with a backsaw, then use the same saw to cut away the outside corners.



This will work. Remove the bulk of the waste between the tenons with a jigsaw or coping saw. Then clamp a straightedge between the two tenons and use a router to make a clean, straight cut.



Refined detail. Make a slight bevel on the ends of the tenons before fitting. After a good dry-fit, mark the outside of the case on the tenon, then increase the bevels to end close to the line.



Overkill. The dowel reinforces the through mortise and tenon joint. It isn't needed, but it's a nice detail to include.



Layered look. Aniline dye stain is coated with tinted Danish oil. This will be followed by a thin coat of amber shellac.

The rabbet acts as a door stop and keeps dust out of the cabinet. After shaping the strip and fixing the hinges I glued these strips to the cabinet sides.

The back is a simple frame and panel. In original examples of this cabinet, the panel was plywood in a solid-wood frame, but I made a 1/4"-thick solid-wood panel. I made the stiles and rails wide so that I could use a single panel from the available material. The bottom front rail is glued to the cabinet bottom. The backsplash is 1/8" thicker than the back panel, with a rabbet on the lower edge to fit over the edge of the cabinet top. This is glued to the edge of the top and at the ends to the sides of the cabinet.

A 1/4"-diameter dowel is driven into a hole centered on the front edge of the cabinet side, and the front through tenons. I made the dowels by driving split scraps through a steel dowel plate. The dowels are long enough to reach 1" or so into the edge of the tenons.

This reinforces an overbuilt joint, but it was a feature of the original cabinet, and it looks good after the dowels have been

trimmed flush to the front edge. There are four shelves that sit on pins, located so that the shelves fall behind the door muntins.

Our local stained glass shop had textured amber glass for the door, a close match to the original. The glass is held in place with 1/4" x 7/16" strips of wood, mitered and pinned to the inside of the rabbets. The door pull is a close copy of the original, and ball-tipped hinges also are typical. A brass ball catch keeps the door closed.

No Fume, No Fuss, No-pop Finish

Don't make the mistake of thinking that the finish should make the quartersawn oak "pop." If that's what you're after, use a pigment stain and just about any clear topcoat. The flakes won't take the stain evenly and will be quite evident when you're done.

Original finishes were more subdued – the product of fuming the raw wood with ammonia, and coating with shellac followed by a dark wax. In later years, Craftsman pieces were finished with early versions of modern dye stains and lacquers.

Fuming is an interesting process, but it

can be unpredictable and time-consuming. Nearly the same look can be achieved with aniline dye. I stained this piece with Lockwood "94 Fumed Oak" alcohol-soluble aniline dye. You get a good idea of the final color while the dye is wet; when it dries it looks like you made a terrible mistake.

I follow the dye with a coat of Watco Dark Walnut Danish oil. The oil will add some darker color to the open pores of the wood, act as a glaze to even out the tone and seal the surface. After letting the oil soak in for about 15 minutes, I wiped off the excess and let the surface dry overnight.

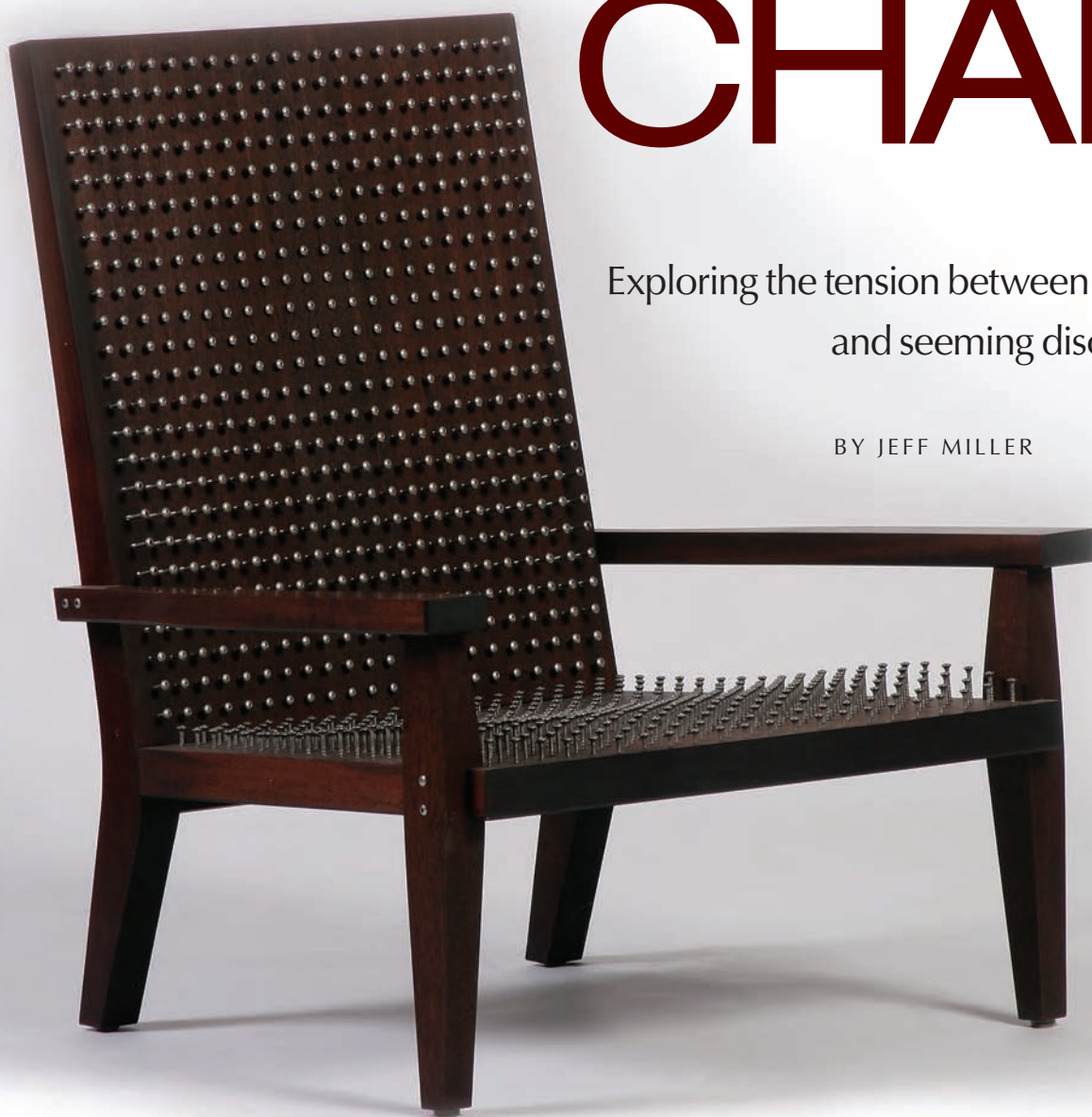
The oil over the dye creates a nice chocolate brown color, but the finish needs to be warmed up a bit. A thin coat of amber shellac applied with a rag adds that, and provides some surface protection. I follow the shellac with wax after giving it a couple weeks to fully cure. If the color needs to be toned down or evened out, a dark wax can be used instead of clear. **PW**

Bob is a senior editor of Popular Woodworking and the author of "Shop Drawings for Craftsman Furniture," available from his web site, craftsmanplans.com.

988 CHAIR

Exploring the tension between comfort
and seeming discomfort.

BY JEFF MILLER



Front view. There are 988 screws in this chair; only 20 of them are in the joinery (and even among those, most are decorative).

Nine hundred eighty-eight screws don't ordinarily find their way into a typical chair. But this chair was something quite different from my usual effort.

The idea for the chair arose out of a desire to find a quick and easy way to experiment with three-dimensional shapes for both chair seats and backs. I had previously used dowels to explore shapes for chair backs and seats, but this method, though very effective,

didn't allow for side to side contours. I was building a rack for musical instrument parts at the time, which had dozens of short dowel posts sticking up out of a plank of wood. On a lark, I sat down on it.

Remarkably, it wasn't bad. How to actually adjust the shape of the surface? Cutting the dowels to various heights seemed tedious. Screws set at various heights seemed like a possible solution.

Shortly thereafter, I received a call for entries for a show entitled "Beyond Function, the Art of Furniture." My idea for exploring seat shapes was still fresh in my mind. This, combined with the opportunity to play around a bit while developing a new piece of furniture for a show, was very exciting. It pointed toward a fairly provocative – and slightly impractical – chair. It would be perfect for the show.

Playful Idea, Serious Execution

The idea may have been playful, but I wanted to treat the design and execution of the idea quite seriously. I knew just what I wanted to do: build a predominantly wooden easy chair that had an “upholstered” seat made of screws. Now I needed the appropriate materials.

Scouring various catalogs led to the discovery of oval-head square-drive stainless-steel screws. Perfect. I ordered what may have been the supplier’s complete stock. They must have been relieved; the screws disappeared from their catalog shortly after my order and have never reappeared.

Dark-stained mahogany seemed like a good contrast with the stainless steel, and I had some on hand that would work well. This also fit in well with my concept of making the wooden structure of the chair with as much attention to detail and refinement as any of my other chairs.

Construction Methods

The construction of the wooden part of the chair was straightforward. I dadoed the back plank of the chair to accept the back of the seat plank. I made the rear legs separately, and mortised them for tenons I cut at the sides of the seat plank. Then I glued the back plank and rear legs together, so that the legs were flush on the front and the top of the back, but appear to grow out of the back of the chair as seen from behind.



Seat detail. The screws that form the seating surface on the chair’s seat and back are driven at different depths to achieve the contour usually carved into wood.

I used a Sam Maloof-inspired housed-lap joint (minus the carving and shaping) to attach the front legs to the seat plank. I cut notches and drilled for screws to secure the back of the arm to the back of the chair, and a mortise-and-tenon joint at the top of the front leg. Before final smoothing and assembly I drilled all of the holes for the screws. Drilling these pilot holes required very careful layout, a few jigs for the drill press and a whole lot of patience.

If I were doing the chair now, I might look for someone with access to a CNC router. Assembly was easy; at least for the wooden part of the chair.

‘Upholstery’

Screws (a total 20 of them – many of them more decorative than functional) in most of the joints helped pull everything tight without much need for clamps. There was no choice but to dye, stain and finish before going any further.

Driving in the remaining 968 screws was more work than I anticipated. It took great care, even with square-drive screws, not to mar the square sockets. And just the right amount of pressure was needed when starting each screw to avoid pulling up a small chip of wood.

Creating the contoured “surface” of the chair was at first very similar to the way I typically carve out a seat in wood. I did some of the basic shaping of the seat surface based on a general idea of what I thought would work, then sat down in the chair to see how it felt. Various screws were adjusted up or down to tweak the comfort.

There was obviously plenty of opportunity to “add material” back to a curve – a luxury not usually available when I work with wood. I used different-length screws as needed. This was necessary due to the variation in height of the screws above the mahogany, which ran from $\frac{3}{16}$ " to $1\frac{3}{8}$ ".

The “upholstery research” phase of the chair was by far the most fun. However, using this method as a tool for generating quick and easy three-dimensional curves seemed to fall short on both the quick and the easy.

Once a basic shape emerged, I refined the curves and made appropriate templates. Ultimately, I generated four templates, which I used in combination to help me tweak every screw to a precise height to create flowing curves of just the right shape.

I love the reactions that the chair generates, from the obvious comments about beds of nails and leaving the screws with their points up, to the disbelief that it can be sat in. It is comfortable – although you’d better not be wearing a loose-knit sweater when you sit down.

More interesting to me is the contrast between materials and surfaces both real and implied, the tension between comfort and apparent discomfort, and the more-or-less functional nature of the chair, despite its frivolous look. **PW**

Back view. From the back, the chair looks like an everyday seating piece – it’s not until you come around the side that you see some decidedly different “upholstery.”



Jeff is an award-winning furniture designer, builder and woodworking teacher who lives in Chicago. You can see more of his work at furnituremaking.com.

Turned Tool Handles

BY KEVIN DRAKE

One of the best uses for a lathe is making tool handles. Most production tool handles leave something to be desired. The good news is that the handle is the part of tool that is the easiest to modify.

Fine gloves are sold in sizes such as 6, 7, 8 and 9. Work gloves are generally sold in dumbed-down categories such as small, medium and large. But when it comes to tool handles, one size is expected to fit all. Having custom tool handles is like having made-to-fit gloves. They feel like part of your body.

Look around your shop for a tool handle that feels good to you and compare that to the rest. My guess is that the one that feels the best will be the one you reach for most often. Plastic handles are molded around the tang and very rarely loosen or come off, but I get rid of them as quickly as I can and make handles that fit my hands. Plus, I much prefer the feel of wood compared to plastic.

The lathe is best suited for making round and oval handles, or a combination of both. I, for example, prefer a turning-tool handle that is round with an oval section near the blade. The oval part allows me to use one hand or the other to torque the tool when I need to without over-gripping it to the point where I lose the tactile feedback that is so essential to successful turning.

Looks good, feels good. Custom-turned handles make a big improvement in your tools; you can see and feel the difference.



Custom-fit your tools to fit your hand.

In this article, I will outline how to turn round handles for both socket and tang chisels.

Template First

Before you make a working handle, turn a template shape that feels good in your hand without worrying about how it connects to the blade. I prefer a chisel handle that has a slight taper toward the end and toward the blade from a high point an inch or so from the blade. That allows me to lean on the tool without squeezing it to death and to keep my hand from dropping onto the shaft of the blade.

That's true for both bench and paring chisels. The slight taper also supports a striking collar at the end of the handle to prevent the handle from splitting under hammer blows. Some woods do not really need a collar, but it's good insurance for chopping chisels.

If, like me, you prefer longer handles for paring, then take that into consideration as well. No need to measure anything. Just play with shapes until you find one you like. Maybe you have a handle that you already like, but don't be too sure. Play with the



Size matters. When you make your own handles, you have control over how they fit in your hand.

shapes anyway. When you find the shape you like it should fit, well, like a fine glove.

Some manufacturers size their handles, at least to some degree, according to the size of the blade; the smaller blade, the smaller the handle, but I prefer to go with the same-size handle regardless of the blade size.

Socket Handles

A socket handle relies on the taper to secure the handle to the blade by friction alone. It works the same way a Morse taper works on a lathe to secure the tooling. A good fit means that the blade won't separate from the handle

unless you want it to. That's the theory anyway. The advantage of socket chisels is that the handle is always compressing into the socket, so a ferrule is not needed.

The hardest part is getting the fit correct, so start with a blank that is long enough to allow for some trial and error. The walls of sockets tend to get thicker as they get deeper, but that's not always the case. This means that the inside of the socket has a different taper than the outside of the socket, but you can still use the outside of the socket to eyeball your starting point.

To get started, round up your blank, leaving it about $\frac{1}{4}$ " larger than the largest diameter on your preferred handle shape. Gauge the depth of the socket with your finger or a pencil, then pull the pencil back about $\frac{3}{16}$ " and mark the depth of the socket on your round. This "pull back" allows the handle to settle into the socket without bottoming out.

I prefer to use a cone-shaped live center on the tailstock and I cut the socket tenon on the tailstock end. This facilitates shortening the tenon if need be while still leaving a center mark. You can trim the tenon down a little bit at a time with a parting tool or skew chisel and crank in the tailstock a bit as you go.

Gauge the inside diameter of the socket mouth any way you can. I use an open-end wrench to get it close. Cut a tenon roughly the size of the socket mouth using a bedan (a specialized parting tool) or a skew chisel.

Turn a taper to roughly match the outside of the socket. There's no need for a precise measurement here. The inside of the taper may not be the same angle as the outside anyway, so an approximation is all you need.



Close is close enough. Don't be fussy with an exact measurement for the depth of the socket; use your finger or a pencil as a gauge.



Room to grow. Leave some extra room to fit the taper. You will need to adjust the angle and the length as you fit the socket.



An open-ended question. Use a wrench to gauge the large diameter of the socket.



A clever answer. Then use the same wrench to tell you when you have reached the desired diameter.



Let the socket be your guide. The inside taper may or may not match the outside. The socket held behind the work will get you close; you will fine-tune it later.



Check it out. A test-fit will tell you when the taper is correct.



Room for compression. A small gap between the socket and the shoulder will keep the handle tight over time.



Drive it home. A few taps with a mallet will seat the handle in the socket.



Beneath the plastic. Most plastic-handled chisels look like this inside. The ferrule keeps the handle from splitting, and a leather ring absorbs shock and fills the gap.



A matter of judgment. The depth of the hole should be somewhat deeper than the length of the tang. The end will be trimmed to fit.



The right tool. An inexpensive pipe cutter makes a cut quickly and leaves smooth edges on the copper ferrule.

Fit the tapered tenon to the socket. If the handle is loose at the mouth of the socket, then increase the taper until it fits. If it's tight at the mouth but wobbles, then decrease the taper. There should be a space between the shoulder of the tapered tenon and the top of the chisel when it fits to allow the handle to compress into the socket with time and use. All you'll need is about $\frac{1}{16}$ " – or a little more for really soft woods and a little less for really hard woods. Turn the blank to your preferred shape and drive it into the socket.

Tang Handles

Tang handles rely on the grip of the tang within the handle to secure them. Wooden handles are driven onto the tang of the blade, and the blades are expected to hold in much the same way a nail is expected to hold, only better. A tang can loosen over time though, and make for a wobbly handle – but a little epoxy can fix that.

A ferrule is usually required to keep a wooden handle from splitting when it is driven onto the tang. Another option, and one I use for paring chisels and chisels that originally had molded plastic handles (they

generally have cast round tangs instead of the more traditional tapered tang), is to make a hole in the handle that just fits over the tang, then fill the hole with epoxy just prior to installing the handle. This mitigates the need for a ferrule, which I don't much care for on paring chisels. Plus when you are converting plastic-handled chisels to wood, driving on a round tang can be a problem.

As in socket handles, start with a blank that is a couple inches longer than your desired length. Once your blank has been rounded up, you will be gripping it with a four-jaw chuck to drill the tang hole and then finish the handle, so you will need some extra length for that.

Round up your blank, leaving it about $\frac{1}{4}$ " larger than the largest diameter on your preferred shape.

I prefer to drill the tang hole prior to mounting the ferrule. You will use the hole as a center once it's drilled to ensure that the hole runs along the centerline of the handle. Replace your drive center with a four-jaw chuck and remount your blank. Spin it to check for alignment and take a rounding cut if you need to, then replace the tailstock center with a drill chuck.

For a round tang, use a bit that is slightly bigger than the diameter of the tang. Do some trial drilling on a piece of scrap to arrive at the bit you want to use. You will be adding epoxy to the hole for a round tang. For a square or rectangular tang use a bit that is just smaller than the diagonal distance from corner to corner to create a friction fit (a square peg in a round hole).

For a tapered tang, use a bit that is just larger than the tip of the tang. You can use a tapered reamer to taper the hole, or create a stepped hole with more than one bit. Trial and error on some scrap will get you a friction fit. Wait until the handle is finished before you use a reamer on the hole.

Spin the blank and crank or push the tailstock into the end to drill the hole. Be sure to occasionally back the bit out to clear the chips to avoid getting the bit jammed in the hole.

Now you are ready to fit the ferrule. With the tang hole drilled, remount the blank between centers. A cone-shaped live center in the tailstock is perfect for this. The cone will center the blank using the tang hole.

I make my own ferrules by cutting short lengths from copper pipe. Gauge the length



Be direct. The cone center fits in the tang hole, keeping the work centered. Use the ferrule to gauge the length of the turned tenon.



Almost home. Make a slight taper on the tenon, then test the fit of the ferrule.



Tap it in. Use a length of pipe to drive the ferrule on to the end of the tenon. The ferrule will shave the last bit of the tenon for a snug fit.



Make it flush. Remove the excess material beyond the ferrule, then move the cone center in.



Shaping up. As the handle takes shape, carefully taper the end of the handle to the edge of the ferrule.

and the inside diameter of the ferrule and cut a tenon to fit the ferrule. Taper the tenon ever so slightly toward the handle. When you have a near fit, use a piece of pipe to drive the ferrule on the handle.

Shape the handle using your preferred shape as a guide. Cut the end of the blank flush with the end of the ferrule, and taper the body of the handle down to the other end of the ferrule.

For round tangs you will want to add some epoxy to the tang hole. The risk here is that the epoxy will create hydraulic pressure that will split the handle. Drill a tiny hole through the wall of the chisel into the tang hole. This hole relieves the pressure and will be sealed by the epoxy as it squeezes out.

For square and rectangular tangs, insert the blade into the handle using hand pressure, then hold the handle and strike the end of it to continue seating the blade. Check and adjust the alignment between blows. Grinding any sharp corners off of the end of the tang can ease the installation.

For tapered tangs, ream the tang hole to



Drill then trim. Use a twist drill to make a hole in the leather, then trace around the taper before cutting the disc with scissors.

widen the mouth and seat the blade as you would a square or rectangular blade.

It only takes a few minutes to turn a tool handle once you get the hang of it, and the benefits accrue every time you pick up a tool that has a handle that fits ... well ... like a fine glove. **PW**

Kevin is a graduate of the Fine Woodworking program at the College of the Redwoods and the owner of Glen-Drake Toolworks, in Fort Bragg, Calif. You can get in touch with him at glen-drake.com.



A dab will do ya. A small amount of epoxy in the hole will keep the tang connected. Place the leather over the tang and drive the handle on.

Milk Paint

This traditional paint looks great on any project – and it's simple to use.

BY MICHAEL DUNBAR

Paint prep. Mix one part water to one part paint, in a wide-mouthed jar.

Woodworkers have been painting their furniture for thousands of years. During that time, they have used many different types of paints. In fact, in historic terms what you will find at the paint store is limited: oil or latex. Modern paints are also pretty limited in their appearance. To put it simply – they are boring. Old paints looked a lot nicer.

If you want to achieve a nicer painted surface on your most recent masterpiece, you're not going to find it in the paint store. Although it's a bit extreme, you could make your own paint. This means mixing a bunch

of hard-to-find ingredients. Some of the ingredients used in historical paints are poisonous and even illegal.

Happily, you do have a safe and easy-to-use option – milk paint. Woodworkers have used milk paint since antiquity. It remains a desirable finish today for the same reason it was favored by the ancients, and every generation of woodworkers in between. Milk paint is quick to apply, easy and forgiving. It results in a rich, lustrous and complex finish that improves with time. Yet it can be applied in an afternoon.

Milk paint doesn't chip like regular paints and it doesn't produce the boring, uniform color of modern products. Instead, it has subtle differences of shading that make it more like the paints used in centuries past.

As a piece of furniture finished in milk paint is used, the paint polishes where it is in contact with hands or body and takes on different levels of sheen. This is very subtle, but results in a finish that is complex and lively. Because of the way this wear plays with light, a milk-paint finish actually gets better as it ages.

Milk paint is nothing more than a mixture of lime, casein, clays and any one of a variety of earth pigments. In the past, woodworkers mixed their own milk paints using a simple formula that had been handed down from one generation to another. Today, it is far easier to buy it; I get mine from the Old Fashioned Milk Paint Company (milkpaint.com).

The paint arrives in powder form and is mixed with water. It has a distinctive earthy smell, but it is not disagreeable. There are no toxic fumes, and it can be washed down the kitchen sink. The manufacturer warns that prolonged exposure to lime can burn wet skin and can injure eyes. In 30 years of use I have never experienced any of these problems. To my mind, the finish is perfectly safe.

Milk paint is not difficult to use. However, it is very different from modern latex and oil paints. Unless you understand these differences you may not get the best results. Most of these differences stem from the fact that milk paint is water based. Oil and latex paints are much thicker than milk paint and sit as a skin on the surface of wood. There is limited penetration into the wood. When struck or scratched these paints will chip.

Milk paint has far less body. It is much thinner and is applied in much thinner coats. Also, water-based milk paint soaks into the wood. That's why antique collectors

have always dreaded stripping this stuff. The good news is that milk paint does not chip. In normal use it will only wear.

Mixing

To mix milk paint, just add water. The manufacturer recommends one part water to one part paint. My method for mixing it is simple. I use a clean wide-mouth plastic or glass jar. A wide mouth makes it easier to dip the brush. Salsa and peanut butter jars are perfect. In a pinch, I will use a small coffee can with a plastic lid for mixing milk paint. Because the mixture includes water, avoid a cardboard paint pot. The water may soak through and the cardboard may fall apart before you are done.

You can mix the paint with a stirrer driven by an electric drill. However, I just pretend I am a bartender making a martini for James Bond – shaken, not stirred. It doesn't take long to mix the paint. About a minute of shaking is more than enough. The shaking or stirring will result in a paint that is frothy and full of air like whipped cream. You will not be happy trying to use this foam. I let freshly mixed milk paint sit for about an hour. This allows the foam to settle back down into a liquid.

Because milk paint is water based, the solids will not suspend like they do in oil and latex. They settle out fairly quickly. I always keep a stirring stick in the jar. I stir before I start painting and I stir regularly during the process.



Shaken, not stirred. Simply put the lid on the jar and shake it for about a minute. The paint will be frothy at first; let it sit for an hour before applying.

Depending on the surface you want, you can either strain your milk paint or use it freshly mixed. Strained milk paint results in a slightly smoother finish. Unstrained, it is rougher to the touch. It is more matte, like an exceedingly fine sand paint. I usually do not strain, but when I do I pass the mixed paint through an old pair of panty hose. You can also buy a strainer at a paint-supply store.

A new packet of Old Fashioned Milk Paint is sealed in a foil bag. Once you open that packet the powder will slowly absorb moisture from the air. As it does, it loses some of its ability to bond. In other words, milk paint has a shelf life. For that reason, I buy one-ounce bags. If I have some powder left over, it is only a small amount. I don't feel too bad about throwing it away. The unused product will last a lot longer if you close the bag tightly and store it in a dry environment. I'm a pretty frugal guy, but holding on to an open bag of paint strikes me as penny wise, pound foolish. I feel much safer opening a fresh bag.

Mixed milk paint, too, has a very short shelf life. Simply put, it spoils. It is a good idea to use it only on the day it is mixed. If you are not able to complete the finish in one day, you can stretch the mixed paint's working life by keeping it in the refrigerator. After two days, it is like Ben Franklin's advice about fish and guests: Get rid of it.

Surface Preparation

If my project has any small holes or blemishes I fill them with Plastic Wood. This material will take the



Old and new. Milk paint is quick and easy to apply, and it ages handsomely, resulting in subtle variations in color over time.

paint. The water used to mix the milk paint will soften latex fillers, which may cause the milk paint to wrinkle. Remember, milk paint has almost no body. You can't expect it to fill small holes the way oil or latex paint will. You have to take care of any voids before you begin. If not, they will show up when you are done.

While I am waiting for the froth to settle out of freshly mixed milk paint, I take on the next step in preparing my project. The water-based paint will raise the grain of the wood. If you apply milk paint directly to a freshly sanded surface, you will have to sand again between coats. I would rather not have to do this extra sanding. So, I raise the grain before I apply the first coat. I spray the wood I am painting with water.

I use a plastic spray bottle, the type available at any hardware store. The trick here is to moisten the surface thoroughly, but not as if

you were washing a car. If the water puddles or runs, you are being too liberal.

There is another advantage to wetting the surface first. Glue spills or glue smears will prevent milk paint from bonding. You can readily see these spots on a moist surface. The glue can be removed by scraping. I use a scraper, a chisel or even a pocketknife. Once the wood is uniformly wet and all the glue is removed, allow the wood to dry. On a warm day or in a heated shop this happens very quickly. If you are in a hurry, you can speed things up with a hair dryer. Do not put your project out in the sun; that may cause parts to warp or split.

Finish-sand the wood and dust it with a clean, soft cloth. You also can use a tack rag.

Milk paint dries very quickly and unless a spill or splatter is wiped up immediately it becomes difficult to remove. I protect my workbench by putting down a layer of build-

er's paper or by cutting open a large cardboard box. I also wear an apron to protect my clothes. I don't bother with gloves. The paint washes off my hands easily.

Brushes

I prefer to apply milk paint with a natural-bristle brush. While nylon-bristle brushes are fine for thicker latex and oil paints, they do not do a good job of holding the thin milk paint. I buy the cheapest brushes available, the ones with unfinished wood handles and blonde bristles. They sell for about \$1 apiece and can be found at most paint, hardware and craft-supply stores. These are low-quality brushes, which is reflected by their low price. However, they are fine for this job.

When applying the first coat of milk paint, lots of bristles will pull loose and stick in the paint. I flick the bristles out with my fingernail. If I miss any, they brush away



Spray. Moisten your workpiece surface thoroughly (but not so much that the water runs) to raise the grain.



Glue alert. In addition to raising the grain, the water also highlights areas from which glue needs to be removed before painting.



In a hurry. If you don't want to wait for the wood to dry, speed up the process with a hair dryer.

when the paint is dry and do not leave a blemish. By the time you have finished applying the first coat and washed the brush, almost all the loose bristles have dropped out. Bristles are less of a problem with the second coat.

How wide a brush to use depends on the surface. For a piece of furniture with a lot of small, shaped parts, such as a Windsor chair, I like a 2" brush. On wider surfaces, such as a chest or tabletop, I use up to a 4" brush.

The manufacturer recommends using a foam brush. They probably work. I have tried them, but never liked them. I guess I'm just an old-fashioned kind of guy. A brush should have bristles.

First Coat

The manufacturer recommends moistening the surface before applying paint, as this makes the application easier. While

I do wet the wood to raise the grain before finish-sanding, I skip this recommended step. Yes, it is easier to apply the first coat to a moist surface. However, in my experience the water used to moisten the wood thins the first coat so much that a third coat is usually necessary for complete coverage. So, I would end up doing more work in the long run.

Because milk paint is nearly water thin, it draws into the wood almost as quickly as it makes contact. This means that you can't draw it as you can oil or latex paint. The action for applying the first coat is more like daubing. Do not apply so much that the milk paint puddles. This is far too much paint. Use less paint and pull it with the brush to work it into a thin film. You do need to work it so it spreads and is absorbed uniformly. In this way too, milk paint is different. It has to be worked vigorously with the brush.

I emphasize this point for an important reason. Read the next couple sentences, then read them again. Most of the problems people have with milk paint are caused by trying to flow it on like latex or oil paints. If the milk paint puddles, you can end up with a blotchy surface, even after several coats. I cannot stress enough the need to work the paint. Remember, while easy to use, milk paint is a very different product than you're probably used to. Also, while applying the paint, remember to stir it regularly.

Because milk paint soaks into the wood, it is difficult to use it to cut in – the process of drawing a fine line of paint with a brush. It is not impossible to pick out areas or parts in a different color, but you do have to be careful. It is easier to paint parts a different color before they are joined. While this is not possible with a lot of furniture, it is a helpful trick when you can use it.

Allow the first coat to dry completely. Milk paint dries through evaporation. So, drying time depends on how warm and dry the air is in your shop. The paint takes a lot longer to dry on a rainy summer day than in a heated shop in the winter. This means that when painting a large piece, where you began painting has often dried thoroughly long before you are done. When this happens you can apply a second coat in as little as an hour. Areas that are not fully dry are very easy to see. They are much darker than the dry areas. So, there is little doubt as to when you can move on.

Once again I have to emphasize a point and warn you. When dry, the first coat will look like something the cat dragged in. Until you become familiar with this product, you



Thin coat. Apply a small amount of paint and pull it with the brush to a thin, uniform coat.



Don't panic. The first coat will look a splotchy and uneven.



Smooth. If you want a smooth surface on your piece, after the first coat dries rub it down with #0000 steel wool, or a green Scotch-Brite pad.

will be sure you have ruined the furniture you spent so much time making. The first coat of milk paint is splotchy and uneven. It is also dead flat, like chalk. This is no time for a faint heart. Be brave. Have faith.

First, rinse out your brush with running water and store it in a jar of water. Remember milk paint dries fast. If you do not keep the brush wet, the paint will dry and you will not be able to use it for the second coat. That mistake could cost you a whole dollar.

You now need to decide what type of finish you want. If you want a very smooth surface, rub down the first coat. I use a fine Scotch-Brite pad. You can use #0000 steel wool, but it leaves a lot of black metal filings. No matter what fine abrasive you use, the excess milk paint will create a lot of dust. You have to clean up. You can use a tack rag, but it is probably overkill. It is only dry dust; you can brush it away with a clean, dry brush. If the piece is small enough, you can blow the dust away or even turn the piece upside down and tap it to let gravity do the job.

Second Coat

Before beginning the second coat, remove the excess water from your brush. I do this by wiping it over the paper layer on the bench. You could also use a paper towel.

The first coat of milk paint seals the wood. This makes it a lot easier to apply the second coat. Even though it is water thin, you can draw the second coat in a manner similar to oil and latex paints. However, do not try to flow it on. You still need to work the paint to spread it evenly and thinly. You can still make it blotchy by slopping it on. You want to avoid puddles and runs. Because the second coat is not being absorbed almost as fast as it is applied, it will take a lot less time than the first coat to complete the job.

Like the first coat, the second coat of milk paint will give you fits of panic. While the coverage is now more uniform, the paint again dries dead flat. It is flatter than anything you have ever seen. It has no luster or highlight. You can still see brush overlaps and areas that you touched up. Again, have courage.

If you want a very smooth surface, rub the second coat too. You can use a very fine Scotch-Brite pad. You also can do this by rubbing hard and vigorously with a soft cloth, such as a dry face cloth.

You will not generally need a third coat. If you want to apply one, follow the instructions for the second coat.



Second coat. The first coat seals the wood, so the second goes on more easily. But again, spread it evenly and thinly to avoid blotching.

Overcoat

The paint needs to be sealed with a topcoat. This final surface has several purposes. First, the topcoat pulls the whole finish together by giving it a deeper, darker, rich color. It also will provide luster. Second, it protects the paint. Raw milk paint will water spot, and these spots are hard to remove.

Over the years, I have tried several different topcoats. I have finally settled on natural (untinted) wiping varnish.

I pour the wiping varnish into a wide-mouthed jar or a coffee can. I apply it with

another of those cheap natural-bristle brushes. When doing this, be liberal. Be sure to wet all the painted surfaces. As you brush on the varnish, any overlaps and thin areas in the milk paint will stand out for several minutes, again causing you anxiety. But these problems that first appear as blemishes begin to blend together into a uniform color.

Let the wet varnish stand for about 10 minutes. Then, wipe off as much as you can with a soft, absorbent rag. Be careful with the rag. It can start a fire. Behind my shop I have an incinerator for getting rid of shavings and scraps. I throw oil-soaked rags in there, too. If you don't have an incinerator, spread your rags on the pavement to dry.

Let this thin coat of varnish dry. Depending on the conditions, this could take as little as a couple hours. Or, you may have to wait until the next day. One coat of wiping varnish will dry to a very pleasant matte finish. If you want more sheen, apply a second coat, just as you did the first. The second coat will usually take longer to dry. Once it's hard, I often apply a coat of Butcher's wax.

I think of milk paint as being like a human face. A young face is perfect and beautiful, but it has no character. The interesting features we think of as character take time to develop in a human face. That is how it is with milk paint. This is a finish that gets better with age. It continues to become more subtle and complex. Use your newly finished piece of furniture as you normally would. Enjoy how the finish develops with time. Like love, the best part of milk paint is growing older together. **PW**

A chairmaker since 1971, Michael is the founder of The Windsor Institute in Hampton, N.H. (thewindsorinstitute.com).



Topcoat. An untinted wiping varnish, applied liberally, will add a deep, rich look and luster, as well protect the paint.

CAM Marking Gauge

BY JIM CRAMMOND

On April 21, 1868, the United States Patent Office issued Patent Number 76,884 to Wessel Brodhead for an improvement to the field of carpenters' marking gauges. Brodhead developed a tool that used a simple, elegant method for securing the bar to the head or fence of a marking gauge. Instead of the more common thumbscrew or wedge systems, this gauge took advantage of a cam-shaped bar that needed only a slight twist to lock itself to the fence.

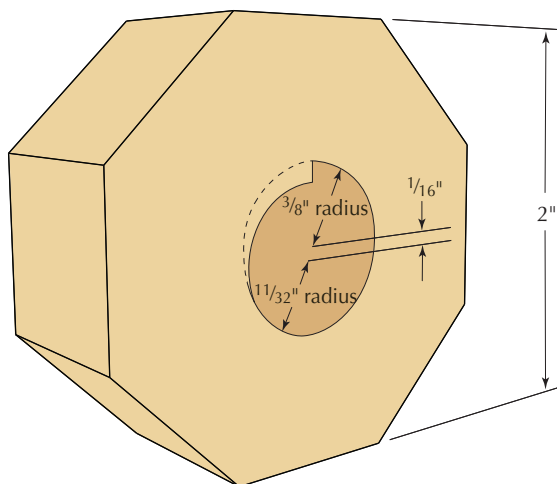
Brodhead's idea became a reality when the Star Tool Co. of Middletown, Conn., began manufacturing this style of gauge in 1872. Though the company was only in existence from 1872 to 1881, the gauge must have been a popular item as a fair number of them have survived. According to advertisements from Star Tool, it produced marking gauges, cutting gauges, mortise gauges and panel gauges that used this securing system. The basic grade of tool was made of beech with premium-grade tools offered in mahogany, boxwood and rosewood.

While these gauges are available on the antique tool market, they are sometimes hard to find, and good examples can be pricey. Because of this, I decided to reproduce a twist-lock gauge for my shop. I have since made examples of three of the styles of gauges that were produced by Star Tool.

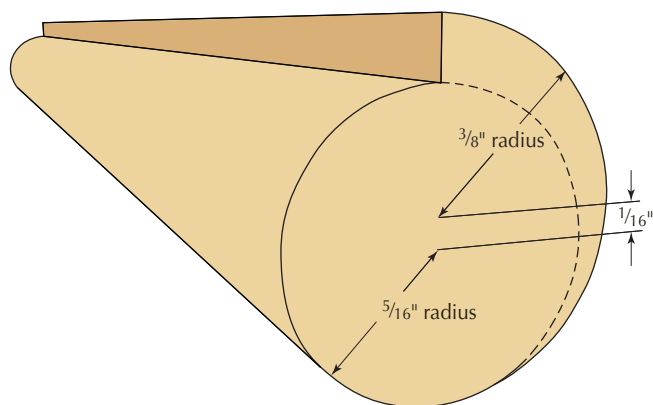
A marking star. This shop-made marking gauge is a copy of the cam-shaped-bar gauge the Star Tool Co. sold in the late 19th century. It's simple to make, and helps you use up those scraps you've been hoarding.



A useful weekend project you can make with stock from your scrap bin.



GAUGE HEAD



GAUGE SHAFT

A Weekend Project

Making one of these marking gauges is a fun, short project that can be accomplished in a couple evenings or during a weekend. Because the construction doesn't require a large amount of material, you can use a stable wood from your cut-off bin or buy something exotic for little cost.

Begin by making the bar. The largest diameter of the bar on the Star originals is $\frac{3}{4}$ ", and the length for the marking and cutting gauges is $8\frac{1}{2}$ ".

Rough out the bar stock to a $\frac{7}{8}$ "-square cross section at least 20" long. I find that the longer length makes it easier to deal with the stock when making the eccentric shape. (This also allows you to make a second gauge with little additional effort.)

To make the stock round, it can be turned on a lathe down to $\frac{3}{4}$ ". Or you can first make

an octagon with a spokeshave, then true the piece from end to end using a $\frac{3}{8}$ " hollow plane to ensure that it is straight and $\frac{3}{4}$ " in diameter.

The final step for making the bar is to make the round section into the desired cam shape. I do this by first making a line along the length of the bar at 12 o'clock with a marking knife, then marking both ends with a semicircle drawn with a compass. The radius of the circle is $\frac{5}{16}$ ", and the center of the circle is lowered from the center of the stock approximately $\frac{1}{16}$ ".

The resulting circle will blend in with the circumference of the stock between 3 o'clock and 6 o'clock. The original patent drawing illustrates this fairly well. Carefully pare away the bulk of the material outside of the smaller circle between 6 o'clock and 12 o'clock with a chisel. Use a shoulder plane

and $\frac{3}{8}$ " hollow to fair the curve down to the circular lines on the ends.

Make the Head

On the original Star Tool marking gauges, the head was an octagon, $\frac{7}{8}$ " thick and 2" from face to face. I make these by milling stock $\frac{7}{8}$ " x $2\frac{1}{8}$ " x 6". This allows you to clamp the piece easily while working on it and again facilitates making a second gauge.

Draw two 2" octagons on the stock and locate their centers. Draw a $\frac{3}{4}$ "-diameter circle with the same center as the octagon. Drill an $\frac{11}{16}$ " hole centered $\frac{1}{16}$ " below the center of the octagon. It is important that this hole is perpendicular to the face. Using a coping saw, saw a kerf at 12 o'clock from the drilled hole to the drawn circle. Using an appropriately sized out-cannel gouge, remove the material inside of the drawn circle between 6 o'clock and 12 o'clock (or left of the center). To avoid blowout on the opposite face, work from both sides of the head but remember that on the second side you will be working between 12 o'clock and 6 o'clock (or right of the center). This process is actually much more straightforward than it sounds. Using a smooth-cut round file, fit the bar to the head so it slides smoothly from one end of the bar to the other.

Finally, cut out the perimeter of the octagon. Because these are fairly small, use a method that you feel can be accomplished safely. I use a miter box and miter saw, but a scroll saw or backsaw also should result in a successful outcome.

Cutter Installation

The last part of the process is to install the point or cutter into the shaft of the marking



Octagon. Begin by making the bar stock. You can turn it round to $\frac{3}{4}$ " on a lathe, or use a spokeshave to make an octagon, then true it with a $\frac{3}{8}$ " hollow plane to $\frac{3}{4}$ " diameter. Or, use a length of dowel.



Fair curve. After paring away the bulk with a chisel, use a shoulder plane and $\frac{3}{8}$ " hollow to fair the curve and create the locking shoulder.



Cope. With a coping saw, make a kerf from 12 o'clock in your drilled hole outward to the marked circle.

gauge. With the bar locked in place, draw a vertical line on one end of the gauge. For a marking gauge, I make the point from a broken $\frac{1}{8}$ " or so drill bit sharpened to my preferred profile with a file.

Using the vertical line on the end of the gauge as a guide, drill a slightly undersized hole $\frac{1}{4}$ " from the end of the bar and insert the point. For a cutting gauge, I make the cutter $\frac{1}{4}$ " wide out of a piece of tool steel, old hack saw or similar blade, grinding it to the appropriate size and shape ($\frac{1}{4}$ " x $1\frac{1}{4}$ " with a slightly cambered cutting edge). I then make a wedge with a 10° bevel out of $\frac{1}{4}$ " square stock.

To make the mortise for the cutter and the wedge, drill a $\frac{1}{4}$ " hole in the bar using the vertical line as a guide then square the hole with a $\frac{1}{4}$ " chisel. Fit the wedge and cutter by inserting both into the mortise from the top and observing the gap between the side of the mortise and the wedge on the bottom. Use the $\frac{1}{4}$ " chisel to pare this amount of material from the top of the mortise at a 10° angle.

Finish the gauge using your preferred finish for tools. I like to give these tools several coats of boiled linseed oil, sanding with #400-grit to #600-grit wet-and-dry sandpaper just after applying the oil. After the oil is completely dry, I apply several coats of paste wax. **PW**

Jim is a civil engineer by day, and practices hand-tool woodworking. His favorite styles are Queen Anne and Federal. Jim is an active member of the Society of American Period Furniture Makers and the Mid-West Tool Collectors Association.



Gouge. Use an out-cannel gouge to create a fair curve from the smaller to the larger circle, to cut the shoulder that locks on the shaft.



Smooth. Use a smooth-cut round file to smooth the interior of the gauge head so it rides smoothly on the shaft.



Perimeter. I use a miter box and saw to safely and accurately cut out the head, but a scrollsaw or backsaw also would work.

Shoji Cabinet

BY RYAN SHERVILL



Inspired by a Japanese screen, this cabinet uses traditional and modern joinery.

Designed to divide a room, the shoji screen is both a practical and artistic piece of furniture that's often found in Japanese homes. It was a shoji screen that served as the inspiration for this bookcase. Designed to be very open, this piece is as at home in the center of the room as it is against a wall.

For the construction of this bookcase I combined the traditional with the modern – not only in the design, but also in the construction methods. A spin on Asian design, this bookcase uses modern joinery techniques and materials to their fullest extent. Traditional mortise-and-tenon joints work in tandem with modern materials, fasteners and glues to create a piece of furniture that will not only last for generations, but also comes together easily. This project also makes use of biscuits, dowels and glued-in-place plywood panels, along with more traditional methods, to prove that sometimes a modern approach can be beautiful, strong and functional.



Light and airy. The combination of maple and cherry imparts a lightness to this cabinet, while the opened area near the top and bottom, along with the ventilated shelves, make it airy.

A Modern Approach

The bookcase sits on four gently curved maple legs. To make the legs, select and dress your material to a final thickness of 1 1/4" then clean up the edges. Crosscut the stock to a final length of 61" then rip each piece in half to produce the four legs.

Mark out the curve on one of the rear legs. I marked this curve with a strip of flexible stock with the top and bottom measuring 2 1/2" wide and 1 1/4" at the center.

Rough cut the first leg with a band saw or jigsaw, and complete the curve by sanding up to the lines with a spindle sander. Use this leg to mark the curve on the remaining three leg blanks, but don't cut them out yet.

The front legs each get two 3/8" x 2 1/8" x 1 1/4"- deep mortises. It's easier to mark and cut these mortises while the stock is square. Locate the mortises and make sure the locations mirror each other before you begin.

With the mortises complete, rough-cut the remaining legs at the band saw. Adhere the finished leg to the blanks with double-sided tape to serve as a template, then remove the waste with a couple light passes with a bearing-guided flush-trim bit in the router table – it's a quick operation and results in identical curves.

Due to the curve in the leg, there's a possibility of tear-out as you begin to transition into the exit part of the curve. An upcut-spiral flush-trim bit is a big help here. But if you are limited to a traditional bit, you can minimize tear-out by ensuring your bit is razor sharp and by taking multiple light passes. Or you can stop at the midway point in the leg, then climb-cut the remaining portion.

Spectacular Panel Strength

With the legs done, it's time to construct the front rails and the five panels that make up the sides, back and doors of the case. The panels are all constructed of 3/4" cherry with glued-in-place maple-veneered plywood. Because the incredible strength of glued-in-place panel construction comes from the ply itself, the joinery between the stiles and rails doesn't need to be exceptionally robust nor complex. I chose to use two 3/8" dowels



Shape a gentle curve. Use a spindle sander to shape one leg exactly to your layout line.



Identical curves. Use the shaped leg, along with a router and pattern bit, to create the remaining legs.



A furrow for your panel. A powerfully quick method to form grooves for the plywood panels is a sharp 1/4" router bit and a nice router table setup.

per joint. A dowelled joint is both strong and easy to make with a quality jig.

Begin by cutting the rails for the front of the cabinet and mark a line 1 1/4" from each end. That's the shoulder of the tenons. Using either the table saw with a dado stack or another trusted method, create a 3/8" x 1 1/4" tenon on each end. Test-fit the tenons into the mortises in the legs, then make any adjustments with a shoulder plane or #150-grit sandpaper wrapped around a flat block.

Once the tenon fit is correct, go ahead and cut the 1"-deep curves in each piece. Begin and end the curve 1 3/4" from each end. (You will need that 1 3/4" straight section to accept the knife hinges later on.)

The rear panel is simply a plywood panel glued into grooves in the stiles and rails. Begin by cutting the rear-panel parts (all but the plywood) to the final dimensions. Mark the 1"-deep curve on the top and bottom rails, then cut the curve at the band saw. With a 1/4" bit in the router table, cut 1/4"-wide x 3/8"-deep grooves centered in the stiles and remaining rails. The grooves in the stiles are stopped grooves. Begin the cut 6 1/16" from the top, then end 6 3/4" from the bottom. Mark your start-stop locations on

your stock and make corresponding marks on your fence to show where to start and end your grooves. With the grooves cut, locate and create the dowel holes for joinery.

Dry-fit the frame, determine the plywood panels' sizes then rip the plywood to final dimension. Fit the plywood into the frame. For the strongest assembly, your plywood should fit perfectly into the grooves with no play. Check for square and label each part with a pencil to make re-assembly easier.

Next, mark the location for your dowels then drill the holes. To assemble the rear panel, apply glue the full length of all of the grooves and to the ends of your rails. Insert your dowels with more glue and clamp the assembly together until the glue is dry.

The side panels are constructed in exactly the same manner as the back panel. The only variation is in the length of the rails (cut these to 9 1/2" in length) and the fact that the top rails – those not accepting the plywood panel – are left without the curve found in the back assembly.

Decorated Doors

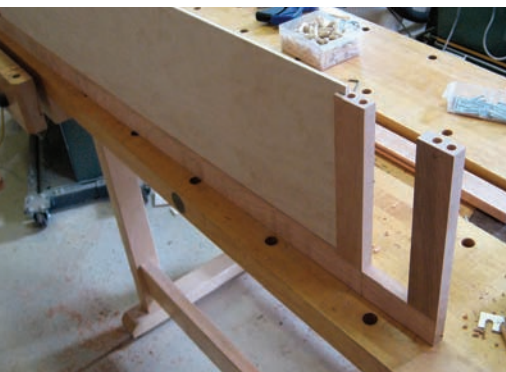
The doors share a similar construction to the other panels, but there are some differ-

ences. Unlike the other three panels, there are no top or bottom rails, and the top ends of the stiles will be trimmed to final length during assembly.

Cut your stiles to an initial length of $55\frac{1}{4}$ " and the four rails to $12\frac{3}{4}$ ". Then mark and cut the $\frac{1}{4}$ " grooves in all of the pieces. The stopped grooves in the stiles are $46\frac{3}{8}$ " long, starting at $3\frac{15}{16}$ " from the stile bottoms. Cut the plywood panels to size, then test-assemble the doors. Check to make sure everything comes together nicely then mark and drill the holes for the dowels. Apply glue in the grooves and the holes, assemble the doors, add clamps and allow the glue to dry.

In order to add to the organic feel of the design, I incorporated a raised sea grass motif into the panels. In the spirit of keeping things easy, I chose to do this by using an appliqué technique – or as I like to call them, “onlays.”

The blades of grass are $\frac{3}{16}$ " x $\frac{3}{16}$ " strips of scrap cherry that I planed to size then brought to shape using a spokeshave, scrap-



In the process. Here you can see a side panel being assembled. Glue at the joints is common, but a full bead around the panel is only used with plywood.



Artistic flair. Shapely pieces of scrap become appliques that add life to your cabinet.



Scads of adjustment. A dowelling jig makes easy work of the many holes that need to be drilled for the adjustable shelves – or you could use a piece of pegboard. Whichever you select, make sure the holes are equally spaced so your shelves lie flat.

ing plane and a stationary belt sander. (Be sure you leave a flat surface on the bottom of each blade to facilitate attachment.)

The formed and sanded individual blades are then mounted to the surface of the plywood panels with glue and held in place with strips of masking tape or a few 23-gauge pins driven at an angle. Arrange the strips to mirror mine or make your own design. Most of the blades of grass bend easily enough, but for shorter pieces you may want to prebend them to shape before applying to the panels. The easiest way to do this is to hold the strips over a pot of boiling water, and bend them to shape while they are in the steam. Hold them in the approximate shape you would like for 30 seconds after removing from the steam, and they will hold with minimal springback.

Ventilated Shelving

With the panels and doors complete, it's time to construct the bottom and shelves for the case. To keep the open feel I chose to avoid solid shelves, and instead went with cherry frames with $\frac{3}{4}$ "-square maple slats that are arranged inside and doweled in place. For each shelf, mill the pieces for the rails and the ends, then each shelf requires six pieces of maple, each with a $\frac{3}{8}$ " hole centered in its end to accept a fluted dowel.

Drill matching holes in the end pieces to accept the slats (align the holes for equal spacing) then drill dowel holes, two per end, to join the ends to the rails.

With enough stock cut and drilled to assemble five units (four shelves and the bottom), go ahead and assemble the units – start with the slats and finish with the front and rear pieces. Clamp the units and allow the glue to dry. Once dry, sand the assemblies so the slats are flush with the frames and set them aside.

Preparation Before Assembly

The next step is to drill the holes in the side panels to accept the adjustable shelf pins. I used my dowelling jig equipped with a bushing to drill a series of evenly spaced $\frac{1}{4}$ " holes. Start the holes 12" down from the top of the panel.

Alternatively, you can use a strip of pegboard and a $\frac{1}{4}$ " drill bit to locate the holes. The only requirement is that each row of holes is identical and that the shelves sit level after assembly. (Make sure you choose a hole size that accommodates the pins you select.)

The last thing to do before bringing everything together is to cut the mortises in the front rails for the knife hinges. This step is far easier to do on individual pieces rather than once the carcass is assembled. Double check that your rails are oriented correctly then put your offset hinges temporarily in place.

Trace the outside with a sharp knife then chisel out the recess to accept the hinge. Stop at a depth where the hinge body is just slightly proud of the wood's surface. Once satisfied with the fit, drill for the hinge screws. This operation is far easier at this point than it is after assembly.

Supplies

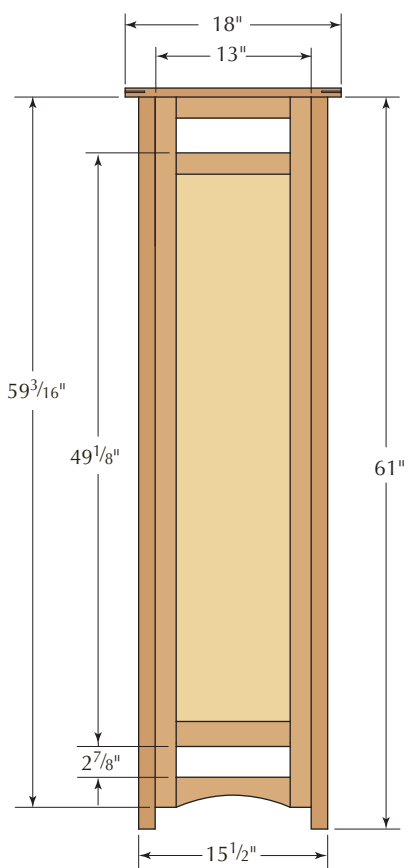
Lee Valley
800-871-8158 or
leevalley.com

1 pkg. ■ brass paddle supports
#63Z06.04, \$8.30

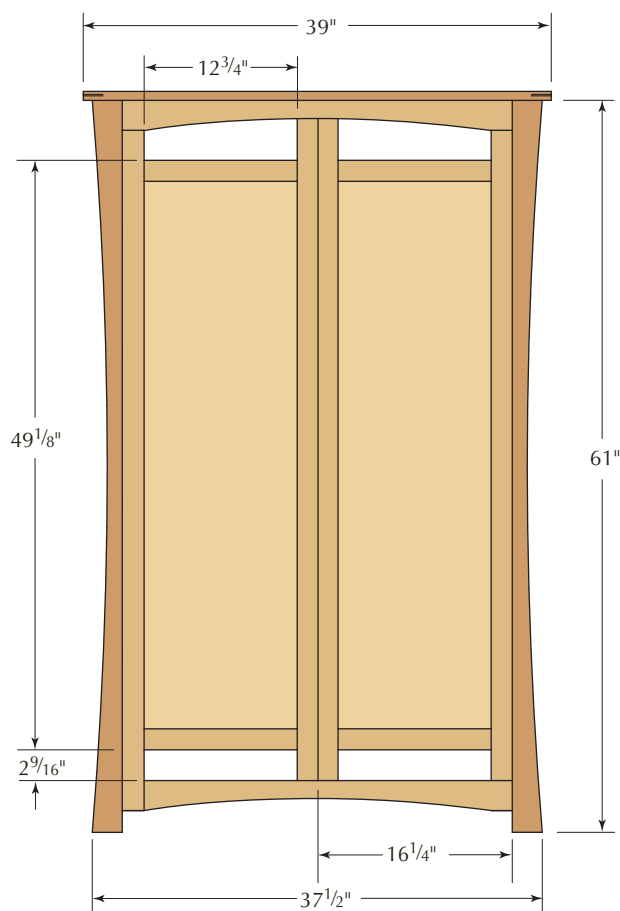
2 ■ Brusso bullet catches
#01B10.08, \$7.40

2 pr. ■ Brusso double offset knife hinges
#01B14.05, \$22.30

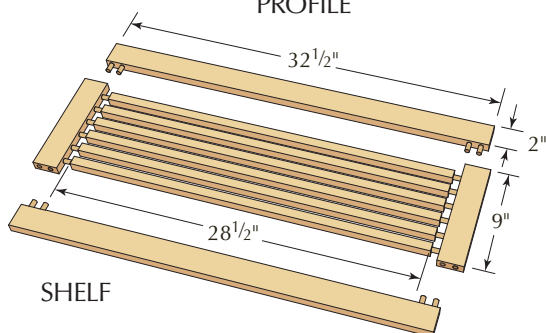
Prices correct at time of publication.



PROFILE



ELEVATION



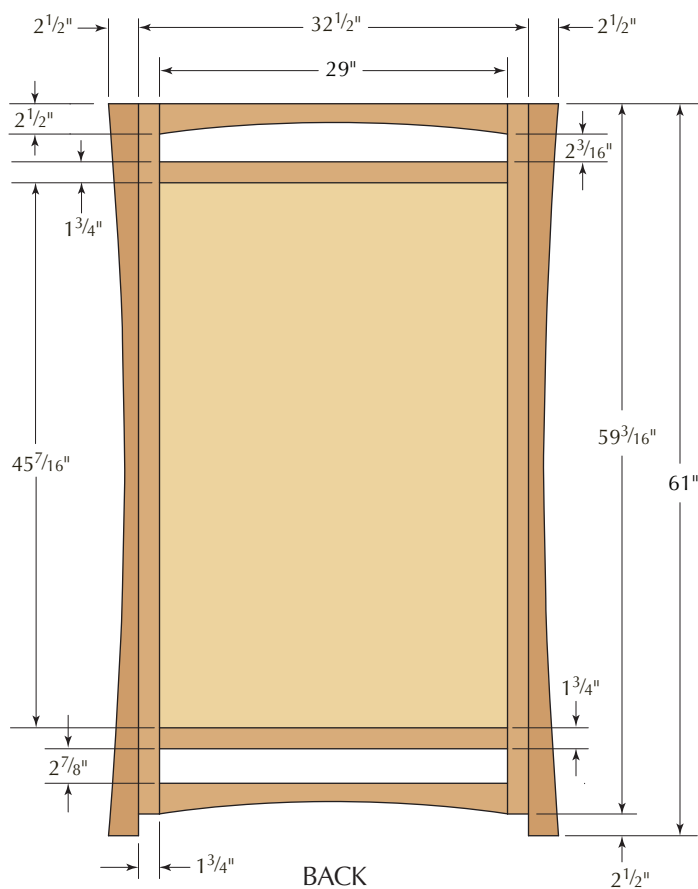
SHELF

Bring it All Together

With five panels, four legs and five shelf units, it's time to bring them all together.

To assemble the case, I use dowels to attach the panels to the legs. Not only do dowels make a strong joint, they aid in the alignment of the pieces. Another benefit is the ability to completely test-fit the carcass without adding glue.

If you prefer to not use dowels, you can use biscuits to help alignment. Or you can carefully clamp the pieces in place with no reinforcement at all. Because these are long-grain-to-long-grain joints, a simple glue joint is sufficiently strong. However, if using the glue-only method, make sure you pay very close attention to the alignment of the panels with the legs. Start by attaching the legs to the front and rear assemblies. Add clamps until the glue is dry.



BACK

The next step is to attach the sides to the front and rear assemblies and insert the bottom. If you're using dowels, position them in such a way that at least one dowel passes through the tenon in the front assembly. This way the dowel not only serves to hold the side panels in position, but it also creates a pegged-tenon joint in the front assembly. Test-fit the front and rear assemblies with the side panels.

When bringing all of the pieces together, begin with the case bottom. Apply glue to the edges of the bottom unit then clamp it in place. Next, add glue to the front and back assemblies then fit them to the side panels.

Add clamps and allow the glue to cure. Once the glue has dried, reinforce the bottom. Glue and screw cleats along the intersection of the bottom and panels, ensuring the cleat is glued to both the panels and the bottom.

Top it Off

The top is a $\frac{3}{4}$ "-thick maple panel in a mitered-corner frame of cherry. Cut the maple panel to width and length according to the cut sheet, then create a $\frac{1}{4}$ " centered tongue around the perimeter of the panel using a dado stack, or handplanes if you prefer.

Cut the top-frame pieces to size, miter

the ends at 45° then mill a $\frac{1}{4}$ " x $\frac{3}{8}$ " centered groove on the inside edges of the four pieces.

Wrap the frame around the center panel and ensure you have $\frac{1}{8}$ " of expansion room between the panel and the frame. Next, apply glue to the ends of the miters and a 2"-long or so bead at the center of each end of the panel's tongue – the glue on the end grain will lock the panel in place, but still allow it to expand and contract along its width. Keep the panel centered in the frame and allow the glue to fully cure.

I used splines to reinforce the joints. To cut the slots for the splines, I built a simple



A strong hold. Long-grain-to-long-grain joints have plenty of hold once you get things located. A few well-placed dowels work wonders to align and reinforce the joint.



The case comes together. To fit the side panels between the front and back assemblies is not a challenge. But throw the case bottom into the mix and the balancing act begins.



Keep them centered. The key to a perfect fit is to keep the grooves in the middle of the top's frame pieces, and to work with straight, flat material.



Jig it up. Splines reinforce the mitered corners on the top unit. To cut the slots, it's best to make a jig that slips over your table saw fence as it holds your assembly at a 45° angle.

sled that allows the assembled top to be carried over a 1/8" sawblade. Center the groove and make one pass over each corner. Then make splines to fit the slots. Add glue and slip the splines in place. When the glue is dry, remove the waste material then sand or plane the splines completely flush.

The top is sized to fit the cabinet in such a way that both the center panel and the frame are independently attached to the rest of the cabinet. The center panel is doweled to the side rails, while the cherry frame is glued in place to the front and rear rails.

Drill a centered 3/8"-dowel hole in the top of each side rail and insert dowel centers. Gently position the top so the overhang is set at 2 1/2" at the sides and 1 3/4" at the front. Push the top down to mark the location for the mating dowel holes. Drill the matching holes then add glue and insert the dowels.

Next, run a bead of glue along the top edge of the front and rear rails, and also into the dowel holes in the side rails. Bring the top down into position. Use clamps to hold the top until the glue is dry.

Fit the Doors and More

Fitting the doors requires some trial and error because you need to match the stile lengths to the opening while taking into account the amount of reveal left on your hinges. The easiest way to approach this is to begin by mortising for and installing the lower knife hinge and sliding the door into position. Use a sharp pencil from the inside

of the cabinet to mark where the tops of the stiles overlap the front rail of the cabinet then trim to that line.

Gradually remove material until the door fits properly then install the top hinge. After the hinges are installed and the doors are mounted in the cabinet, check that the doors close. You will likely need to adjust the width of the inner stiles a small amount to provide the clearance needed to prevent the doors from binding against one another. Work to achieve a perfect fit and an even reveal.

With the doors fitting, you need a way to keep them closed. You can make or buy a magnetic catch, or you can install 1/4"-diameter ball-bearing bullet catches, as I did. Locate and drill the holes for the bearing portion, centering them on the bottom rail. Carefully mark and drill the matching hole in the bottom of the inside door stiles, insert the hardware and test the function. Make

any adjustments required then remove the hardware until after finishing.

The Finish Line

To maintain the contrast of the maple against the cherry, I used Target Ultima 6000, a water-based lacquer, as my topcoat to avoid the amber hue from oil-based finishes. Apply four coats of lacquer and scuff sand between coats. Once the finish is fully cured, go over the entire piece with #0000 steel wool to remove any imperfections and knock the finish back to a nice semi-gloss. Follow up with a coat of paste wax, then move the cabinet to its new home. **PW**

Ryan is an award-winning woodworking and outdoor writer who lives in the Georgian Bay Region of Ontario, Canada. When he's not outdoors enjoying the forests and waters surrounding his home, you can likely find him in his rural workshop building custom furniture for clients located throughout North America.



No nails needed. The frame of the top is glued to the front and back panels while the top's panel is doweled to the cabinet sides. Get your clamps ready.

Shoji Cabinet							
NO.	ITEM	DIMENSIONS (INCHES)			MATERIAL	COMMENTS	
		T	W	L			
❑ 4	Legs	1 1/4	2 1/2	61	Maple		
❑ 2	Front rails	3/4	2 1/2	35	Cherry	1 1/4" tenon both ends	
Back Panel							
❑ 2	Back stiles	3/4	1 3/4	59 3/16	Cherry		
❑ 1	Top rail	3/4	2 1/2	29	Cherry	Curved edge	
❑ 1	Bottom rail	3/4	2 1/2	29	Cherry	Curved edge	
❑ 2	Inner rails	3/4	1 3/4	29	Cherry		
❑ 1	Back panel	1/4	29 3/4	46 3/8	Maple plywood		
Side Panels							
❑ 4	End stiles	3/4	1 3/4	59 3/16	Cherry		
❑ 2	Bottom rails	3/4	2 1/2	9 1/2	Cherry	Curved edge	
❑ 2	Top rails	3/4	1 3/4	9 1/2	Cherry		
❑ 4	Inner rails	3/4	1 3/4	9 1/2	Cherry		
❑ 2	Side panels	1/4	10 1/2	46 3/8	Maple plywood		
Doors							
❑ 4	Door stiles	3/4	1 3/4	55 1/4	Cherry	Trim to fit opening	
❑ 4	Rails	3/4	1 3/4	12 1/4	Cherry		
❑ 2	Door panels	1/4	13 1/2	46 3/8	Cherry		
Shelves & Bottom							
❑ 10	Stiles	3/4	2	32 1/2	Cherry		
❑ 10	Ends	3/4	2	9	Cherry		
❑ 30	Slats	3/4	3/4	28 1/2	Maple		
Top							
❑ 2	Rails	3/4	2 1/2	39	Cherry	45° mitered ends	
❑ 2	Ends	3/4	2 1/2	18	Cherry	45° mitered ends	
❑ 1	Panel	3/4	13 5/8	34 5/8	Maple		
Miscellaneous							
❑ 2	Long cleats	3/4	3/4	31	Cherry		
❑ 2	Short cleats	3/4	3/4	13	Cherry		
❑ 70lf	Grass blade	3/16	3/16		Cherry	Rounded, one side flat	

One for the Road



A cabinetmaker's tool chest
that's ready to travel.



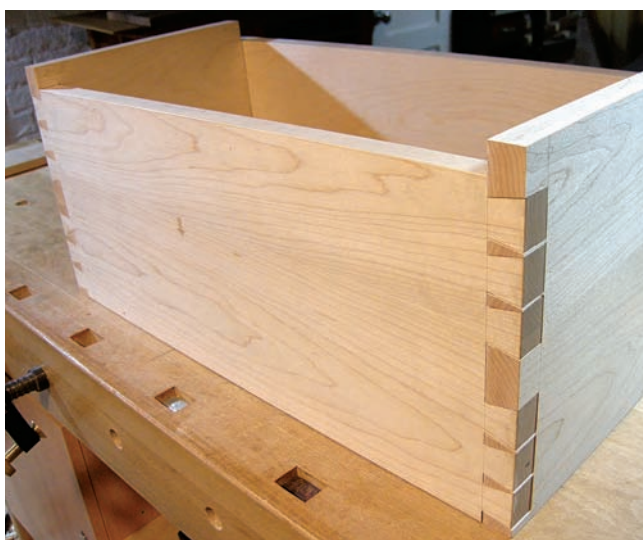
Small but mighty. This tool chest will hold a surprising amount of hand tools and features some handy “on the road” benefits. In the “open” picture above, you can see the backsaw holders, the shooting board on top and the cam clamps that are used to secure the chest to any surface.

BY TOM FIDGEN

When I think of a tool chest, I think of a carpenter's box, usually open and inviting, a little rough perhaps but clearly made by the hand. Think of Roy Underhill merrily skipping over the stream ... remember the toolbox he was carrying? What I've come up with is a toolbox, made entirely by hand, that is both practical and traditional in construction. Well, sort of ...

Do you need to carry tools? Are you going to be on a jobsite outside of your workshop? This chest will be manageable and hold most of your workshop essentials while incorporating some unique and practical design elements.

For starters the sliding lid, (captured in dados) pushes off the back and is held open to access the interior. While in the open position the lid serves as a shield to cover your two backsaws that are safely held on the exterior back with a protective shelf underneath them. This turns into



A tale of tails. This is a typical dovetail layout – but for visual interest I simply refrained from cutting out the center tail after marking.



A bit of choice. You can use a bit and brace to remove the majority of the waste in a dado.

a little shelf to place things like tiny screws you'd surely lose on-site if you didn't have such a dedicated area to toss them.

It has a built-in shooting board, and a workspace complete with surface clamp and miter hook that will get all of the applause from your fellow craftsmen on site. I don't know how many times I've been installing a cabinet or perhaps some finish moulding somewhere, and a makeshift bench surface, saw hook and shooting board would have been really handy – it's also nice to rest your arse on the edge from time to time. It's imple in form, as a tool chest should. We'll get started with the basic box so we can get on to some of those unique design elements.

The Carcase

Whether you're using four wide planks or joining up some narrower widths, assemble the four main carcase components after working up your cutting list from the illustrations (yes, it's an important part of the process!). Those pieces are the front, back and the two ends, or sides, if you will.

The front corner joinery will be through-dovetails; the back has a tenons housed in stopped dados. The sides will continue past the chest back, creating a kind of shelf location where two backsaws will live. Follow your through-dovetail procedure and lay out, cut and dry-fit the front to the side pieces.

To create this “staggered” or “broken” dovetail pattern, I laid out the entire width of the pieces as per normal, then simply refrained from cutting out the center tail after marking. When you scribe the tail board over to the pins, it'll be business as usual.

This break creates some visual interest and actually saves you time in construction! If all is well in dovetail land we can disassemble, mark and scribe the interior dado to house the back-panel tenon.

Once I have the bulk of the waste removed I like to take my Japanese Dozuki, (yes, I said pull saw ... this is one application where a Western-style saw would not be appropriate) and by laying the saw plate in the narrow shoulder of the stopped dado, draw the saw back toward me to begin establishing the depth of the dado. Again this is just something I like to do to help with tear-out and could easily be accomplished with a wide chisel.

Once you get close to your finished depth, remove the rest of material with the mortise chisel. Clean up the bottom with the router plane and call it done. In the outside edges of the toolbox back, cut a corresponding tongue or tenon with either a skew block plane or rabbet plane. Another dry fit and we'll cut the stopped dados for the bottom panels.

Because we're using through-dovetails here, the bottom dado needs to be stopped so it doesn't show up in the outside end grain. You could let it (this being a toolbox) but I'm going to take the extra steps to cut stopped dados. Lay out the dado and starting at one corner, chop out the waste by hand. This will give the end of your plow plane somewhere to go when beginning. Now with my plow plane, I can safely cut the dado.

I purchased these “Roto” hinges years ago for a project and they were sold in a bag of six. I figured they'd come in handy someday and this lid design is the perfect application.



Clean up. A router plane completes the dado and cleans up the bottom.

Make sure the dado is deep enough to let the hinge travel its full distance. Cut the lid to size and drill the corresponding holes. A dry-fit and test-run will be next.

Interior Components

Before I disassemble I'll measure, cut and fit the interior cleats that will hold the till inside. This is also a good time to double-check the size of the bottom panel and mark out the dovetail for the back stretcher.

Assemble the pieces needed for the till. I used some poplar, and this lightweight wood will help to keep the toolbox lighter. Cut the two side pieces to length then measure and cut out the shoulders that will hang off of the interior cleats. A nice snug fit here is what

we're after. It'll be dovetailed shortly and when we trim our tails it will be shortened ever so slightly for a perfect fit.

I'm using through-dovetails for the till but didn't want to go through the trouble of cutting stopped dados for the bottom. This is kind of a neat method for through dovetail construction without having to go through the steps of stopped dados.

Assemble the till components. The two long sides are already cut to fit; now cut the two ends to size as well. Begin on the ends with laying out and cutting the tails as you normally would do for any dovetail.

The next step is where this method differs from usual. Take the two short ends and cut the groove for the till bottom. Now before we go ahead and scribe the thickness of the ends onto the two long pieces, we'll rip the sides off at the tails at the same depth as the newly cut dado, creating a thinner version.

Next, with our tails ripped and crosscut to width and the waste removed, we can go ahead and transfer this new thickness to the long sides of the till. Once scribed we'll transfer the tails over to the pin board using our usual methods.

With the tails scribed, cut out the pins. Now we don't have to worry about the dados showing on the outside of the till. Cut the dado to the full length of the front and back till components.

Measure and cut the till's bottom panel. It's also a good time to round over the top edges of the till sides and drill for the dowels which get set into the inside ends. These



Roto hinge. A Roto hinge will hold the top lid in place and allow it to travel freely, holding it in place again at the back while in the open position. Once the lid travels past the back panel it'll swing down to rest in the vertical position.



will act as handles and will make it much easier to pick the full till up from inside the tool chest. A dry fit and we're ready to glue. I didn't put any finish on mine, deciding to leave it in its natural state.

With the interior components completed I'll measure, mark and cut out the dovetails for the back bottom stretcher.

This piece is also rabbetted using the same "no-stop rabbet" method of cutting the tail. Plow out the bottom-panel groove then rip the tail to width, essentially cutting off the groove's shoulders. Scribe the tail to the side panels and cut the sockets.

I decided to add a decorative bead to the stretcher as well as the top and bottom of the front panel.

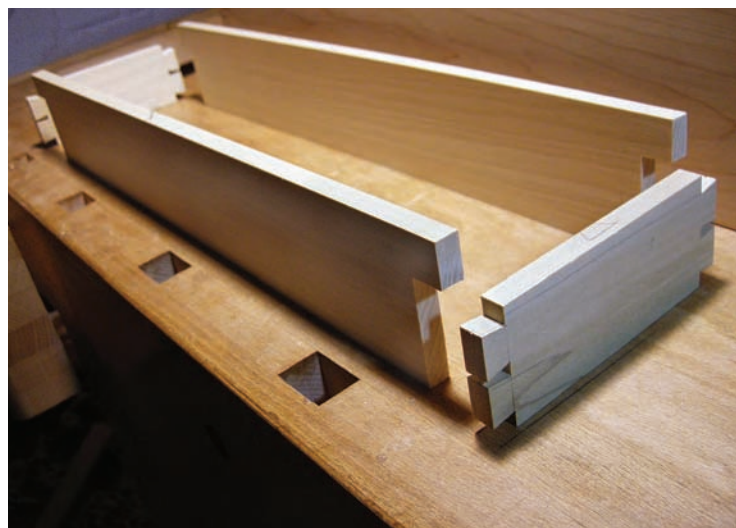
Measure and cut the bottom panels and give everything another good going over. With that, it'll be time to spread some glue.

Exterior Frame and Handle

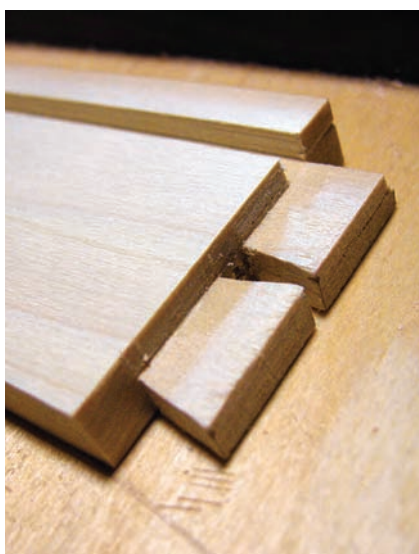
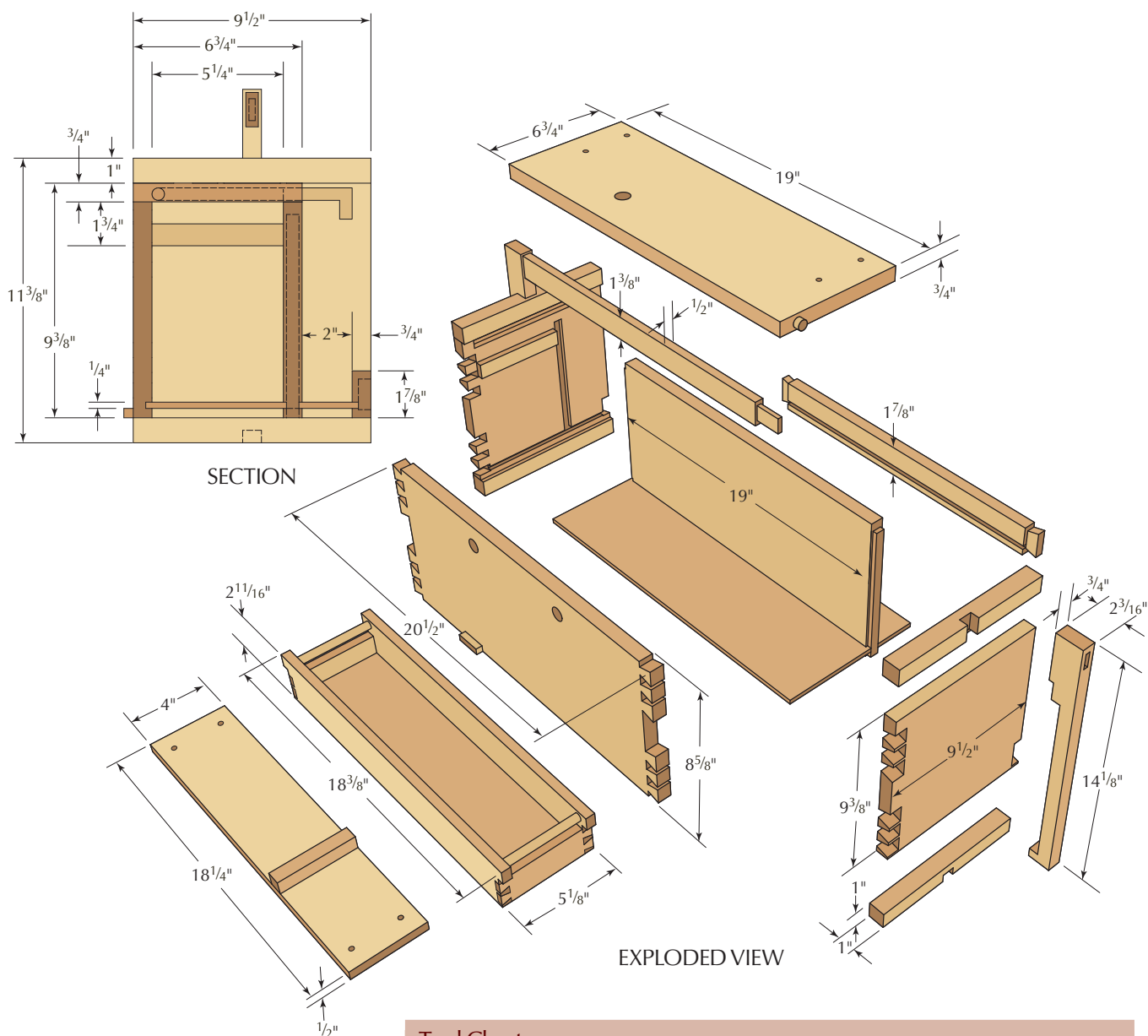
I used some walnut offcuts and built a kind of cradle that will capture the ends and transfer the weight through the handle, down the sides and underneath, to help pick up some of the weight of the finished toolbox.



Dado work ahead. You can see the lid stops at this point; I will disassemble the tool chest and lengthen the 'L' shaped dado so, when open, the lid will be flush with the top of the sides.



Till parts. Till components cut with the ends already dovetailed.



Ready to move on. The end pieces are now ready for the next step.

Tool Chest

NO.	ITEM	DIMENSIONS (INCHES)			MATERIAL	COMMENTS
		T	W	L		
❑ 1	Back panel	3/4	8 5/8	19	Hard maple	
❑ 1	Front panel	3/4	8 5/8	20 1/2	Hard maple	
❑ 2	Side panels	3/4	9 3/8	9 1/2	Hard maple	
❑ 4	Top & bottom caps	1	1	9 1/2	Walnut	
❑ 1	Back stretcher	3/4	1 7/8	20 1/2	Hard maple	
❑ 1	Lid	3/4	6 3/4	19	Hard maple	
❑ 2	Till cleats	3/4	7/8	5 1/4	Hard maple	
❑ 1	Wide bottom panel	1/4	5 5/8	19 1/2	Hard maple	
❑ 1	Thin bottom panel	1/4	2 3/8	19 1/2	Hard maple	
❑ 2	Till end	1/2	1 15/16	5 1/8	Poplar	
❑ 2	Till sides	1/2	2 11/16	18 3/8	Poplar	
❑ 1	Till bottom	1/2	4 5/8	16 7/8	Walnut	
❑ 2	Till handles	1/2 dia.		4 5/8	Walnut	Dowels
❑ 1	Top handle	1/2	1 3/8	23 3/8	Walnut	
❑ 2	Handle supports	3/4	2 3/16	14 1/8	Walnut	
❑ 1	Shooting board base	1/2	4	18 1/4	Hard maple	
❑ 1	Shooting board stop	3/4	3/4	4	Walnut	



Ready for assembly. The frame components are now ready for assembly.

With two bottom runners cut to length, I'll cut and chisel a small open mortise that will house the stub tenon at the bottom of the two side uprights. This will be glued and screwed using some cast-bronze screws left over from my boat-building days. This type of hardware is great for any application that may see moisture, such as the bottom of a tool chest.

When all of the handle joinery is to your liking, disassemble and give everything a good going over with a smoothing plane. Glue and re-assemble. When the glue is dry, I'll drill and install some dowels through the tenons and runners to lock everything in place for good.

Backsaw Holders

The backsaw holders are cut from maple scraps. I used my bowsaw to shape them and some file and rasp work to finish. These will be screwed to the back along with a small block holding two inset rare earth magnets. The backsaws simply fit over the custom-shaped cleats and grab the magnets, which holds everything in place for our adventures on down the road.

Online EXTRAS

This story is a shorter version of "Going Down the Road" from Tom Fidgen's new book "Made by Hand." To download the complete story, visit:

popularwoodworking.com/feb10



Trace. Here, I'm shaping one of two cleats that will become back saw holders. These were simply traced from my hand saws and cut out.

When we get to our destination, we need to hold our work. Anyone who's been at a client's home trying to saw a board or dress an edge on their kitchen counter or coffee table will know this is awkward to say the least. We'll make some custom benchtop appliances suited for this scale of work.

Once at our jobsite the first thing you'll do is clamp the tool chest to a table or countertop ... this is done with our two wooden cam-clamps that will live in front of the backsaws on our rear panel. A couple of little blocks glued in place will be plenty enough to hold them while en route.

Now onto the lid and front. Drill a few $\frac{3}{4}$ " holes in your nice new toolbox. Don't worry, these will turn this pretty little tool chest into an on-site, tabletop workbench! The front two holes are used in conjunction with a surface clamp, bench dog or simply, a wooden dowel.

For vertical workholding applications I also cut and shaped a little shelf or lip that provides somewhere for the end of a board to sit while clamped to the front panel. This small maple shelf receives a rabbet and is then glued and screwed.

On-site edge jointing? Again, no worries. Clamp your workpiece horizontally into the left-side hole and rest the opposite end on a bench dog or dowel installed in the right side. This is why we clamped our box down when we began.

What's that? An on-the-job shooting board attachment? Cool ... Measure, cut and square up a thin piece of stock suitable for a shooting board. Drill and glue four dowels into the bottom corners and when the glue is dry, cut them so they're in the $\frac{1}{4}$ " ballpark. Drill four corresponding holes into the top

of the lid, giving these a nice countersink. The lid serves as the plane track.

The fence is screwed in place, up from the bottom; make sure it's perfectly square to the ramp side. When you're not using the board it can stay put there on top; when you need the surface lid space for other workholding needs, it can be stored on the back shelf in front of the backsaws.


A mixture of oil and varnish for the outside and we can call this first project done. Congratulations, you now have somewhere to keep your essential, on-site hand tools and a great little workbench for out-of-shop work. **PW**

Tom is a hand-tools only, Toronto-based custom furniture maker. This story was excerpted from his new book, "Made by Hand" (Popular Woodworking Books), which is available at WoodworkersBookShop.com.



Field jointing. With the surface clamp in one of the front holes and a $\frac{3}{4}$ " dowel in the other, I can edge joint a board up to 24" long!

Better Vision in the Shop



Proper lighting and vision aids can make a woodworking world of difference.

BY ROB PORCARO

See the light. A diffuse light will show through even the smallest of gaps – as in between this straightedge and a handplane sole. The gap is at most .0005".

Woodworking is a visual art. The capabilities of our eyes and visual system, as well as the quality of the conditions in which we use them, are essential to good woodworking. Basic knowledge of visual function in the shop and the aids used to enhance it can improve a woodworker's skill. It is also helpful to know a few visual tricks to achieve even better visual performance than seems usually possible.

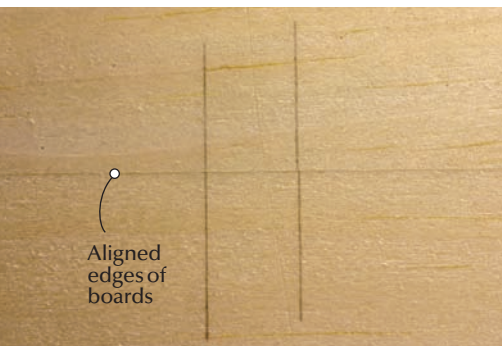
Let's first look at the power of this marvelous tool – the visual system. If you are fortunate enough to have 20/20 vision

in either eye, with or without corrective lenses, you are able to distinguish, at a viewing distance of 14", in proper conditions, critical detail in your work of .004" (four thousandths of an inch). That means if you are cutting dovetails with your eyes 14" away from the wood, you can see detail equal to the thickness of a sheet of paper.

Even more powerful is "vernier acuity" with which you can discern a displacement of less than .001" of two fine lines, such as registration marks on a pair of boards. When using this "super" visual ability to

align your work, your eyes equal or exceed the accuracy of the finest calipers likely to be in your shop.

Further, the eye can readily detect a gap of light of a mere .0005" (half a thou) under a straightedge placed on the sole of a plane held up to diffuse light. That's probably more accuracy than you need. Turn out all the lights in your shop except one narrow beam aimed across the room to see previously invisible, minute dust particles in the air hovering long after a sanding session and destined for your lungs.



Vernier acuity. This photo illustrates vernier acuity. The pair of lines on the left were marked with the ends of the pieces aligned. The pair on the right were marked with one of the boards offset with a .002" shim. The pieces were then realigned and the photo taken. Thus, the lines on the right show an offset of .002", which, remarkably, is fairly easy to see.

So, the eyes are great tools, but to get the most out of them it is helpful to keep in mind two important factors: lighting and optics. This is especially true if you are older than 40 (when you are, of course, getting much wiser).

Lighting: Angles are Key

Just as in buying a home, the keys to good lighting are location and quality. Think of light as coming from its source at an angle, striking a flat surface, and bouncing off at the opposite angle, just like a ball bounced on the floor outward in front of you. If the eye is at the receiving end of the light's bounce, you will likely see a lot of glare and not much detail in your work.

Therefore it is best to locate a light source so the bounce goes away from your face. This usually means the light should come from the side of the direction you are facing, not from in front of you. Practically, this means it is essential to have some moveable light in the shop. I would not be at my workbench without my adjustable-arm lamp that can be easily relocated into two holders near each end of the bench. I also frequently use a portable, rechargeable light that can be optimally placed for everything from sawing to a line on a piece of walnut, to checking the height of a router bit at the router table. Lamps with magnetic holders and flexible arms are handy for machine work, especially at the band saw.

Proper lighting angles are especially important to appreciate detail and texture on the surface of wood, such as when planing a board or applying a finish. Direct a light

at a very low angle to the surface to reveal detail that would otherwise be invisible. The idea is to reduce glare and to create revealing shadows. Minute defects in the human retina are detected in clinical examination with essentially this method.

I have emphasized the location of the light source instead of its strength because the illuminance of light on an object decreases rapidly as the light source is moved farther away. Practically, the location of a lamp is more important than whether it has a 75- or 100-watt bulb. Also, a ceiling lamp 8' over your workbench is not enough for cutting dovetails.

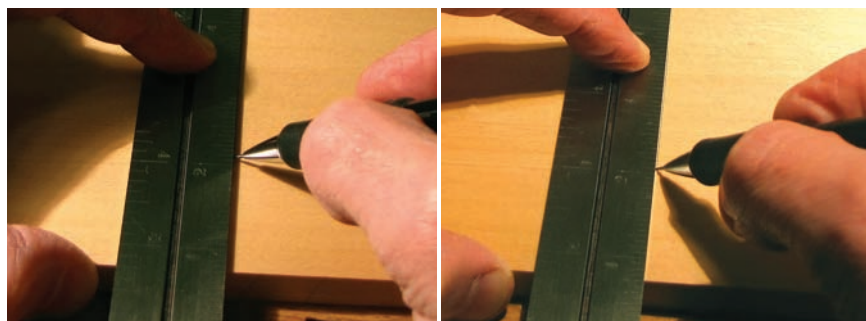
Light quality is a large topic, but here is a helpful concept: Different light sources are composed of different distributions of wavelengths (colors), described by "color temperature." A piece of wood is seen as having a particular color because it reflects to your eyes a portion of the group of colors in the light cast upon it. Thus, the color that

you see depends on the qualities of the light as well as those of the wood. Therefore, it is helpful to evaluate your work, especially when choosing a finish, in lighting similar to that in the location where the piece will be used. Tungsten, "daylight," "soft white" and so forth are all subjective preferences; awareness and consistency are what matter.

Prescriptions for Woodworkers

If you are younger than 40, you can probably skip this section, at least for a while. That's because your eyes' focusing mechanisms are probably still sufficiently flexible to focus throughout any range of distance in which you are likely to do woodworking (with single vision corrective lenses or laser vision correction, if required).

However, after about 40 years of age, the focusing mechanism becomes increasingly inflexible so as to require a different optical correction for near work, such as for most woodworking. Your eye doctor can help you



Shadow play. These photos show the value of moveable lighting. In the shot on the left, the marked line is invisible, hidden by the shadows of the square's blade and my hand. In the photo on the right, you can see the marked line.



Raking is revealing. Here we see two photos of the same board. In the one on the left, light is aimed directly at the board, obscuring the surface. In the one on the right, a raking light (light coming in at a low angle) reveals surface imperfections.



Visual aids. On the left is a Donegan Optimisor LX with a 10" focal length, which allows you to focus at least that close to your work. On the right is a hand-held multi-element magnifier, which is useful for getting a close look at very small items – such as when you're checking for grit scratches on blades while sharpening.

with this, as there are innumerable variations depending on each individual's eyes, but you can work with the doctor by defining your specific needs as a woodworker.

In woodworking, the eye is often focused at an "intermediate" distance, in the 20"-30" range. This may, increasingly with age, require a different lens correction than for reading small print at a distance of 14". This can be achieved in different ways. For example, some woodworkers find it invaluable to have a bifocal or progressive lens ("no-line bifocal") with the top portion set for approximately a 26" range (at the table saw) and the bottom portion for a 14" range (chopping dovetails). Keep in mind that your visual focus distance will affect your physical posture, so you will have to experiment and heed advice from your other health care providers, as needed, to find what gives overall working comfort for you.

Woodworkers doing built-in work which can involve viewing into many odd angles up and down, may find any multifocal glasses difficult to use. The point is to discuss your particular needs with the doctor.

The "right" prescription really does depend upon your functional needs. It is probably no surprise that I recommend you address this issue at the eye doctor's office, not at the rack of ready-made glasses in the supermarket. I enjoy meeting the particular functional needs that my patients describe to me and I think the same will be so with your eye doctor. While this article is not about eye safety, I do suggest you consider polycarbonate lens material for any eyeglasses used in the shop because polycarbonate is highly shatter resistant.

Optical Aids for Close Work

Sometimes you want to get your vision in very close, for example, checking an edge after sharpening.

A hand-held multi-element magnifier in the 10x range is useful for this. A head borne loupe, such as the Donegan Optimisor LX, keeps your hands free to perform tiny tasks. I suggest you avoid choosing these in "magnification" power and instead select a suitable focal length. I like an 8"-10" model. Any closer would leave too little room for my hands. Keep in mind that lens distortions increase and field of view decreases as you go to stronger (shorter focal length) lenses. These can be used over your distance or reading glasses, as required for you. And no, they won't ruin your eyes.

"Magnification" can be useful, but more is not necessarily better. There is no point in cutting dovetails with a 6" focal length loupe when they will be viewed in normal conditions at 14"-20". With few exceptions, it is best to match your working optics to the conditions under which your project will be viewed and save the magnifiers for specialized tasks.

Limitations and Sight Enhancements

As useful as sight is, sometimes it takes second place to a woodworker's sense of feel. For example, it is more accurate and easily consistent to set a hook rule against an edge than to align a rule by eye. End stops for crosscutting at the table saw will outperform repetitive visual set up.

Similarly, it is easy to feel minute misalignments where edges meet such as when flushing the surfaces of exposed joinery. Determining how tightly a tenon should enter a mortise is not a visual task.

Transferring the knife line for a tenon shoulder around the corner of the workpiece is done mostly by feel. The same holds for setting a chisel edge in a cutting gauge line when chopping to the base of a dovetail. It is quick to swing a straightedge on a surface to feel if it wants to pivot about its center or at an end to sense whether the surface is convex or concave.

Working together, the eyes are more efficient and can detect minute differences in depth – about $\frac{1}{32}$ " at a distance of 14" – without additional cues such as shadows and overlapping, by virtue of stereopsis.

This enhanced vision only works if both eyes have a clear, unobstructed line of sight



Intermediate vision. At the table saw, you use "intermediate" vision – about 30" in this case – to sight the meeting of the board with the rip fence. For most folks in the, say, 50+ category, this viewing distance will be clear with neither their reading nor distance vision prescriptions. They can work out options with their friendly eye doctor.

to what you are looking at. Stereopsis won't work if, for example, you stand at the band saw where one eye's vision of the workpiece is obstructed by the blade guide post. Try threading a needle 14" in front of you using both eyes then with one eye's view obstructed and sense the difference.

It should also be noted that it is impossible to fixate the eye's sharpest, central vision ("look at") two places at once. For example, when sawing a dovetail, I place the saw to start the cut by eye, then lock in the angle and squareness of the saw and maintain them mostly by feel as my eye tracks the saw teeth down the layout line.

Reminder

While this article is only about functional vision, I would be remiss (you knew this was coming) if I did not remind you of the value of periodic visits to your eye doctor. Don't take your eyesight for granted. The frequency of checkups will vary widely based upon your personal and family medical and eye history and your age. How to know? Ask your eye doctor, especially if it's been a while. **PW**

Rob has been a practicing doctor of optometry for 28 years and a woodworker for longer than that. He writes about woodworking at rwoodwork.com/blog.

Choosing a Spray Gun

Though a good finish can be achieved with other methods, guns are faster.

As I've explained many times in *Popular Woodworking*, you can achieve a near-perfect finish using a rag or brush: You can apply a wipe-on/wipe-off finish such as oil, wiping varnish or gel varnish; you can sand a brushed finish level and cover the sanding scratches with wiping varnish or gel varnish; or you can sand a brushed finish level and rub it to the sheen you want using fine abrasives.

But spray guns have some important advantages over brushing or wiping. The most obvious is application speed; applying a finish with a spray gun is much faster than brushing or wiping.

Spray guns also allow you to use fast-drying finishes to build a thickness rapidly with minimal dust nibs and make it possible to apply a finish film that is almost perfectly level (no orange peel) and to "tone" the wood.

Toning is spraying a finish with a little colorant (pigment or dye) added to tweak or adjust the color of the wood—whether stained or not. Toning can also be used to create highlights and other decorative effects.

The downsides of spray guns compared to brushes and rags are greater cost, increased waste because of overspray, and considerably more complexity to keep the tool in good operating condition.

So how do you choose a spray gun if you decide you want to take advantage of its benefits?

It's actually quite straightforward. First, you decide on your source of air: compressor or turbine. Second, you choose a spray-gun configuration: siphon-feed, gravity-feed or pressure-feed. Third, you decide on quality—that is, how much you're willing to pay.

And finally you choose a brand. Because competition keeps all manufacturers on the cutting edge of the technology, this is not as complicated as you may think.



Three configurations. Spray guns are available in three configurations: siphon-feed with the cup under the gun, gravity-feed with the cup on top of the gun, and pressure-feed where the finish is fed to the gun through a hose connected to a separate pressurized pot. To illustrate the three configurations, I'm using the Apollo Atomizer spray gun, which is unique in that it can be set up in all three configurations and it can run off either a turbine or a compressor.

Source of Air

Your first choice is between a gun that runs off a compressor and one that runs off a turbine.

It's important to emphasize that almost all compressor-supplied spray guns sold today produce the same soft spray, called HVLP, or High-Volume Low-Pressure, as do turbine-supplied guns. Practically speaking, there is only HVLP anymore.

Choose a compressed-air spray gun if you already have a compressor that produces at least 7 or 8 CFM (about 2 horsepower) and has a 20-gallon or larger air-storage tank, or if you need a compressor to operate other tools such as a sander or nail gun.

Choose a turbine spray gun if you need portability or if you're short on space; turbines are small. Turbine spray guns are usually sold together with the turbine, but you can mix and match if you like because the connections are standard.

A compressor gives you more control over

the air to the gun than a turbine does because you can increase the pressure as much as you want (though going over 10 pounds per square inch at the air cap breaks the definition of HVLP and can be illegal in some areas). But the air produced by a turbine is dry so there's no need to insert moisture-removing filters as there is with compressors.

Configuration

Spray guns that operate off each air source are available in three configurations: siphon-feed, gravity-feed and pressure-feed. All three work well, but for slightly different situations.

The siphon-feed configuration has a material cup attached under the spray gun. In the old high-pressure guns, a vacuum draws the fluid up through a tube into the air stream where it is atomized.

But high-volume air in HVLP guns doesn't create enough suction to do this. So the cup has to be pressurized through a tube running from the gun body to the cup. Some of the air

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is thus siphoned off from the airflow, which can cause poorer atomization and increased orange peel if the air supply isn't adequate.

Though most under-the-gun cups are now pressurized, manufacturers still call them siphon-feed.

Gravity-feed guns, with the cup on top of the gun, don't need to be pressurized. The fluid flows into the atomizing air stream by gravity alone. No pressure is needed, though some turbine-supplied guns do pressurize this cup to increase the fluid flow.

Having the cup on top of the gun has the advantage of eliminating the possibility of dragging the cup across a horizontal surface if you aren't careful.

But you can fit a siphon-feed spray gun into an interior cabinet space much more easily than you can a gravity-feed gun, and a siphon-feed gun is more versatile because it can be converted to pressure-feed simply by replacing the cup with a connecting hose to a separate pressurized pot.

The pressure-feed system, with its separate pot that is pressurized by compressed air, is usually limited to production situations where a high volume of work is being finished. But not having a cup attached below or above the gun frees the gun to get into small spaces and even to be used upside down. You may find that having these options is worth the extra effort involved in cleaning the pot and connecting hose.

Most turbine guns are siphon-feed. Gravity-feed guns seem to be more popular with finishers using compressors, probably because this is the configuration used by auto-body finishers. This is the bigger market, so most available compressor guns are gravity feed.



Compressors. Compressors big enough to supply spray guns sometimes come with wheels but are otherwise not easily portable. Turbines are small and fairly light so they are very portable. This compressor is 5 hp, produces 15 CFM and has a 60-gallon tank. The turbine is three stage – the smallest that atomizes adequately.

Quality

Just as with woodworking tools, always buy the best quality you can afford. Quality in spray guns translates primarily to better atomization leading to reduced orange peel. It also means tighter control of the spray pattern, more accurately machined parts and the use of more damage-resistant metals.

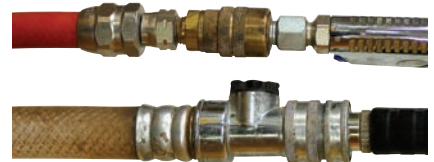
Brands

Once you've decided on quality, you need to choose a brand.

Atomization. The biggest difference between inexpensive and expensive spray guns is the quality of atomization they produce. The finer the atomization of the liquid material, the more level the surface produced—that is, the more reduced the orange peel. The spray pattern on the left (made by an inexpensive spray gun) has a much poorer atomization than the spray pattern on the right, which was made by an expensive spray gun. This is evident from the much larger dots around the edges of the pattern on the left.



Air inlets. Quick-connect air inlets differ for compressor- and turbine-supplied spray guns. The air inlet on top is for turbine air; the one on the bottom is for compressed air.



Hoses. Air hoses also differ for compressor- and turbine-supplied guns. The red air hose is for compressed air. The amber one with a larger diameter accommodates the high volume air produced by a turbine.

There's not a big difference among brands in any given price range. So the key factor you're looking for, after you've decided how much you want to spend, is service. You will usually get faster service from a local distributor than from mail order.

For compressed-air spray guns, I recommend you shop at a local auto-body supply store. In my experience, non-chain stores are more knowledgeable about spray guns than the national auto-parts chains.

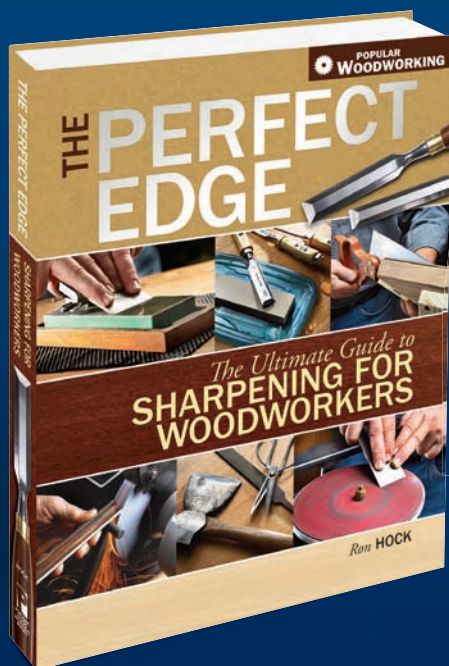
Find out from the clerks which brands the local auto-body guys use and choose from among those brands. The clerks will understand the subtleties of these brands and the store will most likely stock parts.

These stores also carry very inexpensive "knock-off" spray guns, or you could buy one at a home center or Harbor Freight. These guns produce fairly good results, but the orange peel they produce is more evident because the atomization isn't as good.

For turbine-supplied spray guns, you should also look for a distributor in your area. Paint stores that target professional painters sometimes carry turbines and guns.

Otherwise, check web sites of the brands you are considering and choose among those that provide the most helpful information and easy parts ordering. Many suppliers to woodworkers carry one or more of these brands. **PW**

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



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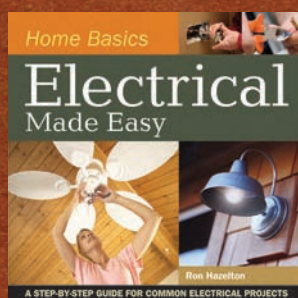


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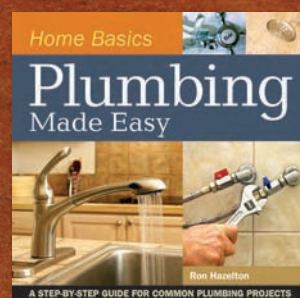
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Beyond the Norm

Norm Abram inspired generations of new woodworkers — even those who weren't Yankees.

Last week I stood in a beautiful living room and relived a scene for at least the 10th time in my career as a writer.

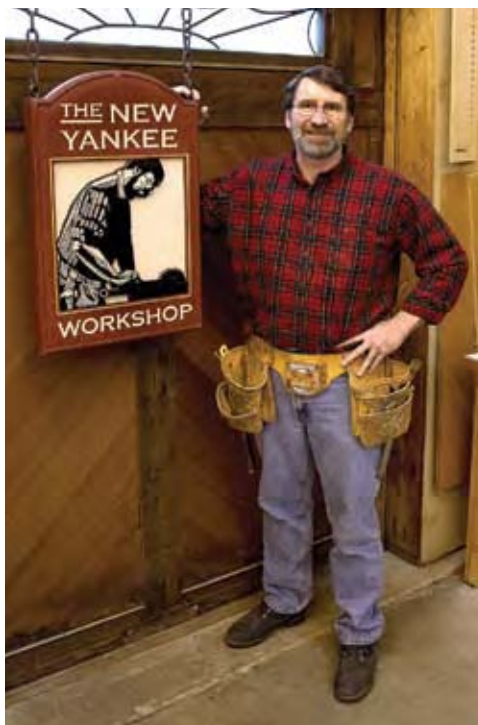
George R. Walker, our new columnist at *Popular Woodworking*, was showing me around his well-kept home in Canton, Ohio. As we stood in the middle of his front room, we were bisecting his long woodworking career.

In one corner stood a nice, darkly stained corner cabinet that was filled with the knick-knacks of life: photos, books and what-nots. In the other corner was an incredible, take-your-breath-away period secretary in tiger maple. It was a tour de force of tombstone doors, secret compartments and a near-endless array of dovetailed drawers. And the secretary was completely empty — Walker had only recently completed it.

"This is my 'apprentice' piece," he explained as he showed off its drop-lid front and prospect cupboard in the center of the base cabinet. Walker turned his body slightly and tipped his head toward the corner cabinet across the room. "That piece is right off of 'New Yankee Workshop.' That's where I began years ago."

Like many woodworkers, Walker and millions of other lignum-loving Americans were first introduced to the glory of working with wood by Norm Abram, the host of WGBH-TV's "The New Yankee Workshop" and a fixture on "This Old House." When Norm began his series in 1989 with the broadcast of the construction of a medicine cabinet, he wasn't even wearing a plaid shirt. And his construction techniques were closer to high-end trim carpentry than they were to high-end woodworking.

But during the last 20 years, Abram has grown as both a woodworker and as a per-



sonal Saturday-morning friend for many.

He's tackled veneering, hand-cut dovetails, Windsor chairmaking, you name it. Abram has been fearless in putting down his nail gun and taking up the tools that separate the dabbler from the serious craftsman.

And that, perhaps, has been his biggest gift to the craft.

Here at the magazine, we end up watching a lot of woodworking TV, and a lot of it is pretty ... lame. I've seen woodworking wizards demonstrate water witching (huh?). We've seen slapped-together project episodes that showed how to make an entire Queen Anne table using only one tool (when it was complete it was ready for the fireplace).

Abram has always taken the high road. Even when he showed techniques more akin

to a commercial shop, they were solid methods that wouldn't get you in trouble. And as Abram himself delved deeper into the furniture record, he took us along for the ride and showed us how these pieces could be built without a lot of fuss.

So it was with great sadness that I learned that Abram and the show's creator, Russ Morash, decided to cease production of "The New Yankee Workshop" after 21 years. Is this the end of TV woodworking? Is the craft now swirling around the toilet bowl?

Well, not if I have anything to do with it. Here's a confession: I have bought only one woodworking plan in my entire life. And it was one of the plans from "The New Yankee Workshop." After Abram visited Winterthur in Delaware, he decided to build one of the clocks from the Dominy family workshop that's on display in that museum.

After I visited Winterthur, I came to the same conclusion as Abram. That clock was an iconic piece of American furniture and deserved to be built over and over.

So I purchased his plans from the "New Yankee" web site. I put them on the shelf in my office, right below the keys to our workshop. Almost every morning I am the first person to walk through the door here. So I pick up those keys to unlock the workshop, and I glance at those plans.

"Soon," I tell myself.

But if you and I don't strive to build well and push ourselves to do better work as relentlessly as Abram has, who will inspire the next generation of woodworkers?

For me, "soon" is just about "now." **PW**

Christopher is the editor of this magazine and the author of the book "Handplane Essentials."

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