

**SAM MALOOF'S BRAND NEW SHOP: AN INSIDE LOOK**  
**WRIGHT AIRPLANE: WOODWORKING PROJECT CHANGED THE WORLD**

JUNE 2003  
ISSUE #134

# Popular Woodworking

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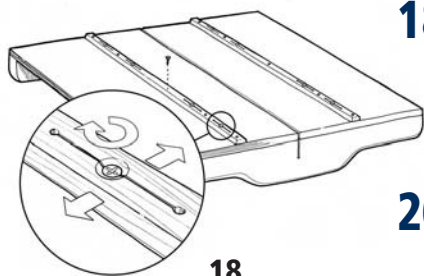
Use Smoothing Planes  
Instead of Sandpaper



# contents

## Popular Woodworking

### IN EVERY ISSUE



18

## 18 Perfect Runners for Miter Slots

### TRICKS OF THE TRADE

Add accuracy to jigs that run in miter slots with these adjustable runners. Plus, a better way to crosscut small pieces safely, and make a marking knife from a spade bit.

## 26 Two Unsung Heroes

### ENDURANCE TEST

Without good glue and decent clamps, woodworking would be a lot more difficult. Titebond II and Bessey Tradesmens have never failed to keep things together.



26

## 28 Fein Turbo III Vacuum

### TOOL TEST

Finally, a shop vacuum to get passionate about. Also reviewed: the Akedo dovetail jig, Veritas's apron plane, Makita's newest jigsaw and Shapton sharpening stones.



28

## 32 Legendary Rocker

### GREAT WOODSHOPS

Get an inside look and personal tour of Sam Maloof's new shop, which was moved to make room for a highway. Now 87, Maloof still works in the shop every day.



32

## 36 Drill Press Mortising Chisel

### INGENIOUS JIGS

There's a better way to square the holes left by chain-drilling your mortises. Your unplugged drill press and a modified mortising chisel makes neat, square holes.

By Nick Engler

## 38 Four Good Ways to Cut Rabbits

### POWER-TOOL JOINERY

Cutting accurate rabbits is one of the fundamental skills every woodworker needs. Learn four good ways to make this joint safely, easily and – significantly – accurately.

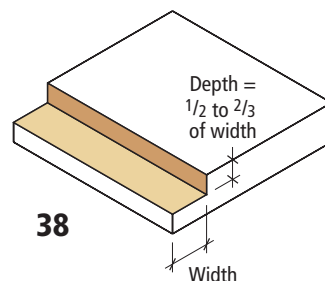
By Bill Hylton

## 42 Why Use Hand Tools?

### FROM THE BENCH

Our newest columnist has spent his career using hand tools to outfit expensive homes. Find out why adding a few hand tools to your arsenal makes good sense.

By Don McConnell



38

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## ON THE COVER

*Smoothing planes are the thoroughbreds of the hand-plane world. These tools can be highly tuned to take off a mere thousandth of an inch of wood, making your project ready to finish.*

Cover photo by Al Parrish

## DEPARTMENTS

**8 Out on a Limb**  
*Draw Your Own Conclusions*

**10 Letters**  
*Mail from readers*

**14 Q & A**  
*We answer readers' most difficult questions*

**91 Caption the Cartoon**  
*Win a Makita drill*

**92 Flexner on Finishing**  
*Finishing Walnut*

**96 Out of the Woodwork**  
*The Heartiest Pine*  
*by Philip W. Leon*

## PROJECTS, TOOLS AND TECHNIQUES

### 46 Smoothing Planes

If you hate sanding, you're going to like smoothing planes. Properly tuned, they can greatly reduce (and almost eliminate) sanding in your shop.

### 53 Saw Blade Box

This handy box protects all your 10" saw blades and gives you fast access to every one with its ingenious (yet simple) staggered sliding trays.



### 56 Jewelry Chest

Based on full-size blanket chests, this small-scale dovetailed box is the perfect early American jewelry box.

*By Troy Sexton*

### 60 CAD for Woodworkers

For just \$50, you can turn your personal computer into a powerful woodworking tool. Make better parts lists. Alter your designs easily. Create full-size cutting patterns and more.

*By John Hutchinson*

### 66 On Wooden Wings

Steel isn't always superior to wood. Nick Engler has built reproductions of the Wright Brothers' aircraft, flew (and wrecked) them and found there's a reason they were made using wood.

*By Nick Engler*

### 70 Home-office Armoire

Whether you work from home or simply need a place to keep your computer, bills and files, this is the project for you.



### 78 Steel-frame Band Saws

Many manufacturers now sell welded steel-frame band saws as an option to the traditional cast-iron saw. We find out if these European saws are right for you.

### 84 Shop Aprons

We test seven popular designs and find that no one has produced the perfect apron – yet.



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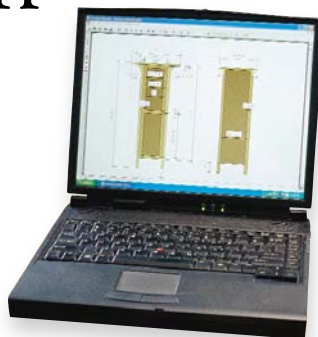
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# Draw Your Own Conclusions



On page 60 you'll find a well-written and researched article on the use of an inexpensive computer software program for making shop drawings. I'm sure many readers will be interested in trying it, and we've even set up some files on our web site that readers can use to enhance the program.

I've never used CAD (computer-aided design) software. But I'm not against it. In fact, I'm grateful for it. It helps us put out this magazine. All of our technical drawings are developed by John Hutchinson, the author of the article on CAD, and he does a masterful job. He is an accomplished architect with years of experience. His mastery of computer-aided drawing is phenomenal.

For me, developing project drawings with pencil, paper, square, triangle, scale ruler and (oh yes) an eraser, is my method of choice. But no matter which way you create plans, I want to make an important point – you must make detailed project drawings, even if it's on the back of an envelope. If you don't, I'd wager your scrap pile is too big.

Starting any project, no matter how simple, without a shop drawing and a cutting list is an exercise in futility. I know, I've tried it a couple times during the past 20 years of almost daily woodworking.

On the most basic level, making a scale drawing of your project will give you an accurate representation of what your project will look like. You'll see the pieces in relation to one another and determine if the proportions are pleasing.

A formal drawing system (like the one I learned in vocational woodworking school years ago) provides many valuable benefits. The most important of these is what is called the "proofing" method of adding dimension lines from which you will later develop your project's cutting list.

The system is simple enough to understand but a little too complex to explain in this column. But the proofing system, as my

vo-ed instructor explained, "raises the questions and finds the answers" to the mistakes you would otherwise later make in the project. By following the rules, each dimension line must add up to the same amount. Whenever they don't add up alike, there's an error in one or more dimensions, so you then go find the errors. Once all the numbers tally correctly, you can confidently make an accurate cutting list.

Even with the power of the computer, you still have to check all your work in CAD. The program will do the math for you, but you still have to find where your mistakes are in the drawing.

Another important benefit of making good elevation, plan and profile drawings is the mental process of building the project in your head, on paper or on screen. As you make the drawing, you draw every part in the project. This process requires you to make decisions about joinery and how the parts relate to one another. You'll learn where the tricky steps are in the building process so you won't be surprised later.

Both CAD and pencils – used properly – give you these benefits. And after you learn to draw on the computer you can focus your attention on what you want to build rather than on how to use the computer software.

Just remember, CAD is another tool, like a table saw or a hand plane. Use it carelessly at your own peril. Whether you are a pencil person or a computer jock, the more planning you do at the front end, the easier every subsequent step will be. **PW**

*Steve Shanesy*  
Steve Shanesy  
Editor and publisher

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## SAFETY NOTE

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

# Safety First in the Magazine, Please

## Always Protect Your Eyes

This is the first time in my almost 63 years that I have felt obliged to write to a publication that I subscribe to. The reason for my writing is safety. Simple safety.

I just got my first issue of *Popular Woodworking* and I think it's great, but I have a problem. In two of the articles, "Classic Wardrobe" by Troy Sexton and "Joints for Boxmaking" (April 2003) by David Thiel and Kara Gebhart, Troy and Kara were both working without safety glasses.

Troy seems more intent on protecting his hearing than his eyes. He has glasses on when using a brad nailer but not when using a router. Kara is using a hammer and a drill with no safety glasses. This might seem like nitpicking but it sets a bad example for readers. You can't do woodworking by sound alone; you need to be able to see.

I have a 6-year-old nephew who loves to come down into my basement shop and "make things." He knows that when he hits the bottom of the stairs it's "can I have my glasses Uncle Bruce?" Other adult friends who come to my shop also know that. I keep a cabinet with eight or nine pairs of safety glasses for visitors, both for their safety and mine.

Bruce Lyle  
via the Internet

## An Idea for Cutting Dados for CD Storage Easily

I enjoyed the article "Simple CD Storage" (February 2003). I am a teacher at Barrington High school in Barrington, Ill., and my students have been making CD and DVD racks for years. As such, we use a jig attached to the miter gauge that has a spacer finger so that each dado is cut an equal distance from the next. It's much like the spacer finger you find on shop-made jigs for cutting box joints on your table saw.

One spacer is for CDs at  $\frac{7}{16}$ "; the other for DVDs is  $\frac{5}{8}$ ". Also, I use a simple method

to determine the length of the board for CDs: For every CD you want, it and its spacer equals an inch. This works out well for the students.

Jeff Blessman  
Barrington, Illinois

## Getting Square Edges With the 'Side-clamp Honing Guide' can be Tough

I wanted to tell you how much I enjoyed the article "Sharpening Plane Irons and Chisels" (April 2003). I have been reading on the same subject for years, and yours has clarified the subject far more clearly than all the previous – collectively.

I particularly enjoyed the conversions you gave for using sandpaper as opposed to traditional sharpening stones.

I do use a "side-clamping honing guide" and find it very convenient – with one big drawback. Specifically, keeping the chisel/plane square. Do you have any thoughts on this? And once honed out of square how does one square it?

Marshall A. Wentz  
Williamsport, Pennsylvania

*I've never had a problem with squareness with the side-clamp honing jig in the seven years I've been using it. Forgive me if this sounds elementary, but there are two clamping faces on the jig. One is straight and one is curved. To ensure my*

## WRITE TO US

*Popular Woodworking* welcomes letters from readers with questions or comments about the magazine or woodworking in general. We try to respond to all correspondence. Published letters may be edited for length or style. All letters become the property of *Popular Woodworking*.  
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*blades are always square in my jig I hold the blade against the straight side using my thumb and then close the curved side onto the jig. This gives me the squarest edge the jig is capable of every time. As a result, my secondary bevels are consistent time and time again.*

*If a tool ever gets out of square, I'll simply regrind it in the side-clamp jig using the coarsest stone I have. Then I hone it using the same setup. The only other things I can think of that could be contributing to your squareness problem is that your chisels aren't properly seated in the grooves in the jig (a common occurrence). Fiddle with the tool and see if it will "snap" into place. Or you need to experiment with where you are putting pressure as you hone.*

*— Christopher Schwarz, senior editor*

### **Where in the Heck Can I Find 'Warm Brown Glaze?'**

You've mentioned in several articles that you "live and die" by the warm brown glaze made by Lilly Industries to finish Arts & Crafts furniture. Since Valspar acquired Lilly Industries, what is the equivalent product, and where is the best place to find it online?

*Bernie Sklanka  
via the Internet*

*You can still purchase the same product under the Valspar name. The best place to find it online is at [woodfinishingsupplies.com](http://woodfinishingsupplies.com). It costs about \$10 a quart, which will go a long way. **PW***

## **CORRECTIONS & CLARIFICATIONS**

*Popular Woodworking* corrects all significant errors. For a list of corrections to the magazine (or to report one), visit our web site at: [popwood.com/features/mag.html](http://popwood.com/features/mag.html).

The "Marble Maze Puzzle" (February 2003) was functionally very similar to a project published in *Woodworker's Journal* in 1994. The similarities – which were picked up after the author purchased a craft item at a garage sale – were inadvertent. We regret the error.

In our review of 12-volt drills (February 2003), the Porter-Cable drill used in the test, the model #9866, is not available in that configuration. The #9966 is a similar upgraded model that includes an ergonomic grip, a lower speed range of 425 rpm and a stated torque of 385 in./lbs. The price should be about \$160.

# Cleats Help Attach Almost Anything

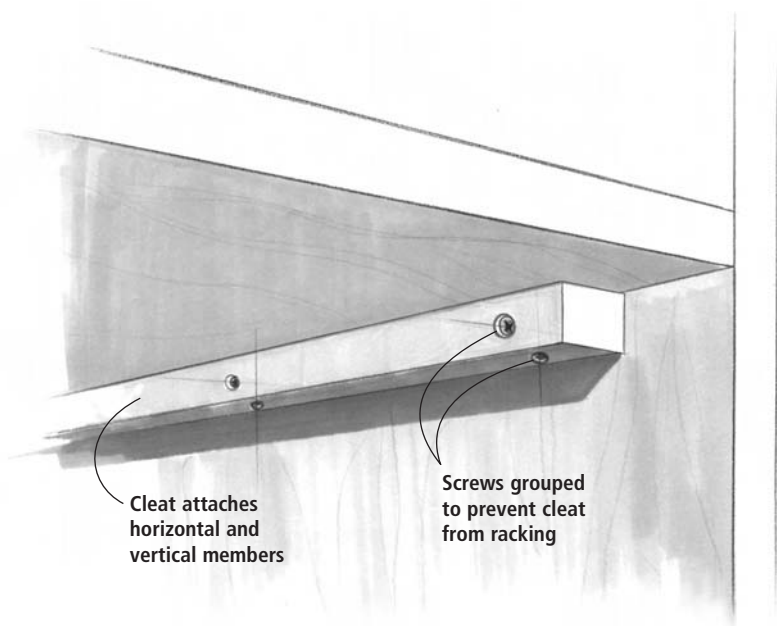


Illustration by Hayes Shanesy

## What are Cleats? And how do I Attach Them to My Projects?

I enjoyed the article on the Gustav Stickley Magazine Cabinet (April 2003), but I do have a question: What are cleats and how are they used to attach the top?

Dwayne Crider  
Austin, Texas

Cleats are lengths of wood (square in section) that hold screws going in two directions. In this particular project, you screw the cleats to the inside top edge of the side assemblies. Then you place the top on the assembled cabinet and screw the top to the cabinet through the cleats. Predrill all your holes before attaching your cleats.

When using cleats, keep in mind how the case and top will expand and contract with the seasons. This is usually a problem when the grain on a cabinet side runs horizontally (though not with this project). When this is the case, you need to bore slotted holes in your cleats to prevent the screws from breaking (or your top from self-destructing) when the wood moves.

Here are a couple other tips for cleats. When using them to attach a top, position the cleat  $\frac{1}{32}$ "

below the top edge of the side to ensure the top will seat tightly against the side. Also, it's best to keep the screws grouped together as shown above. This prevents the cleat from bowing.

— Christopher Schwarz, senior editor

## What's the Best Cutterhead Speed?

I own a 4" jointer powered by a 1,750 rpm motor. The drive sheave is 6" and the driven sheave is  $2\frac{3}{4}$ " — or a 2.18 ratio. I figure this gives a cutterhead rpm of 3,815. Is this sufficient for a clean cut?

Nick Bontempo  
Fremont, California

Most 4" jointers run between 6,000 to 11,000 rpm. That's faster than the larger units because most of these are powered by universal motors. The 6" and 8" jointers with induction motors average about 4,500 to 5,000 rpm at the cutterhead. So your 3,815 rpm is a little slow, but I think it's acceptable. You can slow down your feed rate to increase your cuts-per-inch, or you can switch the driven sheave to a 2" pulley, which will increase your speed to 5,250 rpm.

— David Thiel, senior editor



### What's the Best Finishing Procedure for a Kitchen Floor?

In a recent issue, you wrote that after letting an oil finish cure for about a week, you could go ahead and put on a film finish. I am considering adding a wooden floor to my kitchen, and I'm hoping to get your opinion on the chemistry and the likely long-term success of my efforts.

After removing the vinyl floor and adding the wooden flooring, I'll apply a coat of tung oil mixed with spar varnish to get a color I'm comfortable with.

Then I plan to add several layers of water-base polyurethane on top. Any compatibility or long-term wear issues with my plan?

John Zachman

Eden Prairie, Minnesota

*Forgive me, but I've got to wonder why you're doing what you're doing. You're talking about a kitchen floor that takes a beating. Why wouldn't you just put on three coats of oil-based polyurethane, which is the most durable finish you have available to you for that type of application, and be done with it? I would think that the coloring would be very similar.*

Oil-based polyurethane is going to wear a lot better than water-based polyurethane.

There are two good reasons to substitute water-based polyurethane for oil-based on a floor:

1. You are trying to avoid any yellowing.
2. You want to avoid the odor of oil-based polyurethane.

Clearly, you're not trying to achieve either. You're putting "yellowing" into your floor with the tung oil/varnish mix, and you're getting the odor (for awhile, at least) from that same finish.

To answer your question: Yes, you can apply water-based finish over the tung oil/varnish mix. But you've chosen the worst possible oil and the worst possible varnish for curing qualities. They cure extremely slowly, and you have to let them cure totally before you can be sure of a good bond (I am assuming you're using real tung oil, not wiping varnish). I'd give the floor several weeks, at least, in a warm room.

But what are you going to do with the floor while you're waiting for that oil/varnish mix to cure? You shouldn't use it at all for at least three days because of the tung oil, and then you're going to have to be very careful not to spill any oily or greasy substance on it. A rule for coating over another finish is that it be perfectly clean—

*not usually a problem (except for dust) in a shop. But who knows what you might be tracking in on your shoes during those weeks.*

*I'd use oil-based polyurethane.*

—Bob Flexner, contributing editor

### Is Cryo a Crock or for Real?

In the December 2001 article on cryogenically treating blades and bits ("Why You Should Freeze Your Tools") you said there would be a follow up on the tools that you had treated. Do you have any results yet?

The reason all this comes up is that recently, after not realizing how long it had been since the iron on the plane I was using saw a sharpening stone and thus gouging a project with a dull plane iron, I looked at the irons that came with my planes. Some were pitted beyond good taste, and I ordered Hock replacements ([hocktools.com](http://hocktools.com)).

I also spent the extra cash for the cryo-treated A2 Hock irons. So I am curious to learn what you have found with the tools you sent for treatment. Even if the cryo treatment makes the irons worse, give it to me straight, without regard to the money already spent; after all, that is what I count on *Popular Woodworking* for.

Paul R. Bruzinski  
Albany, New York

*I've been using the items we had treated to see if there's a difference. My unscientific conclusion is that it has helped some items and not others. The high-quality tooling (that was probably heat-treated really well at the factory) hasn't shown much difference. But the low-quality stuff (like some cheap chisels) now wear longer.*

The other factor to consider with irons for hand planes is that some say A2 won't take the keen edge that O1 (high-carbon steel) will. I can't tell any difference. I can get A2 as sharp for woodworking. Maybe there's a difference at the microscopic level, but not that I can tell.

Bottom line? Keep your A2 cryo stuff. A good cryo lab will correct any heat-treating problems during manufacturing and ensure your blades are as durable as they can be. Should you buy all cryo stuff? It doesn't hurt (the upcharge is minor), but the No. 1 consideration with edge tools is always buy the best quality you can afford, regardless if it's A2, O1 or something more exotic. **PW**

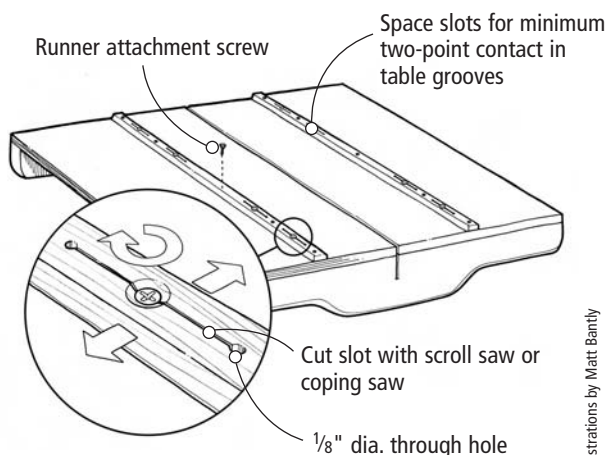
—Christopher Schwarz, senior editor

# Adjustable Runners for Jigs and Fixtures

## THE WINNER:

Many table saw jigs, such as crosscut sleds, use runners that slide in miter gauge slots. Fitting the runners can be challenging because the jig's accuracy depends on a close but sliding fit. The runners also can wear in time, ruining their fit. However, you can simplify the fitting and maintenance of runners by incorporating built-in adjustment slots.

Using a hard, straight-grained wood such as white oak, first size the runners for an easy sliding fit in their grooves. Then lay out at least three 2"-long adjustment slots in each rail so that at least two of them will always rest in the miter gauge slot in use. In the center of each slot location, drill a clearance hole and countersink to accept a #6 flathead screw. Then bore a  $\frac{1}{8}$ "-diameter hole 1" to either side, as shown in the drawing. Complete the adjustment slots by using a scroll saw or coping saw to connect the holes.



Adjustment slot detail

Illustrations by Matt Bantly

Drill and countersink additional holes for screwing the runners to the jig. (Don't count on the slot adjustment screws for attachment.) Then screw the runners to the jig without glue. After installing #6 screws in the adjustment slots, wax the runners, then fine-tune their fit by tightening the screws to expand them as necessary to remove any slop in the runner.

Mike Callihan  
Burnsville, North Carolina

*continued on page 20*

## CASH AND PRIZES FOR YOUR TRICKS AND TIPS!

Each issue we publish useful woodworking tips from our readers. This issue's winner receives a finish-sanding kit from **Fein Tools**, including the Turbo III vacuum and a MSF 636-1, 6" right-angle sander. Next issue's winner will receive a **Grizzly G0555 14"** band saw. This fantastic band saw has two speeds, a 1-horsepower motor, upper and lower ball-bearing blade guides, a precision fence, a quick-tension lever and a 4" dust port. We named this \$375 value as one of the Best New Tools of 2002. Runners-up each receive a check for \$75.

When submitting a trick you must include your complete mailing address and a daytime phone number. You can send your trick by e-mail to [popwoodtricks@fwpubs.com](mailto:popwoodtricks@fwpubs.com) or mail it to:

Tricks of the Trade  
Popular Woodworking  
4700 E. Galbraith Road  
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**Grizzly**  
Industrial



*continued from page 18*

### Crosscut Short Pieces Without Making Missiles

A stop block provides the most accurate and efficient way to crosscut multiple workpieces to the same length. For safety, the “keeper” section of the workpiece is normally held firmly against the stop block and fence, with the “offcut” unrestricted on the opposite side of the blade. However, it’s unsafe to cut short multiples this way because a grip on the keeper piece places your hand dangerously close to the blade.

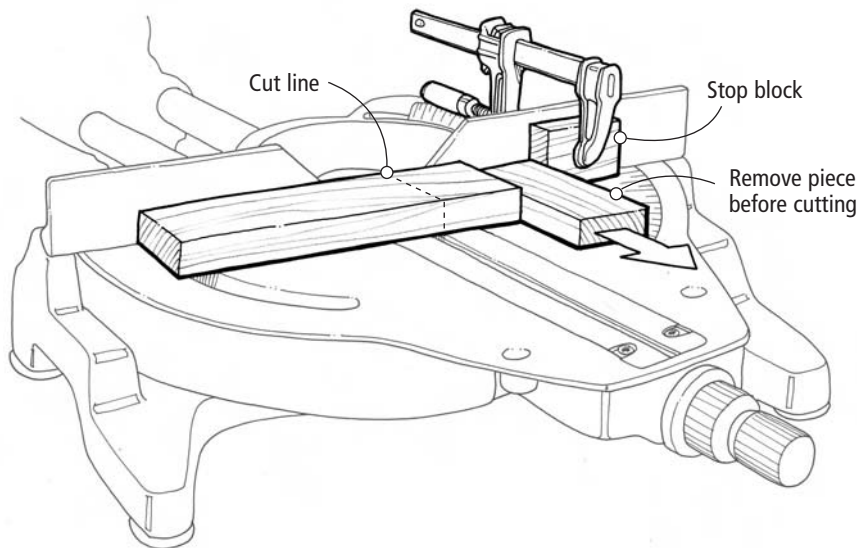
The solution is to use a stop block and spacer on what would normally be the “off-cut” side of the blade, as shown in the drawing. Set up the cut with a spacer stick placed between the workpiece and the properly positioned stop block. Before making each cut, simply remove the spacer stick while holding the workpiece firmly against the saw fence opposite the keeper piece. This will prevent the “offcut” (which, in this case is actually your keeper piece) from pinching between the blade and the stop block during the cut, which can cause it

to be violently thrown. This technique works well on a miter saw, radial arm saw, or on a table saw crosscut sled.

*Bob Howard*

*St. Louis, Missouri*

*continued on page 22*



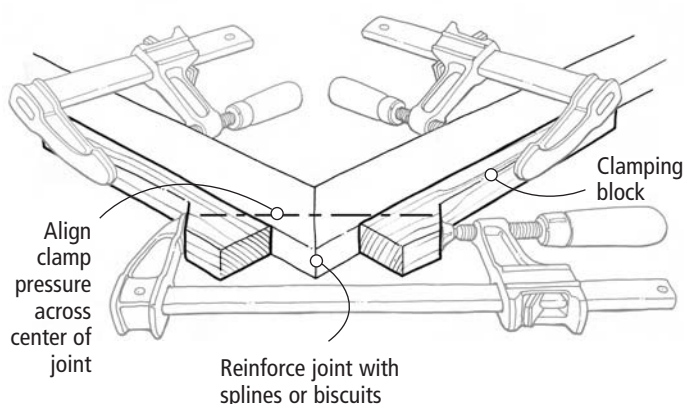


continued from page 20

## Miter Clamping Blocks

Clamping odd angles can be a real challenge because the clamping surfaces don't provide parallel faces for clamp purchase. The answer is to make clamping blocks with ramped faces that run parallel to the joint line (45° as shown below). Clamp the long section of each block to its workpiece so that the clamping pressure will be centered across the assembled joint. Splines or biscuits keep the faces of the workpieces aligned and provide the reinforcement necessary for a miter joint.

Fred Matlack  
Emmaus, Pennsylvania



## Shimming with Shavings

The round tenon on a rung for your stool project is a tad loose. What to do? If you glue it up as-is, it will work loose in time. The same problem occurs in re-gluing old joints when making repairs. By the time you've cleaned off the old glue, the fit is loose. The difference between a loose fit and a good fit is measured in thousandths of an inch. The material for a fix is right at hand (or right at your feet) in a wood shop. Plane shavings make the perfect shim for wrapping a loose tenon. Apply a thin layer of glue to the tenon, wrap it with a shaving and you'll have a much sweeter fit. Shavings also work well to fix the fit of rectangular tenons.

Ric Hanisch  
Quakertown, Pennsylvania

## Anti-marring Clamp Pads

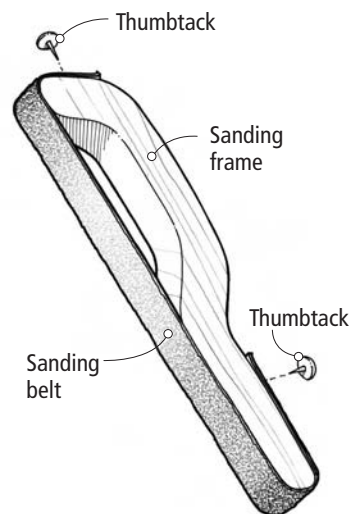
Pipe clamps really benefit from soft pads on the clamp faces. The pads help prevent the clamps from marring your workpiece and slipping during glue-ups. But commercially available rubber pads are too expensive for a frugal (my friends pronounce it "cheap") woodworker like me. I've found that a great alternative is to attach scraps of 1/8"-thick leather to my clamp faces using contact cement.

Anthony Lias  
Sonoma, California

## A Hand-held Strip Sander

I made this handy sander from a scrap of wood and a 1"-wide sanding belt that broke prematurely. The sanding frame is made from a piece of 7/8"-thick maple about 11" long and 2" wide. Attach the belt to the handle with a few thumbtacks, leaving it a bit loose for sanding curves or turnings using the slack section of the belt over the handle's curved section. By holding the curved section of the frame, I can use the straight section as a sandpaper file.

Joe Hurst-Wajszczuk  
Westminster, Colorado



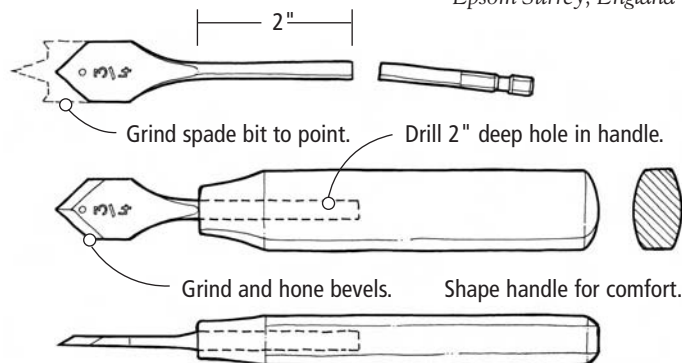
## A Bit of a Marking Knife

If you enjoy making your own tools, as I do, here's a good-quality marking knife you can create from a humble used-up spade bit and a small scrap of wood.

To make the knife, begin by grinding a 3/4" spade bit to a V-shaped tip as shown, then grind the bevels on one face of the bit. When grinding, quench the metal occasionally in water or oil to prevent bluing it and drawing the temper. Then hone the bevels and opposite face of the bit to a mirror polish on sharpening stones. Then use a hacksaw to cut the round shank about 2" long.

To make the handle, first cut a piece of stock to about 5/8" x 1" x 5". (Here's a chance to use some of that exotic scrap you've been hoarding.) Drill a 2"-deep hole into one end, then shape the handle for a smooth, comfortable feel. Epoxy the shank into the handle and – voila! – you've got a beautiful, functional marking knife that probably will outlive you. **PW**

Peter Giolitto  
Epsom Surrey, England



# Two Unsung Heroes

While these “tools” are within arm’s reach of almost every woodworker, we don’t often talk about the value of good glue and stout bar clamps.

In the old days, “glue” meant white glue. Most woodworkers now use aliphatic resin glue (yellow glue) because it cures fast. Years ago we switched to cross-linking polyaliphatic glue – Titebond II. It’s a little stronger than regular yellow glue and water-resistant.

In fact, we use Titebond II more than any other glue. It gets tacky fast to speed assembly, and it’s stronger than the wood itself. Most modern glues are stronger than the wood, but Titebond II offers a higher bond strength quicker than other glues (more than 200 pounds of strength in three minutes).

The five-minute assembly (open) time isn’t always a benefit. When assembling a

large case piece we use Titebond II Extend, offering 15 minutes of assembly time or more.

We also prefer yellow glues for their visibility. While a clear-drying glue hides better, we’d rather see the glue so we can clean it or sand it off before it spoils a stain.

And then there’s the benefit of the glue’s water resistance. While that’s not usually a concern for furniture construction, it’s easier not to have to worry about switching glues if you’re building something that may spend some time outside.

Titebond II is a great woodworking glue, and it continues to stand the test of time in the *Popular Woodworking* shop.

We’ve had Bessey Tradesmen bar clamps hanging on the ends of our benches for more than eight years. We don’t think about them much because they’re always handy and always do exactly what we ask.

These aren’t the least expensive bar clamps out there, but you get what you pay for in this category (and many others).

Tradesmen medium-duty clamps come in two throat depths, (2½" and 4") and are built around galvanized profiled rails (either ⅝" x 1" or ¼" x 1" rails, depending on throat depth). The rails themselves are serrated on either side. The serrations lock into the cast-iron arms in a cam-style grip. These clamps give a strong, solid hold without slippage. You might think that these serrations biting into the cast iron would wear the clamp, but they still hold as well as day one.

Large wood handles and oversized threads on the screws make it fast and easy to tight-

en and release the clamps. The large jaw faces are protected by non-marring plastic caps that stay on when necessary and snap on and off easily as required. Amazingly we haven’t lost more than a couple of pads in eight years.

We prefer the extra reach offered by the 4" throats, but there’s a place for the 2½" clamps as well. Overall, these clamps apply more than enough pressure (up to 600 or 880 pounds of pressure, again depending on the throat depth) for any woodworking task. There’s never a concern of the bars flexing during a glue-up and they’re virtually maintenance-free.

You can save a few bucks and buy a similar bar clamp; but honestly, we’ve found these Bessey clamps to be worth every penny. Stout and reliable, you might not think about them often, but when you need a clamp, they’re always ready. **PW**

— David Thiel, senior editor



Photos by Al Parrish

## SPECIFICATIONS

### Titebond II

**Street price:** 8 oz., \$4  
16 oz., \$6  
Gallon, \$20

**Nice features:** “Just right” open time; not too thin, not too thick; excellent strength and a really nice no-clog spout design.

**Recommended modifications:** Self-closing lid, in case I forget!

**For more information:** Contact Franklin Adhesives at 800-669-4583 or titebond.com.



## SPECIFICATIONS

### Bessey Tradesmen Bar Clamps

**Street price:** 2½" x 12", \$12  
4" x 12", \$21

**Nice features:** Strong, no-slip design. Reliable and easy to care for.

**Recommended modifications:** Round handles can slip in your grip. A faceted handle would offer more grip strength.

**For more information:** Contact American Clamping at 585-344-1160 or jamesmorton.com

### ABOUT OUR ENDURANCE TESTS

Every tool featured in this column has survived at least two years of heavy use in our shop here at *Popular Woodworking*.

## Fein's Turbo III Vacuum a Whisper-quiet Performer

Seven years ago I assumed all wet/dry vacuums were similar in quality, performance and ear-splitting volume. But when Fein Power Tools stopped by to show off a new random-orbit sander and vacuum, I discovered that not all vacuums are the same.

Since that time there have been a few versions of the Fein vacuum, culminating in the current Turbo III model shown here. It's a little larger (14.5 gallon dry capacity), more powerful (125 cfm suction), impossibly quiet and still competitively priced compared to other high-end shop vacuums.

With the auto-tool trigger, this vacuum is designed for more than keeping the shop tidy at the end of the day. In fact that's probably the least of its chores.

The Turbo III, with its 5-micron filter, keeps our shop tidy before the dust hits the air. By hooking the vacuum to any number of dust-creating tools you can remove much of the unhealthy dust from the work process before it enters your shop or lungs.

Plug a tool into the outlet on the vacuum

and the Turbo III will switch on automatically when you start the tool. The low noise (a pleasant 57.8 dB) will actually catch you off guard the first couple of times. I've had to turn the tool off to make sure the vacuum was running – it's that quiet. When the tool is switched off, the vacuum runs for another few seconds to clear debris in the hose.

You can easily turn the vacuum on manually using the sealed switches. The 16' rubber cord gives you lots of room to travel, and the 10' vacuum hose is built to take abuse.

Oh, and if you just need to clean the workbench, shop or car, this vacuum has more than enough power to handle those tasks. If you want to go a little further and vacuum the house, Fein offers a vacuum wand and brush attachment for another \$60.

OK, \$260 is a lot for a shop vacuum by itself, but when you consider the Turbo III as an integral air filtration tool for your shop, it's actually well priced.

—David Thiel

For more information, circle #162 on Free Information Card.



Photos by Al Parrish

### SPECIFICATIONS

#### Fein Turbo III Dust Extractor

**Street price:** \$259 - \$285

**Motor:** 10 amps

**Features:** 57.8 dB at 3½ ft.; 14.5 gallon (dry) capacity, 12 gallons (wet); 5 mic. filtration; auto on/off function; 125 cfm air flow; 105" static water lift; 36 lbs.

**Performance:** ●●●●○

**Price range:** \$ \$ \$ \$ \$

Fein Power Tools: 800-441-9878 or feinus.com

## Akeda Dovetail Jig Proves Adjustment-free

Most of my experience with dovetail jigs included a great deal of fussing to set things up accurately. So Akeda's boast of being a "variable pitch dovetail jig that's completely free of adjustments" sounded a little too good to be true. Well, I was wrong.

The jig comes fully assembled from the factory. Once it's out of the box, there's some required reading to understand the principle of the jig, but the mechanics are simple and nearly foolproof. In use, the pieces to be machined are held in place against either vertical or horizontal clamping bars that are tightened with a removable handle.

Pin and tail guides are simply snapped in place where you want them. By adjusting a dovetail bit in your router, you can go to town making half-blind dovetails all day long. With a simple bit change you can make through-dovetails with similar ease.

Even without making test pieces (I'm impatient) the Akeda jig cut tight, excellent dovetails. Understanding the pin and tail snap-in system has a learning curve, but after one drawer I felt confident enough to put

aside the instruction book and grab the router.

The basic Akeda jig provides everything you need (including a 7/16" router template guide) for 7° through- and half-blind dovetails with adjustable spacing in 1/8" increments. You can buy optional accessory packs to expand the variety to 9°, 11°, 14° and 20° dovetails. You also can make sliding dovetails and box joints with the jig with the proper accessories.

Another optional accessory pack allows you to hook a shop vacuum to the jig, which makes routing dovetails tidier.

This is an accurate, easy-to-use dovetail jig that offers a good range of design versatility. At \$299 (\$550 with all the accessories) you get no-hassle joinery with a lot of options for a pretty reasonable price. —DT

For more information, circle #163 on Free Information Card.



### SPECIFICATIONS

#### Akeda DC-16 Dovetail Jig

**Street price:** \$299

**Joints:** Through, half-blind

**Capacity:** Max 16" wide and 1" thick

**Spacing increment:** 1/8"

**Dovetail angles:** 7°

**Performance:** ●●●●○

**Price range:** \$ \$ \$ \$ \$

Akeda Jigs: 877-387-6544 or akedajigs.com



## Veritas Apron Plane

A good block plane should be precise, durable and always within arm's reach. The new Veritas apron plane is all three. The plane's adjustment mechanism allows exact adjustments to both the depth of the cut and the iron's parallelism to the plane's sole. The body is made of unbreakable ductile iron. And the plane's delightful small size (5½" long) allows you to tuck it in your apron.

The plane is reasonably priced at just a few dollars more than the inaccurate mass-produced planes we're all used to. If you've been suffering with a poorly made block plane, here's an excellent opportunity to remedy the situation.

— Christopher Schwarz

For more information, circle #164 on Free Information Card.



### SPECIFICATIONS Veritas Apron Plane

**Street price:** \$59  
(\$67 with A2 blade)  
**Weight:** 14 ounces  
**Bedding angle:** 12°  
**Performance:** ●●●●○  
**Price range:** \$ \$ \$ \$ \$  
Lee Valley Tools:  
800-871-8158  
or leevalley.com

## Makita's Built-in Light Jigsaw

Do you need a light on your jigsaw? Well, maybe not *need*, but it's actually pretty handy. Even in some of the best-lit situations, the cutting area in front of the blade can be dark. While the light on the 4341FCT Makita isn't dazzlingly brilliant, it does a nice job of illuminating this shadowy area.

Along with the LED lifetime bulb, Makita has designed a saw with the highest-ampere motor in the category and included electronic speed control to provide constant power. Makita also upgraded its blade-changing system with a nice combination blade shield/release lever, which makes blade changing toolless.

At \$170 it's priced near the top of the category, but this is a nicely designed and powerful saw that answers all your jigsaw needs – and adds a light. – DT

For more information, circle #165 on Free Information Card.



### SPECIFICATIONS 4341FCT Makita Jigsaw

**Street price:** \$170  
**Features:** 6.8-amp motor,  
800-2,800 strokes per minute,  
1" stroke length, four-position  
orbital cut, electronic speed  
control, toolless blade change  
**Performance:** ●●●●○  
**Price range:** \$ \$ \$ \$ \$  
Makita: 800-4MAKITA  
or makita.com

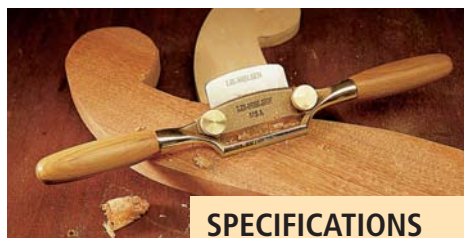
## Lie-Nielsen's Boggs Spokeshave

Lie-Nielsen Toolworks, with the assistance of chairmaker Brian Boggs, now makes a new spokeshave that puts most modern shaves to shame.

Thanks to the heavy 12-ounce bronze body, you can focus more on your angle of attack than on just keeping the tool to the work. And the ⅛"-thick A2 blade – held in place by thumbscrews and a massive bronze cap – makes chatter unlikely. The thoughtfully designed body ensures your thumbs will find comfortable places to rest while either pushing or pulling the tool.

At \$125 this is likely the most expensive spokeshave on the market. But because it blows away every new \$25 shave, we consider the Boggs spokeshave a wise investment. – CS

For more information, circle #166 on Free Information Card.



### SPECIFICATIONS Boggs Spokeshave

**Street price:** \$125  
**Body:** 10" long, 12 ounces  
**Blade:** 2" wide A2 steel  
**Performance:** ●●●●●  
**Price range:** \$ \$ \$ \$ \$  
Lie-Nielsen: 800-327-2520  
or lie-nielsen.com



## NEWEST IN DOWELING

The Miller Dowel is a darn clever idea that can make some kinds of joints faster and easier. Essentially, the stepped-dowel concept offers the strength of a standard dowel, with the ease of a tapered dowel. Alignment and splitting difficulties often associated with standard dowels are no longer a concern, while the strength offered is actually better than with a standard dowel thanks to the ribbed design (increasing glue coverage).

These stepped dowels also can be used to replace screws in many applications – think of it as a self-plugging screw. For outdoor work, stepped dowels remove the worry of rust from exposed screws. For finished furniture it can be a step-saving feature with good strength. How about knockdown furniture?

We're going to stop short of advocating Miller Dowels as a replacement for all screws. While the strength is excellent, they still won't pull up an ill-fitting joint like a screw will. It's also not quite as cost effective. A pack of 50 dowels (2¾" or 3½" in length) and the necessary bit will run about \$30. Packs of 25 dowels run about \$7. That's about 28 cents per dowel versus 4 cents per #20 biscuit, and about 8 cents per premium screw.

Cost aside, we like the idea of an all-wood, strong and simple joint. The dowels are available in birch, red oak, cherry and black walnut, and more weather-resistant species are on the drawing board. Miller Dowel, 866-WOODPEG, or millerdowel.com. – DT

### TOOL RATINGS

Performance is rated on a one-to-five scale, with "five" indicating the leader in the category. Five dollar signs in "Price range" means highest in the category, with three indicating an average price. If you have other tool questions, call me at 513-531-2690 ext. 1255, or e-mail me at david.thiel@fwpubs.com. Or visit our web site at popularwoodworking.com to read previous tool reviews and sign up for our free, bimonthly e-mail newsletter.

—David Thiel, senior editor

## Shapton Stones a Great Leap Forward in Sharpening

Shapton sharpening stones are so good at rapidly producing a mirror finish on your edge tools that it feels like you are using alien technology. In fact, Shaptons have almost everything you could wish for in a sharpening system: They cut as fast or faster than Japanese waterstones, but they wear slowly like an oilstone. You don't even need to soak them in water before use – just a splash and you can go to work immediately.

Shaptons, which have been sold in Japan for 20 years, were developed by Nobuaki Ishida initially for sharpening cutlery. The latest generation of stones, the "Professional Series," has been available in this country for only about a year. Shaptons are made by pressing ceramic material into a binder that's sort of like a glue. Because Shaptons are pressed into shape instead of being baked like other man-made stones, they are not porous and don't absorb much water. That's why you don't have to soak them before use.

For the last three months we've been using the Shapton "Professional Series" stones

to tune up every edge in our shop. The orange #1,000 stone is great for getting out small nicks in blades and minor edge shaping. (For major edge problems, a grinder or the #120 stone is the better choice.)

Then you can go right to the purple #5,000 stone and get a mirror finish with just a dozen strokes. For most chisels, you can stop there. But for plane irons and tools that need to be dangerously sharp, you must try the green #8,000 stone. Unlike other Japanese 8,000-grit stones, this one doesn't require you to build up a slurry with a Nagura stone. A little water and then you go to it.

You can flatten the Shaptons with a lapping plate and lapping powder (also made by Shapton), which works quite well. We also had good luck flattening them on DMT's extra-coarse diamond stones.

These stones cost more than other sharpening systems. But as far as I can see, these stones cut better and wear longer than any other system we've tried. – CS

For more information, circle #167 on Free Information Card.



### SPECIFICATIONS

#### Shapton "Professional Series"

**Prices:** #1,000: \$49  
#5,000: \$76  
#8,000: \$95  
Lapping plate: \$120  
Lapping powder: \$15 to \$20  
Chisel sharpening DVD: \$30

**Performance:** ●●●●●

**Price range:** \$ \$ \$ \$ \$

JapaneseTools.com: 877-692-3624  
or shaptonstones.com

## Delta Variable-speed Drill Press: The Way Things Ought to Be

Let's all hope that the two new drill presses from Delta Machinery are a sneak peak at the way all drill presses will someday be made.

Both of these benchtop machines (the DP250, a 10" model, and the DP350, a 12" model) have a variable-speed knob on the front rather than the traditional belts and pulleys on most drill presses. To change the speed of these two drill presses anywhere between 500 to 3,100 rpm, here's what you do: Turn on the machine and turn the knob to the correct speed. Yes, that's all.

There are no belts or greasy pulleys to mess with. Until this year, this was a feature found only on professional floor models.

We've been using the DP350, the 12" model, for about six months now, and we're impressed. While the speed-changing mechanism is a little stiff at times, we suspect that it's a quirk of the machine we tested. We've tried out some other DP350s and found them to be smoother. Even with the stiffness, it's a world easier to change speeds than with a traditional drill press.

Another feature we like – but were sus-

picious of at first – is the depth stop. The DP350 uses a threaded rod that's similar to the rod on drill presses that use two nuts to limit the depth of travel. Instead of two nuts, the DP350 has a single nut that has a button. Press the button and the nut slides. Release the button and the nut sticks in place. We were concerned that it would be too coarse of an adjustment, but it wasn't.

The 1/3-horsepower induction motor has enough power for most woodworking tasks. We bored lots of 1"-wide mortises with this rig and could not stall the machine or bog it down significantly.

And lastly, I have to mention the light. The machine's light is on a gooseneck attached to the side of the head; it's a real nice feature because you can move it easily and it's always there.

In a world where most consumer-grade drill presses are mere clones of each other, it's encouraging to find someone is finally fixing a nuisance that has been annoying woodworkers for decades. **PW** – CS

For more information, circle #168 on Free Information Card.



### SPECIFICATIONS

#### Delta DP350 Drill Press

**Street price:** \$200-\$250

**Chuck:** 1/2"

**Table size:** 9 1/2" x 9 1/2"

**Motor:** 1/3 horsepower, 1,720 rpm

**Weight:** 78 lbs.

**Performance:** ●●●●○

**Price range:** \$ \$ \$ \$ \$

Delta: 800-438-2486 or deltamachinery.com



# Legendary Rocker

Sam Maloof, a world-class craftsman, has a new location for his shop but the same dogged attitude toward his work.

Most woodworkers are aware of who Sam Maloof is. The son of Lebanese immigrants, Maloof turned his skill for graphic design and a passion for woodworking into a career that has made him one of the most sought-after and successful craftsmen in the world. His signature pieces – sculpted chairs and rockers – are made using intricate joints and have lines that draw you from one detail to the next, while the shape invites you to sit in perfect comfort.

What many woodworkers don't realize is that Maloof now has a new shop. His old shop in Alta Loma, Calif., was relocated because his shop of 50 years was in the way of progress – or more correctly, in the way of the 210 Freeway. Because of Maloof's stature, the

Sam Maloof strikes a pose with a love seat in mid-construction. The piece includes his trademark sculpted appearance with hard and soft lines blended together into seamless elegance.



Photo by Gene Sasse

property was considered worthy of preservation, and the house and shop were moved intact to a new location three miles north of the original site. The shop space continues in use, while the original house now serves as a gallery and museum, displaying a dizzying array of pieces from throughout Maloof's career, as well as a glimpse into his 50-year marriage with his late wife, Alfreda.

On the day before his 87th birthday, Maloof took time out of his hectic schedule to lead a tour of his new workshop, home and lumber-storage facilities. During the tour, what was striking was that despite his fame and success, Maloof even today still simply thinks of himself as, "Just a woodworker."

The iconographic Maloof rocker has been made for presidents, celebrities and captains of industry. Made in a variety of woods, the form itself has changed continuously. Maloof allows each piece to form as he works on it, using only templates to guide his rough work. The finished shape is guided by an experienced eye and talented hands.

## Sam and the Boys

Though acknowledging his advancing age, Maloof continues to have an active part of every piece of furniture. "Any of the boys (his three employees) can do what I do," he says. "But I just don't want to walk out and do nothing. I'd die! So I still work."

The "boys" are Larry White, Mike Johnson and David Wade. White was 19 and looking for a summer job in 1962 when he became Maloof's first employee. He spent seven years with Maloof then went out on his own. In 1992, events conspired to allow White to come back to work with Maloof.

Johnson was an industrial arts major in college when he and his wife saw Maloof at a local mall. His wife encouraged him to go talk to Maloof, which he did. It just so happened that Maloof had a job opening and told him to stop by. That was in 1981 and Johnson has been with Maloof since.

Wade, a journeyman craftsman with Maloof's operation since 1989, liked working with wood in high school. One day a girl in a class noticed the parts to a project of his stashed under his desk.

"If you like wood," she said to Wade, "you should meet my grandfather, Sam Maloof." Well the budding woodworker knew a good thing when he saw it and is now a solid member of the Maloof shop.



## Always After Amazing Wood

Maloof always has been picky about who works in his shop – just like he is picky about his wood. After a visit to his shop you can see how it is a never-ending obsession.

Maloof's pieces are made predominately from walnut, though maple and zircote are also strong sellers. While beautiful, Maloof doesn't really like working with zircote because of the toxic dust.

Right before lunch that day, a local landscaper stopped by to chat with Maloof. He was taking down some Torrey pines (five or six feet across and maybe 100 feet straight). He'd found trees for Maloof in the past and wanted to know if he wanted these. Sure, Maloof says, and they worked out the arrangements. But Maloof also brought up a particular walnut tree he'd seen and wanted to know when he could get that one. The tree wasn't scheduled to come down any time soon, but Maloof knew where the good wood was, and he was keeping his eye on it.

Of the buildings on his property, two are dedicated to lumber storage, and Maloof is currently overseeing the construction of a third. He designed the new structure with a peak to mirror the San Gabriel mountain peaks looming directly behind the building.

The wood storage sheds hold thousands of board feet of quilted maple, figured walnut, rosewood, ebony and zircote. It's more than most woodworkers could use in a lifetime, but not Maloof. "Those pieces, you can see how wide they are (five-feet wide and easily 2" thick), those are beautiful. They're fiddleback walnut, and I'm making a dining table for the kitchen in the other house and the other will be a conference table."

## Building a Maloof Piece

David Wade describes the process in making a piece of Maloof furniture. "Sam does all the sculpting on the band saw, does the joinery and the wood selection and puts everything together. But it's a continual back-and-forth process. He'll put a seat together, then I'll get it and carve out the shape, then it goes back to him. He puts the back legs on, then it goes to Mike or Larry and they start shaping it. When that's shaped it goes back to Sam and he'll do the arms. Everyone gets their hands on it."

The process starts in one of the wood stor-



In "Sam's shop" (more accurately the machining room) templates for a dizzying array of chair designs line the wall. Standing at the ready is a 20" planer, 12" jointer and tucked in the left of the photo is a Laguna 20" band saw, one of four band saws currently in the shop.



On the opposite side of the room above is a 12" table saw and heavy duty shaper. More templates adorn the walls (they're fixtures in most of the rooms) and a chalkboard and props stand at the ready for weekend lectures where Maloof walks attendees through the construction processes of one of his chairs.

age rooms with Maloof picking 5"-to-7" width, 8/4 material for the seats in the rough. Backs will be 12/4 or 14/4. Maloof heads straight to the band saw to cut the lumber to size, then lays out the pieces using one of the hundreds of patterns hanging in the shop.

Maloof rough-sculpts the pieces on the band saw. He also will use the templates as shaping patterns, nailing the template to the piece, then heading to the shaper and using the template to guide the shaper as with a flush-trimming router bit.

"It would take me a lot longer if I didn't cut them out like I do on the band saw (free

handing the large chunks of wood rapidly through the machine)," Maloof says. "I can make a couple items in 15 minutes, but if I were doing it all by hand it would probably take me four or five hours." But he doesn't recommend his freehand shaping method because of the safety factor. "I didn't know any better when I started ... It's sorta dumb. You can say that, too. It's sorta dumb."

He's had his choice of band saws throughout the years, working his way up from a 14" cast-iron Rockwell band saw with an extension block, to his current 32" Agazzani.

"I use machines wherever possible," Maloof





In the assembly room you pass a rack full of clamps. Pipe, bar and C-clamps are organized and handy. While none are brand new, all are in good shape even after years of use.

says. "But I'd say 90 percent of it is hand work. You can't do it with a machine. There's no way. There isn't a machine made that would do the things that we do by hand. It's very time-consuming... but we don't let anything out of the shop that we don't like. We'd rather cut it up and throw it away."

With the pieces roughed, the rest is shaping. Wade explains this part of the process:

"There's a lot of detail work, a lot of shaping to get the hard lines established. And then sanding from there. We use pneumatics, files and Nicholson #49, 10" rasps. The Dynabrade's really helpful for sanding, and we use electric quarter-sheet sanders. (There's a) lot of hand sanding. We've made foam blocks in different shapes that we use to get into the curves."

Wade recommends Klingspor sanding products, saying they seem to cut better than any other papers they've used, last longer and don't load up as much. With all the sanding that goes on, they rely on air cleaners and attic fans to keep things clean. On Fridays the shop gets a thorough cleaning. Wade says he's even resorted to a yard blower.

## Finishing Remarks

The last step is putting on the finish. Maloof developed a two-part finish 50 years ago and continues to use it on all his pieces. The first step is the poly-oil (one-third semi-gloss urethane, one-third raw tung oil and one-third boiled linseed oil). The second step is wax-oil (same as the first mix, but leaving out the urethane and adding a couple handfuls of shredded beeswax per gallon to the mixture. This is heated in a double-boiler until the wax melts).

You can buy Maloof's finishes pre-mixed from Rockler ([rockler.com](http://rockler.com)). That's what's on his shelves, and that's what they use.

"Four coats of the poly-oil, and one coat with the wax-oil and it gives it a nice sheen," Maloof says. "It's a friendly finish. It's real easy to apply, just rub it on and rub it off. No need for a spray booth. It's friendly down the road, too. If you do have a dent or a cup ring or something, it's easy to repair."

The Maloof team works a standard 40-hour week, but the guys also help out with Maloof's Saturday workshop lectures.

"I know a lot of people, very good friends of mine, that just think I'm crazy doing what I do, as far as giving workshops," Maloof says. "They say, 'You don't owe anybody anything, you've been doing it for so long.' But I still enjoy giving workshops, I like to share what I do. I don't have any secrets."

Maloof's past is all around him, with many pieces coming back to his shop for repairs or on their way to museums. Though Maloof has a lifetime of experiences already, his zest for life has not decreased. He remarried a lit-



In the fitting room, Johnson (at left) and White use a variety of hand sanding and sculpting tools to final-fit the pieces. A 14" band saw stands handy, and a large and small lathe are available for any turning needs. The photo above shows the lathe tools and some spindles ready to be fit into the back splat.



In the assembly room, more templates dot the walls, while partially assembled pieces wait for the next step. A 10" cabinet saw sits amidst rough-sanding machines, including an edge sander, large disc sander, spindle sander and contour sander.



## MALOOF FOUNDATION

The Sam and Alfreda Maloof Foundation, established in 1994, is committed to creating a pre-eminent center that preserves the Maloofs' legacy and fosters the arts and crafts movement. The work of the foundation recognizes the ever increasing role of the crafts in our world of machine-made products – the reconnecting of human values with natural forms and materials.

A principal responsibility of the foundation is protection and conservation of the art, furnishings, structures and grounds entrusted to it. The foundation is also making the Maloof Center available to the public, artists and researchers, and developing a variety of programs, including visiting craftsmen, workshops and arts and crafts exhibits.

Sam Maloof continues to create furniture at the new site and add to his fine art collection that encompasses work from all media, including many renowned artists such as Maria Martinez, Millard Sheets, Paul Soldner, Kay Sekimachi and Bob Stocksdale.

Friends' contributions help conserve and maintain the foundation's art collection, structures and grounds, as well as support foundation programs that seek to create an awareness of the way in which crafts enrich our culture.

To learn more about becoming a member of the Maloof Foundation, or to get tour information, contact them at:

P.O. Box 397, Alta Loma, CA 91701  
909-980-0412

or e-mail at [Malooffoundation@earthlink.net](mailto:Malooffoundation@earthlink.net)

To learn more about Sam Maloof's remarkable life and his woodworking, visit his web site at [sammaloof.com/gallery.htm](http://sammaloof.com/gallery.htm). Or we suggest:

"Sam Maloof, Woodworker"

by Sam Maloof

Published by Kodansha International

"The Furniture of Sam Maloof"

by Jeremy Adamson

Published by The Smithsonian  
American Art Museum



Left to right: Larry White, Mike Johnson, Sam Maloof, David Wade, Slimen Maloof (Sam's son) and business manager Roz Bock.

tle more than a year ago, and to who else, but a former customer.

Maloof had built a dining table for a couple early in his career and throughout the years they'd stayed in touch. Beverly and her husband had divorced over time, and then Maloof's first love, Alfreda, "had to leave" as he explains her 1998 death.

Some time later, Beverly "invited me to her house for lunch and I couldn't see the grain through the finish (in the table he'd made). It looked awful. So I told her I'd come

by and pick it up and redo it for her. I did, and I think that's the reason she married me."

Maloof continues to take orders on new furniture pieces and has about a four-year waiting list at this time. With his newly formed Sam and Alfreda Maloof Foundation for the Arts and Crafts (see the story at right for more details), his plate is full, but his work will continue to delight and dazzle generations to come. **PW**

— David Thiel, senior editor

As Johnson and White fit the back splat on a love seat, you might think they're getting close to being done. There's still many hours of sanding and shaping before this piece will bear the Maloof maker's mark.



# Drill Press Mortising Chisel

Simpler is better.  
Way better.

Once upon a time, back before all these funky little benchtop mortisers were available, the only tools worthy of the name “mortiser” were industrial behemoths that looked as if they were welded together from spare tank parts.

For the small-shop guy who wanted to drill square holes, the tool companies offered a “drill press mortising attachment,” an accessory whose name was more of a practical joke than an accurate description of its capabilities. A hollow mortising chisel requires a great deal of pressure to bore a square hole, and most drill presses do not provide the necessary leverage for the job.

However, a drill press does provide enough leverage to cut a mortise with an ordinary chisel. In fact, if we were to go back one more generation of mortising machines, you’d see that 19th-century mortisers looked a great deal like drill presses with chisels in place of bits. You simply placed the chisel over the wood, then used a hand- or foot-operated quill to press the chisel into the wood.

## Making a Mortising Chisel for Your Drill Press

To cut with a chisel mounted in your drill press, the back of the chisel has to be parallel to the axis of the quill. If it isn’t, the cut will drift and your mortises will be angled.

Consequently, one of the best chisels you can adapt to your drill press is one that was designed for it – a hollow mortising chisel. Its back is perfectly true to the action of the quill. You can’t use it as designed, but



Photos by Al Parrish

with a few minor modifications, you can make a useful tool out of it.

Grind away the front and sides of the chisel, leaving just the back. On the chisel shown, I exposed about 2½" inches of the back – I rarely cut mortises more than 2" deep. If you cut deep mortises, you might have to grind more metal. Sharpen the tip

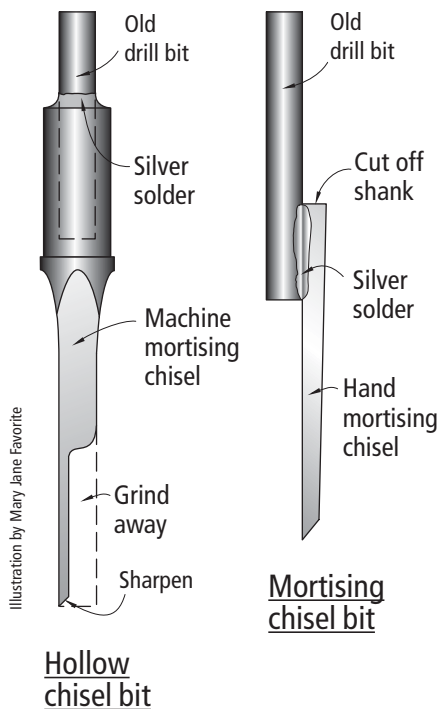
of the chisel as you would an ordinary flat chisel, but increase the angle of the bevel slightly. Bevels between 35° and 40° work best when chopping mortises.

There are two ways to mount the chisel on your drill press. You can use the yoke that came with the drill press mortising attachment, but this will make it difficult to change the orientation of the chisel when you want to switch from cutting the sides of the mortise to cutting the ends. Instead, I prefer to mount the chisel in the chuck so you can rotate it where you need it. I found

by Nick Engler

*Nick Engler, the author of more than 50 books on woodworking, is currently building a replica of the 1903 Wright Flyer, the first true airplane.*





an old drill bit that fit the center hole in the top of the hollow chisel, then secured it in place with silver solder. This created a shank that I could mount in a chuck.

You can also make a drill press mortising chisel from a hand chisel. Cut the shank off the chisel blade, then silver-solder the back of the blade to an old drill bit or a length of drill rod. I used an actual hand mortising chisel – the blade is thicker than an ordinary chisel, and this seems to work better, especially when chopping the ends of a mortise.

### Using the Mortising Chisel

When using these chisels, the first rule is to unplug the drill press. You don't want the press to spin the chisel – it might grab the wood and fling it at you. When the power is disconnected, mount the chisel in the chuck or in the yoke of your mortising attachment.

I remove most of the stock in a mortise by first drilling a sequence of overlapping holes. If the mortise is going to be  $\frac{3}{8}$ " wide, I'll use a  $\frac{3}{8}$ " drill bit. Then I shave the sides and ends of the mortise with the chisel to square the corners.

Lay out your mortises with a marking gauge. The tiny groove that the gauge leaves is a big help when it comes time to align the chisel with the cut. Place the sharp edge of

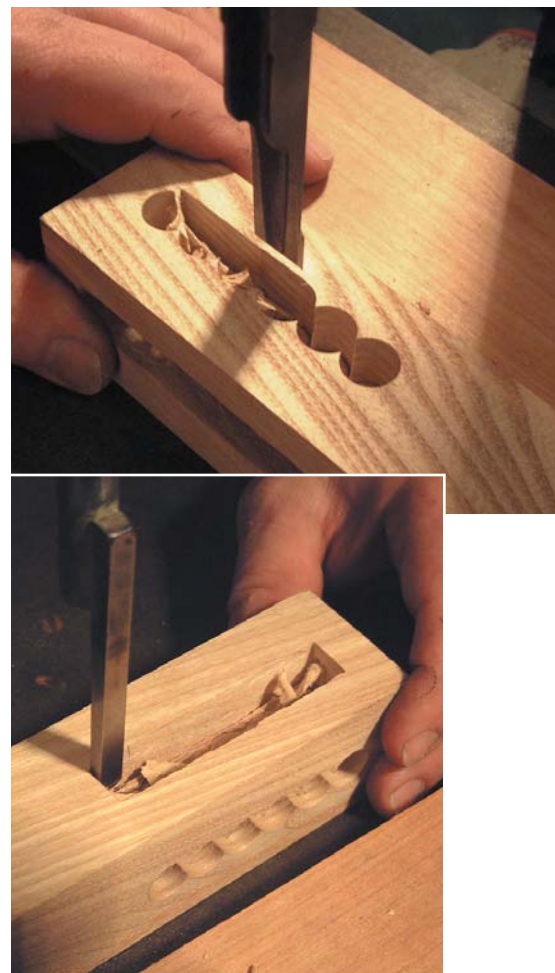


When you silver-solder the parts of the mortising chisel together, imbed the chisel blade in sand. The sand will draw the heat away and prevent it from affecting the temper of the steel. You don't have to use sand from Kitty Hawk, by the way. We just happen to have tracked a lot of the stuff back to Ohio after flying our gliders in North Carolina. I'm betting there was a can or two of this in the Wrights' shop.

the chisel in the groove, then cut down with firm, even pressure on the drill press quill feed. Use the depth stop on the drill press to stop your cut at the bottom of the mortise.

### The Wright Tools for the Job

By the way, the old-time drill press that I used to demonstrate this technique was used to make parts for the 1903 Wright Flyer and other Wright aircraft. Really! It belonged to the Garrison Machinery Works, about three blocks east of the Wright Cycle Co. The Wright brothers employed Garrison to make gears for their engines. We have senior machinist Harold Gaskill to thank for preserving this machine in good working order when Garrison disbanded, and his family to thank for donating it to us. We allow the young people who work with us to use it to build the Centennial Flyer and our newest Wright airplane project, the Friendship Flyer. The Friendship Flyer is being built by kids from Ohio and North Carolina. **PW**



Remove most of the waste from the mortise by drilling a line of holes, then shave the sides and end of the mortise with the chisel. Use a fence to guide the stock when you drill and when you cut with the chisel. This will keep the sides of the mortise straight.



Here you can see the profiles of the two different types of mortising chisels I made.

# Four Good Ways to Cut Rabbets

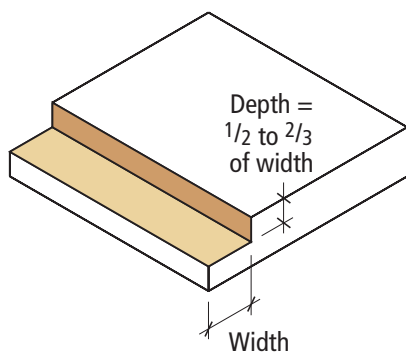
Learn to cut this essential casework joint cleanly and easily with a table saw or a router.

The rabbet joint surely is one of the first ones tackled by new woodworkers. The rabbet is easy to cut, it helps locate the parts during assembly and it provides more of a mechanical connection than a butt joint.

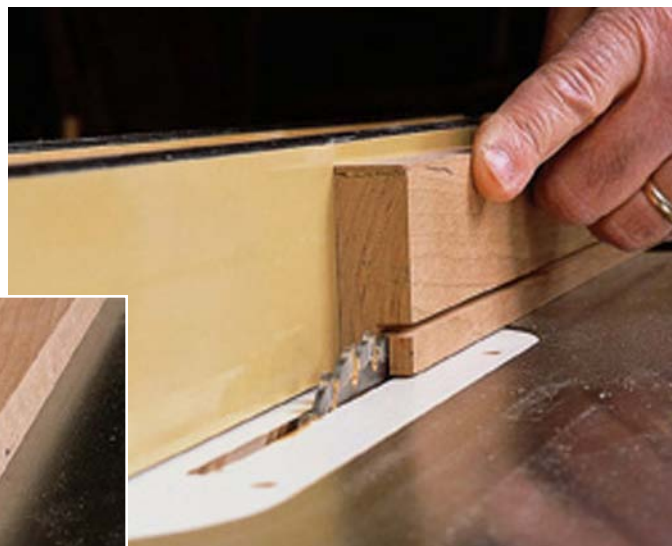
I vaguely remember thinking, back when I was tackling my first home-improvement projects, that with practice I'd outgrow rabbet joints. Well I'm still cutting rabbets because woodworkers never outgrow them.

The most common form is what I call the single-rabbet joint. Only one of the mating parts is rabbeted. The cut is proportioned so its width matches the thickness of its mating board, yielding a flush fit.

The depth of the rabbet for this joint should be one-half to two-thirds its width. When assembled, the rabbet conceals the end grain of the mating board. The deeper the rabbet, the less end grain that will be exposed in the assembled joint.



Saw a rabbet on the table saw in two steps. Set the blade elevation and fence position first to cut the shoulder (above) then adjust either or both as necessary to cut the bottom.



In the double-rabbet joint, both the mating pieces are rabbeted. The rabbets don't have to be the same, but typically they are.

The rabbet works as a case joint and as an edge joint. Case joints generally involve end grain, while edge joints involve only long grain. In casework, you often see rabbets used where the top and/or bottom join the sides (end-grain to end-grain), and where the back joins the assembled case (both end-to-end and end-to-long). In drawers, it's often used to join the front and sides.

Because end grain glues poorly, rabbet joints that involve it usually are fastened, either with brads, finish nails or screws concealed under plugs. (OK, in utilitarian constructions, we don't sweat the concealment.)

by Bill Hylton

*Bill Hylton makes noise, dirt and the occasional piece of furniture in his basement workshop. His book "Chests of Drawers" (The Taunton Press) shows both his shop and his handiwork.*

L-shaped cuts made with or across the grain are called rabbets – whether they are on the end or along the edge of the stock.

We don't necessarily think of the rabbet as an edge-to-edge joint, yet we all know of the shiplap joint. Rabbet the edges of the mating boards and nest them together. Voila!

It's also a great right-angle edge joint. We see this in the case-side-and-back combination, but also in practical box-section constructions such as hollow legs and pedestals. Long-grain joins long-grain in these structures. Because that glues well, you have a terrific and strong joint.

You can gussy up the joint's appearance by chamfering the edge of the rabbet before assembly. When the joint is assembled, the chamfer separates the face grain of one part from the edge grain of the other. Because the chamfer is at an angle to both faces, it won't look inappropriate even though its grain pattern is different.

One important variant is the rabbet-and-dado joint. This is a good rack-resistant joint that assembles easily because both boards are positively located. The dado or groove doesn't have to be big; often it's a single saw kerf, no deeper than one-third the board's thickness. Into it fits an offset tongue created on the mating board by the rabbet.

The rabbet-and-dado joint is a good choice for plywood casework because it's often difficult to scale a dado or groove to the inexact thickness of plywood. It's far easier to customize the width of a rabbet. So you cut a stock-width dado, then cut the mating rabbet to a custom dimension. An extra cutting operation is required, but the benefit – a big one – is a tight joint.

There are lots of good ways to cut rabbets. The table saw, radial-arm saw, jointer and router all come to mind. The most versatile techniques use the table saw and router.

### Rabbeting on the Table Saw

Rabbets can be cut at least two different ways on the table saw. Which method you choose may be influenced by the number of rabbets you have to cut, as well as the sizes and proportions of the workpieces.

It's quickest to cut the rabbets using whatever blade is in the saw. Two passes are all it takes. But if you have lots of rabbets to cut,

or if the workpieces are too big to stand on edge safely, then use a dado cutter. (The latter is especially appropriate if your job entails dados as well as rabbets.) Let's look at the quick method first.

The first cut forms the shoulder. To set it up, adjust the blade height for the depth of the rabbet. There are a variety of setup tools you can use here, but it's always a good idea to make a test cut so you can measure the actual depth of the kerf.

That done, position the fence to locate the rabbet's shoulder. This establishes the rabbet width, so you measure from the face of the fence to the outside of the blade.

The cutting procedure is to lay the work flat on the saw's table, then run the edge along the fence and make the shoulder cut. If you are rabbeting the long edge of a board, use just the fence as the guide. When cutting a rabbet across the end of a piece, guide the work with your miter gauge and use the fence simply as a positioning device. It is easy to set up, and the miter gauge keeps the work from "walking" as it slides along the table saw's fence. Because no waste will be left between the blade and the fence, you can do this safely.

Nevertheless, if you feel uneasy about using the miter gauge and fence together, use a standoff block. Clamp a scrap (your standoff block) to the fence near the front edge of the saw's table. Lay the work in the miter gauge and slide it against the scrap. As you make the cut, the work is clear of the fence by the thickness of the scrap. (Try using a 1"-thick block to make setup easier.)

Having cut the shoulders of all the rabbets, you next adjust the setup to make the bottom cut. You may need to change the height of the blade or the fence position. You may need to do both.



Clamp a sacrificial facing – a strip of luan plywood here – to your table saw fence when cutting rabbets with a dado head. Run the cutter up into the facing, exposing only enough of the cutter to form the rabbet.

Adjust the blade to match the width of the rabbet. Reposition the fence to cut the bottom of the rabbet, with the waste falling to the outside of the blade. Make that cut with the workpiece standing on edge, its kerfed face away from the fence.

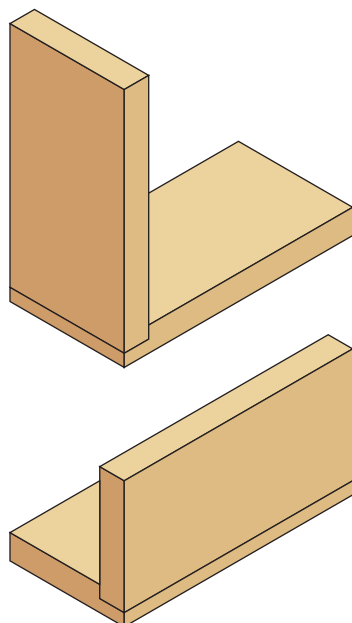
When the workpieces are so large as to be cumbersome on edge – cabinet sides, for example – you want to cut the rabbets with a dado cutter. That way you can keep the work flat on the saw's table. Control the cut using a cutoff box or the fence. It's very easy to set the width of the cut with this approach.

Where the proportions of the workpiece allow it, use the rip fence to guide the cut. Clamp a sacrificial facing to the fence. Don't fret about the width of the stack, so long as it exceeds the width of the rabbet you want. Part of the cutter is buried in the fence facing, and you just set the fence to expose the width of the cutter that's working. Guide the work along the fence.

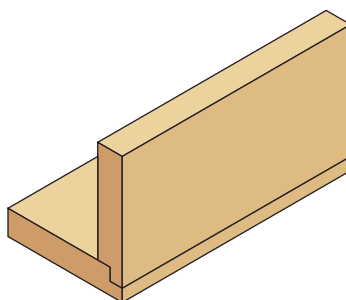
Alternatively, use a cutoff box to support the work and guide the cut. You get the same advantages in rabbeting that you do with dadoing: The work really doesn't move, the box does. Use a stop block to position the work to yield the width of rabbet you want. On the other hand, it may be a little more difficult to get exactly the cut width you want.

### Rabbeting with the Router

The router is an excellent tool for rabbeting, in part because you can deploy it as a hand tool. For some jobs, you just want to



Single-rabbet joints



Double-rabbet joint

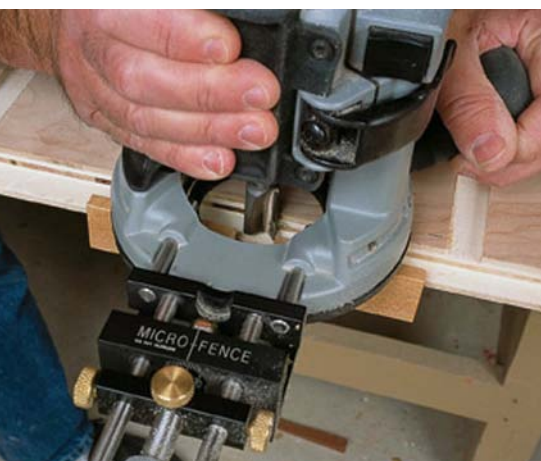


immobilize the workpiece to your bench and move the cutting tool over it. In those situations, the router is the tool to use.

Occasionally, you might want to cut a rabbet into an assembly – perhaps a frame for a door or lid. If you use a router, you can wait until the frame is glued up and sanded, then produce the rabbet for a pane of glass or a panel. You do have to square the corners, but that's simple with a chisel.

A major benefit of the hand-held router approach is that you can see the cut as it is formed. On the table saw (and the router table), the work itself conceals the cut.

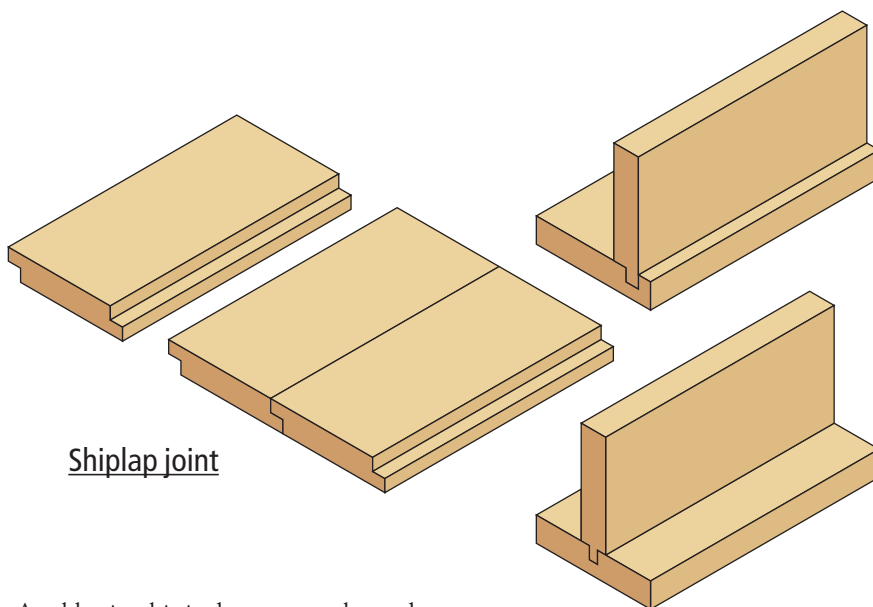
You can cut rabbets on the router table as well, of course. But I want to focus on hand-held approaches here. Cutting a rabbet on the router table is quite similar to doing it on the table saw with a dado head.



With an edge guide and straight bit, you can customize the rabbet's width, forming it in a series of passes.



One bit with a selection of bearings enables you to cut rabbets of many different widths.



Shiplap joint

Rabbet-and-groove  
(or dado) joints

A rabbeting bit is the commonly used cutter, but it is not the only one that will work. If you use an edge guide to control the cut, you can use a straight bit or a planer bit.

The rabbeting bit is piloted, and the typical bit makes a  $\frac{3}{8}$ "-wide cut. Most manufacturers sell rabbeting sets, which bundle a stack of bearings with the cutter. Want to reduce the cut width? Switch to a larger bearing. The set I have yields six different widths from  $\frac{1}{2}$ " to  $\frac{1}{8}$ " (no  $\frac{3}{16}$ "), and with the largest bearing the bit can do flush trimming work.

The piloted bit enables you to rabbet curved edges. You can't do that on the table saw. Making a cut with a piloted rabbeting bit is pretty much a matter of setting the cut depth, switching on the router and diving in. Cut across the grain first, then with the grain. If you are routing only across the grain, either climb-cut in from the corner or clamp a backup scrap at the corner to prevent blowout as the bit exits the work.

The bit and the bearings do work very well, but I'm often inclined to use an unpiloted bit with an edge guide for rabbeting. I get an infinitely variable cut width with this setup, rather than a few predetermined widths. In addition, I have better control over the tool and the cut.

With a piloted bit alone, the cutting edges begin their work before the bearing makes contact with the edge. All too often, you dip around the corner of the workpiece at one end of the cut or the other. That doesn't happen with an edge-guide-controlled cut because the guide surface extends well beyond the cutter both fore and aft.

Keep the guide in contact with the workpiece edge throughout the feed – beginning before the cut actually starts and continuing until the bit is clear of the work – and you won't run into trouble.

The latter is especially true if you elect to circumvent blowout by climb-cutting in from a corner. The guide gives you the good control needed for a climb cut.

The edge guide is a big help in beginning and ending stopped or blind cuts as well. Brace the tip of the guide against the workpiece edge, shift the whole router as necessary to align the bit for the start of the cut, then pivot the router into the cut. **PW**

*Coming next issue: Bill Hylton shows you the best way to use your power tools to cut half-lap joints, a useful frame-making joint.*



# Why Use Hand Tools?

Are you hostile to hand work? Find out why working with muscle power is worth the risk.

With chisel and mallet at the ready, I paused, knowing that soon there would be no turning back. In that moment, I also became aware that the painter working on the landing nearby was watching with puzzled curiosity. His curiosity turned to shock as I struck the chisel with the first mallet blow.

The previous afternoon, while sanding the continuous, three-story custom handrail, I had discovered a small but deep area of blowout. In many situations, it might not have warranted such a radical repair, but this would be quite visible and was part of an elliptical stairway that was one of the focal points of this high-end house. Additionally, I knew the site manager to be extremely detail oriented, and unlikely to tolerate a “paint and putty” approach in such a critical place.

Though I knew there was some risk of making matters worse, I had reluctantly decided that the best solution was a patch, executed in a “neat and workmanlike manner.” The goal was to match the color and figure well enough that, at worst, it would blend into the surrounding material. At best, it would be “invisible.” Accordingly, I had selected the most likely candidate from three or four blanks I’d prepared in the shop, and I proceeded to chop out the “mortise” to accept the patch.

The work was fairly straightforward. My blank had been prepared to match the width of the chisel I was using. And with the use of a sharp, finely set block plane (and a couple of jigs to guide my tools), I obtained a tight fit of the “ever-so-slightly” wedge-shaped patch in the mortise. I then continued to do some additional cleanup work in the area while the glue dried, then carved the patch down to match the surrounding profile, and



Photos by Al Parrish

finished sanding the area. I was pleased to discover that I’d been extraordinarily lucky in finding a scrap that matched the figure, color and chatoyance (the gleam) of the surrounding material almost perfectly. The patch all but “disappeared.”

by Don McConnell

*Don McConnell builds furniture and does ornamental carving in Fredericktown, Ohio. Formerly at the cabinetmaker's shop at The Ohio Village, he remains an avid student of the history of the trade, tools and shop practices.*

## An Act of Madness

At that point, I went back out to the van for additional tools and supplies. When I returned, I was taken aback to find the painter kneeling on the stairs and peering intently at the handrail. Startled, he looked up somewhat sheepishly and said, with a bit of wonderment in his voice:

“Where is it? I can’t find it.”

Now this painter worked around accomplished finish carpenters every day. So he was accustomed to seeing high-quality wood-



Handsaws might seem like an antiquated way to size lumber, but a straight and sharp saw is highly effective (and a joy to use).



The brace and bit produces immense amounts of torque that your cordless drill could only dream about. Plus, many models (not the one shown here) have a ratcheting feature that allows them to be used in corners and right up against wall moulding.

work being carried out. Yet he was shocked and astonished by this simple, straightforward bit of work. Why?

I believe the primary reason was that the work he typically observed was carried out almost exclusively with power tools and machinery. And, based on that experience, he shared an assumption that is common on construction sites (and in woodworking circles), that critical and quality work cannot be effectively accomplished using hand tools. For him to see someone deliberately drive a chisel into a completely installed and all but completed, curved, custom handrail, must have seemed an act of madness.

### Hostility and Camaraderie

In a way, I was not surprised by his reaction. Typically, when I show up on a job site with my carving tools, a roll of chisels, a plane or two and possibly a small back saw, I can tell that my presence creates a stir. There are a variety of reactions. Sometimes it's mild hostility ("Hey, don't you know they've invented routers?"), most often from those in other woodworking trades. Sometimes it's simple curiosity. And, sometimes it's instant camaraderie with other tradespeople whom I've never met before. These latter, I've observed, are often accomplished in an unusual trade, and may also feel anomalous on many job sites.

My purpose in relating this anecdote is to illustrate there is a widely shared perception that exclusive use of power tools and machinery is the only "sensible" route to take in woodworking. To offset this, advocates of using at least some traditional hand tools often argue that hand tools are safer, quieter, less polluting and less expensive. Additionally, there is often the (sometimes implied) message that it's easier than it looks.

While there is a good deal of validity to these arguments, I think they fail to address the fact that many power-tool woodworkers (vocational or avocational) do not consider hand tools to be safe, easy or effective.

They may have, in fact, attempted to use hand tools at one point or another, only to be utterly frustrated. Or, worse yet, they've spoiled the work.

This could be for any number of reasons, including an inadequately sharpened or tuned tool, an inappropriate tool for the job, and/or lack of experience, skill and knowledge needed for success. Whatever the reason, for these woodworkers, the "safe" course of action seems that of continuing along the path they're already on.

### Risky but Rewarding

Truth is, there is risk involved in deciding to use hand tools. Risk, if nothing else, in the form of a real, and sometimes steep, learn-

ing curve. There will be failures and frustrations. It takes time and effort to learn about the tools, how to sharpen them, when, where and how to use them, along with the equipment and appliances needed to use them effectively. Without the appropriate sharp chisel and the necessary skill, I would have been "mad" to use it on the handrail.

Despite this, I believe there are a variety of valid reasons to consider the possibility of making some use of hand tools. For example, you may have some historic interest in what it was like to work in some bygone era. Or, you might simply desire to explore some design and construction details which don't readily lend themselves to a machine-only approach to woodworking.

It is not the purpose of this column to convince every woodworker to use hand tools. Rather, it is to encourage those with such an interest to "live dangerously" and begin, or advance, along the lines of that interest. In a sense, the existence of this column is based on the presumption that many woodworkers have such an interest. Though, in today's woodworking climate, they may not have acknowledged that interest, even to themselves.

The good news is that the knowledge, skills and techniques are eminently learnable by anyone with average motor skills and abilities. And it is the primary purpose of this column to help that learning process by discussing the tools, trade techniques and applications in a manner which I hope will be informative and provocative.



Learn to properly tune up a plane, and you'll be hooked. Planes are capable of a great variety of tasks, from producing crown moulding to preparing lumber for its final finish.



## CHOOSING A PROPER BENCH FOR WOODWORKING

A suitable workbench is key to satisfactory hand-tool woodworking. While each person can best determine the most suitable bench for their needs, I thought it might be useful to outline a few basic considerations.

Fundamentally, the purpose of a workbench is to support and/or immobilize the wood in a comfortable and accessible position for whatever work is being done.

Height, length, weight and rigidity are general characteristics that play a role in meeting this purpose.

Not surprisingly, the height of a bench depends on the woodworker as well as the nature of the work. For example, a bench that is low enough for heavy planing will be too low for extended periods of carving. This can be addressed with the use of more than one bench, but most woodworkers settle for a compromise if they are not specializing.

There are various methods to determine this compromise – the aim being to account for the person's height and arm length. One method is to hold your straightened arms downward, at a slight forward angle, allowing you to comfortably stretch your hands forward with level palms. The height of the palms determines the bench height.

A bench length of 6' is a generally accepted minimum for most work. Though more length can be useful if the shop space allows. A bench width of approximately 2' (often, including a 6" to 8" tool tray at the rear) is usually adequate. You can reach only so far over the bench, in any event, and additional width can limit access from the "off" side.

The benchtop needs to be thick enough to resist deflection under planing pressure as well as undue vibration from hammer or mallet blows. This tends to depend on the material used, but it can be about 1½" to 2", minimum, for the moderately hard woods, such as beech, birch and maple, which have traditionally been preferred bench woods.

The undercarriage of the bench needs to be rigid enough to resist racking pressures from planing. The illustrations show two of the traditional approaches used to achieve this. The Joiner's bench is easier to construct in the absence of a suitable workbench, though the upper skirt can sometimes become an obstacle.

Finally, there is the question of holding the work itself. Surprisingly, this can be accomplished with a few clamps and battens, though this can require inordinate set-up time. For that reason, a face vise, planing stop and possibly a holdfast,

could be considered a minimum arrangement. The Continental-style cabinetmakers bench, with its face vise, tail vise, bench dogs, etc., adds a great deal of convenience.

Much additional information is available, and it's worth consulting if you are considering building or buying a workbench. It can become very confusing, though, so having a grasp of some fundamentals, and a realization that no single bench is ideal for every purpose, can help sort things out. **PW**

— Don McConnell

### MORE INFORMATION ON WORKBENCHES

Two excellent books on workbenches include "Making Workbenches" (Sterling) by Sam Allen and "The Workbench Book" (Taunton) by Scott Landis. While both books offer a dose of history, plans and construction information, Allen's book focuses more on step-by-step instruction while the Landis book has more information about history and use. Both books are worth owning as you decide what kind of bench you need for your woodworking.

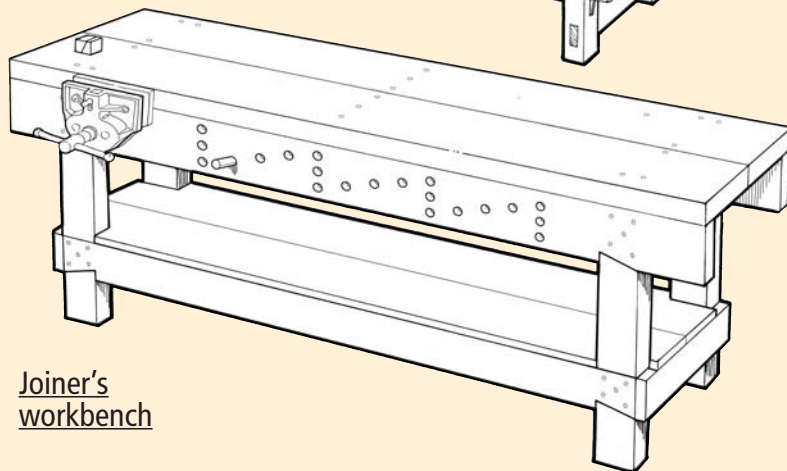
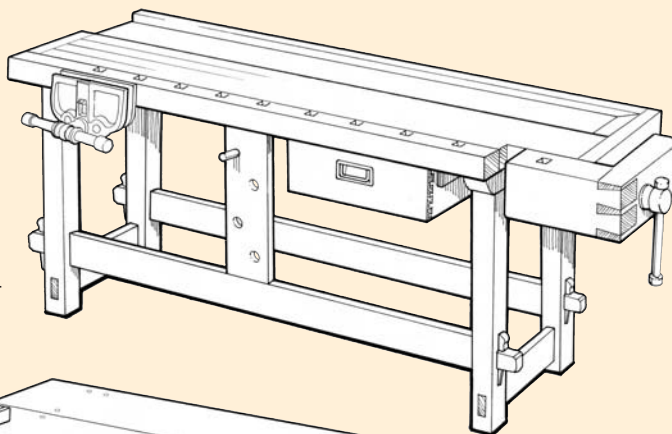
Another excellent resource is the Internet. I like two sites in particular:

- Building a Traditional Workbench [pages.friendlycity.net/~krucker/Bench/index.htm](http://pages.friendlycity.net/~krucker/Bench/index.htm)

Keith Rucker walks you through the entire process of building a Continental-style workbench. The site includes construction drawings, a cutting list and step photos of the entire process. You can even download the entire bench plan in pdf format that is printer-friendly. Rucker covers the topic thoroughly with more than 60 pages of information.

- Bob's Bench Pages [terraclavis.com/bws/benches.htm#intro](http://terraclavis.com/bws/benches.htm#intro)
- Bob Key's web site is another essential waypoint as you design your own bench. Key's site includes plans for a basic beginner's bench and an advanced model. Plus there's lots of good information about all the "accessories" that help your work at the bench: bench hooks, bench slaves, shooting boards and the like. Plus, Key keeps an eye on other workbench-related sites on the Internet and has a list of good links for you to explore.

Continental workbench



Joiner's workbench



# Use a Smoothing Plane *instead of sandpaper*



Smoothing planes – when set up and used properly – can eliminate a lot of sanding. Here's a tip for planing doors: Don't assemble the door and then plane it; you'll have to plane around corners and that's tricky. Instead, before assembly, plane the rails down so the stiles will be a little proud when the door is assembled. Then glue up the door and plane the stiles flush to the rails.

Tune up a smoothing plane and you will greatly reduce the amount of sanding you do. Here's how to select, fine-tune and use this oft-neglected traditional tool.

**I**n the days before sandpaper was invented, fine furniture was prepared for finishing using planes, scrapers and little else.

Smoothing wood surfaces with a handplane is a skill, and doing it well takes practice. But the rewards are substantial. With a well-tuned plane, you can quickly take a piece of wood from rough to ready-to-finish. In fact, I find that in many situations, smoothing planes can be faster than a random-orbit sander.

Also, surfaces that have been smoothed are different than surfaces that have been sanded. The wood fibers have been sheared

cleanly instead of abraded. So the wood looks – in my opinion – luminous after it has been smoothed.

And finally, smoothing is healthier. It's a mild upper-body workout, though nothing like running a 5K. But more importantly, smoothing is better for your lungs. You're not producing clouds of the unhealthy lung-clogging dust that power sanding kicks up.

But before you can get started in smoothing, there are three important hurdles: selecting the right plane, tuning your tool and learning the basic strokes.

### Picking a Plane

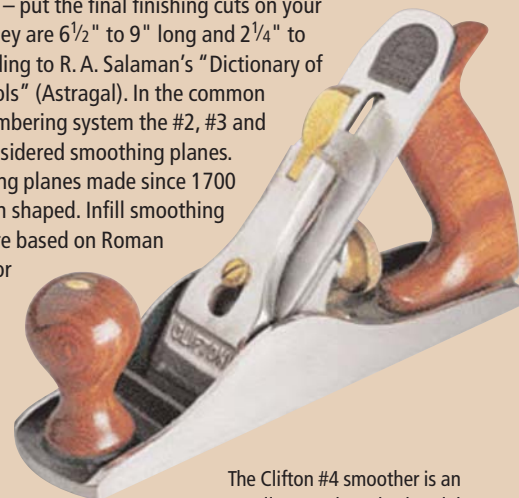
For some, choosing a smoothing plane is like picking a computer operating system, spouse or a religion. It's personal, and people get worked up about it.

So let me say this: All good-quality smoothing planes can be tuned to handle most workaday smoothing tasks. Each kind of plane has its strengths and weaknesses; and in the end, you'll probably end up owning several smoothers. But before we talk about the different varieties of smoothing planes, let's look at the factors that make smoothing planes work well.

**A Well-bedded Iron:** Without a doubt, the most important characteristic of any plane is that the iron be firmly fixed to the body of the plane and not rock or vibrate in use (even the tiniest bit).

## WHAT IS A SMOOTHING PLANE?

All planes smooth wood to some degree, but not all planes are "smoothing planes." Smoothing planes – or smoothers as they are sometimes called – put the final finishing cuts on your work. Typically, they are 6½" to 9" long and 2¼" to 3¼" wide, according to R. A. Salaman's "Dictionary of Woodworking Tools" (Astragal). In the common Stanley plane-numbering system the #2, #3 and #4 planes are considered smoothing planes. Wooden smoothing planes made since 1700 are typically coffin shaped. Infill smoothing planes – which are based on Roman planes believe it or not – are usually the most expensive planes and are highly prized by collectors.



The Clifton #4 smoother is an excellent modern-day handplane.

If the iron isn't seated well, it's going to chatter.

**The Angle of the Iron:** Garden-variety Stanley smoothing planes have the iron bedded at a 45° angle to the work. This angle allows the plane to be pushed without too much effort and handles most straight-grained domestic woods without tearing out the

grain. Some smoothing planes have irons bedded at 47½°, 50°, 55° or 60°. The higher angle makes the plane harder to push, but it increases the plane's performance on some tricky woods such as curly maple and situations where the grain is interlocked or wild. You'll get less tearout with a high angle.

Other smoothing planes have

Here you can see the different angles that smoothing planes commonly come in: a low-angle, a Norris 47½° pitch, 50° and 55°. The higher the pitch, the better the performance on tough-to-plane woods (but the harder the tool is to push).



by Christopher Schwarz

Comments or questions? Contact Chris at 513-531-2690 ext. 1407 or [chris.schwarz@fwpubs.com](mailto:chris.schwarz@fwpubs.com).



an angle of attack that's lower: usually 37°. These low-angle smoothing planes work great on end grain, pretty well on straight-grained species and have mixed utility on the wild stuff. Sometimes a low-angle plane is the only plane that will work on a weird piece of wood. So they're good to have in your arsenal.

**The Throat Size:** This is a matter of some debate in the world of handplanes, but many woodworkers contend that a tight throat (the opening between the cutting edge and the plane's sole) is another key to reducing tearout. There are a lot of physics involved in the reason why. But the dime-store-novel explanation is that a tight throat keeps the wood fibers pressed down before they are sheared by the iron so tearout is less likely to start and then progress along the grain. In my personal experience, I've found that a tight throat seems to help sometimes; and other times it doesn't seem to make a difference at all. It depends on the wood.

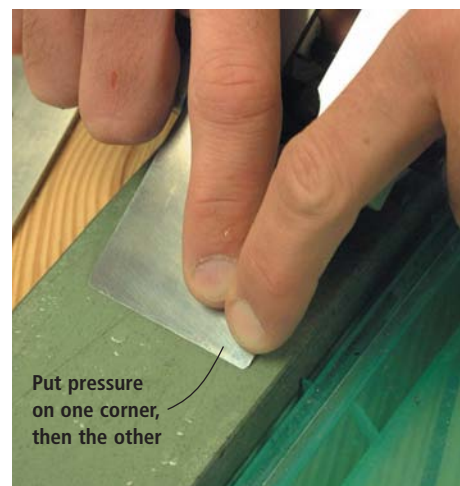
For many of the planes on the market, the throat is adjustable so you can try it either way and decide for yourself.

There are basically four different kinds of smoothing planes

To avoid "plane tracks," clip the corners of your iron by filing a tight radius on the corners of your cutting edge.



To sharpen an iron for smoothing, work the corners on your sharpening stones. This will give your cutting edge a bit of a bow – which is perfect for smoothing.



available: wooden-bodied planes, Bailey-style planes, low-angle planes, and infill planes. See the story on page 52 "Choosing a Smoothing Plane" for a discussion of the strengths and weaknesses of each type of plane.

### Sharpening for Smoothing

Without a sharp iron, smoothing is impossible. You must learn to put a keen edge on your iron and shape the edge for smoothing.

For a basic lesson in sharpening, check out "Sharpening Plane Irons and Chisels" in our April 2003 issue. For a complete education on the topic, read Leonard Lee's "The Complete Guide to Sharpening" (The Taunton Press).

Unlike a chisel or the iron for a block plane, the cutting edge of the iron for smoothing planes needs to be shaped differently. With a chisel, you want a straight edge that's perfectly perpendicular

to the sides. With a smoothing plane, you want the edge to have an ever-so-slight curve.

Here's why: If you smooth a piece of wood with a perfectly straight iron, the corners of the iron cut a small shelf in the wood. These are called "plane tracks," and they are undesirable. They feel like small ridges to your fingers and they can be noticeable after you finish your project.

To reduce or eliminate the plane tracks, you need to do two things to your plane's iron. First, you need to clip the corners of the cutting edge. I usually do this on a belt sander or with a file. You only want to take off about 1/32" of the corner or so. And you want it to be a smooth curve – like the radius of the smallest roundover router bit you can imagine.

Then you need to sharpen the iron so it has a slightly scalloped edge – so the iron actually scoops out the wood. The tooling marks left by an iron sharpened this way are far less noticeable.

Luckily, it's easier to sharpen an iron this way than it sounds, especially with a honing guide. As you sharpen your iron, most people start with a coarse grit, move up to a medium grit and finish on a fine grit.

At the coarse-grit stage, finish sharpening at that stone by moving your hands' downward

pressure on the iron to one corner of the iron and then making about a dozen strokes. Then shift your pressure to the other corner for another dozen strokes. Sharpen at the medium and fine grits the same way. When you hold up the iron against a square, you should be able to see a curve or belly in the edge of just a couple thousandths of an inch.

### Other Tune-ups

With your iron in good shape, make sure your chipbreaker (if your plane has one) is seated firmly on the back of the iron. Place it so its leading edge is 1/32" to 3/32" from the cutting edge. Placing it further back allows you to tighten up the throat more on planes that have adjustable frogs.

In general, the rest of the tuning is much like you would tune any plane. For smoothing, the sole of the plane should be as flat as you can make it. I flatten plane soles on 120-grit sandpaper stuck to a flat piece of granite. Then I finish up on 220 grit.

The iron needs to fit perfectly on the plane and be secured as tightly as possible. For metal planes, this might involve tuning your frog: Flatten the face that contacts the iron, remove any burrs and make sure the frog attaches securely to the plane body.

With wooden planes and in-

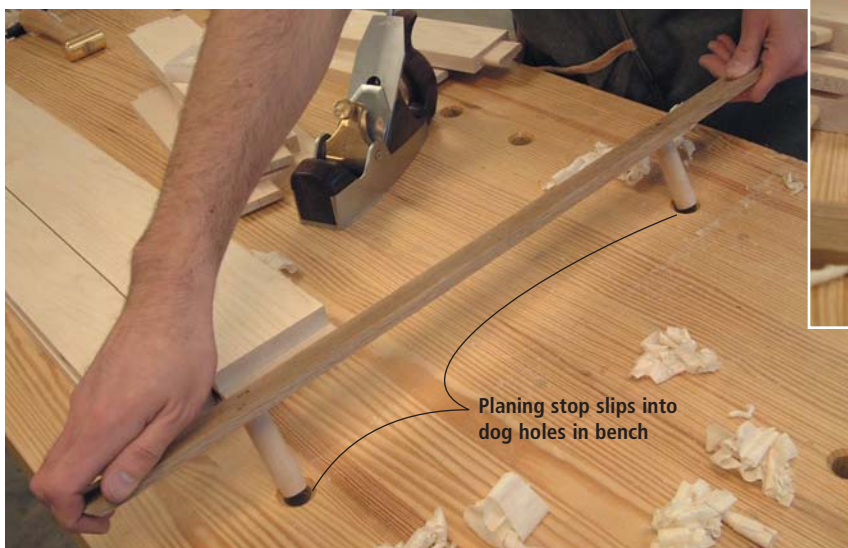


Take a look at the throat on this Clark & Williams coffin smoother. See it? Neither can we. This is a tight mouth.



For smoothing work, position your chipbreaker between 1/32" to 3/32" from the cutting edge.





A shop-made planing stop is a simple and effective way to hold your work for smoothing (left). The force you use to push your plane also holds your work down and against the stop (above).

fills, this usually involves filing the wooden bed of the tool.

Then turn your attention to the device that holds the iron in place. On wooden planes, this is a wedge that might require a little sanding to seat just right. For infills and metal planes, the lever cap must be screwed down tight.

Now set your iron square to the sole. For planes with adjusters, set the iron so it projects a little from the sole. Turn the plane upside down and look down the sole from the front of the plane. Adjust the iron until it projects evenly from the sole, then retract the iron. Now advance the iron until it takes the lightest cut possible. Your wood should already be true – either from machining or earlier planing. Final smoothing removes just a few thousandths of an inch of wood.

### A Stop Before you Start

The boards you plane need to be fixed on your bench so you can smooth them quickly. Some woodworkers use bench dogs and a shoulder vise equipped with a dog to secure the wood. This works, but it's a lot of trouble and should be reserved for times when your other efforts fail.

In my opinion, the best way to keep your boards in one place

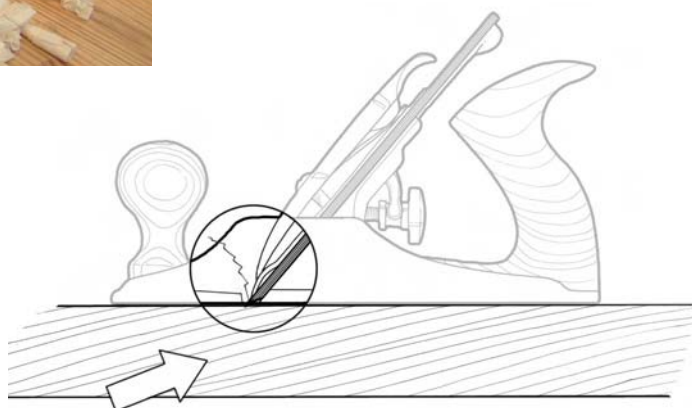
during planing is to use a “planing stop.” This simple jig is a piece of hardwood that's  $\frac{7}{16}$ " thick, about 2" wide and as long as your bench is deep. My planing stop has a couple dowels screwed to it that allow the whole thing to be slipped into two dog holes on my bench (see the photo above).

Place the far edge of the wood to be planed against the stop. The downward and forward pressure of your plane will keep most work pieces in place against the stop. Very narrow wood or irregular shapes require some thought to clamp. This little jig works for about 90 percent of my needs.

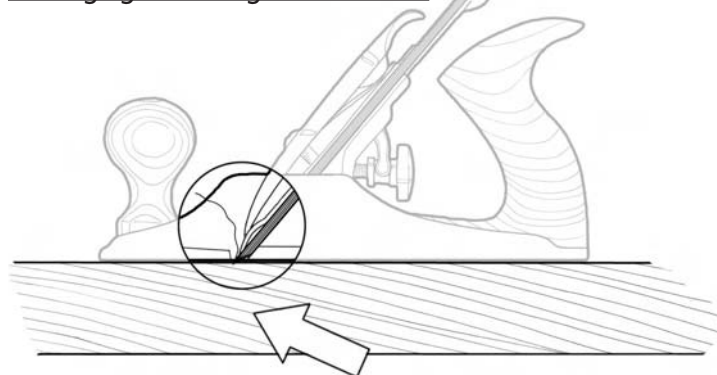
One more thing you should consider as you set up your area for planing: A lower benchtop height (34") is better for planing than a higher bench (36" or higher). With a lower bench you can use your weight to hold the plane against the work instead of relying mostly on your arms. Old-time benches were 28" off the floor. People were shorter then, but you get the idea.

### Reading the Grain and Actually Planing

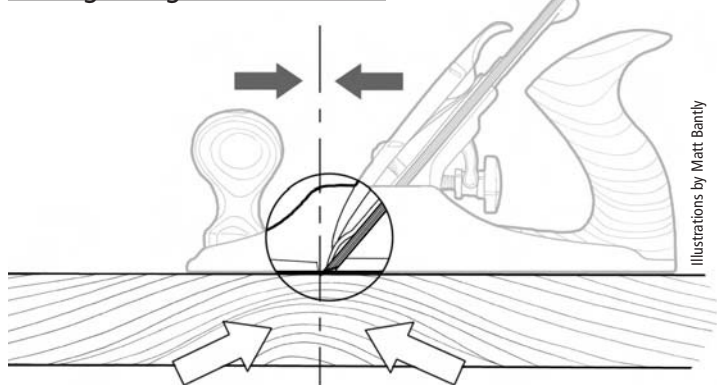
It's almost always best to plane with the grain. The illustrations at right show you what I mean better than words ever could.



Planing against the grain – tearout



Planing with grain – no tearout



Reverse grain – plane both directions to avoid tearout

Illustrations by Matt Bantly



A little canning wax on your sole makes the work easier and your cuts lighter.

Now rub some wax on the sole of your plane. I use squares of canning wax that I buy from the supermarket. It's cheap and effective. The wax cuts down on the effort required from your arms. Apply the wax again after a dozen or so planing strokes.

Grip the plane. Many smoothing planes require a three-finger grip on the rear handle. If your four fingers feel jammed in there, remove your index finger and wrap it on top of the iron.

The body mechanics you use when smoothing are the same as when you use a jack plane or other bench plane. Begin with the toe of the plane (the part below the front knob) on the wood with most of the force on that knob.

Begin moving the plane forward. As you begin cutting, shift the downward pressure so it's evenly distributed between the front knob and rear handle (called the tote). At the end of the cut, shift your pressure to the rear handle or heel of the plane.

The shavings should emerge from the middle of the iron only. The edges shouldn't be cutting if

you sharpened your iron correctly. To remedy this, you should tap the iron left or right to get it projecting squarely from the mouth.

Start planing at the edge of the board that's closest to you. After the first pass, make a second pass that slightly overlaps the first as you work your way to the other edge, and so on. Think of it like mowing a lawn. You want to avoid going over the same areas again and again.

I recommend that many beginning woodworkers start by planing Baltic birch plywood. I know that planing plywood sounds nuts, but it's good practice. The plywood has been sanded at the factory so it's easy to see where you are planing and where you aren't. Plus, the grain on this stuff is generally easy to plane.

When you have made it across your practice board, take a close look at the surface for tearout and to make sure you're hitting everywhere on the face. A bright light at a raking angle helps this process. If the board looks good, run your fingers across its width to make sure you're not leaving plane



See how the shaving emerges only in the middle of the iron? That's how you know your iron is sharpened and set correctly.

tracks. If you are, it's probably one of three things:

- Your iron doesn't have enough curve at the cutting edge.
- You're taking too deep a cut.
- One corner of your iron is cutting deeper than the other.

### Problem Grain

Of course, wood is cantankerous. Sometimes the grain in a board will switch directions. Or sometimes you'll plane with the grain and get tearout. Or – even more frustrating – a small section of the board will tear out but the rest of the board will be perfect.

Tearout can happen with every

wood: domestics, exotics, you name it. What do you do? The trick is to try different approaches until you find one that works. You might have to plane most of a board in one direction and reverse direction for a small part of the board. Here are the things I do to tame tearout:

- Try skewing the plane. Sometimes by angling the plane's body (which effectively lowers the cutting angle) magical things happen. But sometimes things get worse, too (bad magic?).

- Try a different plane or reconfigure yours. Depending on the length of the plane's body,



This is what tearout looks like. Avoid it. When a finish is applied, it looks terrible.





Skewing the plane body during the cut can help in tricky grain situations.

the mouth, the angle of the iron and the wood, some planes work better on some woods than others. If you can tighten up the throat, try that. Or switch to a different tool with a higher angle or a tighter throat.

- Sharpen the iron. A sharp tool is always less likely to tear out the grain than a slightly dull one. If you are planing a board that refuses to be tamed, try touching up your iron on a sharpening stone and then attacking your problem area immediately.

- Go against the grain. Once in a great while I'll plane a problem board against the grain and it solves all or most of my problems. Wood, as I mentioned before, can be vexing.

- Shellac. Wipe on a spit coat

of thin shellac to the problem area and let it dry for 10 minutes. Then give the area a try. This tip, which I picked up on the Internet, has worked for me. The shellac stiffens the fibers and allows you to shear them more easily. You only get a couple passes, though, before the shellac is gone.

- Scrape. My last resort is my scraper plane and my card scraper. The scraper plane handles the larger problem areas (half a board). The card scraper is for the small sections that refuse to behave.

Finally, just keep at it. Refuse to give up. Smoothing is one of those skills that seems to develop in fits and starts. Don't be ashamed if you have to resort to sandpaper or power sanding.

Another suggestion I give be-



A little shellac on a problem tearout will stiffen the wood fibers and allow them to be sheared cleanly – sometimes.

ginners is to begin developing their planing skills by smoothing the interior parts of their case-work. If you botch things there, it generally won't show.

Then, when you think you've got that down, I encourage you to plane all the parts of a project and then power sand it with 220-grit paper. This will quickly point out where you planed too little or too much. Depending on how messed up things are you can con-

tinue with the sandpaper or go back to the plane.

Just remember: Sometimes a plane is the right tool for the job, and sometimes you need to resort to the random-orbit sander or the scraper. But as you get more experience with a smoother, I think you'll find your power-sanding equipment sitting dormant for longer periods of time.



To tame difficult tearout, I turn to my scraper plane, the Lie-Nielsen #85. This plane and the #80 cabinet scraper are the two easiest types to sharpen and use.



# CHOOSING A SMOOTHING PLANE

There are lots of brands of smoothing planes available, especially if you start adding in all the vintage flea-market specimens available.

I do have some old smoothing planes, but for budding hand-tool users, I usually recommend they buy a new, premium smoothing plane. Restoring a plane is a separate skill unto itself, and smoothers are tricky enough to tune anyway. Here are some of the smoothing planes I use in my shop, and their advantages and disadvantages.

## VERITAS LOW-ANGLE SMOOTHING PLANE

Low-angle smoothing planes are odd birds. Sometimes they are the only plane that will get the job done. Their advantages are that they have no chipbreaker to adjust, they work well on end grain (and miters) and you can adjust the throat as tight as you please – these tools have an adjustable throat like a block plane. The Veritas version is simple, well-made and costs only \$139.

One bonus is you can adjust the angle of attack simply by grinding a steeper bevel on the iron. That's because the bevel faces up in these planes. Grind the iron's bevel at 35° and you have a 47° smoother. Grind the iron at 90° and you have a scraper plane.

Lee Valley Tools: 800-871-8158 or [leevalley.com](http://leevalley.com)



## RAY ILES A5 INFILL SMOOTHING PLANE

I recently finished building an infill plane from Shepherd Tool Co. and produced an excellent tool. If you don't want to build your own infill, I highly recommend the Ray Iles A5 (\$650). It's a reproduction of the legendary Norris A5. Iles has made several improvements to the Norris design, including the excellent blade adjustment mechanism.

The iron is bedded at 47½°, making it a bit better than the standard Stanley 45° angle for tricky grain. The Ray Iles plane looks and performs beautifully. I recommend you check it out.

The Museum of Woodworking Tools: 212-228-9884 or [toolsforworkingwood.com](http://toolsforworkingwood.com).



## LIE-NIELSEN #4 WITH A HIGH-ANGLE FROG AND A LIE-NIELSEN #3

These Bailey-style planes are heavy, expertly made and easy to tune to a high level for beginners. I used to use the #3 (\$245-\$275) for about 80 percent of my smoothing. But since Lie-Nielsen has come out with a #4 plane with a 50° blade angle (\$250-\$300), I now turn to that for problem-grain boards, too.

The nice thing about Bailey-style planes is you can adjust the size of the throat so the planes can be used for rough and fine work. I am partial to the way you adjust the irons in this style of plane. The Bailey-style adjuster and separate lateral-adjustment controls are precise and hearty systems. These are world-class tools that you'll be glad you own for the rest of your years.

Lie-Nielsen Toolworks: 800-327-2520 or [lie-nielsen.com](http://lie-nielsen.com)



## CLARK & WILLIAMS 2¼" COFFIN SMOOTHER

Time for some honesty. I never liked wooden-bodied planes much until I tried those made by Steve Knight and Clark & Williams. Vintage wooden planes can be more difficult to tune than metal ones, in my opinion. These two plane makers have truly revived the art of wooden planes in this country. I'm partial to the Clark & Williams plane (\$265, pictured) because of its particular ergonomics. The plane has no chipbreaker and a .005" throat. With the iron installed for a light cut, you can barely even see the throat. This is my plane of last resort. When I encounter grain that no other tool can tackle, the Clark & Williams with its 55° blade and tight throat has yet to let me down. Of course, because of the tight throat, it's good only for smoothing. These are beautifully made tools finished to a high degree. Other sizes are available.

Clark & Williams planes are available from The Museum of Woodworking Tools: 212-228-9884 or [toolsforworkingwood.com](http://toolsforworkingwood.com). Knight's planes: Knight Toolworks: 503-421-6146 or [knight-toolworks.com](http://knight-toolworks.com). **PW**





# Saw Blade Box

Photo by Tim Grondin

Protect your investment in saw blades by protecting their brittle teeth – and keep them well organized and handy at the same time.

One of my objectives in building the “Under-the-saw Cabinet” in our December 2002 issue was to show a saw-blade storage solution for inside the cabinet. I was tired of, and embarrassed by, my traditional “nail in the wall” approach.

After building a prototype, I finalized this simple, functional and handy blade-storage box that you can build in little more than an hour using shop scraps.

by Steve Shanesy

Comments or questions? Contact Steve at 513-531-2690 ext. 1238 or [steve.shanesy@fwpubs.com](mailto:steve.shanesy@fwpubs.com).



The most important thing to remember when starting this project is that you will cut the sloping, angled front *after* the box is fully assembled. What you are first building is a simple five-sided box.

The box sides are made using  $\frac{3}{4}$ "-thick plywood, and the "shelves" for the saw blades are  $\frac{1}{4}$ " plywood. Start by cutting the top, bottom, sides and back to size. Then, using your table saw or router, cut a  $\frac{3}{4}$ "-wide x  $\frac{1}{2}$ "-

deep rabbet on two long and one short edge of the top and bottom, and one rabbet on one short edge of each side piece.

Before assembling these five pieces, you must cut the grooves in the sides to support the  $\frac{1}{4}$ " plywood shelves. An angled dado is necessary to capture the secondary  $\frac{1}{4}$ " back, which acts as the stop for the shelves and blades.

I used my table saw with a rip blade to cut the grooves in the sides. Set the blade to make  $\frac{3}{8}$ "-deep cuts. Next, lay out the locations of the five grooves on the front edge of the left side. You need to mark only one edge, and remember you will be making right- and left-handed sides. This means you'll run one side with the back edge facing the blade and the other with the front. Run both parts using the same setup.

Each groove requires two passes to make the correct size. Make an allowance for the plywood thickness being about  $\frac{1}{32}$ " less than  $\frac{1}{4}$ " thick.

When done, cut the  $\frac{3}{8}$ "-deep dado for the secondary back. I



With the top removed you can see how the inside pieces fit together.

used my slot miter gauge set to  $20^\circ$  to make the cut.

Before assembly, cut the secondary back to size and test-fit the dry assembly. You can now glue and clamp, or nail the assembly and make sure the secondary back is in place. If you nail it, be sure to place the nails away from the future cutting path of the sloped front edge.

While the glue is drying, cut out the pieces of  $\frac{1}{4}$ " plywood you'll need for the shelves. Remember the bottom shelf is  $\frac{3}{4}$ " narrower in width because it simply rests on the bottom of the box.

Refer to the diagram and lay out the cuts for the round shapes on the front of each shelf. I used a hole saw to make the  $2\frac{1}{2}$ " cut before band sawing the larger

## DO YOU REALLY NEED 6 BLADES?

You might be wondering why this box is set up to handle six saw blades. Most woodworkers get by with just one (a combination blade) or two (a rip and crosscut blade).

Here are our thoughts on the matter: First, keep the steel blade that was likely shipped with your saw. It's not much good for fine woodworking, but it is a great "beater blade." Use it when you're cutting into material that might have content that could damage your other blades, such as nails, staples or even bullets.

In three other slots, keep a combination blade, a rip blade and a crosscut blade. Having these three blades is ideal for several reasons. As you first machine your stock, it's best to do most of your ripping with a rip blade and your crosscutting with a crosscut blade. Your cuts will be cleaner. Then use the combo blade for the general work that follows machining, which will save you time switching between blades.

The other advantage to this system is that if one of the blades gets dull, you'll still be able to both rip and crosscut with the two left.

And the last two slots? When you have the cash, get a plywood blade and leave the last slot open for the future.



This saw blade box fits perfectly in the "Under-the-saw Cabinet" featured in the December 2002 issue. The cabinet is a great project for the small shop. It offers considerable storage beneath the wing of your saw – usually wasted space. For complete plans for the cabinet, order the back issue (issue #131) by visiting our web site at [popwood.com](http://popwood.com) or calling 888-419-0421.



semi-circle. This larger diameter, at 10<sup>1</sup>/<sub>4</sub>", will make sure any 10" blade's teeth will rest inside the wood edge and be protected from unintentional dings. Sand all the edges smooth.

The final chore is cutting the angle on the front opening. First lay out your cut lines following the diagram. Again, make sure there are no nails in the cutting path. Make your first cuts on the top and bottom with your table saw's blade tilted to the 20° angle.

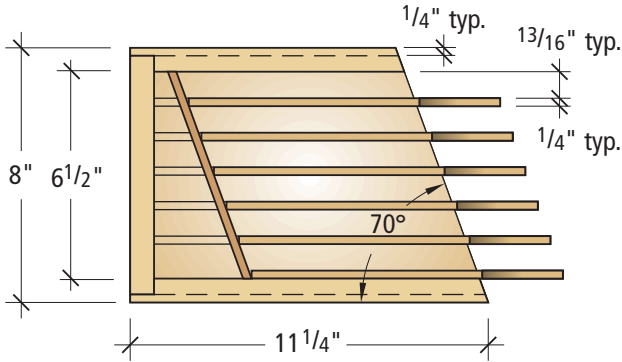
Raise the saw blade only enough to clear the thickness of the plywood. Set your fence to the appropriate distance for each cut.

Next, bring your saw blade back to 90° and set your slot miter gauge to 20° to make the cuts on the sides. Again, the blade height should be only as high as necessary to clear the plywood.

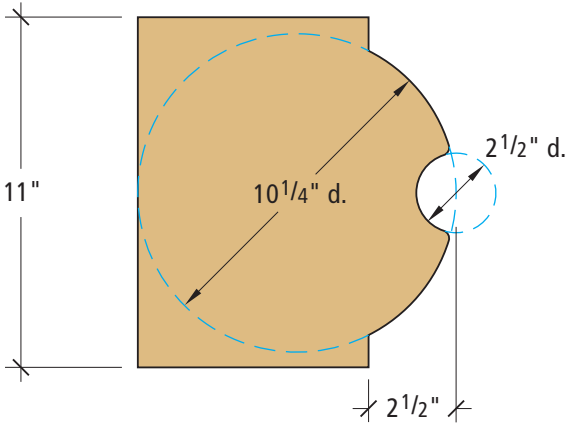
When done, give the box a light sanding, break the edges, insert the shelves and put your blades safely away. **PW**

### SAW BLADE BOX

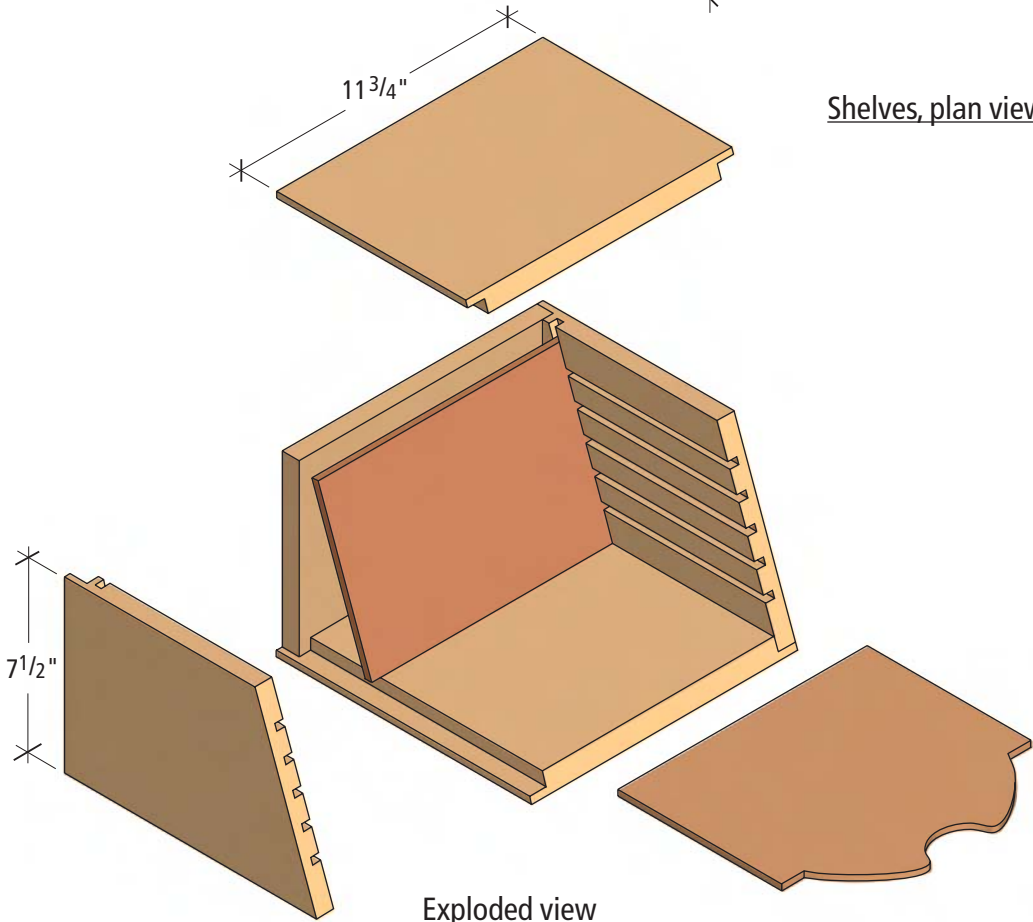
| NO. | ITEM           | DIMENSIONS (INCHES)   | MATERIAL      |
|-----|----------------|---|---------------|
|     |                | T W L   |               |
| ❑ 2 | Top and bottom | 3/4 11 <sup>3</sup> / <sub>4</sub> 11 <sup>1</sup> / <sub>4</sub> | Birch plywood |
| ❑ 2 | Sides          | 3/4 7 <sup>1</sup> / <sub>2</sub> 11 <sup>1</sup> / <sub>4</sub>  | Birch plywood |
| ❑ 1 | Back           | 3/4 11 <sup>1</sup> / <sub>4</sub> 7 <sup>1</sup> / <sub>2</sub>  | Birch plywood |
| ❑ 1 | Second back    | 1/4 6 <sup>7</sup> / <sub>8</sub> 11                              | Birch plywood |
| ❑ 5 | Shelves        | 1/4 11 10 <sup>1</sup> / <sub>4</sub>                             | Birch plywood |
| ❑ 1 | Shelf          | 1/4 10 <sup>1</sup> / <sub>4</sub> 10 <sup>1</sup> / <sub>4</sub> | Birch plywood |



Section, box profile



Shelves, plan view



Exploded view

# Jewelry Chest

Based on the proportions of full-size early American blanket chests, this project's small size makes it easy to build.

Last year, the kids and I decided to surprise my wife, Terri, with a special woodworking project that we all worked on.

It's usually easy to get children involved in building a project in the shop, but it's hard to keep them interested. With the exception of birdhouses, most woodworking projects take a good deal of time and patience to produce something worthwhile.

And that's why this jewelry chest is a great project. I developed the proportions directly from full-sized blanket chests, so it looks good and right to the eye. But the joinery and its small size make it a project that we could complete easily in a long afternoon. In fact, as you'll see, this project turned out better than I could have imagined.

by Troy Sexton

*Troy Sexton designs and builds custom furniture in Sunbury, Ohio, for his company, Sexton Classic American Furniture.*

*Troy is a contributing editor for Popular Woodworking.*

Photo by Al Parrish

These small boxes feature all the joinery and detail of the full-size classics. Building this piece is great practice before tackling the big stuff.





The WoodRat in action – as seen from below. Check out the company's web site at [woodrat.com](http://woodrat.com) to see all the useful joints this system can build.



The WoodRat allows me to space the pins and tails in almost any configuration I please. And because one part acts as the template for the other, the fit is nice and firm.

### Dovetailed to Your Taste

The four sides of this box are joined using machine-cut through-dovetails. But there's no reason you have to do it this way. If you have a machine that cuts half-blind dovetails in  $\frac{1}{2}$ "-thick stock, that would be fine. Or if you hand-cut your joints, that's OK, too. And if you're just not ready for dovetails, you can always cut a  $\frac{1}{4}$ " x  $\frac{1}{2}$ " rabbet on the ends of the front and back pieces, and join your case using glue and nails.

To cut through-dovetails, I use my WoodRat ([woodrat.com](http://woodrat.com)), a jig that you see quite a lot in England, but rarely in this country. I've had mine for years and have always relied on the accuracy and versatility of this jig. I often wonder why the WoodRat never caught on here. Dovetails are just one small function of this useful joinery system.

Cut your tails and pins and then finish sand the inside of the box. I start with 100-grit paper and work up to 180-grit.

Apply glue to the joints and clamp the box up. Measure the box from corner to corner to ensure it's square. A shove or a tap



The bottom piece is small enough that wood movement isn't much of an issue. I simply nailed it in place.

usually will knock things into place with a box this small. When your glue is dry, sand the outside of the case to its final grit.

### Small is Simple

Because this box is small, there's no need to make the bottom complicated. In a full-size blanket

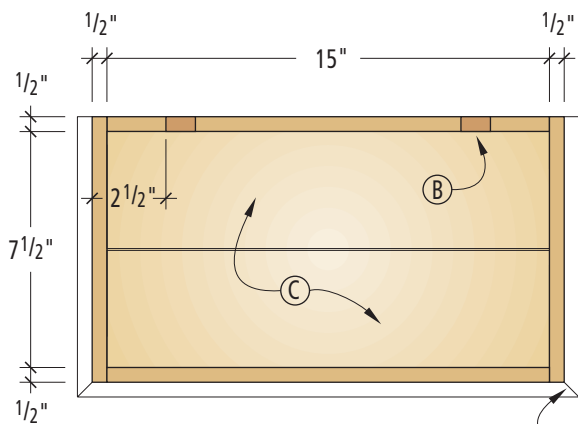
chest, the solid-wood bottom would float in a groove cut into the four sides, or it would rest on cleats screwed to the sides. Either of these two strategies would allow for the expansion and contraction of the bottom and allow the chest to carry some serious weight.

Luckily, this bottom doesn't

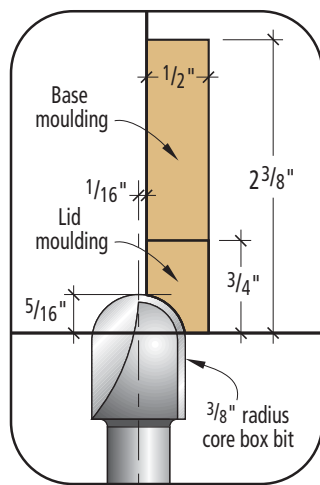
need to carry much weight. And the bottom piece is so narrow that wood movement isn't much of a problem with this project.

There are two ways to do this. One way is to cut your bottom to fit exactly inside the sides and then rip off about  $\frac{1}{16}$ " of the width. Then put the bottom in place and

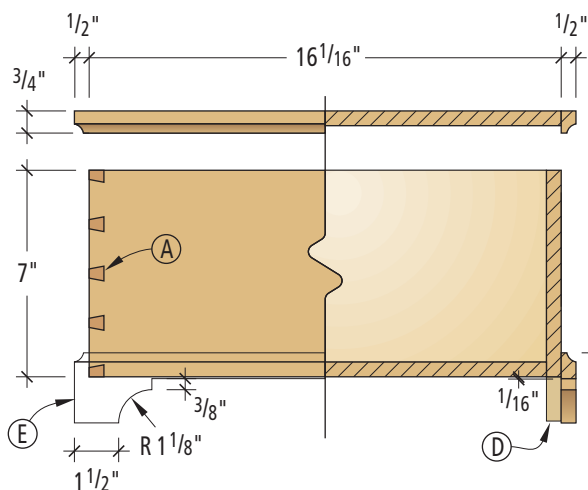




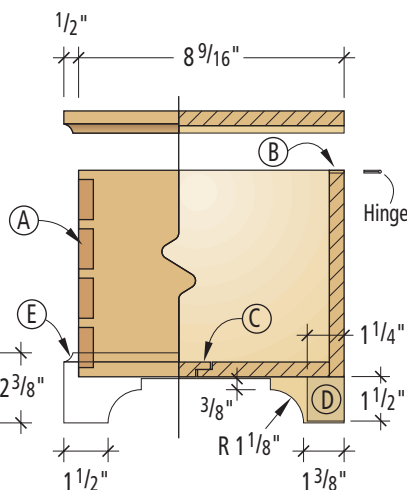
Top plan, lid removed



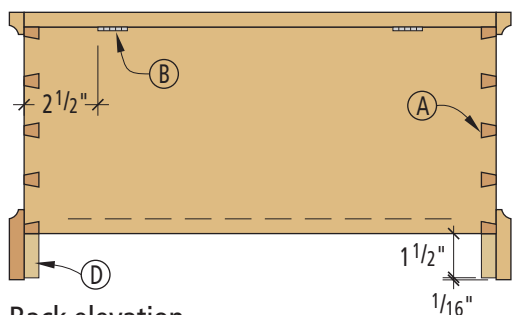
Moulding machining



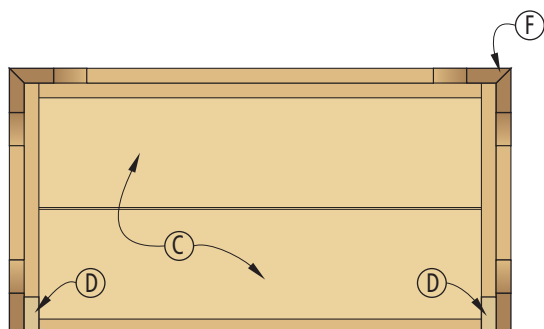
Front elevation/section



Profile/section



Back elevation



Bottom plan

#### Construction Notes:

- (A) Through-dovetail corner
- (B) Hinge mortise depth equal to combined thickness of hinge plates
- (C) Shiplapped bottom boards
- (D) 1/2" thick x 1 1/2" w. x 1 1/4" l. back leg support block
- (E) Outline of base moulding
- (F) Miter mouldings at front corners

secure it with nails. Or make your bottom in two pieces (as shown in the diagrams) and cut a 1/4" x 1/2" shiplap to join the two pieces. Then nail the two pieces in place. The second way, while a little more complex, results in no gap in the bottom.








The base moulding also is simple. First rout a small cove on the top edge of your trim pieces using a 3/8" core-box bit. Miter the three pieces as shown in the photos. Then cut the feet to shape as shown in the drawings at left using your band saw or jigsaw.

Finish sand the moulding and then glue and nail it in place. To reinforce the base moulding at the rear of the case, glue and nail two back leg support blocks as shown in the diagrams.

Attach the top to the base using small brass hinges, mortising the leaves into the case only. Make your hinge mortise as deep as both leaves of the hinge. This saves effort and is less likely to result in errors. I recommend you purchase high-quality hinges for this project. Hinges intended for jewelry boxes that open to 95° would be best.

Now prepare to attach the top moulding to the top. This moulding has the same small cove routed on its edge as the base moulding. Miter, glue and nail it in place just like the base moulding.

#### JEWELRY CHEST

| NO.   | ITEM | DIMENSIONS (INCHES) |                             |                                | MATERIAL                        |        |
|---|------|---------------------|-----------------------------|--------------------------------|---------------------------------|--------|
|   |      | T                   | W                           | L                              |                                 |        |
|  | 1    | Lid                 | 1/2                         | 8 <sup>9</sup> / <sub>16</sub> | 16 <sup>1</sup> / <sub>16</sub> | Cherry |
|  | 2    | Front, back         | 1/2                         | 7                              | 16                              | Cherry |
|  | 2    | Sides               | 1/2                         | 7                              | 8 <sup>1</sup> / <sub>2</sub>   | Cherry |
|  | 1    | Bottom              | 1/2                         | 7 <sup>1</sup> / <sub>2</sub>  | 15                              | Poplar |
|  | 2    | Back leg supports   | 1/2                         | 1 <sup>1</sup> / <sub>2</sub>  | 1 <sup>1</sup> / <sub>4</sub>   | Poplar |
|  |      | Base moulding       | 1/2                         | 2 <sup>3</sup> / <sub>8</sub>  | 38                              | Cherry |
|  |      | Top moulding        | <sup>3</sup> / <sub>4</sub> | 1/2                            | 38                              | Cherry |



When mitering the base moulding, first cut a couple miters and check to make sure your saw is set for the right angle to make an airtight fit.



Clamp a plywood spacer to the front that positions the base moulding exactly where you want it. I always find the cut line for my miters by placing the work on the piece and marking from the underside as shown in the photo. This is more accurate than measuring.



Once your miter is cut, check the fit before adding the glue and nails.

### Custom Trays

Now you can build a few trays with dividers for all the jewelry. The trays simply rest on top of each other inside the chest. Butt joints, nails and glue are all that's needed here. The bottoms can be covered in felt or flocked after finishing the trays.

Speaking of finishing, I finished this piece with three coats

of lacquer using my HVLP system, sanding between coats.

We completed Terri's jewelry box in record time, and the kids had a blast building it. In fact, the project turned out so well, we decided to sell some of these chests at a furniture show. And the kids are now helping me build the next batch – after the homework's done, of course. **PW**



Repeat the same operation with the moulding for the top piece.

Our technical illustrator unplugs his high-end software, gets back to the basics with an entry-level program (\$50!) and walks away with some surprising results.

# CAD

## FOR WOODWORKERS

In the dead of winter, my daughter Carah and her husband, Dan, felt the need for some extended family time and set out to visit Carah's maternal grandmother, an antiques dealer in Belfast, Maine. While there, Carah developed an interest in painted and stenciled wood furniture, and Dan had an opportunity to catch up on some reading, including the February 2003 issue of *Popular Woodworking*. Both of them (as was I) were taken by the lines and proportions of Warren May's Kentucky Sideboard, which appeared in that issue. A little sketching on Dan's part convinced them that the piece could easily be transformed into a small dresser – the missing element in a bedroom remodeling project at home. Dan would build it and Carah would do the painting and stenciling. As a practicing architect and project illustrator for *Popular Woodworking*, I was selected to be the design development member of the team.

Rather than simply recycling the drawings I'd done for the project, I decided to start from scratch like anyone else, and work with the information in the article and some entry-level CAD (computer-aided design) software I'd been wanting to put through its paces. When I'm illustrating for *Popular Woodworking*, I use a combination of AutoCAD 2000 (from Autodesk), Macromedia Freehand, and Microsoft Excel – all told, about a \$3,000 investment. The new

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by John Hutchinson

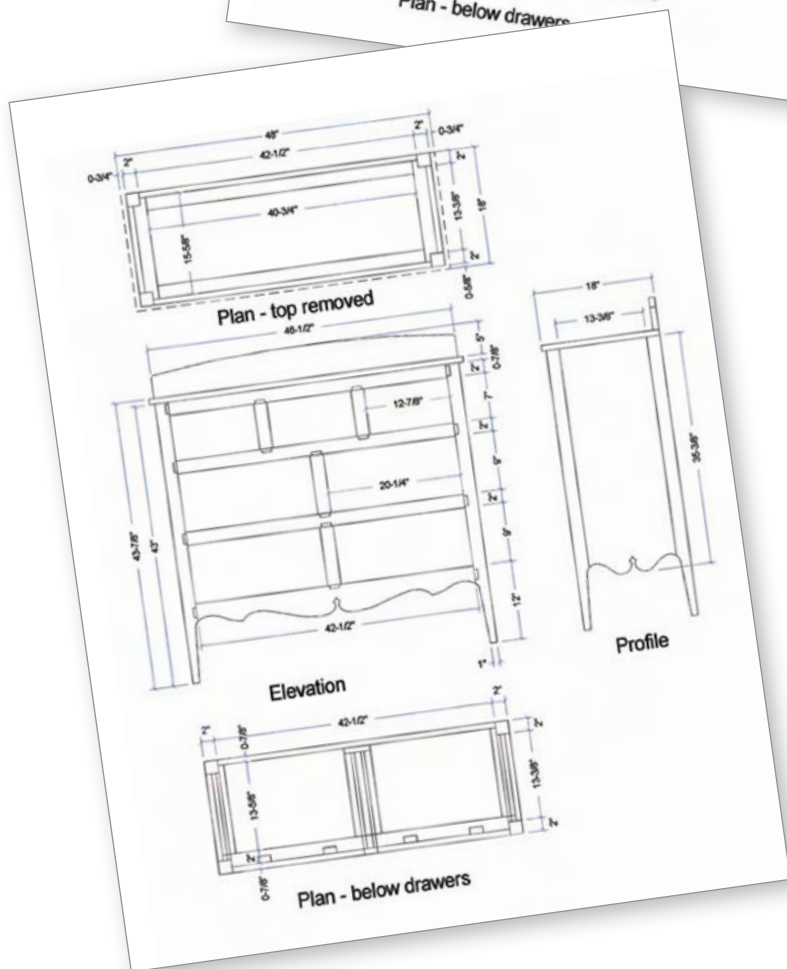
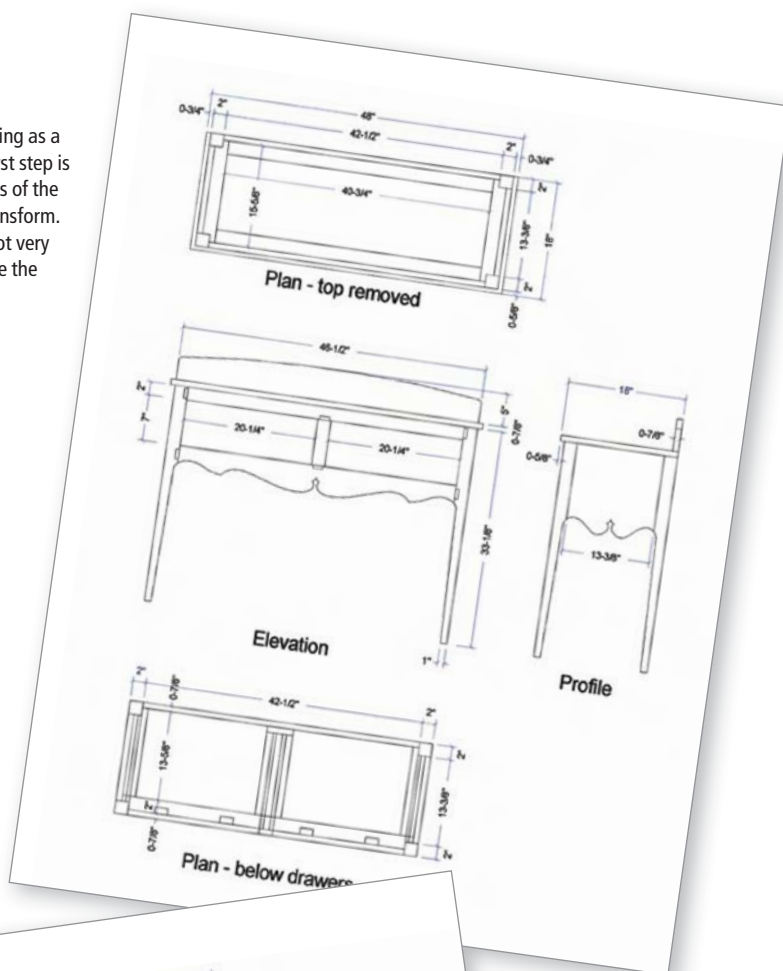
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Comments or questions? Contact John at [jhutchi2@columbus.rr.com](mailto:jhutchi2@columbus.rr.com).





When using an existing drawing as a basis for a new design, the first step is to draw the basic components of the existing piece you wish to transform. Although the drawings are not very exciting in themselves, they're the basic "words" that make the "sentences" that lead to the "story" of the design.



After I created the basic components of my design, QuickCAD allowed me to easily transform the original drawings into what you see here.

(to me) CAD software was Autodesk's QuickCAD, the baby brother of the professional AutoCAD 2000 program I use on a daily basis. I'd heard that it contained some of the best features of my drafting, illustration and spreadsheet programs, yet cost only \$50. I assumed that the power of the program would be proportional to its price. After working through Carah and Dan's dresser project, I'm pleased to report that QuickCAD is a powerful tool and an amazing bargain.

The leap from pencil to screen is easier than you think. Why take the jump? QuickCAD dramatically increases the flexibility of your design and saves you hours of drawing time – all for \$50. For example, with QuickCAD, you always get a straight, consistent line. And you can turn, flip and move that line in seconds. Need a box that's square? Simply add several lines together. See what your design would look like with an extra drawer, wider door stiles or a different edge treatment. And all that can be done (and undone) with a few swift mouse clicks.

When your design is complete, you can consult your electronic drawing during construction to work out joinery details or calculate complex setbacks. It is an astonishingly powerful \$50 tool.

QuickCAD isn't alone; there are several inexpensive CAD drawing programs available with similar features, including TurboCAD ([imsisoft.com](http://imsisoft.com)) and DeltaCad ([dcad.com](http://dcad.com)).

### No Problem to Show Less Leg

According to Carah and Dan's first e-mail message from Maine, the footprint of the dresser was to remain the same as the original sideboard: 18" deep by 48" wide. Conversion of the sideboard to a dresser required shortening the legs and lengthening the body



for the addition of two large and three small drawers. I began the transformation by drawing the basic components of the original sideboard. Once the drafting labor is behind you, the power of CAD really kicks in.

The drawings now are putty in your hands, waiting to be copied, arrayed, scaled, trimmed, rotated, mirrored, stretched, moved and aligned at will with mouse clicks and keyboard commands. QuickCAD handled all of these tasks with ease and precision. When everything looked right, QuickCAD let me save the drawing as a common JPEG file, as shown at left, that I e-mailed to my newest clients for approval.

### Go Bravely Into the Third Dimension

Because I've been looking at architectural drawings my entire professional life, I forget that many people have difficulty when mentally attempting to join disassociated plans and elevations into a coherent whole. My daughter falls into that group.

Her response to my drawings was: "I guess it's fine Dad, but what the heck will it really look like?"

QuickCAD answers this dilemma by offering the option of drawing in three dimensions simultaneously on an isometric grid. Although it's not technically the correct term, most people refer to this type of drawing as a perspective (or a 3D drawing). I often use isometric drawings in my magazine illustrations. In my opinion, they can't be beat as a tool for conveying a design message without the distortion of a true perspective.

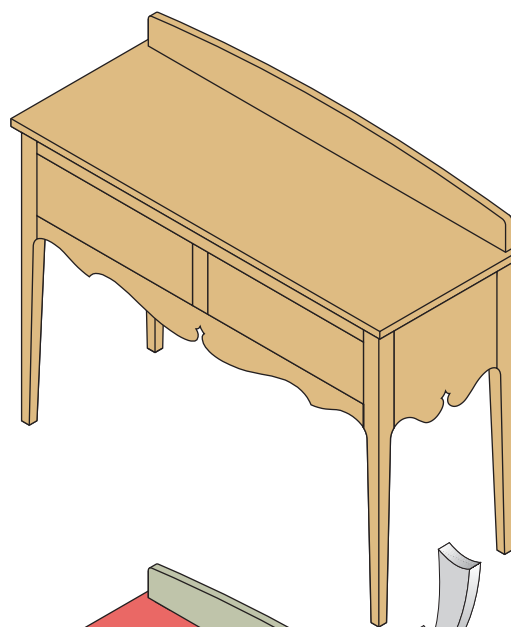
### Electronic Tracing Paper and Paint-by-numbers

After Carah and Dan gave the thumbs up on the isometric, I learned that Carah and her grandmother had been out shopping for material for the bedroom drapes. Carah suggested that when she got home, we could incorporate the drapery colors into the dresser's paint scheme, and perhaps use the drapery material's designs for her stenciling patterns. I told her it wasn't necessary to wait for the homecoming. All she had to do was stop at the local library, scan a section of the material, and send me the file. I'd take care of the rest.

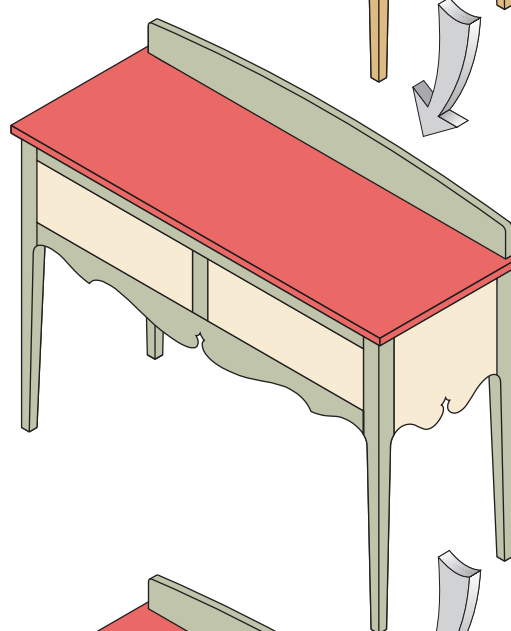


This is a scanned image of a fabric swatch from which I extracted a palette of colors.

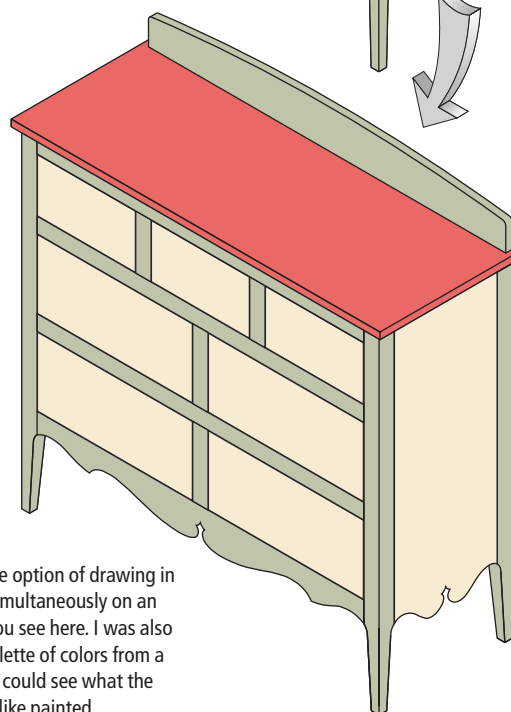
Original sideboard



Painted sideboard



Painted dresser



QuickCAD offers the option of drawing in three dimensions simultaneously on an isometric grid, as you see here. I was also able to extract a palette of colors from a scanned image so I could see what the project would look like painted.

QuickCAD allowed me to import the scanned image onto my drawing page where I locked it in place, traced the designs, and extracted a palette of colors. I then made copies of the dresser and painted away with the electronic brush by simply dragging color patches to the various parts, as shown on the previous page. With the painting complete, I turned to the stenciling details, as shown below. Once drawn and colored, they, like the dresser parts, were mine to duplicate and manipulate as needed.

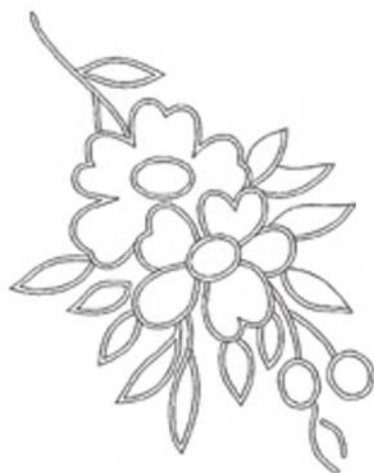
### Make Full-scale Patterns so You Can Paste and Cut

When we publish articles such as the Kentucky Sideboard, we often include enlarged details overlaid with a scaled grid. The end board and bottom-rail scrollwork were illustrated this way. It's a mutual understanding that the reader will make a pattern by laying out a full-size grid on a large sheet of paper, transfer the points where the undulating lines meet the grid, and then connect the dots either freehand or with the assistance of drafting curves. This technique for conveying information, which cannot easily be described by dimensions, has been a staple of woodworking drawings since Noah received plans for the ark.

CAD programs allow you to draw and print full scale so all of the labor, drafting tools and inaccuracies associated with the grid method are eliminated. Most professional CAD software, however, assumes that you have ready access to a large-format printer or roll plotter. QuickCAD makes no such assumptions. To produce



With a neat feature called "page tiling" you can print full-scale drawings using your home printer. Simply tape the pages together, paste them on your wood and cut.



Once drawn and colored, QuickCAD allows users to duplicate and manipulate details, such as these stencil drawings. The colors and design of the stencil pattern match the fabric swatch.

a full-scale pattern for the bottom rail scrollwork, I used a neat feature called "page tiling." The rail was copied out of the overall 1"=1' ( $\frac{1}{12}$  scale) drawing, pasted into a new drawing where the scale was set at 1"=1" (full scale), and rotated 90° to give it a vertical orientation. Although only a small portion of the rail fits on

an 8.5" x 11" page, the page tiling printing option allowed the entire 43½" rail to be printed out on a series of five letter-sized sheets. QuickCAD even throws in handy-dandy registration marks to serve as a guide for splicing the pages together. The same full-scale drawing and printing process was used for the stencil patterns.



Plan



Elevation



Profile



## Creating a Cutting List

When I begin to illustrate a project, I start with simple, dumb lines. You know the drill – point A to point B. Once I have all the lines down, I group them into meaningful objects. In other words, I create parts that are this wide by that long with this size tenon on that end. Once I create the objects on the screen, I add dimensions, and then begin to manually transcribe that information to a cutting list. With QuickCAD, I can embed all of that information within the individual parts and then ask the program to spit out a cutting list. All of my professional software combined can't do that for me! Here's a brief summary of how it works:

QuickCAD asks me to create "fields" for the drawing I'm working on. Following the standard *Popular Woodworking* format, I tell it that I'm interested in assigning each part a name, the number of times it appears in the project, its overall dimensions prior to machining, and a wood species. Because QuickCAD is a two-, rather than a three-dimensional drawing program, and doesn't (yet) have a mind reading button on the toolbar, I need to manually enter parameters such as thickness, quantity and species. QuickCAD does the math on the length and width by calculating the "extents" of the piece or the full size of the board I need, including things like a tenon. No wonder I've long ago forgotten where I put my pencils.

## Mission Accomplished

By time I picked up Carah and Dan at the airport, I had a nice collection of construction draw-

ings, colored isometrics, full-scale patterns and a cutting list waiting for them on the back seat of the car. They'll be starting the project in a couple weeks. In the mean time, I'll be enjoying my payment: Maine lobster.

## Time to Share

At *Popular Woodworking*, we're always looking for ways to share information with fellow woodworkers. While we can't loan out the latest dovetailing jig to every reader, we can lend information electronically on our web site.

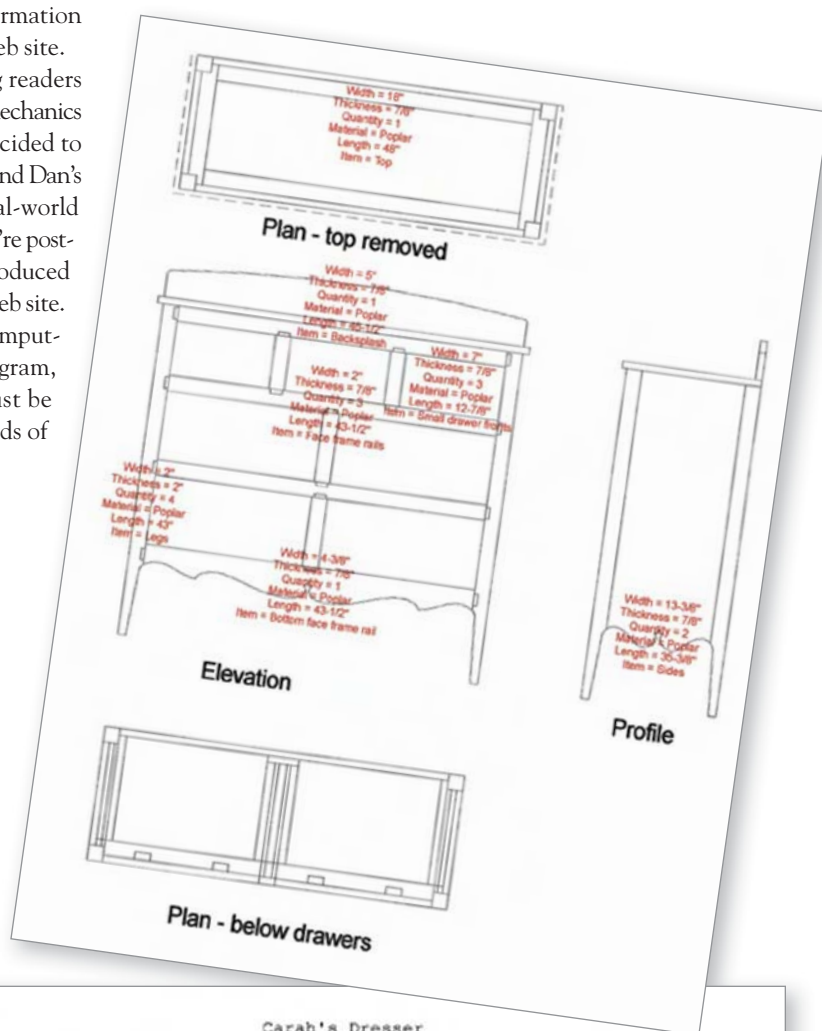
Rather than leading readers through a course in the mechanics of using the tool, we decided to relate the saga of Carah and Dan's dresser to illustrate a real-world application of CAD. We're posting the drawing files, produced in QuickCAD, on our web site. As with any general computer-assisted drawing program, QuickCAD's focus must be narrowed to fit the needs of

After manually entering certain parameters such as thickness, quantity and species, QuickCAD can calculate the length and width of each piece in your drawing.

the user. In these prototype files, we've preset many of the parameters that will make the software more woodworker-friendly. I hope they will serve as templates for those thinking about making the leap of faith from pencil to keyboard. The experienced CAD user can also tell us where we can make improvements. Hit us with your best shot. We're learning, too. **PW**

## WHERE TO BUY QUICKCAD

QuickCAD is easy to find from most software retailers. You can purchase it online from a variety of merchants, including Amazon.com (\$47), Gateway.com (\$46) or from the manufacturer at Autodesk.com (\$49). These prices were correct at time of publication.



| Carah's Dresser |                         |          |           |         |         |          |
|-----------------|-------------------------|----------|-----------|---------|---------|----------|
| UID             | Item                    | Quantity | Thickness | Width   | Length  | Material |
| 39940           | Top                     | 1        | 7/8"      | 18"     | 48"     | Poplar   |
| 57013           | Small face frame stiles | 2        | 7/8"      | 2"      | 8"      | Poplar   |
| 74730           | Small drawer fronts     | 3        | 7/8"      | 7"      | 12-7/8" | Poplar   |
| 57016           | Sides                   | 2        | 7/8"      | 13-3/8" | 35-3/8" | Poplar   |
| 57001           | Legs                    | 4        | 2"        | 2"      | 43"     | Poplar   |
| 74725           | Large drawer fronts     | 4        | 7/8"      | 9"      | 20-1/4" | Poplar   |
| 57007           | Face frame rails        | 3        | 7/8"      | 2"      | 43-1/2" | Poplar   |
| 57009           | Bottom face frame rail  | 1        | 7/8"      | 4-3/8"  | 43-1/2" | Poplar   |
| 57004           | Backsplash              | 1        | 7/8"      | 5"      | 46-1/2" | Poplar   |
| 39937           | Back                    | 1        | 7/8"      | 42-1/2" | 35-3/8" | Poplar   |
| 39938           |                         |          |           |         |         |          |
| 39939           |                         |          |           |         |         |          |
| 39941           |                         |          |           |         |         |          |
| 39942           |                         |          |           |         |         |          |
| 39943           |                         |          |           |         |         |          |
| 39944           |                         |          |           |         |         |          |
| 39945           |                         |          |           |         |         |          |
| 39946           |                         |          |           |         |         |          |

Once the calculations are done, QuickCAD allows you to print out a complete cutting list.



Will and Orv had to know a lot about woodworking  
to build this world-changing project.

**I**t flies. This contraption actually flies. I'm standing at the base of a sand dune in the North Carolina Outerbanks, just south of Kitty Hawk. At the top of the dune, Lt. Cmdr. Klas Ohman, USN (call sign: "Santa") has just been launched into the air aboard a replica of the 1902 Wright Glider – the aircraft in which Wilbur and Orville Wright learned to fly. Santa follows the slope of the dune at a slow, stately pace. This glider cruises at 18 miles per hour, and the wind is blowing upslope

at just more than 15 miles per hour. Santa's launchers follow behind him at an easy trot.

For Santa, however, the flight is far from leisurely. The 1902 glider is a primitive flying machine with unfamiliar, rudimentary controls. The pilot must work frantically to keep it in the air – Santa's cockpit workload is every bit as consuming as the F-18 Hornets he flies from the decks of the USS Kitty Hawk. In fact, flying the 1902 glider is a humbling experience for the four military test pilots

by Nick Engler

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*Nick Engler is the author of more than 50 books on woodworking and is a passionate pilot. He is leading the Wright Brothers Aeroplane Co. on an expedition in aviation archaeology to build and fly all six of the experimental airplanes the Wright brothers designed between 1899 and 1905 in their quest for a practical airplane.*



and instructor pilots we have gathered to recreate this historical event – the flights of the first fully controllable airplane. As simple as this glider looks, it takes great skill to fly. An errant wind gust, incorrect control input, a moment of inattention and the plane will dive for the sand.

This is just what is about to happen to Santa. He lets the nose get a little too high, the glider slows and loses flying speed. Suddenly the nose drops and the glider begins to fall out of the air sideways. The left wing tip catches first, wrenching the entire structure of the plane. The spars bend and keep bending as the aircraft crunches into the sand. Those of us who built this replica watch horrified as the plane seems to fold in half. We are waiting for the loud cracks that will announce the destruction of the wooden frame. But the loud cracks never come. The glider skids to a stop then suddenly springs back into shape. Both the aircraft and its pilot are unharmed.

We have just learned something important about the genius of the Wright brothers. They understood their materials intimately.

### Properties of Wood

Orville and Wilbur Wright were skilled woodworkers. Their mother was the daughter of a carriage

maker and she learned to work wood from her father. She passed this knowledge on to her sons and they made good use of it. Their home, which is preserved at Greenfield Village in Michigan, showcases some of their handiwork – a carpenter gothic porch,

an ornate mantle, a hand-carved cherry staircase and several pieces of their furniture.

They applied this expertise to their aircraft. Wood, because it was relatively light and reasonably strong, seemed the natural choice for early aircraft builders. But there was more to it than that. Airplanes must withstand tremendous stresses. The wings must lift not only the weight of the airplane, but also that of the flight crew, passengers, luggage and fuel. In a banked turn, these loads go up precipitously due to centrifugal force. When using wood to engineer structures like these, you must consider three important properties:

- Compressive strength – how much stress a wood species can stand parallel to its grain.

- Bending strength or modulus of rupture – how much load a wood species will take perpendicular to the grain.

- Stiffness or modulus of elasticity – how much the wood deflects or flexes perpendicular to the grain before it breaks.

The Wright brothers chose to build the frames of their airplanes from ash and spruce: ash for the bent parts and spruce for the straight ones, as a general rule. Although they probably based their decision on traditional woodworking lore rather than scientific data, it was a good choice. If you check the tables of “mechanical properties” in the “Wood Handbook: Wood as an Engineering Material” compiled by the U.S. Department of Agriculture, Forest Service, Forest



Learning to fly all over again, Capt. Jim Alexander (USAF) plows the sand (above). Alexander is one of the Air Force’s top instructor pilots and is more at home driving an MC-130 Shadow. Wright historian Louis Chmiel and a volunteer repair the damage to the canard after a hard landing (left).

## THE 1902 GLIDER

The in-flight photos you see in this story were taken of the 1902 Glider, the precursor to the 1903 Flyer, which we are building now. The Wrights flew the 1902 Glider at Kitty Hawk almost 1,000 times between September and October 1902, with flights up to 622 feet and durations of up to 26 seconds.



Stored at Kitty Hawk throughout the winter, they used this glider for practice in 1903 while building the powered airplane.

## ABOUT THE 1903 FLYER, THE FIRST TRUE AIRPLANE

After a failed attempt on Dec. 14, 1903, by Wilbur, the Wrights flew the world's first powered airplane at Kitty Hawk on Dec. 17, 1903. Beginning at 10:35 a.m., Orville flew it about 120 feet (in about 12 seconds), Wilbur, about 175 feet; Orville, about 200 feet, and, about noon, Wilbur flew it 852 feet in 59 seconds.

This biplane had 40.3-foot span; 0.83-foot anhedral; 6.5-foot chord; 6.2-foot separation; 510 square-foot area; 1/20 camber; 48 square-foot double horizontal front rudder; 21 square-foot twin movable vertical rear rudders; 21.1-foot overall length; and weighed 605 pounds. The right wing was 4" longer than the left to compensate for the extra weight of engine.

This was the only aircraft the Wrights tried to preserve. Damaged by wind after the fourth flight, they returned it to Dayton; Orville sent it to the Science Museum in London in 1928; since 1949 the Smithsonian has displayed it as the world's first piloted powered airplane.

Products Laboratory, you'll find that ash and spruce are among the strongest woods in all three of these categories.

### Aircraft Design

The strength of the wood in the 1902 Wright Glider does not completely explain its remarkable durability, however. The other half of the story has to do with the design of the aircraft.

When Will and Orv set out to build this airplane, they knew they were going to crash it. They were teaching themselves to fly. Their previous gliders, built and tested in 1900 and 1901, had shown them that piloting required great skill. And because these previous gliders hadn't flown all that well, the brothers hadn't yet acquired that skill. So Will and Orv built an airplane that would protect them in the event of a crash and was relatively easy to repair when damaged.

A biplane structure offered the necessary strength and resilience. Two wings, one above the other, were trussed like a bridge. Although the individual wings were lightly built, when the structure was braced with wires under tension, it became incredibly

strong. When the structure slammed into the ground, the force of the impact was quickly distributed throughout the frame via the bracing wires. Instead of the wooden parts at the point of contact taking the blow, the force was divided up so each part absorbed some of the impact. As a result, the glider was able to withstand crashes that would have

destroyed other structures. And because the biplane formed a cage around the pilot; he, too, was protected from harm.

Some damage was inevitable, however. To make the glider easy to repair, Will and Orv decided to lash the parts together rather than fasten them with hardware. If a part was broken, all they had to do was cut the lashes, slip out the old part, then lash a replacement in its place. If a major part such as a spar broke, it could be quickly splinted and wrapped with lashing cord. In some cases, the repaired part actually became stronger than it had been before it was damaged.

Lashing may seem a strange assembly method to those of us who prefer to fly on aircraft that are held together by something stronger, but it was a logical choice for the Wright brothers. In their day, every kid learned marlinship (knot tying) as soon as they could tie their shoelaces. Today, the only vestige of this ancient skill is the knot-tying section of

the "Boy Scout Handbook." But in Will and Orv's day, it was essential. In the days before adhesive tapes, lashing was the best way to make quick, strong, temporary joints. The wax-covered linen cord that Will and Orv used to lash their airplane together was the Victorian equivalent of duct tape.

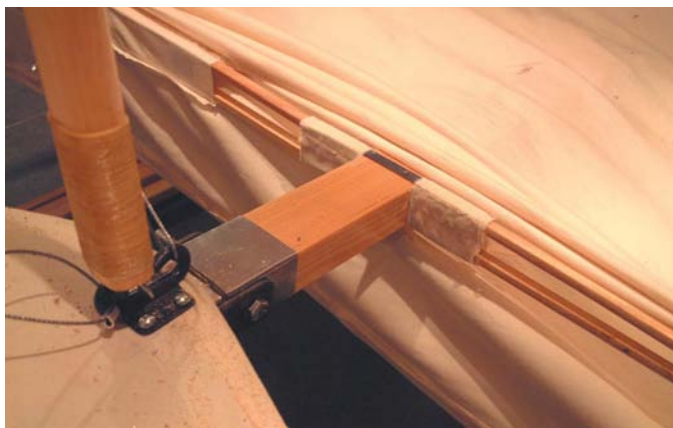
Just how well this system worked for the Wright brothers was made apparent to all of us when Maj. Dawn Dunlop, an F-15 Eagle-driver and test pilot for the U.S. Air Force, became the first pilot to complete an inside loop in a Wright glider. Floating in for a landing, Dunlop lost forward speed and began to slide backwards in the air. A gust of wind caught the underside of the wings and rolled the glider onto its tail, its back and then its nose. It rolled right-side up again before the launchers could catch it.

I came running up and found Dunlop unhurt, protected as she was by the biplane cage and the soft sand. The aircraft was less



Lt. Cmdr. "Santa" Ohman (USN) brings the 1902 Glider in for a smooth landing. Ohman is a Navy test pilot whose day job involves landing F-18 Hornets on the USS Kitty Hawk.





Each rib of the 1903 "Centennial Flyer" carries the signatures – and perhaps the dreams – of the young people who made it.

fortunate – the tail outriggers were snapped and the forward elevator cracked. There were a few other broken sticks here and there. Taking inventory of the damage, I was amazed at how light it was considering we had just rolled the aircraft. Most folks who had witnessed the crash thought surely this was the end of the flying, but it wasn't the case. We splinted and lashed the broken parts and within the hour the glider was back in the air.

Dunlop and the other military pilots went on to make some of the longest and most spectacular glides later that same day.

### The Right Stuff

From time to time, I am approached by an aeronautical engineer with plans to build Wright gliders or flyers from some new cutting-edge material, usually some fiber-reinforced polymer. I have to smile when this happens. Wood is a fiber-reinforced polymer. Specifically, it's made up of cellulose fibers glued together with lignin. New materials may be stronger and lighter, but that doesn't necessarily make them better suited for this structure.

The craftsmen who build and restore old airplanes often tell stories about trying to adapt some new material or technology to an

old airplane only to find that it flies worse than it did before. Airplanes are complex aerodynamic systems, and a small change in one component often has unforeseen effects on the entire system. If you replace the wood in a Wright glider with something stronger, you may find you've sacrificed something important like the ease with which it can be repaired. If you substitute a material because it's lighter, you've changed the glider's flying characteristics and not necessarily for the better. When Capt. Tanya Markow, U.S. Army, flew the glider, we had to add 25 pounds of lead shot to bring the weight up to what the glider would have weighed with Wilbur or Orville aboard. Otherwise, the strong sea breezes blew her all over the sky. On the other hand, Capt. Jim Alexander, USAF, weighed 40 pounds more than the Wright brothers and made some of our longest flights.

Among the many talents that the Wright brothers used to unlock the secrets of flight was a remarkable understanding of wood and the things that it could be made to do. There are stronger, lighter, newer materials we could work, but none with the beauty, versatility and wonderful possibilities of wood. **PW**



## NEXT STOP: FLYING THE 1903 FLYER

Right now we're assembling the 1903 Flyer at the Boonshoft Museum of Discovery in Dayton, Ohio, in preparation for its centennial flight at Kitty Hawk, N.C.

Children across America (and the world) built the ribs of this airplane, and we're busy adding the fabric and wires to make this historic craft fly. As the Centennial Flight nears, we'll be showing off the 1903 Flyer and the other Wright gliders we've built at events, including the 2003 Dayton Air Show. We're also booking appearances at other air shows around the country. To see a list of places you can go to see this amazing woodworking project, visit the web site of the Wright Brothers Aeroplane Company and Museum at: [first-to-fly.com](http://first-to-fly.com)





# HOME-OFFICE *Armoire*

Here's how  
to shoehorn an  
entire workstation  
into a small space.

**W**earing a bathrobe, a bit  
of last night's dinner and  
three day's growth, I was  
a telecommuting pioneer.

It was 1990, and I was one of  
only 3.4 million people in the en-  
tire country who worked for a cor-  
poration from home, connected  
to my boss up the highway by a  
poky modem and the occasion-  
al harassing telephone call.

When I first set up my office  
as a newspaper reporter in a small  
town, I had no clue how tricky it  
is to establish a work space. My  
desk was a barely usable drafting  
table. My chair was designed  
for church picnics. As I accu-  
mulated files I piled them in milk  
crates. I stacked my newspapers

in the corners. I'm normally a  
neat person, but eventually that  
room looked like home to one of  
the mound-building tribes of Ohio.

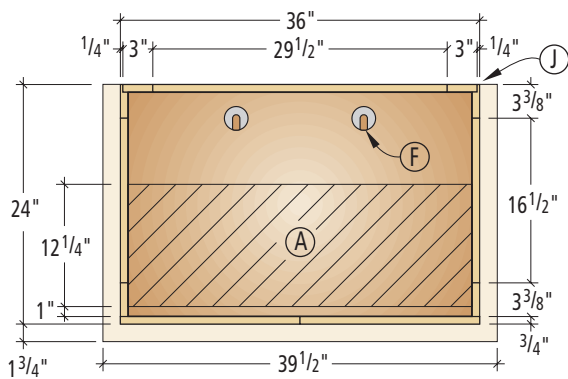
Nowadays the number of peo-  
ple telecommuting is estimated

by Christopher Schwarz

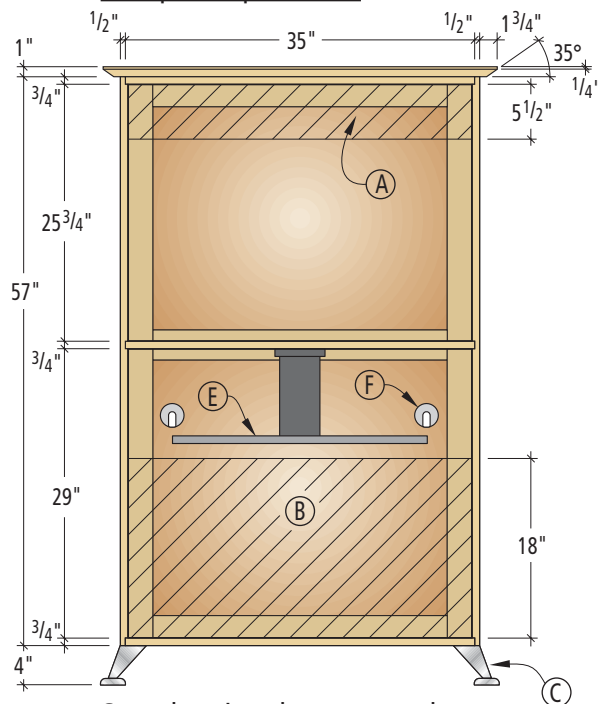
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*Comments or questions? Contact Chris at 513-531-2690 ext. 1407 or  
chris.schwarz@fwpubs.com.*

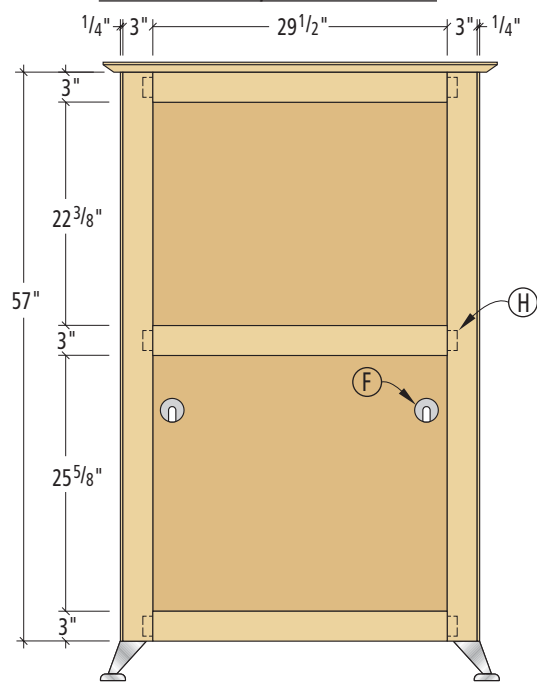




Case plan, top removed



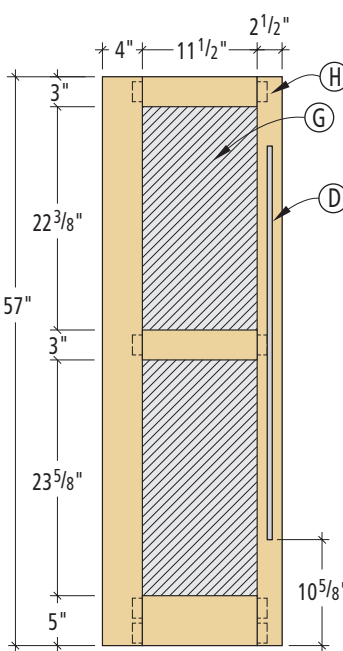
Case elevation, doors removed



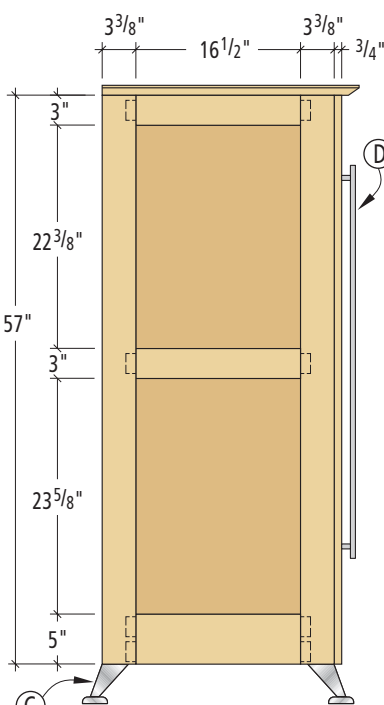
Case back

#### Case Construction Notes:

- (A) Cubbyhole unit
- (B) File unit
- (C) Adjustable steel leg
- (D) 1000 mm stainless steel bar
- (E) Sliding keyboard tray
- (F) Wire grommet
- (G) Corrugated plastic glazing
- (H) 1" long x 2" wide x 3/8" thick tenon
- (J) 3/4" wide x 1 1/2" deep rabbet



Door elevation



Case profile

at 137 million, according to the Cathers In-Stat Group. And the modern-day telecommuter is a lot more savvy about organizing a home office. We've done our homework, too. This cabinet has just about everything you need to set up shop at home in a small space – it's also great as the family business center, for paying bills, doing taxes and answering e-mail.

The cubbyholes, drawers and shelves should keep your important stuff handy. And when you're done with business, you can call it a day by closing the doors.

Building this project doesn't require a lot of advanced skills. The joinery is simple: mortises and tenons, rabbets, dados and a few biscuits. But building a project of this size that has so many assemblies requires the patience and precision that comes with some experience. If you're considering building this project, you should have already built a few pieces that use these joints. You don't want to practice something new on something this size.

So instead of walking you through every construction step in agonizing detail, I'm going to focus on how to meet the challenges faced by this particular project: designing a frameless cabinet so it won't rack, building a cabinet using several frame-and-panel assemblies, and installing tall doors that tend to warp.

#### Wobbly Frameless Cabinets

There's a reason traditional furniture uses face frames. These wooden frames, glued to the front of a cabinet, stop the case from racking when it's moved or simply sitting on an uneven floor. But not every cabinet needs to resist racking. Frameless built-in cabinets use a thicker back (5/8" or 3/4") to give the case rigidity. And screwing your frameless project to the wall helps, too.





After the tenons and mortises are cut on all your parts, rough out the grooves for the panels using a dado stack in your table saw.

But this project isn't a built-in, so it needs a hand to keep its shape. The frame-and-panel back made from  $\frac{3}{4}$ "-thick maple and  $\frac{1}{2}$ "-thick plywood helps quite a bit. But even with the back screwed in place you can rack the front of the case by lifting one of the feet. So that's where the cubbyholes and file box help. They're separate cabinets that you screw to the sides, top and bottom. I had considered building their functions into the cabinet by

adding shelves and dividers, but that wouldn't have added the rigidity I needed.

Once you screw these two assemblies in place, the whole thing really tightens up nicely.

## Building Using Frame-and-panel Assemblies

The sides and back are built in an identical manner: The stiles and rails are joined using  $\frac{3}{8}$ "-thick x 2"-wide x 1"-long tenons (the thicker bottom rails get two tenons). The flat plywood panels are glued into  $\frac{3}{16}$ "-deep grooves cut into the rails and stiles. You can glue these panels in place because the plywood won't shrink and swell with the seasons.

In hindsight, the mortise-and-tenon joints on these three frames were probably overkill. Because these plywood panels can be glued in place, biscuits would have been a fine way to join the rails and stiles. But I'm a sucker for the traditional tenon.

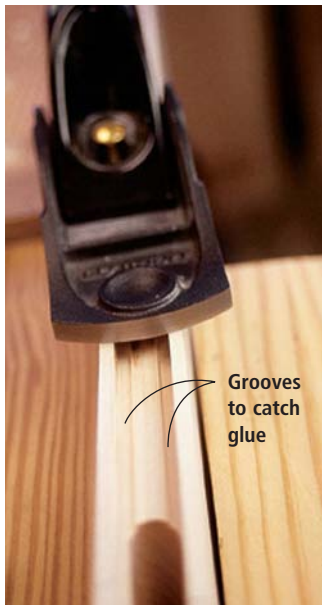
The groove for the panels is a bit different than what you're accustomed to. When gluing plywood panels in place, I like to give the excess glue someplace to go (rather than letting it squeeze out). So I cut my grooves in two stages. First cut the groove to approximate size using a dado stack set to  $\frac{3}{16}$ " high in your table saw.

Then install a 10" rip blade in the saw and set the blade height to  $\frac{1}{4}$ ". With this setup, cut the groove perfectly to size in the center by running the rails and stiles with one face against the fence, then flipping the piece around and cutting the other way. This extra step guarantees the groove will be centered on your edge, and it's easier to guide your material over the rip blade because you're not removing much material. And finally, it cuts two shallow grooves at the bottom of your groove so excess glue has a place

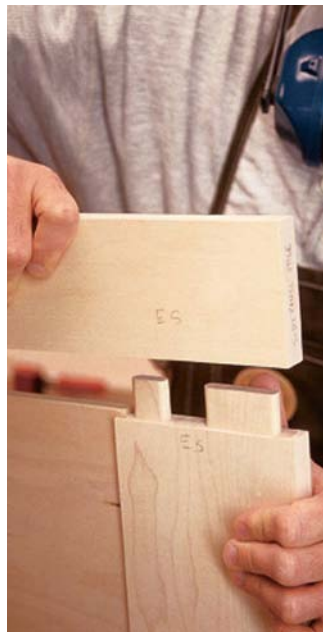
## HOME-OFFICE ARMOIRE

| NO.               | ITEM                     | DIMENSIONS (INCHES) |                  |                    | MATERIAL  | COMMENTS   |
|-------------------|--------------------------|---------------------|------------------|--------------------|-----------|--|
|                   |                          | T                   | W                | L                  |           |  |
| <b>Main case</b>  |                          |                     |                  |                    |           |  |
| ❑ 3               | Top, bottom, middle      | $\frac{3}{4}$       | 22 $\frac{1}{2}$ | 35                 | Plywood   | in $\frac{1}{4}$ " x $\frac{3}{4}$ " dados                   |
| ❑ 4               | Side panel stiles        | $\frac{3}{4}$       | 3 $\frac{3}{8}$  | 57                 | Maple     |  |
| ❑ 4               | Side panel small rails   | $\frac{3}{4}$       | 3                | 18 $\frac{1}{2}$   | Maple     | 1" TBE   |
| ❑ 2               | Side panel, lower rails  | $\frac{3}{4}$       | 5                | 18 $\frac{1}{2}$   | Maple     | 1" TBE   |
| ❑ 2               | Side panels, top         | $\frac{1}{2}$       | 16 $\frac{7}{8}$ | 22 $\frac{3}{4}$   | Plywood   | in $\frac{1}{2}$ " x $\frac{3}{16}$ "-deep groove            |
| ❑ 2               | Side panels, bottom      | $\frac{1}{2}$       | 16 $\frac{7}{8}$ | 24                 | Plywood   | in $\frac{1}{2}$ " x $\frac{3}{16}$ "-deep groove            |
| ❑ 2               | Back panel stiles        | $\frac{3}{4}$       | 3                | 57                 | Maple     | in $\frac{1}{2}$ " x $\frac{3}{4}$ " rabbet in side assembly |
| ❑ 3               | Back panel rails         | $\frac{3}{4}$       | 3                | 31 $\frac{1}{2}$   | Maple     | 1" TBE   |
| ❑ 1               | Back panel, top          | $\frac{1}{2}$       | 29 $\frac{7}{8}$ | 22 $\frac{3}{4}$   | Plywood   | in $\frac{1}{2}$ " x $\frac{3}{16}$ "-deep groove            |
| ❑ 1               | Back panel, bottom       | $\frac{1}{2}$       | 29 $\frac{7}{8}$ | 26                 | Plywood   | in $\frac{1}{2}$ " x $\frac{3}{16}$ "-deep groove            |
| ❑ 1               | Top cap                  | 1                   | 25 $\frac{3}{4}$ | 39 $\frac{1}{2}$   | Ply/maple | plywood edged with maple                                     |
| <b>Doors</b>      |                          |                     |                  |                    |           |  |
| ❑ 2               | Outside stiles           | $\frac{3}{4}$       | 4                | 57                 | Maple     |  |
| ❑ 2               | Interior stiles          | $\frac{3}{4}$       | 2 $\frac{1}{2}$  | 57                 | Maple     |  |
| ❑ 4               | Small rails              | $\frac{3}{4}$       | 3                | 13 $\frac{1}{2}$   | Maple     | 1" TBE   |
| ❑ 2               | Large rails              | $\frac{3}{4}$       | 5                | 13 $\frac{1}{2}$   | Maple     | 1" TBE   |
| ❑ 2               | Top panels               | $\frac{9}{64}$      | 12               | 22 $\frac{7}{8}$   | Plastic   | in $\frac{7}{16}$ " deep x $\frac{1}{4}$ " rabbet            |
| ❑ 2               | Bottom panels            | $\frac{9}{64}$      | 12               | 24 $\frac{1}{8}$   | Plastic   | in $\frac{7}{16}$ " deep x $\frac{1}{4}$ " rabbet            |
| <b>Cubbyholes</b> |                          |                     |                  |                    |           |  |
| ❑ 2               | Top, bottom              | $\frac{3}{4}$       | 12 $\frac{1}{4}$ | 34 $\frac{1}{2}$   | Plywood   | $\frac{1}{4}$ " x $\frac{1}{2}$ " rabbet on inside long edge |
| ❑ 4               | Vertical dividers        | $\frac{3}{4}$       | 4                | 12                 | Plywood   | biscuited to top, bottom                                     |
| ❑ 1               | Back                     | $\frac{1}{4}$       | 5                | 34 $\frac{1}{2}$   | Plywood   | screwed to case  |
| <b>File unit</b>  |                          |                     |                  |                    |           |  |
| ❑ 2               | Top, bottom              | $\frac{3}{4}$       | 19               | 34 $\frac{1}{2}$   | Plywood   | $\frac{1}{4}$ " x $\frac{1}{2}$ " rabbet on inside long edge |
| ❑ 4               | Sides, vertical dividers | $\frac{3}{4}$       | 18 $\frac{3}{4}$ | 16 $\frac{1}{2}$   | Plywood   | biscuited to top, bottom                                     |
| ❑ 2               | Adjustable shelves       | $\frac{3}{4}$       | 8 $\frac{7}{8}$  | 18 $\frac{3}{4}$   | Plywood   | screwed to case  |
| ❑ 1               | Case back                | $\frac{1}{4}$       | 17 $\frac{1}{2}$ | 34 $\frac{1}{2}$   | Plywood   |  |
| ❑ 1               | File drawer false front  | $\frac{1}{2}$       | 15               | 13                 | Plywood   |  |
| ❑ 1               | Top drawer false front   | $\frac{1}{2}$       | 15               | 5                  | Plywood   |  |
| ❑ 2               | Top drawer sides         | $\frac{3}{8}$       | 3 $\frac{1}{2}$  | 18                 | Plywood   | $\frac{3}{16}$ " x $\frac{3}{8}$ " rabbet on ends            |
| ❑ 1               | Top drawer front         | $\frac{3}{8}$       | 3 $\frac{1}{2}$  | 12 $\frac{1}{8}$   | Plywood   |  |
| ❑ 1               | Top drawer back          | $\frac{3}{8}$       | 3                | 12 $\frac{1}{8}$   | Plywood   |  |
| ❑ 1               | Top drawer bottom        | $\frac{1}{4}$       | 12 $\frac{1}{8}$ | 17 $\frac{13}{16}$ | Plywood   | in $\frac{1}{4}$ "-wide x $\frac{3}{16}$ "-deep groove       |
| ❑ 2               | File drawer sides        | $\frac{3}{8}$       | 9 $\frac{3}{4}$  | 18                 | Plywood   | $\frac{3}{16}$ " x $\frac{3}{8}$ " rabbet on ends            |
| ❑ 1               | File drawer front        | $\frac{3}{8}$       | 9 $\frac{3}{4}$  | 12 $\frac{1}{8}$   | Plywood   |  |
| ❑ 1               | File drawer back         | $\frac{3}{8}$       | 9 $\frac{1}{4}$  | 12 $\frac{1}{8}$   | Plywood   |  |
| ❑ 1               | File drawer bottom       | $\frac{1}{4}$       | 12 $\frac{1}{8}$ | 17 $\frac{13}{16}$ | Plywood   | in $\frac{1}{4}$ "-wide x $\frac{3}{16}$ "-deep groove       |

TBE=tenon both ends



This is what the groove looks like after cutting it to its final dimension with a 10" rip blade. You can see the two channels at the bottom, which will catch excess glue at assembly time. The plane is cleaning up the saw marks.



Always dry-fit all your parts before assembly. This will allow you to make sure your panel isn't too big, which would prevent your assembly from going together.

to go. This works really well. You would have to gorge yourself on glue to force it to squeeze out.

### Think Square with the Frame-and-panel

It's easy to get into trouble with frame-and-panel assemblies. Even if all your rails, stiles and panels are square, once you assemble them, the resulting assembly might not be square. For that reason, I always rip my stiles, top rails and bottom rails about  $\frac{1}{8}$ " wider than the cutting list calls for. I also crosscut my stiles  $\frac{1}{4}$ " longer. This makes the assembly panel  $\frac{1}{8}$ " larger all around – which is more than enough to square it.

After the frame-and-panel assembly is glued, clamped and allowed to dry, take it out of the clamps and then joint one long edge of the assembly. Now rip the

assembly to width in a couple passes on your table saw so you can remove stock from both long edges. Then you need to crosscut the assembly to width. If you have a sliding crosscut table on your saw, this is easy. If you don't, then I recommend you clamp a straight-edge to your assembly and rout the top and bottom edge of one assembly to length.

Once you get one of the sides square, you can use it as a template for the other side assembly. Clamp the unsquare side on top of the square side. Line up the long edges of the two pieces. Then use a router with a pattern-cutting bit to make the top assembly just like the bottom one.

Small steps like this one will ensure your case can be easily squared up when you glue the top, middle and bottom pieces in place.



All of the plywood parts have solid-wood edging glued to them. We don't own any edge clamps, so I clamped the edging to the panels using our bar clamps. The edging is  $\frac{5}{16}$ " x  $\frac{3}{4}$ " and a little longer than the piece it is being glued to.



After the glue is dry, trim the edging flush to your plywood using a low-angle block plane.



The same plane can trim the edging flush at the ends. This allows you to sneak up on a perfect fit with your other panels.



## Eternally Warping Stiles

The doors use plastic panels instead of glass or wooden panels. The plastic panels we chose are typically used for building greenhouses. They're rigid, stable and durable. A 4' x 8' sheet costs only about as much as veneer-core plywood (see the supplies box), but the shipping costs are especially expensive for the Midwest and East. Using a utility knife, I cut the panels in a chevron pattern with the corrugations running at a 45° angle. It's simple work to change the pattern to make a shallower or steeper chevron, or to have the corrugations run vertically or horizontally.

And if you're not looking for a contemporary look, it's easy to substitute plywood panels, glass or other material. After the project is finished, install the pan-

els by nailing in 1/4" x 1/4" cleats around the rabbet in the door.

The doors should be built the same way you built the frame-and-panel assemblies for the carcass: Cut your parts oversized and trim the final assembly to size after it's glued up. This will make hanging your doors easier.

Another thing that will ease installation is to have doors that are flat. Making large doors is a confounding woodworking puzzle. Long and narrow stiles tend to warp or twist when ripped on the table saw. Even a little warp can prevent the stiles from lining up when the doors are shut. The first set of doors I built for this cabinet had stiles that warped more than 1/4". This is too much warp in my book. I built a second set of doors, and they warped about 3/32". And that you can fix.

## MATERIALS

Maple: I used about 60 board feet of 4/4 hard white maple.

Plywood: You'll need two sheets of 3/4" maple plywood, one sheet of 1/2" maple plywood, one sheet of 1/4" Baltic birch plywood and one sheet of 3/8" Baltic birch plywood.

## SUPPLIES

Lee Valley Tools, 800-871-8158 or [leevalley.com](http://leevalley.com)

| # | ITEM NO. | NAME                         | PRICE EACH |
|---|----------|------------------------------|------------|
| 2 | 01W83.14 | 328mm stainless bar handle   | \$4.80     |
| 2 | 01W83.20 | 1,000mm stainless bar handle | \$12.70    |
| 3 | 00H37.50 | pair of reversing hinges     | \$1.30     |
| 2 | 02K30.18 | 100-lb. slides, pair         | \$9.90     |
| 1 | 12K88.30 | slide w/rest & mouse pad     | \$99.50    |
| 4 | 00U07.22 | 2 3/8" gray grommets         | \$1.50     |
| 4 | 00S81.50 | adjustable steel leg         | \$4.50     |

You can order a kit of all these parts by asking for item # 05D15.13.

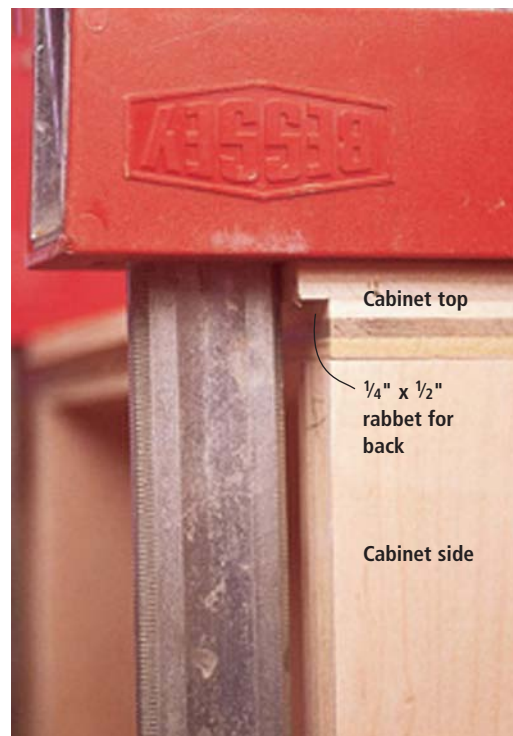
Plastic panels:

Farm Wholesale Greenhouses, 800-825-1925 or [farmwholesale.com](http://farmwholesale.com)  
Double-walled panel, 4'1" x 8'1" panels (5mm thick), item #GS-240, \$28.95 plus shipping.

*Prices correct at time of publication*



With the top, middle and bottom pieces all ready for assembly, rout the dados and rabbets in the sides. I use a shop-made fence and a router bit that's slightly undersized (23/32") to compensate for the undersized plywood.



The interior cabinets are assembled using biscuits and glue. One important detail is the way the back works. The rabbet is cut on the top and bottom piece of the file unit and the cubbyhole unit. When you screw the back in, you can see the plywood edge from the side, which is OK because it will be concealed when the interior cabinets are in the main case.

The drawer boxes are simple. The front and back rest in  $\frac{3}{8}$ " x  $\frac{3}{16}$ "-deep rabbets in the side pieces. The bottom slides into a  $\frac{1}{4}$ " x  $\frac{3}{16}$ "-deep groove in the sides and front. The back is  $\frac{1}{2}$ " shorter than the front piece to allow the bottom to slide in.



When building drawer boxes, the most critical dimension is the width of the assembled box. If you are off by more than  $\frac{1}{32}$ ", your drawer slides will not function. It pays to mock up an assembled drawer to get the fit just right. The slides listed in the supplies box require  $\frac{1}{2}$ " of space between the drawer box and case, so I'm shooting for a drawer box that is exactly 1" less than the case opening.



How do you get the warp out of the doors? Two ways: judicious planing and two sets of magnetic catches for each door – one at the bottom and one at the top. First hang the doors. Here's a good tip for hanging doors on frameless cabinets: Install the doors while the cabinet is on its back. If you hang them while the cabinet is on a floor or bench that isn't dead flat, any rack or twist in the case will be translated into the doors' position as you hang them. When the cabinet is on its back, it's not racked.

Once you get the doors hung, install the adjustable feet on the bottom of the cabinet and put the case on the floor. Adjust the feet until the doors line up like they did when the cabinet was on its back. Now you can deal with the warp. Install the magnetic catches; put one set at the top of the cabinet and one at the bottom. Adjust the catches forward and back until the stiles are in the same plane at the top and bottom of the cabinet.

Now check the middle of the doors to see how the stiles line up there. If one is proud of the other, take a marking knife (a knife with a single bevel is most accurate) and scribe the difference on the proud door. Remove the door that's proud and plane the stile down to that line. Rehang the door and check your work.

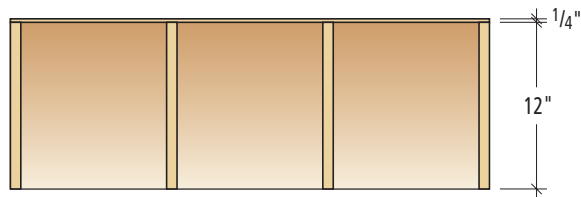
Like everything in woodworking, it's the myriad small details that add up to a job well done. And this project has a mound of them. **PW**

When installing side-mount slides like this, I like to use spacers made using scrap to position the slides. I can simply hold the slide against the spacer and then screw it in place.

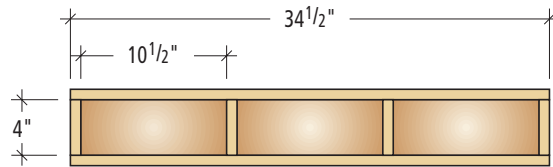


## DESIGN NOTES

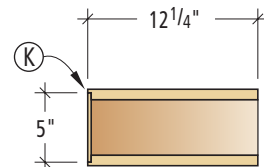
Customize the lower file cabinet and cubbyholes to your needs. If you want to use hanging files, increase the overall drawer width to 13". If you have a large printer, remove a divider and the adjustable shelves from the file unit. If you use legal paper, increase the depth of the cubby-hole unit to 14½".



Cubbyhole plan, top removed



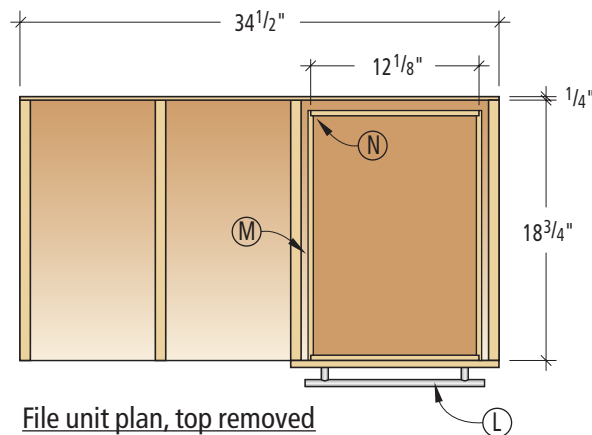
Cubbyhole elevation



Cubbyhole section

### Cubbyhole Construction Note:

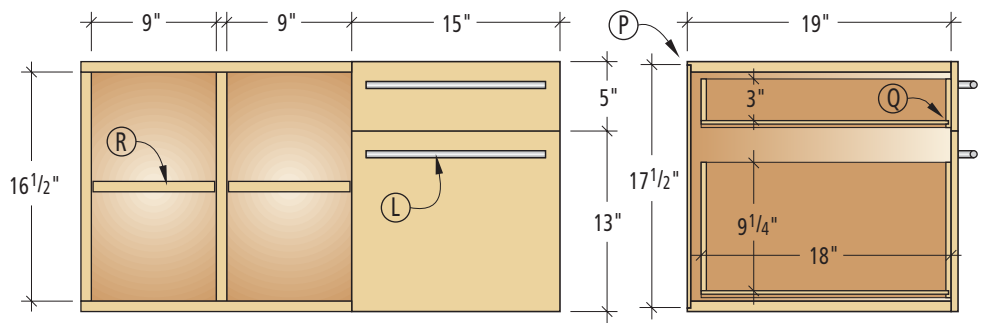
- (K) ½" wide x ¼" deep rabbet



File unit plan, top removed

### File Unit Construction Notes:

- (L) 328 mm stainless steel bar handle
- (M) Full-extension drawer slides
- (N) ⅜" wide x ⅜" deep rabbet
- (P) ½" wide x ¼" deep rabbet
- (Q) ¼" wide x ⅜" deep groove
- (R) Adjustable shelves



File unit elevation

File unit section

The false front for the top drawer is trickier than installing the bottom front. I'm installing it here using a couple dabs of 5-minute epoxy. Shift the drawer front around a bit until it lines up with the lower drawer front then let it sit for about 30 minutes. Then you can open the drawer and screw it in place.

The top is made by gluing and nailing ¼" plywood to ¾" plywood. I used strips of ¼" instead of a single piece for two reasons. One, it saves material. Two, it gives me a way to ventilate the cabinet. With the center part left open, all I need to do is drill three 7/8" holes in the top of the cabinet (behind the cubbyhole unit). This allows warm air to rise up and out through the back.



A steel-frame band saw, built for resawing.



The traditional cast-iron band saw, with riser block.



Photos by Tim Grondin and Al Parrish



# Steel-frame Band Saws

Steel-frame machines are the hottest thing in the band-saw market. Is it time to get one for your shop?

**T**he newest thing in band saws is the European-style steel-frame band saw. They tend to be more expensive than traditional cast-iron band saws. And while they look interesting, we've decided to tackle the question of whether they belong in your woodshop.

Ultimately we found that if you're considering one of these machines as an option or upgrade to your 14" cast-iron saw, a 14" or 16" steel-frame saw may make a fine choice. The larger model steel-frame saws are priced, and designed, to meet the needs of a more demanding category of woodworker. Should you make the leap? Let's find out.

## Apples to Apples

In considering a switch to steel-framed saws, we've found that not all steel-frame saws are the same, just as all cast-iron band saws aren't the same. The category more accurately breaks into two smaller groups, 14", 15" and 16" steel-frame saws, and the 18", 20" and larger saws. There are also 17" saws that offer larger capabilities at smaller prices.

As a starting reference point, we chose the traditional band saw for most woodworkers: a 14" cast-iron model such as the Delta shown at left. It has two large castings (upper and lower wheel mount/housings) that form the basic frame of this saw. It can be mounted on an open frame or enclosed base and usually features a 6" to 7" resaw capacity (the maximum amount of blade that can be exposed), a 12" to 13" throat capacity (blade to post) and usually includes a  $\frac{3}{4}$ - to 1-horsepower motor. A cast-iron table mounted to aluminum or

cast-iron trunnions completes the design. These saws usually handle up to a  $\frac{3}{4}$ "-wide blade and are good for most woodshop needs. With a riser block between the upper and lower cast frames, you can increase the resaw capacity to 12".

In comparison, steel-frame saws are made from formed steel. The essential structural part is the spine or column of the saw. This column can be made a number of different ways depending on the manufacturer (see the accompanying article on column design). The body of the saw is still more steel, fabricated into upper and lower housings with the wheels welded onto mountings in the housings. A cast table and a trunnion assembly completes the package. They accept blades as large as 1" and 1½" in width. Depending on size, they offer resaw capacities from 8" to 12". These saws include tables that can be 80 percent larger and increased motor sizes from 1½ to 3 hp.

Many of the features on the steel-frame saws are common to every size model, but this article will focus on the 14" to 17" models, which are similar in price and capacity to the 14" cast-iron saws. In our opinion, the larger steel-frame saws are for small industrial operations or dedicated resawing.

## Why Steel Frames?

To help determine the benefits of steel-frame saws, we consulted some biased (and unbiased) experts. All had reasons to recommend a steel-frame saw, but Torben Helshoj, owner of Laguna Tools, started with a neutral position and then explained the benefits from a manufacturing point of view.

by David Thiel

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Comments or questions? Contact David at 513-531-2690, ext. 1255 or [david.thiel@fwpubs.com](mailto:david.thiel@fwpubs.com)



## PARTS OF A EURO SAW

**A. Cast-iron wheel** - The non-spoke cast-iron wheel is safer for fingers and also will withstand high (30,000 psi) tension without turning into a potato chip.

**B. Column** - While it's hard to tell the internal construction of the post without cutting it into a cross section, it's good to ask the salesperson to describe it. This will help determine the twist-strength offered.

**C. Table** - Solid, stable and large, these tables provide great support for even large lumber, while still allowing adjustable angle cutting.

**D. Upper & lower guides** - Where the blade is ultimately controlled. Guides provide side-to-side and rear guidance to keep the blade straight and in line.

**E. Tension wheel** - Bring the blade to proper operating tension. It's a good idea to reduce or release blade tension when the saw is not in use to keep wheels and the blades themselves from being damaged and to preserve the life of the tensioning spring.

**F. Fence** - Not standard on all saws, a decent fence is important to quality resawing. If it's not included, check into buying one or making your own.

**G. Wheel brush** - Again, not available on all saws, the wheel brush keeps sawdust from building up on the tires, causing the blade to track poorly, ultimately affecting the cut, or damaging the blade.

**H. Brake** - Another sometimes-included option, the foot brake makes changing your setup faster and keeps the blade from running for extended periods after shut-off due to built-up inertia. The machine may be quiet, but the blade can still be spinning. It's a good safety feature.

"I don't have any preference over steel-frame or cast-iron saws. There's nothing wrong with cast-iron for a saw. The only concern (when choosing a band saw) is you must have a perfect anchor for the wheels to mount to so they stay perfectly aligned. That can be cast iron or steel," Helshoj says. "The difference between the two is that steel-frame saws look nicer, and the manufacturing process allows you to do many steps at once."

### Manufacturing Benefits

While steel-frame saws require more steps to produce (bending, adding bracing and welding) than cast frames, the process can be

highly automated, a big benefit.

Curtis Wilke, president of Wilke Machinery (manufacturers of Bridgewood machinery) says if a manufacturing plant uses CNC (computer numerical control) machinery for the cutting, bending and welding, then manufacturing can be affordable. It's less expensive, in fact, than foundry work for cast iron.

Jesse Barragan, owner of Eagle Tools, the U.S. distributor for Agazzani band saws, agrees. A manufacturer can pay twice as much for a cast-iron body as a steel body, he says.

Unlike casting the iron frame, (then milling the surfaces and boring the necessary holes), steel

saws can be cut and formed at one time, Helshoj says. The sheet steel is laser-cut to size and shape, and any holes are laser-cut at the same time by CNC machines. The next machine bends and shapes the pieces, and the next machine welds the structure together.

### Resawing Benefits

While ease of manufacturing (depending on the technological level of the factory) is an advantage to steel-frames, many of our experts cite resaw capacity as the big advantage for the end-user.

Lonnie Bird, a contributor to *Popular Woodworking* and author of "The Bandsaw Book," says the reason to purchase a steel-frame

saw is to gain affordable resaw capacity. Resaw capacity is determined by the distance from the table to the bottom of the upper blade guide at its highest point. He says that though throat depth is also larger in the steel-frame saws, it's not as critical a statistic as the resaw capacity.

Resaw capacity can also be limited by the machine's ability to tension the blade properly, Bird says. To tension a spring-steel blade requires somewhere around 24,000 lbs. per square inch of tension, he says. A carbon-steel blade requires half that tension. For resawing, a better quality, larger-width blade is a plus, and this blade requires more tension. Bird says steel-frame saws are designed to better meet this requirement.

Wilke also cites tensioning ability as a reason to buy a steel frame, explaining how tensioning can impact a band-saw frame.

"It's not actually a bending of the frame under tension that's a concern, but a twisting," he says. "As much as a .040" twist in the frame can pull the wheels out of co-planer alignment and keep the blade from tracking properly. You can compensate by using the blade guides to keep the blade from walking off, but it's not the right way to do it."

Wilke considers steel-frame saws to be more rigid because of the column construction. It's not just the fact that it's a steel column, but also the shape of the steel column. He says the column can be a single square-tube design, a dual-tube, or a column with channels and bends to increase rigidity. The thickness of the steel must also be considered.

Barragan has noted recent upgrades to cast-iron band saws to increase capacity and performance. In his opinion, it's not enough. He says the problems with 14" cast-iron band saws are



still capacity and power. "If you upgrade everything on a 14" (cast-iron) saw, including the motor, guides and add a riser block, it's still not the same as a steel frame saw," Barragan says.

"It's stretching the machine beyond its design capabilities. Steel-frame saws offer much better rigidity, and body rigidity also produces less vibration. These saws also have increased throat capacity and improved features at a good price. The tables are larger and the trunnions are larger. Everything is designed for more robust work."

In fact, Barragan says a band saw can replace a table saw for many tasks and is safer because there is no danger of kickback.

### Factors Beyond Resawing

Our experts also agree that wheel design plays an important role in determining how much tension can be loaded on a band saw, again a benefit for resawing. In general, cast-iron wheels are preferred. While this is standard on the majority of larger steel-frame saws, the wheels on the smaller saws that we're focusing on can be either aluminum or cast iron and of varying design.

Wilke prefers cast-iron wheels, but says that aluminum is OK up to 15" in diameter. Beyond that, he says, they're not really capable of sustaining the tension without warping. Wilke also says a spoke design is less safe (accidentally sticking fingers in while spinning at any speed is bad).

Barragan also prefers cast-iron wheels, saying that they have more inertia. A heavier wheel's inertia while spinning adds more force behind the cut. But recognizing that cast iron isn't always as economical, he says he'll look first for a well-balanced wheel. "I'd still prefer a well-balanced aluminum wheel over a poorly balanced cast-iron one."

Bird agrees, adding that a well-balanced aluminum wheel with a properly powered motor will also provide good results.

### Table Height

When we started looking at steel-frame saws we hadn't realized that as the throat and height capacities increased, the table height on these saws got lower.

If you're using these saws for resawing, the lower table allows a more natural body position for feeding big boards through the

The top photo shows how tricky it can be to determine what type of column construction is used. While the top of the column looks like a single-tube tapered design, it is actually a dual-tube design. The column in the photo below is easier to read, showing a dual-tube column design with extra bends to increase strength against twisting. Also note the trip switch on top that keeps the machine from being turned on when the door is open.



blade. Conversely, if you intend to use a 17" steel-frame saw for a variety of applications in your shop, you may find the table is too low for comfortable use.

As Barragan mentioned earlier, the band saw can replace the table saw for ripping. Helshoj expands on that thought and connects the table height to it. He points out that the table heights on the larger steel-frame saws are at table-saw height. He would like to see Americans use band saws more routinely for ripping. Not only are they safer, he says, but they are more efficient at rip-

ping material thicker than  $\frac{3}{4}$ ".

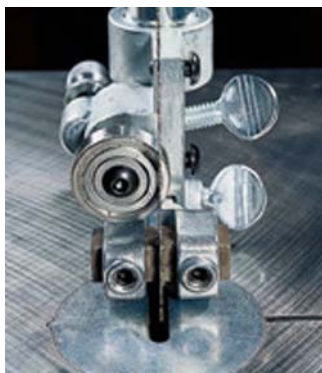
When asked if then the larger band saws then shouldn't be used for detailed curve-cutting operations because of the table height, Helshoj says, "No, they can tension and guide an  $\frac{1}{8}$ " blade as well as any saw. Just pull up a stool and have a seat."

### Guides

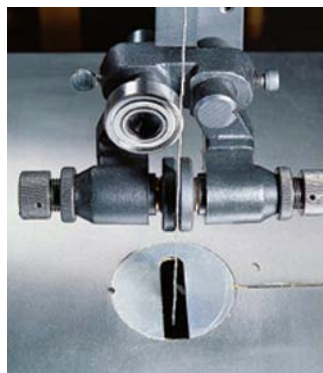
No matter what size saw you prefer, the guides are important. One standard upgrade found when moving into steel-frame saws is nicer guides. All of our experts have different opinions about



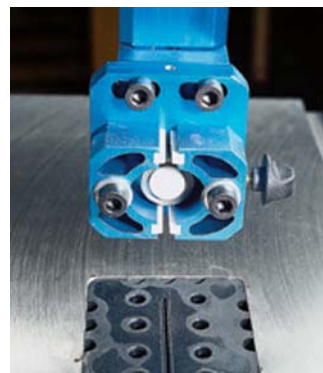
The wheel at the far left is of the spoke design, while the wheel at the right is not. Though a subject of debate, the spoke design is likely less rigid and likely to hold-up less well under tension. The non-spoke design also offers more inertia while spinning, providing a slight turbo-charging effect to the cutting power of the motor. There is also some discussion about the safety issue of the two designs, with the spoked version more susceptible to fingers getting caught.



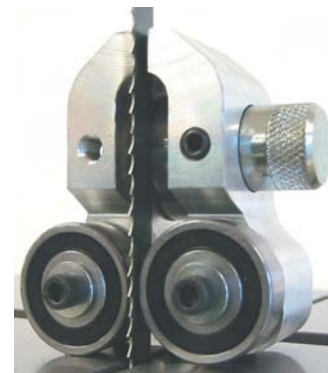
Bird is a fan of the traditional block side guides. Frequently made of steel, these side-guide blocks are also available in a plastic or ceramic. Bird recommends an even lower-tech option, scrap wood: "They're inexpensive, guide the blade, and if an expensive carbide tooth happens to touch the block, the block will give way, rather than the tooth."



Barragan prefers Euro-guides. Bearings that mount face-to-face almost touching the blade body provide side support, while a bearing mounted tangentially to the blade provides rear support. He says that even though they can be fussy to set up, the end result is better performance during the cut.



Helshoj says guides should guide the blade and reduce vibration. He prefers a ceramic block guide because it reduces heat and can touch the blade to dampen vibration (on at least one side of the blade; if the weld is perfect, then on both sides). Blocks are better than bearings because there are no moving parts, further reducing vibration.



Wilke says the Carter Guide-All design is preferable over the Euro guides because the thrust bearing is moving with the direction of the blade, but it is still able to provide stable support. In addition, he says, the grooved track provides excellent guidance.

what guides offer the best performance, and we've posted their opinions above.

### Do you Need a Band Saw Designed for Resawing?

Now we get down to the essence of the question. While our experts agree that the rigidity and capacity found in steel-frame band saws is a benefit to resaw-

ing, you need to decide how important resawing is to you.

Traditionally (and for most woodworkers) the band saw has been a good machine for making curves and some joints. The band saw has become a necessary but an occasionally used tool. Today, woodworkers are becoming more sophisticated in their woodworking – and material selection – and

the value of the band saw as a resawing tool has increased.

Woodworkers are using more expensive and exotic woods, and the idea of losing one-third the thickness of that wenge to the planer is unthinkable. Accurately resawing 12"-wide lumber has become a primary job of the band saw for many woodworkers.

That said, is it necessary, or

even beneficial, to consider a steel-frame saw as the only choice for quality resawing?

Bird says that for the average woodworker, a 14" cast-iron saw with a riser block to extend the resaw capacity and a good blade will do a great job. He says one drawback of cast-iron saws has traditionally been the motor size, which he considers underpow-

## A QUICK LOOK: THE DELTA 14" COMPARED TO THE EURO SAWS

| MODEL              | PRICE | RESAW SIZE        | GUIDE CAP. | WHEEL TYPE | MAX. BLADE | TABLE SIZE      | TABLE HEIGHT | HP    | VOLTS   | WEIGHT | WEB SITE            |
|--------------------|-------|-------------------|------------|------------|------------|-----------------|--------------|-------|---------|--------|---------------------|
| Delta 28-241       | \$800 | 14 6 1/4 (12 1/4) | M          | AL         | 3/4        | 14 x 14         | 44           | 1 1/2 | 120/240 | 224    | deltamachinery.com  |
| General 90-100     | 550   | 14 7              | CB         | AL         | 3/4        | 14 x 14         | 43           | 1     | 115/220 | 210    | general.ca          |
| Laguna LT14        | 945   | 14 8 5/8          | C          | CI         | 1          | 15 x 15         | 44           | 1 1/2 | 220     | 230    | lagunatools.com     |
| Laguna LT14SE      | 1,095 | 14 12             | C          | CI         | 1          | 15 x 15         | 44           | 2     | 220     | 264    | lagunatools.com     |
| Shop Fox W1672     | 550   | 14 7              | M          | AL         | 1          | 14 x 14         | 38           | 1     | 110/220 | 215    | shopfox.biz         |
| Grizzly G1148      | 445   | 15 7 1/2          | M          | AL         | 3/4        | 16 x 16         | 38 1/2       | 1     | 110/220 | 164    | grizzly.com         |
| Agazzani B16       | 1,795 | 16 10             | ES         | CI         | 1          | 22 x 17         | 35 1/2       | 2     | 230     | 288    | eagle-tools.com     |
| Jet JWBS-16        | 890   | 16 10             | ES         | CI         | 1 1/4      | 17 x 17         | 37 1/2       | 1 1/2 | 110/220 | 310    | jettools.com        |
| Laguna LT16 SEC    | 1,095 | 16 12             | C          | CI         | 1          | 19 1/2 x 15 3/4 | 34 1/2       | 2 1/2 | 220     | 320    | lagunatools.com     |
| Mini Max MM16      | 1,795 | 16 13             | ES         | CI         | 1 1/4      | 17 3/4 x 24 1/2 | 35           | 3.6   | 220     | 450    | www.minimax-usa.com |
| Shop Fox W1673     | 825   | 16 8 1/2          | M          | AL         | 1 1/4      | 16 x 16         | 43           | 1 1/2 | 110/220 | 265    | shopfox.biz         |
| Bridgewood PBS-440 | 1,795 | 17 12             | ES         | CI         | 1 3/16     | 16 1/2 x 22 3/4 | 34           | 3     | 230     | 480    | wilkemachinery.com  |
| Felder FB-450      | 1,990 | 17 10             | ES         | CI         | 1 1/4      | 16 x 23         | 33           | 4     | 230     | 350    | felderusa.com       |
| General 90-240     | 1,100 | 17 12             | B          | CI         | 1          | 17 x 17         | 37 1/2       | 2     | 110/220 | 321    | general.ca          |
| Grizzly G0513      | 750   | 17 12             | ES         | AL         | 1          | 17 x 17         | 37 1/2       | 2     | 230     | 321    | grizzly.com         |

CB:carbon block; C:ceramic; ES: Euro-style; M:metal block; B:bearing guides; CI:cast iron; AL:aluminum; Delta cast-iron saw in red.

Thanks to the Olson Saw Co. for providing blades for this article.



ered for resawing. Manufacturers are now offering larger (1½ hp or more) motors to compensate.

### What Category Fits You?

So back to the determining question. If you are a woodworker who will occasionally benefit from better resawing performance, then a smaller steel-frame band saw may be a good move.

Prices for the 14", 15" and 16" steel-frame saws range from an amazingly low \$410 to a steep \$1,795. Because of this dramatic range, you have to look closely at the actual benefits offered to meet your needs.

If you're considering the lower-priced models (\$600 or less), you're not actually gaining much but looks and some possible frame rigidity. The tables aren't actually larger, the motor is 1 hp, the guides are similar and the resaw capacity is 7" or 7½".

If you're considering steel-frame models in the same category as a "premium" cast-iron saw (around \$800) you begin to see larger tables, larger motors and improved guides. When you push over the \$1,000 mark, the benefits become greater. Much larger tables, 2 or 3 hp motors, 12" or more resaw capacity, as well as other nice features, including improved fence systems; brakes to quickly slow the inertia-driven wheels after turning off the power ... and of course, they look good!

### What we Think

At this point you're probably wondering what we think. I want to give you one more expert opinion first. It's from Kendall Smith, product manager for band saws at Delta Machinery.

Smith says Delta is comfortable with the ability of its cast-iron 14" model to compete with

the new 14" to 18" steel-frames.

"The footprint on the 14" cast-iron saw is smaller, saving shop space," he says. "The 1½ hp motor on our newest models will outperform the 16" and 18" steel-frame saws."

(Needless to say, manufacturers of the steel-frame saws take issue with that claim.)

And Smith says that with the riser block added, the Delta cast-iron saw's resaw capacity is as good or better than that on the steel-frame models.

Smith says the tensioning capacity of the saws also is important, and Delta's tensioning spring (recently upgraded to a die spring) will tension a ¾" blade to 12,000 psi. Smith also says more upgrades are coming to meet the needs of band-saw users.

In general, we think the basic 14" cast-iron saw is an effective machine for scrollwork, curve-

cutting, joinery and some resawing. And the recent upgrades on cast-iron saws ensure it will remain a staple of the home shop.

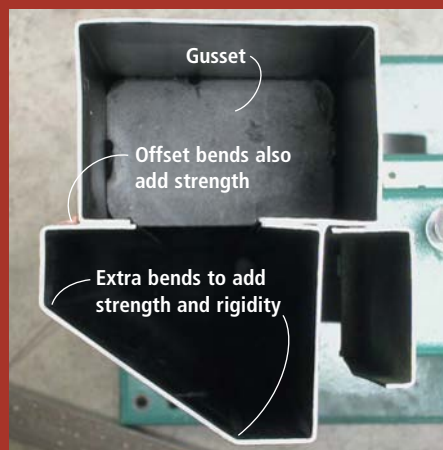
But if you are a demanding user, especially when it comes to resawing, the steel-frame saws offer some mighty big advantages. You also must consider that a good-quality resaw band saw makes it easy to resaw. As a result, you'll resaw more often, and you'll become more discriminating in your material selection.

Here's how we look at the equation: Consider the cast-iron band saw like you would a contractor-style table saw, and then equate the \$1,000-plus steel-frame saw to a cabinet saw.

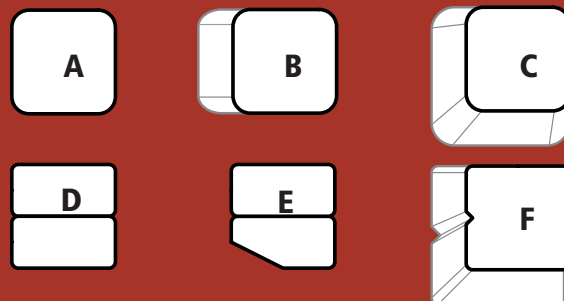
You will do fine with the basic unit for a long time. But if you want commercial-quality machinery in your shop, then the \$1,000-plus steel-frame saws are where you should shop. **PW**

## COLUMN CROSS-SECTIONS

The spine of every steel-frame band saw is the column. Depending on the size of the saw (14" to 20"), manufacture and design, these columns can provide adequate or excellent support, rigidity and anti-twist characteristics. When you look at a band saw in a store it can be impossible to determine what construction design has been employed. Nicely filled and sanded welds actually hide quality designs and make them look simple. While you may have to ask a store employee to describe the column construction to fully understand it, these six examples of column concepts – not necessarily those used (as presented) by any manufacturer, will give you some insight.



The photo at left shows a cross section of a Bridgewood band saw that was cut open for us (it was a damaged machine, don't worry). You can see the double-tube design, as well as the extra bends to add strength and one of the gussets welded in place to increase the tube strength.



A. The basic single-tube runs straight from the top to bottom. It provides reasonable support for less demanding tension.

B. The single-tube design that flares to a wider base to the left. This increases the strength and anti-twisting capabilities.

C. The single-tube design that flares to a wider base on two faces. This increases support a step further.

D. The straight double-tube design adds strength by adding a weld joint and doubling the number of corners. This design could also widen at the base as in B or C.

E. By simply clipping a corner of one tube, the corner strength has increased the anti-twisting ability. Again, this design can widen at the base as in B or C.

F. While still technically a single-tube design, the widened base and corrugation on one (or more) faces increases the strength of this design.

# Shop Aprons

We tested 7 popular designs that cost less than \$50 in search of the best. Unfortunately, we're still searching.

It's a rare day when your neighbor dashes over after hearing about your new, 600-denier Cordura nylon shop apron with fully adjustable straps, bar tacked at all junctions. It's an even rarer day when they ask to try it out and give a low whistle of awe. In the realm of woodworking, shop aprons just aren't exciting.

But a shop apron is a compulsory item for those who like to have certain tools within reach and are tired of dusty clothes.

Some woodworkers choose to sport homemade shop aprons, usually ripped and sewn from a pair of Big Smith's. But for those of you who are wondering what Big Smith's are (bib overalls) and/or really don't have an inclination to sew, there are lots of shop aprons on the market to consider when buying.

## Pockets, Pleats and Threads

Comparing shop aprons involves debates about pleated pockets and differentiating stitch types rather than listing horsepower and testing torque. In fact, test-

ing shop aprons is uncomplicated work: Whenever we entered the shop, we simply put on a different shop apron.

Despite requiring a simple test, there's lots to consider when reviewing shop aprons. Comfort, ease of use, pocket placement, the number of pockets, pocket size, apron dimension, cost, fabric type, thread type, stitching and seams all play important roles when determining what makes a good and hardy apron.

Because it's a tool you wear, comfort is important. A shop apron should be heavy-duty but it shouldn't deter body movement or retain body heat. A shop apron also should have crisscross straps or a yoke-style harness, forcing the weight of the apron on the back rather than the neck.

Ease of use also is key. An apron with poor pocket placement can cause frustration when balancing a board, holding a tape measure in place and digging for a pencil. Bib pockets are wonderful for items like pencils that could break if stored closer to the waist where

by Kara Gebhart

Comments or questions? Contact Kara at 513-531-2690 ext. 1348 or [kara.gebhart@fwpubs.com](mailto:kara.gebhart@fwpubs.com)

Photos by Al Parrish





## LEE VALLEY

This apron offers great dust management. The pockets are kept dust-free by a long flap that folds down over both of them and is kept closed with a snap button. The pockets are nice and big, but a few dividers in each would mean a little less digging. The apron's adjustable neck strap and waist band are bar tacked at all junctions. The apron is easily removed by simply working the straps' two clips, but crisscross straps would be better. Made from cotton with polyester webbing, this apron is not as durable as others in our review. For \$15 this apron might be considered a good deal. But for \$5 more, you can buy a better one.



## DENIM WORKSHOP

You can purchase this traditional style almost anywhere. The material offers durability but the stitching lacks and three pockets aren't enough. The bib pocket, sewn to the apron across the top only, might keep tools from falling out when bending over, but we fear that lessens its durability. The side flaps are too wide and the apron is too long. It would be nice if the apron included a way to connect the two strings where they cross in the back to keep things together. Although a classic, we can't recommend it.



## DULUTH'S CLASSIC CANVAS

If you're going for the Dennis Hopper look in "Apocalypse Now," then this is the apron for you. The average woodworker carries about seven tools in his or her shop apron. The convenience of an apron is lost when you end up searching three pockets for your 6" rule. And while having options is nice, an apron filled with 20-plus tools can make it difficult to bend over. But the yoke-style harness does transfer weight to the back. Pockets with flaps are great; flaps deter dust. But this apron features its flap on the bib pocket while the pockets that see the most dust are left open. Although fun to look at, this apron is overdone, which is reflected in its high cost.



## DULUTH TRADING CO.

This apron was our favorite in the bunch. The side pockets keep your tools out of the way when bending over and their placement helps deter excess dust. Worried that our tools would fall out of the pleated pockets, we realized that bending over causes the apron's material to fold, forming a closed pocket. The crisscross straps were good and the material kept us cool. The bib pockets could be divided into two. And while a long apron offers more protection, this one is almost too long. But, with swanky leather trim and a nice color, this apron is well worth its reasonable price tag.

movement occurs. Pockets on the side of the apron or those with flaps will resist filling up with dust.

The number and size of the pockets is important, too. You'll quickly run out of room with an apron with three pockets or less, and you'll never be able to find anything wearing an apron with 10 pockets or more. There should be two pockets perfectly sized for a lead and grease pencil or chalk, and a pocket for a calculator or

notebook is nice, too. Pockets with deeper wells for tools such as your tape measure and dial calipers should be located near the waist where you can easily thrust your hand for quick extraction. Hammer loops, for woodworkers, are mostly unnecessary.

A shop apron's dimensions also are an important factor. Longer aprons offer better protection while shorter aprons allow you to move more freely. (The

\$3 cotton bib aprons that you commonly find at home center stores, which we refer to as the "teddy of shop aprons," are too short for any woodworker older than five.) The perfect length of an apron is dependent on personal preference.

Cost is important, too. When purchasing a shop apron, you can spend anywhere from \$3 to \$50 (or more, but we didn't test those). As you'll soon see, we haven't

found an apron worth \$50 yet.

Last, and most importantly, you must consider durability. Fabric, thread, stitch and seam type all play important roles in determining how long an apron will last. We contacted Ann Braaten, a graduate instructor at the University of Minnesota's Department of Design, Housing and Apparel, to help us out. She evaluated an apron that had failed in use, gave us advice on what to

look for and told us what you can do at home to improve any shop apron. Check out her analysis, “Preventing Apron Failure” below.

### Seamless Results

Venturing into the world of woodworking attire left us feeling frustrated. We all had the perfect shop apron in mind but we certainly didn’t see it. Therefore, we were unable to hand out an Editor’s Choice award to any of the aprons. We were, however, able to award Duluth Trading Co.’s shop apron our Best Value award. Although the apron presented some flaws, for \$20 it’s a good deal and it won our respect compared to the other aprons in our review. You can read our comments about each apron on the following pages. And do check out “Preventing Apron Failure” below. You’ll not only walk away with a better understanding as to why shop aprons fail, but you’ll feel better about your next shop apron purchase, knowing you can fix some of its flaws at home. **PW**



**BUCKET BOSS  
SUPER BIB**

The straps on this apron are durable but we would like to see crisscross straps. The pockets located around the waist excel at collecting dust, not a feature you want to tout. The stitching is similar to our failed shop apron, shown below. This apron features many pockets but it’s not as overloaded as others in our review. We wish the pencil pockets were longer. This is a good apron, if only it featured better seams. It’s no fun constantly picking up tools that fall out of busted pockets when you bend down.



**LOCAL HOME CENTER  
COTTON BIB**

Every home-center store has a bin full of cotton aprons. Although it might be sold as one, this apron is not meant for a woodworker. The first thing to get soiled in a woodworking shop is the waist and thigh area – not the chest. And its minimal pockets (although slightly more durable than some in our review) only allow for a few stored tools. But, despite its deficiencies, we have to recognize its low cost: \$3. Perhaps the best thing to do would be to buy 10 of them and sew a couple together.



**WOODCRAFT'S  
DELUXE CORDURA**

This apron sports many features others miss, such as the split up the middle of the bottom. The pockets are nicely arranged and close up when bending over, and the cross-over neck strap is good. Although heavy-duty, the material is hot and stiff. The stitching on the pockets is worrisome. Overall a good design but we’re too concerned with the choice of material and durability to justify spending \$50.

## PREVENTING APRON FAILURE

Senior Editor Christopher Schwarz wore the Bucket Boss shop apron (right) for six months before it fell apart. After a little stitch work, the apron lasted three more months before it was finally retired.

So we mailed the failed apron to seam guru Ann Braaten, a graduate instructor at the University of Minnesota’s Department of Design, Housing and Apparel. Following are her comments along with some recommendations for improving similar shop aprons at home.

“What failed on the Bucket Boss apron was not the seam, stitches or thread, but the fabric,” Braaten wrote in an e-mail. The strength of an apron’s fabric is the most important feature. According to Braaten, a seam should be slightly weaker than the fabric. Mending a few broken stitches is easier than mending torn fabric.

The pockets on this apron are stitched using a “straight lock stitch,” with “back stitching” at the ends of the seams. According to Braaten, lock

stitches (the most common stitches in today’s sewn products) are the type of stitches made by a traditional home sewing machine. A top thread and a bottom thread are twined together, which “locks” the stitch in place. A back stitch is created by stitching forward three to four stitches and then reversing the direction and stitching backwards three to four stitches, Braaten wrote. The seam is sewn and then the back stitching procedure is repeated at the other end of the seam. The extra stitches strengthen the beginning and the end of the seam.

The apron at right was made using cotton canvas fabric. According to Braaten, cotton canvas is a relatively strong fabric because it packs a large number of threads per square inch. The fabric is woven, meaning it has interlacing horizontal and vertical threads. This woven design creates strength, but isolating stress to a few single threads can cause failure. Why? Each individual thread that makes up the fabric is

relatively weak, compared to nylon or polyester.

Below you can see where the pockets have become disconnected with the fabric. According



According to Ann Braaten, a graduate instructor at the University of Minnesota’s Department of Design, Housing and Apparel, seam, stitch and thread type didn’t fail, rather the strength of the apron’s fabric was too weak, causing the pockets to rip away from the apron’s body.



## SHOP APRONS

|                     | LEE VALLEY                                    | DENIM WORKSHOP                    | DULUTH'S CLASSIC CANVAS   | DULUTH TRADING CO.                                     | BUCKET BOSS SUPER BIB   | HOME CENTER COTTON BIB                              | WOODCRAFT DELUXE CORDURA                             |
|---------------------|---|-----------------------------------|---|--|---|---|--|
| Item #              | #67K10.04                                     | N/A                               | #83300  | #83490   | #83200  | N/A   | #140352  |
| Cost                | \$15  | \$15                              | \$50  | \$20   | \$20  | \$3   | \$50   |
| Dimensions*         | 28" x 33"                                     | 27" x 38"                         | 21½ x 34"   | 27" x 38"  | 23¾" x 23¾"   | 17" x 19"   | 34" x 29"  |
| Weight**            | 10 oz.  | 12 oz.                            | 21 oz.  | 10 oz.   | 12 oz.  | N/A   | 12 oz.   |
| Material            | cotton canvas                                 | denim                             | canvas w/ leather trim  | cotton duck (canvas) leather trim                      | cotton duck (canvas)  | cotton  | Cordura nylon  |
| Stitching           | pockets double stitched and locked at corners | #40 thread in lock stitch pattern | single stitched seams, heavy-duty thread, bar tacked at junctions | single stitched seams, double stitching around pockets | single stitched seams, heavy-duty thread, bar tacked at junctions | single stitched seams, back tacking at end of seams | bar tacked at junctions, heavy stitched on all seams |
| Number of pockets   | 5   | 3                                 | 18  | 6  | 13  | 4   | 7  |
| Pocket flaps        | yes, two bottom pockets                       | no                                | yes, bib pocket   | no   | no  | no  | no   |
| Size of pockets     | 3 small bib, 2-8" x 8" waist                  | swing-style chest, lower patch    | 11 small tool, 7 deep well  | 2 small bib, 4 large side                              | 8 smaller, 5 larger   | 2 small bib, 2 large waist                          | 4 small bib 3 large waist                            |
| Hammer loops        | no  | no                                | 2 + key keeper/ tape strap  | 0  | 2   | no  | no   |
| Criss-cross straps? | no  | yes                               | yes   | yes  | no  | no  | yes  |
| Contact             | 800-871-8158<br>leevalley.com                 | available from many stores        | 800-505-8888<br>duluthtrading.com                                 | 800-505-8888<br>duluthtrading.com                      | 800-505-8888<br>duluthtrading.com                                 | avail. from any home center store                   | 800-225-1153<br>woodcraft.com                        |

\*Dimensions listed as width x length. \*\*Weights listed are the number of ounces in one square yard of fabric. Winner is labeled in red.

Key to stitches: Lock stitch: Top thread and bottom thread twined together – a common stitch. Back stitch: Stitch runs forward and then back three to four stitches at the end of a seam. Bar tacked: A short row of zigzag stitches that are closely spaced.

to Braaten, this is because the stitching was supported by only one or two threads that make up the fabric. The fabric's threads weren't strong enough to support the pockets' load.

Braaten wrote that cotton canvas works well as shop apron fabric because it's comfortable, relatively lightweight yet protective. The fabric would be strong enough if the seams used covered more area of the fabric and a layer of fabric reinforcement was added. Braaten also wrote that a cotton twill weave, such as denim or drill (a strong, twill cotton fabric), would also be appropriate if it had a high number of threads per inch. And while polyester and nylon offer more strength, they're usually heavier and not as absorbent, so less comfortable to wear.

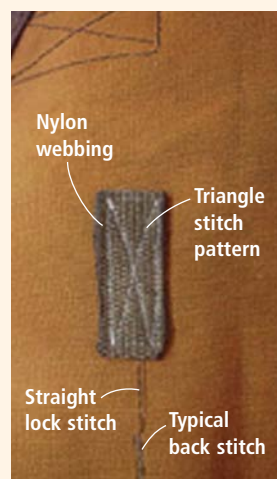
Although the apron shown here has been officially retired from the shop, there are several steps you can take to ensure that your apron doesn't fail. All it takes is a sewing machine (or finding a friend who knows how to use one).

According to Braaten, the apron's pockets can last much longer if first the fabric is strengthened wherever it sees the most stress, which is often at the ends of the stitching located at the pockets' tops. Here's what to do:

First, head out to your local fabric store and buy nylon webbing similar to the material shown in the picture. Now cut the nylon webbing into small rectangles or squares. Make sure they're not too big – you don't want to sew the pockets on the front of your apron shut. Using a match, carefully melt the ends of the webbing so the ends won't fray. Attach the webbing to the fabric using a washable glue stick first – it will help hold the webbing down.

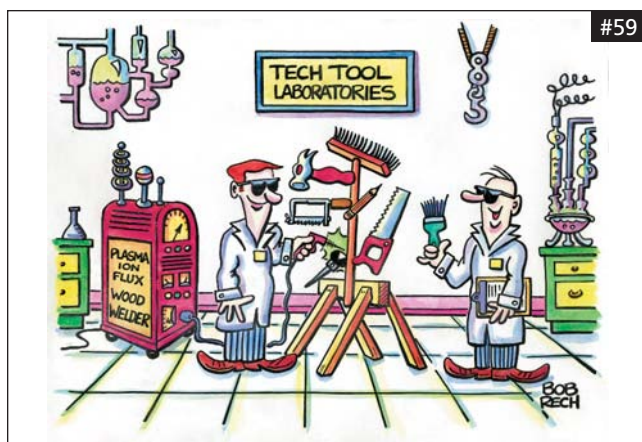
Select a stitch pattern that spreads the stitch over more of the fabric's threads than a straight row of stitching would, such as bar tacks (a short row of zigzag stitches that are closely spaced) or a triangle stitch pattern. Using your selected stitch pattern, stitch the nylon webbing on the

This extra nylon webbing, sewn to the back of the apron, reinforces the pocket seams. The triangle stitch pattern spreads the stitch over more of the fabric's threads than a typical lock stitch would.



back side of the apron at the end of the pockets' stitches at the pockets' tops. You can see our modified Duluth's Super Bib apron above.

— Kara Gebhart



## We Now Take E-mail Entries!

Submit your captions for this cartoon by e-mailing them to [cartoon@fwpubs.com](mailto:cartoon@fwpubs.com) (be sure to put "Cartoon Caption #59" as the subject of your e-mail) with your name, address and phone number. Or send it to us on a postcard: *Popular Woodworking*, Cartoon Caption #59, 4700 E. Galbraith Road, Cincinnati, OH 45236 by **July 1**. Winners will be chosen by the editorial staff.

This issue's winner receives the Makita 6317DWDE, MFORCE 12-volt cordless drill. This two-speed, 1/2"-chuck drill offers two 2.6 amp-hour nickel metal hydride batteries providing more than 300 in./lbs. of torque. It was recognized by *Popular Woodworking* as one of the best cordless drills available today. The runners-up each win a one-year subscription to *Popular Woodworking*.



"As the great woodworking psychoanalyst Freud once said: 'Old tools never die even if they have been hit by a Jet, attacked by a Grizzly or drowned in the Delta...we shall see them again as their spirits fly on the dovetail of that Great Woodworking Show in the sky!'"

**Leo Glowe**, of Henderson, Nevada, is the winner of our Cartoon Contest from the February issue and recipient of the Makita drill. The following runners-up each receive a one-year subscription to *Popular Woodworking*:

"He died bit by bit."

**Vicky Landro**, Williston, North Dakota

"After a boring life, may you rust in peace."

**Joseph L. Medley**, Louisville, Kentucky

"She was survived by her three cordlesses, ages 18V, 12V and 9.6V."

**Jason Brown**, Naperville, Illinois



# Finishing Walnut

Unlock the awesome beauty of this classic cabinet wood with simple finishing techniques.

Though American black walnut has lost some of the popularity it had a decade or two ago, it remains one of the easiest of all woods to finish, primarily because almost every possible stain, finish or other decorative material looks good on it – even the non-film-building finishes, wax and oil.

All wood stains, whether pigment or dye, look good on walnut, and most tend to make the wood, which has a naturally cold cast, look warmer. The pores of walnut are relatively tight for an open-grained wood, and they look good kept “open” with very thin finishes and also filled to a mirror-flat appearance. Two-part bleach can be used to make walnut nearly white (it can then be stained to whatever color you want), and black dye stain can be used very effectively to “ebonize” it. (Figure 1.)

The only finishing product I can think of that doesn’t always look good on walnut is water-based finish, which tends to make the wood look flat and washed out. But even this isn’t always the case, because manufacturers are getting better at giving these finishes a warmer, deeper-penetrating appearance.

## Choosing a Finish

The three primary qualities you look for in a finish are ease-of-application, durability and color. Considerations of application ease and durability are the same for walnut as they are for all finishes.

Oil and wax are the easiest finishes to apply because you wipe off all the excess. So there aren’t any runs, brush marks or orange peel, and dust isn’t a problem. Oil-based varnish and polyurethane are the most difficult finishes to make look nice because they dry so slowly that runs have time to develop and dust has lots of time to become embedded. All other finishes fall in between.

Oil and wax are also the least durable finishes because they never get hard. Shellac,



Photo by Al Parrish

lacquer and water-based finish are next, and oil-based varnish and polyurethane are the most durable common finishes. Catalyzed lacquer is also very durable, but it is used primarily in professional shops and factories.

Color is the finish quality that has specific meaning for walnut. Some finishes darken wood more than others, and other finishes add a yellow (actually more of an orange) coloring to the wood. In my opinion, walnut looks best with this warmer orange tone. (Figure 2.)

Clear wax is the only finish that doesn’t darken wood. Oil finishes tend to penetrate and darken wood more than faster-drying finishes such as lacquer. Along with orange (amber) shellac, varnish and polyurethane, oil finishes also add more yellowing than do other finishes.

Water-based finishes darken wood but they don’t add yellowing. Blonde or clear shellac, nitrocellulose lacquer and catalyzed

lacquer add some degree of yellowing, but not as much as varnish and polyurethane.

You can clearly see that there are real choices to be made with finishes, but all look good on walnut depending on your priorities.

## Choosing a Stain

All stains look good on walnut, too. Though walnut blotches a little, it does so in a way that most people find attractive. So blotching, the ugliest effect that can occur in staining, isn’t a problem with walnut.

The question is whether to stain at all, and there is a widespread feeling in the wood-working community that wood, especially a high-quality wood such as walnut, should not be stained. Maybe it’s all right in factories where boards are glued up randomly, but woodworkers can pick and choose boards and arrange them to achieve maximum beauty. Why would anyone want to stain walnut?

I have two answers: one general to the broader question of staining and the other specific to walnut itself.

Amateur wood finishers in the United States suffer greatly because manufacturers are so sparse (and often inaccurate) with the

by Bob Flexner

*Bob Flexner is the author of “Understanding Wood Finishing” and a contributing editor to Popular Woodworking.*

information they provide on their cans, and woodworking magazines and books haven't filled the void – publishing too much information that is contradictory and therefore confusing. As a result, most woodworkers don't feel comfortable with stains, finding them the cause of too many problems.

Implied here is that woodworkers would not be so adamant against staining if they had control of the process.

Specific to walnut, it has a colder natural coloring than most woods and almost always looks warmer with a stain, even if it's nothing more than an off-the-shelf "walnut" stain. (Figure 3.)

### Dealing with Sapwood

If walnut has a problem, it is the sharp color contrast between heartwood and sapwood – and stains can be used effectively to blend these colors. The easiest method is to apply a walnut dye stain to the entire surface. (Figure 4). But a more effective method is to apply a "sap stain" to the sapwood before applying a wiping stain. (Figure 5.) These methods can also be used, of course, to blend white woods such as maple and poplar to walnut.

Sap stains aren't widely available, but it's easy to make the stain yourself. Just add a little black dye stain to walnut dye stain (any type will work) so it becomes "off black." The amount you add will vary depending on the strengths of the particular dyes you're using, but think in terms of 10 to 20 percent black to begin with and adjust from there. Practice on scrap wood to get the feel.

It's best to apply the sap stain by spraying so you don't leave a sharp line at the intersection of sapwood and heartwood, but you can use a brush or cloth if you "feather" the stain onto the heartwood. A little sap stain getting on the heartwood isn't a problem as long as the stain is feathered out because it will be disguised by the next step.

When the sap stain is dry, apply an oil-based, walnut wiping stain, which won't cause problems with any dye stain. Finally, when this stain is dry, apply the topcoat finish of your choice.

American black walnut is considered the king of woods for its beauty and working qualities, and it should receive the same acclaim for its finishing characteristics. **PW**

Figure 1: Walnut resembles ebony when dyed black (left), and it can be bleached almost white (right).



Figure 2: Varnish applied to the left side of this walnut board adds a warmer coloring than does water-based finish applied to the right side.

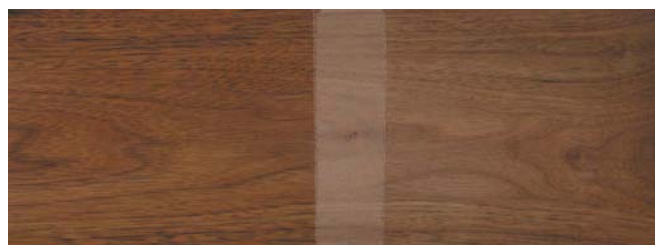


Figure 3: The walnut stain applied to the right side of this walnut board adds warmth to the normally cold coloring of walnut. (A lacquer finish was applied to both sides.)

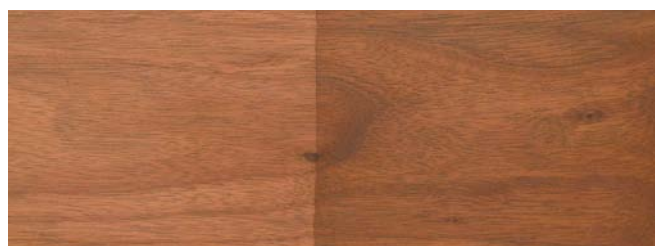


Figure 4: The dye stain applied to the right side of this walnut board is fairly effective at blending the sharp contrast between sapwood and heartwood.

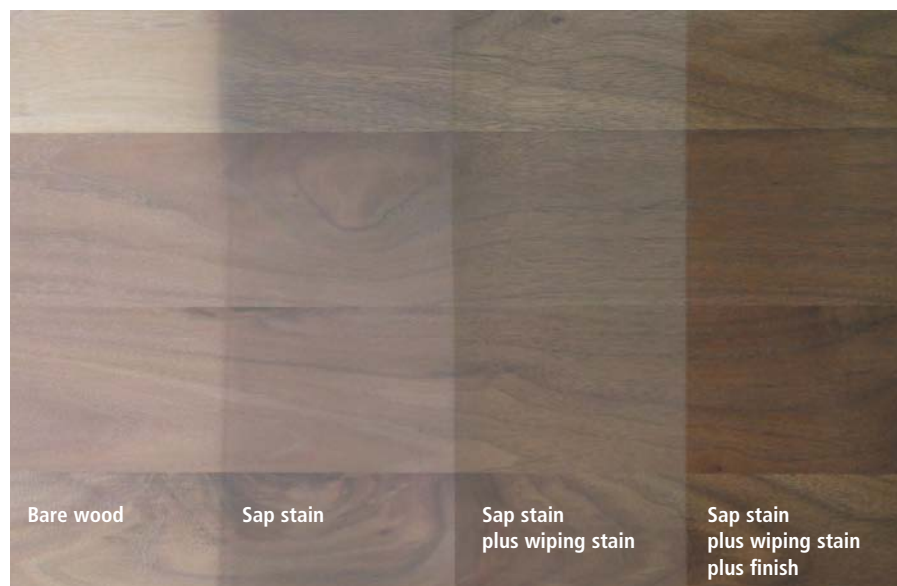


Figure 5: A more effective method of blending sapwood with heartwood is to apply a sap stain (first colored column from the left), then apply a walnut wiping stain and finally apply a finish.

Photos by the author



# The Heartiest Pine

A few old floorboards riddled with rust spots and the remnants of wood worms are a link to one man's past.

My wife's grandfather built his rural home in the 1890s, and when it was razed a few years ago her parents salvaged the heart pine floorboards. After installing the floor in their own home they offered us all of the beautiful wood that was left over.

I did not hesitate when they made the offer, and my workshop is still full of these knot-free boards. Somehow the stack never seems to diminish despite my using the wood for many projects, perhaps because I am reluctant to discard even the smallest scraps.

For my first project with these antique boards, I told my wife that I would make for her a blanket chest, an instant heirloom. I carefully cleaned, joined and planed the boards, eliminating those with nail holes, worm holes and rust stains. I hand cut the dovetail joints and finished the piece by applying several coats of polyurethane.

As my wife and teenage son dutifully admired my completed project, I assured him that he would one day inherit this chest. Even as I spoke those words I realized that I had done it all wrong. These 100-plus year-old boards, now clean of defects and remnants of paint, were a legacy from another century, a link from my son's great-grandfather to him, and I had used every trick in the woodworker's book to disguise their age.

I had been too zealous in bringing these boards back to perfection. Sure, I needed to clean and joint them, straighten a slight crook here, a small cup there. But did I need to plane them to sawmill newness? Did these boards need to be pristine?

I learned my lesson. Now when I make a project I include the flaws. The rust spots that leached from the nails driven long ago enhance the wood. The delicate tracery of wood worms adds character and authenticity. I do mainly casework projects such as

small chests of drawers. I like traditional American-style furniture, but I also think the antique pine complements the size and nature of a Japanese tansu chest when it is properly fitted with hardware. I discovered that antique shops usually have a bin of hardware salvaged from damaged furniture. These cheap accessories are just right for my projects. The rustier the better! No shiny bright brass for my antique boards. Old is good.

Working with this material is a woodworker's dream. The turpentine smell of the resin still locked in the heart pine fills the shop with an aroma as pungent as the day the wood was first milled. We seldom see pine boards today with the consistency of that grain, so close, so parallel. Cutting one of those boards is like finding the sweet spot on your driver when you tee off.

Recently my parents moved from their home into a retirement village and cleaned out 60 years' worth of married-life accu-

mulation. Among the items they gave me were tools handmade by my grandfather who helped to build the Panama Canal. He was a blacksmith, fabricating iron and steel into wonderful cold chisels, bores for drills, blades for block planes, calipers and heads for all kinds of hammers. I enjoy just knowing that my shop houses this treasure trove of handmade tools.

Now, whenever possible, I use my grandfather's tools to work on my wife's grandfather's wood. There is a symmetry there that is hard to explain, but I feel it when I run my hands across those boards, when I grasp my grandfather's brace and bit to bore a hole for a rusted drawer pull, or when I inhale the perfume of pine from a fresh cut.

Maybe this is why they call it heart pine.

**PW**

*Philip W. Leon teaches American literature at The Citadel in historic Charleston, South Carolina.*

