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Robin Wood Carving Axe

POPULAR
Woodworking
MAGAZINE
November 2017 ■ #235

Arts & Crafts Sideboard

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WITH RIVING KNIFE

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- Capacity: 3" @ 90°, 2⅛" @ 45°
- Rip capacity: 26" R, 8" L
- Footprint: 20½" x 20½"
- Approx. shipping weight: 508 lbs.

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- Maximum cutting height: 6"
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- Motor: 2 HP, 110V/220V, single-phase, TEFC, prewired 220V, 1725 RPM
- Amps: 20A at 110V, 10A at 220V
- Precision-ground cast iron table size: 17" x 17" x 1½"
- Table tilt: 45° R, 10° L
- Floor-to-table height: 37½"
- Cutting capacity/throat: 16¼"
- Blade length: 131½" (⅛" to 1" wide)
- Approx. shipping weight: 342 lbs.

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- Motor: 1 HP, 110V/220V, single-phase, prewired 110V
- Swing: 17"
- Drill chuck: 1/64"–⅝"
- Drilling capacity: 1" steel
- Spindle taper: MT#3
- Spindle travel: 4¾"
- Speeds: 210, 310, 400, 440, 630, 670, 1260, 1430, 1650, 2050, 2350, 3300 RPM
- Quill flange/collar diameter: 2.85"
- Precision-ground cast-iron table size: 13⅝" x 13⅝"
- Table swing: 360°
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- Overall height: 70"
- Approx. shipping weight: 283 lbs.

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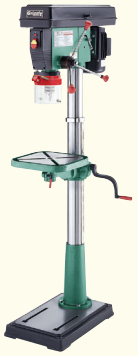

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G7947 ~~$599.95~~ SALE $539.95

12 SPEED 20" FLOOR DRILL PRESS

- Motor: 1½ HP, 110V/220V, single-phase, prewired 110V
- Swing: 20"
- Drill chuck: 1/64"–⅝"
- Drilling capacity: 1¼" steel
- Spindle taper: MT#4
- Spindle travel: 4¾"
- 12 Speeds: 210, 310, 400, 440, 630, 670, 1260, 1430, 1650, 2050, 2350, 3300 RPM
- Collar size: 3.642"
- Precision-ground cast-iron table size: 18¾" x 16¾"
- Overall height: 70¾"
- Approx. shipping weight: 331 lbs.

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- Motor: 1 HP, 110V/220V, prewired to 110V, single-phase, 14A/7A
- Table size: 6⅝" x 47⅜"
- Number of knives: 3
- Cutterhead speed: 5000 RPM
- Cutterhead diameter: 2½"
- Maximum depth of cut: ⅛"
- Maximum rabbeting depth: ½"
- Cuts per minute: 15,000
- Fence size: 29⅛" L x 4" H
- Approx. shipping weight: 252 lbs.

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- Table size: 6⅝" x 47⅜"
- Number of knives: 3
- Cutterhead speed: 5000 RPM
- Cutterhead diameter: 2½"
- Maximum depth of cut: ⅛"
- Maximum rabbeting depth: ½"
- Cuts per minute: 15,000
- Fence size: 29⅛" L x 4" H
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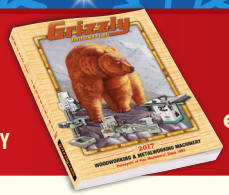

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- Max. cutting width: 12½"
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- Feed rate: 32 FPM
- Number of knives: (2) HSS reversible
- Knife size: 12½" x 23/32" x 1/8"
- Cutterhead speed: 10,000 RPM
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- Max. cutting height: 4½"
- Max. cutting depth: 1/8"
- Feed rate: 26 FPM
- Cutterhead knives: (2) reversible HSS
- Knife size: 12½" x ½" x 1/16"
- Cutterhead speed: 8750 RPM
- Number of cuts per inch: 60
- Approx. shipping weight: 72 lbs.

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- Maximum cutting depth: 1/8" (planing)
- Maximum profile depth: ¾" (moulding)
- Maximum width capacity: 4 9/16" (moulding)
- Planing feed rate: 24 FPM
- Moulding feed rate: 12 FPM
- Number of knives: (3) HSS
- Knife size: 13" x 5/8" x 1/8"
- Cutterhead speed: 5000 RPM
- Overall size: 23½" L x 23" W x 44½" H
- Approx. shipping weight: 236 lbs.

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- Max. planer cutting height: 8¼"
- Jointer table size: 12½" x 40 15/16"
- Planer table size: 9¾" x 23⅛"
- Cutterhead speed: 6500 RPM
- Cutterhead knives: (2) HSS
- Knife size: 10¼" x 1 1/16" x 1/8"
- Cuts per minute: 13,000
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- Approx. shipping weight: 378 lbs.

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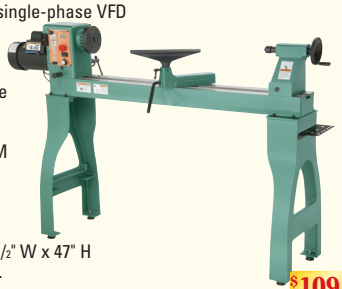
- Spindle bore: .445"
- Tool post diameter: 25mm
- Overall dimensions: 77 1/16" L x 22½" W x 47" H
- Approx. shipping weight: 394 lbs.



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- Motor: 2 HP, 240V, single-phase, 9A
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- Maximum static pressure: 10"
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- 6" inlet has removable "Y" fitting with three 4" inlets
- Canister filter size (dia. x depth): 19⅝" x 23⅝"
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- Overall size: 37⅜" W x 31½" D x 71" H
- Approx. shipping weight: 150 lbs.

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3 HP DUST COLLECTOR

- Motor: 3 HP, 240V, single-phase, 3450 RPM,12A
- Air suction capacity: 2300 CFM
- Static pressure: 16.7"
- 7" inlet has removable "Y" fitting with three 4" openings
- Impeller: 12¾" cast aluminum
- Bag capacity: 11.4 cubic feet
- Standard bag filtration: 2.5 micron
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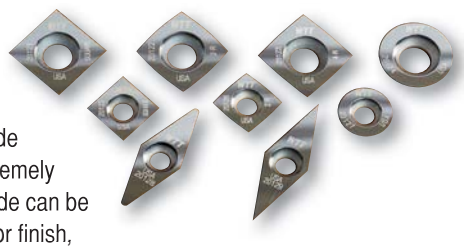

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Keep the tool flat on the tool rest and level to the ground for fast stock removal and basic shaping cuts.

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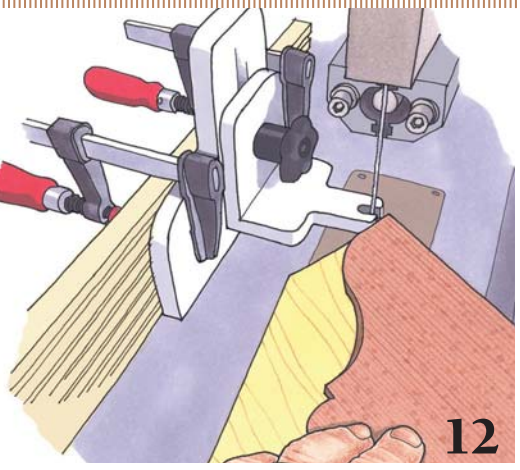

REGULARS

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POPULAR Woodworking MAGAZINE

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Nominal Knowledge

I don't know exactly when I learned that a 2x4 isn't 2" x 4", but I'm quite sure it was well before I joined the staff of *Popular Woodworking*. I studied English literature and journalism in college, and took one shop class in grade school that covered little more than basic turning – no construction.

When I was a kid, I was busy playing soccer and bugging my mom to let me take riding lessons, not building stuff. And neither of my parents built stuff, either (though I recall hearing some cursing during a DIY tiling job). My grandfather built stuff, but it wasn't until I was in my 20s that I ever joined him in the shop.

Yet I knew as a kid that "2x4" was a nominal measure (though I wouldn't have at the time used that term), not the actual width and thickness of the stick in question. And just look at a 2x4 – it is clearly not 2" x 4".

Commercial construction lumber hasn't matched its nominal S2S size when dry since 1906, according to the 1964 the Forest Products Laboratory "History of Lumber Sizes" report. And the current standards have been around since before I was born – they were proposed in that same report.

Rain is wet. Everybody poops. A 2x4 isn't 2" x 4".

My house was built just before construction lumber began shrinking; the interior framing is 2" x 4" (some of it with axe marks in evidence). For my renovation project I at times need to match it; I have to cut my own studs out of thicker and wider material. I can't just run down to the home center and buy it. This causes me inconvenience, costs me a bit and slows my progress. It causes some people to call a lawyer.

It seems ignorance has become an acceptable excuse. (See: Coffee is hot.)

All three of the large home center companies in the United States have now been sued for the size of their wood, and while two of those suits are recent and pending, Lowe's has already had to pony up.

In 2004, a Marin County California superior court judge directed the company to pay a $1.6 million settlement for inaccurate description of building materials. Lowe's has since updated its signage to indicate both the product name (2x4) and actual dimensions ($1\frac{1}{2}$" x $3\frac{1}{2}$").

Home Depot and Menard's didn't heed that judgment.

In June of this year, suits were filed against those two companies; plaintiffs are asking for $5 million in each case. The suit against Menard's alleges the "defendant has received significant profits from its false marketing and sale of its dimensional lumber products." Home Depot faces accusations of being "false and misleading."

Both of these accusations are, I suppose course, arguably true – but it has been more than a century since a 2x4 was 2" x 4". So in effect, the plaintiffs have filed lawsuits for failing to properly inform themselves before making a purchase…or perhaps because they were a bit short of dough.

If you're unfamiliar with lumber and can't be bothered to learn enough about it to know what you're buying, take up fishing instead. But don't tell any fish tales; those could land you in court. **PWM**

PHOTO BY THE AUTHOR

POPULAR WOODWORKING MAGAZINE

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Cross-grain Chest Construction

I want to build the "Country Toy & Tool Chest" from the February 2007 issue (#160) – but I have a question before I attempt this.

Why is wood movement not a problem with this design given that the sides run the grain vertical and the front and back are horizontal?

I did this once on a chest I built for my grandson and the lid seems to have a hard time meeting the top as the seasons change and the wood's moisture contents goes up and down.

I thought that maybe just nailing the sides on would have helped allow for wood movement but I read in the article that you used glue also.

Steve Poetzl,
via email

Steve,

As you note, that chest (which is constructed a lot like a typical six-board chest) exhibits cross-grain construction, which we've all been taught is verboten. But there are six-board chest examples that have survived for centuries, so despite warnings to the contrary, they don't typically explode.

The reason it works here is indeed the nails. Nails bend and allow the wood to move – even if (when) that cross-grain glue joint fails – while holding the project together.

Plus, pine is fairly stable (once it's dry, especially if it's quartersawn), which is one theory as to how these types of chests have survived without major splits.

But for the sake of appearance, so that the front of the lid and top of the chest stay aligned as you want them to, you can force (at least for a while) the movement toward the bottom and back.

To keep the top of the front board aligned with the top of the sides, apply glue only on the first 2" or so of the top-front piece before nailing it to the side. And apply glue only to the front of the lid and battens, then ream only the second hole in each lid board. That will force the movement toward the back.

Megan Fitzpatrick, editor

P.S. This article is among our many free I Can Do That pieces, and is available at popularwoodworking.com/projects/country_toy_chest.

Slipping Router Bits

I was routing a rabbet on my router table and completed several test cuts to achieve the depth and width of cut I needed.

When I made the cut in my workpiece, however, I discovered that the router bit had risen nearly 1/8", thus ruining my board.

I thought I had tightened the collet securely but even if I hadn't, I don't understand how the bit managed to rise! I can understand dropping but not rising.

Since then, I always make sure that I tighten and tighten again, but I am still curious as to what happened.

Frank Sajovec,
Colfax, North Carolina

Frank,

Routers with dirty or defective collets (or improperly secured bits) do exactly this – the bit slips out of the collet. It doesn't matter if the router is mounted in a table or not.

I would disassemble the collet and clean it thoroughly. When you put the router back in service, be sure to not allow the bit to bottom out in the collet, which reduces its grip. Keep the end of the shank of the router bit about 1/8" from the bottom of the collet. That ensures the collet will close as tightly as possible.

Christopher Schwarz,
contributing editor

'Journée' to Journeyman: All in a Day's Work

Bob Flexner in his "Colonial Apprenticeship" article (August 2017, issue #233) writes that a "journeyman" is so called because he would journey to wherever he could get the best wages.

An expansion on the term is as follows: Jeffrey P. Greene, in his book "American Furniture of the 18th Century" (Taunton) states the term "journeyman" is derived from the French "journée," meaning a day's work, rather than from the idea these men were willing to work or able to travel.

Victor Chinnery, in "Oak Furniture: The British Tradition" (Antique Col-

CONTINUED ON PAGE 10

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CONTINUED FROM PAGE 8

lector's Club), refers to journeymen "as qualified artisans employed by the day in the masters workshop."

Ralph Babcock,
Kalamazoo, Michigan

Smoothing Plane Preference

I remember Christopher Schwarz writing on his blog that he would use only a No. 3 as his smoothing plane for six months or so, then tell us what he thought. Has he reached a conclusion?

Steve Dixon,
via email

Steve,
I think you're remembering my blog entry about using only the No. 2, which I abandoned as my daily smooth plane.

My first smoother was a No. 3, and though I have tried many different shapes and sizes of smoothers, I keep coming back to the No. 3 size. It fits my hands perfectly.

Christopher Schwarz,
contributing editor

Reversing a Drawbored Joint

I'm constructing a timber-framed arbor for my upcoming wedding ceremony. Using some wedged joints, I am able to assemble and disassemble the main joints fairly easily and with the help of just one extra pair of hands.

For the knee brace joints, which I'll need to prevent wracking, I plan on using drawbored mortise-and-tenon joints. Do you think I would have a problem knocking the pins back out to disassemble the joints after the big day?

The wedding is not on our property, and we want to be able to re-assemble the arbor in our garden to enjoy it for years to come.

Michael Camaleri,
via email

Michael,
The short answer is that it can be done. Use a peg slightly narrower in diameter (or a long metal pin of that slightly smaller diameter if you have one handy), and whack the snot out of it with a heavy mallet to knock the original peg through.

That will likely work just fine, given that the wood won't have much time to dry and shrink around to peg to hold it tightly in place.

But if that doesn't work, you can carefully drill out the peg, then reassemble the arbor in the permanent location with a new peg (perhaps with a slightly larger peg and a newly offset drilled tenon).

Megan Fitzpatrick, editor

All-in-one Cabinet Cutlist

I'm building the "All-in-one-cabinet" from the April 2001 issue (#121), and am confused about a particular item. The last sentence on the first page says to install "the hanging rail into the top of the case." The parts list and the drawing call out a "support cleat."

I assume the hanging rail and the support cleat are one and the same. If so, I don't understand the 23½" length for the material – the case is 24" wide, minus the two ¾" sides, leaves only 22½". Am I misunderstanding something?

Wayne Elliot,
via email

Wayne,
The hanging rail and support cleat are one and same. As to the length, we got it wrong. It should be 22½", as you correctly surmised.

And for other readers, we've uploaded a free (corrected) PDF of the article to our website: popularwoodworking.com – search "all-in-one." **PWM**

David Thiel,
video manager

ONLINE EXTRAS

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PHOTO BY THE AUTHOR

Highly Recommended

I was introduced to small convex-soled planes by a violin maker – now I reach for mine all the time. Ibex Finger Planes are great users, with good steel in the cambered blades and precise castings – and for a reasonable price ($53-$80). I use them when making pulls and cleaning up concave or carved details – mine often stands in for a gouge, curved scraper or spokeshave. I've even used them when making spoons. They're available from a number of online retailers.

— Brendan Bernhardt Gaffney

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THE WINNER:

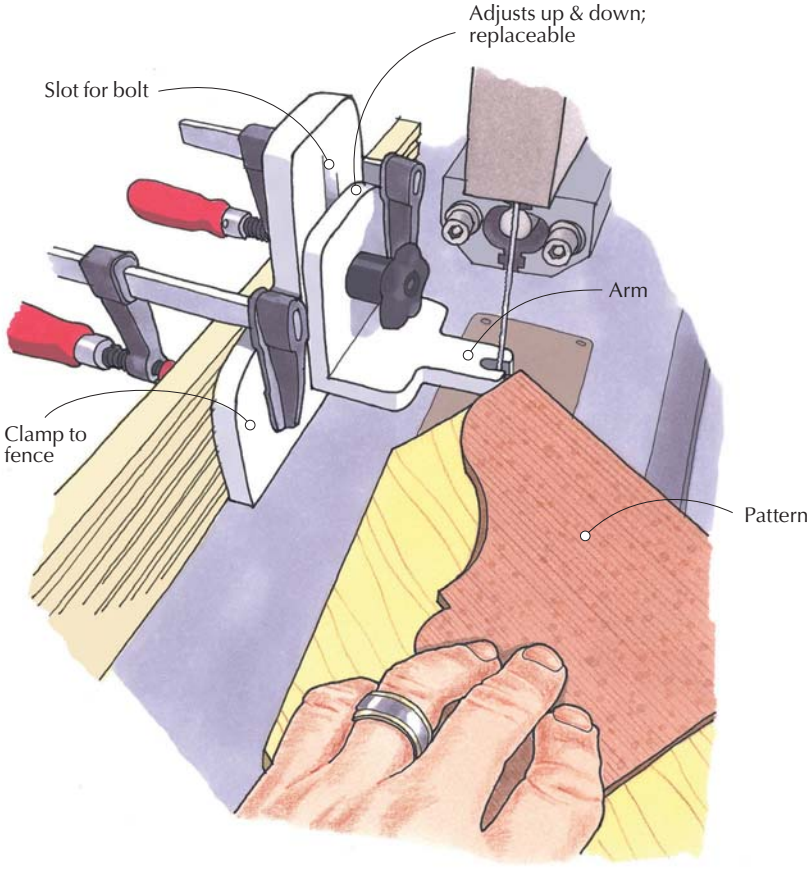
Band Saw Pattern Jig

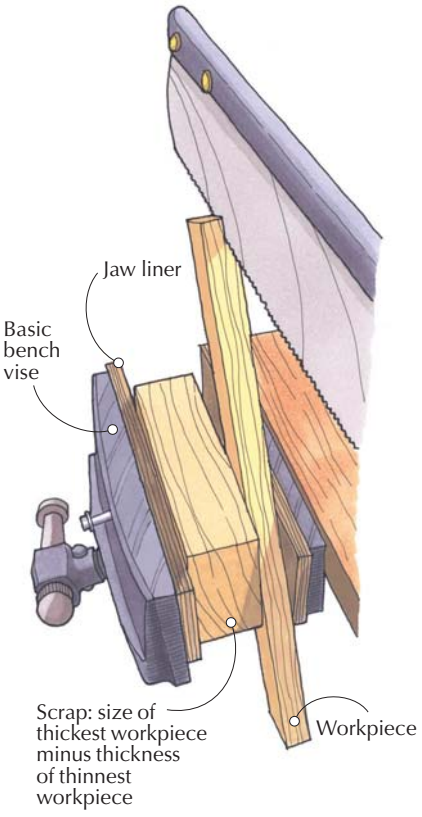
I made this jig for cutting patterns on the band saw. It works especially well on woods where the line is difficult to see, or if your near eyesight is starting to deteriorate.

Simply attach the pattern to your piece and let the arm of the jig ride on the pattern like a guide bearing on a router's pattern bit. The jig moves closer to or farther out from the blade to cut closer or farther from your template. The arm that extends out from the fence can be adjusted in height for woods of different thicknesses.

I also made several additional arms of different lengths that can be switched out by removing the knob and replacing the arm.

Dave Diaman,
Baltimore, Maryland





Faux Quick-release Vise

Sometimes, I have to work with a regular vise without a quick-release feature. Instead of spending a lot of time adjusting the jaws for various thicknesses of stock, I make a spacer block or set of them, depending on how many pieces of various thicknesses are involved in my work.

The largest is the thickness of my thickest piece, minus the thickness of my thinnest piece. (And I can make as many as needed, always subtracting the thickness of a given thinner piece from the thickest.)

That way, I can set the vise just wider than the widest opening required (that for the thickest workpiece). When working on the thinner stock, I can slip the spacer block in front of the work and secure both in place with a single twist of the vise screw.

Then it's just a twist of the screw the other way to remove the block then secure the wide piece in place.

Charles Mak,
Calgary, Alberta

A Template for Perfection

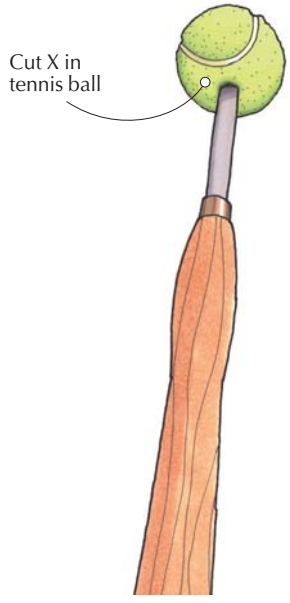
I use this trick to make sure I have fair curves on my templates. After drawing out my desired shape on the template stock, then sawing it out on the band saw and fairing the edges, I take one additional step.

I place the template on a piece of paper that's large enough to fit it entirely. I then use a pencil to trace all around the template then remove it. Any irregularities in the template edges show up clearly on the paper.

Yes, it's an extra step, but it sure beats ruining a piece on the router table and having to make a new one.

Michael Handrinos,
Dover, Delaware

ILLUSTRATIONS BY MARTHA GARSTANG HILL



Tennis Ball Tip Protector

I came up with this simple solution just after I finished making a set of carbide lathe tools; I needed a way to protect the cutting tips when the tools are not in use.

While pulling into my garage, the solution hit me – just like the tennis ball hanging from the ceiling hit my windshield to tell me when to stop.

I picked up some tennis balls and cut an X in each. Now, I simply slip these over the cutters when my lathe tools are at rest.

Rick Barbato,
Erie, Pennsylvania

Measuring Tools are Baked In

Many times I use the physical characteristics of my combination squares to set up my machinery or measure objects. For example: The blade of my 6" combination square is exactly 3/4" wide and 1/8" thick. The head of the square is ground exactly 1/2" wide. My 12" combination square has a different set of "baked-in" measurements that can be used as set-up blocks at the table saw or router table.

Christopher Schwarz,
Ft. Mitchell, Kentucky

Nailing on the Level

When using a nail gun on thin stock, it is painfully easy to inadvertently shoot the nail or pin out the top or bottom of your project. I know I've done it – I'll bet you have, too.

The problem is that when you are shooting a nail, you're above the tool – so it is not easy to see if you are pointing the gun at an angle.

To solve this, I grabbed a spirit level out of my toolbox and duct-taped it to the side of my nail gun. Since then, by keeping an eye on the bubble, I have had great success always shooting on target.

Dan Martin,
Galena, Ohio

Ice Scraper

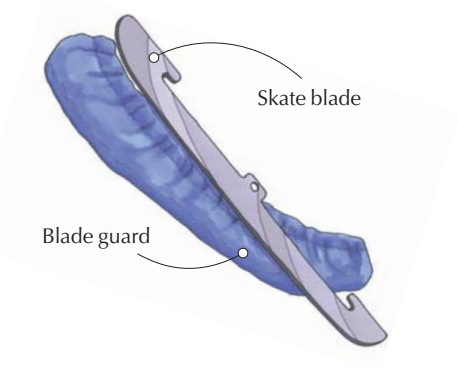
This is a trick that isn't as likely to be accessible for readers from warm climes – but if, like me, you live in an area where ice hockey is king, you might have at hand an excellent source for curved scrapers.

Sure, I have "regular" cabinet scrapers – but I also save the blades from old hockey skates. Skate blades are rigid, hold a great edge and are easy to sharpen – plus they are curved at each end; that comes in handy for detail work.

Bonus: They come with their own protective bag – the skate guard.

I've found my "ice scrapers" excel at chair work. **PWM**

Jeremy D. Beck,
Wilmington, Delaware



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Veritas Combination Plane

This large plane excels as a plow, and does a decent job of other tasks.

A plow plane is a joinery powerhouse in the hand-tool shop. Not only can you plow grooves with it – you can, if necessary, use it for rabbets and tongues, though it's a laborious tonguing process. Enter the combination plane – a plane that excels at grooves and has changeable cutters for not only other joinery, but decorative mouldings as well.

Hunting down a vintage Stanley No. 45 or Record #405 in good condition can be a challenge, though, and they're often pricey. But there's a new option: the Combination Plane from Veritas.

It's heavier than the company's Small Plow Plane (natch), but light enough to not tire me out. I weighed it on our postal scale against a Stanley No. 45, both with a 1/4" plow blade inserted. At 3.68 pounds, the Veritas is more than a pound lighter than the Stanley (4.72 pounds) – but still heavy enough to stay easily in the cut.

I tested it mostly with the 1/4" plow blade that it comes with; that's what I'd use it for most often and it's where this tool excels. Additional blades (for rabbets up to 1" wide, and tongues, beads, reeds and flutes in various widths) are sold separately, as are straight plow blades from 1/8" to 3/8". (Blades are also available in sets and in metric sizes.)

Perhaps most notable on this new tool is that Veritas has rethought the split-collet system used on some of its older fenced planes. Instead, this tool uses knurled thumbscrews that lock directly to the fence rods, the depth stops and other parts of the castings. And they lock tight. I tried mightily (applying far more force than typical) to overcome the depth stops and fence. I couldn't do it.

Also notable is the blade guide knob. This clever improvement over the Stanley and Record combination planes snugs against the blade – any size blade – as you move the sliding section into position to set it in the correct location without much fussing at all. (If you've ever used the No. 45, you know it's a matter of eyeballing the correct location of the sliding casting, locking it, testing it, adjusting it…repeat.)

The combination plane ships with two sets of rods (5" and 8"), which allow you to use the fence and sliding section on either side of the body.

Shavings shoot nicely from the escapement. My only niggle is that the adjustable scoring spur on the body (there's a second one on the sliding section) clogged a bit in softwoods, even though I had it raised completely. The engineers at Veritas suggested backing it off slightly by turning the set screw behind it, but that didn't quite do it. However, these little blades aren't used that often (they're for scoring cross-grain work), so it's simple to remove them when they're not needed.

Compare the price ($399) with a new wooden plow (upward of $1,000) and this tool is a no-brainer as a plow alone. And, of course, if you don't have dedicated planes for its other operations, it's right handy for those, too.

— Megan Fitzpatrick

CONTINUED ON PAGE 16

Plow & more. *The stops on the new Veritas combination plane are practically undefeatable. Blades (right) are available for grooves, tongues, rabbets and more.*

Veritas Combination Plane

Veritas ■ leevalley.com or 800-871-8158

Street price ■ from $399

■ **VIDEO** *Watch the author explain the 17 knurled knobs and what they do.*

Prices correct at time of publication.

PHOTOS BY AL PARRISH

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CONTINUED FROM PAGE 14

Microjig Matchfit Dovetail Clamps

A lot of the work in any machine-oriented woodshop revolves around creating and improving jigs. While I've used hold-down and F-style clamps in most of my shop fixtures, the Microjig Matchfit Dovetail Clamps offer a new means of integrating adjustable clamping into a jig, securely and out of the way of blades and bits.

The clamps have a dovetail cross section on the top arm that fits into a 14° angle, 1/2"-wide x 3/8"-deep dovetail groove in any piece of wood that's at least 5/8" in thickness. This allows you to easily create a new guide for your circular saw or router, new table saw or band saw fixtures and whatever power tool paraphernalia you've got to make.

The clamps run in and out of the groove tightly, without much slop – a little wax on the head might make it run even smoother. I'm not looking for slop in a clamping setup, though, so the tightness is appreciated. They have a clamping range of up to 5 1/4", which makes them deep enough to clamp to even the widest table saw fences or machine tables in our shop, and also makes them eligible for clamping onto thicker benchtops.

A handheld router or router table is pretty much essential to use these clamps – putting in sliding dovetails by hand in a shop fixture might be more work than it's worth. That said, I can imagine an array of uses in a hand-tool shop, too – a paring block for dovetailing, cauls for keeping wide glue-ups flat, a thick planing stop and joinery jigs to name just a few. And the price is low enough (about $40 per pair) to justify keeping a pair or two on hand.

— Brendan Bernhardt Gaffney

Matchfit Dovetail Clamps

Microjig ■ microjig.com or 407-696-6695

Street price ■ $39.90/pair

■ **VIDEO** *Watch how these work in a couple of typical shop situations.*

Price correct at time of publication.

Robin Wood Axe for Carving (and More)

As a bowl carver, I am frequently asked about recommendations for beginner sets of tools. Though the Robin Wood Axe is always on that list, it's not just a beginner's axe.

Weighing in at 1 pound, 9 ounces, it is a midweight carving axe, and considerably lighter than the Gransfors Bruks (GB) Swedish Carving Axe (just more than 2 pounds), making it much more manageable for long-term use and controlled cuts. Though its lighter weight might imply that it's not suited for heavy stock removal, it can be used for roughing work or even felling and sectioning small trees.

Having used the heavier GB carving axe quite a bit, I do notice a difference when roughing out bowls. The weight of the GB helps with removal of large amounts of waste wood when bowl carving, but for a beginner or for a spoon carver, this is a moot point.

The double bevel allows for right or left handed use.

Where I find the Robin Wood axe most useful is when I have rough-carved a bowl to shape and need to remove small amounts of material with controlled cuts to reduce the thickness of the work's walls. With the GB, these types of controlled cuts are possible, but unnecessarily wear me out. I've discovered that using my GB for roughing work then following up with the Robin Wood axe is the perfect balance.

For beginner or seasoned carvers, this would surely be a very welcome addition to any tool kit. The price (about $50 with the current exchange rate) absolutely can't be beat for the quality of the tool, and though it ships from England, it got to my house in Maine in three days. **PWM**

— Danielle Rose Byrd

Robin Wood Axe

Wood Tools ■ wood-tools.co.uk

Street price ■ from $50

■ **VIDEO** *Watch the author use the Robin Wood Axe.*

Price correct at time of publication.

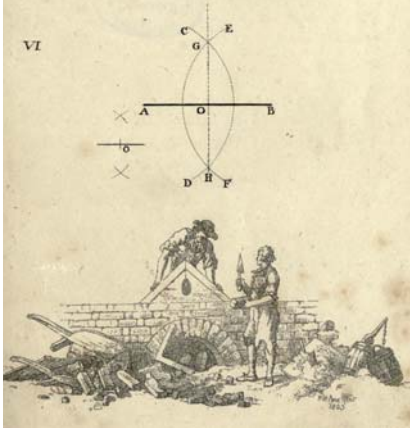
Artisan Geometry

The universal and timeless structure of our imaginations.

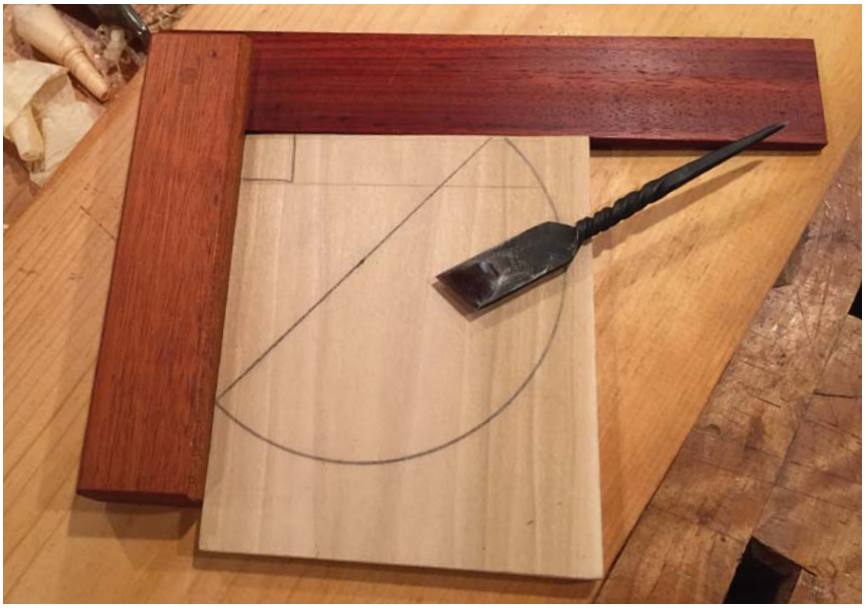
Woodworking spans the globe and is a common thread linking humans across the ages. This craft shares a basic tool kit across time and space with more similarities than differences. An artisan from feudal Japan might view a Western backsaw with suspicion, but would still recognize it as a saw. Tools such as chisels, planes and saws are universal and they work in parallel with a universal design language that is baked into both the tools and the way we execute design.

This language, which I call "artisan geometry," was used and passed down by builders since the earliest of times. This blue-collar builder's language was used both in the design process to visualize ideas and on a practical level employed in the actual layouts at the workbench.

In our high-tech world it's easily mistaken as some antique method or set of rules that might constrain creativity. Far from it. Geometry is the structure that lifts our imagination much like the roots and stem of a plant support the blossoming of a flower.



Building 101. *Early books on the craft almost always began with geometry lessons.*



Artisan geometry. *The template used to establish the "square" in this shop-made wooden try square was generated with a little help from artisan geometry.*

This isn't the geometry you were forced to memorize in the eighth grade with theorems and proofs. This is an artisan's language expressed with a pair of dividers, a length of string and a straight stick. Yes, it was written down, often in the opening chapters of early books on building like Roubo's treatise on joinery ("l'Art du Menuisier") or "Natte's Practical Geometry."

It's also lurking just below the surface, embodied in the common user-made layout tools such as try squares, straightedges and marking gauges.

Imagination Highway

Today's woodworker can buy accurate layout tools and even machines equipped with lasers. What need is there to learn this artisan geometry? The short answer is that this is basic knowledge at the root of our craft. On a day-to-day basis we might use a calculator to solve math problems. But that doesn't mean we wasted our time in grade school learning to add, subtract and multiply. To the contrary, the calculator is a powerful tool exactly because we understand the math behind it. But this goes much deeper than just mastering some fundamentals.

It always struck me that antique layout tools were often user-made. At first I thought this was a practice born of necessity. After all, tools like try squares, miter gauges, straightedges and winding sticks could be made from scraps of wood. But I wondered if there was more to it. Could the making of these tools be a doorway into this artisan geometry?

In an attempt to deepen my understanding I set out to make my own layout tools just using artisan geometry to give birth to them out of thin air as it were. I'm not talking about using an engineer's precision square as a master. That would have defeated what I

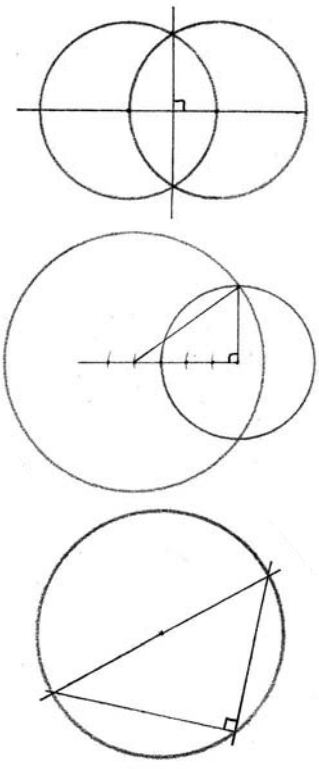
CONTINUED ON PAGE 20

CONTINUED FROM PAGE 18

needed to learn. Instead, I used artisan geometry by itself to find true square.

That proved to be a pivotal step. The act of using my hands to make physical tools that embodied such geometric truths as points, lines and planes allowed me to cross a new threshold. I'm now convinced that artisans made these tools not because they were frugal but because they all needed to cross that threshold.

There is something about artisan geometry that engages the imagination in unique ways. It's a language spoken with our hands. It reveals itself through the scribing of circles across the clean face of a pine board or using an awl to punch a series of points to mark important joinery on a table leg. This hand-to-eye to brain connection is a powerful conduit that awakens the imagination, that part of our mind that can see images in space. Think of it like a playground where you let your ideas rub against reality. The reality flows from our fingertips as we begin with a point then a line. By connecting those lines they become planes that eventually morph into solids. We take it for granted, but this is a raw primal thing like eating wild strawberries picked from the forest floor. These are profound and fundamental truths at the root of everything we know about the material world. Even the simple act of using a compass to scribe a right angle pulls us into something at the base of reality itself.



Multiple methods. *Here are three ways to conjure a right angle from thin air. Which construction was used to build the try square in the opening photo?*

More Than One Solution

On a purely practical level, artisans who can speak this language can quickly find multiple ways to resolve problems at the workbench.

Take the simple right angle as an example. Suppose you need to scribe a right angle in a tight spot too small for your try square to fit, or you need an accurate right angle to lay out the foundation for a new workshop, something beyond the scale of your try square. Or you simply want to make your own wooden square as our ancestors did.

At left are three geometric layouts that use circles and a straightedge to create a right angle. Note that they can be drawn at a small scale with a compass or at a massive scale by swinging arcs with a rope attached to a stake anchored to the ground. Each is drawn showing its entire circle, but in reality, once you understand them you can simply scribe small sections of circles out in space where important intersections need to be located.

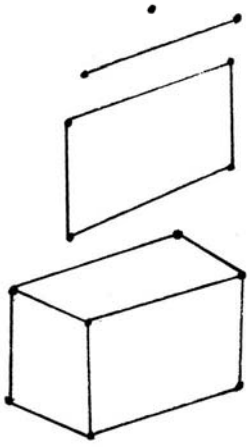
Take few moments and draw each several times until it sinks into your memory and understanding.

The top one uses two identical circles that overlap. In this case, the center for the second circle lies on the circumference of the first. A line connecting the two centers will be perpendicular to a line that connects where the circles intersect.

The middle example uses circles to draw a 3-4-5 triangle that will always contain a right angle. On a straight line, step off five equal spaces. Place the compass point on the first mark and scribe a circle using the third mark to size it. Then open the compass to span all five marks and reset the compass point to the fourth mark then draw a circle. The resulting triangle is the 3-4-5.

Finally, draw a circle then a line crossing the circle through its center. Any two straight lines that connect the end points of the diameter and the circle's edge will create a right angle.

Now go out and build a wooden try square or lay out the foundation for that dream shop you've been thinking about for years. You have the power with a little help from artisan geometry. **PWM**



Building blocks. *Everything we build can be boiled down to points, lines, planes and solids.*

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

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About This Column

Design Matters

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

Hickory Can't Wait

This hardwood is best harvested for its bark and wood soon after cutting.

Green woodworking has a different set of criteria when it comes to stockpiling material. Unlike those who work with seasoned stock, those of use who use green wood try to keep a large log from drying at all; we want to rive and work the stock with a high moisture content. Ease of cutting is one principal reason for this.

One question I often get from people wanting to try their hand at this work is, "How long will the wood stay green?" With the oak I typically use, it's an amazingly long time. Left in large unsplit sections, an oak log will begin to decay before it will truly dry. Over time, the sapwood will rot away, but inside, the heartwood will be wet, smelly and just as strong as the day it was felled.

As a result, I am a green woodworker who is usually in no hurry. Recently, I split and planed some red oak that was rough-split out more than a year ago. It's not quite as easily worked as it would be if it were just felled, but the semi-dry wood is still within my strength limits.

A group I work with held the second annual Greenwood Fest in Plymouth, Mass., last summer. Among the leftovers were two hickory saplings that Tim Manney used to demonstrate making woven bark seats for his elegant ladderback chairs. Once Manney's program was done, I quickly moved to stash the hickories, knowing I could make good use of them afterward.

Hickory bark. *If a hickory log comes my way in the springtime, all other work stops while I harvest first the inner bark, then the wood. Bark seats like these are the best there is. I also use straight-grained hickory wood in many ways.*

Getting a Jump on Hickory

But hickory won't wait. Neither, for that matter, will ash, maple and birch among others. So when I got settled after our festival, I jumped right on the hickory to strip the inner bark off the sapling and store it for future seat weaving and other similar uses. I propped the log up on a bench with one end stuck in my riving brake. Then I used a drawknife to shave away the rough, scaly outer bark. Under this layer is the stuff seat-weaving dreams are made of – the leathery inner bark that in the spring peels off the sapling like a 10'-20' banana.

I tend to shave a swath of outer bark about 3" wide down the length of the log, then score through the inner bark down to the wood with a sharp-pointed knife. Once that score is cut, I pry under the end of this inner bark and lift it slowly off the log. As I peel it, I look to make sure no fibers are sticking to the log. If they are, it's usually because the scoring wasn't deep enough. Get in there and snip it, then keep lifting.

I coil the strips into rolls then proceed to the next one. Once the first strip is off the log, it's easy to see the thick-

First the outside. *Shaving off the crusty, tough outer bark is hard work. I place the piece in my riving brake and shave off about 3" at a time, leaving the bark in place on the rest of the log. This helps prevent the inner bark from drying out if I get interrupted.*

CONTINUED ON PAGE 24

PHOTOS BY AUTHOR

CONTINUED FROM PAG22E 22

Score! *After removing the hickory's outer bark, score the inner bark with a knife to establish the strip width.*

Inner bounty. *After scoring the inner bark, I lift the end of that strip with my knife then peel the strip off down the log.*

ness of the adjacent strips. This allows me to refine the shaving so I get an even thickness of the inner bark. Carefully shave this bark to a consistent thickness, then score it and peel it. Then coil it, and go on to the next strip.

I want to peel the whole thing in short order. Once the log starts drying, the bark doesn't peel as easily. If I'm interrupted in this work, I leave the outer bark intact. That's why I only shave off the outer bark a few strips' worth at a time.

This stuff gums up the drawknife something awful, so hone your tool frequently as you work.

Use the Whole Sapling

After I have the bark stripped, coiled and stored, then it's on to the wood. The diameter of these trees was too small to make ladderback chair parts, but there was enough straight-grained wood for some bending parts. I started two firewood carriers, and bent various basket rims and handles.

This work is right smack in the middle of green woodworking – shaving horse, drawknife, steam-bending. Straight, clear hickory rives like almost no other wood I know. It shaves beautifully when green and gets like iron when it dries. That's part of why you don't wait with hickory.

The stuff with knots is destined for froe clubs, the wooden persuader used to knock the froe into the end grain when riving stock. I hew and shave down a handle, then let it dry before putting it to use. Green froe clubs self-destruct.

Any straight-grained leftover short bits will become tool-handle stock – I keep a stash of roughed-out stock for replacement handles. It makes perfect sense to save long stuff for axe handles and the like, but it can get ridiculous saving 4"-long pieces for chisel and gouge handles. I can't resist though; hickory excels in impact applications. Why waste it? It can always burn later. As firewood, hickory is outstanding.

It took me about three days to harvest the bark and work the riven wood of these two 10' saplings. Time to get back to the red oak; I've got the hickory right where I want it now. **PWM**

Wood-carrying wood. *The bows for these firewood carriers are steam-bent from riven hickory. A clear riven piece of hickory is ideal for bending. I even prefer it over white oak, and that's saying something.*

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

ONLINE EXTRAS

For links to all online extras, go to:

- **popularwoodworking.com/nov17**

BLOG: *Read Peter Follansbee's blog.*

ARTICLE: *Read "Give Me a Brake" to learn how to make an appliance for processing green wood.*

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

About this Column

ARTS & Mysteries

"Arts & Mysteries" refers to the contract between an apprentice and master – the 18th-century master was contractually obligated to teach apprentices trade secrets of a given craft (and the apprentice was expected to preserve those "mysteries").

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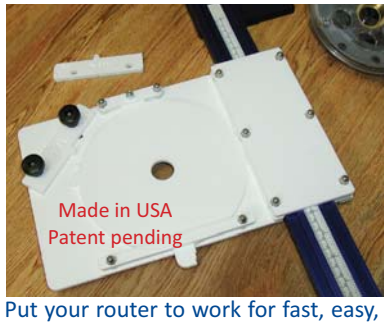

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ARTS & CRAFTS Sideboard

BY NANCY R. HILLER

This Harris Lebus classic is a tour-de-force of the English aesthetic.

When we think of the origins of the Arts & Crafts movement in England toward the end of the 19th century, we tend to focus on the revival of handcraft in reaction against the soul-deadening monotony of factory production. Many furniture makers pursued the ideal of handcraft wholeheartedly. But over time it became clear that then, as now, the market for furniture and other wares made to a high standard by hand is limited. Even William Morris complained that he resented spending so much time "ministering to the swinish luxury of the rich" and agreed, late in life, that machines had their place in performing repetitive processes.

While Morris and other idealists looked askance at machines, some workshops eagerly adapted elements of the Arts & Crafts aesthetic to factory production. By doing so, they not only maintained a healthy bottom line, they went a long way toward realizing the movement's ideal that all homes, not just those of the wealthy, should be furnished with objects that are beautiful and well made.

One of these businesses was Harris Lebus of Tottenham in North London, which made the original version of the sideboard pictured here, as well as numerous variations on the theme. At the turn of the century, Lebus produced bedroom and dining room furniture for an international clientele, in addition to its English market.

With strong lines and a commanding presence, this circa 1903 sideboard is an outstanding example of how this English manufacturer brought graceful utility to homes of the middle class.

Base Cabinet

Mill and glue up the stock for the top, divider, floor and side panels, leaving all parts oversized in width and length. Clamp the parts in cauls to keep them flat.

Next, mill the legs – again, a little oversized in width and thickness, leaving at least a couple of inches in additional length. Let the legs sit for a few days to allow the wood to move, then mill to finished thickness and width, leaving the extra length.

Start by turning the feet, using calipers to keep the diameter of each salient point, i.e. the widest point of the ring-turned foot, the narrow point just above the "ring," and the spot 2½" up from that narrow point, consistent. After you've finished turning, cut each

LEAD PHOTO BY AL PARRISH; STEP PHOTOS BY THE AUTHOR; ILLUSTRATIONS BY DONNA HILL

leg to length. (Obviously this cut will be at the top of the leg. Don't cut off the feet you just turned, right?)

Now mark the inside of the front legs for the positions of the mortises for the center rail, bottom rail and bottom trim. Be sure to set the mortises for the front middle rail in 1/2" from the back edge of the leg to allow for the 1/2"-deep groove that will hold stub tenons for the drawer runners.

Mark the inside of the back legs for mortises that will hold the bottom rail and trim.

Chop or rout the mortises, then cut the tenons. Determine the cut-back of the tenons by standing each tenon on its mortise in the position where it will be when the casework is assembled and transfer the mark directly, then cut with a tenon saw.

When the basic mortise-and-tenon joints have been cut, dry-clamp the front and back assemblies. Use a spacer board or even a 2x4, clamped in place, to ensure that the top of the back assembly is the same width as it is at the bottom.

Next, measure the distance between the legs and add 1 3/4" to get the overall length of the dovetailed top rails.

Cut these rails to length.

Use a dado stack (or a tenon saw) to lap each end of the front and back top rails with a shoulder 7/8" from the end. Now lay out a dovetail at each end, staying about 3/16" away from the outside face to help keep the legs from splitting when you try the joints' fit. As with the front middle rail, set the dovetail in from the back edge by enough that it will not interfere with the groove you'll rout to hold stub tenons for kickers. Place each top rail (front and back) on its dry-clamped assembly and mark out the pins. Square the line down to the depth of the lap joint and cut with a saw, then chop out with chisels. (You can, of course, unclamp the assemblies now.)

Once you've fit each dovetail joint, lay aside the front and top rails.

Cut a 5/16"-wide x 1/2"-deep groove in the back of the top front rail and the front middle rail for the runner and kicker stub tenons. Position the groove so it will coincide with that of the tenon on the front middle rail.

Assemble the basic carcase dry and clamp it together to check the fit before disassembling and moving on.

Rout the 3/8"-wide dovetail slot for the bracket that will go at the top of each leg, setting up the router table so the slot will fall at the center of the leg's width. Clamp a stop to the fence to finish the slot at 3"; clamping the stop about an inch above the table will allow waste to blow out of the way.

Mill the beveled trim pieces that go above and below the door section, leaving them long. Rip the face edge at 45°, leaving about 3/32" of flat area on the front. Cut one end square. Now place one of the bottom front rail tenons in its mortise and clamp a piece of beveled trim in place above it.

Scribe the position of the beveled trim's top edge on the leg. This will be the position of the top of the dado for the cabinet floor. Transfer this mark onto each of the legs.

Dry-fit. *Clamp the front and back assemblies together and check for square – the success of the rest of the project rests upon it.*

Tail transfer. *After cutting the half-lap dovetails, transfer the tail shape onto the legs then chop out the sockets.*

Trim fit. *With the trim clamped to the rail, you can accurately scribe its position on the leg, then transfer the mark to the other legs.*

Side Panels

Rip the side panels to width and cut to length. The length of the side panels will be the length of the legs minus 6".

Set up your table saw fence (or router) to cut the dado for the cabinet floor in the side panels. The dado depth should be about half the thickness of the side panels (so about 5/16" deep), with the width equal to the thickness of the cabinet floor (3/4"). Check that your floor material will fit easily into the dado before you break down the table saw set-up; in this case it is better to err a little on the side of a loose fit, because you'll be inserting the cabinet floor at a critical time during the glue-up.

Next, mark out and cut the decorative angled detail at the lower edge of each side panel.

Sand the end panels and the inside edges of the legs, taking care not to sand the areas where there will be joints, lest you mar the fit.

Dados. *The bottom edge of the dados in the side panels for the cabinet floor must align with the marks on your legs derived from the beveled trim.*

Arts & Crafts Sideboard

NO.	ITEM	DIMENSIONS (INCHES) T	W	L	MATERIAL	COMMENTS
BASE CABINET						
❑ 4	Legs	1 5/8	1 5/8	35 1/2	White oak	
❑ 1	Front top rail	15/16	1 5/8	40 1/2	White oak	7/8" DBE*
❑ 2	Fr mid & bottom rails	15/16	1 5/8	40 1/2	White oak	7/8" TBE**
❑ 1	Front bottom apron	5/8	2 1/2	40 1/2	White oak	7/8" TBE
❑ 2	Side panels	5/8	16 3/8	29 1/2	White oak	
❑ 1	Vertical divider	15/16	19	28	White oak	Oversized; trim to fit
❑ 1	Div. depth extension	15/16	1	5	White oak	
❑ 4	Base brackets	1 1/16	3 1/2	5 1/8	White oak	3/8" DTB†
❑ 2	Bevel trim pieces	1	1 5/8	38 3/4	White oak	
❑ 1	Top	7/8	22 5/8	54	White oak	
❑ 1	Floor	3/4	18	42	White oak	Oversized; trim to fit
❑ 1	Floor support strip	3/4	1 3/4	38 3/4	White oak	
❑ 1	Back top rail	15/16	1 5/8	40 1/2	White oak	7/8" DBE
❑ 1	Back bottom rail	15/16	1 5/8	40 1/2	White oak	7/8" TBE
❑ 1	Runner support rail	3/4	2	42	White oak	Oversized; trim to fit
❑ 4	Drawer runners	3/4	1	18	White oak	Oversized; trim to fit
❑ 2	Kickers	3/4	1 3/4	16 1/2	White oak	Oversized; trim to fit
❑ 2	Drawer guides	1/4	1 1/2	12	White oak	
❑ 1	Back	1/4	27	40	1/4" oak ply	Oversized; trim to fit
DOORS						
❑ 4	Stiles	15/16	3 1/2	17 3/16	White oak	
❑ 2	Top rails	15/16	2 1/8	32††	White oak	
❑ 2	Bottom rails	15/16	9	32††	White oak	
DRAWERS						
❑ 4	Sides	3/8	5	17 1/2	White oak	
❑ 2	Backs	3/8	5	19	White oak	Oversized; trim to fit
❑ 2	Fronts	3/4	5	19	White oak	Oversized; trim to fit
❑ 2	Bottoms	1/2	18	19	White oak	Oversized; trim to fit
UPPER SECTION						
❑ 4	Outside stiles	1	2 7/16	27 1/4	White oak	
❑ 2	Outside top rails	1	2 1/2	6 1/8	White oak	1" TBE
❑ 2	Outside bottom rails	1	11 3/4	6 1/8	White oak	1" TBE
❑ 2	Outside end returns	1	2 1/4	27 1/4	White oak	
❑ 2	Center stiles	1	2 1/4	27 1/4	White oak	
❑ 1	Center top rail	1	2 1/2	31 7/8	White oak	
❑ 1	Center bottom rail	1	7 1/2	31 7/8	White oak	
❑ 3	Bevel trim	1	1 1/4	30	White oak	Oversized; trim to fit
❑ 1	Top ext. for ctr. sect.	1	7/8	33 1/2	White oak	Oversized; trim to fit
❑ 1	Cornice	15/16	8 1/4	90	White oak	Oversized; trim to fit
❑ 1	Dust board	5/16	9	65	White oak	Oversized; trim to fit
❑ 4	Candle shelf uprights	9/16	5 1/4	6 5/8	White oak	3/8" DTB
❑ 2	Candle shelves	3/4	6 1/2	8 5/8	White oak	

"Verify in field" all sizes; *DBE=Dovetail both ends; **TBE=Tenon both ends; †DTB=Dovetail at back; †† Length for both; cut right & left from one board for continuous grain

Rip some 3/4"-thick scrap to use for spacers that will hold the panel up to create a 1/4" reveal between the outside face of the legs and the face of the panel. With the panel resting face-down on these spacers, glue the side panels to their respective legs. Pay attention to ensure that you glue the legs to the panels in the correct positions.

When the panels have dried, clean up any glue residue.

Now cut the decorative front bottom trim. I used a backsaw to cut the angles, then cut out the waste on the band saw. Clean up the cut using the fence on your table saw, paring the area near each end with a chisel.

Now assemble the whole cabinet and clamp without glue. Be sure to clamp the beveled trim in place, too, to make sure everything fits.

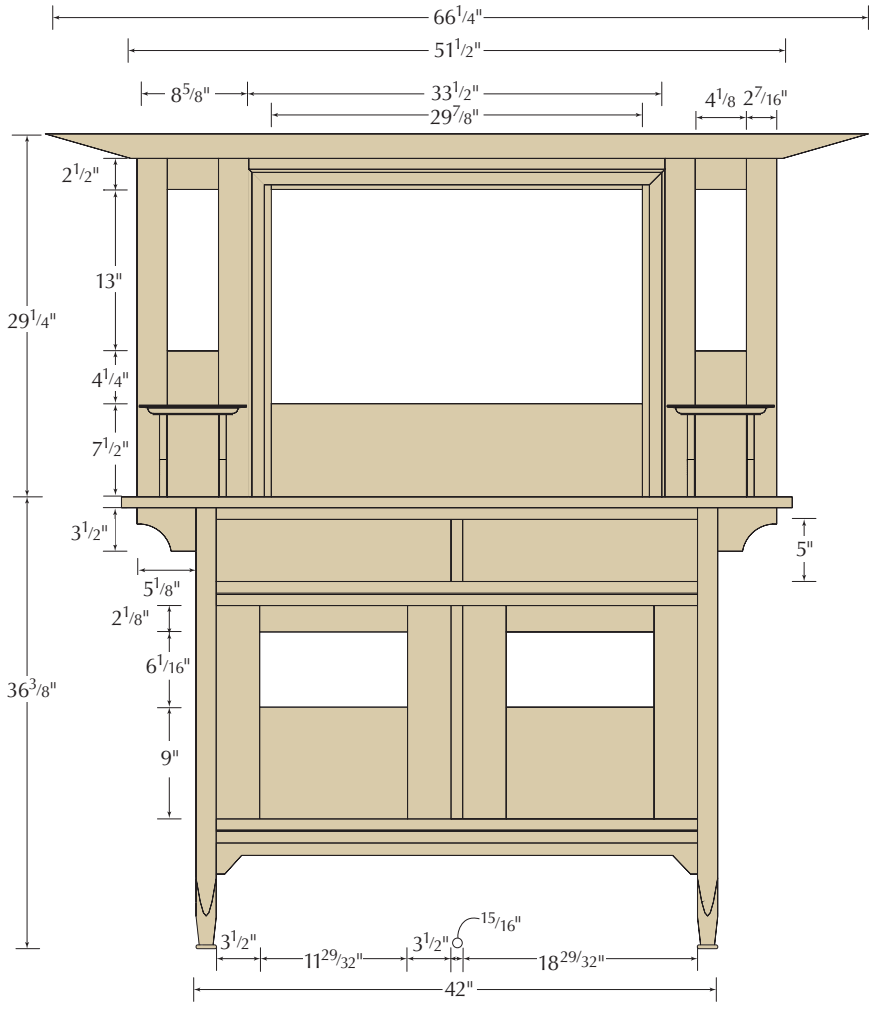
Measure from the back edge of the front bottom rail to 5/16" in from the back of the back rail; this 5/16" space will be rabbeted to accommodate the back. Rip the cabinet floor to this measurement.

Measure between the left and right side panels and add a scant 5/8" for the cabinet floor to go into the dados. Cut the floor to this length. To mark out the notches where the floor will fit around the back legs, hold the floor up against the back (inside) edge of the bottom front rail, at an angle, and mark the position of the inside edge of each back leg.

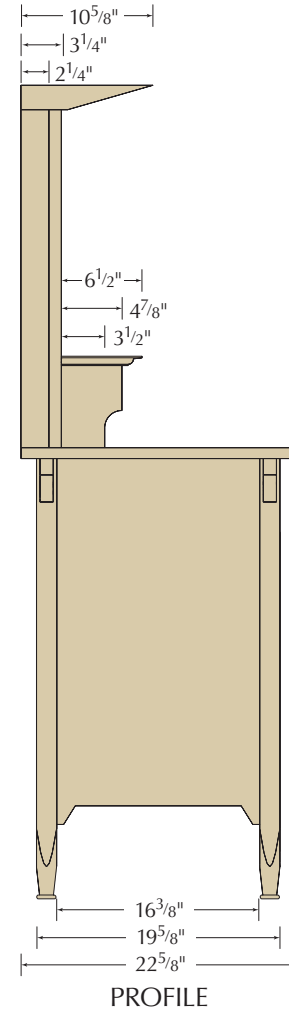
Cut the notches, then tap one side of the cabinet off the dry assembly, insert the floor in the dado, replace the second side, and clamp dry to make sure everything fits.

Sand the front bottom apron and clean up the inside edge of the top rails (front and back) and mid rail.

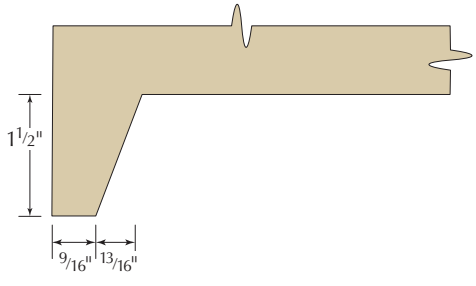
Lighten up. *The angled cutouts on the side panels lighten the look of the bottom case.*



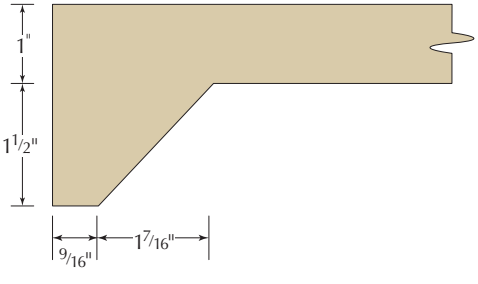
ELEVATION



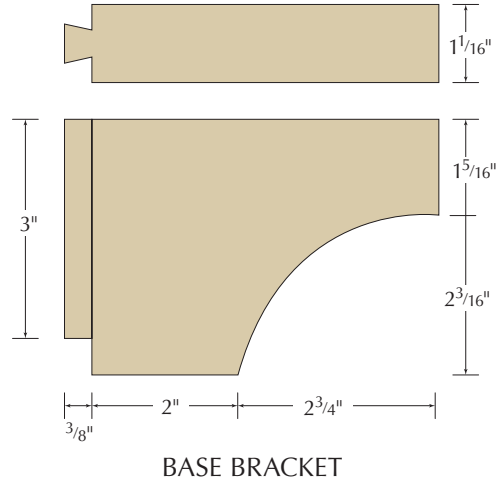
PROFILE



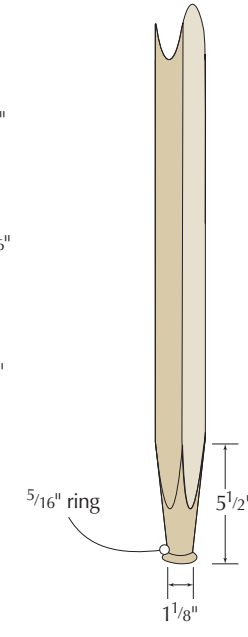
SIDE PANEL DETAIL



FRONT BOTTOM APRON DETAIL



BASE BRACKET



LEG DETAIL

Assemble the Cabinet

I did the glue-up alone, but it would be easier with a helper. If you're flying solo, I recommend using Titebond Extend as a sanity enhancer.

Lay one side assembly on your bench and insert the cabinet floor (no glue). Now put glue on the tenons for that side and insert. Put glue on the tenons for the other side and place the other side assembly atop them. Now you should have all the tenons in place. Carefully glue the lapped dovetails and tap into place.

When all the joints are glued, stand the cabinet on your bench and clamp the entire assembly. Check the diagonals across the top and front and adjust as necessary to get the cabinet square. Check across the top rails to ensure there's no twist. Clean up excess glue.

When the glue is dry, place the case on its face. Rout a 5/16"-deep x 3/8"-wide rabbet for the back then chop the rabbet corners square with a chisel and mallet.

Turn the cabinet upside down and glue on the floor support strip at the back of the front bottom rail. Clamp it in place, then reinforce the glue with countersunk screws. (Can't hurt.)

Supporting member. *A 3/4" x 1 3/4" strip glued and screwed to the underside of the back of the bottom front rail adds support and stiffness.*

Vertical Divider

Now stand the cabinet up. Hold the square end of the bottom beveled trim up against the bottom front rail and mark the length. Cut it to length and clamp it place (no glue). The vertical divider will come to the front edge of the flat section on this piece. Measure the distance from the back edge of the cabinet floor to the front edge of this flat section, then rip the vertical divider to this width.

Now mark the centerline of the width of the floor and use a square to lay out a dado for the vertical divider. The dado will be 1/4" deep by the thickness of the vertical divider. To get this spot-on, I clamped a straightedge (a piece of 3/4" plywood) to the floor of the cabinet along the pencil line of one side of the dado and used a pattern-cutting bit to make the first router pass. Then I held the divider in place against the shoulder of the first cut, marked the position for the other shoulder, and repeated the process so that the dado accommodates the vertical divider's full thickness.

Measure the distance from the bottom of the dado to the underside of the top front rail and cut the vertical divider to this length. (Mine was 24 3/4", but yours may be significantly different.) Insert the vertical divider, tapping it up against the back edge of the front beveled rail. The divider will be notched over the flat part of this beveled rail. Mark the top edge of the beveled rail.

Next, transfer the position of the top and bottom face of the front middle rail onto the divider. Pull the divider back out. Set a marking gauge to the flat section of the beveled rail and transfer this to the lower notch and the middle notch.

Cut both notches and insert the divider to check the fit. Also check to ensure that the back edge of the vertical divider comes to the inside of the rabbet for the cabinet back, trimming if necessary. Remove the vertical divider.

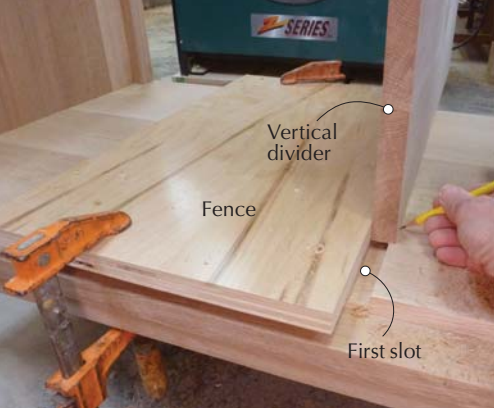
Bottom front. *Cut the trim angles by hand then remove the waste between at the band saw. Stopped cuts at the table saw clean things up, followed by chiseling at both ends.*

Verify in field. *I'm a proponent of, whenever possible, marking off the work rather than relying on measurements. It cuts down on errors. Here, I'm marking the floor for where the leg notches must be cut.*

Runner Support Rail Notch

Use a framing square to transfer the position of the underside of the front middle rail to the inside edge of each back leg. This is the location for the top edge of the runner support rail. Hold the rail up to the back leg and mark the bottom edge of the notch. Use a marking gauge to scribe the depth of the notch on each back leg. (Add the thickness of the back rabbet to the thickness of the runner support rail.) Saw and chop the notches, then cut the runner support rail to length.

Dry-fit the vertical divider once more and mark the position of the runner support rail on the divider's back edge. Remove the divider, saw and chop



Two passes. *Rout one shoulder of the dado, hold the vertical divider in place to locate and mark the second shoulder, then reclamp the fence and rout again.*

Gauged in. *Set a marking gauge off the flat back edge of the top beveled trim, and transfer that setting for the notches in the vertical divider.*

Screwed & glued. *After you've cut the notches in the vertical divider, glue then screw the vertical divider through the top rails.*

the notch for the runner support rail, and check the fit of both. Sand both the vertical divider and the runner support rail (again, don't sand the joints), then glue them in place. Measure to ensure that the top of the divider is equidistant from each side at the back and front. Drive a 1¼" x #8 screw into the divider through the front and back top rails to secure it in place.

Top Beveled Trim

To ensure a snug fit, mark the length of the top beveled trim off of the case then cut it to length. This piece gets notched to fit over the vertical divider. Tap it into place and mark the vertical divider's position.

Use a marking gauge to scribe the flat section and cut the notch at the table saw or with a saw and chisel.

Try the fit and adjust as necessary. Sand the bevel and lower edge, then glue and clamp the trim in place.

Measure for the strip that will extend the depth of the divider at the front between the top and middle rails. Cut it to size and glue in place. (It's noted as "Div. depth extension" in the cutlist.)

Sand the entire assembly.

Notch location. *With the vertical divider inserted in its dado, mark where it meets the front mid rail.*

Decorative Brackets

Cut the bracket stock to size, allowing ⅜" for the sliding dovetail on the length. Rout the dovetails on a router table and cut the shoulders flat at the bottom of each bracket.

Make a pattern for the curve in ¼" plywood and use it to mark out the brackets. Cut out the curve and trim it using a pattern-cutting bit.

The brackets are small with scarcely any room for clamps, so I nailed the pattern onto each bracket with two wire nails, then pried it off when finished.

Fair the curves by hand, sand the brackets then glue them in place.

Doors

Measure each door opening. Mill the parts to thickness and width, then cut the stiles to length. Calculate the length of the rails by subtracting two times the stile width from the width of each opening, then add 2" to yield a 1" tenon at each end of each rail. Cut the rails to length.

Today, it's easy to make glazed doors and mirror frames by using a router to rabbet a mortise-and-tenon frame after assembly. So if that's your preference, go ahead and cut, then fit the joinery, then glue up the doors (check for square and confirm there's no twist). When the glue is dry, fair the joints as needed then rout a rabbet for the leaded glass panels and square the rabbet corners.

But traditional glazed doors and mirror frames were built from rabbeted stock, which called for stepped-shouldered tenons. If you want to read about achieving that traditional look with modern tooling, see the Online Extras at the end of the article.

Fit the doors to the case, using pennies to shim them up on the bottom front rail. Plane the hinge stile as necessary to get the same margin on the hinge stile side as you have at the bottom. Now trim the top edge so that the doors fit into their openings when shimmed on pennies all around – but at this stage, it's not a bad idea to leave the fit a little tight at the top and center, in case you need to plane a little more once the doors are on their hinges.

Now mark out the doors for the hinges. Because the doors are set back from the cabinet's face, they will only open to 90°. Note also that the hinges get mortised only into the doors, not the cabinet legs; this is the only way they will open.

Lay out the mortises using two marking gauges: one set to the depth of the leaf plus half the diameter of the hinge barrel; the other set to the diameter of the hinge barrel minus the width of the margin you desire around the doors' edges.

Cut the mortises (I use a chisel), then screw each hinge in place with a temporary steel screw the same size

> "In the trade, the names Harris Lebus and furniture are synonymous; we cannot think of one without the other."
>
> —*From* The Cabinet Maker and Complete House Furnisher, *July 1950*

Double up. *Set one marking gauge to the hinge leaf width plus half the barrel's diameter; set the other to the diameter of the hinge barrel, subtracting the desired gap.*

Show the work to the work. *Hold the kicker against the front rail and leg to mark it for notching.*

as the brass screws you'll insert later.

Set each door in its position on the pennies and wedge them securely using a scrap of wood or shim. Mark the position of the front face of each hinge stile on its adjacent leg. Use a small square to mark the position of the top of each hinge on the adjacent leg. Then remove the doors and use the square to extend those lines across to the back of the legs.

Now set a marking gauge to the sum of the distance between the front of the leg and the front face of the door plus the original hinge leaf setting. (Do the math!) Measure the total height of each hinge and mark the approximate position of each hinge's bottom on the legs, then use the marking gauge to scribe the back edge of the leaf for each hinge. Saw and chop the mortises.

At this point you can either hold the door in position to drill for the first screw then insert it, or remove a hinge from a door and use it to mark and drill the holes for all the hinges. (Holding the door with one hand while drilling and screwing with the other is a bit awkward.) Screw the doors into place with one screw per hinge and adjust the fit as necessary.

Mill the door stops. Mark the positions for rare earth magnets (assuming you are using them as catches) and drill those holes now, using a Forstner bit (doing so while the stops are off the cabinet is far easier than after they've been installed). Do not insert the magnets yet! They will go in after the cabinet has been finished. Run a small bead of glue on the door stop, then hold it against the back of the door with the door closed to make sure you have the stop in the correct position. While still holding the stop in position, pull the door open with your other hand, then fasten the stop in place with brads.

Mill glass bead (the strips that hold things in place) for the leaded glass, the art glass and the mirror. Sand but do not fit them until after finishing.

Drawers

The runners get stub-tenoned into the front middle rail and rest on the runner support rail, where they are attached using a screw and fender washer with an oversized hole, to allow the front to back movement of the carcase.

The kickers get tenoned into the front top rail and are fastened to the cabinet sides (and center divider) with oversize screw holes to allow the cross-grain panels to move freely.

So tenon each kicker at the front to fit into the groove you routed in the top front rail. Mark each tenon where it will notch around the leg and cut the notch.

Drill an oversized hole toward the back of each kicker through which you will screw it to the cabinet side, then cut slots for the tabletop fasteners that attach the cabinet top the base. (I did this with a biscuit joiner.)

Glue the tenons into the front top rail and screw the kickers to the side panels and center divider using 2¼" x #8 Twinfast screws, cup washers and fender washers (the washers give the screws enough bearing surface on the oversized hole).

Follow the same basic procedure with the runners, except that they will sit on the center back rail instead of attaching to the side panels.

Mill the drawer parts slightly oversized, then resaw 4/4 stock and glue up panels wide enough to make the bottoms. The grain should run from side to side so that the drawer bottoms don't shrink right out of their grooves.

Trim the drawer fronts to just fit inside their openings, and plane the top of each drawer side so that it will slide into position.

Now dovetail the drawers (half-

Allow for movement. *Drill an oversized hole to accept the screw (with washer) to attach each kicker to its side panel, then cut slots in it for the tabletop fasteners of your choice.*

Groovy. *Before gluing the drawers, cut grooves in the front and sides for the bottoms.*

All in the details. *Here's the finished screw slot at the bottom back of the drawer.*

Saw stops. *I sawed two angled stops for each drawer from a thin strip of oak.*

blinds at the front, through-dovetails at the back). I usually set the depth to leave about 1/8"-5/32" at the front for half-blind dovetails.

After you fit the joints, groove the sides and drawer fronts on the table saw.

The height of the blade should be about half the thickness of the drawer sides, with the bottom edge of the groove about 1/2" up from the lower edge of the drawer sides and fronts. After you've made each of the first cuts, move the fence over by about 1/8" to widen the groove to about 1/4". Now rip the backs to the same setting, so that they will sit just above the groove.

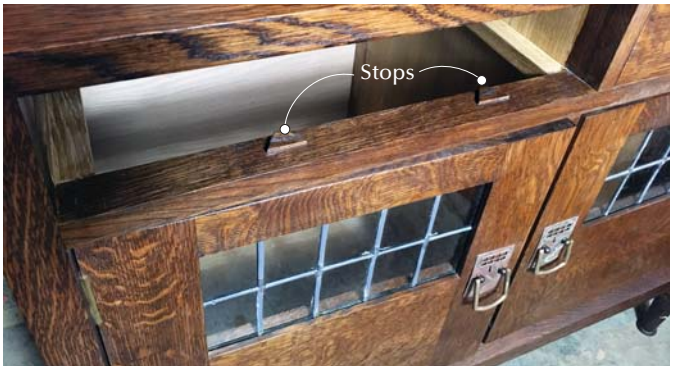
Glue up the drawers and check for square and twist.

While the glue dries, plane their bottoms to 3/8" thick. Measure the drawers to get the dimensions for the bottoms (don't forget the grooves!), then rip and cut them to length. Because the grain runs side to side, the length should be a hair under the sum of the inside drawer width plus two times the depth of the groove. The width (front to back) should allow for the bottom to seat fully in the front groove while overhanging the drawer back by about 1/16".

With the bottoms cut to size, bevel the front and side edges to fit the grooves. I did this at the table saw.

Clean up the drawers and plane the sides as needed to fit their openings.

Now drill and countersink two holes through the drawer bottoms, then square a line from the outside edges of the hole to the back of the drawer bottom. Saw a kerf along each line and remove the waste. Use a paring chisel to extend the countersink bevel to the back edge. These slots allow you to screw the bottoms to the back, allowing for seasonal movement. Insert the bottoms and screw them into place.



Full stop. *Here's what the stops look like after installation (shown here after the finish has been applied).*

Saw the drawer stops from a thin oak strip, then glue and pin them in position.

Ease the edges to remove splinters.

The drawer stops go on the middle front rail immediately behind the inside of the drawer face. Measure the thickness of the drawer face and draw a pencil line on the rail as a rough guide to where the stops will go. Apply a dab of glue to the underside of two stops (don't use a lot of glue, because that will cause the drawer stop to stick to the drawer) and place them so the front edges are just in front of this line. Now insert each drawer, pushing it carefully in until the drawer face is flush with the carcase face. Leave them in place until the glue dries, then gently remove the drawers. Drill and pin the stops in place with two pins in each.

After finishing the sideboard (after you've made the upper section), screw the plywood back in place.

The Upper Section

The top consists of three simple frames joined together, then decorated with beveled trim and candle shelves. The cornice is added last.

Mill the frame parts to thickness and width, then cut the outside stiles and end returns to length.

Mark out the mortise positions and cut the joints. The mortises should be set back 5/16" from the face; each should be 5/16" wide by a little over 1" deep.

Now cut the rails to length, allowing for a 1"-long tenon at each end.

Use a mortised stile to set up a dado stack in your table saw to cut the face-side cheek of the tenons. Cut all the face-side cheeks. Then adjust the dado blade for the back cheeks and cut.

Transfer the mortise positions onto each tenon, then saw them to fit.

Glue and clamp each frame.

When the glue is dry, fair the joints, then rout a 3/8"-wide x 3/4"-deep rabbet around the inside edges of each and chop the corners square.

Now clean up the inside edges. Plane the bottom of each frame flat if the stiles are protruding at all, then trim each one to precisely the same height by running the frames' lower edges against the table saw fence.

It's time to measure for the beveled mirror and art glass. Be sure to allow at least 1/16" margin in the width and height respectively in case of any ir-

regularity. Order the glass now so that the maker will have time to fabricate it while you complete the rest of the piece.

Rip two strips to the thickness of the center frame and use these to prop up the side frames level with the one in the center. Each side frame will overlap the center frame by about 1/2". Lay the side frames in place on top of the center frame.

Mark the position of the depth extension rail that goes at the top of the center frame, fit snugly between the outside frames. Cut the rail to length, and glue in place with clamps.

While the depth extension rail is drying, rout the slots for the candle shelf dovetails. I used two set-ups on my router table – one with the fence for the side closest to the edge of each frame, then I removed the fence and clamped a straightedge to the table to get the far slot in the appropriate position.

Once the slots are cut, clean up the frames, then glue and clamp the left frame in place, taking care to position it so the reveal between its inside edge and the edge of the center frame (the one that holds the mirror) is consistent.

Next, mill the upper beveled trim at 45°, leaving each piece overlong. Miter the top of the left piece and the left end of the top piece. When the miter fits well, cut the left piece to length. Sand or scrape it smooth, then glue in place using pins or brads to secure it.

Now glue and clamp the right frame in place. Miter the right end of the top piece of beveled trim, clean up any machine marks, then glue and pin or nail it in position. Finally, repeat the process with the right piece of beveled trim.

In position. *Use strips the same thickness as the center frame to prop the two outside frames in place for marking and measuring.*

Candle shelves. *The slots for the candle shelves' vertical supports take two set-ups. For the slot close to the edge, use your regular fence. For the far slot, make an ad hoc fence by clamping a length of scrap to the table.*

Pin it. *Set up the panels on the scraps again, clamped in place. Then glue and pin the beveled trim to the side frames.*

Stand up. *With the upper section standing up on the bench, glue and clamp the returns in place.*

After the glue dries, stand the frame up on your bench (a second person is helpful for this) and measure for the side returns, then glue them on. Make sure they are square to the face of the frames.

Candle Shelves

Mill the uprights, then rout the sliding dovetail on the back of each one. Saw the decorative shape, then use a router with a pattern bit to clean each one up.

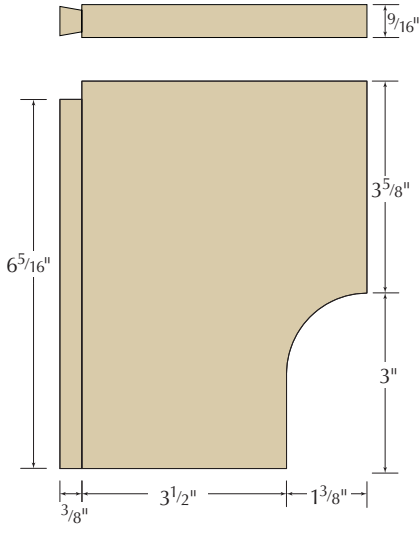
Trim off the stopped portions, then sand or scrape them and glue in place, making sure that each one is square to the frame assembly.

Cut the shelves to size. Cut a beveled kerf on the front and two sides of each shelf on the table saw with the blade set at 11/16" high and 7°. Mark the profile on the end of one shelf to use as a guide.

For the second cut, set the saw blade at 90° to produce a 3/32" high kerf at 1 1/8" overall from the fence (be sure to include the thickness of the saw blade when you set the fence!).

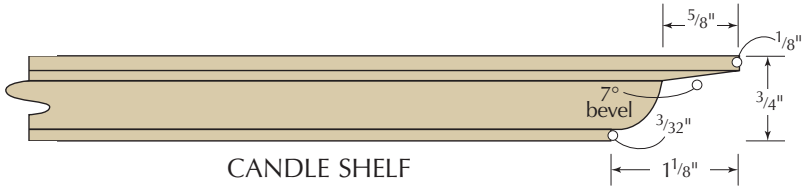
Next cut kerfs with the blade raised a little higher and the fence a little closer to the blade, to nibble away the waste close to your profile line. Use a block plane or finger plane to form the curved part of the moulding on the front and sides of each shelf.

Sand the shelves and secure them in place with a little glue and brads.



CANDLE SHELF UPRIGHT

Kerfs. *The table saw cuts remove the bulk of the waste for the candle shelf profile.*



The Cornice

It's finally time to top things off, so mill the cornice stock to width and thickness.

Set your table saw blade to 16° and rip a bevel along one long edge.

Flip the stock over and rip the same bevel on the opposite edge and face.

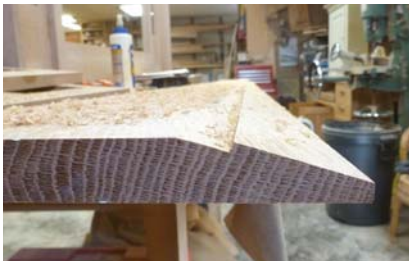
With the stock on a bench or in a vise, rout a rabbet to accept the dust panel – a thin piece of oak that sits in this rabbet to form a solid top for the cornice. Be sure to keep the base of the router resting firmly on the beveled part of the moulding to ensure the rabbet is parallel to this angle.

Heavy bevels. *The cornice gets a significant bevel along its front and back edges. Cut one, then flip the stock and cut the same bevel on the opposite edge.*

Sand the front edge – the top section that shows in front of the dust shelf – and the broad lower face that angles up.

Next you'll determine how much of the flat part of the bottom bevel will sit over the three-part frame (I had about 1½" relative to the center section) and mark this in pencil near each end of the longest piece of cornice moulding, then extend the line along the length.

To determine the positions of the miters, it's easiest if you have someone who can help you hold the pieces firmly in place. Cut the miter at one end of the long piece and set it on the frame assembly so that the overlap coincides with your pencil line. Holding it in place, mark the position for the miter at the other end. I suggest that you cut the second miter a little long, then finesse the fit in conjunction with the mitered returns; that way you will avoid cutting the long piece too short. (Note: You can have as little or as much overlap as you wish, as long as there's enough to support the cornice and keep it stable.)



Dust panel. *The dust panel sits in a flat on top of the cornice. To cut that, I used a rabbeting bit in the router, with the fence registered off the edge.*

Now you are ready to cut the miters on a sliding miter saw or a table saw with a crosscut table. I shimmed the stock with scrap so that the lower beveled portion was sitting squarely on the saw table in the same orientation as how it seats on the finished upper section. This allowed me simply to cut a 45° angle at each corner.

Drill pilot holes in the center section so you can tack the moulding in place with screws while fitting the miters. Apply glue to each miter, then use tape or clamps to hold the joint closed while the glue dries. (Because this is a delicate joint, leave the miters clamped overnight.)

Clean Up the Joints

Screw the mitered moulding firmly into place on top of the three-part frame.

Resaw or plane quartersawn stock for the dust panel to sit in the rabbet at the top. Cut a couple of spacer blocks to support the dust panel in the center, drill slightly elongated holes in the dust panel to allow for wood movement and attach to the cornice with screws.

The original sideboard is stained a warm medium-brown. To finish this one, I started with a coat of honey amber Transtint dye, followed by Minwax Early American oil-based stain. The next day I brushed on a coat of amber shellac and finished with a coat of paste wax. **PWM**

Nancy designs and builds custom furniture at her shop near Bloomington, Ind.

ONLINE EXTRAS

For links to all online extras, go to:

- **popularwoodworking.com/nov17**

BLOG: *Make rabbeted doors the traditional way (but with contemporary tooling).*

BLOG: *Read about Nancy Hiller's forthcoming book on English Arts & Crafts.*

WEBSITE: *Visit Nancy Hiller's website and read her blog at nrhillerdesign.com.*

IN OUR STORE: *"Making Things Work," a hilarious memoir by Hiller about her life as a furniture maker.*

Our products are available online at:

- **ShopWoodworking.com**

Devilishly Clever ‘Doe’s Foot’

BY CHRISTOPHER SCHWARZ

These notched sticks simplify your workholding at the bench.

Workbenches didn’t always have vises. In fact, for most of human history, workbenches around the world were nothing more than a stoutly made table with a few holes. The woodworker kept the work stationary with a combination of pegs, battens, holdfasts, parts of their bodies and a few notched sticks that were sometimes called “doe’s feet.”

I first became fascinated by the doe’s foot after seeing U.K. woodworker Richard Maguire use one in lieu of a tail vise. And after several years of research and trials at my own bench, the doe’s foot has become an indispensable part of my workholding.

It’s a fiendishly clever and simple appliance. And even if you have a workbench with all the bells and whistles, you’ll find a doe’s foot useful in a pinch. Plus, if you ever work on-site without a workbench – or on a picnic table on vacation – the doe’s foot is a lifesaver.

Hard-working toes. *The two toes on the end of a doe’s foot can be flat or pointed. I prefer flat because they won’t mark your work and are more robust.*

Held fast. *You don’t need a tail vise to traverse a board – a notch in a scrap can work wonders. Jam the far end into a planing stop, then secure the other end in the notch. Even as you traverse, this workpiece is going nowhere.*

PHOTOS BY THE AUTHOR

SURE FOOTING FOR YOUR DOE'S FOOT

A coarse grip. *Sticky-back sandpaper or cork can greatly increase the grip of a doe's foot on your benchtop.*

If your benchtop is slippery for some reason (perhaps you coated it with a film finish), then your doe's foot appliance might need some extra traction to stay put.

I have found three solutions that don't involve nails. One: apply sticky-back sandpaper to the underside of your doe's foot. Any coarse grit will do, such as #80 or #120. Two: apply sticky-back rubberized treads. These usually are applied to the rungs of ladders so the ladder doesn't get slippery when wet. Three: adhesive-backed cork will work.

These products are available at any decent hardware store.

—CS

How Does it Work?

The doe's foot is simply a piece of wood of almost any size with a 90° notch cut into its end. The device works by allowing your workpiece to get snagged in the notch between the two "toes" of the foot, immobilizing it.

The doe's foot can be used both in front of the work or behind the work. It can be secured to the benchtop with a holdfast, clamps, pegs or even nails driven through the doe's foot and into the benchtop.

To get started, I recommend you make one that is ½" x 7" x 12". Cut a 90° notch at one end as shown in the photos that leaves a ¼" flat at the corners. We'll call these flats the "toes."

In Front of the Work

In some old paintings you'll see the doe's foot used in front of the work instead of a planing stop. In many ways, I have found the doe's foot to be more useful than the traditional single-point planing stop. Here's why.

A single-point stop is great for planing narrow stock; pretty much anything less than 6" wide is easy to control against the stop. But once you start planing wider stock, things get tricky. You either have to keep moving the stock or skew the plane just right to prevent the wood from spinning on the benchtop.

With a doe's foot you plane narrow stock by pressing it between the toes. With wider stock you press it against the two toes, forcing the doe's foot to act as a wide planing stop.

Note that this works when planing boards on their faces or on their edges. The doe's foot is quite effective for planing narrow boards on their edges.

But what about planing even wider panels, such as an 18"-wide side of a typical chest of drawers? That's when you move the doe's foot so it's behind the work.

Behind the Work

Some people don't believe this technique works until they try it. So if you are doubtful, give it a whirl before you dismiss it.

For planing wide panels, push the front of your workpiece against a planing stop (or a doe's foot). Then place the notch of a doe's foot against the far corner of the rear of the board. (Look at the photo at the beginning of this article – it's simpler than my words suggest.) Secure the doe's foot against the benchtop – I use a holdfast.

Now you can plane the board either with the grain or across the grain. Yup, the doe's foot is a lifesaver for traversing. Planing across the grain wedges your board against both the planing stop and the doe's foot like magic.

Best foot forward. *With the doe's foot in front of the work it can wedge narrow pieces (top) or support wider work with its tippy-toes (bottom).*

For me, that was the moment I knew I didn't need a tail vise. Armed with a couple of doe's feet and a pair of holdfasts, there's almost nothing I cannot do to a piece of wood when building furniture. **PWM**

Christopher is the editor at Lost Art Press and is on an eternal search for the simplest workbench.

ONLINE EXTRAS

For links to all online extras, go to:
- **popularwoodworking.com/nov17**

BLOG: *Read Richard Maguire's original post on the "notched batten."*

BLOG: *Read about the rubberized treads to improve the doe's foot.*

BLOG: *See where the author locates holdfast holes on his workbench.*

TO BUY: *Benchcrafted's Planing Stop.*

IN OUR STORE: *"Workbenches: From Design & Theory to Construction & Use," revised edition, by Christopher Schwarz.*

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GRAND PRIZE

MORNING GLORY DEMILUNE TABLE

14" d x 30" w x 31" h

AL SPICER
Bessemer City, North Carolina

The grand prize goes to Al Spicer for his demilune (half-moon) marquetry table, featuring on its top a flowering morning glory vine in various veneers. The legs are solid sapele with holly stringing and an accent bud, and the apron and top are pomelle sapele with a border of quartered sapele.

Spicer began his career as a photographer and spent 36 years working on the visual side of things in newspapers. In 2006, he left his job and decided to pursue what had until then been a self-taught avocation. "Life is short and I wanted to spend more time doing something I really enjoyed," he says.

So he enrolled in the Fine and Creative Woodworking program at Rockingham Community College where he re-learned not only the basics, but studied furniture history and various styles. He loved the attention to detail and the clean lines of Federal furniture, and has built several reproductions in that style, "but for today's lifestyle they seem too formal," Spicer says.

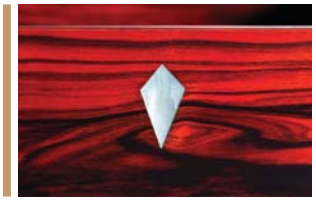
The Federal foundation is certainly evident in the form of this table, but it's the well-executed contemporary marquetry image married to that foundation that made this table our winner.

"I really can't pinpoint one thing that inspired the Morning Glory Demilune," Spicer says. "Ideas or inspiration seem to come from various visuals, especially nature, but sometimes a piece just evolves as I work through the design or while I'm in the middle of building it. On the morning glory table I wanted the marquetry to dominate the top without overpowering it."

Spicer, who builds on commission as well as speculative pieces, works as much as possible in veneers. "I'm not opposed to 'brown' furniture, but veneers incorporated into a nice piece can add another dimension, a uniqueness."

See more of his award-winning work on his website at spicerwoodworks.com and @spicerwoodworks on Instagram.

PHOTOS BY THE MAKERS UNLESS OTHERWISE NOTED



EDITORS' CHOICE

EBONY BOX
14" d x 16" w x 3½" h

CRAIG THIBODEAU
San Diego, California

Perhaps you read Thibodeau's "Design & Create a Marquetry Panel" in our February 2017 issue (#230), or have seen his stunning work in other publications – he's been featured in many, and has won numerous awards, including the 2016 Veneer Tech Craftsman's Challenge.

We chose perfection in a small package as the Editors' Choice winner in this category, charmed by Thibodeau's elegant Macassar ebony box with mother-of-pearl inlay, lined with black calfskin and finished with high gloss polished Polyester

Thibodeau studied mechanical engineering in college and has taken woodworking instruction with Paul Schurch, Patrick Edwards and Brian Newell.

See more of his work at ctfinefurniture.com and @ctfinefurniture on Instagram.

READERS' CHOICE

HOLLOWS & ROUNDS
3½" h x 9½" l

JEFFREY MURRAY
Greenwood, Indiana

Murray's half-set of even-numbered hollows & rounds (Nos. 2-18), plus a set of snipes bill planes, garnered top approval in this category. He modeled his planes after a 19th-century John Moseley and Son No. 4 set (the darker-colored plane at the top back of the stack).

This half-set is made of American beech, and the snipes bills feature Osage orange boxing on the beech bodies; all the planes are finished with Danish oil. The new blades are O1 steel, and others were sourced from period material.

Murray's introduction to woodworking was through carving, but it was the furniture bug that bit him when he and his family were looking at bedroom furniture. "I could make that for far less money than buying it…." (Sounds familiar!)

After a friend piqued his interest in wooden planes, Murray decided to give them a go, and didn't quit until he had this half-set. Each plane, he says, took about 10 hours.

EDITORS' CHOICE

WINDSOR SACK BACK SETTEE
18" d x 45" w x 35" h

DAVID DOUYARD
Pine Meadow, Connecticut

This traditional sack-back Windsor settee is made of pine, maple and red oak, and features an aged finish made of layers of green, red and black milk paint with an oxidized shellac topcoat. We couldn't resist its period perfection.

Douyard studied biochemistry in college and worked in sales after a short stint in the lab (he hates being cooped up). Then, he decided to change direction and apprenticed to a boat-builder-turned furniture maker…before turning to marketing and corporate management to help get his kids through college. But he kept working in his own shop.

Later, he built his first chairs while studying with Ian Kirby and studied Windsors with Mike Dunbar (though unlike Dunbar, he now uses traditional green woodworking techniques and mostly hand tools). Douyard is now a full-time traditional chairmaker and teacher, and has been featured in *Early American Life* magazine.

See more from Douyard at daviddouyardchairmaker.com and @ddouyardchairmaker on Instagram.

READERS' CHOICE

BUTTERFLY GARDEN BENCH
25" d x 65" w x 17" h

MIKE SCHWING
Townson, Maryland

Schwing began this project as "just another live-edge bench" – but realized that, when he had to cut some butterflies to secure the cracks, he could use a laser engraver to cut them in the shape of actual butterflies. "So of course," he said, "I made the legs to match." The top is walnut with maple butterflies, and the legs are quartersawn sycamore with some nice chatoyance – to mimic the shimmer of a butterfly's wings.

He got his start in woodworking as a kid, helping his father and grandfather build boats, and some of his turnings are in museums around the world.

See more of his work at schwingwoodworking.com.

EDITORS' CHOICE

PIANO-SHAPED ACCENT TABLE
15" d x 34" w x 31" h

JEFF JONES
Southlake, Texas

This ash and cherry table was designed as an accent piece for a specific wall space. It balances against that wall on two legs while also providing a large enough surface for a lamp and decorative items. The drawers are dovetailed, and the legs are through-mortised through the top.

Jones learned woodworking from his self-taught father, who started a cabinet making and building business. Instead of following directly in those footsteps, Jones earned a degree in construction management. In the last few years, he's gotten back into woodworking, and has enjoyed learning hand tools. "I have a beautiful shop and never miss a day doing something productive there, even if it's just stepping in to smell the sawdust and plan my next step," he says.

READERS' CHOICE

HARRINGTON SIDE TABLE
19" dia. x 30¾" h

GAVIN HARRINGTON
Los Angeles & Dublin, Ireland

Harrington's parquetry table in wenge, sycamore, mahogany, cherry and rosewood (over a substrate of Douglas fir) is the overall winner in the Readers' Choice category. The legs are doweled to a hidden center leg that stops before the curvature, and the top is screwed to the leg assembly though petal-shaped pieces underneath

The inspiration was offcuts from another project, says Harrington, who never lets anything go to waste. "I could see the shape of the legs. The rest fell into place from there; with the legs almost looking like a stem, the flower with the sunburst seemed like the obvious choice for the top."

He's been a woodworker for more than 25 years, and apprenticed in the trade in his native Dublin, Ireland, both in a one-year trades course and in a four-year comprehensive program for City and Guilds certification.

Harrington works on everything from original concepts – such as his table here – to period reproductions and maritime furniture.

See more at harringtonwoodworks.com and @hwoodworks on Instagram.

SIDE TABLE PHOTOS BY AUTUMN HARRINGTON

EDITORS' CHOICE

BARBER'S MUG CABINET
21" d x 47" w x 95" h

JOHN BOWLING
Mechanicsville, Maryland

This curly maple cabinet, which features accents of bird's-eye and burl maple, simply blew us away with the detail work, including the many cubbyholes. It's a near reproduction of a piece listed in an 1884 barber's supply catalog.

Bowling began woodworking as a teenager, honing his skills in the stair shop of his father's building supply company and lumberyard. After graduating from the Roberto Venn School of Luthiery in 1998, he stepped up his precision skills while working as an acoustic guitar maker at Collings Guitars before turning to antique restoration.

Since 2007, Bowling has owned Dellabrook Woodworking & Restoration, where he builds about 40 pieces for customers per year, along with restoration work. His website is dellabrookwoodworking.com.

READERS' CHOICE

ARK OF THE COVENANT
13 1/2" d x 27" w x 13 1/2" h

RICHARD MCGANN
Lynchburg, Virginia

McGann's reader-award-winning piece is a reproduction of what he considers one of the most important religious relics in history. A cubit is equal to 18", so this is a half-scale reproduction that features 23 turnings and hand-carved angels' wings. It's constructed of walnut, mahogany, birch plywood, spalted pecan and poplar (and is finished in gold paint).

McGann says this project, among the hundreds he's made in his 50 years of woodworking, "has been far and away the most interesting," and has garnered more attention than any other." It's been displayed at his woodworking and turning clubs, churches, and an art show – plus his local television station ran a segment on the piece on the Sunday evening news.

ARK PHOTO BY JIM BARTLEMAN

EDITORS' CHOICE

STATEHOUSE EAGLE
28" d x 28" w x 60" h

MARK ARNOLD
Sunbury, Ohio

The masterful carving on Arnold's mahogany and mahogany veneer eagle, designed and made for the Ohio Statehouse, was the clear winner for us in this category. We're captivated by how the details were designed to reflect other furnishing in the House chamber, including the faceted turnings and the scrolled knee braces. Beyond the carving, the piece involved faceplate and spindle turning, veneering, joinery and hardware improvisation.

Arnold, a full-time woodworker and 1996 graduate of the North Bennet Street School, has written many articles for this and other magazines, and is a past editor of *American Period Furniture*, the journal of the Society of American Period Furniture Makers. He also teaches classes in his shop and at schools around the country.

Visit his website at bostonwoodworking.com.

READERS' CHOICE

LIGHT COVER
16" w x 48" w x 6" h

JOHN WIEDMEYER
Elgin, Illinois

Wiedmeyer's Frank Lloyd Wright-inspired light cover design comprised more than 800 pieces of rift-sawn oak (along with glass, plywood and oak veneer).

Specializing in historic home preservation, Wiedmeyer makes the new look as if it has been there forever, recreating the smallest details to bring period houses back to their full glory. He's an award-winning carpenter, mill worker, furniture maker and 16-time Chicago "Painted Lady" winner.

You can see more of his work online at qualitypaintingandcarpentry.com. **PWM**

LIGHT COVER PHOTOS BY KEITH FRENCH PHOTOGRAPHY

Smooth Operator

BY STEVE VOIGT

Make a traditional double-iron coffin smoothing plane.

From the Middle Ages until the dawn of the 20th century, wooden planes were the dominant bench plane form in the Western world. But when I started woodworking (in the hand-tool dark ages of the late 20th century), this traditional form seemed practically extinct. As I became interested in planemaking, I found plenty of information on laminated Krenov-style planes, but very little on traditional mortised planes.

Eventually, as I began to wrap my brain around these planes, I came to realize how enormously sophisticated and ingenious their design is. Virtually every feature has some functional purpose, even if it might not be immediately apparent. I came to think that traditional planes, in particular the British and American designs of the late 18th and early 19th centuries, represent the peak of the planemaker's art.

Making a traditional plane poses challenges, but it's a great way to hone your hand-tool skills. It requires a small tool kit, and while a few specialized tools are needed, they are of modest cost (and you can make most of them, if you're so inclined).

I'll walk you through the design and construction of a traditional double-iron coffin smoothing plane (so-called because they resemble coffins, not because they were used in the mortuary industry!). A well built coffin smoother is an extremely useful and versatile tool – mine is rarely out of arm's reach on the bench.

Materials

First, acquire a suitable double iron. Look for one that's 1¾" or 2" wide and at least 7" long. The cutting iron should have at least 1½" of usable length below the slot. It should also be tapered in thickness; most old irons are approximately 3/16" thick at the bottom and 3/32" at the top. Try to avoid irons that are badly pitted or twisted. I've found old irons at antique shops, swap meets and flea markets, including a "donor plane" with a ruined body but a usable iron. Another great source is eBay (particularly the U.K. site); search for "tapered double iron" or "vintage

LEAD PHOTO BY AL PARRISH; STEP PHOTOS BY THE AUTHOR

double iron." And there's a new source for the irons: Red Rose Reproductions (redrosereproductions.com), though you'll have to make or buy the cap iron.

Next, you'll need a billet for the plane. It should be at least 3/4" wider and 5/8" taller than your iron, and will finish at 7 1/2" long. If you can get it, use beech, the traditional wood for planes. If you can't find beech, there are plenty of alternatives: hard or soft maple, yellow birch, apple and pear are all nice. Avoid softer hardwoods, such as mahogany, and very hard exotics. Ring-porous woods such as oak or ash are prone to chipping; however, with care a nice plane can made from these woods; there are plenty of historical examples in these species.

More important is how the annular rings are oriented. They should be as close as possible to parallel the sole, thus perpendicular to the sides. Avoid rift-sawn billets – they expand and contract unevenly, so you'll have difficulty keeping the iron and wedge fitting well.

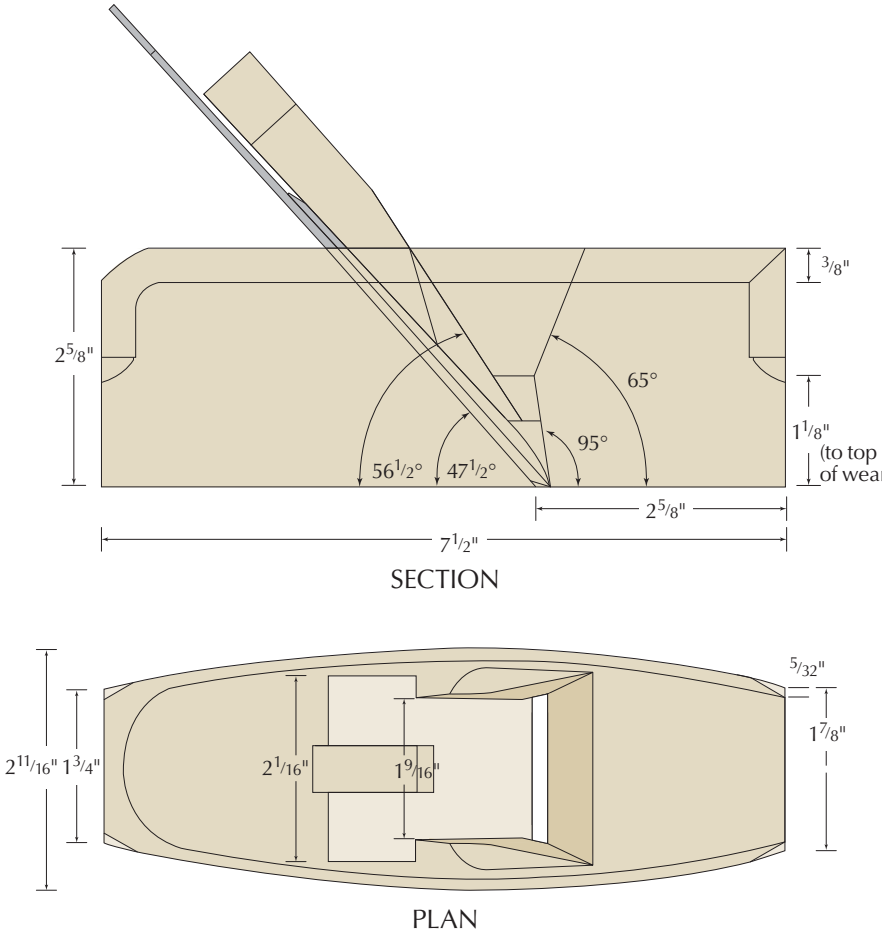
Finally, you'll need a wedge blank that's approximately 3/4" thick, 6" long, and 1/8" wider than your iron. Grain orientation of wedge stock is a subject of some controversy. It's clear that 18th- and 19th-century planemakers preferred stock that was quartersawn in its widest dimension, with the annular rings running perpendicular to the mouth of the plane. I make my wedges this way; I believe that the old makers preferred this orientation because it makes the wedge less likely to warp, and the quartersawn faces conform more easily to the iron and abutments, making for a better fit. A number of prominent modern planemakers, however, do the opposite, orienting the annular rings parallel to the mouth.

Tools for Planemaking

You'll need a few specialized tools, but you don't need to spend a lot of money. First, let's talk about floats. The two floats I couldn't live without are an 1/8" edge float and a 5/16" mortise float, both of which cut on the push stroke. If you are on a budget, you can make both of these yourself out of O1 steel (if you can file a saw, you can make a float). If you're only making a few planes, you don't even need to harden the steel. If you'd rather buy them, they're available from Lie-Nielsen Toolworks (lie-nielsen.com).

If your budget allows, a bed float and a side float (again in push configuration) are nice to have. Making either of these by hand is an exercise in frustration, so buy them or do without. A great alternative is the "blunt chisel scraper" popularized by renowned planemaker Bill Carter. This is simply an ordinary chisel sharpened with a 90° microbevel. To hone the edge, hold the chisel vertically on a coarse stone with the bevel facing you, and pull the chisel toward you, repeating until you feel a burr. Lap the back, then repeat on your fine stone. Lap again and you're done. Don't strop. Scraper chisels are incredibly useful; I've got half a dozen in various sizes.

A flush-cutting saw is also nice to



Tools for planemaking. *From left are shown a 5/16" mortise float, 1/8" edge float, abutment saw, 1/8" bed float and 1/8" side float. At the top is a planemaker's sinking-down gauge.*

have for cutting the abutments. Some people use the Japanese-style flush-cut saw. I prefer to make my own; the first one I made was a $5 drywall saw, with all the set pressed out and the teeth refiled for a rip cut. I've since made nicer ones out of 1/16"-thick saw steel. If you don't have a saw, you can get by with the edge float.

One other tool you'll need is a planemaker's "sinking-down gauge." This is simply a flat piece of scrap, about 1/2" thick, cut into a U-shape. Bevel the tips of the two forks so the gauge can fit all the way down to the mouth of the plane. To use the gauge, lay one of the forks on the bed (or breast) and compare the other fork to your layout lines.

There are a few other simple-to-make jigs, but these are optional and I'll cover them as I go.

Clean Up the Iron

Before you start making your plane, clean up the iron. A roll of 3"- or 4"-wide coarse-grit adhesive-backed sandpaper, stuck down to a flat surface, will make short work of this. As with any plane iron, you'll need to flatten the back. Flatten the bottom 3 1/2" or so of the front, too, so the plane will bed well. Before you do this, check the iron for twist. You can easily remove any twist by grabbing the bottom 2" in a vise, putting a C-clamp on the top third of the iron, and twisting in the opposite direction. But don't twist too hard. On laminated irons, only the bottom 2" or so is hardened; the rest is mild steel or wrought iron so it's fairly malleable.

Billet Prep & Mortise Layout

Make your billet flat, square and parallel. Traditional bench planes are typically square in cross section and about 5/8" wider and taller than the iron's width, but for a coffin smoother, you need a slightly wider billet. Start with one that's a bit long, and trim the ends later.

Study the grain to determine the correct orientation for your plane, and label the sides and ends. Traditionally, the bark side is the sole and the heart side is the top. The grain on the sides, if not parallel to the sole, should run downhill from toe to heel.

Clamp to scrap. *It's easier to accurately trace the outline of the iron if you first clamp a piece of scrap to the bed line.*

To lay out the mortise, start by marking the cutlines for the ends. On the sole, use a square and knife to scribe a line for the back of the mouth 2 5/8" from the toe. Set a bevel gauge to your desired bed angle (I typically use 47.5°, but anything from 45°-50° is fine) and with a pencil, mark the bed line on both sides (for all angles that follow, make sure you mark the angle on both sides before resetting your bevel gauge). After you've marked the bed lines, connect them across the top of the plane with a square.

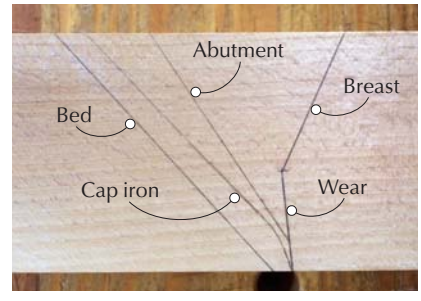
Next, lay the assembled double iron against the bed line and trace the front of the cap iron and tip of the cutting iron. Now you know exactly where the cutting iron will protrude from the sole, so mark the front of the mouth across the sole. Aim for a zero-clearance fit and err on the side of a too-narrow mouth; you can always open it up later.

Now mark the wear angle. On a double-iron plane, the wear needs to be much steeper than on a single iron, otherwise shavings will be trapped by the cap iron. Early double irons had steeper wears than the factory-made planes of the 19th century. By making the wear steeper, the early planemakers were able to have relatively tight mouths, whereas the later planes had shallower wears but very wide mouths, probably because it was easier to mechanize production this way. With a 47.5° bed, I use an 85° wear (relative to the rear of the plane – the angle is 95° relative to the front, as shown in the diagram).

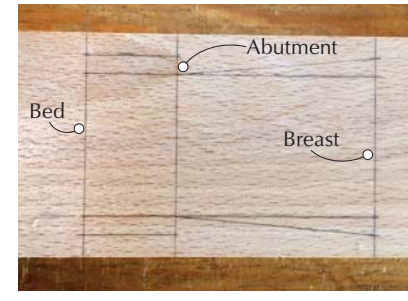
Set your bevel gauge and draw the wear line, making sure the wear angles back toward the bed, not the other way! Mark a point on the wear line that is 1 1/8" above the sole. This point is the top of the wear, and it intersects with the breast. Set your bevel gauge to 65° (angled away from the bed) and scribe the breast line from the top of the wear up to the top of the plane. Use a square and connect the two breast lines across the top of the plane.

Now mark the abutments. Set your bevel gauge at 9° greater than the bed angle (56.5° for a 47.5° bed) and position the gauge about 3/32" forward of the highest point on the cap iron, just above where the cap iron curves down to meet the cutting iron. Draw the line down from the top until it intersects the wear. Do this on both sides, then connect the abutment lines across the top.

Now mark the width of the rough mortise. This should be 1/2" narrower than your iron, so for a 2" iron, you want a 1 1/2" mortise. Draw the lines on both the sole and the top of the plane,



Completed layout, side view. *Both sides of your billet should now look like this.*



Completed layout, top view. *The flared-out lines that connect the abutments to the breast define the escapement. Add these lines now, or wait until the rough mortise is chopped.*

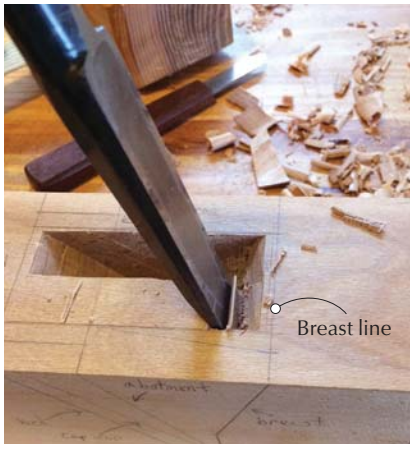
and make sure the mortise is centered.

Finally, mark the width of the mortise between the bed and the abutments. I like this mortise to be approximately 1/16" wider than the iron at the top of the plane and 1/32" wider than the iron at the sole. I'd rather have the mortise a tad too wide than too narrow – you don't want the iron to bind in the mortise or be difficult to adjust square. Measure the width of your iron at both the bottom and in the middle, where it emerges from the top of the plane; vintage irons are often slightly tapered in width as well as thickness.

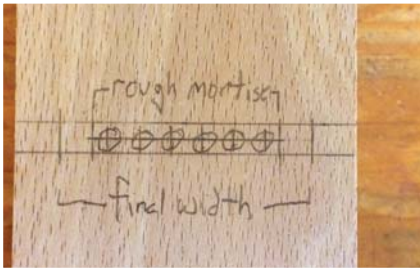
Rough Mortise: Drill & Chop

Before you start chopping, use a square and a marking knife to scribe lines 1/8" in front of the bed line and 1/8" behind the breast line; these define where you'll rough-chop. Then use a chisel or a marking gauge and score the lines that define the sides of the rough mortise. This will keep you from tearing out big chunks outside your layout lines.

Use any sturdy chisel that is approximately half the width of the rough mortise. Start at the breast, about 1/4" behind the line. Make a small V then work backward, bevel down, until you're 1/4" from the bed. Hold the chisel at about an 80° angle, as shown below. If you find the going gets too tough, flip the plane around and work in the other direction. Chop one side of the mortise from bed to breast, then do the same on the other side. Don't worry too much about the angles at this stage; just make sure you don't go too deep, and stay inside the lines.



Rough mortise. *Here, I've completed the first pass on the far side to rough out the mortise, and am just getting started on the near side.*



Drill the mouth. *You'll save yourself a lot of work if you can drill closely spaced holes parallel to the wear angle. At right is the layout for the eight holes to waste out the mouth.*

At this point, your mortise will almost certainly be too shallow, so start deepening it. You can either chop or pare, but keep working with the chisel bevel down; that will give you more control and you'll be less likely to cut too deep. As you go, pare away the side walls and check your progress frequently with the sinking-down gauge.

In the roughing-out stage, the bed and breast angles meet in a V at the bottom of the mortise. Later, you'll incorporate the wear angle.

When the mortise reaches a depth of roughly 3/4" above the sole, flip the plane over and get ready to drill through the mouth. Scribe a line that splits the distance between the front and back of the mouth and lay out your holes on closely spaced centers. Make sure you stay inside the rough mortise (remember, the rough mortise is 1/2" narrower than the width of your iron).

A drill press is ideal for this task, but you don't need one. Hold the billet in a bench vise so that the wear line is vertical, and drill through with an 1/8" brad point bit . You may want to place a square on the bench for reference. If you miss on the angle, miss by angling toward the bed, where you have plenty of clearance.

While you've got the plane upside-down, chop a mortise about 1/32" deep, just inside the layout lines of the mouth. This will help prevent blowout later on. Use your edge float to saw through the mouth. If the float won't go through, chisel away some of the waste.

With the mouth opened, it's time to clean up the bed and breast surfaces. Pare with a chisel, being careful as you approach the mouth opening not to slam your chisel into the wear surface too hard (this can cause the front of the mouth to chip badly). When you've gotten as close as you can with the chisel, finish up with a bed float or the blunt chisel scraper. To work aggressively with a float, raise the handle and use

Angle judge. *The sinking-down gauge is invaluable for checking the accuracy of the bed and breast surfaces.*

Use the bed as reference. *For the first kerfs, cut just shy of the abutment layout lines, with your saw resting flat on the bed (this is why it's important to first get that bed flat).*

Saw guide. *A guide wedge makes it easy to cut the other kerf for the abutments, and a line marked on the saw blade makes it easy to see how deep you're cutting.*

Breast cuts. *The saw cuts at the breast lines are approximately 1/4" deep at the top of the mortise, tapering to nothing at the top of the wear surface.*

the front tooth as scraper. It also helps to skew the tool a little.

Whatever tools you use, keep working until the bed and breast are nice, flat surfaces. If you are confident, you can work right to your layout lines. If not, stay back about 1/16" – later, I'll show a nifty trick with the edge float that will make nailing the bed angle easier.

After the bed and breast are cleaned up, finish the rough mortise by paring away the wear surface. Hold the billet in a vise so that the wear surface is vertical, and concentrate on keeping the chisel plumb. Finally, chop straight down along the line that defines the back of the mouth. Accuracy here will make fine-tuning the bed easier.

Saw the Abutments

Now make three pairs of cuts with your saw or edge float. First, use the bed as a reference surface and cut just shy of your layout lines, leaving a bit to be cleaned up later.

The next pair of cuts defines the abutments. The foolproof way is to first make a 9° wedge to guide your saw. It should be about 5/16" thick at the bottom, 7/8" thick at the top and just wide enough to fit into the rough mortise. In order to leave both hands free while cutting, press-fit the wedge into the mortise or apply a little spray adhesive onto its back to temporarily glue it to the bed. Afterward, a couple taps with a mallet will release it, and the spray adhesive will clean off easily with mineral spirits.

The abutment cuts are somewhat more difficult because they are stopped; you're cutting right up to the wear. Go slow, use some wax on the saw blade and clean out the slot and saw teeth often.

For the last pair of cuts, at the breast, hold the saw at an angle so that the teeth just graze the mortise wall at the top of the wear surface.

Next, use a chisel to knock out the waste between the bed and the abutments. Be aware of grain direction here; on one side (usually the right side) the waste will pop out easily, while on the other the chisel will want to dive below the surface of the cut. Take light cuts until you've determined which side you're dealing with.

After you've pared away most of the waste, lay the edge float against the bed on one side and saw right to your layout lines. Then lay the float against the abutment on the same side and saw to the lines again. Remove the remaining island of waste with a side float if you have one; otherwise carefully chisel the waste away, or use overlapping strokes with the edge float. This method makes it easier to get a flat surface than going straight to the side float.

The next step is to define the escapement. If you have followed the directions so far, your abutments should be approximately 9/32" thick. In the finished escapement the abutments are 1/4" thick, and the front of the escapement is wider at the top than at the bottom; this helps shavings flow out of the escapement more easily. It follows that the cheeks are not in a flat plane. It's a lot easier to cut this shape than to describe it.

Start by paring near the front of the escapement, angling the chisel to create the trapezoidal shape. Gradually work your way backward; when you're almost to your layout lines, switch to cross-grain strokes to take the abutments to their final thickness. A 1/4" chisel

Remove the island. *Cut to the layout lines with the edge float, then chisel or float away the island in the middle.*

held against the abutments makes a handy guide for assessing whether your abutments are the right thickness. Cut yourself a little slack here: If the abutments are bit thicker or thinner than 1/4", or if they taper a little, it doesn't matter – the plane will work just as well.

When you're satisfied with the shape of the escapement, finish the bed and breast. Do the breast first – it's almost inevitable that a few stray chisel strokes will slam into the bed while you're working the breast. Because the precise angle of the breast is not as critical, just pare to your layout line with a chisel, then clean up with a float (or use the blunt chisel scraper).

Finishing the bed calls for a different approach. Use your edge float and make three or four saw kerfs on the bed – two at the sides and one or two in the middle. These kerfs should just hit your layout lines on the top and sole. It's critical that the float doesn't rock up and down as you do this; the bottom of the kerf must be as flat as possible. When you're done, chisel off most of the waste between the kerfs, then finish with either a bed float or the blunt chisel scraper.

Now sight down the bed to see if it's twisted or has any obvious problems. Slide your cutting iron (without the cap iron) in as far as it will go (the mouth at this point should be too narrow for the cutting edge to protrude out of the sole). Check to see if the blade rocks. While holding the blade firm to the bed with one hand, try to slip an .001" feeler gauge up through the mouth between the blade and bed, then try the same thing at the top of the plane. Correct any problems by floating or scraping away the high spots. If there are any problems, it's actually easier to fix them now than when the slot is in the way.

Float kerfs. *An edge float makes it easier to cut a flat bed surface.*

Slot cuts. *These saw cuts are full depth at the top of the cap-iron slot and taper to nothing at the bottom – it's a bit like cutting a half-blind dovetail, without overcutting it.*

Defined walls. *Sawing the sidewalls of the slot allows you to chop most of the waste aggressively, as I'm doing here, bevel down (which affords more control than bevel up).*

Keep in mind that the bed doesn't need to be perfectly flat; the cutting iron just needs to make good contact at the top and bottom of the mortise, so a little concavity in the middle is fine. What you don't want is convexity or twist.

When the bed seems satisfactory, cut the slot for the cap-iron screw. The slot needs to be a generous 1/16" wider and deeper than the screw. It should be about 2" long, but the precise length will depend on your cap iron. Just make sure the slot is long enough that the screw won't bottom out when setting the iron for a heavy cut.

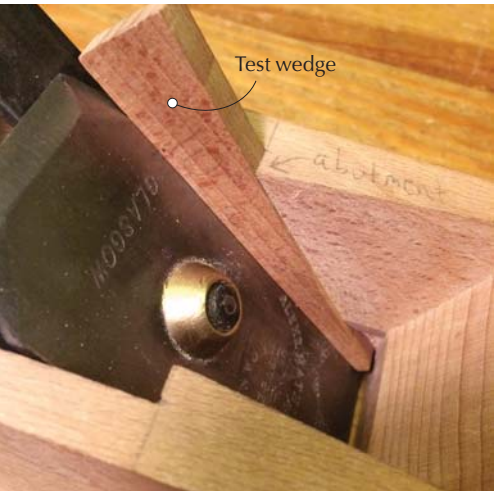
There are a couple of ways to cut the slot. If you have a drill press, you can hog out most of it with a Forstner bit, then finish with a chisel. If you're without a drill press, use a backsaw to define the slot walls, leaving a little bit to pare away later (and don't cut past the bottom of the slot).

Define the bottom of the slot with a couple good whacks with the mallet on your chisel, then chop bevel down to take out most of the waste. Finish the slot by paring bevel up.

Next, finish the wear surface. The easiest way to do this is with a chisel and a paring guide. Take a piece of scrap about 2" thick and cut an 85° angle on one end. Clamp it to your layout line at the front of the mouth. Make sure the block angles back toward the bed, not toward the breast. Then pare away. Aim for a mouth opening of about 1/64" – you'll open it a bit more when you fine-tune the bed and flatten the sole.

The final step here is to taper the bottom of the abutments. This taper starts at the top of the wear and terminates about 1/16" above where the high point of the cap iron will be (usually 5/8" to 3/4" above the sole). Without this taper, shavings would run into the abutments and clog the mouth immediately. (If you've been wondering why the wear surface needs to be so tall, this is why.) For a clean mortise design, you want the abutment tapers to start at the top of the wear, and the taper angle to be gradual – somewhere between 20° and 30° – so that shavings will easily crumple as they squeeze between the wedge fingers and pass out of the escapement.

I cut the abutment tapers by holding the plane upright in a vise and nibbling away with a chisel held at approximately 25° off vertical and adjusting as necessary. I always chop with light, controlled taps to avoid driving the chisel into the mortise sides. Clean up any remnants by reaching through the mouth with a narrow chisel. Congratulations; you're done with the mortise.



Mini-wedge. *A narrow test wedge makes tuning the abutments a snap.*

Abutment Tuning & Wedge

It's important that the opening for the iron and wedge be symmetrical, otherwise the wedge will be lopsided, which can cause problems with adjustment. It's easy to tune the abutments with a test wedge. Thickness a piece of scrap to 5/16" and cut out a 10° wedge. (Why 10°, and not 9° as I used earlier? The double iron has approximately 1° of taper.) With the plane on the bench, drop the assembled double iron in place and press the test wedge in on one side, finger tight. Make a pencil mark where the wedge meets the top of the plane, and repeat on the other side.

Now you know which side has the larger opening, so start on that side and use the mortise float to fine-tune the angle. A .001" feeler gauge, slipped between the test wedge and the abutment, is useful for checking the angle. When you have the angle right, pencil another mark to indicate the depth of the opening, then tune the other side until the angle and depth match.

Now for the wedge. Take your test wedge and make a mark 1" above your previous mark (at the point where the test wedge meets the top of the plane). This gives you the thickness of your wedge blank. The blank should be flat and square, and just wide enough that one end will begin to fit into the mouth.

To lay out the primary 10° angle, use your test wedge (boy, that thing comes in handy) to scribe the angle on one side. Carry the line across to the other side with a square, then scribe the angle with the test wedge again.

Wedge support. *A simple fixture keeps the wedge from flexing while you're planing it.*

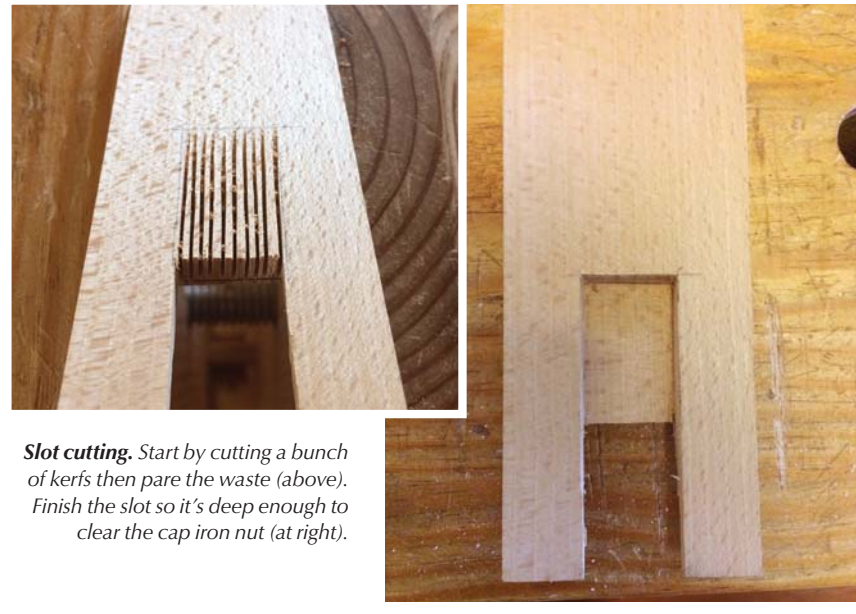
For production planemaking, I use a table saw jig to cut the angle, but if you are just making one, sawing by hand is faster and safer. I saw this angle the way Robert Wearing saws a tenon: Make a shallow kerf across the end grain, then saw on a diagonal on both sides, and finish up by sawing straight down.

Next, plane down to your lines with a small smoother or block plane. If you hold the wedge in a vise, the bottom will flex a little because it's thin, so I prefer to hold the wedge blank in a support fixture like the one shown at left. Alternatively, you can clamp or screw the top of the wedge to something (right now your wedge blank should be 1/2" to 1" longer than its final length).

At this point, your plan of attack will vary depending upon what type of cap iron you have. If yours doesn't have a nut protruding from the top (lucky you), proceed directly to the section on bedding the iron. If you do have a nut, you'll need to make a slot for it. Start by cutting a notch out of the bottom of the wedge that is about 1 1/8" long and a fat 1/16" wider than the cap iron nut. This will leave two "fingers" about 5/8" wide. These will eventually be trimmed to about 1/4" wide, but leaving them fat now will make them easier to plane.

Next, lay the wedge on top of the cap iron and determine the length of the slot. It needs to be long enough to allow the wedge fingers to reach the high point of the cap iron plus about 1/4". On this plane, the slot is 2 3/4". Mark the slot on the back of the wedge, and mark its depth at the bottom of the notch you just cut (5/16" here). Kerf, then pare the slot as shown below.

Any time you are paring toward the fragile bottom end of the slot, support the other side on a bench hook or piece of scrap – but don't worry if you get a little blowout; it should disappear when you cut the secondary ramp.



Slot cutting. *Start by cutting a bunch of kerfs then pare the waste (above). Finish the slot so it's deep enough to clear the cap iron nut (at right).*

With the slot finished, check the fit of the wedge. Push it in finger tight and look for gaps at the abutments. If there are huge gaps, plane the wedge until it fits better, but don't try to get a perfect fit at this stage. You'll need to do some bedding first.

Traditionally, either oil or candle soot is used as a transfer medium. I've used oil, but now I prefer a modern alternative: dry erase marker. Rub the beveled side of the iron with the marker in two places: just above the bevel, and where the iron will meet the top of the plane. Put the iron in the plane, tap the wedge in place, and tap the top of the iron a couple times to move it a bit. Now take the iron out and inspect the bed.

Because the cutting iron is sprung by the cap iron into a convex shape, the contact areas will be small, but you want to see a thin line across the bottom of the bed, indicating continuous contact. You also want the iron to contact the top of the bed on both sides of the cap iron slot. If you have uneven contact, use the blunt chisel scraper or a bed float to scrape away the high spots. Reapply dry erase marker and repeat the process until the iron is properly bedded.

Next, fit the back of the wedge to the iron using a similar approach. Rub dry erase marker on the bottom of the cap iron (above the curved part) and below the top edges. Tap the wedge into place, then remove the iron and inspect. You want to see dry erase ink on the bottom of both wedge fingers. Remember that the wedge fingers will finish at 1/4" wide, so you don't need contact all the way across. You also want good contact at the top of the cap iron. The most common problem at this stage is that only one side at the top of the cap iron will be contacting the wedge, probably because either the cap iron or the wedge has a very slight twist. Fix this problem before moving on, or the wedge will not fit properly. Plane or scrape away the ink and repeat until you're satisfied.

Now fit the wedge fingers to the abutments. Plane the fingers until you can't see any gaps. Then try sliding a .001" feeler gauge between the wedge and the abutments. Once the gauge won't fit anywhere, inspect the fingers for burnish marks from the abutments. These can be tough to see, so use raking light.

Two saws. *Make the vertical cuts with a backsaw. Slide a coping saw down the kerf; move it back and forth while rotating your wrist. When you're at 90°, commence cutting the horizontal.*

Wedge layout. *Here are the wedge fingers and secondary ramp laid out. If your cap iron is nutless, you won't have the notch pictured here.*

If you don't see anything, try reinstalling the wedge several times, seating it firmly with a mallet; the abutments will slightly compress the wedge fingers and help you see the burnish marks more clearly. Plane or scrape the burnish marks away; repeat until you can see that both abutments are making even contact with the wedge.

When you're satisfied, tap the wedge in firmly one more time, then trace the outline of the abutments onto the wedge. Mark a line across the top of the wedge where it meets the top of the plane. Measure the distance from that line to the wedge tips, divide that distance in half, then mark another line across the wedge, between the fingers. This line marks the bottom of the secondary ramp, which helps sweep shavings over the cap iron and out of the plane. Finally, extend the full width of the fingers down to the bottom of the wedge. This will provide a place to start the saw cut for the fingers.

Next, use a backsaw to cut the fingers down to the line that marks the bottom of the secondary ramp. When doing this, angle the saw about 15° (the exact angle isn't critical) so that the fingers will be fatter on the bottom than on the top. This angle, like every other angle inside the escapement, is designed to help evacuate shavings more efficiently; it may also help to distribute force from the wedge to the cap iron more evenly.

Don't cut the tapers yet at the ends of the fingers; leave them a full 1/4" wide all the way down. Those tapers are fragile, and you don't want them to get beat up during subsequent operations.

Now it's time to form the secondary ramp. Once again, pick up your backsaw and make a series of kerf cuts from the bottom of the secondary ramp to just shy of the line that marks the top of the plane. Then pare the remaining waste with your chisel. If you have a slot for the cap iron nut, the secondary ramp will cut into this slot. Cut carefully around the slot so you don't get too much blowout.

Now pare the fingers to your layout lines, then install the wedge and check your work. The insides of the fingers should fit flush with the cheeks; if they don't, pare them until they do. Remember to follow the angle of your saw cuts so that the fingers remain fatter on the bottom than on the top. When the fingers look good, clean up the secondary ramp with the blunt chisel scraper.

***At an angle**. When cutting out the fingers, angle your saw toward the center of the wedge.*

Then finish the fingers by paring away the tips until they match the tapers at the ends of the abutments.

Before you cut the wedge to length, take a look at the where the main ramp meets the upper portion of the wedge. There should be a sharp arris that is roughly 1" above and parallel to the top of the plane. The distance is unimportant, but if it's not parallel it may look a little funny. You can fix this if necessary by planing the top portion of the wedge until it looks right.

Now cut the top of the wedge to length so that there is approximately 1 1/2" between the top of the iron and the top of the wedge. Add side bevels adjacent to the top of the wedge. It looks nice if the angle of the bevels matches the bevels on the iron. Chamfer the edges of top of the wedge and you're ready to move on to finishing the body.

***Kerf-cut the secondary ramp.** If you have a slot for the cap iron nut, the kerf cuts will break through the slot.*

Body Shaping & Details

Surprisingly, there is no standard shape for a coffin smoother. Nearly all examples I have seen share three general features: They are widest in the middle; they are narrower at the heel than at the toe; and there is some rounding of the heel. Within these parameters, designs vary widely.

The shape I use is nearly symmetrical, has restrained curves and a heavily sculpted heel. At the other extreme, a Victorian-era Mathieson plane I own has an exaggerated teardrop shape, with minimal rounding of the heel. Take your pick between these options, or design your own.

Once you've got a design you like, trace it onto the top of the plane and start cutting. If you don't have a band saw, don't try to cut the curve; just make four straight cuts with a handsaw to define the sides, then use shaping tools (drawknife, spokeshave, plane) to define the shape.

I refine the shape by light traversing cuts with a plane using (don't forget to chamfer the far side to avoid spelching), then fair the curves with a bed float and clean up with a card scraper.

Like the shape of the plane, the chamfers and gouge cuts vary widely on historical examples. Planes from the 18th century have crisp flat chamfers and well-defined gouge cuts, while later planes have more rounded-over edges and indistinct gouge cuts.

Start by laying out the chamfers. Set a combination square for 5/32" and scribe six lines across the top and down the heel and toe. Change the setting to 3/8" and scribe six more lines below the top and down the sides. There's nothing magical about these numbers – I like a slope of a little more than 2:1, but anything from 2:1 to 3:1 will look fine.

Most planemakers cut the long chamfers first, but I have always started with the stopped chamfers. Do whatever makes sense to you. Cut the stopped chamfers with a chisel, and use a stop-block to keep from cutting too deeply.

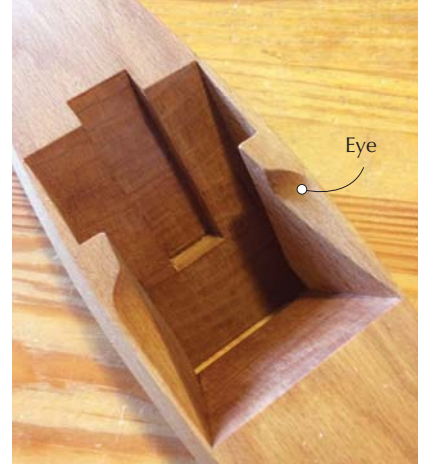
Cutting the long chamfers cleanly can be tricky due to the curved surface. I use a high-angle spokeshave followed by a gunstock scraper. Before I had those tools, I used a small plane and a file. No matter the tools, take light cuts, work down hill and stay true to your lines.

When the chamfers are done, make the gouge cuts below the stopped chamfers. I use a gouge with a radius of slightly more than 1/4", which gives a stylish undercut; however, a larger radius is more common, and is easier to cut.

***Form the secondary ramp.** I butt the wedge fingers up against the back of my bench hook, pare with a chisel (left), then finish with a blunt chisel scraper (right). The only downside is that this is hard on the bench hook.*

***Matched bevels.** A nice aesthetic touch for the top of the wedge are bevels that echo those on your iron.*

Stop. *I use a 1¼"-tall stop-block to achieve chamfer cuts of a consistent depth.*



Nice eyes. *The eyes make it easy to reach into the escapement without chafing your fingers.*

A nice 18th-century detail is to leave a fillet (roughly 1/32" to 1/16") above the gouge cut, but many old planes lack this fillet. Again, it's a matter of taste. These touches – while nice – are non-functional.

Next, lay out and carve the eyes (the teardrop shapes in front of the abutments). A quarter is handy for marking the radius. I carve the eyes with a Sloyd knife, but a chisel or shallow (No. 2 or No. 3 sweep) gouge will work.

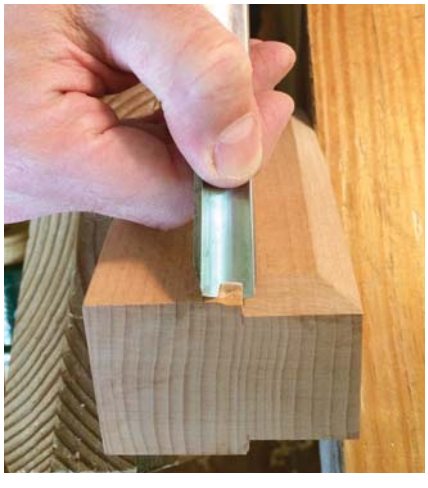
The final detail is to round the heel. As with the other details, the heel shape can vary quite a bit. I like a sculpted heel that is a stylized interpretation of an early 19th-century design. However, many old smoothers have a pretty perfunctory rounding – just enough to keep the plane from being uncomfortable in use. The important thing is to choose a design that pleases your eye and feels comfortable in your hand.

Sole, Tune & Finish

The final step in the build is to flatten the sole. Install the iron so that the cutting edge is about 1/16" above the sole. Tap the wedge in firmly, pencil some witness marks across the sole, and abrade it on some sandpaper stuck down to a flat surface. Once the sole is flat, check the mouth opening.

With the iron set for a shallow cut, the mouth should be about 1/32". If it's wider, no problem; a double-iron plane depends upon the cap iron to control tear-out, so mouth size is mostly a cosmetic issue. If it's not wide enough, grab the paring block you used earlier and pare the wear a bit. Then sharpen the iron and take your plane for a test drive.

Just about any oil finish will make your plane look great: Watco Danish Oil, Minwax Antique Oil Finish and Tru-Oil Gun Stock Finish are all popular among planemakers. I avoid using finishes that have a lot of varnish in them inside the mortise. A coat of wax will protect the outside of the plane, but don't get any wax on any of the mating surfaces inside the mortise. **PWM**



Details. *The gouge cuts are a visually pleasing way to terminate the stopped chamfers, and a small fillet left above the gouge cut is a nice touch. A rounded heel is comfortable in the hand.*

TYPICAL ADJUSTMENTS

It's not unusual to have to work out a few kinks before the plane will work optimally. Here are a some things to watch out for.

If the mouth clogs, make sure the abutments and wedge fingers aren't too close to the sole. Remember, the wedge fingers should terminate above the high point of the cap iron, usually about 5/8" to 3/4" above the sole. Double-check that the mouth is open at least 1/32".

If the iron flutters, leaving faint chatter marks, it's probably not bedded properly. Repeat the bedding process with dry erase marker.

If the iron slips when cutting, the wedge may not be properly fit. Recheck the fit on both sides of the wedge.

If the cap iron slips (relative to the cutting iron), the wedge fingers may be extending past the high point of the cap iron, or there may be a burr at the top of the cap iron. Inspect the back of the wedge to make sure the cap iron is not digging into it.

When properly tuned, the plane should adjust easily and shavings should shoot right out of the mouth.

— SV

Steve began making planes in the late 1990s; he turned his avocation into a business in 2015. He lives and works in the Shenandoah Valley.

ONLINE EXTRAS

For links to all online extras, go to:
- **popularwoodworking.com/nov17**

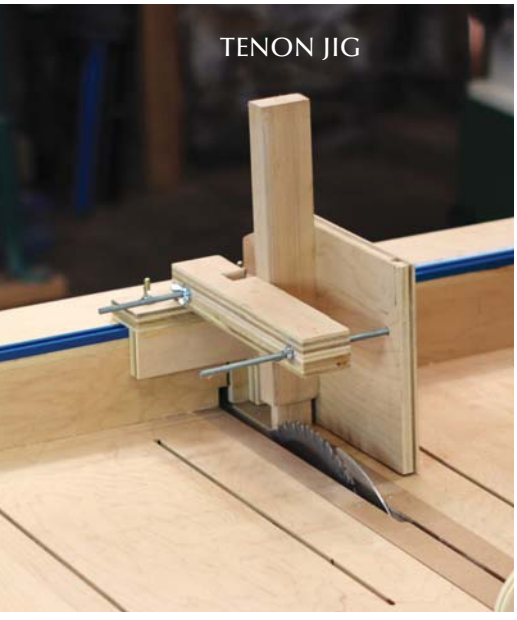
WEBSITE: *Visit voigtplanes.com.*

MODEL: *Download the SketchUp model for the coffin smoother.*

ARTICLE: *Make a wooden panel-raising plane.*

IN OUR STORE: *"Handplane Essentials, Revised Edition," by Christopher Schwarz.*

Our products are available online at:
- **ShopWoodworking.com**



Crosscut Sled Jigs

BY JAMES HAMILTON

Make your 'MegaSled' into a shop workhorse.

In the previous issue, we built the MegaSled—a table saw sled designed to accommodate a series of joinery jigs. The jigs and attachments I cover in this article are just the beginning—and with them, you can cut flawless finger joints, tenons, lap and bridle joints, and even splined miters. Once you see how they interact with the unique features of the Mega Sled itself, you may be inspired to create your own unique accessories.

Refer to the cutlist to cut out all the parts at the outset, or prepare your parts one jig at a time (I recommend using hardwood-veneered plywood from the home center). Whatever course you take, be sure to label each piece with its assigned letter. Cut each piece so that all corners and edges are square, and as you assemble them, check each part with a combination square to keep everything true. A pneumatic brad-nailer will reduce clamping time.

Most of the jigs are designed to attach to the T-track in the sled fence with T-bolts and wing nuts or star knobs. Wait to bore the holes for these bolts until each jig is completed. Then place the jig on the fence and mark the locations of the holes directly on the jig.

Micro-adjusters. *A spring between the blocks is what makes these work.*

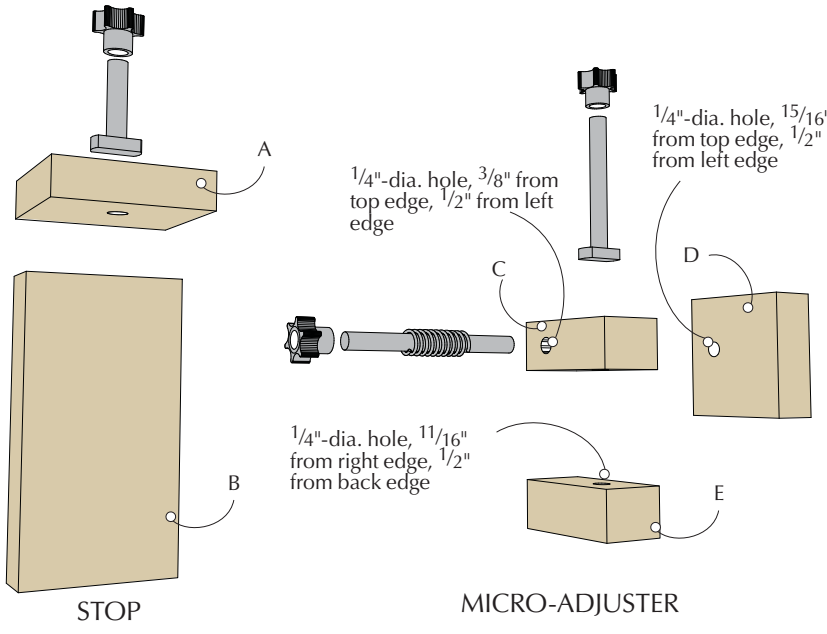
Micro-adjusters & Stops

One of the most useful features of this sled design is its ability to make accurate, repeatable crosscuts. A simple stop, made up of parts A and B in the diagram at right, attaches to the T-track on the sled's fence and fence extensions.

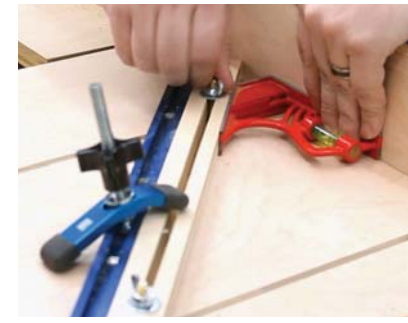
To fine-tune the stop's position, I designed a pair of micro-adjusters. Refer to the diagrams to prepare their parts, paying careful attention to the position of the holes, all of which are 1/4" in diameter. Parts C and E should be glued together before the hole is bored through them. Slip a T-bolt through the hole and place a washer and wing nut on the end. Slide a carriage bolt through the holes in parts C and D, place a spring in between, then secure them with a wing nut and washer.

Stop. *The micro-adjuster allows you to fine-tune the stop position on the T-track.*

PHOTOS & ILLUSTRATIONS BY THE AUTHOR



Miter fences. *These are mirror images of each other – one for each side of the sled.*



Held down. *The miter fences use the sled's base slots. Hold-down clamps can be attached to the T-tracks.*

Miter Fences & Hold-downs

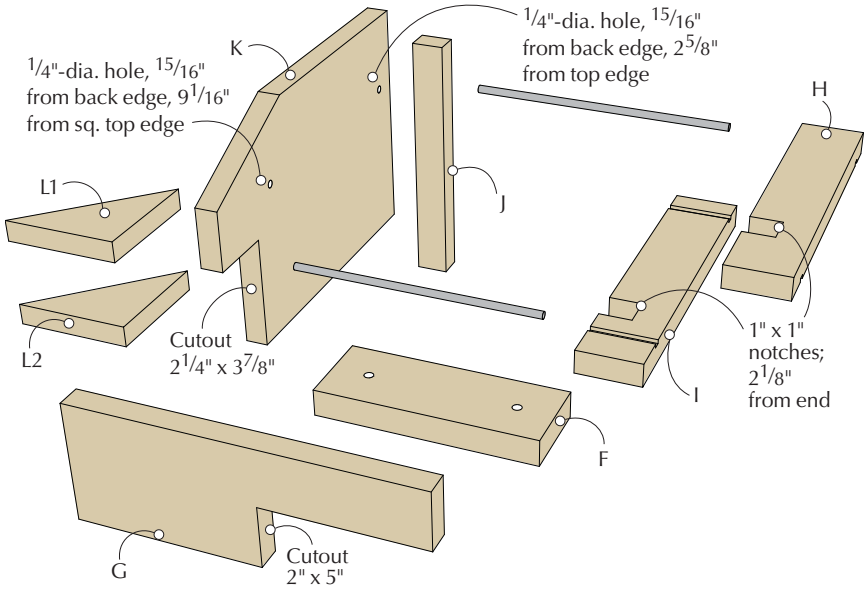
Table saw sleds are all about safety and accuracy, and these miter fences are designed to achieve both. They're simple: a mirrored pair of 2" x 18" strips of plywood with a 5/16" slot cut 3/8" from the edge, stopping 2" from one end and 4" from the other. This slot, combined with T-bolts and wing nuts, secures the fences to the mating slots in the sled's base panel while allowing for full adjustability. A T-track is embedded in the opposite edge, making it possible to attach hold-down clamps to secure your workpieces during the cut, or to attach a homemade stop for repeated cuts. But these fences aren't only for cutting miters – you may also use them to secure any small or oddly shaped workpiece to the sled for safe cutting. Simply attach a fence next to the workpiece and use its T-track clamping feature.

The Tenon Jig

Tenons, lap joints and bridle joints are possible with this jig. To build it, prepare parts F-K by cutting the shapes and boring the holes laid out in the diagram. Parts H and I are glued together, and a pair of 3/8" holes are bored in the seam, 1" from each end. Attach part G to part K, using the two triangular brackets (L1 and L2 in exploded diagram) to support and square up the assembly. Glue and brad nails will shorten clamping time

MegaSled Jigs

NO.	ITEM	DIMENSIONS (INCHES) T	W	L	MATERIAL	COMMENTS
MICRO-ADJUSTER, STOPS & MITER FENCES						
❑ 1	Stop cap	3/4	2	2	Plywood	A
❑ 1	Stop body	3/4	2	3 5/16	Plywood	B
❑ 2	Upper adjuster blocks	3/4	1	1 7/8	Plywood	C
❑ 2	Main adjuster blocks	3/4	1	1 7/8	Plywood	D
❑ 2	Lower adjuster blocks	3/4	1	1 7/8	Plywood	E
❑ 2	Miter fences	3/4	2	18	Plywood	
TENON JIG						
❑ 1	Fence bracket cap	3/4	6	2 1/4	Plywood	F
❑ 1	Fence bracket face	3/4	3 7/8	10 3/4	Plywood	G
❑ 2	Clamping blocks	3/4	2	10 1/4	Plywood	H&I
❑ 1	Alignment strip	3/4	1	8	Plywood	J
❑ 1	Main body panel	3/4	8	12 1/4	Plywood	K
❑ 2	Panel support brackets	3/4	4	4	Plywood	L1&L2
FINGER-JOINT JIG						
❑ 2	Adjuster blocks	3/4	1 7/8	1 1/4	Plywood	M1&M2
❑ 2	Fence caps	3/4	1 7/8	12	Plywood	N1&N2
❑ 2	Face panels	3/4	3 7/8	12	Plywood	O1&O2
❑ 2	Sacrificial face panels	1/4	3 7/8	12	MDF	P1&P2
SPLINE-JOINT JIG						
❑ 1	Rear top panel	3/4	3 7/8	12	Plywood	Q
❑ 1	Rear back panel	3/4	3 7/8	12	Plywood	R
❑ 1	Rear bottom panel	3/4	5 11/16	12	Plywood	S
❑ 1	Box platform	3/4	7 5/8	12	Plywood	T
❑ 1	Box platform base	3/4	3	12	Plywood	U
❑ 1	Fence base panel	3/4	3	6 7/8	Plywood	V
❑ 1	Fence panel	3/4	3	6 7/8	Plywood	W



TENON JIG

throughout this project. Attach strip J to part K, just to the right of the missing corner; be sure it's perpendicular to the top edge. Part F attaches to the top edge of G. Two pieces of 1/4" threaded rod should next be epoxied in the holes in the body of the jig.

SUPPLIES

Any hardware store

Small Accessory Hardware
- 3 ■ 5/16" x 1 1/2"-long T-bolts
- 2 ■ 5/16" x 2 1/2"-long T-bolts
- 5 ■ 5/16" ID wing nuts or star knobs
- 5 ■ 5/16" ID washers
- 2 ■ 1/4" x 3"-long carriage bolts
- 2 ■ 1/4" ID washers
- 2 ■ 3/8" ID 1"-long stiff springs
- 2 ■ 18"-long T-tracks

Tenon Jig Hardware
- 2 ■ 1/4" OD x 8"-long threaded rod
- 2 ■ 1/4" ID wing nuts or star knobs
- 2 ■ 1/4" ID washers
- 2 ■ 5/16" ID wing nuts or star knobs
- 2 ■ 5/16" ID washers

Finger Joint Jig Hardware
- 2 ■ 3" x 3 1/4"-wide steel angle brackets
- 4 ■ 5/16" x 1 1/2"-long T-bolts
- 4 ■ 5/16" ID wing nuts or star knobs
- 4 ■ 5/16" ID washers

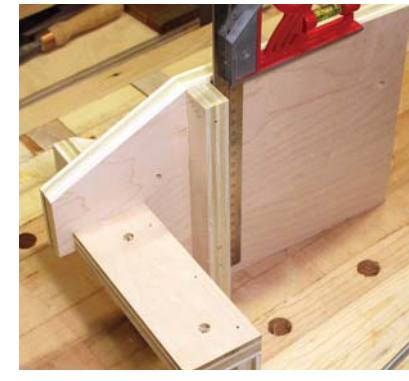
Spline Jig Hardware
- 1 ■ 12"-long T-track
- 2 ■ 5/16" x 1 1/2"-long T-bolts
- 2 ■ 5/16" ID wing nuts or star knobs
- 2 ■ 5/16" ID washers

This jig works much like any other table saw tenon jig. The workpiece is held perpendicular to the top of the saw, and secured in place with the clamping mechanism.

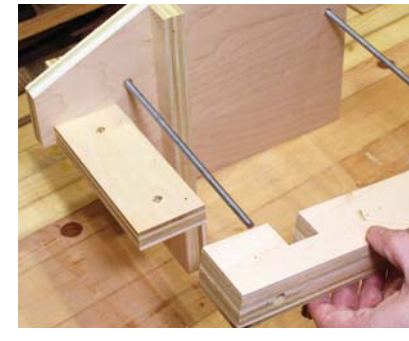
What makes this tenon jig unique are two features: First, the sled's base itself keeps the end of the workpiece from dragging across the top of the saw, and potentially shifting out of place during the cut. Second, the position of the jig may be fine-tuned by attaching one of the micro-adjusters next to it on the sled's fence.

In using this jig, I typically cut my tenons a bit oversized, then use the adjuster to nudge the jig toward the saw blade, fine-tuning the tenon's size with multiple light passes on opposite cheeks, until it perfectly fits my mortise.

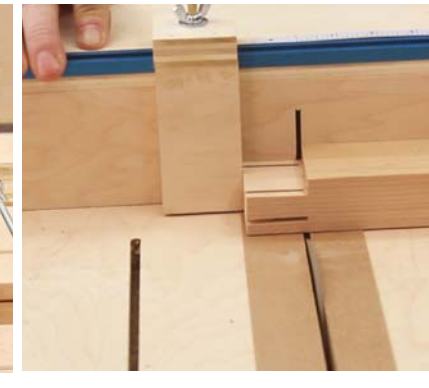
Assembly. *Only one bracket (L1) can be seen in this view. The second (L2) is mounted beneath it.*



Square up. *Check all parts for square as you work.*



Attaching the fence. *The fence slides onto the threaded rods. T-bolts through the vacant holes in part F will secure the jig to the sled.*



Tenon jig in use. *Cut the tenon's cheeks with the jig, then the shoulders on the sled itself.*

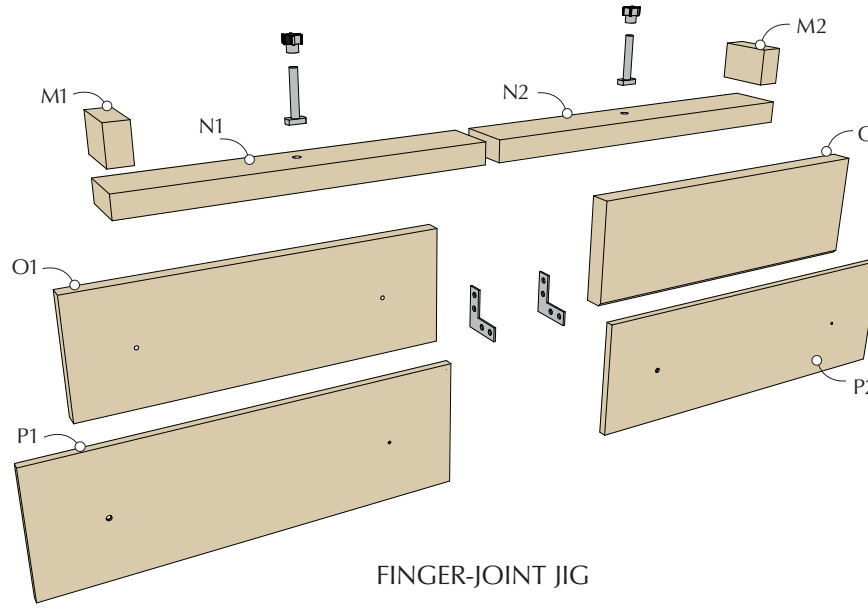
The Finger-joint Jig

There are two assemblies to the finger-joint jig, and they are mirror images of each other. The small rectangles (M1 and M2) attach to the long, narrow parts (N1 and N2). Then these attach to the long edges of the large rectangles (O1 and O2). Next, attach a pair of steel angle brackets to the end of each assembly as shown in the illustration.

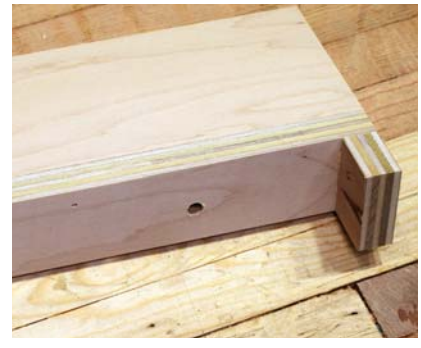
In the diagram, note the pair of 1/4"-thick pieces labeled P1 and P2. These are optional sacrificial faces. Because you'll cut into the jig with your dado stack during use, you may wish to install these faces later. One covers the kerf in the jig, providing new, zero-clearance support for your next joint; the other serves as a spacer to keep both halves of the jig on the same plane.

This jig works like many pin-based finger joint jigs, except that it is fully adjustable. Both halves attach to the sled's fence with the fingers (the angle brackets) on the right side of your dado stack, facing one another. The steps required to set up and make the cuts are shown in the accompanying photos. You will be cutting both halves of the joint together, using a dado stack that's equal to the thickness of the fingers you wish to cut.

It is not necessary to clamp the workpieces to the jig, but take care to hold them firmly against the base of the sled and the face of the jig during each cut. Also, keep an eye out for sawdust buildup along the base of the jig, blowing it away as needed.



FINGER-JOINT JIG

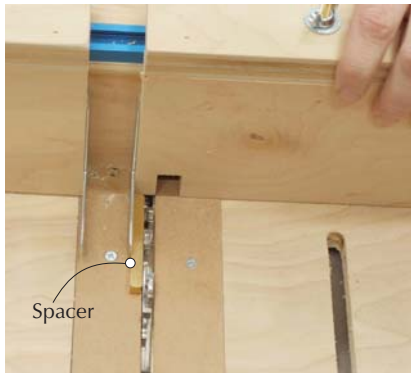


One side. *Here's one of the two finger-joint assemblies. The holes are for mounting it to the sled's T-track with T-bolts and wing nuts.*

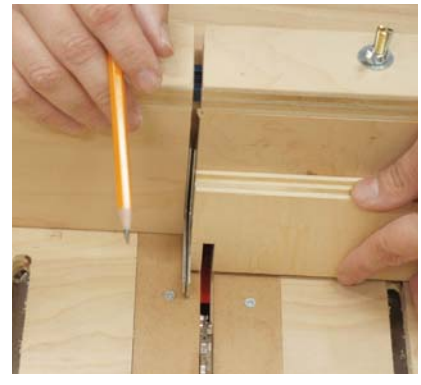
All together. *The two assemblies for the finger-joint jig are mirror images. Note how the angle brackets are attached to the ends.*

The Spline Jig

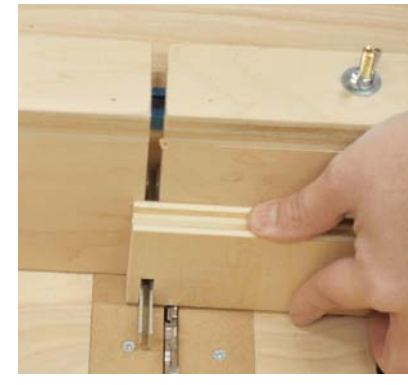
Splines strengthen or accent mitered joints on boxes and frames. While cutting your parts to size according to the



Step one. *Use a spacer to set the distance between the teeth of the dado stack and the inner finger; lock that half of the jig to the sled's fence.*



Step two. *Make a setup block by placing its end against the inner finger and making a cut.*



Step three. *Use the setup block to set the outer finger's distance from the inner finger.*

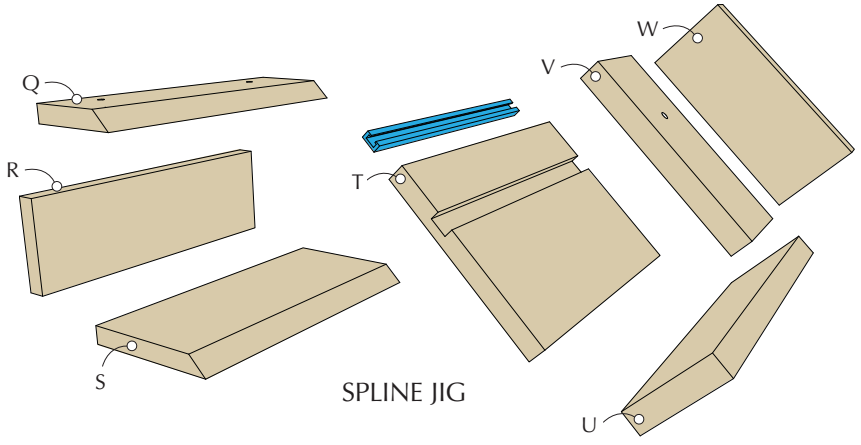
Step four. *Set the dado set slightly higher than your workpiece is thick.*

Step five. *Place one workpiece against the inner finger, while offsetting the other by a finger's width (a spacer is useful in this case).*

Step six. *As you make each cut, slip the newest kerf over the fingers, shifting the workpiece to your right and positioning them for the next cut.*

cutlist, add 45° bevels to the edges of parts Q and S. Part T requires a groove 2" from a long edge, wide and deep enough to fit your T-track. In the photo at right, you can see how the five major parts come together, with part T resting at a 45° angle. To construct the fence, attach part W to the edge of part V, place

The right fit. *If your fingers are too tight, add a shim to your dado set. Too loose? Remove a shim.*



SPLINE JIG

the assembly on the jig, mark the hole location through which the fence attached to T-track, and bore a 5/16" hole.

The spline jig should be placed against your sled's fence, where you will bore holes through the portion that overlaps the T-track, and attach it as you did the other jigs. The first time you use the jig you will kerf through it. You might cut more than one kerf through repeated use, but it is wise to align a previously cut kerf with the saw's blade to extend the life of the jig.

To position your work for cutting, slide the fence to the right or left across the jig and place the box against it. This way, you shift the position of the box, rather than the entire jig, when a joint requires more than one spline.

And that's just the beginning of what the MegaSled can do – but with just these jigs and accessories, this crosscut sled is already a real workhorse in my shop. And I'm already thinking up new ways to use it! **PWM**

James is a woodworking author and instructor, and publisher of "Stumpy Nubs Woodworking Journal" and stumpynubs.com.

Keep it steady. *The bottom edge of the fence assembly helps keeps it square as you slide it across the jig – so mount it as close to 45° as possible. Attach a hold-down clamp to the T-track to secure the work during the cut.*

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ARTICLE: *Read & make the "MegaSled," from the October 2017 issue.*

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Chicago Doctor Invents Affordable Hearing Aid

Outperforms Many Higher Priced Hearing Aids

Reported by J. Page

CHICAGO: A local board-certified Ear, Nose, and Throat (ENT) physician, Dr. S. Cherukuri, has shaken up the hearing aid industry with his new line of medical-grade, affordable hearing aids. ***These revolutionary hearing aids are designed to help millions of people with hearing loss who cannot afford—or do not wish to pay—the much higher cost of traditional hearing aids.***

"Perhaps the best quality-to-price ratio in the hearing aid industry" — Dr. Babu, Board-Certified ENT Physician

Dr. Cherukuri knew untreated hearing loss could lead to depression, social isolation, anxiety, and symptoms consistent with Alzheimer's disease. **He didn't know why hearing aids were so expensive when the prices on so many consumer electronics like TVs, DVD players, cell phones, and digital cameras had fallen.**

Since Medicare and most private insurance plans do not cover the costs of hearing aids, which can cost between $2,000-$6,000 for a pair, many of the doctor's patients could not afford the expense. Dr. Cherukuri's goal was to find a solution that would help with the most common types of hearing loss at an affordable price, similar to the **"one-size-fits-most" reading glasses** available at drug stores. He evaluated numerous hearing devices and sound amplifiers, including those seen on television. Without fail, those were found to amplify bass/low frequencies (below 1000 Hz) and were not effective amplifying the frequencies related to the human voice.

Inspiration from a Surprising Source

The doctor's inspiration to defeat the powers-that-be that kept inexpensive hearing aids out of the hands of the public actually came from a cell phone he had just purchased. **"I felt that if someone could devise a smart phone for about $700 that could do all sorts of things, I could create a hearing aid at an affordable price."**

Affordable Hearing Aid Superb Performance

The high cost of hearing aids is a result of layers of middlemen and expensive unnecessary features. Dr. Cherukuri concluded that it would be possible to develop medical-grade hearing aids without sacrificing the quality of components.

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"I have been wearing hearing aids for over 25 years and these are the best behind-the-ear aids I have tried. ***Their sound quality rivals that of my $3,500 custom pair of Phonak® Xtra digital ITE."***

—Gerald L.

"I have a $2,000 ReSound® Live hearing aid in my left ear and the MDHearingAid® *in the right ear.* ***I am not able to notice a significant difference in sound quality between the two hearing aids.***

—Dr. May, ENT Physician

"They work so great, my mother says she hasn't heard this well in years, even with her $2,000 digital! ***It was so great to see the joy on her face.*** *She is 90 years young again."*

—Al P.

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Cabinet-grade Finishing

Not everything has to have a furniture-grade finish.

If you read the woodworking magazines or look online, you often come across instructions for filling pores, glazing, toning, rubbing out and so on. These are wonderful techniques for use on sophisticated projects such as furniture. But they are often overkill for basic kitchen or bathroom cabinets.

So it may be helpful to divide finishing into two categories: furniture-grade and cabinet-grade. This article describes the simpler cabinet-grade finishing. It involves just three – maybe four – steps: wood prep, sealing, topcoating and sometimes staining.

Color putty. *A fast and efficient way to fill the small nail holes often found on cabinet frames is to press some widely available "Color Putty" into the holes with one finger and wipe it level with another. This is done between coats of finish, and there's no need to sand.*

Wood Prep

Preparing wood for a finish involves sanding, steaming out dents, filling gouges and dealing with glue seepage, which may cause a finish or stain to appear lighter in color.

The goal of sanding is to remove mill marks caused by machining, and other flaws. You need only sand enough to accomplish this goal. Sanding can be done with stationary or hand-held power tools or by hand. Whichever method you use, the steps are the same.

Begin with a grit of sandpaper that removes the flaws efficiently without creating larger-than-necessary sanding scratches. Then work up through the grits, making the scratches smaller and smaller until they won't be seen after staining or finishing. In most cases, you would begin with #80 or #100 grit and work up to about #180 grit. The finest grit you use should always go with the grain to help disguise the scratches left.

Mill marks. *Mill marks caused by machining the wood have to be removed by sanding, scraping or handplaning. Otherwise, they will be highlighted, especially when using a stain – that will create an unprofessional look.*

Dents can often be steamed level by dripping some water into the depression and touching it with a hot object such as a soldering iron to turn the water into steam.

Gouges can't be steamed away because some of the wood is missing. So fill these with solvent- or water-based wood putty. Colored wood putties are available in wood tones, which you can use to more closely match the end color.

Glue seepage should be removed or it will hinder penetration of the stain or finish and affect the color. To reduce glue seepage, apply less glue to joints and keep your hands clean.

Remove glue seepage by washing off the still-wet glue or waiting until the glue begins to set up, then lift it off with a putty knife. If you have applied

Sanding sealer. *Sanding sealers contain additives that make the finish turn to powder when sanded. You can use a sanding sealer under lacquer and non-polyurethane varnish to help keep the sandpaper from gumming up.*

CONTINUED ON PAGE 68

PHOTOS BY THE AUTHOR

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a stain before noticing the problem, sand or scrape off the glue, then wet sand the entire part with more stain to help even the coloring.

With dent, gouge and glue-seepage repairs, you need to sand again with at least the finest grit to level the repair or remove raised grain.

Sealing

Sealing is accomplished by the first coat. This can be the finish itself or a separate product used to solve a problem. Whatever you use, you should sand this first coat to create a smooth surface under subsequent coats.

Use sanding sealer to make sanding easier – except under oil-based polyurethane or water-based finishes because these finishes are easy enough to sand themselves.

Shellac is often mentioned as a sealer, but it is needed only when trying to block off a problem in the wood, such as silicone oil, odors from smoke or animal urine, or natural oily resin in many exotic woods. Shellac is a useful sealer when refinishing but rarely needed when finishing new wood.

Topcoating

The topcoat is critical because it's the layer that provides most of the protection against moisture (very important in kitchens and bathrooms) and durability against scratches and heat. It also provides the sheen (gloss, satin or flat) and some of the coloring. For the topcoat you'll probably choose from among the following:

- Oil-based polyurethane is among the most durable and water-resistant of all finishes. It dries slowly so it's easy to brush on. It imparts a slight yellow-orange coloring to the wood.
- Water-based polyurethanes and acrylic finishes are durable and water-resistant enough, but less so than oil-based polyurethane. Neither adds much color, so these are good choices for light woods such as maple and ash when you want to keep the natural color. The first coat, though easy to sand, raises the grain more than solvent finishes.
- Nitrocellulose and cab-acrylic lacquers dry fast so they are sprayed. Both are less protective and durable than polyurethanes, but they are easy to use if you have a spray gun.
- Pre- and post-catalyzed lacquers and varnishes are durable like polyurethane and also dry fast, so they are sprayed.
- Shellac is similar to nitrocellulose lacquer in scratch and water resistance.
- Oil finishes are too thin and soft to perform well on kitchen and bathroom cabinets.

The most common error made in topcoating cabinets, whichever finish is used, and especially when spraying, is not coating the edges of the doors well enough. A thin finish at these locations is quickly broken through by water. Pay special attention to the edges and all three-dimensional surfaces, such as raised panels.

Cabinet doors. *Be sure to apply full coats of finish to the edges of both the frames and panels of cabinet doors. This is especially important for doors under sinks to prevent splashed water from working its way through and causing the finish to peel.*

Blotching on birch. *The most efficient way to prevent blotching on hardwoods such as cherry and birch is to apply a washcoat before staining (top half). Wood conditioner is a varnish washcoat. Contrary to directions, it must be allowed to dry thoroughly, usually overnight, to be effective.*

Staining

Stain is applied before sealing to add decoration to the wood, but it also increases the likelihood of problems, including the following:

- Blotching is usually caused by irregularities in the wood. For pine use a gel stain to avoid the problem. For blotch-prone hardwoods such as birch and cherry, apply a washcoat (the finish thinned with 3 to 10 parts thinner) and let it dry thoroughly before staining.
- Darkened end grain is primarily the result of inadequate sanding. The still-rough surface retains more stain when the excess is wiped off. A washcoat will help even the coloring and also stiffen the wood fibers to make sanding easier. You can use a rag or brush to target the washcoat just to the end grain.
- Poor bonding is most often caused by not wiping off enough of the excess stain. Stain has much less binder than paint, so it separates when knocked against.
- Poor bonding can also be caused by applying a water-based finish over an oil-based stain before it has thoroughly dried.

Whatever finish or procedure you use, it's best to test on scrap wood before committing to a full set of cabinets. **PWM**

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

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LIMIT 1 - Cannot be used with other discount, coupon or prior purchase. Coupon good at our stores, HarborFreight.com or by calling 800-423-2567. Offer good while supplies last. Shipping & handling charges may apply if not picked up in-store. Non-transferable. Original coupon must be presented. Valid through 2/3/18. Limit one FREE GIFT coupon per customer per day.

SUPER COUPON — 20% OFF
ANY SINGLE ITEM
41662070
Limit 1 - Coupon per customer per day. Save 20% on any 1 item purchased. *Cannot be used with other discount, coupon or any of the following items or brands: Inside Track Club membership, Extended Service Plan, gift card, open box item, 3 day Parking Lot Sale item, compressor, four jacks, saw mills, storage cabinets, chests or carts, trailers, trenchers, welders, Admiral, Bauer, Cobra, CoverPro, Daytona, Earthquake, Hercules, Jupiter, Lynxx, Poulan, Predator, StormCat, Tailgator, Viking, Vulcan, Zurich. Not valid on prior purchases. Non-transferable. Original coupon must be presented. Valid through 2/3/18.

Haul-Master — SUPER COUPON
1195 LB. CAPACITY 4 FT. x 8 FT. FOLDABLE HEAVY DUTY TRAILER
Customer Rating ★★★★½
• DOT certified tires

SAVE $140 $259.99 ~~$299.99~~ Compare $399.99
ITEM 62648/62666/90154 shown
41693347
LIMIT 3 - Coupon valid through 2/3/18*

SUPER COUPON
7 FT. 4" x 9 FT. 6" ALL PURPOSE WEATHER RESISTANT TARP
Customer Rating ★★★★½

SAVE 65% Compare $8.58 ~~$4.99~~ $2.99
ITEM 69249/69115/69137
69129/69121/877 shown
41696542
LIMIT 8 - Coupon valid through 2/3/18*

Bauer — SUPER COUPON
SAVE $39
20 VOLT LITHIUM CORDLESS 1/2" COMPACT DRILL/DRIVER KIT
• 450 in./lbs. torque
• 1.5 amp hour battery
• Weighs 3.4 lbs.
Customer Rating ★★★★★

NEW
$59.99 ~~$69.99~~ Compare $99
ITEM 63531
41697830
LIMIT 5 - Coupon valid through 2/3/18*

CHICAGO ELECTRIC POWER TOOLS — SUPER COUPON
12" SLIDING COMPOUND DOUBLE-BEVEL MITER SAW
Customer Rating ★★★★½
• Powerful 15 amp motor
• Makes precision cross, bevel and miter cuts
• Laser guide

Blade sold separately.
SAVE $169 $129.99 ~~$199.99~~ Compare $299
ITEM 61969/61970/69684 shown
41702063
LIMIT 5 - Coupon valid through 2/3/18*

PITTSBURGH — SUPER COUPON
50" CLAMP AND CUT EDGE GUIDE
Customer Rating ★★★★½ SAVE 57%

$14.99 ~~$22.99~~ Compare $34.99
Tools sold separately.
ITEM 66581
41706012
LIMIT 7 - Coupon valid through 2/3/18*

CENTRAL PNEUMATIC — SUPER COUPON
18 GAUGE, 2-IN-1 NAILER/STAPLER
WE CARRY A FULL LINE OF NAILS
SAVE 77% Customer Rating ★★★★½

$15.99 ~~$22.99~~ Compare $69.98
ITEM 63156
68019 shown
41726498
LIMIT 6 - Coupon valid through 2/3/18*

CENTRAL MACHINERY — SUPER COUPON
350 LB. CAPACITY FOLDING SAW HORSE
Customer Rating ★★★★☆

SAVE 49% $8.99 ~~$13.29~~ Compare $17.97
ITEM 60710/61979/69446 shown
41727533
LIMIT 9 - Coupon valid through 2/3/18*

U.S. GENERAL — SUPER COUPON
26" 4 DRAWER TOOL CART
Customer Rating ★★★★½
• 6200 cu. in. of storage
• 580 lb. capacity
• Weighs 97 lbs.

$99.99 SAVE $269 Compare $369.32 ~~$149.99~~
ITEM 61634/61952/95659 shown
41736512
LIMIT 5 - Coupon valid through 2/3/18*

CHICAGO ELECTRIC POWER TOOLS — SUPER COUPON
6" VARIABLE SPEED DUAL ACTION POLISHER
Customer Rating ★★★★½

SAVE $64 $54.99 ~~$69.99~~ Compare $119
ITEM 62403
62862/69924 shown
41737663
LIMIT 3 - Coupon valid through 2/3/18*

HaulMaster — SUPER COUPON
• 1000 lb. capacity
MOVER'S DOLLY

Customer Rating ★★★★★ SAVE 59%
$7.99 ~~$10.99~~ Compare $19.97
ITEM 61899/62399/63095/63096
63098/63097/93888 shown
41740581
LIMIT 8 - Coupon valid through 2/3/18*

CENTRAL MACHINERY — SUPER COUPON
10", 12 SPEED BENCHTOP DRILL PRESS
Customer Rating ★★★★☆

$109.99 SAVE $67 ~~$139.99~~ Compare $177.59
ITEM 63471/60237 shown
41741475
LIMIT 4 - Coupon valid through 2/3/18*

PORTLAND — SUPER COUPON
1750 PSI PRESSURE WASHER
Customer Rating ★★★★½
• 1.3 GPM
• Adjustable spray nozzle
NEW

$79.99 SAVE $99 Compare $179.33 ~~$99.99~~
ITEM 63255/63254 shown
41742075
LIMIT 4 - Coupon valid through 2/3/18*

KRAUSE & BECKER — SUPER COUPON
AIRLESS PAINT SPRAYER KIT
Customer Rating ★★★★½

SAVE $124 $174.99 ~~$219.99~~ Compare $299
ITEM 62915/60600 shown
41771557
LIMIT 3 - Coupon valid through 2/3/18*

CENTRAL MACHINERY — SUPER COUPON
2 HP, 5 MICRON INDUSTRIAL DUST COLLECTOR
Customer Rating ★★★★★
• 70 gallon capacity
SAVE $215

$169.99 ~~$199.99~~ Compare $384.99
ITEM 61790/97869 shown
41746939
LIMIT 4 - Coupon valid through 2/3/18*

Lifetime CARBIDE — SUPER COUPON
ALUMINUM OXIDE SANDING SPONGES PACK OF 10
Customer Rating ★★★★★

FINE
ITEM 46753
63912
MEDIUM
ITEM 46752
63915
COARSE
ITEM 46751
63918
~~$4.99~~ YOUR CHOICE $3.99
41760046
LIMIT 9 - Coupon valid through 2/3/18*

HaulMaster — SUPER COUPON
STEP STOOL/ WORKING PLATFORM
Customer Rating ★★★★★

SAVE 65% Compare $57.55 ~~$29.99~~
• 350 lb. capacity
$19.99
ITEM 62515/66911 shown
41769045
LIMIT 7 - Coupon valid through 2/3/18*

*Original coupon only. No use on prior purchases after 30 days from original purchase or without original receipt. Valid through 2/3/18.

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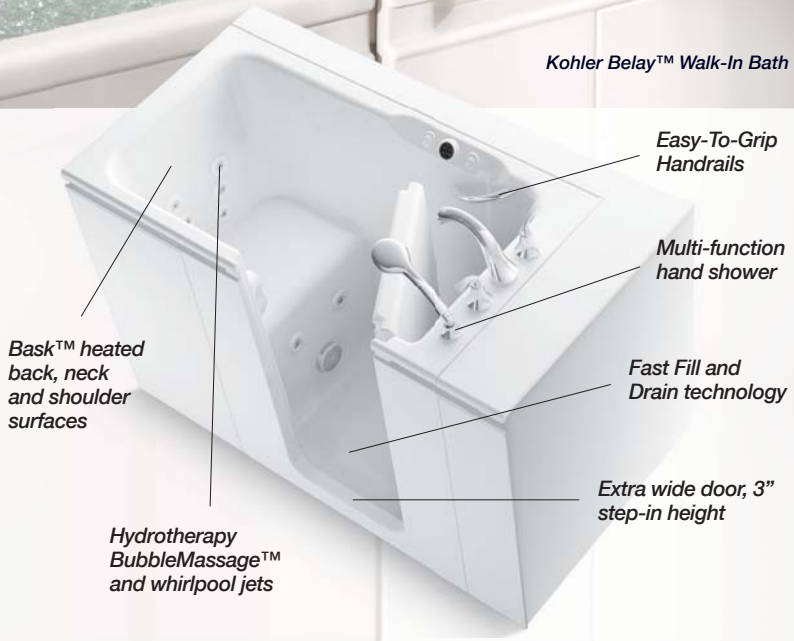

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Bigger Buttons

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"My friends all hate their cell phones… I love mine!" Here's why.

FREE Car Charger

Say good-bye to everything you hate about cell phones. Say hello to the Jitterbug Flip.

"Cell phones have gotten so small, I can barely dial mine." Not the Jitterbug® Flip. It features a large keypad for easier dialing. It even has a larger display and a powerful, hearing aid compatible speaker, so it's easy to see and conversations are clear.

"I had to get my son to program it." Your Jitterbug Flip setup process is simple. We'll even program it with your favorite numbers.

"What if I don't remember a number?" Friendly, helpful Personal Operators are available 24 hours a day and will even greet you by name when you call.

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"My cell phone company wants to lock me in a two-year contract!" Not with the Jitterbug Flip. There are no contracts to sign and no cancellation fees.

Available in Red and Graphite.

Monthly Plan	$14.99/mo[1]	$19.99/mo[1]
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Voice Dial	FREE	FREE
Nationwide Coverage	YES	YES
30-Day Return Policy[2]	YES	YES

More minute plans and Health & Safety Packages available. Ask your Jitterbug expert for details.

"My phone's battery only lasts a short time." Unlike most cell phones that need to be recharged every day, the Jitterbug Flip was designed with a long-lasting battery, so you won't have to worry about running out of power.

"Many phones have features that are rarely needed and hard to use!" The Jitterbug Flip contains easy-to-use features that are meaningful to you. A built-in camera makes it easy and fun for you to capture and share your favorite memories. And a flashlight with a built-in magnifier helps you see in dimly lit areas. The Jitterbug Flip has all the features you need.

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Form Before Figure

Proportion and structure outweigh ornament and showy materials.

Have you ever found such a stunning piece of wood that you were almost afraid to cut into it? You know the boards I'm talking about. The tiger maple with such unbelievable striping you just want to put a frame around it and hang it on the wall. Or the curly cherry with the surface that looks so deep you could drown in it. It's not too common to luck into boards like these, so when we do, our first instinct is often to try to showcase that unbelievable figure on every surface of a project that we can. That approach, however, frequently leads to less-than-stellar results that can range in appearance from "meh" to "blech."

Similar results can occur from the overuse of other decorative elements such as mouldings, carvings, inlay, decorative painting or contrasting wood species. Any element whose main purpose is to highlight can also serve to detract if there's too much of it, or if the underlying form is lacking.

We should also include exposed joinery in this discussion. Many woodworkers today are obsessed with showy joinery. Air-tight dovetails, pillowed through-mortise-and-tenon joints and ebony pegs, when used with restraint, can indeed add an element of visual interest to a piece with strong underlying form.

If the overall proportions and basic structure of a piece of furniture are lacking, however, it really doesn't matter how perfect your hand-cut dovetails or keyed tenons are. Flawless skin cannot make up for poor bone structure.

> "If the form itself is lacking, the best wood in the world will not make up for it."
>
> —George Walker, PWM Design Matters columnist

Fine form. *Even though this chest was built with fairly straight-grained, "boring" wood, the overall form is to my eye elegantly proportioned and well executed. That makes it far more appealing than a piece with overused wildly figured grain or a poorly proportioned design.*

If, on the other hand, the underlying form is good, you can get away with a less-than-perfect complexion. Just look at the furniture on display in most museums. It can be riddled with over-sawn dovetails, surface tear-out, inconsistent turnings and be made with straight-grained, figureless wood. But the piece can still be exemplary because its basic form is well executed, and its decorative elements serve to highlight the piece and draw your eye rather than clutter the look and create a chaotic appearance.

So what's a woodworker to do? How do we use the wood in that wonderful board in a way that won't result in utter disappointment? The answer is to start with the basic form then highlight it sparingly. Forget about the figure in the board; look past the surface. Instead, perfect the underlying skeleton before turning your focus to the skin.

Once the overall form and functionality of the piece are worked out, only then should the ornamentation – including the figure in the wood – be considered. Thinking about your designs in this way will increase the likelihood that the wood will enhance the overall appearance of your work rather than clutter it. **PWM**

Bob is a self-taught craftsman and designer of 25 years who specializes in hand-tool woodworking. He teaches woodworking at the Chestnut Creek School of the Arts and builds custom furniture from his home shop in Grayson County, Va.

ONLINE EXTRAS

For links to all online extras, go to:

- popularwoodworking.com/nov17

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The Veritas Combination Plane is the result of four years of research and development. It is precisely machined, easy to adjust and holds settings securely – all features that, together with the improved blade technology, also make it fully reliable in use. It represents our continuing commitment to designing and manufacturing exquisite woodworking hand tools that do not limit the expression of the person that is wielding it. Like all Veritas products, our combination plane is designed with the discerning woodworker in mind; it is built to the highest standards, comfortable to handle, and made in Canada.

We have prepared a 16-page brochure that provides detailed information about the Veritas® Combination Plane. You can view it online or add a copy to your next order.

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Configure the plane for left- or right-hand use or to accommodate grain direction.

Accessories
Two Baltic birch plywood boxes are available separately: one provides a place to keep the fully assembled combination plane; the other, holds blades side by side in two 6" long rows.

Our combination plane will accept the right-hand (and unhanded) blades available with the Veritas Small Plow Plane, as well as the blades used with the Stanley #45 and most of those used with the Stanley #55. We also offer an all-new assortment of blades to create a variety of decorative profiles.

Box for combination plane

Blade box

Combination plane blades

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- Accepts All 5" Pinless Blades
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- Onboard Dust Blower
- 2½" Dust Collector Hookup
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