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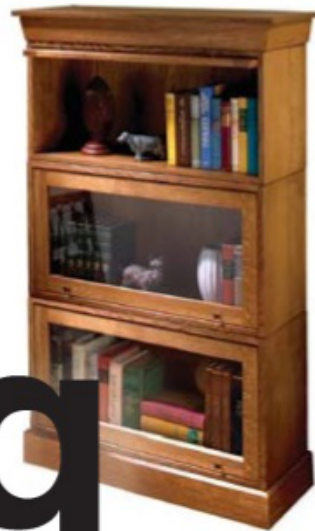
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Popular Woodworking

OCTOBER 2019 | #248



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Contents

OCTOBER 2019 | VOL. 39, NO.5

Popular
Woodworking

POPULARWOODWORKING.COM

■ Build

22 The Straightest Path to a Great Chair

Learn small-shop tricks for maximizing comfort and customization building a very comfortable chair.

BY TOM DOLESE

34 Arts & Crafts Tile-Topped Table

This timeless side table teaches the hallmarks of Arts & Crafts design and is the perfect showcase for beautiful tile.

BY SETH KELLER WITH ASEESE GREWAL

42 Barrister Bookcase

Build an heirloom-quality project that's modular and stackable for storing a few books or an entire library's worth.

BY GLEN D. HUEY



42



22



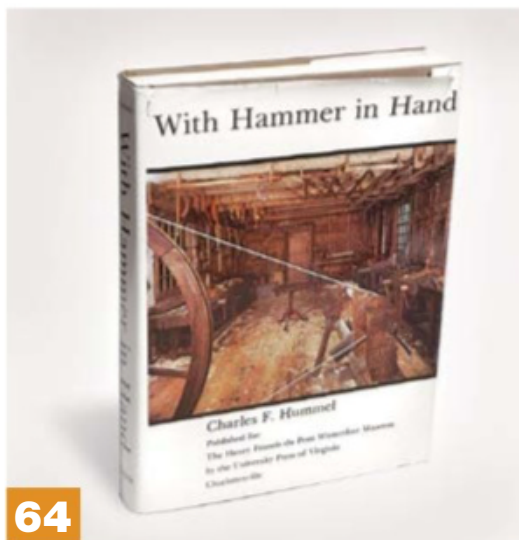
34

Contents

OCTOBER 2019 | VOL. 39, NO.5

Popular
Woodworking

POPULARWOODWORKING.COM



■ Connect

04 From the Editor
Woodworking through it.
BY ANDREW ZOELLNER

06 Workshop Tips
Router table circles, a reusable tack cloth, frame clamps and a convex sanding pad.
FROM OUR READERS

■ Craft

10 I Can Do That
Create extraordinary frames with ordinary router bits.
BY TIM JOHNSON

18 Design Matters
Successful furniture designs draw viewers closer and reward them.
BY GEORGE WALKER

52 Shop Skills
The nuts and bolts of making hardware new again.
BY YOAV LIBERMAN

60 Flexner on Finishing
Understand the critical parts of your spray gun.
BY BOB FLEXNER

64 End Grain
Learning from the past can secure our future.
BY TOM CASPAR

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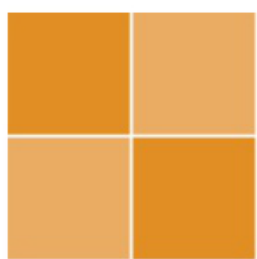
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Connect

■ FROM THE EDITOR

Woodworking Through It

By Andrew Zoellner

As this issue goes to press, *Popular Woodworking* is changing ownership. The last few months have been a rollercoaster of emotions for me, my colleagues, readers and contributors. There's been uncertainty about jobs, the status of stories and projects, and an overall sense of unease about the world at large. And it's during this time that it's been clearer than ever how much woodworking means to me and the role it plays in my life.

Just about a year ago, I tore the kitchen of my 1906 house down to the studs, which started a journey that included rewiring and replumbing the entire house, replacing some rotted sill plates and spending more time in the basement and attic than I ever want to do again. At the moment, I'm installing the kitchen cabinets I built, and the end of the project is visible (if not completely in focus yet). When I talk about this project with friends, I sound crazy. I could've bought cabinets from a store, or hired out portions of the project. But really, this project is exactly what I needed.

Spending my nights and weekends, holed up in the shop with a complex, multi-step project, is my favorite choice of therapy (I'm betting it's also comparable in cost to the real thing). Yes, I'm focused on the task at hand, but there's plenty of time in between steps to think about those things and ask the big questions: What should I be doing with my life?



The past few months haven't been easy, but woodworking has made it better.

Are magazines the best way to serve woodworkers? If I move my lumber rack up a foot, could I fit another workbench under it? Where did I put my tape measure?

I've never built an entire kitchen's worth of cabinets before. We're going to be living with them for the foreseeable future. They need to be up to the quality of the old-world craftsmanship that's throughout the rest of the home, but still have the modern conveniences a world-class baker and cook must have. As much as I want to get this project over with, I also can't rush it. Setting ourselves up for success in the future takes work, often unseen, to make the result feel cohesive, effortless and part of the house.

That's a lot like the journey this magazine and brand has taken over the last six months. How do we continue to publish inspiring projects and stories and helpful advice, shoot informative videos, interact with our readers across social media and still find time to sleep.

It's a process that's always being tweaked and improved, rethought and rejiggered. I'm happy to report that, for the first time in a while, things are looking up for *Popular Woodworking*. And, I've forgiven the previous inhabitants of my house for the shortsightedness of their last kitchen remodel.

Andrew Zoellner

The hottest trend in
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Don't put off tackling your live edge slab project any longer. Find out more about Woodpeckers Slab Flattening Mill at **woodpeck.com** or your local Woodcraft retail store.

WORKSHOP TIPS



Quick Router Table Circles

One afternoon my wife called out to my shop with an urgent request. She needed me to make a round cake plate from $\frac{1}{4}$ " plywood for a charity auction. I assured her it would be no problem. I was in the middle of a project and didn't want to spend all afternoon on this. Then it hit me, I could use my router table.

I ripped a $\frac{3}{4}$ " wide strip of $\frac{3}{8}$ " hardwood to fit the miter slot and drilled a pilot hole near one end for a box nail, which I inserted from the bottom. Then I clamped the hardwood strip into my router table's miter slot so the distance from the nail to the bit equaled the circle's radius.

I drilled a center hole in the soon-to-be cake plate, and positioned it on the nail. I held the edge of the plywood up while switching on the router, then lowered it onto the bit very carefully. After the bit bored through, I rotated the plywood counterclockwise, opposite the bit's rotation, to cut a perfect circle. — *Doug Bittinger*

Reusable Tack Cloth

Microfiber cloth picks up tiny dust particles as well as, if not better than, a tack cloth. Unlike a tack cloth, microfiber cloths are washable and reusable. Rockler Sells Norton's microfiber finishing cloth for \$5-7, but any microfiber cloth will work as long as it has hemmed edges.

— *Kevin Southwick*



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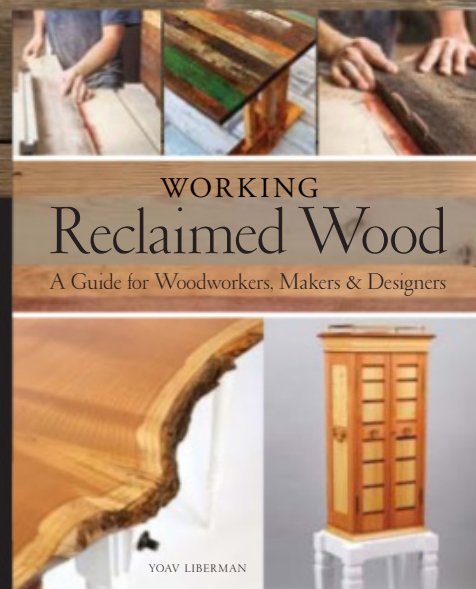
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Frame Clamp

Two triangular maple blocks and a pair of sharp-tipped drywall screws are all you need to make corner clamp blocks for picture frames.

Drill and counterbore a hole for a drywall screw through one leg of each block, positioned so the screw's tip is centered in the hypotenuse (photo). Make sure the screw threads through the shank hole, so you can turn it in and out. For hard woods, extend the screws so their tips barely protrude; extend the tips a bit further for soft woods.

To use the blocks, assemble the joint, with one frame side clamped to your bench. Press a clamp block to each side. When you clamp across the joint, the screw tips bite in and keep the blocks from sliding. The screws leave small dimples, which can be easily taken care of with wood filler or a few drops of water to raise the grain. To accommodate joint angles other than 45°, simply modify the shape of the blocks. —Rick Baird



Convex Sander Pad

In the process of refinishing an old chair, I found that my random orbit sander's flat surface didn't work for sanding the concave hollow of the seat. My sander uses hook-and-loop paper, so I purchased some adhesive-backed hook-and-loop material at the hardware store.

After sticking the material together with the hooks on one side and loops on the other, I cut out a disc shape that was small enough to fit in the center of my sander without blocking the dust collection holes. I then applied the paper over the pad. It worked perfectly to create a slight convex bottom on my sander that conformed to the chair's curve, and held the sandpaper firmly in place. —Steve Laber



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- Insight into John Ruskin's "Moral Elements of Gothic"
- Plans for Voysey's iconic two heart chair, with its woven seat and sharp finials
- How to build a striking sideboard design from Harris Lebus, one of England's largest furniture manufacturers at the turn of the century
- Detailed instruction on making Gimson's hayrake table, with challenging joinery and hand-carving

Weekend Picture Frames

Create extraordinary frames with ordinary router bits.

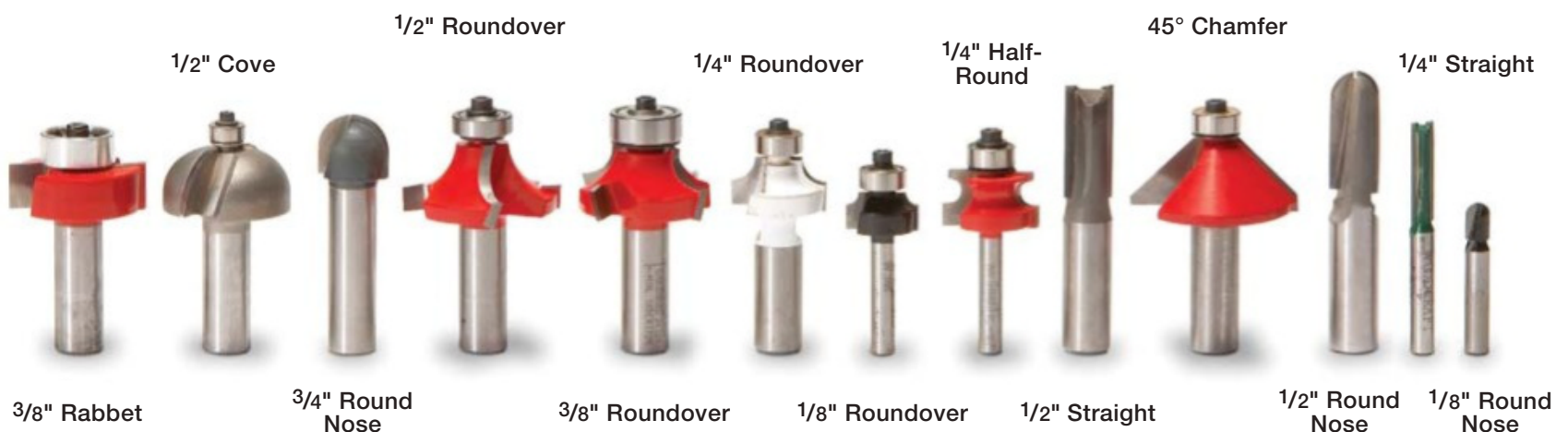
By Tim Johnson

Here's a fun way to save money, be creative, make something useful, and use up scrap stock: make your own picture frames. You can start from scratch and have finished frames in a day or less, and the only tools you need are a tablesaw and a router table. The challenge is to create unique profiles using the router bits you already have.

The frames and instructions that follow will get you started. You probably don't have all the same bits, but that doesn't matter. Just substitute and experiment. You'll find that a little tinkering yields an amazing range of profiles.

Most frames are made using small stock, so be sure to work safely. Always use guards, featherboards

and push sticks. Never use stock less than 12" long. Create profiles on long stock; then cut individual frame pieces from the profiled stock. Similarly, use wide stock to create thin pieces; rout the profile, then cut to final thickness. Rout large or deep profiles in multiple passes, raising the bit or moving the fence in small increments before each pass. **PW**



Final Size: 1 1/8" x 1 1/4"



1

Part A: Start with a 13/16" thick by 2" wide blank.

1 Round over the top edge by making one pass on each face with the 3/8" roundover bit.

2 Saw a 7/16" deep by 7/8" wide groove on the inside face, 3/8" from the rounded edge.

3 Rip the blank to final 1 1/4" width. Orient the blank outside-face down (grooved-face up), with its rounded edge against the fence.

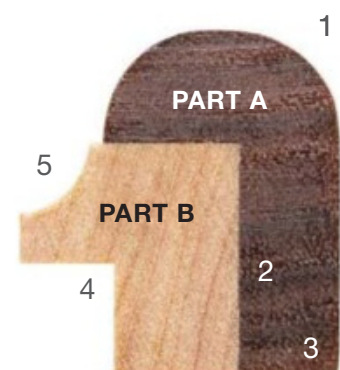
Part B: Start with a 3/4" thick by 7/8" wide blank.

4 Rout a 1/4" by 3/8" rabbet on the inside face. Orient the blank bottom-

edge down, with its inside face against the fence.

5 Rout a 1/4" cove on the inside face, using the 1/2" round nose bit. Orient the blank top-edge down, with its inside face against the fence.

Glue Part A to Part B.



TRACK SAW MASTER PACK

- Motor: 120V, 1.1kW, 5500 RPM, 9A
- Blade rim speed: 9070 FPM
- Max. cutting depth at 45°: without rail 1⁵/₈", w/ rail 1⁷/₁₆"
- Max. cutting depth at 90°: without rail 2⁵/₃₂", w/ rail 1³/₃₂"
- Includes saw blade: 160mm x 20mm x 48T
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W1832 Track Saw Master Pack

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- Cast iron table size: 27" x 40¹/₄"
- Table size with extension: 27" x 53⁵/₈"
- Arbor speed: 4300 RPM
- Arbor size: 5/8"
- Max. dado width: 1³/₁₆"
- Max depth of cut @ 90°: 3¹/₈", @ 45°: 23/16"
- Max. rip capacity: 29¹/₂"
- Overall dimensions: 62" L x 41" W x 40" H
- Approx. shipping weight: 527 lbs.

Includes 10"
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W1819 10" 3 HP Table Saw with Riving Knife

13" 3/4 HP, BENCH-TOP OSCILLATING DRILL PRESS

- Motor: 3/4 HP, 110V, 1725 RPM
- Overall height: 38"
- Spindle travel: 3¹/₄"
- Swing: 13¹/₄"
- Drill chuck: 5/8"
- Speeds: 12, 250-3050 RPM
- Table: 12³/₈" dia.
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12" X 15" VARIABLE SPEED BENCH-TOP WOOD LATHE

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New



W1843 Knife Belt Sander/Buffer

14" SUPER-DUTY RESAW BANDSAW

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- Amps: 15A at 110V, 7.5A at 220V
- Table size: 21³/₄"L x 16¹/₂"W
- Table tilt: 5°, 45°
- Floor to table height: 37"
- Max cutting height: 14"
- Max throat capacity: 13¹/₂"
- Max cutting width with fence: 12"
- Overall size: 29"W x 32¹/₂"D x 76"H
- Dual 4" dust ports
- Footprint: 23"L x 18"W
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W1867 1-1/2 HP Portable Cyclone Dust Collector

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Final Size: 3/4" x 1 1/2"



Use a 3/4" thick by 1 1/2" wide blank.

1 Rout a 45° chamfer on the inside face, leaving a 1/8" wide edge on the top. Then, set the fence and orient the blank inside-face down. Then complete the cut by making several shallow passes.

2 Create the 3/8" deep rabbet with two tablesaw cuts. First, cut a 3/8" deep kerf on the inside face. Next, set the fence so this cut leaves a 1/8" shoulder between the rabbet and the chamfer.

3 Make the second cut with the blank's outside face against the fence. Raise the blade to meet the first cut and set the fence at 3/8".

4 Rout a 45° chamfer on the outside face with the bottom edge 3/16" wide.



Final Size: 3/4" x 2 1/2"



Part A: Start with a 1/4" thick by 1 5/8" wide blank.

1 Round both edges, using a 1/4" half-round bit.

2 Rip the blank in half, to create two completed 3/4" wide Part A blanks.

Part B: Start with a 3/4" thick by 2" wide blank.

3 Rout 1/8" roundovers on both top face edges. Then, orient the blank on edge, with its top face against the fence for both cuts. To create the

fillets, raise the bit's straight shoulder above the table.

4 Glue Part A blanks to the edges of Part B.

5 Rout a 3/8" by 3/8" rabbet on the inside edge.



Final Size: 1" x 1 3/4"



Part A: Start with a 3/4" thick by 1 3/4" wide blank.

1 Rout or saw a 1/8" by 1/2" groove on the top face, starting 1/8" from the outside edge.

2 Rout or saw a 1/4" by 3/8" groove on the same face, starting 1 1/8" from the outside edge.

3 Rout a 1/4" tall by 3/8" wide cove on the inside edge, using a 3/4" round nose bit. Orient the blank inside-edge down, with its top face against the fence. After routing, the remaining inside edge should measure 3/8" wide.

4 Rout a 3/16" deep by 1" tall cove on the top face, using a 1/2" round nose bit. Use the same orientation as for Step 3 (inside edge down, with the top face against the fence).

5 Rout a 1/4" by 1/4" rabbet on the inside edge.

Part B: Start with a 1/2" thick by 1 1/2" wide blank.

6 Rout 1/4" roundovers on one edge.

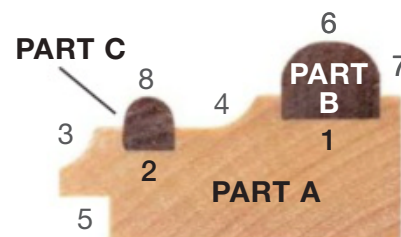
7 Rip the blank to final 3/8" thickness, with the rounded edge on the offcut side of the blade.

Part C: Start with a 1/4" thick by 1 1/2" wide blank.

8 Rout 1/8" roundovers on one edge.

Rip the stock to final 1/4" thickness, with the rounded edge on the offcut side of the blade.

Glue Parts B and C to Part A.





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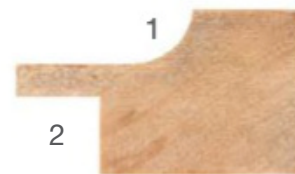
Final Size: 3/4" x 1 1/4"



Use a 3/4" thick by 1 1/4" wide blank.

1 Rout a 1/4" by 3/4" cove on the top face, using a 1/2" round nose bit. Orient the blank inside-edge down, with its top face against the fence. To complete the cut, make multiple shallow passes, raising the bit incrementally.

2 Rout a 3/8" by 3/8" rabbet on the inside edge.



Final Size: 3/4" x 1 1/2"



Use a 1 1/2" thick x 1 1/2" wide blank.

1 Rout a 5/16" chamfer on the top inside edge.

2 Saw a 17° bevel on the top face. Tilt the blade away from the fence, and orient the blank chamfered-edge up, with the chamfer facing the blade. Set the fence so the bevel meets the tip of the chamfer. Make the cut. Then remove the saw marks by sanding or planing.

3 Rout evenly spaced flutes on the beveled face, using the 1/8" round nose bit.

4 Rip the blank to final 3/4" thickness. Make the cut with the blank outside-edge down and its beveled face on the outfeed side of the blade. After sawing, the blank's outside edge should measure 5/16" wide.

5 Rout a 3/8" by 3/8" rabbet on the inside edge. Orient the blank bottom-face down, with its inside edge against the fence.



Final Size: 3/4" x 7/8"



Use a 3/4" thick by 7/8" wide blank.

1 Rout a 3/8" by 3/8" rabbet on the inside edge.

2 Rout a 1/4" by 1/4" cove on the top face, using a 1/2" round nose bit.

3 Rout a 1/8" roundover on the top face. Orient the stock outside-edge down, with its top face against the fence. To create the fillet, simply raise

the bit's straight shoulder above the table.



Final Size: 13/16" x 13/16"



Part A: Start with an 11/16" thick by 13/16" wide blank.

1 Rout 1/8" roundovers on the top edge.

2 Rout a 1/4" by 1/2" rabbet on the inside face.

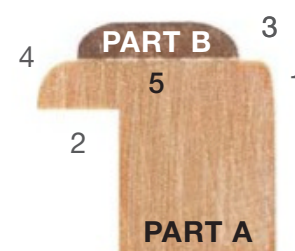
Part B: Start with a 1/2" thick by 1 1/2" wide blank.

3 Rout 1/8" roundovers on one edge.

4 Rip the blank to final 1/8" thickness,

with the rounded edge on the offcut side of the blade.

5 Glue Part B to Part A.



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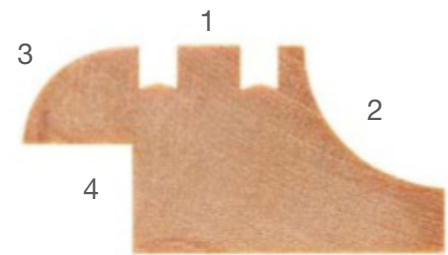
Final Size: 3/4" x 1 1/2"



Use a 3/4" thick by 1 1/2" wide blank.

- 1** Rip 1/8" by 1/8" saw kerfs in the top face, starting 3/8" and 3/4" from the inside edge.
- 2** Rout a 1/2" cove on the outside edge. Orient the blank top-face down, with its outside edge against the fence.
- 3** Rout a 3/8" roundover on the inside edge. Orient the blank top-face down, with its inside edge against the fence.

- 4** Rout a 3/8" by 3/8" rabbet on the same edge, with the blank oriented bottom-face down.



Final Size: 3/4" x 1 1/4"



Part A: Start with a 3/4" thick by 1 1/8" wide blank.

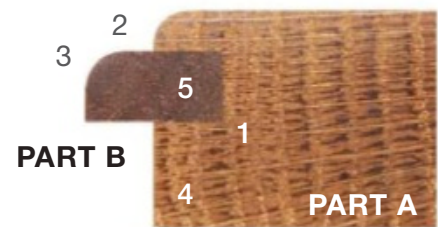
- 1** Rout or saw a 1/4" by 1/4" groove on the inside edge, starting 3/8" from the bottom face.
- 2** Rout a 1/8" roundover on the inside edge of the top face.

Part B: Start with 1/4" thick by 1 1/2" wide stock.

- 3** Rout a 1/8" roundover on the top edge.

- 4** Rip the stock to final 1/2" width, with the rounded edge on the offcut side of the blade.

- 5** Glue Part B to Part A.



Final Size: 1" x 1 3/4"



Part A: Start with a 3/4" thick by 1 3/4" wide blank.

- 1** Rout a 1/2" cove on the outside edge, leaving the edge 1/4" wide.
- 2** Rout a 1/4" by 1/4" cove on the inside edge, using a 1/2" round nose bit. Then orient the blank inside-edge down. Be sure the top face is against the fence.
- 3** Rout or saw a 1/8" by 1/2" groove in the top face, centered between the two coves.
- 4** Rout a 3/8" by 3/8" rabbet on the inside edge.

Part B: Use a 3/4" thick by 2" wide blank.

- 5** Rout 1/4" roundovers on one edge.

- 6** Using a 1/2" straight bit, rout 1/8" deep by 1/4" wide dados on both faces, starting 1/4" from the rounded edge.

- 7** Rip the blank to final 3/8" thickness, with its rounded edge on the offcut side of the blade.

- 8** Glue Part B to Part A.



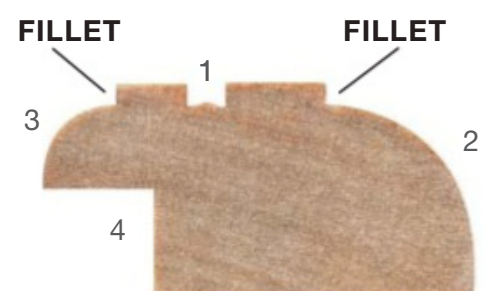
Final Size: 3/4" x 1 3/4"



Use a 3/4" thick by 1 3/4" wide blank.

- 1** Saw or rout a 1/8" by 1/8" groove in the top face, starting 1/2" from the inside edge.
- 2** Rout a 1/2" roundover on the outside edge. Then orient the blank top-face down, with its outside edge against the fence. Next, create the fillet by raising the bit's straight shoulder above the table.
- 3** Rout a 1/4" roundover with a fillet on the inside edge.

- 4** Rout a 3/8" by 3/8" rabbet on the inside edge.





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Two Looks

Successful furniture designs draw viewers closer and reward them.

By George Walker

Out of the corner of my eye it caught my attention, a fire-engine red 1966 Chevy Impala Super Sport. Memories flooded back to my first car, a model just like this except mine was green with a white roof-top. The problem with memories is that they often clash with reality. As I got closer to inspect the car, the view made me wish I'd stayed at a distance and not seen the bad sheet metal repairs and sketchy interior.

I've experienced the same thing when looking at furniture pieces. A chair or cabinet can have wonderful curb appeal from across the room, and then fall down completely upon closer inspection. For a design to succeed it needs to draw our attention from a distance and then reward us for making the trip across the room. It should surprise and delight us up close. That sounds easy, but it's not.

From a functional standpoint we may have a long list of requirements for any design. A chair must sit well and feel like we can trust it if we lean back or shift our weight. A cabinet may need a shelf sized to fit our vinyl record collection. But the aesthetic requirement to please us from afar and close-up is a different animal. In the first place that alluring look from a distance always takes into account the room setting our design resides in. Another way to think about this is that the distant view is how the piece comes across as a solid object taken as a whole. (Image 1) The interior space where it resides is the setting our design needs to compliment.

Wall or Window

Since the across-the-room look is a marriage between the piece and the interior setting, it's important



The fine details discovered in a piece of furniture delight viewers when they look closer.

to think about what we're trying to achieve. One of the first questions I ask is, do I want a wall or a window? By this I mean, do I want a design that has a solid mass more like a wall. Or do I want a design that's more "air" than structure and which allows my eye to look through it like a window.

A good example of a design that falls into the wall category is the iconic Arts & Crafts chair design by Mackintosh. These exaggerated high-backed chairs (image 2) were quite a departure when they came on the scene. Mackintosh used this design to create an intimate dining setting. Place these chairs around a dining table and their visual mass created a small room within a room.

Contrast that with a Windsor chair that's more air than wood. You can pack a room full of Windsor chairs and the space still feels open



1

1 Our first impression of how well a design fits in a room's setting is usually from a distance.

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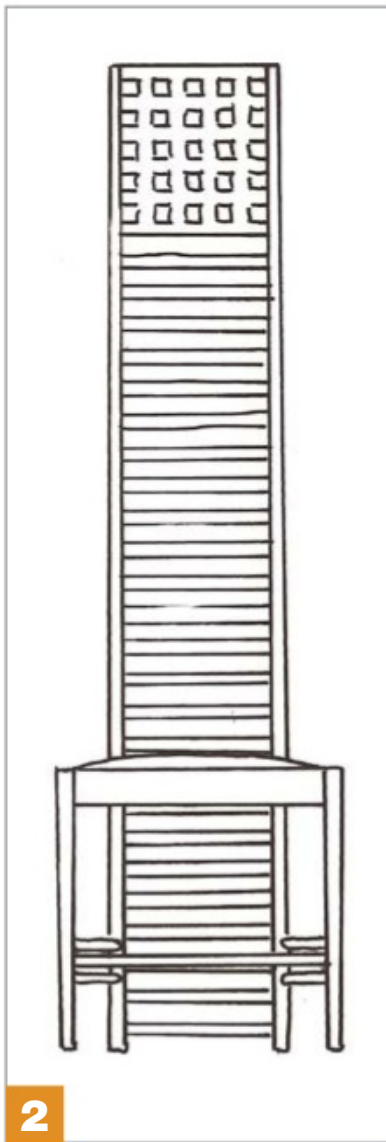
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2 These high-backed chairs around a table create a sense of being in a private booth.

3 The “airy” variations of Windsor chair designs help a room feel larger and more open.

4 Small details in a design provide up-close pleasure not initially noticed from afar.

and airy. You can apply this idea of wall or window to cabinets. Do you want something that creates a cozy intimate space in a study (a wall), or do you want an open feel that invites your eye to see further. A tall bookcase with floor-to-ceiling height might add to the sense of privacy and seclusion to a study. Contrast that with a sunroom—do you want a chair that’s more like a window and gives the feeling of being outside in the garden (image 3)?

Sparkly Details

Let’s jump to that close-up view where we want to add some little gem to delight and connect with the viewer. My first rule of thumb is: anything meant to delight up close shouldn’t be visible from a distance. It’s easy to go overboard about showing off some new carving or marquetry skill you’ve just learned. It’s also tempting to

go over the top with it and create a wedding cake.

I like to think of the up-close details as the soft background music that compliments the overall form. Details that delight up close can include carefully chosen figured panels or crisply cut dovetails or small ebony pegs that give a bit of contrast to the joinery (image 4). Close-up surprises aren’t confined to visual sparkles. They can also be something as simple as a door pull that wraps nicely in our fingers or a chair arm that seems to fit perfectly when we rest our elbows to read a book.

Another appealing up-close detail is the look and feel of surfaces that’ve been worked with hand tools. We do have the ability with modern abrasives to create glass-smooth, perfect surfaces. To my eye, the look and feel of a surface that shows some unevenness from a

tool or an artisan’s hand is a strong connection that I enjoy.

Of the two looks, the distant view is perhaps the most important to get right. It’s all about the overall form and how it invites us to interact. It’s where your ability to design is tested. Yet we don’t want to disappoint when viewed up close. The up-close view is where you can put some of your craft skills on display.

Take note of these two views when looking at furniture designs you admire. What draws your eye from a distance? What delights your eye or touch up close? Think about the volume settings on those up-close details. Is the volume cranked up loud or toned back and subtle? **PW**

George Walker is the co-author of two design books and writer of the By Hand & Eye blog with Jim Tolpin. Read more at www.byhandandeye.com.

The Straightest Path to a Great Chair

This versatile approach is easily adapted to other styles and uses.

By Tom Dolese

PROJECT #1916

Skill Level:

Advanced

Time: 2 Days

Cost: \$300



It's deeply satisfying to sit in a chair that you've created in your own shop—and watch others do the same. Building chairs is also a great way to learn new skills and techniques.

To be fair, chairs face more challenges than any other type of furniture. To be comfortable for a wide array of people, they must incorporate key dimensions, curves and angles. Those same bodies put tremendous stresses on a chair, so strength is also critical. Last, you have to deliver that strength and comfort in a graceful package.

I've been making chairs and teaching the craft for many years, and this design is the straightest path I know to a strong, comfortable, elegant chair.

This design is also versatile. As I did here, you can add arms and tilt the back for comfort, making it a fine addition to any living room or den. I also pushed the style toward Greene-and-Greene, with arched shapes, a splined cloud-lift shape on the arms, and the use of sapele, which is close in color to the Greenes' favored mahogany.

All of these elements—functional and aesthetic—are easily changed without changing the overall approach to construction. Leave off the arms and stand the back up a little straighter, and it's a classic dining chair. Replace the Greene-and-Greene elements, taper the legs, redesign the back slats, whatever, and the appearance changes significantly.

If you go with a thinner or narrower seat frame, however, you might consider adding a stretcher system to the legs to strengthen the structure, as I sometimes do.

As for the seat itself, I like upholstery, which adds comfort and contrast. I'll show you how to make a seat template you can take to your local upholsterer (I recommend hiring a pro for this job) or use as your own guide.

Follow along and I'll show you how I break down a beautiful chair into a series of straightforward steps.

Eliminate Angles Where You Can

As they do on many attractive, comfortable chairs, the side rails on my chairs splay outward at the front, by 10°, and also drop down toward the back. At the same time, the front legs are vertical and the back legs are curved. That creates compound (both horizontal and vertical) angles where the side rails meet the front and back legs.

The key to my approach is simplifying angles where I can while refusing to compromise on what matters most. For example, while some chairmakers lean the front legs back slightly to meet the backward-leaning seat frame squarely, I've found that a chair looks more pleasing if these legs are vertical in every direction.

At the back of the chair, however, I'm able to make things easier on myself and my students. While some chair designs twist the curved back legs outward, adding another angle to the joints at the back of the seat frame, I've found that my chairs look best with both the front and back legs vertical (plumb) in the front view. That makes the angles simpler at the back seat rail, and also means that both back rail and the crest rail above it are the same length with square ends.

I also bevel the two facing edges of the crest and back rails so the lumber slats meet them squarely and can therefore all be the same length. These subtle moves greatly simplify the construction without any negative impact.

Loose Tenons Simplify Compound Angles

I've tackled chairs many different ways, but for me using loose tenons (also called slip tenons) offer the most straightforward approach. Making the tenon separate means the parts all have simple butt joints, which are far easier to cut at compound angles than traditional tenon shoulders are. That also makes the lengths of parts easier to calculate.

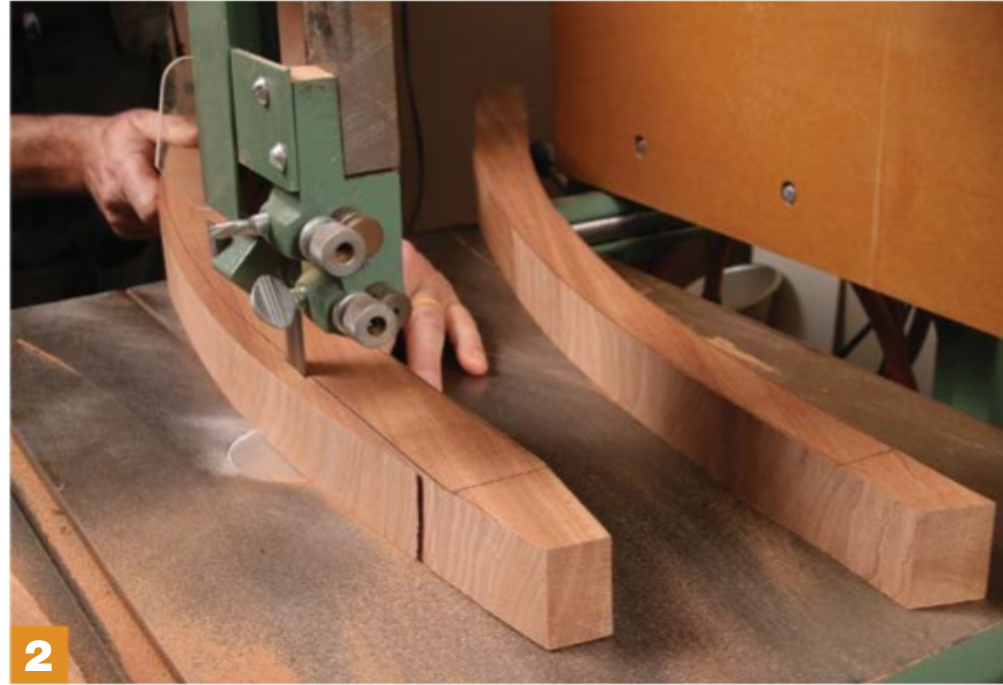


A Straighten the back a little and delete the arms, and you have a standard dining chair.

B Change the leg and rail contours.

C Add brackets like these and move the chair into Greene & Greene territory.

Straightest Path to a Great Chair



1 Make a template for the rear legs and reverse it when marking out each one. I use the same template to lay out the shaper jig for smoothing the curves.

2 Cut out the legs on the bandsaw. If you're using a router or shaper template to remove the waste, cut wider from the line.

3 Carry the mortise locations onto all sides of the leg. As you smooth the sides you'll need to redraw some lines.

4 The simplest option is to smooth the curves by hand, with a spokeshave in the inside and a bench plane on the outside.

5 The fastest option is power. A shaper or router jig speeds things along. Register the legs on the jig using your layout lines and the location of the mortises.

Last, I can get perfect-fitting tenons right off the planer.

Part of why I love slip tenons is my horizontal mortiser, which makes it easy to cut matching mortises in the ends or edges of any workpiece. See “Horizontal Mortiser” for more on my mortiser and some good alternatives.

Mill and Shape the Parts

I begin the design process with a full-size side view of the chair, which I draw on a piece of $\frac{1}{4}$ " MDF. This lets me see how the chair will look and sit, and lets me work out the main dimensions and angles. Add to that a few patterns for the curved parts, plus a plan (top) view, and you have what you need to start building. With this article, of course, you have all of that already, but I would still consider drawing out the main views full-scale.

You'll definitely need to make a template for the curved back legs, using more of the $\frac{1}{4}$ " MDF, which includes the locations of the mortises for the seat rails and crest rail. I use that template to lay out the legs on my lumber with two goals in mind: minimal grain runout and symmetrical grain on the front face of each leg, especially at the top. I achieve the latter by flipping the template to lay out each leg.

After cutting out the shapes on the bandsaw, I carry the line for the top of the side-rail mortise from the template to the workpiece, and around all four sides. It'll be my reference for a number of subsequent steps, so I don't want to lose it as I joint and plane the legs to final thickness.

The bandsawn curves can be spokeshaved and handplaned to their final shape, but if you're making more than one chair, I recommend taking the time to make a template jig for the shaper (see photos 1–5). You can do the same on a router table; you'll just need to take lighter cuts and be more careful to avoid tearout. After shaping the back legs,



Horizontal Mortiser: A Furnituremaker's Best Friend

As my woodworking projects became more complicated, I built my own horizontal mortiser. I recognized back then that using slip tenon-joinery would let me cut my rails and pieces at clean compound angles on the tablesaw, without having tenon shoulders to fit and extra tenon length to account for.

On the mortiser, once I fit the piece wherever I wanted it to go, I just had to align the ends of that piece with the front edge of the mortiser table and cut a mortise. Also, the mortiser cuts mortises just as easily in the ends of parts as it does in their edges.

As I started doing this sort of joinery, I found that the whole process was much faster and more precise, even with simple pieces like doors. I've never looked back since then, and I think my success as a furniture maker is due in large part to having horizontal mortisers in my shop. Some of my chairmaking students show up as doubters, but most start looking for a horizontal mortiser as soon as they leave class.

After a while I bought a commercial mortiser called a Stanfield, and eventually became a dealer for the product. When the owner retired, I bought the remaining stock. I redesigned the machine a couple times, had it manufactured locally, and sold 50 more over the years.

On the other hand, lots of machines and techniques will deliver good slip-tenon joinery, including the Multi-Router, PantoRouter, European-style horizontal mortisers, and mortising attachments that come with some jointers and multipurpose machines. With a few jigs, the Festool Domino works well too.

The reason I prefer the Stanfield concept is because the piece of wood you're working on is right in front of you as you work, letting you see your layout as you set up the machine, and the cutting action as you mortise. And the wood stays stationary while the bit moves, which is a significant advantage for large pieces, like bed rails. I use metal-cutting, solid-microcrystalline end mills for the mortiser, since they are just a fraction of the cost of woodworking bits. I'm not pushing the product, but I've still got some to sell. Contact me at terrafirmadesignnw.com if you're interested.



6 Make an accurate MDF sample with labels to help set up the four cuts without getting confused.

7 Lay out $\frac{3}{8}$ " mortises in all four ends of the side rails. These will enter at an angle, so cheat them a little to one side so they don't pop out of the edge of the rail.

8 To set up the compound mortising angle for the ends of the side rails, align the end of the part with the front edge of the table, and tilt it upward until it is aligned vertically.

9 Place a $\frac{3}{8}$ " bit in the collet and use the layout to set up the height of the bit.



I mill the rest of the chair stock to its rectangular shapes.

Start With the Side-Rail Joinery

Joinery starts with the side seat rails, which have compound angles on each end. These four ends require four different setups on the tablesaw, with both the blade and miter gauge angled each time. To keep track of those angles, and set them up accurately, I make a copy of each side rail in $\frac{3}{4}$ " MDF. Trust me: It's worth it. These templates are labeled with all the necessary angles, they'll show you how long to cut each part, and you can save them for the next time you make this chair.

With the butt joints cut I lay out the $\frac{3}{8}$ "-thick mortises on the ends of the pieces, making sure I leave mortise walls that are at least $\frac{1}{4}$ " thick. Orienting the side rails for mortising is as easy as bringing their compound-angled ends parallel to the front face of the mortiser table and wedging a piece of wood under the back of the workpiece to bring that face into vertical alignment with the edge of the mortiser's table. The horizontal mortiser makes it easy.

After clamping the rail in place, I set the height, depth, and end stops on the mortiser, and cut the mortise.

To locate the tops of the mortises in the curved back legs, I use the line I transferred from the shaper

jig. To create the $\frac{3}{16}$ " reveal I want between the legs and rails, I measure the mortise wall on the rail (see photo 10), and then extend the square to lay out the same mortise wall on the corresponding leg.

After considering the orientation of the front legs for the best grain match, I locate their mortises vertically by hooking a long square onto their bottom ends, and use the direct-measuring trick again to set the amount of inset between rails and legs.

Because the mortises go into the rails at an angle, they can go squarely into the front and back legs. That means the legs can lay flat on their sides on the mortiser table.



10

10 Use the rail mortises to lay out the leg mortises. To create a $\frac{3}{16}$ " reveal, I extend my combo square past the front mortise wall by that amount.



11

11 Use the marks from the leg templates to lay out the top and bottom of the side-rail mortises.

12 The back legs lie on their side, with the flat area aligned with the edge of the mortiser table, and the mortise goes squarely into the leg.



12

How I Handle Slip Tenons

At this point I mill tenon stock to fit the mortises I've cut so far. I like ash here because it's stable and inexpensive, with large pores that give the glue a little more bite. I start each piece on the jointer and planer, test the fit in a mortise, and then move to the tablesaw and router table to rip each piece to width and round the edges before chopping the tenons to a bit under the depth of the two mating mortises, to give excess glue a place to go.

After a quick dry-fit to make sure everything comes together well, I always glue the tenons into the rails first, so I can dry-fit the chair as it comes together. I use Titebond III,

and clean up any squeeze-out so the other mortise will go on easily later. I've got more mortising to do on the front and back legs, so I leave those separate for now.

By the way, I always mark the outside faces of glued-in tenons to help me to keep the pieces oriented properly through the rest of the build.

More Seat Joinery

Now we can go on to mortising the front seat rail as well as the back one, which is extra-thick now to accommodate its curve. Because all four legs are vertical in the front view, the back and front rails enter them squarely, making the joinery simple. Note that the mortise in the back rail

is set back $\frac{3}{8}$ " from the front edge so you don't expose the tenon when cutting the curve.

To locate all of the leg mortises vertically, I simply carry a line around from the side-rail mortises. By the way, to keep the side, front, and back tenons from interfering with each other inside the legs, I make the back- and front-rail mortises a little shorter. Most of the stresses in a chair occur in the side-rail joinery, so I want those tenons to be as long as possible.

Also, I locate the front-rail mortises for the same $\frac{3}{16}$ " reveal used on the side rails. And once again, I mill up the loose tenons I need, and glue them into the rails only at this point.

Add the Crest Rail

Next I cut the joinery for the crest rail. Once again, because the back legs are vertical and parallel in the front view, the crest rail can be the same length as the rear seat rail, and square in its ends. With legs that twist outward, the crest rail can be very tricky and time-consuming to cut, join and fit.

I switch to a $\frac{1}{4}$ " tenon here so I can get the reveal I want between crest rail and back legs without the tenon popping out of the curved rail. And I make the mortises in the legs an extra $\frac{1}{8}$ " long so the crest rail can be pulled down tight on the lumbar slats later. I take the position of these mortises from the back-leg template.

Once the tenon stock is glued into the crest rail (which is still a thick piece of stock at this point), I can dry-fit the back of the chair. This reveals a complication: Because the back legs are curved and the crest and seat rail also curve, the bottom edge of the crest rail and top edge of the rear seat rail are not parallel to each other, which means the two center lumbar slats would have to be slightly shorter than the two outside ones, with angled ends.

My trick for avoiding this complication is to bevel the bottom edge of the crest rail and the top edge of the seat rail to 10° before cutting their

curves, so these edges end up parallel and square to each other in the chair.

After making these slightly angled rip cuts, I lay out the curves again on those edges, and cut the curves on the bandsaw. I always start with the concave side. That gives me a square side to rest on the bench when smoothing them (with a big curved sanding block). After the fronts are sanded, I cut out the back curves. The rails rest steady on their two ends as I smooth the curves with a random-orbit sander.

The Slats and Back

To figure out the length of the lumbar slats, I dry-fit the rear legs and rails, tap the crest rail up to the

top of its extra-long mortises, and measure down to the seat rail. That leaves room for the crest rail to push down tightly on the slats with no gaps. Then I cut the slats to length. Since the inside edges of the rails will be square to each other, the ends of the slats are square too.

Because this "occasional" chair leans back a little more than my dining chairs do, it gets a lumbar curve that is less pronounced. I use a template to mark the curves on all four slats.

The ends of the slats are square, but the tenons will be going into a rail that is angled at 10° , so I tilt the slats the same amount when mortising them. Before gluing tenons into the slats, I use the mortises to



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13 For the slip tenons, plane the stock to a snug fit, then rip to width and round the edges.

14 Mark the location and orientation of these tenons in the seat frame.

15 Mortise the front and back rails. Be sure the mortises in the back rail (and crest rail) are located so they will stay inside the curves of those parts. Mortise the legs too.



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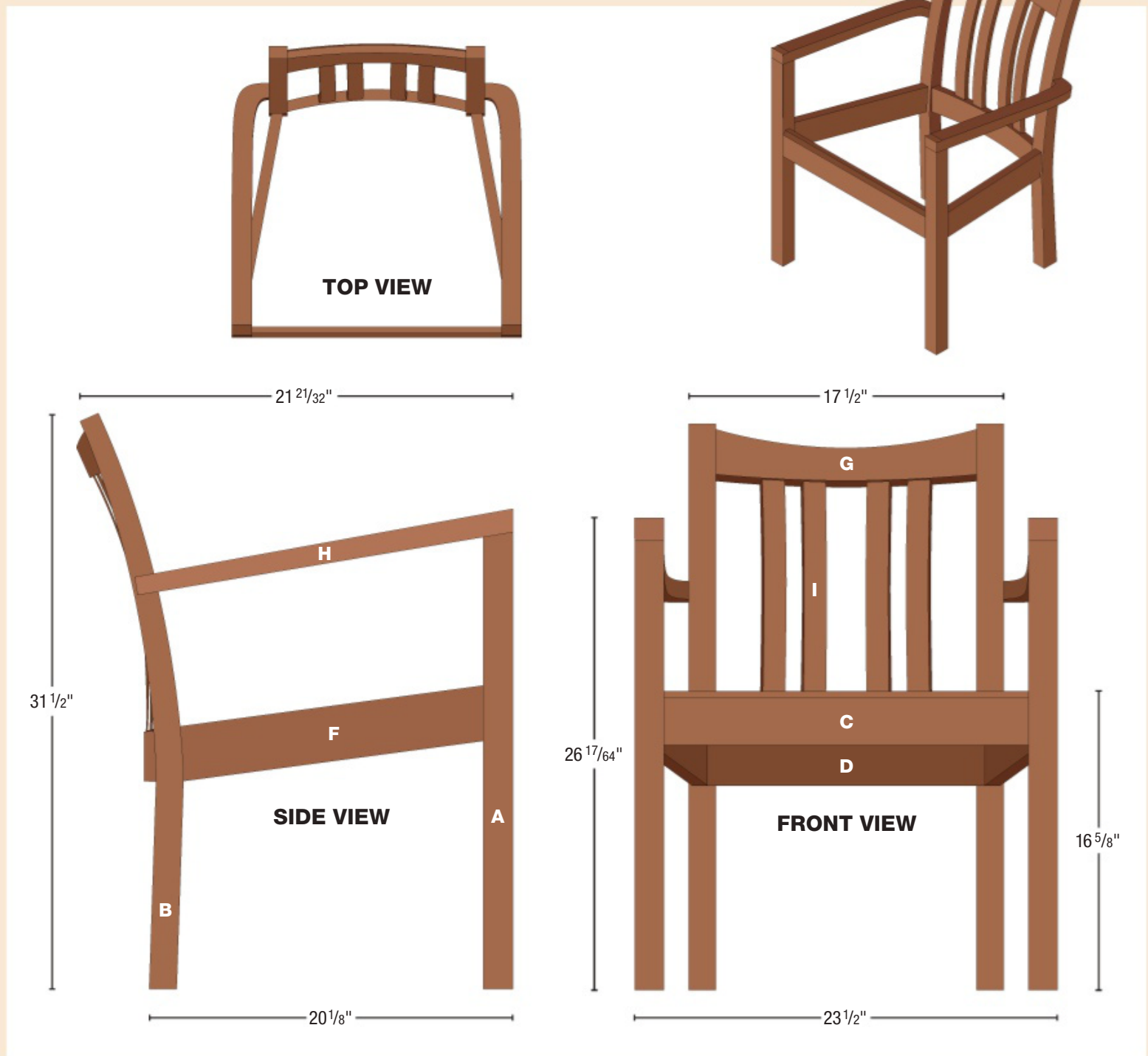
16 Use the leg template to mark the location of the crest-rail mortises, and cut them.

17 Last, mortise the crest rail and glue in its tenons.

18 The lumbar slats are next. I find it helpful to bevel the crest and rear seat rails so they are square and parallel to each other.

19 Dry-fit the chair to find the length of the lumbar slats.

■ Occasional Chair



Cut List

No.	Item	Dimensions (inches)		
		T	W	L
2	A Front Legs	1 5/8	1 5/8	25
2	B Rear Legs *	1 1/2	3 1/2	31 1/2
1	C Front Stretcher	7/8	3	20 1/4
1	D Rear Stretcher *	1 13/16	3	14 1/2
2	F Side Stretchers *	7/8	3	17
1	G Back Rail *	2 3/4	6 3/4	14 1/2
2	H Arms *	1 1/4	8	21
4	I Back Slats *	1 1/4	1 9/16	14 1/4

*Cut to shape

help lay out the corresponding mortises in the crest rail and rear seat rail.

Next cut out the curves on the bandsaw, following the same process for cutting and smoothing I used on the curved rails. As I go, I round the edges by laying the pieces on edge on the router table and using a 3/16" roundover bit.

You're now ready for your first glue-up, joining the curved rails to the curved slats. This is the time to do any last shaping of these parts, so I put a curve in the top of the crest rail now, saving the cut-off to be used as a clamping caul. I also bevel the back of that top edge



with a block plane to add a little more grace. After that, it only takes two bar clamps to assemble the back.

Glue Up the Frame

This version of the chair has arms, which run from the back legs to the extra-tall front legs. So before final assembly, we need to cut some extra joinery. Sometimes I mortise arms to legs, but on chairs like this one, which has wide seat rails giving the frame all the strength it needs, I don't. I attach the arms front and back with $\frac{3}{8}$ " dowels.

To do this you first need to cut off the tops of the front legs at 9° , to match the angle of the arms. Next I center a dowel hole on the top of the arm, using a drilling attachment on the horizontal mortiser, with the leg tilted to 9° (this can also be done on

the drill press. On the sides of the back legs, where the back of the arms land, I drill another dowel hole.

I now fit the glued-up back assembly into the back legs, make a mark $\frac{1}{4}$ " above the crest rail, and cut off the tops of the legs. This is also the time to finish shaping and rounding the other chair parts. To keep clamps from slipping as I glue up the two sides of the chair, I make clamping cauls with the same compound angles as the joinery.

Once the side assemblies have been clamped for at least an hour, you can add the front seat rail and the back assembly and connect the two sides.

Add the Arms

After the main frame of the chair is glued up, I work on the arms. I

make a template for the general shape and trace it onto my stock. Because the arms flare outward to match the sides of the seat, they cross the back legs at an angle. So I need to bevel the inside face of the arms at 4° to meet the back legs

20 Mill and mortise the thick lumbar pieces before cutting their curves.

21 Use the lumbar slats to lay out the corresponding mortises in the curved rails. Wait until after smoothing the curves to lay out the front-to-back locations.

22 Saw and smooth the curved rails.

23 Clamp the curved rails to align each mortise in the curved row. The mortises go in square to the workpiece.

Straightest Path to a Great Chair

25 I save the offcut from the band-sawn curve to protect the top of the crest rail during clamping, and thin MDF pieces to protect the faces of both rails.

26 After giving the arm a tap to mark the mating dowel hole in the arm, mark the angled line where the front of the arm will end.

27 After drilling dowel holes in the back legs where the arms connect, dry-assemble the chair.

28 Cut the curves on the arms and the shallow taper. If desired, but leave the arms a hair long at the front end. You can sand them flush later.

cleanly. Then I drill a dowel hole into this beveled flat, by placing a wedge under the workpiece.

To locate the dowel hole at the front of the arms, I attach them briefly to the back legs and place a dowel center in the hole in the top of the leg, giving the arm a tap to dimple its lower face for a mating dowel hole. This step also shows me where to cut off the front end of the arm. I leave them about $\frac{1}{32}$ " proud at this point, cutting them at a compound angle to match the front face of the legs (miter gauge at 4° and blade tilted at 9°), and sand them flush after assembly.

Next, I lay out the cloud-lift shape on the front of the arm. I do

it with a shaper jig, but you could do it on the bandsaw and smooth it by sanding. Then I use my horizontal mortiser again to cut the slot for the spline (a router jig would also do it), and square off the back of the cut with a chisel.

After the arms are cut out to their general shape, I taper their bottom face so they get thicker at the front, to echo the general splay of the chair. The taper starts $\frac{1}{4}$ " deep at the back and ends about 1" from the front end. Now the arms can be rounded over, sanded, and glued onto the chair. Last, I make splines that echo the cloud-lift shape, and fit them to their slots.





29 Here's how to make an accurate seat base that you can take to an upholsterer. Notch a thin template to fit around the legs, and use a pen to trace the interior of the seat frame. Offset that line inward by $\frac{1}{8}$ " to make room for the upholstery. Cut out that template and trace it onto $\frac{3}{4}$ " Baltic birch plywood.

30 Saw and smooth the seat blank and cut a hole in the middle for webbing. Note the corner blocks are screwed into the frame to support the seat, as well as the extra ledger strip up front where the pressure is greatest.



I saw out the shape, beveling the front edge at 9° so it doesn't bind when I drop it into place. I also cut the back of the front leg notches at 9° for the same reason, using my backsaw.

I usually have my upholsterer install webbing for comfort so I need to cut out the middle of my plywood, leaving a 3"-wide frame all around. I do this with a jigsaw.

I turn over the chair at this point, brand it with my logo, and drill $\frac{5}{64}$ " holes in the center of the bottom of the legs in case Hafele felt pads will be added in the future.

Before applying finish, I go over the chair with a red 3M pad. I finish my chairs with three coats of Livos Interior Oil Sealer (#244) or Sam Maloof Poly/Oil Finish, waiting at least 24 hours between coats. I go over the chair three times with clean rags or paper towels after applying each coat, working the intersections hard, so as not to leave any residue there. If I rub the wet coats firmly and thoroughly, each one glistens with an even, satin sheen and I don't have to sand between them. **PW**

Finishing Touches

I use thick corner blocks to support the upholstered seat bottom, as well as a ledger strip at the front edge where most of the pressure hits. They are angled to match the corners of the seat frame. I set the top of the blocks down 1" from the seat rails, clamp them in place with a Quik-Clamp, drill, countersink and screw them in.

Next I make a seat-bottom template to take to my upholsterer. It

sits inside the frame with a $\frac{1}{8}$ " gap all around. The size of the gap is dependent on how your upholsterer (or you) wraps the seat bottom, but $\frac{1}{8}$ " works well for the upholsters I've used.

The actual seat blank is made with $\frac{3}{4}$ " shop-grade plywood. After making the template, I trace its shape on the plywood and then flip it over to make sure it's symmetrical, to keep things consistent for my upholsterer. If it looks good

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Tom Dolese makes furniture and teaches chairmaking at his shop in Bellingham, Washington. See more at terrafirmadesignnw.com

■ Arts & Crafts Tile-Topped Table

Handmade tile and expressive joinery make this a very special table.

**By Seth Keller with
Aseese Grewal**

PROJECT #1917

Skill Level:

Intermediate

Time: 2 days

Cost: \$250

When I first started building furniture, I learned a lot from reproducing original Shaker and Arts & Crafts designs. Measured drawings were often available, so I could learn how experts like Stickley would construct a table or chair and use these parameters for my own versions. I read about a Stickley side table that sold at auction for over \$50,000 and was in awe.

What set the table apart was beautiful ceramic tiles made by Greuby Faince Ceramics company, which went out of business in 1920. The tiles allegedly used lead in the glazes which were richly iridescent, but possibly poisonous in the manufacturing process. The tiles used in this project are also beautiful and hand made, but were hand-made in the last year.

The Small Changes

The original design had twelve rectangular tiles and a shelf with distinctive pegged tenons and curved

aprons. This design is smaller, using only six square tiles and has the pegged shelf tenons, with straight aprons instead of curves. The smaller scale is better for a wider range of rooms and would be great as a pair, flanking a sofa.

Lay the Tile Out

The exact size of the top is defined by the shape and size of the tile. These handmade 4" x 4" tiles are from a maker in Minnesota and have a deep beautiful blue glaze, but are slightly irregular. Before building the top frame, it is important to lay out and measure the tile, which requires a template.

Rip a $\frac{1}{8}$ " strips from hardboard to make $\frac{1}{8}$ " spacers for laying out the tiles. When making thin rips, measure to the outside of a scrap piece and line up the mark with the blade. This method is safer than ripping thin pieces against the fence, which can result in dangerous kick-backs. Arrange the tiles with the spacers

between the tiles and then trace each tile on the plywood. Number the tiles to coordinate with a spot on the plywood blank. The inside of the top frame will be $\frac{1}{4}$ " larger in each direction that the final measurements for the array of tiles.

Creating the Top Frame

Mill all of the lumber to thickness and then rip to width, and cut to the correct length. Next, cut tenons on the top stiles. Long tenons like this can be made in myriad ways. I chose to lay them flat on the tablesaw and make multiple passes with a single blade to remove most of the material, and clean up the joints with a shoulder plane.

In photo 3, an auxiliary fence is attached to the miter gauge and a square stop is clamped at the depth of the shoulder, which is $3\frac{1}{16}$ " long. The cheeks and shoulders are different depths, but while the stop is set, it is wise to cut all the way around as a first step. Clean up the rest of the



1 To help lay out the tiles evenly, cut some simple spacers to keep everything aligned. With the spacers in place mark the position of each tile on the plywood base.

2 Because the tiles are handmade, there'll be variations, so it's a good idea to number the tiles and locations.

3 Use an auxiliary fence and stop block to cut my tenons flat on the table saw.

■ Tile-Topped Table



4 With such a large through mortise, start with the drill press to remove most of the waste. A couple of sharp chisels will clean up the rest of the mortise and help size things.

5 To help the fit, ease the corners of the tenon with a chisel.

6 Don't let the glue fool you, there was a dry fit of this frame first. You don't want to be surprised once the glue is flowing!

7 With the glue on the frame cured, use a rabbeting bit in a router table to create the recess for the plywood insert.



tenon with a bandsaw and chisels.

The mortises on the rails are a challenge. Three inches long and cut all the way through, there are a number of tricky parts including making sure that the tenon starts and ends in the right place, and that tear-out on the 'back side' is avoided. While there are many ways to cut mortises, hogging the material out with a drill press, and cleaning up the edges with a chisel is tried and true. If you have a hollow chisel mortiser, this would be a good time to tune it up!

Mark the mortise on both sides of the top ends. Take time to set a fence on the drill press so the bit is perfectly centered in the work piece.

Drill the ends first, and then clean out the inside of the mortise, cutting just over half-way through. After drilling the waste on one side, flip the piece over knocking out all of the dust before drilling the second side. After roughing all of the mortises, clean out the waste with two chisels, one 1" for the sides, and a 1/4" for the ends. This takes some time!

Dry-fit the top to make sure the tenon slides all the way through and sticks out 1/16", taking care to avoid blowing out the mortise as it protrudes through the part. Label the parts on the bottom, and pull the assembly apart, or knock apart with a rubber mallet. Chamfer all

of the edges with a chisel or small hand plane, the ends of the through tenons as well as the sides of the outward facing mortise. After an additional dry-fit, this assembly is ready for glue up.

Insert the through tenons 1" into the respective mortise. Apply a light coat of glue on both sides of all of the tenons. This method avoids any glue squeezing out through the end of the mortise, which would be difficult to clean. Clamp the assembly using two clamps, and let the glue dry. Clean out any glue squeeze out right away.

After the glue dries, cut a 1/2" x 1/2" rabbet around the inside bottom of the tabletop assembly to accommo-



8 A chisel helps square up the corners for a perfect fit.

9 Set the tiles in place using simple construction adhesive on the plywood.

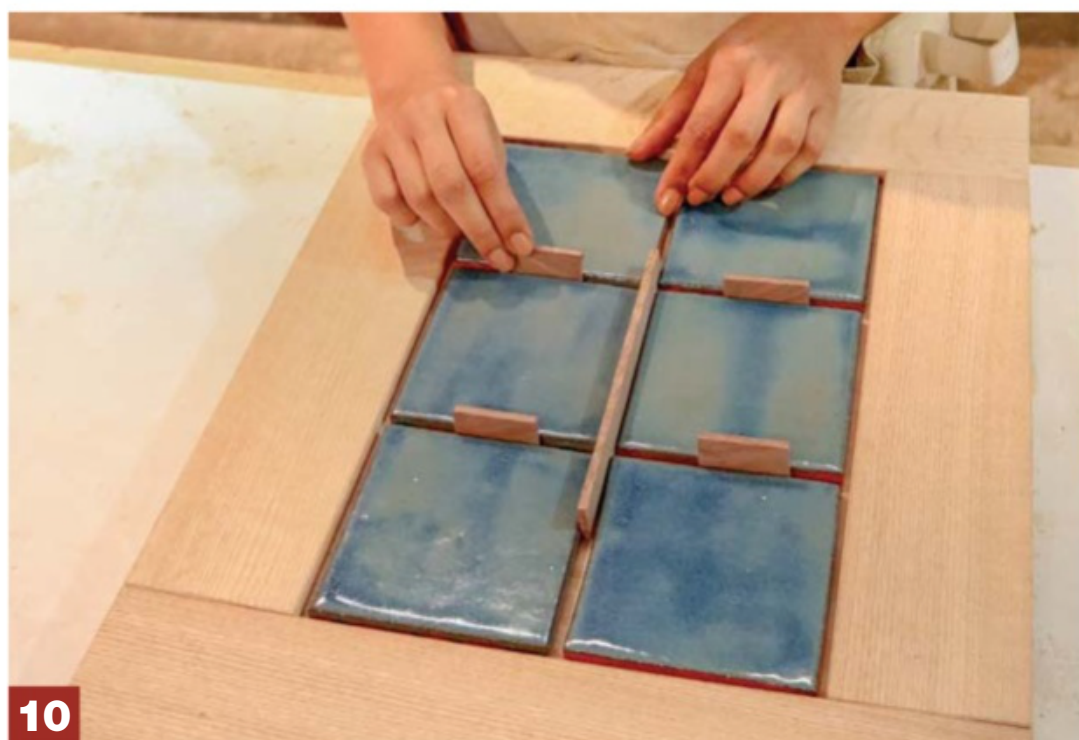
10 Pay attention to the numbering on your tiles, and don't hesitate to use your spacers again to keep things even.

date the plywood sub-top. To get the exact depth, flip the table over and use a tile for exact measurement. This is the correct depth to aim for. Install a rabbeting bit with bearing into the table router. Take multiple light passes as the porous white oak is prone to chipping and tear-out. This leaves a perfect rabbet with rounded corners.

Flip the top assembly over, extend the straight lines to define the 90° corner, and chisel out the waste. Once the rabbet is set, cut the plywood sub-table for the tile and set it in place. Apply construction adhesive thickly only underneath the tiles and set the tiles using the spacers. Don't allow construction adhesive to get on the spacers.

Make the Legs

The legs are the simplest part. Lay out the mortises on the legs. Each leg will have two mortises on top for the aprons, and one mortise



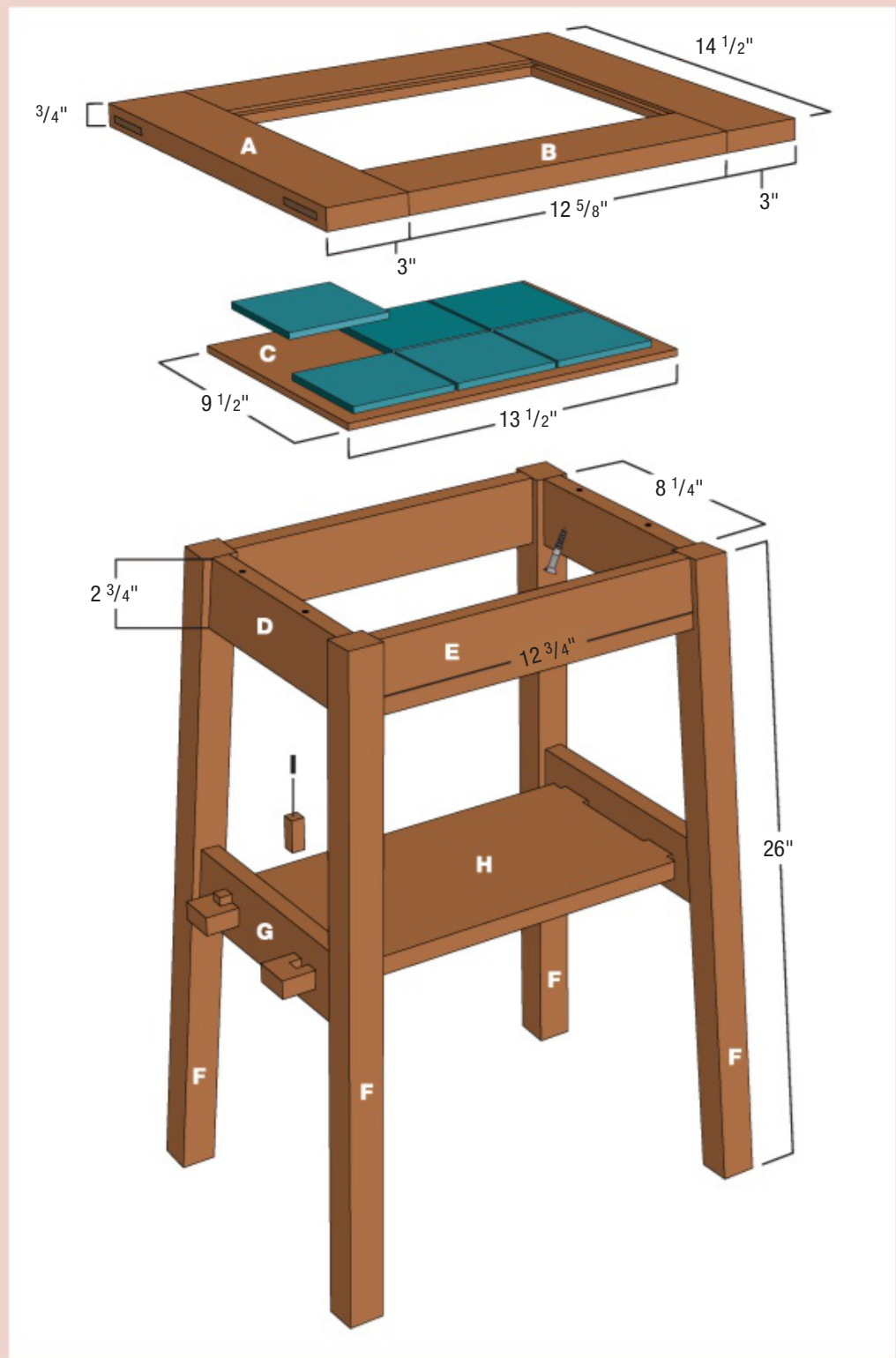
midway down for the stretcher which will hold the shelf in place. To simplify the design, all of the mortises are in the center of the legs. Using the same technique as the top frame, use a drill press to excavate most of the material and clean up the mortises with chisels.

The Angled Stretchers

The legs angle out at 3° in each direction. All of the leg joinery is

cut at 90°, but all of the tenons are angled at 3°. The first step is to attach a sacrificial fence to the miter gauge and set a 3° angle. Cut each part to the overall length with an angle on each side. Next, set a 3° angle on a sliding angle finder, and then mark a 1/2" long tenon on each stretcher. Set the blade to 1/4" above the table top surface, and use one of the marked pieces to set the correct depth of the tenon. Clamp a

■ Tile-Topped Table



Cut List

No.	Item	Dimensions (inches)			Notes
		T	W	L	
2	A Top Rail	3/4	3	18 5/8	Includes tenons
2	B Top Stile	3/4	3	14 1/2	
1	C Plywood	1/4	9 1/2	13 1/2	
2	D Short Apron	3/4	2 3/4	9 3/4	Includes tenons
2	E Long Apron	3/4	2 3/4	14 1/4	Includes tenons
4	F Legs	1 1/2	1 1/2	26	
2	G Lower Divider	3/4	3	12 1/8	Includes tenons
1	H Shelf	3/4	8	19	Includes tenons
4	I Wedge	1/2	3/4	1 1/2	

small block on the sacrificial fence and cut all of the tenons on one side, making multiple passes on the tablesaw. Re-set the miter gauge at 3° on the opposite side of the blade, set a new block and cut the second side of the tenon. Complete the tenon by securing the parts in a bench-vise and saw the shoulders of the tenons at an angle with a Japanese pull-saw.

The shelf stretchers have horizontal angled mortises cut in them. Mark the mortises on both sides of the stretcher. Make a simple jig to position the shelf stretchers on a 3° angle. Chuck up a 1/8" drill bit in the drill press and cut the inside corners of all four stretcher mortises, and then use a 3/4" Forstner bit to hog out the waste. Clean the mortise with chisels, and then chamfer the edges of the mortises.

Complete the Shelf

The shelf has pegged tenons, and a challenging 3° angle on the end face of the shelf which requires careful and accurate cutting on the bandsaw. After the shelf is cut to length and width, mark the tenons with mortises. It is wise to clamp the table up and confirm the length of the shelf with a dummy blank. Cut the shoulders of the shelf tenons with the bandsaw.

Next, cut a parallel relief cut in the waste to make room for the following step. Set the bandsaw to a 3° angle and sweep in the relief cut and cut the end face. Do the same on the opposite end. Clean up the joint with a Japanese saw and chisels. At the drill press, hog the waste from the mortises and use a chisel to square the joints.

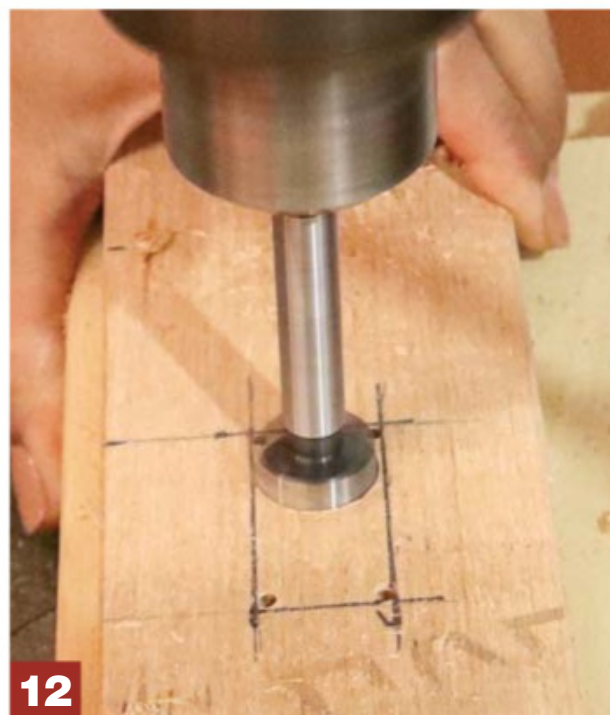
Cut the Pegs

Mill a 12" long piece of white oak to 1/2" thickness and mark a tapered peg with pencil. Cut the parts on the bandsaw, and clean up with a plane and chisels. Test these in each hole to make sure they fit.



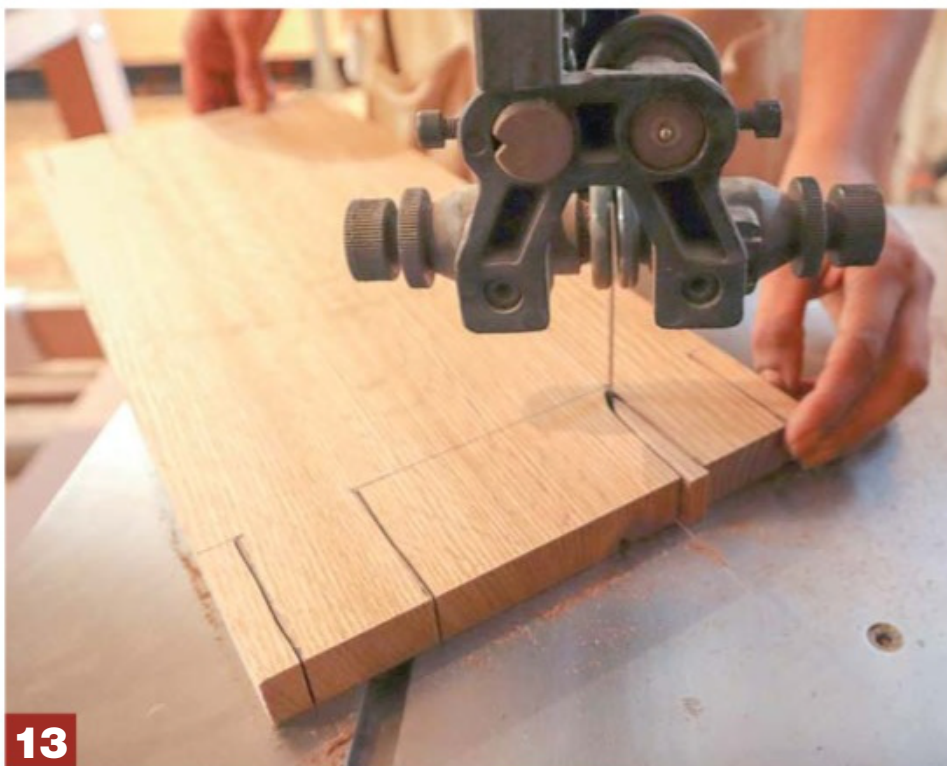
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11 The stretchers tenons are cut at a 3° angle set on the miter gauge. Next, use a pull saw to cut the tenon shoulders.



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12 Multiple passes with a Forstner bit creates the through tenon in the lower stretchers. Then clean up the mortise walls with a chisel.



13

13 Two parallel cuts on the bandsaw create the shoulder of the tenon and room for the blade to turn during the next step.

14 Next, set the bandsaw table for a 3° angle. Use the set-up piece from the aprons.

15 Cut the end faces at 3° on both ends then use a pull saw to clean up the bandsaw cuts. Follow with a chisel to leave a clean surface.

16 The mortises for the pegs are started with a Forstner bit and completed with a chisel.



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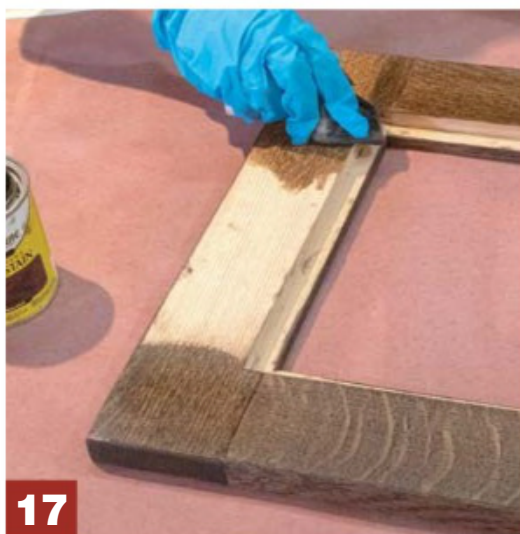


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■ Tile-Topped Table



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17 Pre-finishing the top before assembly and grouting the tile will save headaches and provide a better overall look to the piece.

18 The same goes for the table base. Where glue will be applied, a little blue painters tape will leave the wood bare to ensure a better bond with the glue.

19 Glue up the two ends of the table first. Because a finish is already in place, use scrap pieces between the legs and the clamps to keep from marring the wood.



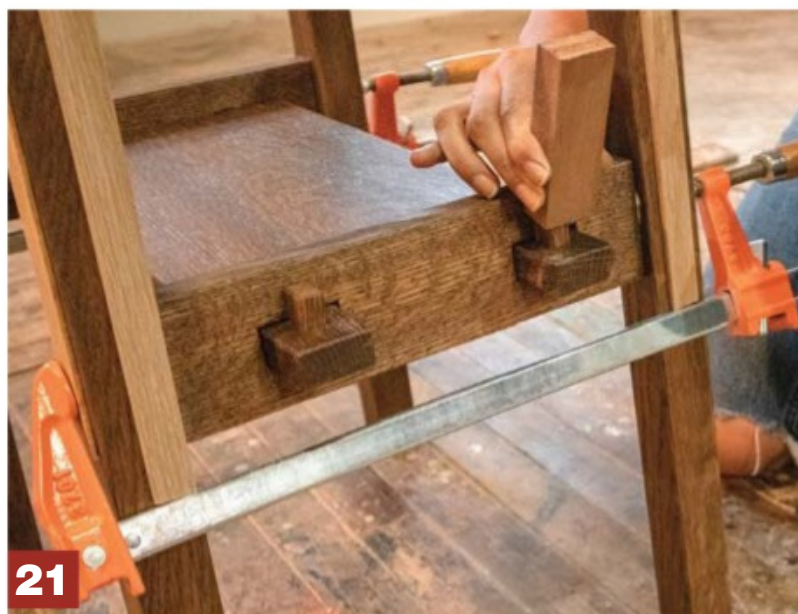
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20 No need to wait on the end frames to dry. The apron and top stretchers can be glued in place by standing the base up on an even surface. Just clamp across the top stretchers at this point.

21 When glued and tapped into place, the pegs themselves apply the clamping pressure against the shelf.

22 After the top finish has dried for 24 hours, attach the plywood sub top to the frame, then tape off the finished wood on the top. A flexible spatula helps push the grout into the gaps around the tiles.

23 With the excess grout removed, clean the grout film left on the tile using a damp sponge. A final wipe with a clean rag to dry the tiles and let the top sit overnight.

Stain & Top Coat

This table benefits from finishing before assembly for numerous reasons. First, the pegged tenon joints are difficult to brush or wipe with finish and are prone to drips. The top will be taped and grouted, so pre-finishing helps protect the top. Varathane makes an excellent black walnut colored stain, which highlights the rays in the quarter-sawn wood. After staining each surface, let the stain dry overnight. Tape all of the glue surfaces and then spray three topcoats of polyurethane.

Clamping

Despite the pegged shelf joinery, this table is not 'knock-down' and must be glued up at once (excepting the top). Because the table has stain and finish on it, it is important to protect the surface from marring.

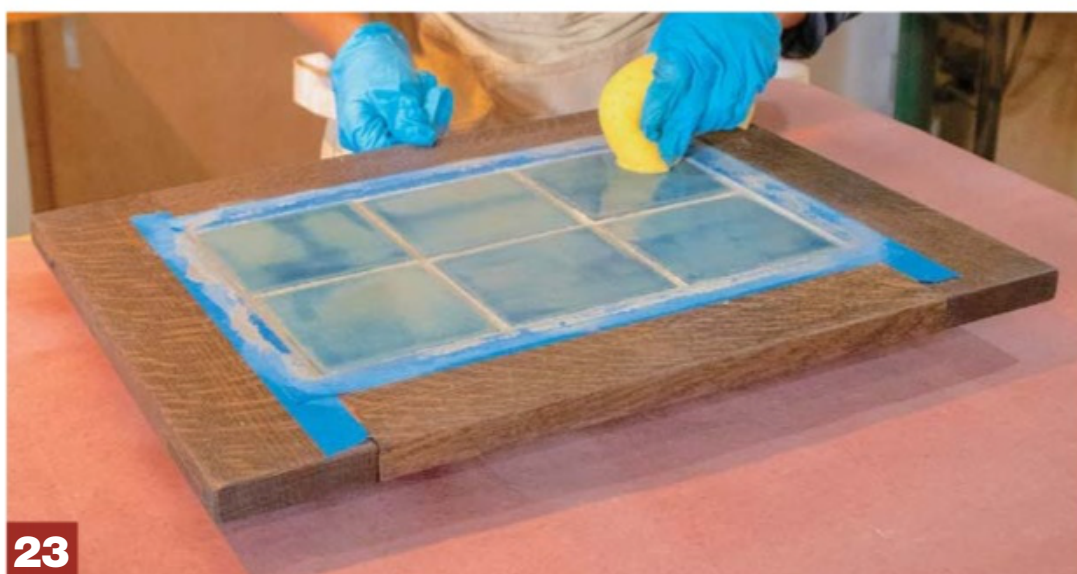
Assemble the two sides with the shelf stretcher first, and then tip these up and while fitting the long aprons, fit the shelf at the same time. Clamp the top first, and after the shelf mortises are inserted through the mortises in the stretcher, drive in the pegs to hold the shelf in place. Unclamp the table.

Because of the angles, the top and bottom of the legs must be trimmed.

Mark lines parallel to the ground plane. Trim the bottom with a Japanese saw, and level the top with a small belt sander. Touch up the stain if necessary. Bore holes to attach the top with Figure 8 tabletop fasteners.



22



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Grouting the Top

After the finish on the top has dried for 24 hours, it is ready for grouting. The tiled plywood sub-top can be fixed in the rabbet in the top with wood glue or adhesive. Wait for the adhesive to set.

Apply painters tape to the top frame, carefully fixing the tape on the chamfered edge of the frame, which will protect the wood from the moist grout. Using a flexible hand spatula, spread grout on the tile, and carefully pack grout into the gaps between the tiles.

After all of the gaps have been filled, wipe all of the excess off with the hand spatula. Clean the grout from the tile with a sponge wet

with water. Remove all of the film with the sponge. Don't let any film dry on the tile. Make one careful pass with a clean rag to dry the tiles, and let the grout set overnight. Remove the tape, and fasten the top to the bottom.

Use this tile top table in the living room alongside an easy chair, or next to your bed for morning coffee. **PW**

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Seth Keller is an independent furniture designer and the director of the Sullivan Fabrication Studio at the School of the Art Institute in Chicago. Aseese Grewal is a designer and furniture maker also based in Chicago.

■ Barrister Bookcase

We redesigned this classic with techniques so simple even a novice can build it! **By Glen D. Huey**

PROJECT #1918

Skill Level:

Beginner

Time: 3 days

Cost: \$400



LEAD PHOTO BY AL PARISH. ALL OTHER PHOTOS BY THE AUTHOR.

Almost everyone likes the look of barrister bookcases. But what makes them so appealing? I think there are a number of characteristics that make the barrister design popular and enduring.

First is that the individual units of the case stack together. And because they are separate units, they can be arranged in any desired height configuration to fit any area of your home or office.

Second, they are elegant as well as functional. The wood-framed glass doors, when lowered, protect your books or other valuables from moisture and dust—not to mention those tiny pudding-laced fingers of the little ones. They also allow you to look through the glass for a specific item without the undo stress of operating the doors. In the open position, with the doors raised and slid back into the case, you have easy access to those leather-bound sources of knowledge.

Third, as you will see, we rethought the construction so these cases can be built with the easiest techniques—without sacrificing any classic design elements. These are the easiest barrister bookcases you will ever build.

We decided to build a stack of three units—each identical in construction and design, with one slightly different in height. There are two larger units for over-sized books and special keepsakes, and one that is slightly shorter in height. Those,

along with the top and bottom units, add up to the appropriate design for our bookcase needs.

Your set can be created with only one unit, or it could be a stack of five, along with the top and bottom sections. (More than five units is unwieldy and potentially unstable.)

One Panel Chops into Three

We wanted the grain on each case side to be consistent from top to bottom as we stacked our individual units. This is a matter of aesthetics, not a necessity. (I'm sure somewhere during this case's lifetime, the units will be stacked without regard to the grain.)

What is a necessity, in order to get the units to stack without problems, is to make the width of each unit equal in size. This is best accomplished by starting with one large glued-up panel of the correct width that is then crosscut into the appropriate lengths.

Once the sides are milled according to the plan, there are three rabbets that need to be cut in each side panel. One rabbet goes at the top and bottom of each side panel. Those rabbets are for the full-width case bottom and the front and back rails at the top. You also need a rabbet at the back edge of the side panels that will house the backboards. That rabbet hides the backboards when viewing the bookcase from the side.

A dado blade is the best choice for

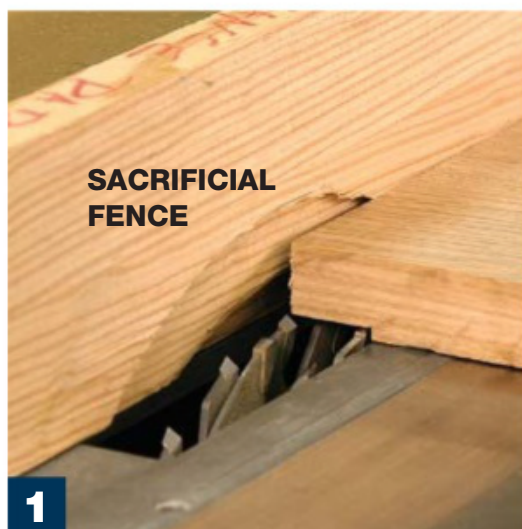
cutting the rabbets. Install a sacrificial fence, set the blade for the widest cut (at least $\frac{3}{4}$ ") and position the blade below the saw top. Adjust the fence to the blade so that $\frac{3}{4}$ " of cutting width is exposed and with the blade running, slowly raise the cutter to a height of $\frac{1}{8}$ ". With this setting, a single pass over the blade will create the $\frac{3}{4}$ "-wide x $\frac{1}{8}$ "-deep rabbets at the top and bottom edge of the side panels.

Next, again with the blade moving, raise the height to $\frac{7}{16}$ ". This is to create the rabbet for the backboards. They fit into a $\frac{3}{4}$ "-wide x $\frac{7}{16}$ "-deep rabbet. If you are trying to keep the grain aligned, as we have, you need to determine the front edge of the bookcase prior to crosscutting the individual side panels into smaller sections. Or, choose the best edge of your stock for the front face at this time and cut the backboard rabbets into the opposite edge.

Your Groove is Important

Creating the groove in which the doors slide is the most difficult task involved in building these bookcases—but all it takes is a plunge router with a guide fence and a $\frac{1}{4}$ " upcut spiral router bit.

Positioning this groove is the trick. It needs to be located correctly from the top edge of the sides, so the guide fence of the router becomes key. Set the fence so the router bit plunges into the side with $1\frac{1}{8}$ " of material between the top edge and the groove.



1 Using the widest setting on a dado stack along with a sacrificial fence is the best choice for creating rabbets for these case sides. This will ensure that the cut clears the waste entirely.

2 Raising the blade height is the only adjustment needed to cut the backboard rabbets. The front edge of this side looks as though it is raised from saw top because of the previous rabbet cut.

The $\frac{1}{4}$ " cut will then be perfectly set for the placement of the centered brass rods in the bookcase doors, and it builds in the necessary $\frac{1}{8}$ " spacing so the top edge of the door does not bind when opened.

Next, you need to find the starting or stopping point of the cut depending on which side you're working. On each right-side panel you'll plunge at the front edge and finish the cut through the backboard rabbet. On the left-side panels you'll begin coming through that rabbet and complete the cut by stopping at the correct location and removing the bit from the work surface. Attacking the groove this way registers each cut off of the top edge of the side panels and makes the best use of the guide fence.

The location that you need to stop on is $\frac{3}{8}$ " in from the front edge of the sides to the beginning of the routed groove. Where did this number come from, beside the plan? The $\frac{1}{4}$ " brass rods that are used to hang the doors are located in the center of the $\frac{3}{4}$ "-thick doors. The outer $\frac{1}{4}$ " of door stock along with the design feature of the $\frac{1}{8}$ " offset of the door

to the front edge of the case adds up to that exact location.

With the setup and location locked in, rout the $\frac{5}{16}$ "-deep grooves into the sides as shown in the picture at right.

The doors will be held in position toward the front with two brass rods per side. The top rod is centered $1\frac{3}{4}$ " from the top edge of the side and in 1" from the front edge. These two rods act as a pivot for the sliding door.

The second rod location is pulled from the bottom edge of the sides and is also set at a measurement of $1\frac{3}{4}$ ". It too is located 1" in from the front edge. This rod placement gives the door something to close against while holding the door parallel to the case front when closed.

Assemble the Box

Mill to size and thickness the material for the top-front rails, rear rails and the catch rails, as well as the bottoms. You can get away with using a secondary wood for the rear and catch rails, as we chose to do, because these pieces will not be seen as you view the bookcase.

All pieces connect to the sides with pocket screws.

Cut three pocket-screw holes on the worst face of the bottoms, leaving the best face for the inside of the piece. Position a hole at $1\frac{1}{2}$ " from each edge and one that is centered across the bottoms. The rails used for the top also attach with pocket screws. Place two holes at each end of both rails.

Now you are ready to assemble the boxes. Position the bottom on your bench and match the two sides to the bottom, making sure that the bottom fits into the shallow rabbets. Next, slide the top rails in place—the oak at the front and the secondary wood at the rear. These rails fit into the rabbets at the top edge. Add clamps as shown below then attach the rails to the sides with the screws. Flip the box then add the screws to attach the bottom.

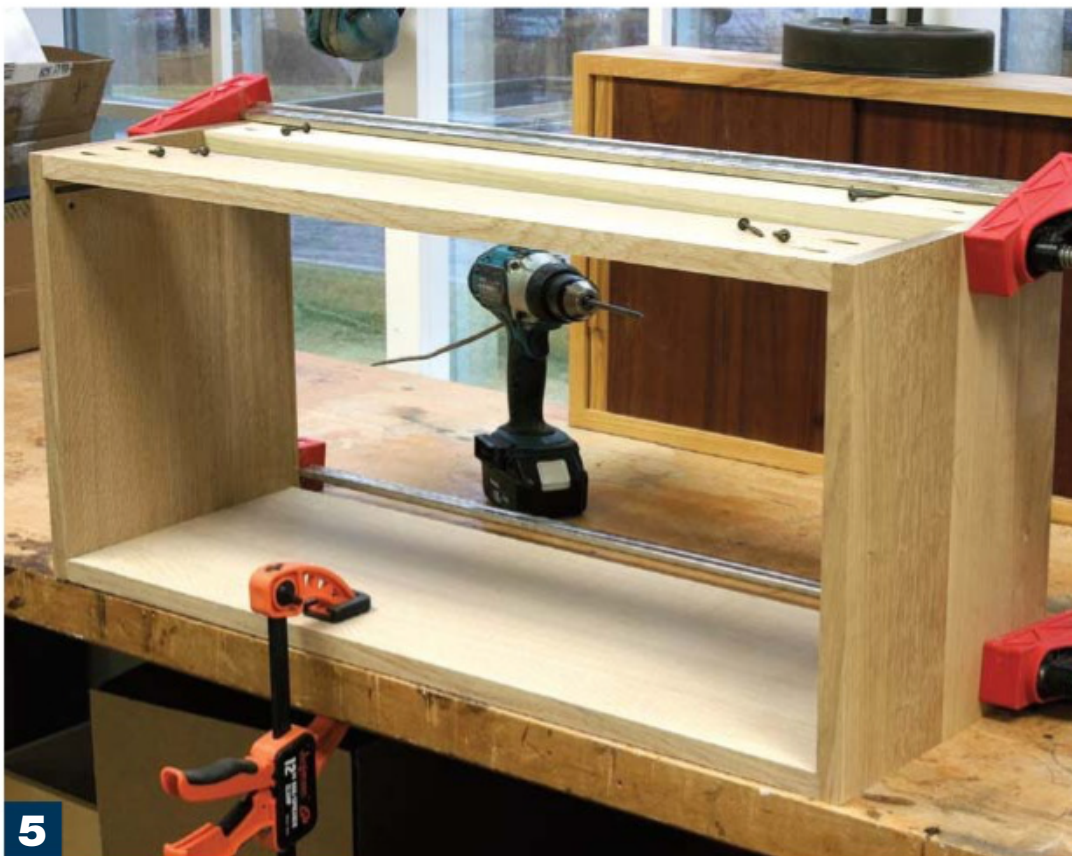
With the box set on its top, position and attach the catch rail to the bottom. Align the piece off of the front edge of the unit and center the rail from side to side. Each rail lines up with the inside face of the side, not the edge of the rabbet area.



3 Creating the groove for the door pins to ride in is the most exacting step of the process. A plunge router with a guide fence makes it short work. Check the layout before routing.

4 There are pin locations at both the top and bottom that act as guides for the doors. Use the drill press for this step—unless you have a very steady hand and good eye.





5

5 Assembling the boxes is a matter of 14 pocket screws. Clamping the box ensures that it will be square. The opening in the top is for the adjoining catch rail on a second unit.

6 The catch rail is fastened to the box bottom. It's important to properly align the piece to fit the other units.

7 The catch rail for the top unit rests inside the end rails. To keep the rail from sliding downward as the screws are installed, rest the piece on a block cut to the correct size.



6



7



8

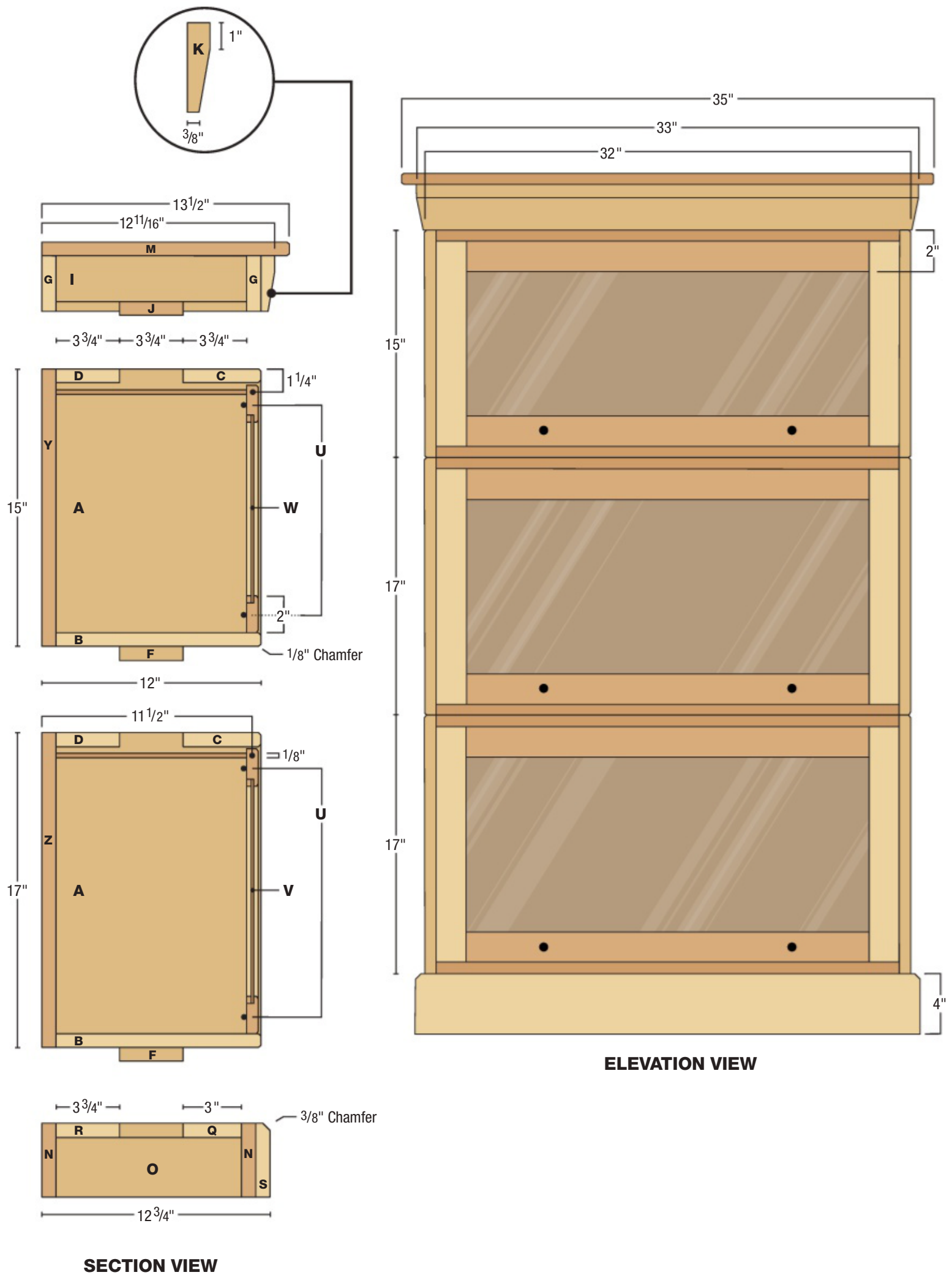


9

8 The 3" rail in the base unit is toward the front while the wider rail is held to the back. Each rail is not only connected to the frame side, it is also attached to the center support.

9 The chamfered base moulding is fit to the base frame on three sides. The secondary wood of the frame is hidden when the bookcase is stacked.

Barrister Bookcases



Attach the rails to the bottom with wood screws.

Creating the frames for the top and base units is next. We found that building the frames and then attaching the mouldings was the best way to approach this part of the project. It also allowed us to use secondary wood for these hidden areas.

Each frame starts with the assembly of a box. The end supports receive the pocket-screw holes and are attached to the rails through that connection. Also, while you have the pocket-screw jig out, add a number of holes to the top frame that you'll use for attaching the top.

With the narrowness of the frames, you should arrange the pieces so the screws are to the outside of the unit. The drill, with the square drive installed, is too large for the inside of the frame. You should also

attach the center support, the piece that runs from front to back and is centered along the width of each frame, through the outside with four #8 x 1 1/4" wood screws.

From this point the construction of the frames differs. In order for the top and base units to fit the design of the bookcase, the top unit must have a catch rail while the base unit receives a front and back flat rail.

The catch rail of the top unit fits between the frame's side rails, with a 1/4" extending beyond the side rails, and attaches to the center support with two #8 x 1 1/4" wood screws.

Make sure that the catch rail is aligned to fit into the top rails of any of the bookcase units—they are all consistently positioned, making them interchangeable.

In the base unit the front and rear flat rails are set flush with the

top edge of the frame and attached using the pocket-screw method. Remember that the front rail is only 3" wide, whereas the rear rail is 3 3/4". Each of these flat rails also attaches to the center support with #8 x 1 1/4" wood screws.

The mouldings are next. Mill the material for the crown moulding, the base moulding and the bookcase top to size and thickness. The top edge of the base moulding has a 3/8" chamfer. Cut the edge with a router equipped with a chamfering bit, then fit the pieces to the base. Because there is a solid frame backing the mouldings you can nail the pieces in place with brads. Add a small bead of glue at the mitered corners as you assemble the mouldings for added strength.

Make the Crown Moulding

The crown moulding is a bit more complex than the base moulding. It begins with a cut at the table saw. Tip the blade to 10° and position the fence so that the blade exits the stock about 1" down from the top. This will leave about 3/8" of material at the bottom edge of the stock. This setting will need to be fine-tuned at your saw. Run the cut for both pieces of stock—one for the front and one piece that is crosscut into the two ends.

I elected to make a pass over the jointer to clean up the saw marks on my mouldings. Set a light depth of cut and be sure to use push sticks. If you choose not to use the jointer you can sand the moulding face smooth. Once the piece is cleaned and sanded it can be attached to the top frame.

I work counter-clockwise around the unit to get an accurate fit when wrapping mouldings. This allows for easy marking of cutlines as well as easy positioning of the cuts at the miter saw and it allows me to make my mitered cuts without changing the angle of the saw. Cut and fit the first mitered corner and clamp the pieces to the frame. Slide the third piece, with its end cut square, to meet the

Cut List

No.	Item	Dimensions (inches)			Comments
		T	W	L	
2	A Case Sides	3/4	12	50	Cut to length
3	B Bottoms	3/4	11 1/4	30 3/4	
3	C Top Front Rails	3/4	3 3/4	30 3/4	
3	D Top Back Rails *	3/4	3 3/4	30 3/4	
3	F Box Catch Rails *	3/4	3 3/4	30 3/4	
2	G Top Frame Rails *	3/4	3	32	
2	H Top Frame Sides *	3/4	3	10 1/2	Makes both sides
1	I Top Frame Center Support *	3/4	2 1/2	10 1/2	
1	J Top Frame Catch Rails *	3/4	3 3/4	30 1/2	
1	K Front Crown Moulding	3/4	3	36	
1	L Side Crown Moulding	3/4	3	26	
1	M Case Top	3/4	13 1/2	35	
2	N Base Frame Rails *	3/4	4	32	Makes both sides
2	O Base Frame Sides *	3/4	4	10 1/2	
1	P Base Frame Center Support *	3/4	3 1/4	10 1/2	
1	Q Base Frame Front Flat Rail *	3/4	3	30 1/2	
1	R Base Frame Back Flat Rail *	3/4	3 3/4	30 1/2	
1	S Base Moulding/Front	3/4	4	36	
1	T Base Moulding/Side	3/4	4	26	Makes both sides
6	U Door Rails	3/4	2	26 3/8	
4	V Door Stiles/Tall	3/4	2	15 1/16	
2	W Door Stiles/Short	3/4	2	13 1/16	
9	X Glass Retainer Strips	5/16	5/16	28	
1	Y Short Unit Back	3/4	14 7/8	31 7/16	
2	Z Tall Unit Back	3/4	5/16	31 7/16	Plywood

NOTE: All pieces are Quartersawn White Oak except those marked with a *, which are popular.

back of the front crown piece as shown in the photo below and mark the top edge on the front moulding.

At the miter saw, align the mark with your blade (saw angled to the right) and make the 45° cut. With the top edge up it is easy to match the blade to the layout line. Now to cut your final miter, simply place the end piece at the saw with the top edge pointing down while the face side is out and make the cut. The angle of the saw doesn't change and the cuts are correct. This is also how I would cut the first mitered corner.

Place the top unit, with the moulding now applied, onto the bookcase top, centered from side to side and flush to the back edge of the top unit. Use pocket screws to attach the frame to the top then set the completed top unit aside.

The Doors are a Snap

The only easier method that could be used to build doors would be a flat-paneled door and that wouldn't give us the glass panels that we need for these cases. The secret for these doors is accurate cutting of the pieces.

Rip the material to the required width then set stops at the saw to allow for accurate cutting of the required lengths. If the pieces are all cut to the same sizes (two matching sets of the rails and stiles per door) two things will happen—one, the doors will be square when assembled and two, the assembled doors will correctly fit the openings of the boxes.

Cut the stiles to be $\frac{3}{16}$ " less than the opening of the box and the rails to be $\frac{1}{8}$ " less than the total width

of that opening. This will build in the appropriate reveal around the doors.

These doors are also assembled with pocket screws placed in the rails, and the location of the holes is important. If the hole is too close to the outside of the rail, as you drive the screws there is potential to crack the end of the stiles. If the hole is set too near the interior of the rails, as you rabbet for the glass, you have the possibility of cutting into the screw area. The best location is at $\frac{5}{8}$ " from both edges.

With the pocket-screw holes cut you can now assemble the doors. Place a clamp over the intersection of the two pieces, a rail and a stile, and drive the screws. Then, work the four corners of each door in the same manner.

Rabbeting the doors for the



10



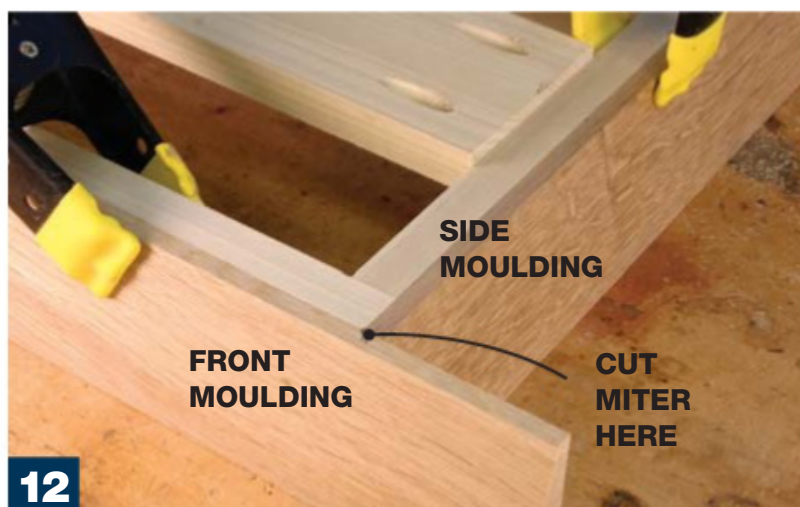
11

10 The cutting of the crown moulding can leave saw kerf indications and burn marks. A quick run over the jointer knives works best to clean the face.

11 While the setup is involved, the ripping of the crown moulding is straightforward. Just make sure to have a push stick handy.

12 The crown moulding is attached to three sides of the top frame. Miter the corners and add a small amount of glue to reinforce the area. Brads will affix the pieces to the frame.

13 Complete the work on the top unit by attaching the moulded frame to the case top. Pocket screws are quick and easy.



12



13

glass and glass-retainer strips is another router operation. Install a rabbeting bit, set for a $\frac{3}{8}$ " rabbet, and cut the interior of the frame. It is necessary to position the door hanging over the edge of your table or bench so the bearing screw does not rub the bench.

If you try to make the entire cut by running the router in the standard manner, into the bit rotation, you're likely to have areas, especially in quartersawn white oak, that will splinter and tear out. To remedy this you must climb cut during a portion of this process.

Start by climb cutting the first $\frac{1}{8}$ " of the rabbet then reverse the routing procedure and complete the rabbet. By having a small shelf of routed area from climb cutting, the removal of the balance of the waste material will shear off at that point and prevent most tear-out.

To complete the rabbet you'll need to square the rounded corners left from the router bit. Use a straightedge to continue the lines to reveal the exact corner and use a sharp chisel to bring the rounded corners to square. Clean the corners until you're level with the bottom of the rabbet.

Before moving forward now is the time to create the small bevel on the edges of the doors as well as the edges of the boxes themselves. Chuck a chamfer bit in a router and set it to cut $\frac{1}{8}$ " and run the profile around the doors outside edge and along the top and bottom of the boxes, including both sides and the front.

Each door edge, at the top of the door, needs to have a hole drilled to accept the short brass rod (available at any hardware store) on which the door will hang and travel in the groove as it is opened. A shop-made jig is just the trick to complete this step quickly and accurately.

Build the jig using a scrap of the cutoff material from your door pieces. Locate the center of the piece, which will be $\frac{3}{8}$ " from the edge, and also mark a line that is $\frac{3}{8}$ "



14 Positioning the pocket-screw holes in the door rails is important. Too close to either edge can cause problems. Don't forget to add glue to the joint.

15 Squaring the corners left rounded from the router bit is a job for the chisel. It works best to begin with a cut across the end grain and to then take small cuts with the grain, removing the waste.

16 The $\frac{3}{8}$ " x $\frac{1}{2}$ " rabbet for the glass and the retainer strips requires that you climb cut a portion to eliminate any tear-out. Adding a small bevel to the edges of the piece will help the joints between the separate units. The edge work also allows the doors to flip up and slide back into the case without binding.

17 Aligning the holes for the doors to pivot becomes easy work with the use of this shop-made jig.



in from the end. At that crossing is where you need to drill the $\frac{1}{4}$ " hole completely through the block. Use the drill press because you need the hole to be straight.

Next, add two pieces of Masonite, or other thin plywood-type material, to both sides of the block. To use the jig, slide it over the long grain of the stile, keeping the $\frac{3}{8}$ " space toward the top edge of the door. Add a clamp to hold the jig and drill the hole using the jig as a guide. Set the drill bit to cut to a depth of $\frac{3}{4}$ ".

Drill two holes per door, install a 1" piece of brass rod using no glue (we need to be able to remove them over the remainder of the project). Once the rods are in place you can test the door to the opening. If you have a problem it will most likely be binding at the top or bottom.

In either case you will need to remove a sliver of material to allow the fit. This can be done at the joint-

er or with a plane. Both solutions require you to work carefully around the end grain. All that's left is to cut the plywood pieces that comprise the backs of the individual units and mill a number of pieces to use as the glass retainers from some scrap.

Finish as Easy as the Project

This finish technique was developed by former Popular Woodworking Senior Editor Robert W. Lang. If this method had been around years ago when I was working with oak, I would have built many more projects from this hardwood. You will not find an easier finish anywhere that I know of.

To begin, don't waste a huge amount of time sanding. I know you like the sound of that! Bring the piece to #120 grit with the random-orbit sander and finish sand by hand using #150 grit sandpaper. Done! Now you

are ready to stain the bookcase.

The staining process continues in the easy category. Rag on a coat of Olympic oil-based "Special Walnut" stain. Apply an even coat and allow it to sit for 15 minutes before wiping any excess away. That coat needs to dry for 24 hours before moving on.

Next up is one coat of Dark Walnut Watco Danish Oil. Apply this in the same fashion as the stain. Rag a coat onto the stained bookcase and allow that to cure for 15 minutes, then wipe away any extra oil with a clean rag. In this process the oil acts as a toner that will even the shading as it adds color to the project. Again, let the oil coat dry for a day.

The rags used in both of the previous steps can become a fire hazard if not disposed of properly. You can lay the rags out on the floor of your shop or put them into a bucket of water. Combustion is a result of these rags thrown into a pile either in the trash



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20



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18 The barrister bookcase gets an Arts & Crafts look with the simple finishing method described for this project. It works great for oak—both white and red.

19 With the finish complete, an easy way to install the glass for the doors is with matching retainer strips. They are cut and fit then attached with a 23-gauge pinner.

20 No glue is used to hold the brass rods in place. They can be removed if the door should ever need to be taken out of the bookcase.

- A** Case Sides
- B** Bottoms
- C** Top Front Rails
- D** Top Back Rails
- K** Front Crown Moulding
- L** Side Crown Moulding
- M** Case Top
- O** Base Frame Sides
- P** Base Frame Center Support
- Q** Base Frame Front Flat Rail
- R** Base Frame Back Flat Rail
- S** Base Moulding/Front
- T** Base Moulding/Side
- Y** Short Unit Back
- Z** Tall Unit Back

can or a corner of the shop. Always dispose of rags properly.

The final step in the finishing process is to apply a coat of amber shellac. Can you guess how this is applied? You bet: Rag it on. Keep a wet edge on the wide-open areas and on any other areas simply coat them. That's it. Once the shellac is dry (the next day) add a coat of paste wax after knocking down any nibs with a non-woven abrasive pad.

The Finishing Touch

Attach the plywood backboards to the back of the units with screws after the finish is complete. All that is needed is to run four screws, one at each corner, through the pieces and into the unit bottom and the rear rail of the unit top. Use a countersink and wood screws for a professional look.

Installing the glass and knobs will complete the bookcases. Have $\frac{1}{8}$ " glass cut to fit the openings of the doors and fit a glass-retainer strip around the inside of the rabbet holding the glass in place.

The knobs are like the rest of the project; simple and elegant. What would finish this project better than a simple brass knob? Find the location and drill a pilot hole to make installing the knobs a snap. A bit of wax on the threads will ensure easy installation.

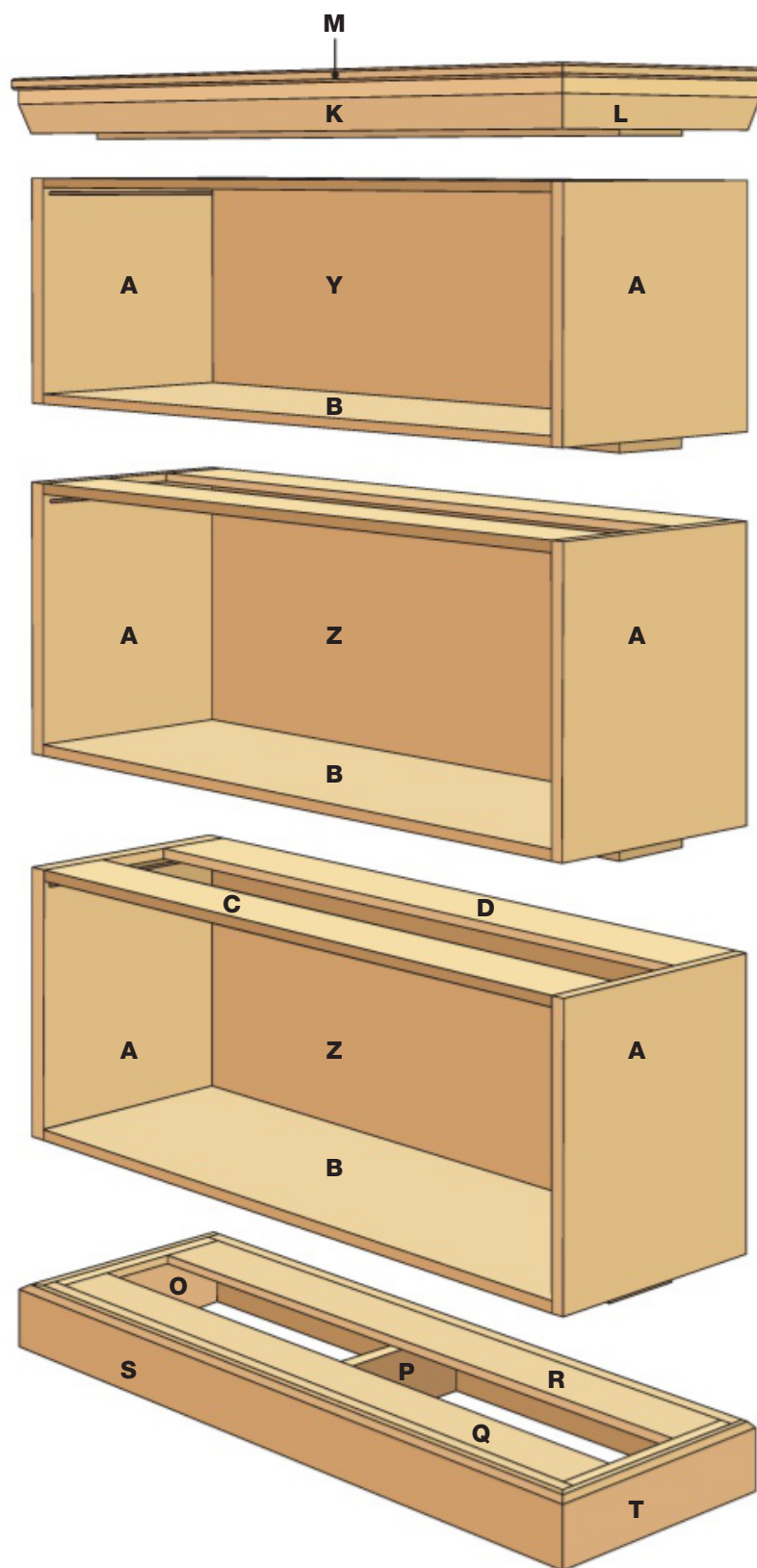
Sliding the doors into the boxes is the last step before filling the book-

case with your books. Slide the door into the case on a slight angle to the front, lift the brass rod on the side toward the rear of the case into the groove and position the other rod to move into the groove as you bring the door square to the front.

Lift the door so it is perpendicular to the case and slide it to the rear of the case. Holding the door up to the top of the unit, install $\frac{3}{4}$ "-long brass rods into the remaining holes. Your barrister bookcase is ready to use.

The great thing about this barrister bookcase design is that as your collection grows, and you know it will, so can your bookcases. You can add to the existing stack or start another bookcase. They are easy to build and adding to the stack is something you will enjoy. **PW**

Glen D. Huey is a period furniture maker, woodworking author and former managing editor of Popular Woodworking.



Restoring Reclaimed Hardware

Learn the nuts and bolts of making hardware new again.

Excerpt by Yoav Liberman

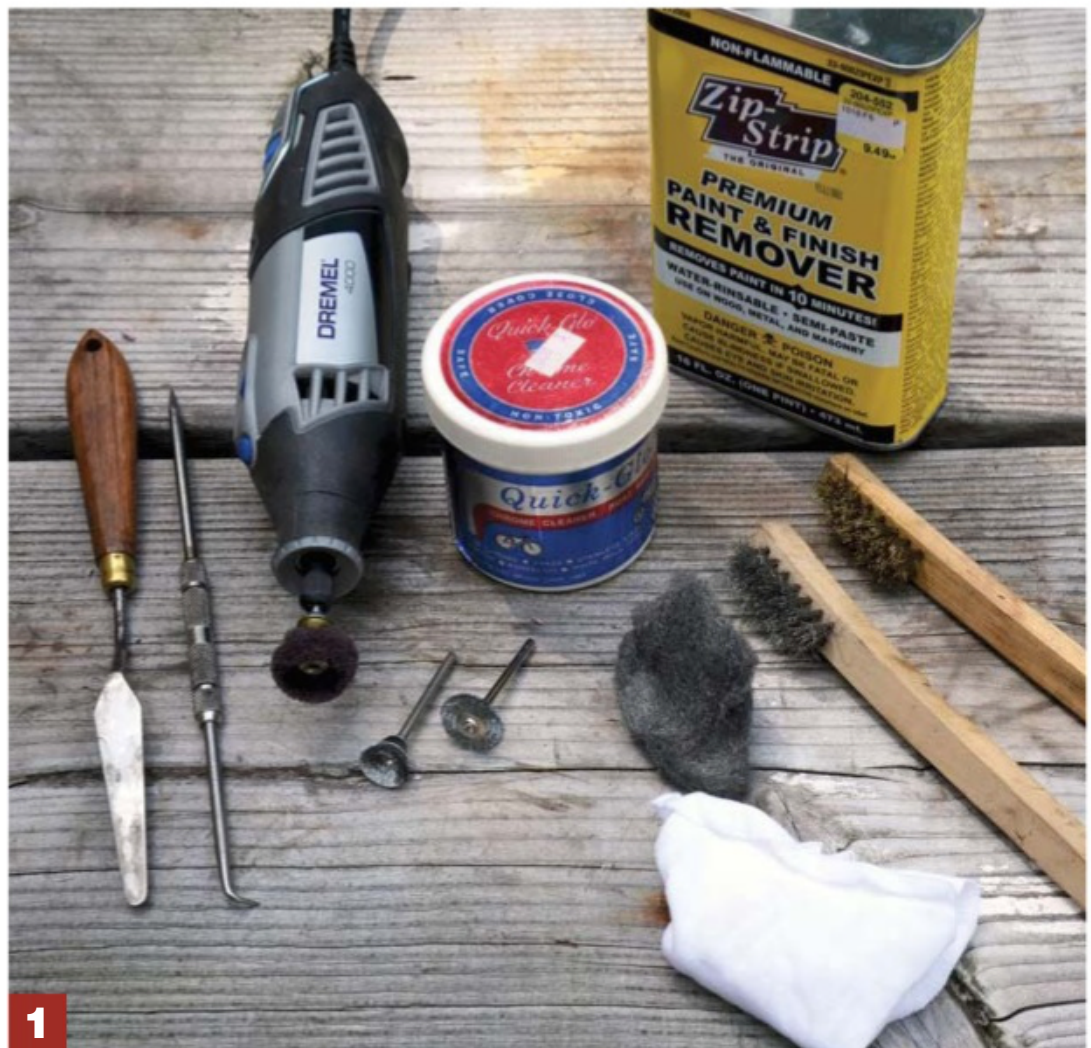
From the time I began collecting reclaimed wood I remember salvaging all kinds of hardware pieces. I like to dismantle hardware from found furniture that is either too damaged or too big to haul back home, or impossible to take apart and lift from the street. This hardware sometimes includes handles and locks, latches and casters, and occasionally even ornamentation worthy of saving. And remember, most items left out on the curb the eve before trash day ends up in the landfill. So, why not save the hardware if you cannot save the furniture?

Over the years I became finicky about the types and quality of hardware I chose to salvage. Where in the past I used to save die-cast zinc and stamped-steel hardware, these days I mainly save stainless steel, cast iron, brass and bronze parts. I am not intimidated by hardware that displays an unattractive surface, or is painted or tarnished, as I know that can easily be rectified.

Removing Paint, Varnish and Tarnish

Salvaged hardware, even if made of corrosive-resistant materials such as bronze and brass, is almost always covered with oxidation (patina), accumulated grime or, in the worst cases, it's painted over a few times.

Sometimes patinated hardware is exactly what you want for a newly designed project. In this case I recommend cleaning the grime and dirt off by lightly scrubbing the item with 0000 steel wool moistened with mineral spirits. Then moisten a cotton cloth or paper towel with mineral spirits, and wipe the hardware clean of any residue left by the steel wool.



1

1 From a powered rotary tool and chemical cleaners, to simple picks and brushes, cleaning reclaimed hardware is often a matter of using whatever works.

2 Thoroughly cleaned, this tarnished brass drawer pull almost looks brand new.



2

Removing Patina

If you'd like to achieve a polished look, use a more aggressive steel wool, abrasive pad or even a high-speed rotary tool equipped with an abrasive disc or brush. Then, once the patina has been removed you can decide what level of polish you want for the new/old surface. By using finer and finer abrasives or polishing compounds you will be able to reach a very high level of sheen.

Painted or Varnished Hardware

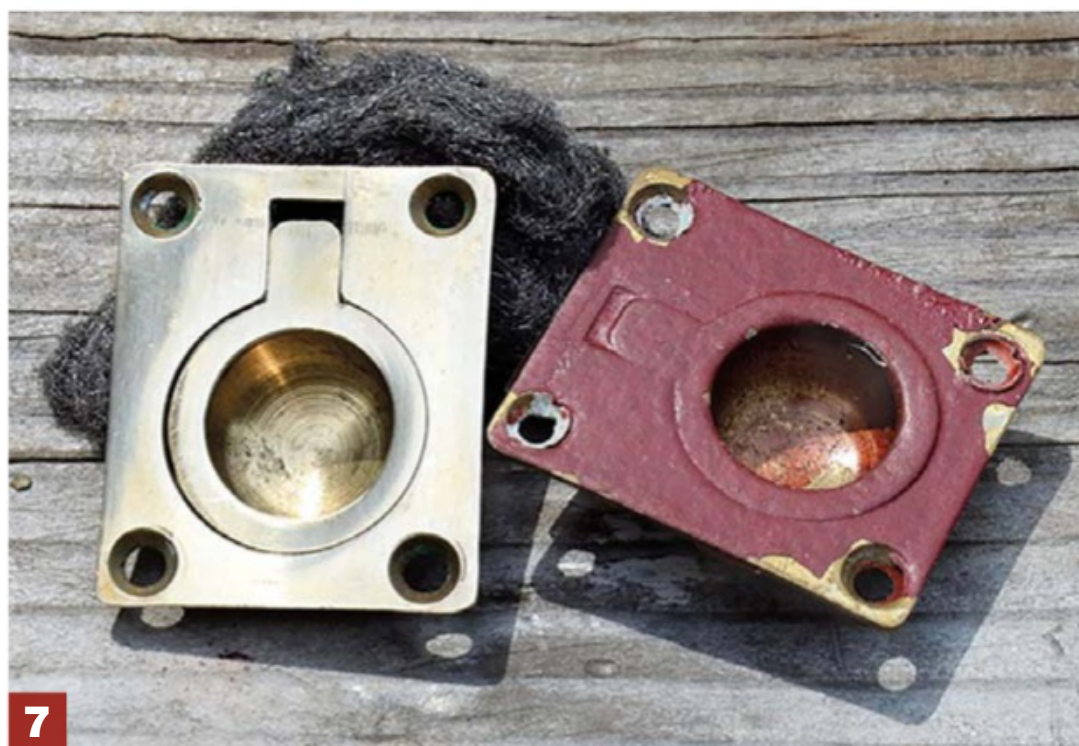
If your hardware item is painted over or is covered with old protective lacquer that looks unattractive, I recommend using paint stripper to entirely remove the old finish.

Rust Removal from Ferrous Hardware

Rust, the mortal enemy of steel and iron, can be removed via a few techniques. You can erode it with abrasives and steel brushes, you can use chemicals or acids, you can submerge rusted objects in a bath of sodium carbonate (also known as "washing soda") and water, and with the help of electricity reverse the corrosion through a process known as electrolysis. And if this is not enough, I have recently learned about a cutting edge technology that utilizes laser beams to incinerate rust away. Which method is best for your application? It depends on the object, the amount of rust on it and how much time you want to invest to remove it.

Removing Rust with Chemicals

In my experience there are two main options: acids and dedicated pH-neutral rust-removing chemicals. Over the years I've experimented with 5% vinegar, 20% vinegar, citric acid solutions and a product called Evapo-Rust. Among the four, Evapo-Rust, and other commercial products of its kind such as Rust-Oleum Rust Dissolver are the only ones with a neutral pH level. That means



3 Apply the stripper to the surface and let it soften the layers of finish.

4 Then use any combination of a scraper, steel brush and/or picks remove the old paint or varnish.

5 If your stripper can be rinsed off with water, then dunk the item in soapy water.

6 Scrub with steel wool or an abrasive pad.

7 When thoroughly cleaned, rinse in water and dry it with a hair dryer or paper towel. The difference with the original look is like night and day.



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8 Submerged in vinegar.

9 A baking soda bath neutralizes the acid.

10 A final rinse.

11 Supplies for making your own citric acid.

that they only work on the rust, and that you don't have to worry about neutralizing acid residues possibly left on the surfaces after the removal process. You just need to wash with water and dry the objects.

Vinegar

Regular 5% vinegar (the food-grade type you buy at the grocery store) is probably the cheapest and the most available means for removing rust. Instead of 5% vinegar you can use stronger 20% vinegar. You won't find 20% vinegar at the grocery. It's usually sold in home improvement stores and online. Using 20% vinegar gives you the same results as food-grade vinegar, but faster.

Fill a plastic or glass container with vinegar, then submerge the object and let the vinegar do its job. Check the de-rusting progress and scrape loose rust off with a brass or steel brush or use steel wool or an abrasive pad. Mechanically



11

removing the loose rust encourages the chemical reaction to access the remaining surface rust.

After a few hours of immersion, check the progression of the de-rusting process and remove additional loose rust with a stiff brush, steel wool, picks, hooks or a scraper. Then immerse the object again as necessary.

When the vinegar has affected most of the rust, buff off the black patina that formed on the metal during the process using a cloth or a very fine polishing media (very fine steel wool can work too).

After the metal is free of corrosion, rinse it with water and neutral-

ize the acidic vinegar in a solution of a baking soda and water. One teaspoon per cup of water is fine.

Give the hardware a final rinse in water again, and then dry immediately—you'd be surprised just how quickly rust can re-form on damp, bare metal. You can use paper towels followed by an air blower (or hair dryer) and when that is done apply a protective coat to the surface such as gun blue, wax, paint, or lacquer to prevent rust from reoccurring.

Citric Acid

You can make your own citric acid from a powder available online and in some stores. I dilute one volume



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12 Apply gun blue patina on an oil-free brass or bronze surface and wait until it stops darkening.

13 Rinse the piece in water and lightly polish with a cotton rag.

14 There are three different surface treatments: brown patina (bottom left), patinated luster (top and bottom middle), and polished (bottom right).

unit of citric acid in 10 volume units of water, which gives an approximate pH level higher than 20% vinegar, around pH 1.5. And if we mixed citric acid in less water we could create an even more potent acidic solution.

Re-patination of Restored Hardware

Newly restored brass and bronze hardware will begin to oxidize within days. Many love to see this slow and natural transformation as the metal succumbs to nature's call. But if you want to protect the shiny surface, consider varnishing, lacquering or applying wax on it.

If you want to bestow your reclaimed hardware with the instant look of an "antique" appearance or even a very dark "ebonized" look, consider using the gun blue family of products. Once the fluid is applied on a grease-free and oil-free surface, it turns the surface dark. The more you apply the darker it becomes. Using cotton Q-tips, (12) apply gun blue on an oil-free brass or bronze surface and wait until it stops darkening.

Once you like the new look, rinse the piece in water (13) and lightly polish with a cotton rag.

In photo 14 you can see three different surface treatments: dark brown patina, patinated luster, and polished. If you wish to achieve a look of a patinated luster surface (not too shiny, but not black), slightly abrade the newly built gun blue layer with fine steel wool (#0000) until

you reach the level of sheen you like. Take into account that the gun blue patina is thin and can be scratched or even rubbed off easily. To preserve its ebony look, apply a coat of wax, varnish or lacquer it. **PW**

.....
Yoav Liberman is a designer, woodworker and educator. He is passionate about reusing discarded wood and found objects. See more at yoavliberman.com.

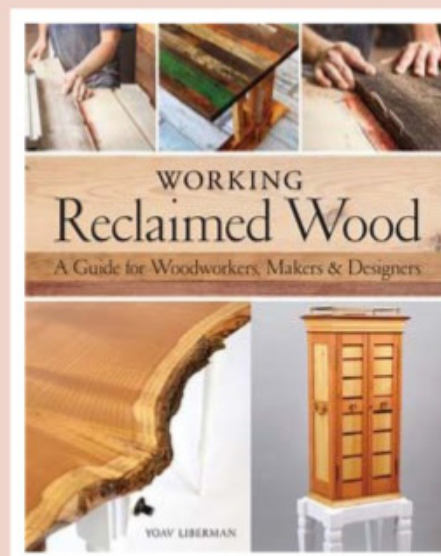
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Bloxygen	56	bloxygen.com
Bradford Exchange	61, 63	bradfordexchange.com
Bridge City Tool Works	7, 9	bridgecitytools.com
Cigar International	57	cigarsinternational.com
Connecticut Valley School of Woodworking	56	schoolofwoodworking.com
Cook Woods	56	cookwoods.com
Dream Products	59	dreamproducts.com
Epilog Laser	13	epiloglaser.com
Furniture Institute of Massachusetts	56	furnituremakingclasses.com
Gorilla Glue	13	gorillaglu.com
Hammer-Felder Group USA	Cvr 4	feldergroupusa.com
Harbor Freight	21	harborfreight.com
John Campbell Folk School	56	folkschool.org

	Page #	Web Address
Knew Concepts	7	knewconcepts.com
Lignomat USA	9	lignomat.com
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Getting the Most From Your Spray Gun

The critical parts are the fluid nozzle and air cap.

By Bob Flexner

As I have said many times, spray guns are pretty simple tools. By comparison, they aren't any more difficult to use than a router. Still, there are a couple of critical parts you should be familiar with to get the best results. These are the fluid nozzle and the air cap.

NOTE: This article doesn't cover airless or air-assisted airless spray guns. Airless are popular with painters who want to cover large surfaces quickly and don't mind the small trade off in quality, and air-assisted airless are popular in industry and large cabinet shops that have a high volume of work to be finished.

Introductory Remarks

In the last issue of *Popular Woodworking* (#247), I explained the basics of spray guns and how to choose which to buy. Here's a short review of the article.

Spray guns work by using air to turn a liquid stream of fluid (paint, finish, stain, glue, whatever) into a mist. This is called atomizing. There are two sources of air: compressors and turbines. Compressors produce air under high pressure. Turbines produce high volumes of air under low pressure. Both can be used to power HVLP (high-volume-low-pressure) spray guns. These are the newer type spray guns that came on the market about 30 years ago and are now so widely used that it's become difficult to find the older high-pressure spray guns.

The advantage of HVLP is equivalent quality atomization at much lower pressure, so there is less bounce-back and therefore less waste.

Fluid Needle and Nozzle

The fluid needle and nozzle are sold as a pair, though with some brands



1 On most spray guns the fluid and fan-width control knobs are on the backside of the gun. The fluid control knob is the lower one in this example. It always lines up with the fluid nozzle and needle.

2 Sometimes the fan-width control knob is on the side of the gun rather than the back.



one size needle can be used with several size nozzles. This is accomplished by milling the needles to a more gradual taper. Either way it's critical that the needle "seat" well into the orifice of the nozzle so it doesn't leak.

The purpose of the fluid nozzle is to control the amount of fluid that exits the spray gun. Larger orifice nozzles allow more fluid to exit and also allow for thicker materials, such as paints and adhesives, to be sprayed. Smaller orifice nozzles restrict the flow. Typical sizes used

for most stains and finishes range from 1.8 mm (0.07 inches) to 0.5 mm (0.02 inches).

Off-the-shelf spray guns usually come with a 1.4 mm (0.05 inches) nozzle. You may find that this works well with everything you spray. It usually does. But if you want more control, especially if you spray a variety of surfaces or a variety of liquid materials, you may want to use different size nozzles. Better quality spray-gun manufacturers offer fluid needles and nozzles in a number of sizes.

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Air Cap

Air caps are also commonly sold together with fluid nozzles and needles as a set. But you can interchange air caps and fluid nozzles to improve atomization. If your source of air is a compressor, you can also use a different air cap to widen the spray pattern or fan width.

The air cap contains a number of holes to atomize the fluid and shape the pattern. The air that comes through the center hole and other holes next to it atomizes the fluid. The air that comes through the hole, or holes, in the horns shapes the pattern. The larger these holes the wider the possible spray pattern as long as there is enough air.

Making Choices

So how would you mix and match air caps and fluid nozzles to improve the quality or efficiency of your work? There are five variables: viscosity of the fluid material; the amount of air your compressor or turbine produces; the speed at which you want to spray; the size and shape of the object you're spraying; and the quality of results you want.

The thicker the liquid you're spraying, the larger the fluid-nozzle orifice you should use because it's harder to push thicker liquids through small holes. Smaller orifices will cause you to have to move the spray gun more slowly over the surface. The exception is the pressure-pot setup where you could turn up the pressure to compensate.

It's obvious that you have to have enough air from your compressor or turbine to atomize the liquid you're spraying to reduce orange peel and move at the speed you want or you won't get good results. You can compensate for too little air, however, by using a smaller fluid nozzle and air cap or by thinning the material so it doesn't take as much air to atomize it. Either way will result in your build being less.

If you want to increase your flow rate, or the speed at which you can



3



4



5

3 Needles and fluid nozzles are usually sold in sets. Some manufacturers mill their needles to a more gradual taper so they can be used with several different sizes of fluid nozzles. These fluid nozzles are 1.3mm, 1.4mm and 1.5mm.

4 The size of the hole in fluid nozzles makes it easier or harder to get thicker liquids, such as paint and adhesives, through. Smaller hole sizes require more air pressure or thinning of the fluid material to get it through and atomized well.

5 The hole in the center of the air cap and the hole, or holes, to the side atomize the fluid. The holes in the horns are smaller on high-pressure air caps (left) and larger on HVLP air caps to let more air under very little pressure through.

move over the surface, you will need to use a larger fluid nozzle and air cap, as long as you have enough air, of course, to get good atomization.

Your efficiency or ability to reduce waste is determined by the size and shape of your work. For example, if you are spraying a large tabletop, your efficiency is increased by using a needle/nozzle set and air cap that gives you the widest possible fan width for fewer passes to cover the surface. By contrast, if you're spraying chairs with narrow legs and arms, you want a narrow pattern to reduce overspray. You can achieve this in two ways. One is to use a needle/nozzle set and air cap that gives you that narrow pattern. The easiest way for most amateurs and small shops is simply to close down the fluid and fan-width control knobs, usually located at the gun's back.

The quality of your work is mea-

sured by the amount of orange peel you get. The less obvious the orange peel the higher the quality. Orange peel is usually caused by spraying too thick a liquid with too little air or by moving the spray gun too rapidly across your work. To correct the first problem, increase the air pressure (from a compressor) and change to a larger needle/nozzle set and air cap, or thin the material. To correct the second problem, slow down or thin the material. You won't be able to increase the amount of air with most turbines.

For most projects you can probably get by with the needle/nozzle set and air cap that came with your gun. But it's good to know that you have more control if you want. **PW**

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Turnabout

Learning from the past can secure our future.

By Tom Caspar

On a sultry day in September, 1832, thirty-three-year-old Felix Dominy was perched high above the rocks of Montauk Point, at the far eastern tip of Long Island, removing the copper dome of the Montauk Lighthouse. The son and grandson of highly skilled cabinetmakers and clock makers who ran a small shop in the nearby village of East Hampton, Felix had never done this kind of work before. He was a woodworker—not a coppersmith. Why was he now in such a precarious position?

Felix's story is part of a remarkable piece of 1960's scholarship, *With Hammer in Hand*, by Charles F. Hummel, then curator of the Winterthur Museum, Garden and Library in Wilmington, Delaware. This 424-page book catalogs the history of four generations of the Dominy family through a firsthand look at their journals, ledgers, tools and the products of their shop. All of these were preserved by the descendants of the Dominys and are now, by a great stroke of good fortune, in Winterthur's care.

The shop itself, basically unchanged since the death of Felix's father in 1852, was dismantled in the late 1950s and rebuilt inside Winterthur. It's a remarkable sight. Dominated by a lathe that was powered by a young man cranking a wheel 5' in diameter, the shop contains three oak workbenches and dozens of metalworking and woodworking tools. Patterns that the Dominy's used for making clocks and furniture hang from the low ceiling.

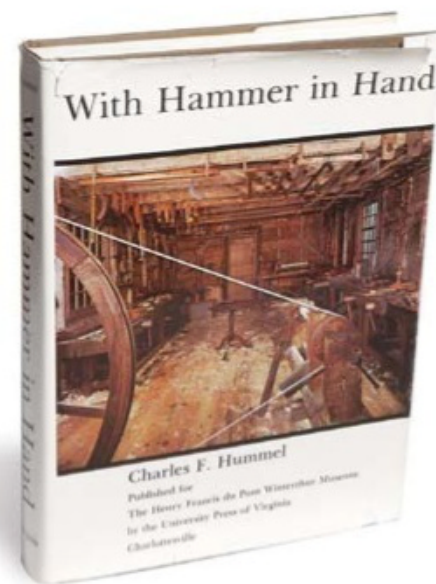
Felix "must have been desperate for work" to take on the lighthouse job, writes Hummel. As a young man, he had fully expected to carry on his family's business. For three generations, "the Dominys could complete

with skill and competence almost any task their neighbors asked them to perform." They had functioned as "clockmakers, watch and clock repairers, cabinetmakers, house and mill carpenters, wheelwrights, turners, toolmakers, gun repairers, metalworkers, and surveyors." But the world was changing. Fewer neighbors were ordering custom-made chairs, chests and clocks.

Hummel writes: "The people of East Hampton Township had begun to patronize shops in Sag Harbor, where manufactured goods could be bought ready-made. Steamboats now brought goods to Sag Harbor faster and more cheaply than the sailing vessels of the 18th century. Sag Harbor storekeepers accepted payment in "country produce and lumber," thus competing with at least one of the business advantages, barter, enjoyed by the Dominys."

As Felix riveted the copper sheets on the lighthouse dome, he must have paused now and then to watch those ominous steamboats as they entered Long Island Sound. He knew that there was no going back to the old ways of the craft taught to him by his grandfather, Nathaniel Dominy IV, and his father, Nathaniel Dominy V. His father would carry on in the little shop attached to the family's house, but Felix had a restless spirit. He abandoned his tools, left East Hampton and became a hotel keeper on Fire Island, one of the outer barrier islands on the south shore of Long Island.

Felix's loss was our gain. His own son, Nathaniel VII, stayed behind in East Hampton but didn't take up the family business, using the tools and shop for odd jobs only. The 1798 Dominy house stayed intact for 100 years after the death of Nathaniel V.



When it was partly demolished in 1946, its two shops—one for wood-working, the other for clockmaking—were moved to a local family's beach property and converted into a clubhouse. The Dominy tools were later discovered in a local antique store and acquired by Winterthur, along with both of the shops.

Hummel spent almost 10 years researching this windfall—his book was first published in 1968. Reading it immerses you in a world completely different from ours, where the word "craft" simply meant a trade, learned through apprenticeship, that was primarily practiced to put food on the table. You begin to ask questions about Felix and his father, Nathaniel V, that aren't easy to answer. Did Nathaniel also see his world slipping away? Did Felix mourn the loss of his workshop life in East Hampton? What was it like to see your craft, your art, succumbing to forces beyond your control?

The book's title, *With Hammer in Hand*, refers to the motto of the New York Mechanics Society: "By Hammer & Hand, all Arts do stand." Felix was fond of drawing small sketches of a mechanic's hand holding a hammer upright—a symbol the Society used on its membership certificates. Hummel closes his preface by writing, "It is hoped that this book can re-create the Dominy's arts and make them stand again." And that's up to us. **PW**

Tom Caspar is the former editor of *American Woodworker* and *Woodwork magazines*.

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Shoulder holds square in place.



End graduated for machinery set up.



Notch allows marking to edge.