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OCTOBER 2006
ISSUE #157

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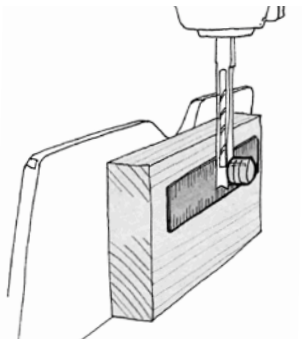

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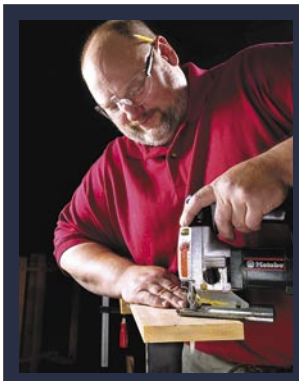

ON THE COVER

Troy Sexton shows how the humble jigsaw can be used to create unbelievable curves that are ready to finish with a mere swipe of the sandpaper.

Cover photo by Al Parrish

DEPARTMENTS

PROJECTS, TOOLS AND TECHNIQUES

Online Tools

You'll Discover Additional Content Online in *Popular Woodworking*'s New Blog

Now you can plumb deeper into the stories that interest you with our newly launched blog – an online diary written by the editors of the magazine. Right now you can read all about our visit to the Lie-Nielsen Toolworks 25th Anniversary party, as well as a review of the web site for Lumberjocks.com.

The blog features additional content that we couldn't fit into the printed version of the magazine: extra drawings, answers to readers' questions (we get a lot of these) and an inside look at the tools we're reviewing and the projects we're building for the coming issues. It's updated every day or so, so check back often. Visit the web site and click on the "Blog" button. **PW**

New on the blog: We tour the Lie-Nielsen Toolworks plant during the company's 25th anniversary.

Inside Online

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Every month, we simply give away some of our most popular project plans.

Article Index
Looking for a specific technique or project, or all the articles from your favorite author? Look no further than the magazine's online article index! And when you find what you need, it's a simple click to order a back issue.

Magazine Extras
Here, you'll find article corrections (yes, it's true – once in a while we make a mistake), expanded project plans, 18th-century shop inventories and other curious items. In short – stuff we thought was important and interesting, but just couldn't fit into the print magazine.

Tool Reviews
From miter saws to metal-bodied spokeshaves, you'll find a selection of tool reviews you need to outfit your shop with the machines and hand tools that best fit your needs and price range.

Writer's Guidelines
Got a great idea for an article? Here's how to submit your proposal.

Contact the Staff
If you have a question about *Popular Woodworking*, about woodworking in general … or even a complaint about the magazine, we want to hear it. You can contact us directly through our web site – and we even give you our direct phone numbers.

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POPULAR Woodworking®

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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.

When the Gospel Truth Isn't True

When the package landed on my desk, my first instinct was to call the police.

Inside the plain brown wrapper was a homemade book made by a reader of our magazine. In the handwritten book, the reader detailed in very small and neat handwriting almost every inconsistency, mistake, misstep or gaffe that I had made in my writings on woodworking.

I've been a journalist for 16 years, so getting cussed at is nothing new or particularly ego-bruising for me. So I took a couple hours and looked over the book in detail. And though I didn't agree with all the guy's criticisms, in truth, he made some good points.

I've been writing for this magazine for almost 10 years now, and it's fair to say that I am not the same woodworker I was when I walked in the door.

You're probably expecting me to say that I now know a lot more about woodworking, but the truth is that I feel like I know a lot less.

When we all enter this craft we seek a set of rules to work by: Tenons should be a predictable thickness, we should switch to the next-finer grit of sandpaper after a definable amount of time, handplanes should always be laid to rest on their sides.

These rules are handed down to us by parents, shop teachers and woodworking writers. The rules are passed around and repeated like currency until they seem to have real value. But I've found that the more I learn about woodworking, the less and less strict these rules are. Many of the things I took as gospel, such as the holy writ that thou shalt always finish both sides of a workpiece, are just absolutely and patently untrue.

For me, the fabric of maxims has started to fray and unravel at the edges. And I am also convinced that this is a good thing for both me and the craft. Here's why:

In June I had the good fortune to spend a day shooting some photos with Michael Dunbar, a Windsor chairmaker with a critical mind. He argued that the way woodworking writers repeat these commandments actually causes a contraction of the corpus of woodworking knowledge. The rules that we spout are repeated ad nauseam and actually shut down debate among craftsmen. Or – worse – make them stop doing an operation that was working fine.

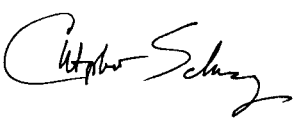
That's not to say that there aren't a handful of hard-and-fast rules for the craft: Wood moves, glue sticks and saws cut. But after that, I invite you to challenge authority.

Dunbar and I talked at some length about one of the classic old wives' tales: Always store handplanes on their sides, not their soles.

"Look at old photographs and paintings of craftsmen at work," he says. "And tell me what you find."

So I did. I spent an afternoon poring over my old books and looked at drawings from the 16th century up to the 19th century. Every image I could find showed planes resting on their soles. I'm sure I missed a few drawings, but I'm convinced – for now.

So do write us if you disagree with something you read here. Send me an e-mail (chris.schwarz@fwpubs.com). Just don't make me another book – I've already got one. **PW**

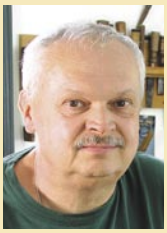


Christopher Schwarz
Editor

CONTRIBUTORS

MICHAEL DUNBAR

When furniture historians write about the revival of Windsor chairmaking in the 20th and 21st centuries, a name they'll certainly mention is Michael Dunbar. With



a degree in French and an early career as a newspaperman, Dunbar might seem an unlikely hero of traditional chairmaking. But since 1971, Dunbar has completely immersed himself in the craft, built hundreds of chairs and taught thousands of students to do the same thing at The Windsor Institute in Hampton, N.H. In his first article for *Popular Woodworking* (on page 73), Dunbar, explores the marking, measuring and organizational strategies you can use to avoid mistakes.

DAVID CALVO

From classical European ornamental carvings to abstract contemporary embellishments, David Calvo has carved it all. He studied with world-renowned carvers

Frederick Brunner, Arcangelo Cascieri and Adio di Biccari, and trained in high-end furniture-making.

Now, he's in demand as a teacher and speaker himself (you may have seen him on "The Woodwright's Shop" with Roy Underhill, or on "The American Woodshop" with Scott Phillips).

In his first article for *Popular Woodworking* (on page 53), Calvo discusses the basic set of carving tools necessary to get started in the craft, and reveals how to refine the tools' edges for optimal performance.

How to Attach a Shelf to Tapered Legs

How Do I Easily Add a Shelf To a Table With Tapered Legs?

I want to build a Shaker-style end table to use as a nightstand beside a tall bed. Most of these tables range in height from 27" to 28", but because the bed is much taller, I want to add 10" to 12" inches to the legs.

To make the table more stable, I believe adding a shelf 8" to 10" up from the floor would do the trick. But I'm puzzled as to what kind of joinery to use to attach the shelf to the legs. I had planned to taper the legs on the two inside faces, so it seems complicated. I've seen a picture of a Shaker-style table from furniture manfacturer Thomas Moser that's offered with a shelf, but it isn't obvious how the shelf is attached. Can you give me your thoughts on how I might approach this?

Carl Schrader
Lexington, Kentucky

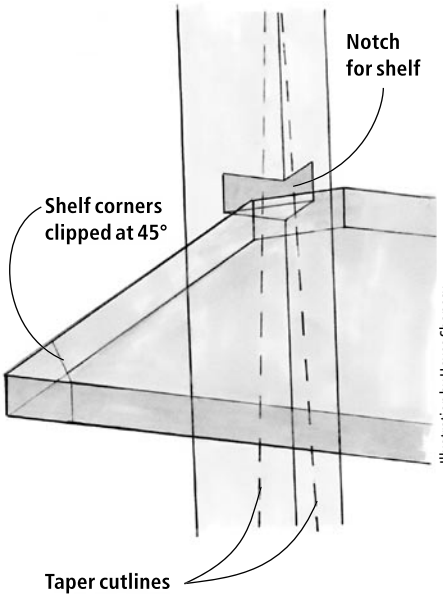


Illustration by Hayes Shanesy

One option is to dowel the shelf in place at the legs after notching the shelf around the legs. This is complicated due to the interior taper on the legs, so it's not my first choice.

The second option is to cut a dado across the interior faces of each leg and then clip the corners of the shelf to fit into the dados. This lets you leave square edges in the vertical planes and would provide some pretty good strength for the shelf.

What I would suggest, though, is to first determine the finished depth of the dados and cut them on the legs before tapering them. It'll be easier than trying to cut the dado after the tapering.

— David Thiel, senior editor

How Flat Should a Band Saw Table Be?

I just bought a new band saw, and the table is out of flat by .018" diagonally and .009" from front to back. What is the acceptable range for the surface flatness of a band saw table?

Daniel Behrends
San Pedro, California

Depending on the type of saw and how much it cost, you are probably a bit beyond what I would personally find acceptable. Machinery experts we consulted generally said that a table that is out by 1/64" (.0156") is acceptable.

If you're using the saw for cutting simple curves I wouldn't worry too much. If you have a precise application in mind, it could cause problems when squaring the table to the blade.

One thing you might try is to loosen the bolts holding the table down and see if that makes it any flatter. Cast iron is actually fairly flexible, and it is possible to put a bend in it when attaching it to the rest of the machine. If it's distorted from the bolts you can either file down the areas that the table attaches to or insert shims to correct it.

— Robert Lang, senior editor

Easier Tabletop Flattening Method

I am writing in response to the question that Tim Sauder from Arma, Kansas, posed in the June 2006 issue (#155) about flattening a tabletop after glue-up. First, I have been a woodworker (as a hobby) for 30 years and have built commissioned projects as well as commercial cabinetry. Professionally, I am a manager for a wine distributor.

I liken the woodworking industry to the wine industry. As in the wine industry, it seems woodworkers have taken something that is so simple and brings so much joy and pleasure, and have made it really complicated.

I laugh when I hear about sharpening plane blades within an 8" radius or measuring wood projects in thousandths of an inch. With all of the articles that discuss blade camber, radius and using micrometers to measure projects, you would think the hobbyist would have an entire month of weekends to grind and measure angles on blades.

Since I have complained, I would also like to offer a solution to Tim's problem. Buy 4/4 stock or thicker depending on your final thickness, joint your edges square and glue up your field. Do not use splines or biscuits because line-up is a real pain. Use cauls to line up your joints. When the glue is dried, scrape off the excess.

Call your local woodworking shop or lumber retailer and see if you can use their drum sander. Run your top through with light passes, until you achieve the desired thickness. If you want, you can measure with a micrometer (just kidding). To bring 4/4 stock to 3/4" usually costs me $8. Ninety-nine percent of the time, the tops come out dead flat. I built a coffee table that is 4' wide with regular old butt joints. I have four kids under the age of 10 that use this table as a jungle gym and the joints have held strong as well as being dead flat. I have glued up many tabletops this way with great results. Good luck to Tim!

Andrew Warshauer
Mequon, Wisconsin

Two Finishing Questions on Food-safe Dyes and Outdoor Finishes

I have two questions about finishing that I hope you can help me with.

I recently made some blocks for my grandson. I bought "toy safe" water-soluble dye and used water-based polyurethane to finish them. But then I got to thinking: Why not use food coloring for the dye?

I live in the boonies and it is either a 300-mile round trip to the nearest woodworking

store or I can order by mail and wait. Food dyes certainly should be food-safe, and if you have ever spilled food dye on anything you know it's impossible to remove. Do you think that it would work?

My next question relates to the UV resistance of spar varnish. How do you know or figure out which one has the most UV inhibitors? I made some outdoor furniture with western red cedar, then finished it with three coats of Valspar gloss spar varnish for outdoor use. The varnish failed in one year (gray spots appeared that the varnish then flaked off of). Looking at the cans from various manufacturers, I can't find anything in the list of ingredients that I can relate to UV resistance. I also couldn't find anything on the Valspar or Varathane web sites that would help.

Joe Weinig
Minong, Wisconsin

You absolutely can use food dyes in woodworking. Food coloring from the supermarket would solve both your problems: convenience and food safety. It's most likely, in fact, that the "toy safe" dyes you are buying are the same thing.

On your question about spar varnish, it's most likely that the reason you can't find any information on the can is that there's nothing to tell. Home-center spar (outdoor) varnishes work well outdoors away from sunlight. But they don't contain enough UV absorber (if they contain any) to make any significant difference in resisting UV light.

If the object you are finishing will be exposed to sunlight outdoors, you should use a marine varnish sold at marinas for use on boats. These varnishes are considerably more expensive than the home-center spar varnishes, but they work, at least for a number of years – especially in your northern exposure. You can do an Internet search for a mail-order supplier. A good example is jamestowndistributors.com. Keep in mind, however, that water will also cause the finish to peel if the water can find a way to get underneath the finish. You have to shield the wood from water contact or thoroughly coat all end grain and joints and keep this coating in good condition.

— Bob Flexner, contributing editor

Can a Water-based Topcoat Work Over an Oil-based Finish?

I recently built an altar and an ambo (an elevated platform) for our church expansion using white oak. I finished them with Minwax English Chestnut (an oil stain), and topcoated with five coats of a water-based urethane. In Bob Flexner's article "Understanding Stains," (June 2006) this sentence appears: "Choose an oil stain to apply under any finish except water-based." I'm now wondering what problems I have to look forward to!

Scotty Bies
McCormick, South Carolina

I apologize for not being more specific. There are two difficulties with applying a water-based finish over an oil stain. The water-based finish wrinkles, or it doesn't bond well. Poor bonding leads to peeling. (Think of putting water on oil; they repel each other.)

The trick for avoiding these problems is to let the stain cure adequately. What does this mean? It's different for each stain and finish combination because it depends on the formulation of each. It also depends on the temperature conditions, with warmer temperatures leading to faster curing.

If your altar and ambo have been knocked a few times and no peeling has resulted, then you are probably OK. But in the future, you should try the combination of oil stain and water-based finish you intend to use on scrap wood and in similar temperature conditions and with the same drying time before committing to the actual project. Many people have had problems using this combination because they didn't allow the stain enough time to dry.

— Bob Flexner, contributing editor

Let Components Dictate Design

I just read your article "Entertaining Designs" (June 2006). It was great to see an article concentrating on designing a cabinet so as to avoid finding flaws at installation time. I was an audio/video installer for eight years and would like to share some of the challenges I encountered from cabinetmakers.

As you mentioned, some audio/video components are around 17" wide; I found that they were mostly around 17¾", so your 18" suggestion is right on and coincidently your DVD drawers fit in that opening as well.

As televisions get thinner, that doesn't mean that the cabinet should diminish in depth. I have found that most built-in cabinets are going into a niche that is approximately 24" deep. I think as much of that depth should be used as possible.

continued on page 15

continued from page 13

While DVD players, CD players and the like get smaller, one thing that doesn't is the amplifier/tuner; it typically will be about 18" deep. The wires connecting to the receiver should be taken into account (kinking will degrade performance). Usually, the equipment has to be connected just outside the cabinet and then slid in, resulting in the wires bunching up behind the equipment. Average installs could have 35 or more wires in the back; 3"-4" should be allowed in the rear.

Amplifiers can get hot and need ventilation. Other components should not be stacked on the amp and the next upper shelf should be at least 2" above.

The most common issue I found was that there were no holes drilled for the wires. Cabinetmakers should spend time with the customer discussing where the components will go and drill 2" holes through all dividers (leaving adjustable shelves 1" short in depth helps also) to accommodate the wires. Holes should lead a path to all components including the TV, subwoofer, electrical outlets and telephone/TV jacks.

I can tell you from experience that installers usually won't have the correct bits, resulting in self-feed Forstner bits, auger bits or, worse, Sawzall holes in that beautiful cabinet – all the while the customer wonders why the cabinetmaker didn't do it.

Mark Nagle
Corona, California

'Compression Wood' is a Traditional Boat-building Material

Sunday afternoon is my time to enjoy a visit to Barnes & Noble in Annapolis, Md. Last week on the way home I regretted not buying *Popular Woodworking*, so I had to return today to pick it up. I was expecting a comprehensive discussion of what you call "compression wood," which I didn't get.

I have some references for you that might just change your view of the usefulness of compression wood:

1) Maryland Public Television (Owings Mill, Md., 21117) published a VHS tape titled "Birth of a Bugeye." It is a 30-minute documentary that shows the late Jim Richardson, of Cambridge, Md., harvesting what you would call compression wood for the Round Stern Bugeye he was in the process of building for himself. Jim was a master boatbuilder of international acclaim.

2) "The Jim Richardson Boat Book" (Ocean World), in part discusses how he sourced and utilized what he correctly calls "compass timbers."

3) "Building The Wooden Fighting Ship" illustrated by James Dodds (Naval Institute Press) shows an engraved advertisement from 1712 that details the various parts of a wooden ship that come from trees that grew anyway but straight.

Bob Giles
Annapolis, Maryland

I am aware that traditional boatbuilding techniques used (and perhaps still use) compression wood. You might also want to check out "Oak: the Frame of Civilization," which has several excellent sections on how trees were chosen for certain boat components.

My note on compression wood (and generally every article in the magazine) relates to building furniture, where compression wood is avoided in all cases, at least as far as my experience and reading indicates. Even in chairbuilding, which is something I enjoy, straight and stable stock is preferred in most cases, even for curved components.

However, your comment is well-taken, and in retrospect it would have been better for me to include a caveat on boatbuilding and perhaps rustic twig furniture. **PW**

— Christopher Schwarz, editor

WRITE TO US

Popular Woodworking welcomes comments from readers about the magazine or woodworking in general, as well as questions on all areas of woodworking. We are more than happy to share our woodworking experience with you by answering your questions or adding some clarity to whatever aspect of the craft you are unsure about. We try to respond to all correspondence. Published correspondence may be edited for length or style. All correspondence becomes the property of *Popular Woodworking*.

Send your questions and comments via e-mail to popwood@fwpubs.com, via fax to 513-891-7196, or by mail to:

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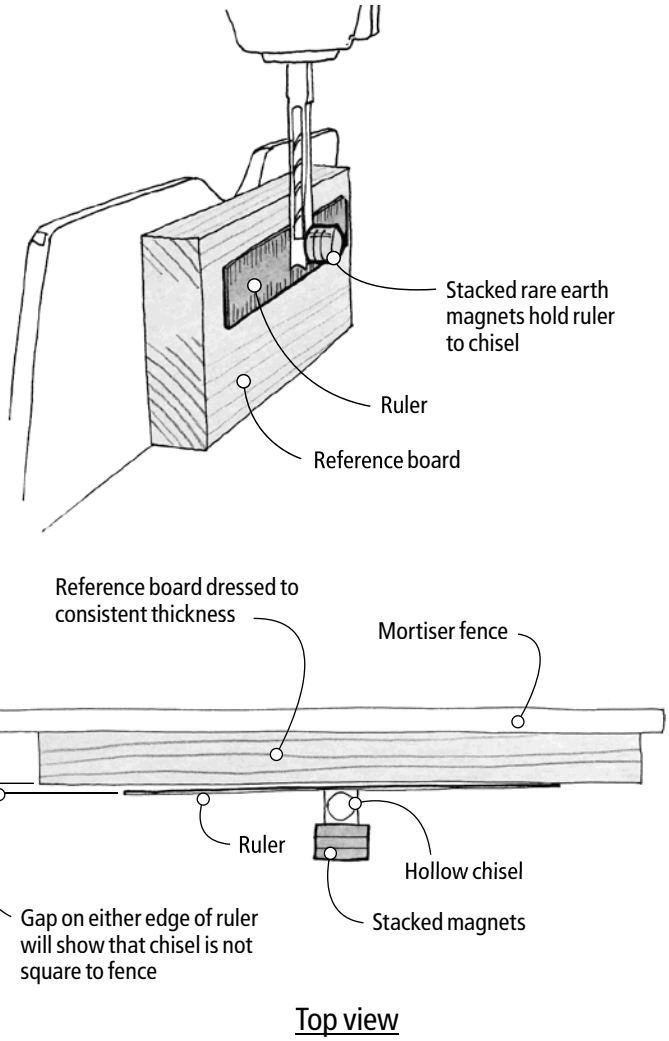
Compiled by Paul Anthony
Illustrations by Matt Bantly

Adjusting a Hollow-chisel Mortiser



THE WINNER:

When installing a square chisel in a hollow-chisel mortiser, it's critical that the chisel is square to the fence; otherwise the joint fit can be compromised. However, this alignment can be troublesome to perform because the narrow face of the chisel doesn't provide much of a reference face against which to set the fence. Here's a way to do the job quickly and accurately.

After adjusting the chisel approximately square to the fence, place a 6"-steel rule or other small ferrous metal straightedge against the rear face of the chisel. On the front face of the chisel, place enough rare earth magnets to hold the straightedge in place. Place a piece of thicknessed stock against the mortiser fence, and adjust the fence so the stock is nearly touching the straightedge. Now rotate the chisel until the straightedge is parallel to the stock. The wood stock simply serves as a buffer against the transferred magnetism that would otherwise pull the steel straightedge against the mortiser's metal fence.

Thomas Wilson
Piscataway, New Jersey

CASH AND PRIZES FOR YOUR TRICKS AND TIPS!

Each issue we publish tips from our readers. Next issue's winner receives a Veritas Mk. II power sharpening system. The combination of interchangeable abrasive discs and a tool rest make sharpening hand tools simple.

Runners-up each receive a check for $25 to $100. When submitting a trick (either by mail or e-mail) you must include your complete mailing address and a daytime phone number. If your trick is selected for publication, an editor will need to contact you. All entries become the property of *Popular Woodworking*. You can send your trick by e-mail to popwoodtricks@fwpubs.com, or mail it to Tricks of the Trade, *Popular Woodworking*, 4700 E. Galbraith Road, Cincinnati, OH 45236.

veritas® Tools Inc.

Acetone Eraser

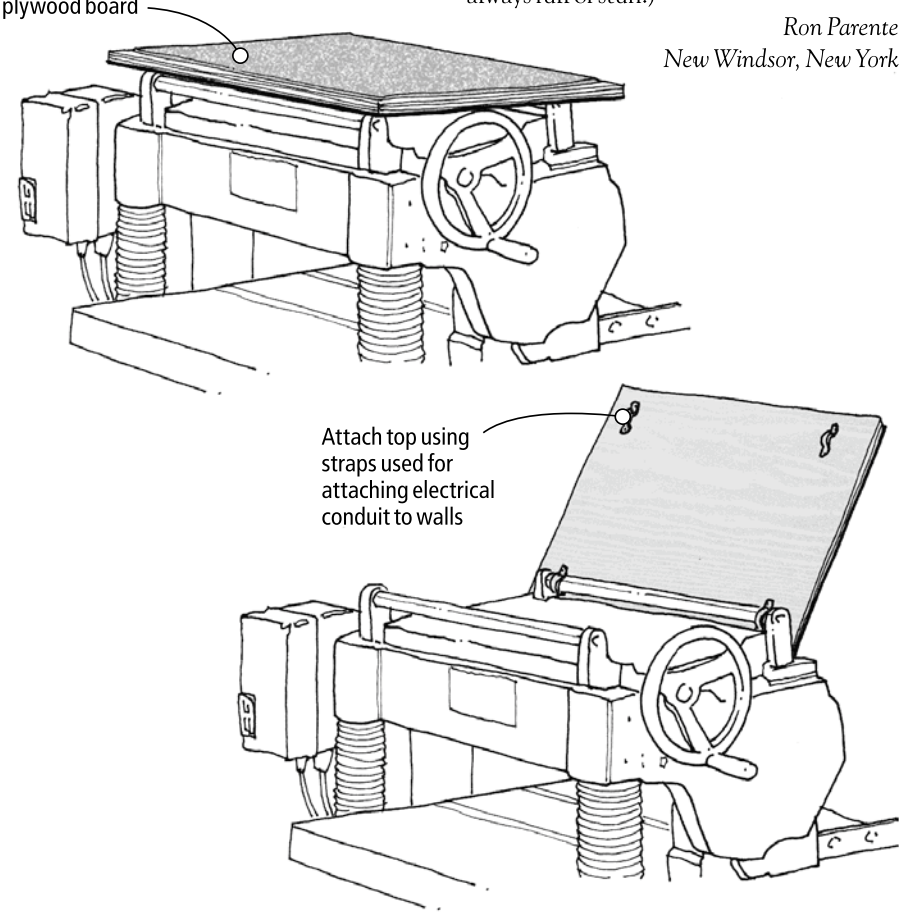
I'm often penciling gauge marks of some sort on my machine fences and tables. For example, when cutting stopped grooves or mortises on my router table, I simply draw a line on the fence to note the starting and stopping points. After a while, of course, the ledger of lines needs to be removed or you risk cutting to the wrong one. I've found that the best way to get rid of the marks is with a quick swipe of acetone on a rag, which removes graphite in an instant and does a much cleaner job than a pencil eraser. It evaporates almost instantly and won't harm surfaces, including bare wood.

Nancy Werteen
Biloxi, Mississippi

A Better Planer Platform

The "return rollers" on the top of many floor-model planers are designed to help carry the load of a large planed board being passed back to the operator for a subsequent cut. However, I used to employ the rollers instead as a staging platform to stack a bunch of boards-in-waiting. The problem with this is that the machine's vibration often shook the boards off. I decided to attach a 3/4"-thick plywood panel to the rollers using saddle-shaped metal clamps, or "straps," sold for attaching electrical conduit to walls, ceilings and other mounting surfaces. I stapled a rug scrap to the panel to protect boards from scratches and to dampen machine vibration. Now I can safely stack as much wood as I like on the platform in readiness for the next pass through the planer. When the planer is not in use, I gain additional shop surface for temporary storage of whatever happens to land there. (And, for some reason, it's always full of stuff.)

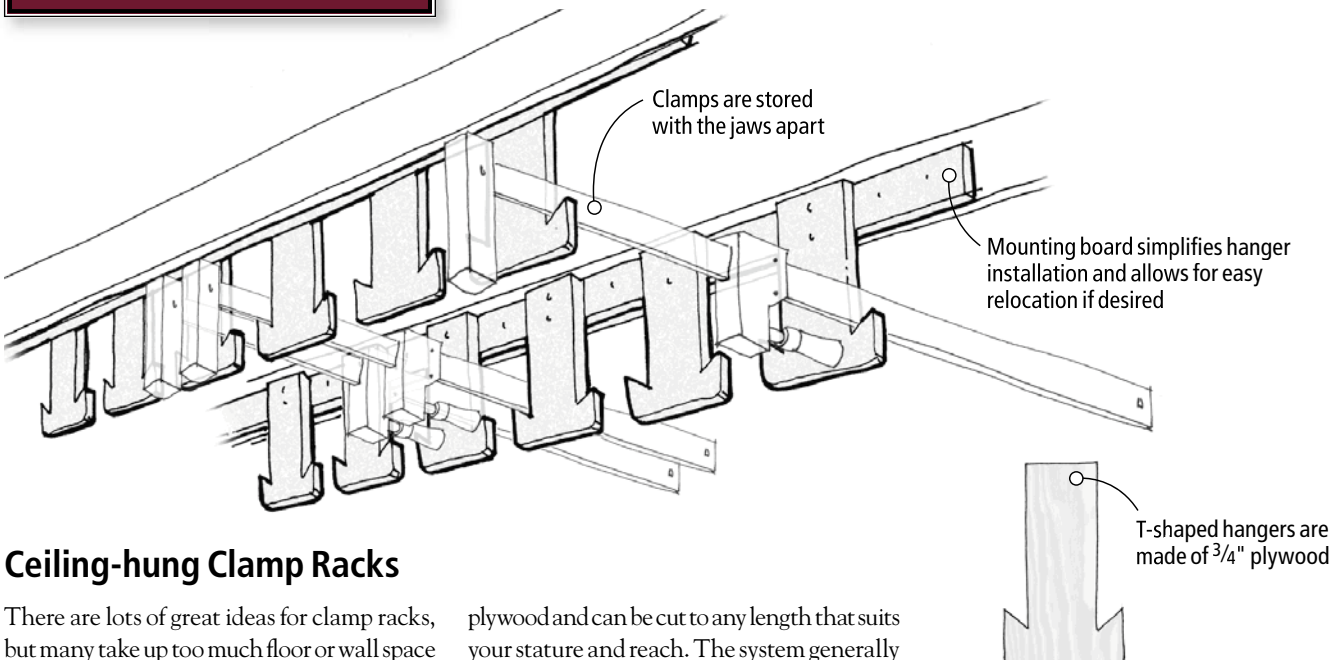
Ron Parente
New Windsor, New York



A Vacuum Strainer

I make wooden intarsia pictures, which consist of a lot of small pieces that are shaped by holding them against a belt sander, disc sander or other power sander. I always mount a vacuum hose nearby to suck up the flying dust. Unfortunately, if I lose my grip on a workpiece, it often ends up traveling down into the vacuum. I have also lost many small pieces this way when cleaning up afterward. To prevent this from happening, I simply wrapped screening around the opening of my vacuum hose, securing it with rubber bands. The plastic mesh used to bag some supermarket produce works well. It's cheap, and sure has saved me a lot of headaches digging around in my shop vacuum for lost parts.

Amy Nielsen
Maple Valley, Washington



Ceiling-hung Clamp Racks

There are lots of great ideas for clamp racks, but many take up too much floor or wall space to work well in small shops. Here's a system that makes good use of otherwise wasted overhead space. It consists of inverted T-shaped hangers of ¾"-thick plywood screwed to overhead joists or rafters. (Fastening the hangers to a mounting board instead of directly to the joists makes for easier installation or subsequent relocation.) The hangers, cut with a band saw or jigsaw, make great use of scrap plywood and can be cut to any length that suits your stature and reach. The system generally works best with an 8'- to 9'-high ceiling. An added benefit is that it's easy to gauge the length of a clamp spanning joists or rafters spaced 16" or 24" on center.

Another nice thing about this system is that clamps can be stored with the jaws apart. In the past, I've had to struggle to release jammed jaws on clamps left standing on their heads against some wall. I've also found that it's very convenient to hang a few select clamps above my workbench or other assembly area, suiting the length of the clamps to the work most often performed there.

Dennis Kugizaki
Colorado Springs, Colorado

Film Containers Double as Small Measuring Cups

Here's a tip you'd better act on before it's too late: With digital photography supplanting film, it's harder to find plastic film containers. The tip is to gather a stash for the shop. Not only do they provide storage for brads and small hardware, they're also handy as small measures for test-mixing stains and finishes, making up small amounts of powdered glues, and other general shop alchemy.

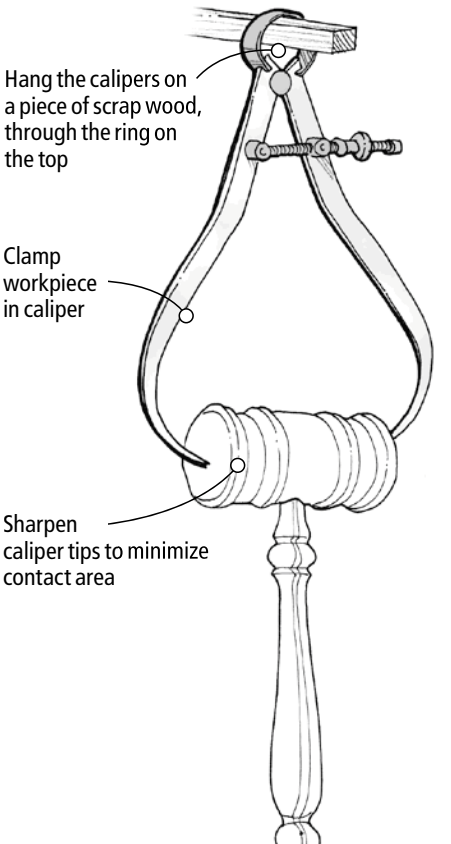
The best kind are the translucent containers because you can gauge hash marks on the side with a felt-tip pen to indicate a half-measure, quarter-measure, or whatever suits the job. This allows for accurate test-mixing before committing large amounts of finish. You can easily gauge the ratio of different liquid stains when creating custom colors, play with the viscosity of shellac, or even mix mineral spirits, oil and varnish to make your own wipe-on finish.

Oliver Griffith
Las Cruces, New Mexico

Outside Calipers Help You Finish Unusual Objects

I was preparing to spray finish on a gavel that I made, and was scratching my head trying to figure out how to handle it during the process. While considering my options, I realized that the calipers I recently bought at a yard sale might help. I sharpened the tips to needle points, then pinched the head of the gavel between them. Holding it like this allowed me to spray all the surfaces at once. And the ring on the calipers provided an easy means for hanging the piece to dry. After rubbing out the second coat I repositioned the caliper tips slightly before spraying the final coat. This eliminated any evidence of contact with the caliper tips. Obviously, this technique would work for all sort of small parts.

Roger Dubois
Dudley, Massachusetts

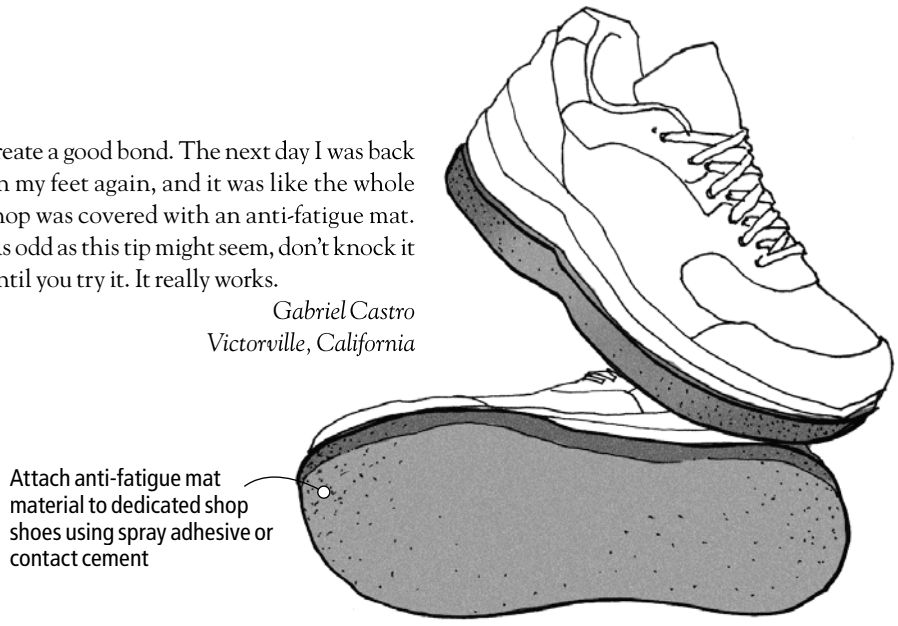


All the World's a Shop Mat

Several months ago I developed a bone spur on my heel. I found that standing on an anti-fatigue mat in my garage shop helped a lot, especially when working at the lathe. Unfortunately, the mats that I had were too small, and I didn't have enough of them for all the machines in my shop, so I was constantly moving them around.

I decided to take a more direct approach and bring the mat to my feet instead of the other way around. Using tin snips to cut the matting, I shaped footprints that matched the shoes I normally wear in my shop. I used spray adhesive to attach the cutouts to my shoes, and wrapped them with packing tape overnight to create a good bond. The next day I was back on my feet again, and it was like the whole shop was covered with an anti-fatigue mat. As odd as this tip might seem, don't knock it until you try it. It really works.

Gabriel Castro
Victorville, California

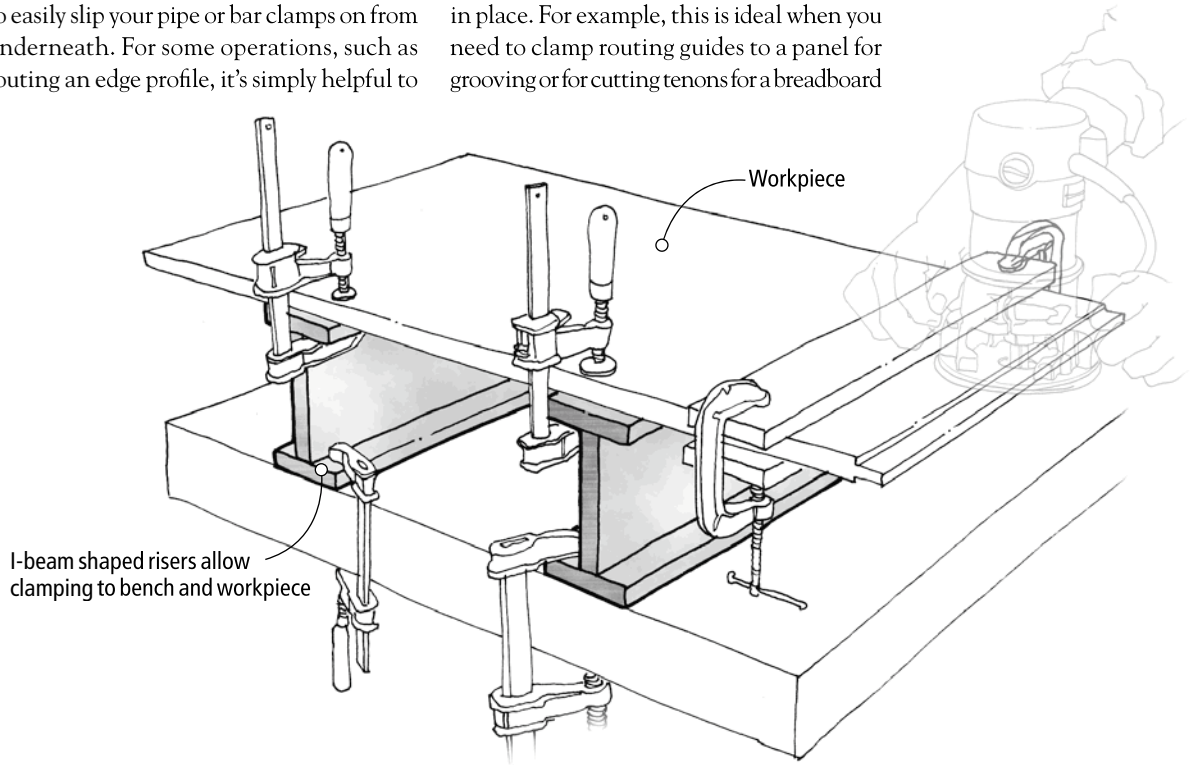


A Helpful Lift from Riser I-beams

It often helps to raise a workpiece up off the workbench, especially when you need clamp access underneath. For example, when edge-gluing a panel you can lay the boards to be joined across a couple of thick boards standing on edge on the bench. (Alternatively, some woodworkers join two boards perpendicularly to create inverted T-stands for better stability.) Laying workpieces across risers like this keeps the panel stock flat while allowing you to easily slip your pipe or bar clamps on from underneath. For some operations, such as routing an edge profile, it's simply helpful to raise the workpiece up higher so you don't have to crouch at the bench.

The problem with using thick boards on edge or inverted T-stands is that there is no easy way to secure the workpiece to the risers if necessary to perform an operation like routing. I've found that using I-beam-shaped risers works much better because you can clamp them to the benchtop, then clamp the workpiece to the top beam's flange to fix it in place. For example, this is ideal when you need to clamp routing guides to a panel for grooving or for cutting tenons for a breadboard end, as shown in the drawing. Even simple edge profiling is more easily done on a secured workpiece. My risers span the width of my workbench to allow easy clamping anywhere along its length. Made of plywood, they raise a workpiece about 7" off the bench, which works fine for most operations. I screwed and glued the pieces together, counter-boring the screws to prevent possible damage to workpieces. **PW**

Paul Anthony
PW contributor



Hitachi Revamps an Old Friend with Mixed Results

For the past 17 years, the M12V plunge router from Hitachi has been a staple in many professional and home shops, often serving as the tool of choice for router tables. Hitachi decided it was time for a makeover, and the M12V2 is the result.

What's the difference? The M12V topped out at 20,000 revolutions per minute (rpm), while the V2 has an extra 2,000 rpm. Hitachi has reworked some ergonomics on the tool and, of course, the V2 now wears the distinctive tennis-shoe body molding like the company's other new tools.

What Hitachi hasn't done is to significantly improve the tool. The plunge depth-adjustment mechanism is easier to use and more accurate. The variable-speed control wheel has been moved from the top of the router to the right handle, which improves the ergonomics during handheld operations. The router does offer plenty of power, and the soft-start feature is great for safety and comfort. The reworked collet lock is an improvement over the old design, and the grip ergonomics are an improvement as well.

However the M12V spends a considerable amount of time in a router table. The tool's switch placement now complicates router-table usage. We found a wobble in the motor-to-column fit that will affect precision plunge operations, such as cutting a mortise. And we were disappointed by the lack of through-the-base depth adjustment that has become almost standard on routers used in tables.

During testing we ran the router in a free-plunge mode (for cutting a mortise) and found that the quick-adjust lever for plunge depth rotated to the locked position due to vibration. This locked the motor in the down position and caused a problem coming out of the cut. A fix for this free-spinning lever is necessary.

In the end, we think the router's table application has been short-changed. And while some performance has been added, the ergonomic changes are a mixed bag with another two pounds added to the tool's weight. Add a higher (though still competitive) price and the M12V2 is not the redesign we might have hoped for. — *David Thiel*

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

SPECIFICATIONS

Hitachi M12V2 Plunge Router
Street price: $229
Motor: 15 amp
Speeds: 8,000 - 22,000 rpm
Collets: 1/4" & 1/2"
Weight: 13.9 lbs
Performance: ●●●○○
Price range: $$
Hitachi: 800-706-7337 or hitachipowertools.com

Craftsman Offers the First Hands-free Drill Chuck

Since the dawn of the first keyless chuck, woodworkers have been taking off layers of skin by grabbing the chuck sleeve and hanging on tight until the bit is seated, then racing to let go before the abrasion begins. Of course, you're not supposed to be hanging onto the sleeve, but that's what we've trained ourselves to do.

Now, Craftsman has designed a chuck to simplify the process and leave the epidermis intact. The #11547 from Craftsman is the model number for the drill itself, but what I want to focus on is the Autolock Chuck.

The chuck has two settings: One setting is for inserting (tightening) or removing the bit or screw tip, and the other setting is for running the drill in screwing or drilling mode.

When the chuck is set for auto-chuck mode, an internal gear opens or closes the chuck jaws according to the forward or reverse setting on the drill itself. There's no need to have your hand on the chuck itself; you need only to hold the bit roughly centered in the chuck's jaws as it tightens. Once the jaws are tight on the bit, you can switch to the drilling/screwing mode and go to work.

The 3/8" Craftsman drill has a plastic chuck sleeve, with a collar positioned directly behind. The collar is rotated to switch between clutching and drilling modes. While the bit is being tightened or loosened, the sleeve continues to rotate with the motion of the shaft. As the bit is fully tightened, the clutch begins to click much like a locking gas cap on a car. It's telling you it's done and you should release the trigger. The same noise tells you when you're done loosening the bit from the chuck.

One observation is that if you're "trained" to hold onto the keyless sleeve to insert or remove a bit on a standard drill, the Craftsman feature may cause you to jerk back initially because the sleeve rotates with the shaft action. The rotation duration between open and closed is pretty short (depending on the bit diameter differences) so you don't wait long at all for the chuck to grab or release. All in all, it's nice. — *DT*

For more information, circle #169 on Free Information Card.

SPECIFICATIONS

Craftsman Autolock Drill, #11547
Street price: $89.99
Voltage: 14.4
Speeds: 0-400 & 0-1,400 rpm
Charger: 1 hour
Stated torque: 300 inch/lbs.
Performance: ●●●●○
Price range: $$
Craftsman: 800-549-4505 or craftsman.com

A Bigger Birdcage Awl

Birdcage awls are outstanding and accurate tools for installing hardware. In essence, they are a boring tool: Place the tip where you want your screw and twist the tool back and forth. When you're done, you have a perfect tapered hole for your screw.

Even with a cordless drill/driver on my workbench I'll choose the awl when pinpoint accuracy matters, as it almost always does when installing hardware.

The tool has become an endangered species of late, and so I was delighted to learn that Chester Toolworks has begun making an elegant and hard-working version. The square-shaped shaft on this birdcage awl is thicker ($^3/_{16}$" square) than most examples I've encountered, but the hole it makes is perfect for most cabinet hardware. The handle is shaped to nestle in your palm and the small bead by the tool's ferrule also helps you apply the right downward pressure.

These tools are handmade by Dave Anderson and can be handled in a variety of woods, including snakewood and ebony (shown).

SPECIFICATIONS

Chester Toolworks Birdcage Awl
Street price: $41-$48, depending on wood
Shaft: $2^1/_4$"-long, O1 steel, Rc 62-63
Handle: 3"-long, $1^5/_{16}$" in diameter
Performance: ●●●●○
Price range: $$$
Chester Toolworks: chestertoolworks.com

Anderson also makes a line of scratch awls, marking knives and bowsaws, all of which are finished to the same high degree.

— Christopher Schwarz

For more information, circle #170 on Free Information Card.

Bosch Pocket Driver Offers Pint-sized Power

I don't care how many cordless drills you own, if you like tools, you're going to need one more. The Pocket Driver elicits the same response from everyone who sees it: "It's cute!" And that it is, but the really nice part is that it performs as well.

Powered by a 10.8-volt lithium ion battery (two included), this drill performs like a good 12-volt model, and it weighs only 4.4 pounds, fitting comfortably in the palm of your hand. Bosch boasts the drill will drive 100 3" screws. Honestly, I stopped at 75 $1^5/_8$" deck screws (comfortably sunk below surface depth in treated pine) because that's more than enough proven power out of a drill that I wouldn't even use for that task.

This drill is designed to be handy, whether dropped in a work belt, shop apron or any number of drawers around the house. Its size lets you work in tight or awkward spaces (think about installing drawer slides) while still providing lots of power.

I did find one thing to pick on. The LED light is a nice addition, but because of its location the clutch ring keeps the light from shining on the actual impact point for all applications. Who cares? Buy one! *— DT*

SPECIFICATIONS

Bosch PS20-2 Pocket Driver
Street price: $127
Stated torque: 80 inch/lbs
Charger: 30 minute, smart charger
Performance: ●●●●○
Price range: $$$$
Bosch: 877-267-2499 or boschtools.com

For more information, circle #171 on Free Information Card.

STEEL CITY TOOLS

If you're shopping for major woodworking machinery, you may want to check out the new guys on the block. While the company name is new, the company's owners and employees can trace their experience back to many years with Delta and Powermatic.

Steel City (headquartered in Pittsburgh, but with offices in Tennessee, Canada and China) unveiled a full line of woodworking machinery from cabinet saws to mini-lathes recently and is showing them at the International Woodworking Machinery & Furniture Supply Fair show in Atlanta in August. While we've only kicked the tires, the line looks solid and built for performance, not frills. View the complete line at steelcitytoolworks.com. *— DT*

TITE-MARK MINI

The best marking gauge on the planet just got smaller. Glen-Drake Toolworks has added a smaller version of the Tite-Mark gauge to its line. This version has the same functions as the regular Tite-Mark but has a smaller shaft ($^5/_{16}$" in diameter) and head ($1^1/_2$" in diameter). And it has a slightly smaller price ($60). It's an excellent gauge for dovetailing drawers and small boxes. And if you have small hands, you may find it to be the only gauge you need. Contact Glen-Drake at glen-drake.com. *— CS*

TOOL RATINGS

Performance is rated on a one-to-five scale. You won't see a low rating ("one or two") because we don't publicize inferior tools. "Five" indicates the leader in the category. Five dollar signs indicates highest price in the category. Three indicates an average price. If you have 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 popwood.com to sign up for our free e-mail newsletter.

— David Thiel, senior editor

Norton 3X Grinding Wheels Run Remarkably Cool

The biggest challenge with dry grinding your tools is that the steel will heat up quickly and then lose its ability to keep a sharp edge.

Because of this problem, water-cooled grinders have become popular with woodworkers. They'll never, ever destroy the edge-holding properties of your tools, but they also cut agonizingly slowly if you need to remove a big chip or – heaven forbid – change the grinding angle of the tool.

Now there is a good patch of middle ground for woodworkers. Norton has introduced a line of 3X Super Cool Grinding Wheels that run on your dry grinder (no matter if it's a high-speed or low-speed machine) but they're much less likely to ruin the edge of a tool compared with the gray wheels that come with grinders and even the nice white wheels we've tried.

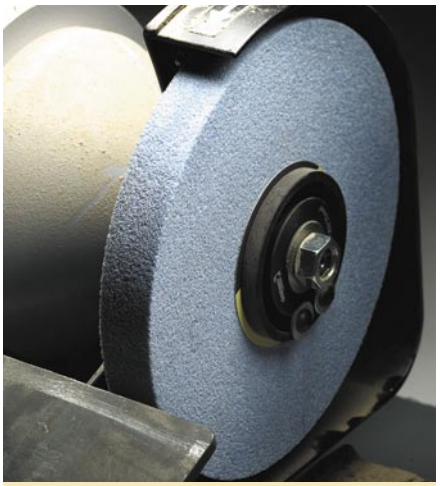
Now, if you're determined, you can still overheat the tool's edge and destroy it, but if you simply grind at a steady pace, you'll find the edge stays much cooler. This also causes the work to go much faster than with a gray or white wheel because you don't have to pause for the tool to cool down or quench it in an oil bath every few passes.

The Norton 3X wheels are ideal even for heavy grinding sessions. Recently I ground back a bunch of fore plane irons for friends so they had an 8" radius curve at the cutting edge. I usually only had to pause once during each grinding session, and that was probably me being over-cautious.

In my opinion the #60-grit and #80-grit 3X wheels on our 8" grinder cut quite fast and seem to require dressing about as much as our older wheels. The wheels are made with a patented ceramic alumina and are available in four common grits (#46, #60, #80 and #100); in 6", 7" and 8" diameters; and with a variety of bushing sizes. They should fit almost any grinder out there. One more thing: The price is quite reasonable compared to other premium grinding wheels.

If you haven't thrown away your gray wheels yet, do it. Pick up a Norton #80-grit wheel to try and you'll never go back. — *CS*

For more information, circle #172 on Free Information Card.



SPECIFICATIONS

Norton 3X Super Cool Grinding Wheels

Street price: $35 to $75
Grits: #46, #60, #80, #100
Bushings: 1/2", 5/8", 3/4", 7/8"
Performance: ●●●●○
Price range: $$$
Norton Abrasives: 254-918-2306 or nortonabrasives.com/consumer

Bostitch Air Power for Woodworkers

While the compressor and 23-gauge pinner from Bostitch shown here aren't offered as a kit, they showed up in our shop at the same time. I think they make a great combination for most woodworking projects, so we'll talk about them both.

First, the compressor. This is one of the smaller-capacity (1.6 gallon) compressors available on the market, but for our applications, that's fine. Recycle time (how often the motor needs to kick on to maintain proper firing pressure) is an important statistic. I was able to fire 10 2"-long, 18-gauge brads (or 23 1 3/16"-long, 23-gauge pins) before the tank needed to recharge. That's decent performance for most woodworking tasks. The motor runs at a comfortable 76 decibels and the vibration from the motor doesn't cause the compressor to walk across the floor. It's also one of the most user-friendly compressors I've seen. The tank and oil-free motor are all housed internally with only the dials and controls necessary to operation exposed. It's a less intimidating compressor than most. At less than $200, this is a good home woodworking compressor, though the price is a little high compared to the competition.

The 23-gauge pinner is a great companion to the compressor. Headless pinners are perfect for much of the small detail work often found in woodworking. The Bostitch model offers a length capacity up to 1 3/16", while many top out at 1". The pinner performs well in both hardwood and softwood, with easy depth-of-drive adjustment. The Bostitch pinner prices out as a bargain against much of the competition. **PW** — *DT*

For more information, circle #173 on Free Information Card.

SPECIFICATIONS

Bostitch 23-gauge Pinner

Street price: $120 (HP118K)
Pin range: 1/2" to 1 3/16"
Safety: Dual trigger
Weight: 2.4 lbs.
Performance: ●●●●●
Price range: $$$
Bostitch: 800-556-6696 or bostitch.com

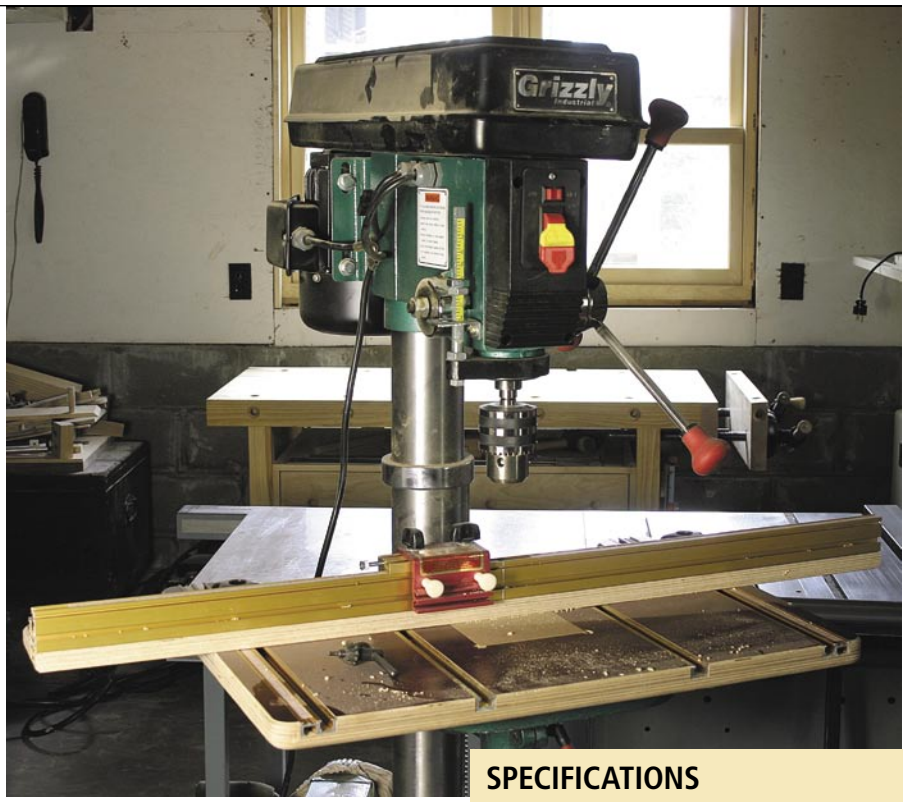
SPECIFICATIONS

Trim Air Compressor

Street price: $180 (CAP1516)
Delivery: 1.8 CFM & 90 PSI
Motor: 1.5 peak HP (8 amp)
Tank size: 1.6 gallon
Weight: 19.5 lbs.
Performance: ●●●●○
Price range: $$$$$
Bostitch: 800-556-6696 or bostitch.com

Grizzly G7944 Drill Press

No unnecessary frills. Just a solid machine at a super price.



SPECIFICATIONS

Grizzly G7944
14" Floor-model Drill Press
Street price: $250
Chuck capacity: 1/8" to 5/8"
Speeds: 12, from 140 rpm to 3,050 rpm
Table tilt: 90° left and right
Height: 64"
Weight: 170 lbs. (approx.)
For more information: Contact Grizzly Industrial, 800-523-4777 or grizzly.com

My first encounter with the Grizzly G7944 drill press began with a fit of cursing but ended with a big smile on my face. You see, I had bought the 14" machine because it seemed an amazing value and my other Grizzly tools had provided superior service.

So imagine my surprise when the G7944 stalled in almost every hole, even with small bits in softwood. After a couple holes I turned the air blue with a few choice expletives and then I paused for a moment of reflection. I opened the pulley cover and tightened the pulley nut that held the pulley to the spindle. The nut had come loose (perhaps during shipping) and was allowing the pulley to slip.

That fixed everything, and since that moment more than three years ago I have had nothing but praise for this machine, which is powerful, accurate and a dang good deal.

Grizzly's business was founded on the drill press. Company President Shiraz Balolia started his tool career selling drill presses in 1975, and it shows in these machines.

Other manufacturers have tried to reinvent the drill press for woodworkers (and failed); I've found that these "advancements" always dramatically increased the price for this simple and essential machine. But Grizzly has stuck to the essentials with its line of drill presses. There are no fancy tables or complex stops or micro-adjustable gizmos. Instead, what you get is a drill press with no significant runout, a well-made chuck that will grab a 1/8" bit, all the speeds you need for woodworking (between 140 rpm and 3,050 rpm) and one single and worthwhile extravagance: a well-placed task light. I have yet to find any application that taxed the machine's 3/4-horsepower motor. Changing speeds is straightforward and easy enough to do. And the removable switch key gives me a little peace of mind with small children in my house. (Some of my more expensive machines do not have this feature.)

Oh, and then there's the $250 price (plus $65 shipping and a fuel surcharge). If you do some shopping, you're going to be hard pressed to find as much machine for this money.

Woodworkers do tend to customize their drill presses, so here's what I've done to mine. First I added the aftermarket table, fence and stop shown in the photo. The table is a nice piece of work, but I have found the micro-adjustable stop to be unnecessary, even for precision chairmaking jobs. If I had to do it over, I might skip the fancy table and add my own – the thing I most appreciate about this aftermarket table is its surface area.

I do tend to misplace the chuck key to the machine from time to time, so I've stuck a small rare-earth magnet to the side of the machine so I can stick the chuck key to that. This works fine. I've also pasted a chart of recommended bit speeds on the inside of the pulley cover.

I do use my drill press quite a lot, actually, so I've found that a little lubrication really is time well-spent. The spindle still runs smooth like butter, but the geared rack that allows you to crank the table up and down can get gummed up with sawdust. Keep it clean with a little machine oil and it will work as well as the day it came out of the box (assuming you already tightened the pulley nut). Other than that, the machine needs little attention. I recommend it without reservation.

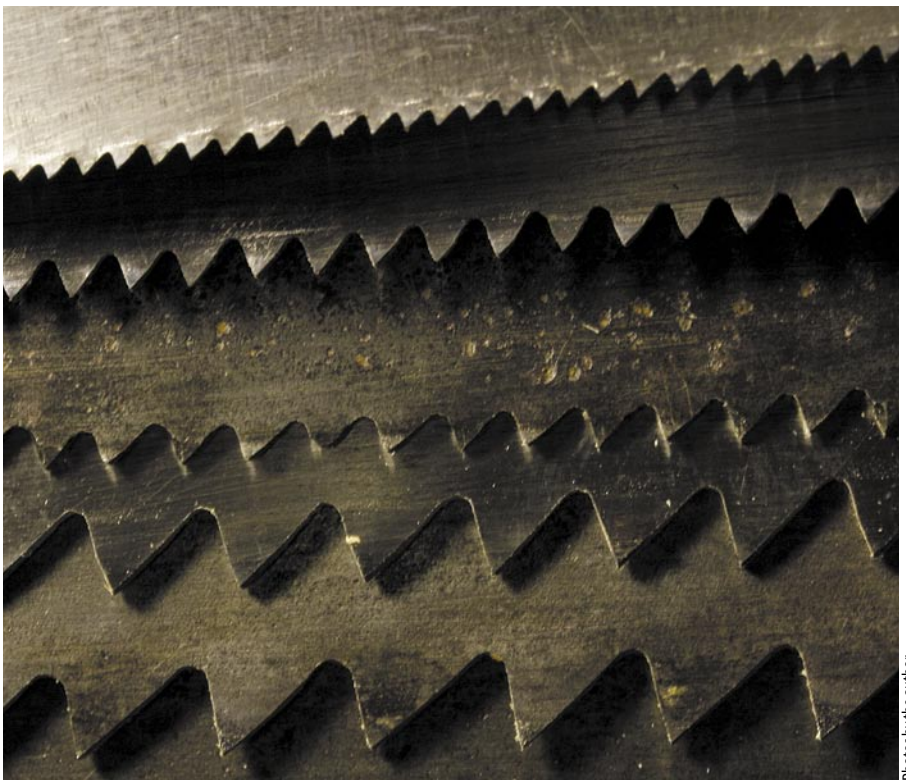
I wish I could say the same thing for my belt/disc sander, which is constantly thirsty for tweaking and attention. Hey, that reminds me, Grizzly makes a fair number of belt/disc sanders, too … I should check them out. **PW**

— Christopher Schwarz

ABOUT OUR ENDURANCE TESTS Every tool featured in our Endurance Test column has survived at least two years of heavy use in our shop here at *Popular Woodworking*.

The Mystery of Saw Teeth

Pitch, rake, fleam and set all contribute to the performance of your tool.



Photos by the author

As a community, we simply cannot abdicate the selection of saw teeth to manufacturers who do not and cannot work wood enough to be experts themselves.

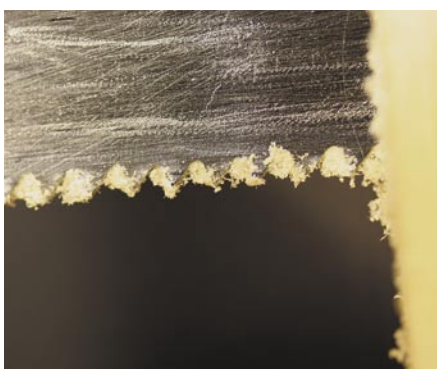
A recent review of dovetail saws in a competing magazine discussed the attributes of different saws as if their characteristics were mystically endowed by their manufacturers. I'm certain the top-rated sawmakers would approve of such a review. In reality, the performance of any saw is based primarily on the shape of its teeth. The following four attributes, pitch, rake, fleam and set, can tell you a great deal about how a saw will perform. By learning how a saw's teeth make the cut, you'll be able to choose a saw that will perform well for your work. If you sharpen your saws, you'll need to know this information so you can make changes (or avoid making changes) to the performance of your saws.

Pitch: Count Your Teeth

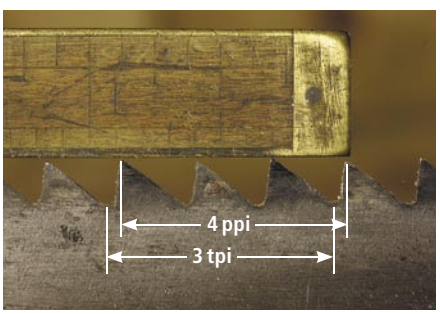
Pitch is used to describe the size of individual teeth. It is expressed in one of two ways: teeth per inch (tpi) or points per inch (ppi). The pitch of a saw's teeth is chosen in accordance with the thickness and hardness of the stock it's being used to cut. If too fine a pitch is chosen, the teeth will clog and stop cutting before they leave the kerf. This slows the cut. If too coarse a pitch is chosen, you run the risk of splitting the stock.

Over the years, workmen have come up with rules of thumb governing how many teeth your saw should have for a given thickness of stock. I think six teeth in the kerf is a good place to start for long handsaws. So if you are sawing $\frac{3}{4}$" stock, with your saw held at a 45° angle, then the length of your kerf through the work is actually $1\frac{1}{4}$" long. So to keep six teeth in your $1\frac{1}{4}$"-long kerf at all times, you need a saw that has 5 ppi.

Now if you are sawing dovetails or other joints where the first nick the saw makes must be right on and where you must finish accurately to a line, I think you need to keep 10 teeth or so in your kerf. If you saw dovetails with your saw held perpendicular to the board's face you will need a 14 ppi saw in $\frac{3}{4}$" stock to keep 10 teeth in the work at all times.



These 10 ppi teeth stopped cutting long before exiting the tenon's 5"-long kerf. This is the reason finer-pitched saws are not universally better.



What's the pitch of this saw again? It depends on how you measure it. Either way this is one coarse saw. I wish every one of you owned this 1890 Disston No. 7 handsaw.

by Adam Cherubini

Having no power tools, Adam relies on hand saws for the construction of his furniture. You can contact Adam at adam.cherubini@verizon.net.

Regardless of what type of sawing you are doing, a saw's pitch is chosen according to the length of the kerf.

Rake: Leaning Forward or Back

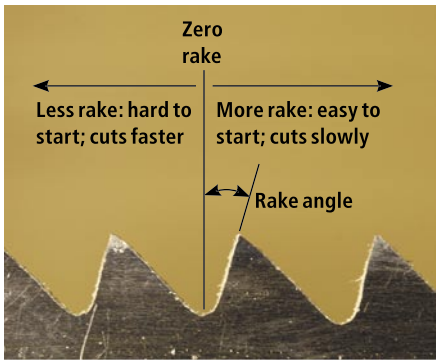
Rake is the angle the front of the tooth makes with respect to an imaginary line drawn perpendicular to the saw's toothed edge. Forward swept teeth have negative rake. Teeth swept back have positive rake. A tooth that's perfectly perpendicular to the edge has zero rake. Rake, and not pitch, is chiefly what you are feeling when a saw cuts smoothly or is easy to start. In general, the less rake a saw has, the more aggressively it cuts. Saws with more rake cut more slowly but are easier to start and give you a smooth feel. If you are cutting very hard wood, a bit more rake makes the job more pleasant. But this same saw will cut softer woods more slowly. Choose rake based on the hardness of your stock. If you have trouble starting your cuts, choose a saw with more rake.

Fleam: The Bevel on the Tooth

Fleam is the angle filed on the front of a tooth with respect to the flat side of the saw. Generally speaking, saws with no fleam (that is, they are filed straight across) are called ripsaws. Saws with any amount of fleam are typically called "crosscut saws." (Please don't confuse handsaws filed with fleam for work across the grain with the long two-man timber saws that are also called "crosscut saws.")

PROGRESSIVE FILINGS

A really coarse ripsaw is a joy to use, but a pain to start. You can have an aggressive saw that starts every stroke easily without an iron wrist. The teeth can vary in pitch and rake along the length of the blade. This was common before machines cut sawteeth, and, contrary to popular belief, was absolutely deliberate. Disston varied the pitch on ripsaws such that a 4 tpi ripsaw may have as many as 7-8 tpi at the toe. It was common to vary rake angles as well. Modern saw filers are experimenting with progressive filings in which only rake varies. You could try varying only pitch. In short, there's no rule that says all a saw's teeth have to be the same. By varying the shape of the teeth along the edge of the saw you can further optimize the performance of your handsaws. —*AC*



Lots of folks know the pitch of their saws, but very few know how much rake they have. Rake makes a huge difference in how a saw feels and performs in different stock. When staring down a piece of ebony or lignum vitae, I'm likely to select a saw based more on its rake than pitch.

Any amount of fleam will greatly improve a saw's performance working across the grain. Too little fleam will cause the grain to "log roll" causing tearout. Too much fleam makes saw teeth weak. I think saws with too much fleam cut more slowly.

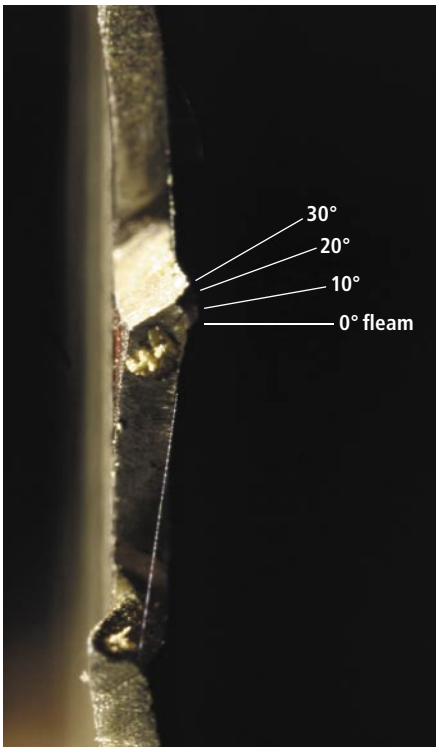
In addition to fleam, some amount of rake is required for a clean crosscut. You can experiment with different amounts of both. I prefer 20° of rake and 20° of fleam.

While fleam alone may define a crosscut saw, some contemporary sharpeners add tiny amounts of fleam to ripsaws. They report even less than 5° of fleam improves a saw's ability to make an occasional crosscut and may be a welcome addition when ripping hard woods.

Set: How Much the Tooth is Bent

Set refers to the amount a tooth is bent sideways (perpendicular to the broad face of the saw). Set allows the saw to lay a slit wider than the thickness of its blade. This reduces the friction of the blade in the slit and is supposed to reduce the effort of sawing. What set does not do is allow you to continue sawing when the stock closes up the slit. The solution to that problem is a wedge.

I'm a proponent of set, but not everyone agrees it's necessary. Some say saws without set lock into the kerf and will stay dead true and straight. My advice is to try a saw without set and see how you like it. I've not found it to be advantageous, but that doesn't mean you won't. Be gentle setting your sawteeth. Too much force can cause teeth to break and set is easy to add and very difficult to remove.



Fleam is the angle of the front of the saw's tooth. It helps make a smooth crosscut … I think. See sidebar below.

IS FLEAM NECESSARY?

I've read and probably asked the question: At what angle to the grain is fleam necessary? Dovetails, for example, are often cut at 10° to 20° off the grain direction. Should these saws be filed with fleam? I think the answer is "no." I don't think to pick up a crosscut saw until the angle is 45° or higher. But the larger question of whether fleam is necessary is more difficult to answer. Colonial Williamsburg's Anthony Hay Cabinet Shop has no saws with fleam. The scholars there have uncovered no evidence that 18th-century saw makers filed fleam, so they have chosen to work without it. They do however, routinely knife all crosscuts. I have noticed that all of their saws seem to have a bit more rake than their modern counterparts. They also seem to link pitch and rake, i.e. they file more rake on higher pitched saws. Unfortunately, there aren't many woodworkers relying solely on handsaws for all their cuts. So I think Arts & Mysteries readers should try some experiments of their own. Can you crosscut with a ripsaw? How much rake is enough to make this job comfortable? Try it yourself and report back. —*AC*

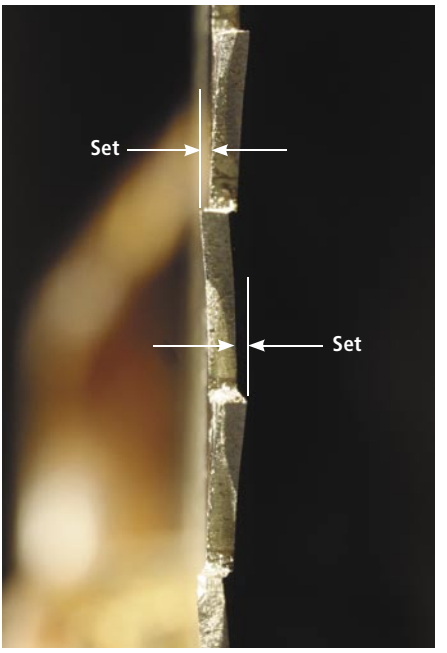
I think set is especially helpful for work in soft, sappy woods such as pine. Waxing or oiling your saw blade also helps.

There is no magic to handsaws. Remember that pitch is chiefly governed by stock thickness but it can also affect accuracy at the start of a cut. Adding rake makes the cutting smoother but slower. Fleam is added for cross-grain work, and set helps reduce friction. Blade thickness primarily affects the speed of the cut, and the length of a blade for rough cuts should be chosen according to your stroke. For finer work, shorter saws are generally better. Armed with all this in mind, you should be able to look at any saw and know what it would be good for by examining its teeth. Conversely, you now should be able to pick the right saw for the job. Rather than replace a manufacturer's lame tooth recommendations with my lame recommendations, my goal for this article was to raise your awareness that:

a) There is no standard way to shape a saw tooth for all cutting situations you will face.

b) You can shape saw teeth to achieve different effects (ease of starting, speed, good for softer or harder woods, etc.).

c) Choose the tooth shapes (or the saw) based on your work – not hearsay, my recommendations, or other subjective reviews. **PW**



The teeth on this rip saw are moderately set. This blade is .040" thick here. The amount of set appears to be a quarter of that. The amount of set on a lightly set saw is barely perceptible. It may be only a few thousandths ($^1/_{1000}$) of an inch on either side. But what may not be obvious to the eye can easily be felt during sawing. Notice how crisp the outer corners of the teeth are. I avoid stoning the sides of my saws' teeth (a common way to reduce a saw's set).

CHOOSING A "SAWPLATE"

When choosing teeth for a saw, two other factors greatly influence the performance: the length and thickness of the blade (sometimes called the "sawplate").

Blade Thickness

For rough work in thick wood, large teeth are best (small teeth clog in thick stock). Because large teeth require more force to push, a thick blade is better because it will resist buckling. When you have a choice, marry coarse teeth to a thick blade.

For thin, hard wood, you need fine teeth, possibly with a positive rake. This will be a slow-cutting saw if the blade is thick. Choosing a thin-bladed saw for these teeth will improve your speed.

Blade Length

Your ripsaw's blade should be as long as your arm. (You can measure from your armpit to the end of your fist.) Long saws cut fast. But a 24"-long dovetail saw would be nearly impossible to use. Common sense tells us we need shorter saws for precision cuts and cuts in thin material. And that's pretty much what we see manufacturers producing: short saws with fine teeth for thin stock, long saws with coarse teeth for thick stock.

The exception is the 18th-century tenon saw. It was used to saw the wide tenon cheeks on everything from doors to frame-and-panel furniture. These saws typically have fine teeth and thin blades for precision cuts, but are very long, typically 16"-20". Their length compensates for their fine pitches, allowing quick work through thick stock. Though largely unavailable for the past century, some custom sawmakers are now building them again.

So just as we married fine teeth to thin saw blades, we should marry fine teeth (for accurate cuts in thin stock) to shorter blades, with the exception being the traditional tenon saw. —*AC*

Dimensional Lumber Bench

By the door or at the foot of the bed, this simple bench is just right for a small space.


Photo by Al Parrish

Don't make the mistake of thinking you need a lot of tools and machinery to get started in woodworking. While it's certainly nice to have a jointer, planer, table saw and router, the only power tool I used to make this bench was a jigsaw. To learn about the simple tools and techniques we use, download the free and newly updated "I Can Do That" manual online at ICanDoThatExtras.com.

We designed this project around available sizes of common lumber and put it together with a simple but strong method: nails and cleats. To add visual interest to this simple design, the ends are thicker than the front, back, sides and top, and all of the joints are offset. This creates lines and shadows at the intersections. It also takes some of the pressure off your precision – if your measurements are slightly off no one will ever know.

Because I planned to paint this piece, I decided to use inexpensive material – #2 pine. I used 2 x 12 dimensional lumber for the ends, and 1 x 12 and 1 x 10 for the rest. If you want to use a clear finish to show the wood grain, you might want to upgrade to clear hardwood. Spend some time picking your material. You want the straightest pieces you can find with the fewest knots and other defects.

The shortest piece of 1 x 12 I could buy was 4' long. This length allowed me to cut between knots to get a clear piece for the top, seen in the photo at right, and I used the extra to make the ¾" x ¾" cleats that hold the front and back panels to the ends. I cut the top ⅛" shorter than the front, back and bottom to provide clearance when it opens and closes.

The two end pieces and the front and back panels were left at their full width; only the top and bottom need to be ripped to finished size. After cutting the ends to length, I marked out the feet at the bottom, made the cuts with the jigsaw, and cleaned up the saw marks with a rasp. I then used my combination square to mark the position of the front and back panels. I placed the panels against my marks as shown in the top photo at right to determine the exact location of the cleats.

When I was sure that my layout marks for the top edges of the front and back panels were 1" below the top of the ends, I cut the cleats to length, allowing space for the bottom. I then put glue on the cleats and nailed them to the end panels. While the glue was drying, I glued and nailed the bottom to the lower edge of the front panel. I then put this assembly on one end panel, gluing and nailing it to the cleat using 3*d* finish nails. Before putting the back panel on, I attached the other end as shown in the photo at near right.

I then placed the box face down on my bench and attached the back panel, using a couple clamps to keep the assembly square and lined up with my pencil marks as shown in the photo at far right. After setting the heads of the nails below the surface with a nail set, I was ready to attach the top to the back panel with a piano hinge.


Removing material from each end lets me avoid the knots in the top piece. It's extra effort, but the end result is worth it.

by Robert W. Lang

Comments or questions? Contact Bob at 513-531-2690 ext. 1327 or robert.lang@fwpubs.com.

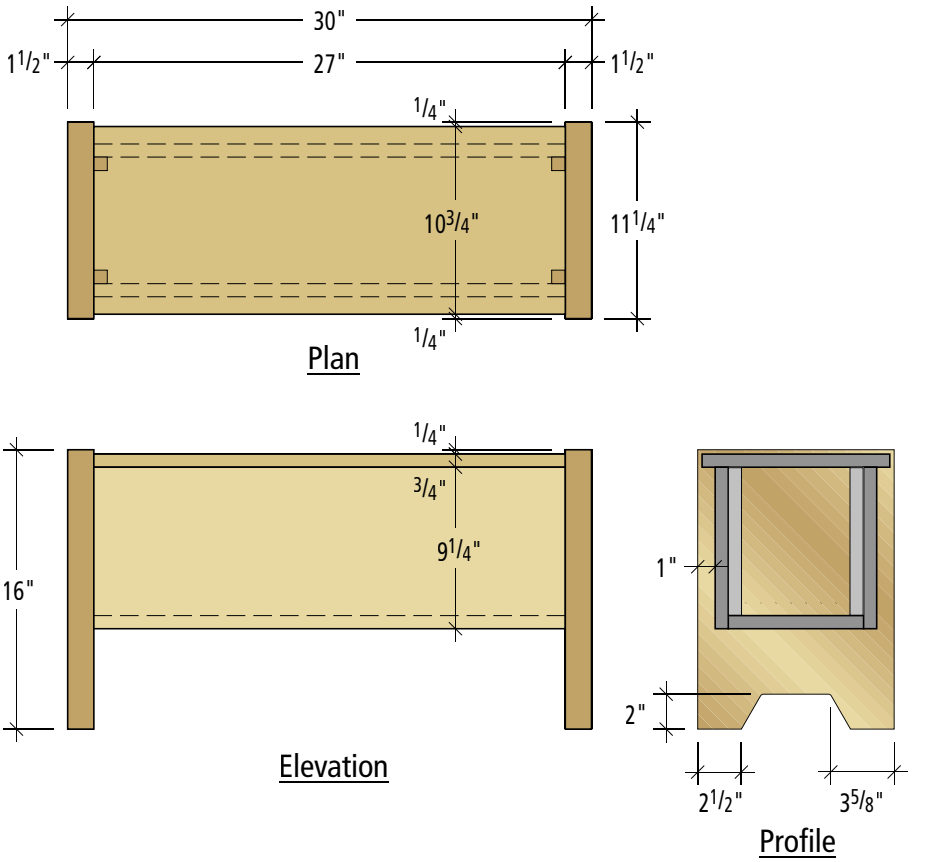
With the top overhanging the back panel, I had room to surface mount the piano hinge. I used an awl to make pilot holes for the screws, and attached the hinge with just a few screws at first to be sure it opened and closed properly. Then I removed the screws and hinge and got the bench ready for paint.

I eased all the edges with my block plane and a rasp, then sanded with #100 grit paper to remove milling marks. If you use a random-orbit sander, stay away from the inside corners where the front and back panels meet the ends. If you get too close, the edge of the sanding disc can dig in. It's better if you stay an inch or two away with the sander, and work into the corners by hand.

I primed the bottom of the hinged top and the bottom edge of the ends first. When this had dried, I put a screw into the end of each foot to hold the ends off the surface while I painted the rest of the bench. **PW**

I used the front and back panels as gauges to locate the cleats that hold them to the ends. This avoids measuring errors.

Planning a logical sequence for assembling the parts is important. I attached the front and bottom together and glued and nailed them to the ends as a single unit.



DIMENSIONAL LUMBER BENCH

	NO.	ITEM	DIMENSIONS (INCHES) T	W	L	MATERIAL	COMMENTS
❑	2	Ends	1 1/2	11 1/4	16	Pine	2 x 12
❑	2	Front & back	3/4	9 1/4	27	Pine	1 x 10
❑	1	Top	3/4	10 3/4	26 7/8	Pine	Cut from 1 x 12
❑	1	Bottom	3/4	7 3/4	27	Pine	Cut from 1 x 10
❑	4	Cleats	3/4	3/4	8 1/2	Pine	

To get the last piece positioned exactly where I wanted it, I used a couple clamps to pull the parts into alignment.

ABOUT THIS COLUMN

Our "I Can Do That" column features projects that can be completed by any woodworker with a modest (but decent) kit of tools in less than two days of shop time, and using raw materials that are available at any home center. We offer a free online manual in PDF format that explains all the tools and shows you how to perform the basic operations in a step-by-step format. You'll learn to rip with a jigsaw, crosscut with a miter saw and drill straight with the help of our manual.

To download the free manual, visit ICanDoThatExtras.com.

MASTER the

With the right blade and body position, you can split pencil lines with ease with this oft-misunderstood tool.

by Troy Sexton

Troy Sexton designs and builds custom furniture for Sexton Classic American Furniture in Sunbury, Ohio, and is a contributing editor to Popular Woodworking *magazine.*

The jigsaw generally gets a bad rap as a rough tool that's best suited for kitchen installations and odd-ball carpentry jobs.

And while I do use my jigsaw for coarse operations – I also consider it one of my essential tools for building fine furniture.

With the right blade, a little confidence and – most important – the right body position, you can do almost anything with a jigsaw that you can do with a band saw. Plus you can do a lot of things that are impossible to do on the band saw.

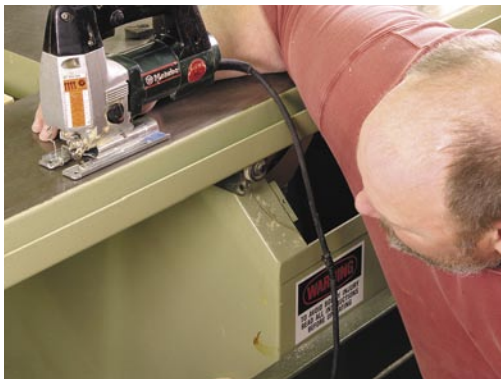
Here's a taste: Recently we were installing a kitchen and had to remove 1" of the depth from a finished cabinet against one wall. The only tool I needed was a jigsaw, and it took just a few minutes to do the job.

Here's another: Early in my cabinetmaking career I made historical reproductions for another shop down the road. A lot of these pieces had fancy bracket bases, but we didn't know what the profile would be until the customers placed their order. So we had to cut the scrollwork on the base after the entire cabinet was assembled. This technique worked so well that it's how I do many of my cabinets today.

These cuts on the bracket base, when done well, require little or no sanding. I can usually just hit the edge with some sandpaper and am done with it.

And, of course, I've used my jigsaw for rough carpentry: cutting vent holes in roofs, framing stud walls, cutting drywall, PVC pipe and sheet metal.

A lot of woodworkers lack the confidence to make finish cuts with a jigsaw, but I contend that it's easier than you think. Read this article, then take some strips of plywood and practice some cutting in the shop. It doesn't take much practice to get good at it.



With a jigsaw with a steel base, such as this Metabo, you can correct a warped base. First put the saw on a known flat surface and look for gaps.

You also should try rocking the base on the flat surface. If the saw rocks, it won't track a line well.

Choosing a Saw

This isn't a tool review, but there are some general guidelines I would follow when buying a jigsaw. First, if you cannot afford a good saw, I'd wait until you can.

What's a good saw? When I buy a jigsaw I'll first turn it on. If it's relatively quiet and doesn't shake too much, that's a good sign – low vibrations contribute to a smoother finished cut.

I also don't like it when a jigsaw heats up in use. Again, this is something that you can only check by turning on the saw and putting some time in on it.

I also prefer the barrel-grip designs to the traditional top-handle designs – although a Metabo top-handle design is used for this article because top-handle models are more common. The top-handle tools are good, too, but the barrel grips allow me to get my hand closer to the work, which improves my accuracy.

Preparing the Tool

Jigsaws tend to get handled a little roughly and are frequently knocked around or dropped. This rough treatment is hardest on the base of the tool.

Why should you care? If you're having trouble tracking a line then chances are your base is out of kilter. And if you can feel the tool rock on the work, your base is definitely not flat.

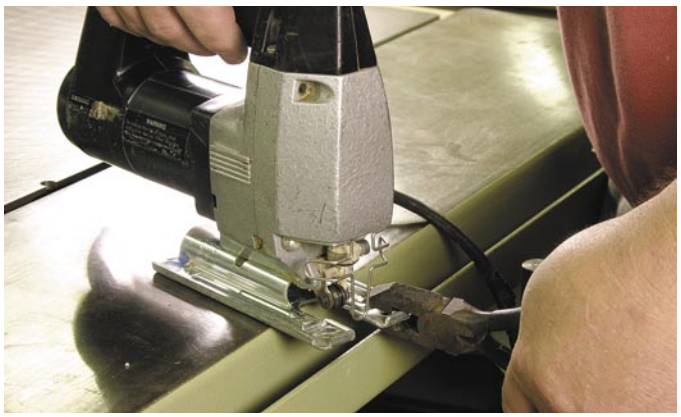
There are two flavors of bases: cast metal and stamped steel. If your base is a casting (as in the jigsaw shown at right), you can crack the base if the jigsaw takes a tumble to a concrete floor. If your base is stamped steel you can bend it back, but these steel bases seem to go out of alignment more often. So neither base has the real advantage in my mind.

JIGSAW

With just a little practice, you can make nearly finished cuts in hardwoods. This foot to a bracket base will require just a few moments of sanding to be ready to install.

Photo by Al Parrish

Photo by Al Parrish



A pair of pliers can fix most problems with a steel base. Hang the troubled corner off your work surface and grab it with the pliers. Lever it up or down and then check your results.

If I suspect my steel base is warped I'll place it on a known flat surface, such as my table saw, and see if I can detect any problems with my eyes or by rocking the base of the jigsaw at the corners.

If I find a problem, I'll bend the high corners down with pliers.

Another thing to check: Routine use can cause the base to tilt a degree or so. I'll check the blade with a square to ensure the blade is 90° to the base.

Most jigsaws have orbital settings – these control how much the blade moves forward and backward as the blade moves up and down. At "zero" the blade moves only up and down and is not aggressive. At "three" the saw is a monster.

For building furniture, I keep the saw set to "one." This offers a good balance of a fine but aggressive cut. When dealing with thick stock, I might switch to "two." When I'm poking a hole in a roof: "three." I almost never use "zero" because I find that the saw cuts so slow that it heats up the blade too quickly. Sometimes I'll choose zero when working in plywood, however, because it does reduce chipping on the face veneer.

Most jigsaws also have a speed setting that you should be aware of. Usually there's a dial that limits the jigsaw's top speed. But the trigger allows you to increase and decrease the speed in that speed range with finger pressure. On a jigsaw with six speed settings, I'll generally keep the top speed at "five." I use the slower speeds for metals and plastics.

These two blades (right) are all I need for cutting wood: The Bosch T101B for most cuts and the Bosch T119BO for tight scrollwork.

I use the T119BO blade (left) only for tight-radius work, such as the small radius in this bracket foot.

Choosing the Best Blade

I've tried a fair number of blades in my career, but I keep coming back to two blades, time and again. For 95 percent of my cutting I use a Bosch T101B. This is a 4"-long blade (almost 3" of that is teeth) and it has 10 teeth per inch. The blade is a little more than 1/4" wide.

The T101B makes smooth and fine cuts at a decent speed. As long as you keep a sharp blade in the tool, you'll require very little sanding. It never seems to mark the wood like some blades do, and it stays sharp for a long time, unless you overheat it.

For tight scrolling cuts I use the Bosch T119BO. It's about 1" shorter than the other Bosch blade, a little thinner and it's quite narrow: about 5/32". It has 12 teeth per inch. Because it's thin and narrow, it tends to wobble more and is more prone to deflection. So I only use it when I have to.

Good Body Ergonomics

How you hold the saw and approach the work will make a radical difference in your results.

First: As you grasp the saw, point your index finger forward. If you have a top-handle saw, that position will put your middle finger on the trigger. Pointing with your index finger improves your accuracy in many situations. I use the same technique when I'm firing a rifle or a bow when hunting. Once you get your hand in the right position on the tool, lock your wrist in place.

Your index finger should be extended when you grip a jigsaw. This is one of the cues to your body to cut straighter.

Next: Your elbow is key. I don't steer the saw with my wrist – it's too flexible; I steer with my elbow (and my body) instead.

Whenever I teach someone to use a jigsaw I tell them to tuck their elbow against their torso and to think about their elbow as they make a curve cut. Steer with your elbow and swing your entire body as you make a curve cut.

To do this properly, you need the work positioned up pretty high. I like to have the board up by the middle of my torso.

I also like to peer over the saw whenever I can to see the teeth making the cut. I generally don't watch the cut from the side or from behind – though sometimes that is unavoidable. As I'm making a cut, I am constantly blowing the line clear of sawdust. (Some saws come with a built-in blower.)

I place a finger or two of my free hand on the base. Do not use these fingers to steer your cut or push forward into the cut. Their job is to hold the saw steady and down against the work. They also make the base of the saw larger, in a sense, so the tool is more accurate and stable.

Using all these techniques together make the saw an extension of your body so you are making the cut as much as the tool is.

The Right Techniques

When beginners use a jigsaw, the tendency is to cut shy of the finished line. They generally figure that they can sand to the line and it will be a more accurate result.

I have found the opposite to be true. If you cut shy of the line then you are trying to keep a consistent gap between your blade and the cutline – and eyeballing a gap is tough for anyone to do.

I find that the more accurate approach is to attempt to split the pencil line with your blade. It sounds difficult, but with the right body position, it's easier than cutting shy of the line.

The other thing to keep in mind here is that you should not apply sideways pressure to the tool, which will bend the blade in the kerf. Many beginners will try to use sideways pressure to correct a wayward cut, but it almost always makes things worse.

Instead, just let the saw do the cutting. I like to tell people that it's like you are following the blade instead of pushing the blade.

And, of course, you should always remember that you're cutting wood. So almost any mistake you make can be fixed with a file and sandpaper.

So what should you do when things go wrong and you stray from the line?

First, stop cutting. Figure out what is causing you to drift. For me, it's almost always a problem with the tool's power cord. The plug (which is always plugged into an extension cord) has snagged on something, usually the work itself. So be mindful of your plug and your cord. For example: When I'm cutting a big tabletop, I'll ask one of my kids to help manage the cord. Or, if I'm alone, I'll pile the cord in the center of the tabletop, which reduces snags.

Proper cord management makes for cleaner cuts, overall. The less you are stopping and starting the saw during a cut, the cleaner the result will be.

After you've made sure your cord moves freely, it's time to correct the cut. For many woodworkers, the urge is to try to drift back to the line with lateral pressure.

Instead, you should back up to the point where you started to drift and start cutting again. You need to go slower than normal during this kind of cut because the blade wants to deflect. There's only material on one side of the blade during this operation and so the saw wants to drift.

You can also run into similar drifting problems when you are cutting tight radii and need to make relief cuts.

Relief cuts are generally good, because they allow your blade to make tight turns and help remove chunks of waste material as you are making your cuts.

But relief cuts can also create situations where the blade is cut-

Here's my favored position for jigsawing. My work is up quite high near the middle of my torso, my elbow is tucked against my body, my wrist is locked. Also, my left hand is holding the saw's base down against the work and my head is peering over the saw to watch the teeth.

CORRECTING A MIS-CUT

Here's a jigsaw cut where I have strayed off the line. The first thing to do is to stop and back up to where the drifting began.

Move the saw forward slowly into the mis-cut area. Don't push laterally. Let the teeth cut.

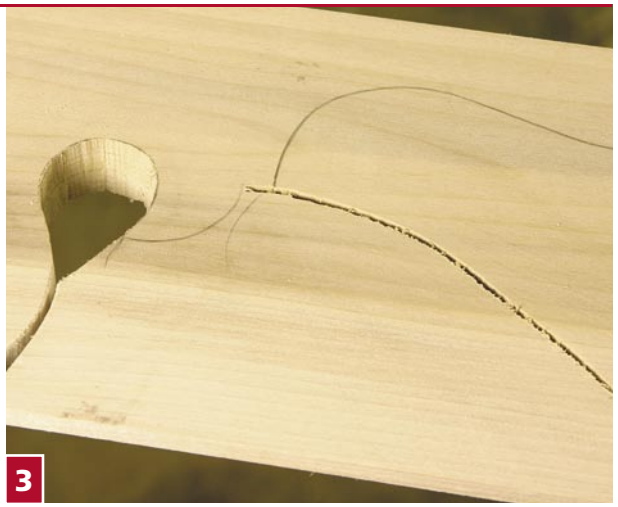
Here you can see what the corrected cut looks like when complete.

Here's why you don't want to apply lateral pressure to the blade to correct a cut. The blade bends very easily, making things worse.

MAKING TIGHT SCROLLWORK CUTS

Here's how to handle tight-radius work: Begin by making a series of relief cuts in the tight radius.

Install the narrower blade in your jigsaw and remove the waste along your finished cutline in one sweeping cut.



Now install your regular blade in your saw and make another relief cut at the next fillet.

Make your sweeping cut along the scrollwork.

Dismount is important. Make sure that you can support the saw and the workpiece as it is cut free.

MAKING SIMPLE STRAIGHT CUTS

Many woodworkers struggle with cutting the long, straight lines in bracket feet. After doing hundreds of these feet, here's my recommendation: Make your first entry cut near the corner. Cut into the corner.

Now turn the saw around and cut all the way across the bracket. This keeps all the waste pieces attached during the critical part of the cut.

ting on only one side, which will encourage drifting and bending. So take extra care in tight turns.

Advanced Jigsaw Tricks

Jigsaws are capable of some surprising operations. When making cutouts in assembled cabinets for power cords or outlets, I frequently use my jigsaw to make plunge cuts into the work. After you practice this a couple times, you'll find it pretty easy.

First, snip about 3/4" to 1" off of the blade using metal shears. A stubby blade won't whip around as much and makes a neater starting kerf as the blade hits the wood.

Here's another useful trick: You can also use a jigsaw to make precise cuts on finished materials or on plywood with the help of some painter's tape.

Use the tape itself to mark your cutline and then cut right along its edge. The tape offers three distinct advantages:

One: When you're cutting material that has a stain and a topcoat finish on it, it's quite difficult to strike or even see a pencil line on your work. The blue painter's tape makes it easy.

Two: The tape protects the finished work from being scratched by the base of your jigsaw (you also can put felt or a couple strips of tape on the base if you like).

Three: The tape greatly reduces the tendency of the veneer on a piece of plywood to chip out.

One last trick that I like my jigsaw for: coping crown moulding. With a special coping foot from the Collins Tool Co. (collinstool.com or 888-83-8988) I can easily cope crown moulding.

The accessory base (a $29 item) allows me to rotate the tool at odd angles and keep support right up at the kerf. **PW**

SUPPLIES

Bosch Tools
877-267-2499 or
boschtools.com

Call or visit the web site to find a dealer in your area that carries the jigsaw blades.

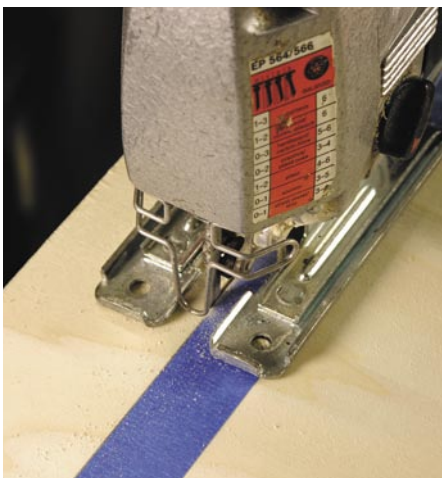
Collins Tool Co.
888.838.8988 or
collinstool.com

The coping foot is available for a wide variety of jigsaws. Visit the company's web site for more information.

MAKING PLUNGE CUTS

(Left) Making plunge cuts looks harder than it is. With the saw off, line up the blade with the cutline and pivot it up on its nose. Start the saw and plunge down.

(Below) Here you can see the results of the cut and how I've snipped off the end of the blade (on purpose) to make a more accurate plunge.



When dealing with thin veneers or with finished goods, use painter's tape to mark your cutline. It offers protection against chipping and scratching.

MAKING COPING CUTS ON CROWN MOULDING

The Collins Tool coping foot allows me to work from below, so I can see where the blade is cutting – and I can rotate the saw to change the angle easily.

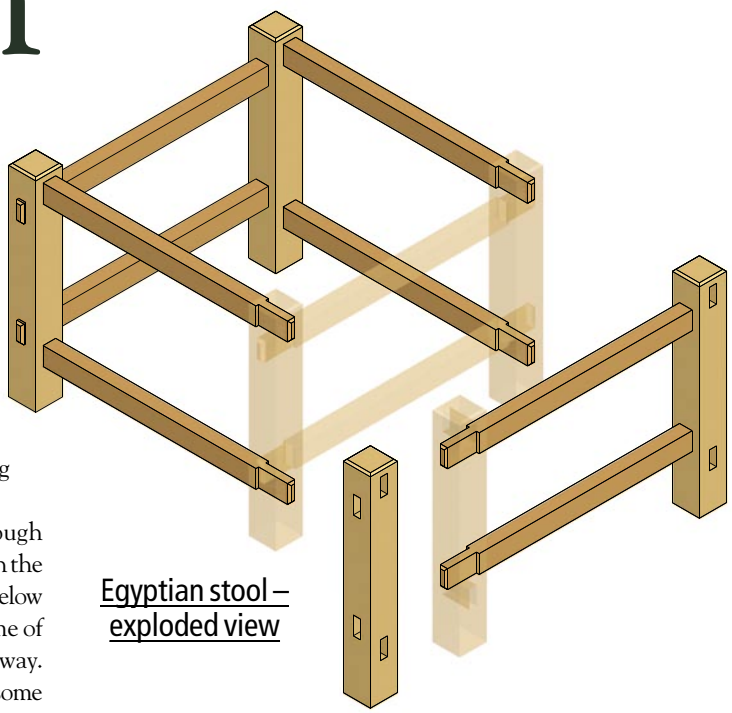
The results are neat and tidy, much easier than using a coping saw.

Photos by Al Parrish

This reproduction of an ancient Egyptian stool is made with through mortise-and-tenon joints.

Master the Through Mortise & Tenon

Three ways to approach this ancient joint.



Egyptian stool – exploded view

In furniture making, while carcases and drawers are dovetailed together, tables and chairs have mortise-and-tenon joinery. In this article, I make a through mortise and tenon three different ways. First by hand, second with a hollow-chisel mortiser and table saw, and third with a plunge router and band saw.

In 1991, I had a very nice commission to make about a dozen pieces of Egyptian furniture for the Newark Museum in New Jersey. I had the opportunity to see the real, original ancient pieces and make measured drawings to do the work. The pieces I had to make are more simple ones which are less well known than the spectacular furniture from the tomb of King Tutankhamun.

This stool at left is a copy of a New Kingdom craftsman stool. I made it 2" higher than the original. The Egyptians were squatting before they had stools and the low height of the stool was designed for sitting in this squatting position.

All the stools have through mortise-and-tenon joints with the seat rails meeting above and below one another at the legs. Some of the stretchers are the same way. Some tenons are pegged and some are wedged; the ancient stools were held together by the webbing. I glued mine.

The seats on the stools are also different. Some have a solid, curved seat carved from four planks, others are woven with reed and rush fibers, while still others have holes on the inner edge of the seat rails and are woven with simple double-braided rush webbing that looks like caning. The ends of all the strands are carefully knotted below the holes and hidden from sight. I made a bed in this manner for the museum.

by Frank Klausz

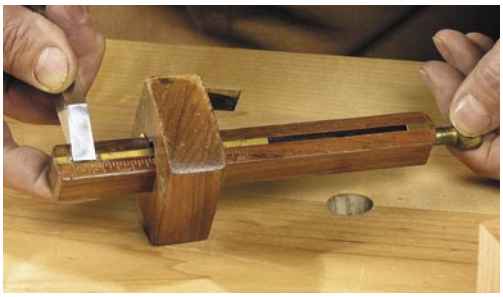
Educated in the Hungarian trade-school system, Frank is a master cabinetmaker, author and owner of Frank's Cabinet Shop in Pluckemin, New Jersey, which specializes in fine furniture reproductions and custom architectural fixtures. He also teaches woodworking. For more information visit frankklausz.com.

Chop and Saw by Hand

To do mortise-and-tenon joints by hand, you have to do a lot of marking. After stock preparation, you mark the corner of the legs with a scribble to indicate the outside corners. With a square and a sharp pencil, mark the thickness of the seat rail 1/2" below the top of the leg. Flip the leg and mark first under the lower rail's location. For a through mortise and tenon, transfer these lines to the outside of the legs. Make sure you end up with pairs. Mark the location of the stretchers at the bottom in the same way.

To locate the tenon shoulder from the rail ends, mark the seat rails and stretchers, using the width of your leg as your guide, plus 1/4" (which is how much the tenon sticks out from the leg). Measure the width of your stool and mark your other shoulder.

Set the two cutters of your mortising gauge to the thickness of the



Setting your marking gauge to the tool lets you use the width of your chisel to determine the width of the mortise.

Clamp the leg securely to your bench and chop halfway through. Then flip the leg over and complete the mortise from the other side.

I use a traditional European bowsaw to cut the tenons by hand.

chisel, as shown at left, then move your fence so the cutters are centered in the stretchers and mark them. Do the same with the seat rails. Reset your marking gauge and mark the legs. Make sure you are in the middle. Clamp the leg to your bench and start chopping. Stay away from the pencil line and take 1/8" chips. Keep going deeper and pry out your chips. When you are halfway through, do the final cut on the line. Turn it over and do the same from the other side. You can clean your hole with a rasp.

For the tenon, I use a bowsaw, as seen at left. I clamp the pieces in my bench and cut them making sure I am on the line. If you do not have a bowsaw, use your tenoning saw. I cut on the waste side, leaving the tenon snug. To cut the shoulders I use a dovetail saw, as seen in the center photo below. I bevel all four sides of the ends of the tenons with a chisel. Try the fit and adjust with the rasp and chisel until it is just right. It should be tight along the width, not from end to end.

Mortiser and Table Saw

To mortise with a hollow-chisel mortiser, mark your legs the same way. You do not need a marking

An alternative to the bowsaw is a tenon saw, filed for ripping.

A dovetail saw, filed for crosscutting, is used to make the shoulder cuts.

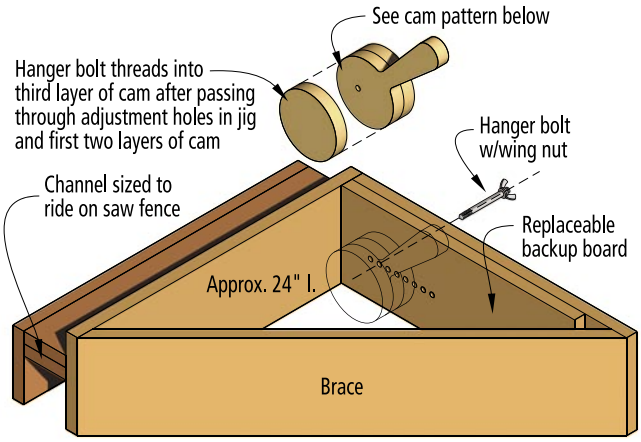
The hollow-chisel mortiser will save some time in marking because the fence on the machine will center the cut.

gauge; the machine's fence will set the chisel to the middle, as shown below right on the facing page. The hollow chisel should be set so that the drill bit has a credit-card thickness gap at the bottom between the chisel and the end of the drill bit to leave room for the chips to go up and not run hot. Mortise halfway, flip it and mortise from the other side. This way you have clean openings.

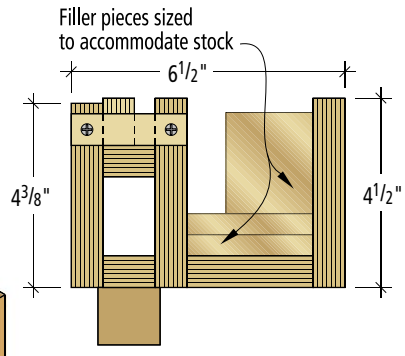
To tenon on the table saw, I use my tenoning jig, which fits on the table saw fence. Mark a scrap with small lines for the width of the tenon. Set up the saw by trial and error until it is right before you cut the real pieces. The cam clamp holds the piece in the jig for a very safe and repeatable cut. To cut the shoulders, set up your blade height and use a block of wood on the fence for extension to leave more gap to clear the scrap (see photo next page). This way your saw will not jam. Use the miter gauge with a block of wood and a piece of sticky-back sandpaper so that your wood does not slide.

Plunge Router and Band Saw

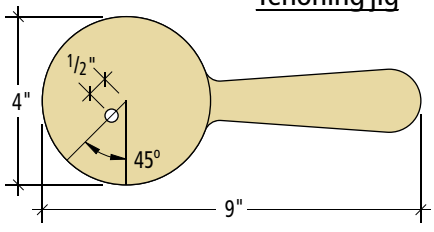
To mortise with a plunge router, you have to make a jig like the one in the drawing at right, and in the photo on the next page. Mine holds a 3" x 3" piece so a table leg will fit into it. Smaller pieces get shimmed and wedged for safe work. Use a two-flute carbide up-spiral bit. On the router fence, I use a block of wood that slides back and forth in the jig safely. Take small cuts of about



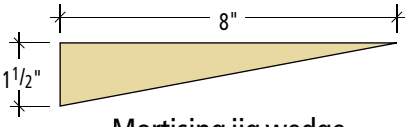
Tenoning jig



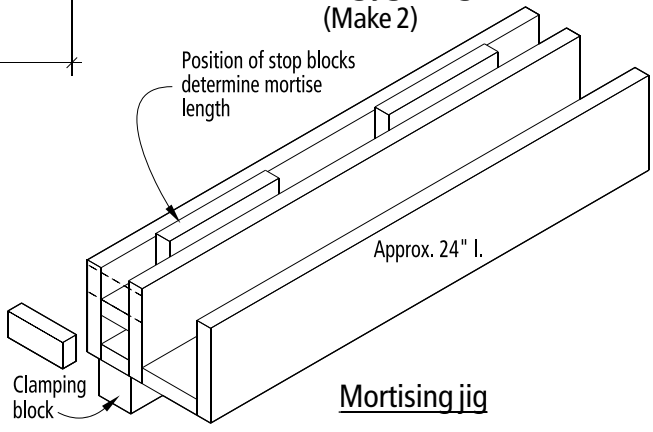
Mortising jig elevation



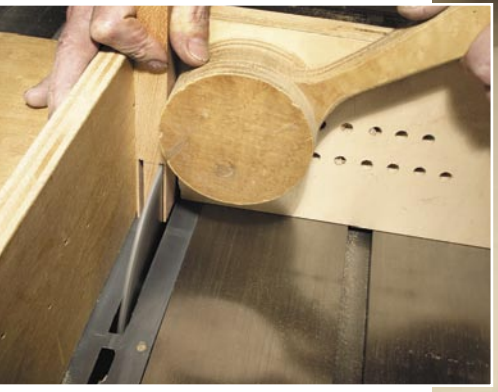
Cam layout



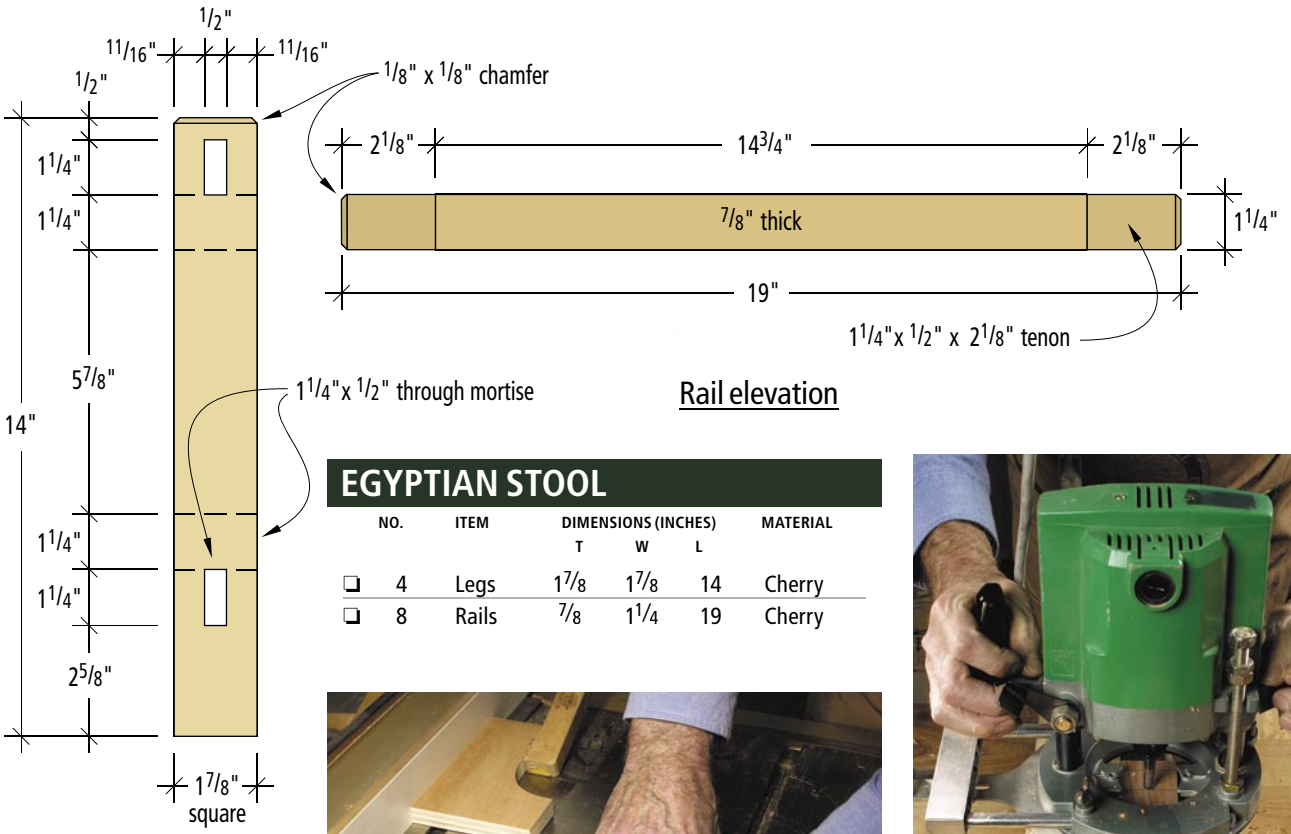
Mortising jig wedge (Make 2)



Mortising jig



My table saw tenoning jig rides on the saw fence and holds the piece vertically. The cam clamp on the jig can be moved to fit different widths of material, and holds the rail in place.



Leg elevation

Rail elevation

EGYPTIAN STOOL

	NO.	ITEM	DIMENSIONS (INCHES) T	W	L	MATERIAL
❑	4	Legs	1 7/8	1 7/8	14	Cherry
❑	8	Rails	7/8	1 1/4	19	Cherry

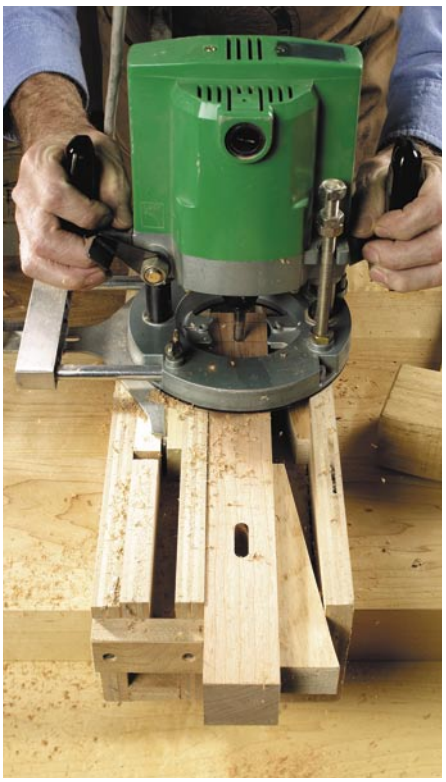
1/4" down each time. Cut halfway, flip and cut from the other side. I square up the corners with a chisel. If I am making doors, I round off the tenons and wedge them, as seen in the photo at the bottom left of the page. It's much quicker.

To cut tenons on a band saw, set up the band saw fence and mark a scrap of wood, as shown at bottom right. As with the table saw, cut it by trial and error and once the scrap is right, cut the real pieces. Cut the shoulders by hand with a dovetail saw.

Remember that all of these methods can be mixed. Use the one you like best.

I antiqued the stool by rounding off the corners unevenly with a chisel, rasp, broken brick, etc. I finished it with shellac and brown wax. From a cow hide, I cut 1" strips for weaving the seat, which I learned from Brian Boggs' DVD on hickory bark, sold by Lie-Nielsen Toolworks (lie-nielsen.com or 800-327-2520). **PW**

The stop clamped against the table saw fence registers the shoulder cut, and keeps the work from jamming between the fence and the blade. Note: There are no shoulders on the edges.



With this jig and an up-spiral bit, a plunge router will make clean mortises quickly.

The router leaves mortises with rounded ends. Square them off with a chisel, or round the ends of the tenons to match.

The fence on the band saw lets you make long straight cuts on the cheeks of the tenons.

WOODWORKING ESSENTIALS

BY DAVID THIEL

CHAPTER 1

Setting Up Shop: The Right Location

Most woodworkers back their way into woodworking, gathering tools and equipment slowly. Because of this fact most woodworkers also grow their woodworking space slowly as well. They may start out with a corner of the garage or basement dedicated to Saturday projects, but as their interest and skills build, so does the need for space.

That's where we want to start with this first chapter of Setting Up Shop – space. When we poll woodworkers about what they need to improve their pleasure in woodworking, space is the number-one answer, followed closely by more time and less expensive wood.

Given *carte blanche* to select a "right-sized" woodworking space, most of us would pick something about twice the size of a two-car garage that is heated and air conditioned, has a vaulted ceiling, windows on three sides and a large garage door on the fourth. When you look out any of the windows, there is a bucolic landscaped-view with not another building in sight. Which brings us back to reality.

Most woodworkers use a converted garage or basement space for their woodshop. The lucky few get to convert an existing out-building or get to actually build a shop to their own specifications. Each of these options involve compromises, and we'll look at them one at a time to help you avoid complications in setting up your shop.

Hole In the Ground

Probably the least appealing – but very frequent – location for a woodshop is in the basement. The negatives are many. First is deplorable access for moving machinery and lumber into the shop, and for moving finished pieces out. Probably less than half the basements in existence have a walk-out door with straight access. Many more require negotiating steps (whether interior or exterior), and many of those stairwells end in a 90° turn at a wall.

Once you're in the basement shop you are often confronted with ceilings that are less than 7' tall and ductwork

PHOTO BY AL PARRISH

Woodworker George Jaeger chose his home in northern Kentucky very carefully. The 1,300-square foot detached barn less than 200 feet from his home makes a perfect woodshop with an unbelievably pastoral setting.

for the HVAC system that for some reason had to be run below the ceiling height – not to mention water and electrical lines. Then there's the frequent lack of windows and the likelihood of dampness that is anathema to woodworking equipment.

When you are woodworking, one of the common byproducts is dust. Guess what else is often housed in a basement? The furnace and air conditioner have a bad habit of drawing air from the basement into the rest of the house. Along with that air goes your wood dust and any woodworking-related odors.

So why in the world are people turning basements into woodworking shops? Because that's the only space they have available. Working in a challenging space is a testament to the enthusiasm woodworkers have for their craft.

Now that we've discussed the negatives, there are a couple of positives worth mentioning. Basement shops are much more likely to be climate controlled, making the space an easier year-round workspace. Heat is often already in place and if the basement isn't air conditioned for the summer months, the below-ground location helps to keep things cooler.

Security and noise are two other benefits. When you're in the basement, casual passers-by aren't able to see the tools and machinery that are a mere locked door away, reducing temptation. Also the noise commonly related with woodworking is muffled in a basement, reducing annoyance to neighbors – though your family might prefer a little more sound insulation.

While a lack of windows in the basement could make lighting an issue, wall space is reclaimed for hanging clamps, jigs and for adding cabinetry for tool and supplies storage.

Power is an issue in any shop, but basements have the advantage of usually having electrical service of some type already in place. Garages and outbuildings are less likely to be pre-wired for adequate electricity. There's a good chance the service will still need to be upgraded to meet your woodworking needs, but it's easier to upgrade an existing service than run new service to an unwired space.

Now let's look at how to make the best of the negatives in a basement shop. Short of digging a new entrance to your basement, loading in materials will continue to be a problem if you don't have walk-out access. In some instances longer lumber can be fed through ground-level windows, but more often than not your best answer will be to cut your lumber and sheet

PHOTO BY AL PARRISH

***Popular Woodworking*'s publisher, Steve Shanesy, has his shop in the basement of a 150-year-old Victorian house. As you can see, space is a challenge, but Steve still manages to crosscut a sheet of plywood. Let's not talk about ripping a 4' x 8' sheet. Machinery needs to be stored out of the way when not in use. Much of Steve's materials are cut down to manageable sizes before being moved into the basement.**

PHOTO BY AL PARRISH

Ductwork, piping and the ceiling itself allow a minimum of head space in Steve's shop. His assembly bench and his most-used machine – the lathe – are positioned near the only window in the workshop to provide as much natural light as possible. Fluorescent fixtures mounted between the ceiling joists provide even light to the rest of the shop, while impacting the ceiling room as little as possible.

goods to a manageable size before bringing them into the shop. A circular saw and sawhorses set up temporarily in the driveway will help. More important, a little planning will make sure you know the minimum sizes necessary for your project, allowing you to cut darn close to finished size in a more roomy space.

Bringing projects out of the shop poses the same problem. It doesn't mean your woodworking is relegated to jewelry boxes and turning projects though. You'll just have to think modular in your designs. Know the limitations of your stairwell and build any cabinetry in pieces that can be assembled once out of the shop.

Ductwork, piping and the ceiling height will continue to be a problem, unless you're willing to make some radical changes. Ductwork can be redirected, or the ductwork can be changed to a more shallow, wider configuration to reduce height encroachment. This means extra money and extra effort and you'll need to determine how much of a problem the overhead clearance will be.

To avoid pulling your wood dust into the rest of your house, consider isolating the HVAC system in a separate room (building it around the system if necessary). You'll need to make sure that you're following local codes for clearance around the unit, but this is one solid option. At a minimum, replacing the filters used in your HVAC system with High Efficiency Particulate Air (HEPA) filters (and changing them regularly) will decrease unwanted dust as well as some odors.

Then, of course, there is the option of creating less dust in the first place. All dust-creating machinery (table saws, power jointers and power planers) should be used only with dust collection in place. Whether you choose to hook up a shop vacuum at the source of the dust (such as a random-orbit sander, for example), or work with more hand tools, either will reduce the ambient dust in the air.

***Popular Woodworking*'s editor, Christopher Schwarz, also has his shop in his basement and has clustered his major machinery around the walk-out door to his driveway. Stock comes in through this door and goes into the racks above the jointer (if it's less than 8' long) and above the planer (if it's longer). After breaking down the stock to manageable lengths with a miter saw (which is positioned to the right of the planer on a rolling tool cabinet), he uses the jointer, planer and table saw to process the rough stock.**

Here's the opposite wall of Christopher's basement shop. The bench is below the window to take advantage of natural light for hand work. All of the hand tools for joinery and surface preparation are in the cabinet on the wall, the toolbox on the floor and the drawers beneath the bench. The garbage can at the end of the bench is perfectly positioned to catch plane shavings as he works against the planing stop on the left end of the bench. Notice that even in a smaller basement shop, Christopher has opted to add a sliding table to his table saw to make working with panels, sheet goods (and accurate crosscuts) easier.

This is my one-car garage shop (attached to my condominium). No, the car won't fit. You'll find a 10" cabinet saw (with dust collector and router table mounted in the wing), 6" jointer, 14" band saw, and 10" sliding compound miter saw. All machines but the table saw are on wheels that allow me to store them against the walls, but quickly pull them out for use. A roller stand makes working with long stock on the table saw easier, while taking up very little floor space. To the right of the table saw is one of two knock-down assembly tables. This is the small one. You'll also notice task lighting over the important areas (unfortunately, no windows). By the way, I did take the bicycles, golf clubs and some gardening tools out of the garage for the photo. Despite no room for my car, it's still a multi-purpose area.

As you move deeper into my shop you'll find the requisite hand tools, a 13" benchtop planer (stored under the bench) and a small benchtop drill press (tucked away under the clamps). There's a benchtop belt/disc sander tucked away on the other side of that cabinet. Out of view to the right are two storage cabinets with five routers, three random-orbit sanders, a fleet of pneumatic nailers and sundry portable power tools. You'll also notice a half-dozen cordless drills stored within easy reach in recycled tennis shoes screwed to the wall. The workbench is still temporary. I'll get around to building the real one any day now. And yes, every shop deserves a swimsuit calendar and a few other personal touches.

Garage Shops

Garage shops (we're talking about attached garages in this case) offer interesting challenges of their own, mostly space related. While you can set up shop in a one- or two-car garage, you will be limited to a smaller space than in many basements, but the space will be more uniformly arranged. No pillars, or bump-outs to work around and the ceiling height is usually 7'6" or more. Plus the ceiling isn't cluttered with ductwork or pipes. On the other hand, there's usually a garage door running across part of the ceiling.

The first decision is whether or not you expect to park your car in the garage as well as use it as a woodworking shop. The two can co-exist, but there will be compromises. In a one-car garage, the compromise is likely to be too much to ask for most dedicated woodworkers. Tools and work surfaces will need to be stored away to allow space for the car. This adds a fair amount of set-up and take-down time to your already limited woodworking time. And you're still going to have to squeeze in and out of the car. My honest recommendation is that a one-car garage shop should be a dedicated space. The car will acclimate to the great outdoors.

With a two-car garage you still have the possibility of parking at least one car in the space, sharing it with the tools and machinery. The compromise here is losing the "fourth wall" of your shop to the car. This may seem a small thing, but in practice it can put a real crimp in your storage space. Also, when sharing the garage, you have to consider dirt and damage to your car. A fine coating of walnut dust isn't in the manufacturer's recommendations – let alone a board that slips and takes out a fender or mirror.

Back to the garage door (or doors). This is one of the great aspects of a garage shop. Bringing materials and projects in and out of the shop is greatly simplified with this large opening. In comfortable weather the open door allows fresh air and natural light for your shop. With windows in the garage doors, natural lighting is still available

during inclement weather. As to lumber and sheet goods, if you have the room to store them, great. If not, buy for one project at a time.

As I mentioned earlier, you do have an issue with the track system for the garage door, especially if you've added ambient lighting to your ceiling. The door needs to clear that lighting when open, and you need to be able to work without that lighting when the door is blocking those lights. In a perfect world, a two-car garage maintains one garage door and the second door is replaced with sliding glass or carriage doors.

As mentioned in the basement section, climate control and electrical supply can add a challenge to a garage shop. Most garages aren't heated and even fewer are cooled. Most woodworkers opt for heating their shops with space heaters or even small wood-burning stoves (a great option for making use of your wood scraps). Either will take the chill off, but you need to make sure your heating option is safe and that there is no risk of fire.

As for cooling, most woodworkers opt for a T-shirt, a pair of shorts and a couple of well-placed fans.

For power, most garages have a minimum service (a single 15-amp breaker) supplied. This is sufficient for running a single bulb and the garage door opener, but when you start running a planer or table saw, it's just not enough. Consider running a separate sub-panel with four 20-amp breakers and the option of one or two dedicated 220-volt breakers. Once the sub-panel is in place you can split the power off to wherever it's most convenient. This is extra work, but well worth the time and expense.

Lighting in a garage shop is the same as in a basement shop: general ambient lighting throughout, with task lighting over the most commonly used spaces.

I mentioned security and noise as issues with the basement shop. If you're in a garage shop that is visible from the street, you can't help but let the neighbors and the casual observer know you have tools and machinery around. We're not worried about neighbors borrowing tools (though that's an issue in its own right), but rather with theft. Improving the locks on any exterior doors is a worthwhile precaution.

Then there's the noise issue. Make friends with your neighbors and remember to be courteous with your woodworking activities. Planing 12"-wide boards at 7 a.m. on a Saturday will not make you any friends.

And even though you're in the garage, dust and smells can still get you in trouble. At the very least, make sure you've got a good floor mat leading into the house to remove some of the dust from your shoes. If possible, add a second door and buffer space to keep things cleaner in the house. Fumes? Just try to be considerate.

PHOTO COURTESY OF BILL STANKUS

In woodworker Doug Matthews' two-car garage, the walls have been significantly reworked to provide a more comfortable shop. To gain more natural light and to avoid dealing with a garage door track attached to the ceiling, the garage door has been replaced with a pair of sliding-glass doors. This door option still leaves ample room for moving materials and projects in and out. Windows (that open for fresh air) have been added on two walls. Also notice the wood subfloor that has been installed. This helps level out an uneven floor and makes standing in the shop all day much easier on the feet.

PHOTO COURTESY OF BILL STANKUS

Jon Magill's converted garage shop above shows the best of both shop and garage worlds. This three-car garage has similar space issues to the one-car garage at far left, but leaves much more room to move around. Multiple machines can be used at one time, rather than one at a time. The garage doors can be opened to bring in fresh air and light, or closed during cool or rainy months. All of the machinery is on mobile bases and collapsible horses. In 20 minutes, two cars can be parked out of the elements by storing the woodworking equipment in the third bay.

PHOTO BY AL PARRISH

If your shop doubles as a television studio like my friend Scott Phillips', then you have to worry about the way it looks inside and out. Scott had the luxury of building exactly what he wanted, so he added a front porch for relaxing between projects (and takes). He added offices at the front of the shop, directly off the porch.

PHOTO BY AL PARRISH

On the inside, Scott designed his shop with the maximum flexibility possible. Lighting is even throughout the shop and electrical connections are everywhere, including junction boxes set flush into the floor. Because he needs to worry about camera angles, many of the heavy pieces are mounted on casters so the layout of the shop can be adjusted by project. A two-car garage door runs across the back of the shop for easy access. While you may not need to worry about camera angles, the planning that went into this shop is definitely something to emulate.

Outbuilding Shops

Most woodworkers would prefer a separate location for their shop to keep noise, fumes and dust away from their home. It also feels more like a "real" shop than a space that's been adapted.

But that's not to say that many outbuilding shops haven't been adapted. They may have started as a detached garage or barn, requiring structural changes to make it the perfect shop.

Beyond the benefits of the physical location of the detached shop are the benefits of arranging windows, doors and ceiling space to best accommodate your needs. In addition, when starting with a blank space, ductwork for dust collection and pre-located power access can all be arranged without negotiating around existing impediments.

Also, unlike in many garage or basement shops, you can start from the ground up with your customizing. Ask any woodworker about standing on a concrete floor all day and they'll tell you they'd prefer something softer. With an outbuilding you should have the option of adding a wooden subfloor.

The benefits to a subfloor don't end at just comfort. By stealing 6" from your ceiling height you gain a perfectly flat floor to work on, and you can actually use the space underneath the floor to run electrical conduit and ductwork for dust collection.

If you prefer natural light to fluorescent light (and who doesn't?) an outbuilding gives you the option of cutting skylights in the roof. There's a slim chance you can do that in your garage, but I guarantee it won't work in your basement shop!

Having a wide-open space to bend to your will also allows you the option of dividing the floor plan into dedicated spaces. Most woodworkers are limited in their finishing options in a garage or basement shop, due to fumes and fire hazards. With an outbuilding, these concerns can easily be addressed with a dedicated space that is properly ventilated and protected from fire by using a metal finishing booth.

If you prefer to separate your machining area from your assembly

area, again, the larger, unrestricted space offered by an outbuilding makes that division a simple matter of preplanning.

Outbuildings also give you the chance to move some of the space-intensive and noisy shop equipment outside. Compressors and dust collectors make noise and take up valuable space. Adding a small "mechanical room" to the outside of an outbuilding moves the noise farther away and leaves the interior space available for working. Again, this is a rare option in a basement or attached garage shop.

As you may have intuited while reading this list of wonderful things available in an outbuilding, it's usually the most expensive of the three options. Beyond the cost of the building itself (if you need to build) there are the concerns of adding water, electrical service and heat to the structure. While you may not need a bathroom, a slop sink is an important feature. Your basement or garage shop is only steps away from a water source.

And, of course, adding a subfloor, skylights and all the windows you'd prefer will increase the costs associated with your new shop. But, you will be paying for the chance to set up shop exactly the way you want it – and that's a very happy thing.

PHOTO COURTESY OF BILL STANKUS

Some stand-alone workshops serve as a place to work and a place to show. Doug Matthews' shop was built to visually fit into the surrounding rural landscape. On the lower level Doug restores and repairs antique furniture, while the upper level of the building houses a showroom for displaying and selling antiques.

PHOTO COURTESY OF BILL STANKUS

Woodworker Charles Caswell built a two-car garage shop at the end of his driveway. The shop offers natural lighting via the open ceiling and skylights, as well as general lighting for less sunny days. The space offers ample room for the European-style combination table saw/jointer with sliding table. The shop's straightforward layout and comfortable, uncluttered work conditions make it a model of efficiency.

What's Your Choice?

While we all may have a dream shop in our heads, only a lucky few will have the chance to set up shop the exact way they would prefer. Most of us will make the best of the space we have available, and there's nothing wrong with that. In fact that's what this seven-part series is all about: Helping you make the most of the space you have available.

We'll look closely at providing the best lighting and power options and the best locations for your machinery to make work flow smoothly, and we'll also look at organizing your hand tools and small power tools for maximum efficiency. At the end of the series we'll tackle the topic of dust collection, then look at the best workbenches and workstations to finish out your fantasy shop.

Whether you're dealing with a low overhead and cracked, sloping concrete floor, sharing your shop space with both the Powermatic and the Pontiac, or have achieved woodworking nirvana (a dedicated pre-planned woodshop), there are tricks and concepts that we'll pass along to make it the most comfortable and efficient shop possible. **PW**

SHOP SHOTS: The New Yankee Workshop

PHOTO BY AL PARRISH

One of the most recognizable (and most coveted) workshops is Norm Abram's New Yankee Workshop. Dealing with the right location is something even Norm had to face. He had to transform an existing space into something that would meet not only his woodworking requirements, but also serve as a television studio.

Shortly before the first show aired, Abram and producer Russel Morash sat down on an airplane and sketched out their plans to turn an existing building into the workshop. They designed the shop using a floor plan and a couple elevations drawn up on a plain piece of paper. There aren't hidden holes in the walls for camera lenses and there aren't missing walls. Several dusty lights hanging from the 16'-high ceiling are the only indication that a TV show is shot in the shop. Otherwise, the space feels and functions like a regular woodworking shop.

The saltbox-shaped shop is 36' x 26' (not including the finishing or lumber storage areas). One wall is only 8' high, resulting in the saltbox shape. The high ceiling (which has several skylights) is great for swinging long boards around, and for tucking away the lighting needed for the show. The shop's concrete floor features radiant heat.

Because of the show's success, TV viewers already are familiar with the layout of Abram's shop. But here are a few things you might not know: Most of the lumber is stored in an outside building. Finishing takes place in a separate room. The shop has an indoor staircase leading to a second floor, which is where Morash's office is located.

Many of the woodshop's fixtures that make the shop unique, such as the miter saw stand, the router station and the work hutch, are projects Abram has built for the show. (For a virtual tour of the workshop, visit newyankee.com and click the "Tour the Shop" link.)

Yes, there's a Timesaver (a very wide wide-belt sander). There's also an excess of clamps and quite a few drills and routers. But much of the shop is actually quite Yankee-esque: Hand-me-down tools cover the shop's walls and old coffee cans (storage bins) abound.

The Timesaver aside, the tools in Abram's shop are the same tools seen in shops across the country. Yes, he owns more than one router (actually, there's a drawer full of them). But most woodworkers own at least two routers and most professional woodworkers own several for projects that require several setups. Almost all of the tools are well-used and well-worn, and many of them are hand-me-downs.

However, the shop isn't perfect. Abram says it was a serious mistake to not put dust-collection ducts in the floor. Another problem with the floor: it's concrete. After a long day of building, Abram says he longs for a softer wooden floor.

Morash says he fantasizes Abram's shop someday being on display at The Smithsonian National Museum of American History. And while the display most likely will include all the glitter of a Timesaver, if it's true to the show, there will also be some coffee cans and Abram's well-worn leather toolbelt.

— Kara Gebhart Uhl

BARE BONES OF CARVING

A master carver looks at essential tools and sharpening techniques.

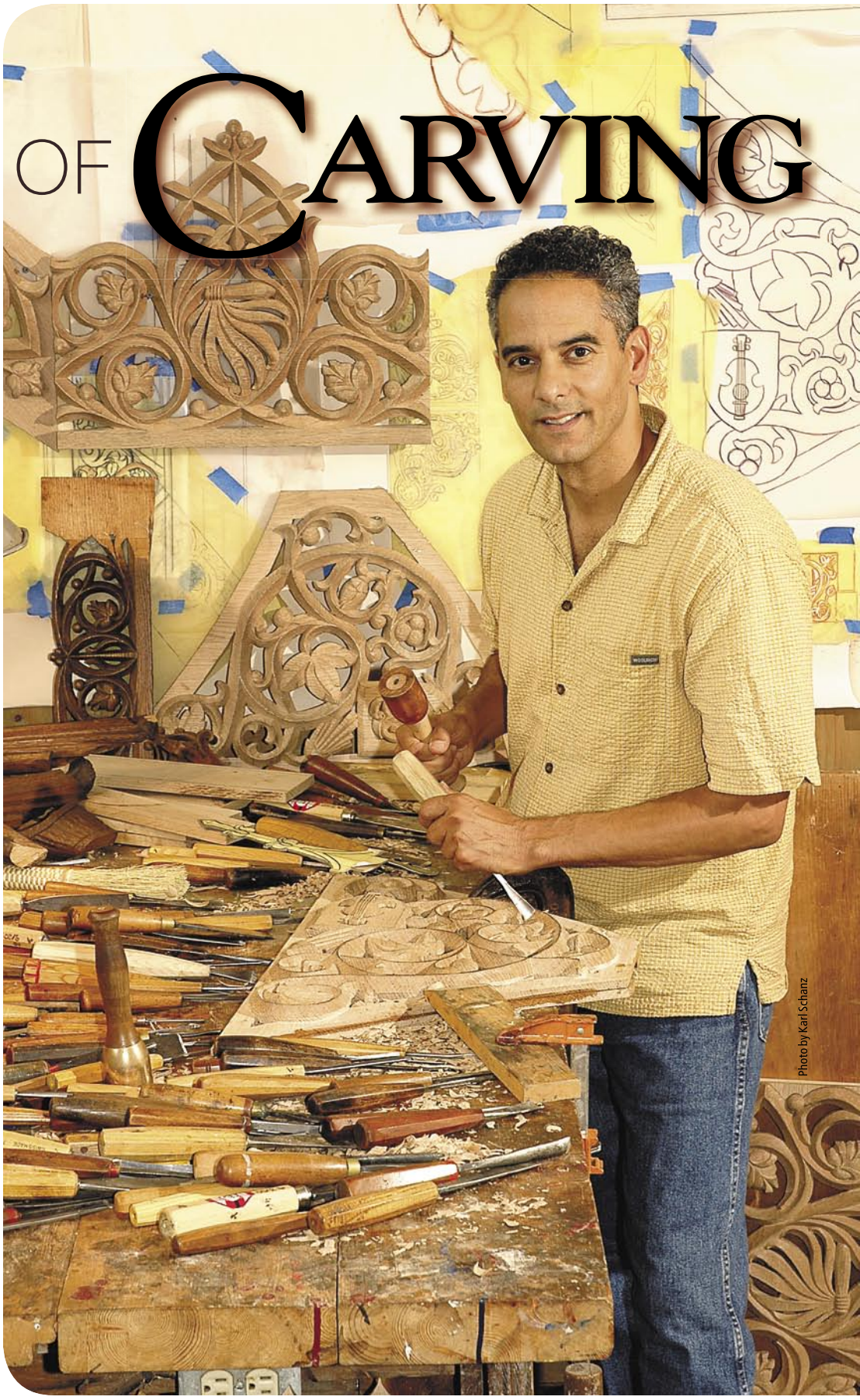


Photo by Karl Schanz

In 1979, after five years of college and with a philosophy degree in my hand, I was heading to interview for my first job as a woodcarver. My prospective employer, a second-generation woodcarver, told me to bring along samples of what I had carved and to make sure that I brought all my woodcarving tools as well.

His parting telephone comment was, "In the end, all I really need to see are your woodcarving tools. By looking at them I can tell a lot about your carving sensibilities."

Still new to woodworking , I thought, "What is he going to do … use my tools like a set of Tarot cards to tell my abilities? Or is he going to read them like tea leaves in the bottom of the cup?"

Today, 27 years later, I have collected a set of tools that have all the qualities he was looking for.

by David Calvo

David Calvo has been a professional woodcarver since 1979, and operates Calvo Woodcarving School. For information, visit his web site at davidcalvo.com.

I can now easily see the importance of his point of view without a second thought. After our interview he decided to hire me, so maybe he did read my tea leaves right. Between then and now I studied with a German woodcarver named Frederick Brunner, who trained in the European apprenticeship program.

He and his protégé put in my hands refined tools and hand techniques that made the carving tool move through the wood like butter. Later, I worked as an apprentice at the renowned studio of Cascieri and Di Biccari in Boston. This studio had a team of woodcarvers and sculptors creating work sent all over the United States and abroad.

I got the chance to work with wonderful carving tools that had been refined through many creative woodcarvers hands. These tools did nothing but encourage me to keep on going. In addition, I had the opportunity to look through my teachers' eyes during the creative process and watch their pencil designs come to life.

Am I trying to entice you with the romance of woodcarving? You bet. It's an approachable skill. And with knowledgeable guidance and enthusiasm on your part, you will be able to add personality to your woodworking projects too.

In a series of articles, we are going to consider woodcarving from the tool edge out. The carving tool is the only thing between you and the wood. Think about that for a moment. This is one of the simplest forms of woodworking. It's woodworking unplugged. So here's where we're going to begin climbing the learning curve: with the study of tool design.

Commercial Tools

I am going to stand on a soapbox for a moment and be absolutely honest. The single largest thing that has discouraged the popularity of woodcarving in the amateur and professional woodworking community has been the poor quality of commercial tools on the market today.

Remember the apprenticeship: This interested young lad walked into the carving studio and the old timer put one of his own gouges in the eager student's hand so that he could feel the beauty of the way it went through the wood. This was encouragement without words. It is the reason why so many professional woodcarvers, out of all other woodworking trades, chase the old tools.

There are a lot of tools on the market today, so like a reality television show, I will address only the best and the worst. German

ESSENTIAL CARVING TOOLS

Note: If fishtail tools are not available, straight gouges may be substituted.

tools have a lot of integrity. To this day, one of the most famous woodcarving schools in Oberrammergau, Germany, is still training woodcarvers. Woodcarving as an occupation is still robust there. German-forged steel is excellent, and the tool designs have remained consistent in quality. Tool steel is very important because carving puts maximum stress to a thin, almost invisible, micro-edge of steel; hence all the steel's characteristics, both good and bad, become quickly apparent.

On the other side of the coin, the poorest quality tools on the market today are the Swiss brands. Their tool design over the years has gotten thin. More significant, the steel quality has deteriorated. Initially, they made a good tool and I have a few old ones myself, but time and untrained consumers have gotten the better of them.

There are a lot of tool suppliers in between these two margins and after reading these articles you will be a more educated consumer. If you want to chase old tools, the English ones are quite a find and there are a lot of them still in circulation today.

'Desert Island' Carving Set

If I were marooned, here are the tools I consider necessary as a basic set in woodcarving. They are the result of the consistent favorites that I have used over the years. They consist of 10 tools, which obviously can be broadened like adding letters to an alphabet. They are organized by sweep radius and width of the gouge or chisel.

This calibration is fairly standardized across most companies. See the photo and illustrations at the bottom of the facing page. The set should also include a brass mallet (shown is the 1.5-pound Calvo Brass Mallet), a whisk brush for cleaning carved surfaces and burnishing the wood, and a set of water slipstones for honing. For most applications these are well suited tools.

An Old Trade Secret

If you are a painter, you know a painting is built on contrast of many colors. But in woodcarving, what do you think the contrast might be? Like night and day, the opposite in woodcarving is as simple as concave versus convex.

Woodcarving is built on the contrasts of shapes. If you look at our tools, the variety of their shapes are exactly for that reason, creating contrast. Here then is our first lesson on tool design. Each tool, by design, is its own contrast. Look at the gouge above right. A bevel is put on the outside of the tool so that you have a shoulder to ride on in the wood.

My German teacher taught me to put a bevel on the inside of the tool as well to have another shoulder to ride on the contrasting side of the gouge. Now you have just doubled your value with a tool that embraces the opposites of woodcarving: a concave shape and a convex cutting shape. The photo above shows this inside bevel.

Equally important, when we add the second bevel the tool controls better and no longer has a mind of its own. It yields to your direction. Often, students come to my class with tools that are of poor quality and not sharpened well, so they have to muscle the tool to work it and I ask, "How did you keep your enthusiasm up?"

The bevel on the outside of the tool provides a shoulder that gives control to the cutting edge.

The bevel on the inside of the tool creates another shoulder, allowing the tool to cut both concave and convex shapes.

A properly shaped flat bevel allows the tool to bite into the work. If the bevel is rounded from the cutting edge back, the tool will skate on the surface and will grab unpredictably.

Flat Bevels or a Good Shave?

The German woodcarver, Frederick Brunner, made me aware of another important key: the necessity for an absolutely flat bevel. We want a straight line from the cutting edge back to where the bevel begins, so there is no resistance.

Having a rounded bevel is like driving down the road with your emergency brake on. The rounded curve gives inherent drag to the activity. We establish the outside bevel first. The angle of the bevel is based on the thickness of the tools. The first rule is that you do not want a long, thin bevel. I always tell my students, "A shaving razor blade is sharp but it is lousy in woodcarving." You need the shoulder to ride on. The inside bevel is usually one-third the length of the outside bevel.

When bevels are set and sharpened, the tools will always act in one of two ways depending on how well it was done. It will either bite or it will skate and grab. If the bevel is rounded instead of flat it will skate just like a skater on ice, it will glide on the surface and won't grab the wood immediately.

If the bevel is flat it will bite. And when it bites into the wood this is the beginning of control in woodcarving as seen in the photo above. A good carver is not fast in terms of miles per hour; it is his or her sensitive control that gives agility and quickness.

Sharpening: The First Step

If you were to ask a room full of woodcarving teachers, "Who knows the best way to sharpen a tool?" every person would raise his or her hand. The fact of the matter is that for each teacher's particular application, they are

SUPPLIES

• Waterstone sharpening machines are available at:

Lap-Sharp
707-838-1976 or
woodartistry.com

Tormek
tormek.com

Sheppach
877-884-5167 or rikontools.com

• The Two Cherries carving tools recommended in this article are available at a number of retailers or from David Calvo's web site at davidcalvo.com.

probably each correct. What is important is that they achieve their desired results.

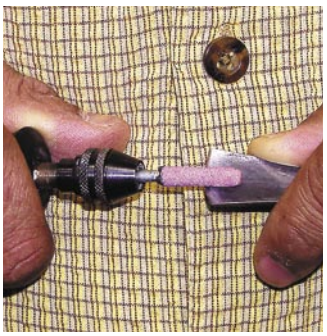
In woodcarving, we have a peculiar set of circumstances. We have very few flat chisels and a whole variety of shapes and sizes of gouges with outside and possible inside bevels. Therefore, we need a consistent hand-sharpening method that addresses both tool varieties, and gives us a consistent working reference point.

There are a lot of sharpening machines out there and we will approach each for its merits. For more than 20 years, I have owned a Japanese horizontal waterstone grinder. We all know the traditional dry grinders found in most workshops. Tormek and Scheppach have the vertical wet grinder market, and there is also the Lap-Sharp which uses 3M abrasive paper technology.

I like the wet grinders and the Lap-Sharp because they also protect your lungs. Respiratory protection is an important topic, worthy of careful consideration.

Finally, don't forget the little mechanical gerbil of grinding: the Dremel, shown above. What is important in woodcarving is first a flat bevel and in the process of sharpening not burning the temper out of delicate tools while shaping. This will be the basis in how to use the machines.

Today, most of the sharpening market in woodworking has progressed to slow-grind machines. Slow ones are the best since grinding should not be a dangerous act. I prefer to use my hands, specifically my wrists, as a guide in sharpening because in my carving style I reference my wrist all the time.



A Dremel tool can be used to shape the bevels on the inside edge of carving gouges.

The outer edge of the waterstone can also be used to shape the inside bevel on larger tools.

The horizontal waterstone features a large flat surface, making it easy to achieve a flat bevel on the tool.

The Lap-Sharp has a large flat area next to the wheel. This allows sharpening with the hands in a natural carving position.

On a bench grinder, the left hand acts as a jig, so the tool can be returned to the same position after visual inspection.

The Best Possible Jig

Woodcarving is a hand skill and I believe we enjoy it because we like to do wonderful things with our hands. They are the most marvelous jig money can buy. I try to approach the machine with only the tool and myself. Here is my overview on sharpening: I use the machine for shaping the tool; once done, I use slipstones to refine the edge and finish on the strop.

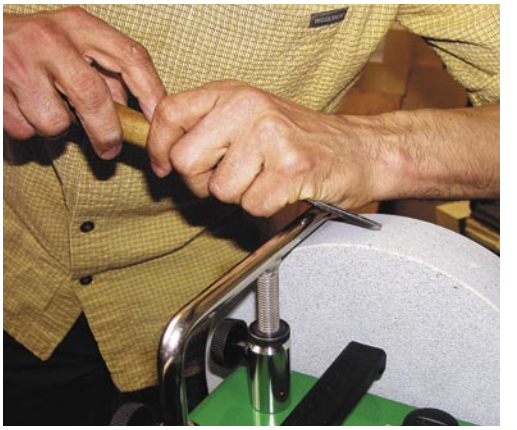
We always need to redesign newly purchased tools so let's address our approach to each machine. The reason I like the Japanese horizontal waterstone, upper right, is it makes it easy to get a flat bevel. It has a #1,000-grit stone, which shapes without excessive scratch marks.

The outer edge on the stone is turned over so that I can address the inside bevel on my broader tools. I also like it because of continuity. I use the corresponding water slipstones to bring the edge up. The other thing I like about the waterstones is that you can shape them easily.

I approach sharpening the same way I approach carving. I try to find a way to drop my hands into position, and register my wrist on the grinder as if I were carving on wood, and use the same angle of approach. My intention is that I will get the corresponding bevel appropriate to my natural hand-carving position. On my Japanese grinder there is a tool rest that goes over a small portion of the wheel. It is perfect, like a bird perch for registering your wrist.

Japanese woodworkers think through their hands, so the

The upper bar support on the Tormek provides a place to rest the wrist while grinding the edge.



The best way to grind a good edge is with the hands as close as possible to the position they will be in when carving.

Holding the Dremel against the body allows the wrists to control both the tool and the grinder.

waterstones they use characteristically have a drag that gives your hand a feeling for whether or not you're establishing a flat bevel. We can learn from their tradition; in all phases of carving you need to think more with your hands and rely less on your eyes.

The other horizontal machine is the Lap-Sharp, shown middle left on the previous page. The first carver I worked for sharpened on a machine he made; it had a vertical, rotating, circular plywood face on which he rubber-cemented fine grits of sandpaper. Technology has come a long way since then and the Lap-Sharp capitalizes on it with its horizontal wheel.

It comes with a variety of jigs for versatility but, like the Japanese waterstone machine, I always look for how I can achieve my hand-carving position as I approach the machine. I found a wonderful place to rest my wrist so that I can get into carving position.

I use the micro-finishing film starting with 40 micron or 80 micron depending on the tool, then the 1 micron lapping film for final honing. Part of shaping the tool is doing as little as possible to get there.

I like that the Lap-Sharp is a gentle machine and you can get a flat bevel with no heat to ruin the temper. I did not like that I could not address inside bevels, critical for woodcarving.

Vertical Grinders

To sharpen on the outside face on a vertical style wheel-grinder the approach is a little different. For the dry-stone grinder you want the slowest speed available (I use only the slow 1,725 revolutions per minute variety).

My German teacher used a dry grinder and he made hundreds of tools. When you are shaping carving tools a light touch is the best. Brunner's touch was so light that he only used a little water for quenching with his assortment of dry grinding wheels. If you are right handed, your left hand acts as the jig on the tool support. It always stays in the same place.

Your right hand holds the tool close to the grinding edge. Set the bevel visually and lock the right hand into the left hand jig, as seen at left on the previous page, so that it is always in the same place. If at any point you lift the tool to inspect it you will not lose your registration on the wheel.

When sharpening, you want to rotate the tool like a pencil. With the faces of round wheels it is important to remember that you approach the stone diagonally. This is hollow grinding, so shifting it to a diagonal approach will give us the closest thing it can to a flat bevel. It will give you your longest straight line.

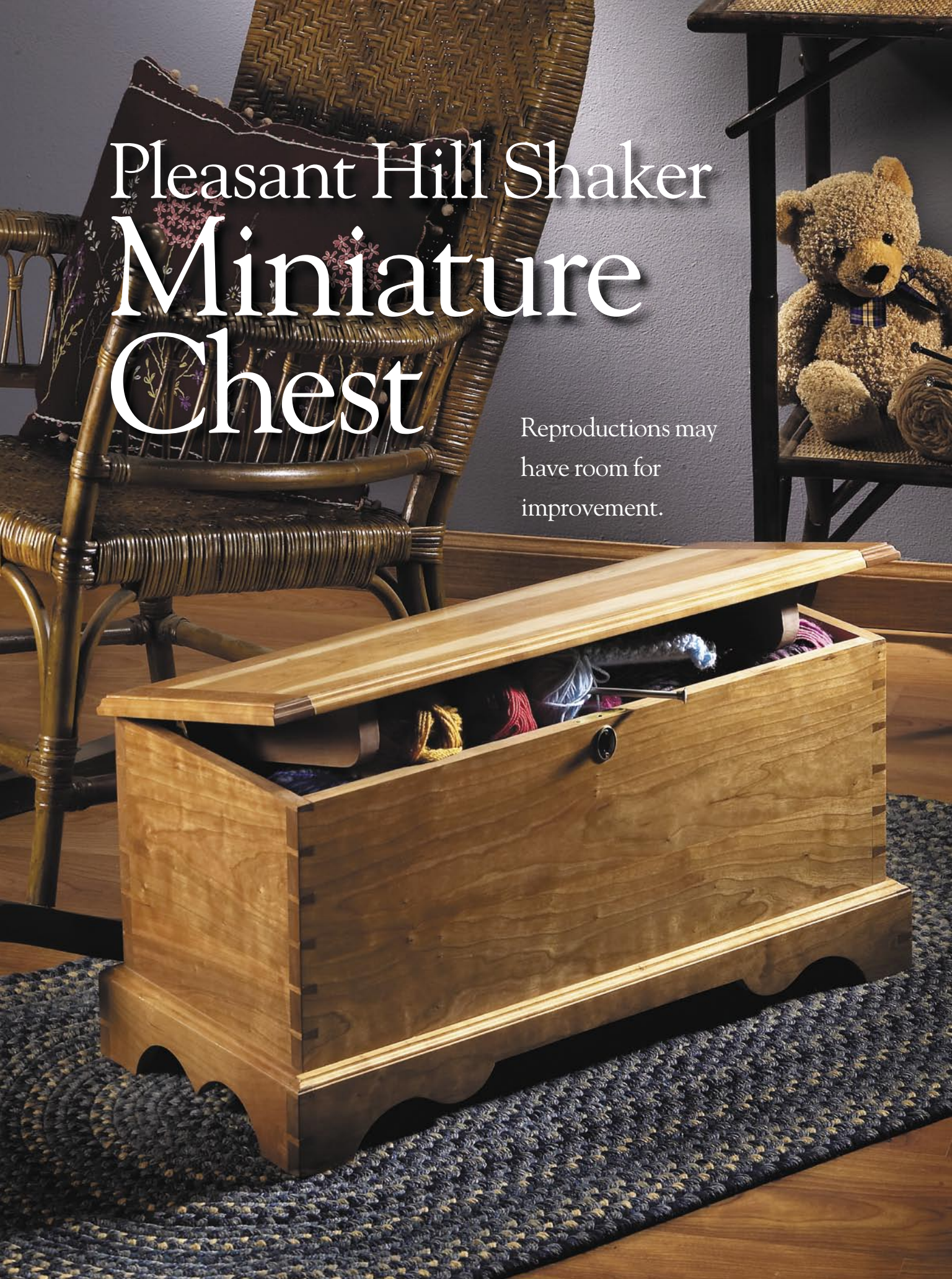
What I do not like with the dry stones is that you cannot get into hand-carving position to set the angle. Both the Tormek and the Scheppach wet-grinding systems address this problem. First a larger wheel will give less of a hollow bevel on the tool, which is an important consideration. Once again, the machines are supplied with clever jigs but I always prefer to see if I can use my hands as a jig instead.

With both machines, I found an upper bar support a convenient place to perch my wrist so that I could get into carving position to set the bevel as shown at left. I had to adjust the height of the machine low enough so that I could reach over the top, but I like it. With the Tormek and the Scheppach, as with the horizontal waterstone, you can round over the edge of the stone to get the inside bevels.

Whatever grinder you have, there is an approach to setting the tool bevels. Look to see if there is a natural way that you can hold the tool against the stone.

Finally, to address the inside bevel of gouges above a #5 sweep, I use my Dremel. I hold the tool close to my body as in the photo above to make contact so that I can register and control using my wrists. I use a chainsaw blade sharpening bit; for corresonding smaller tools I use smaller aluminum oxide wheels.

Once the bevels, both inside and out, have been set to our new angle we are ready to address hand sharpening. I will share my methods in an upcoming issue of this magazine. **PW**



Pleasant Hill Shaker Miniature Chest

Reproductions may have room for improvement.

Photo by Al Parrish

Furniture reproductions are never exactly like the originals on which they're based. In some cases, that's because the skill and artistry of the reproducer don't measure up to the skill and artistry of the original craftsman. In other cases, it's because the reproducer consciously made the decision to vary from the original, substituting, for example, curly maple for cherry or machine-cut dovetails for hand-cut dovetails. In other cases, it's because the reproducer decided that the original could be improved on in some way.

The last is true of my version of this delightful little blanket chest from the Shaker Village of Pleasant Hill, which is located outside Harrodsburg, Ky.

The original was appealing in several ways: diminutive size, charming country-style details and solid joinery. But it also had some problems. Instead of the chest bottom's edges being let into grooves cut on the inside surfaces of the four sides of the case, the bottom of the original was simply nailed inside the case with the result that, when the solid-wood bottom underwent inevitable shrinkage across its width, gaps appeared on either side, visible when you look into the case from above. Also, the material was, I believe, simply too thick for this relatively dainty form. The material of the original was dressed to a chunky 7/8", a thickness that would have been more appropriate for this chest's bigger, full-sized brothers.

I opted for 5/8" material throughout, and I set the edges of the bottom into grooves, although in the drawing, I showed the original 7/8" material.

I have a theory about the original. I think it might have been an apprentice piece. The master in the shop would have discouraged the youngster from testing his skills on a full-sized piece with a full-sized appetite for material, directing that youngster instead to this little miniature.

At least that's my theory.

So why would I reproduce a piece that I think might have been the work of an apprentice?

Well, I like it.

The Big Three-hearted Tree

Material selection and arrangement is always critical, but it is, I think, doubly so in the case of a simple piece like this on which there isn't any carving or veneering.

When I'm gluing up panels for such a simple piece, I begin by pulling boards with similar color and figure.

I then begin to lay out the cuttings on the surfaces of those boards, making an effort to ensure each panel will be glued up of pieces taken from the same board. This means, for example, that the five pieces from which the lid is glued up were all taken from the same board. Three 25"-long sections of that board came together for the lid's main panel. The breadboard ends were then ripped from the offcut left behind. This approach is critical, I believe, because even though all the boards I might pull for a particular piece will have similar color and figure, the very best matches are those taken from the same board.

We woodworkers are often tempted to cut our stock from the edges of our boards. That is, after all, the logical way to proceed.

Step photos by the author

If possible, cut lengths from the same board for each piece of a panel you are going to glue up. This strategy offers the best possible color and figure match.

by Kerry Pierce

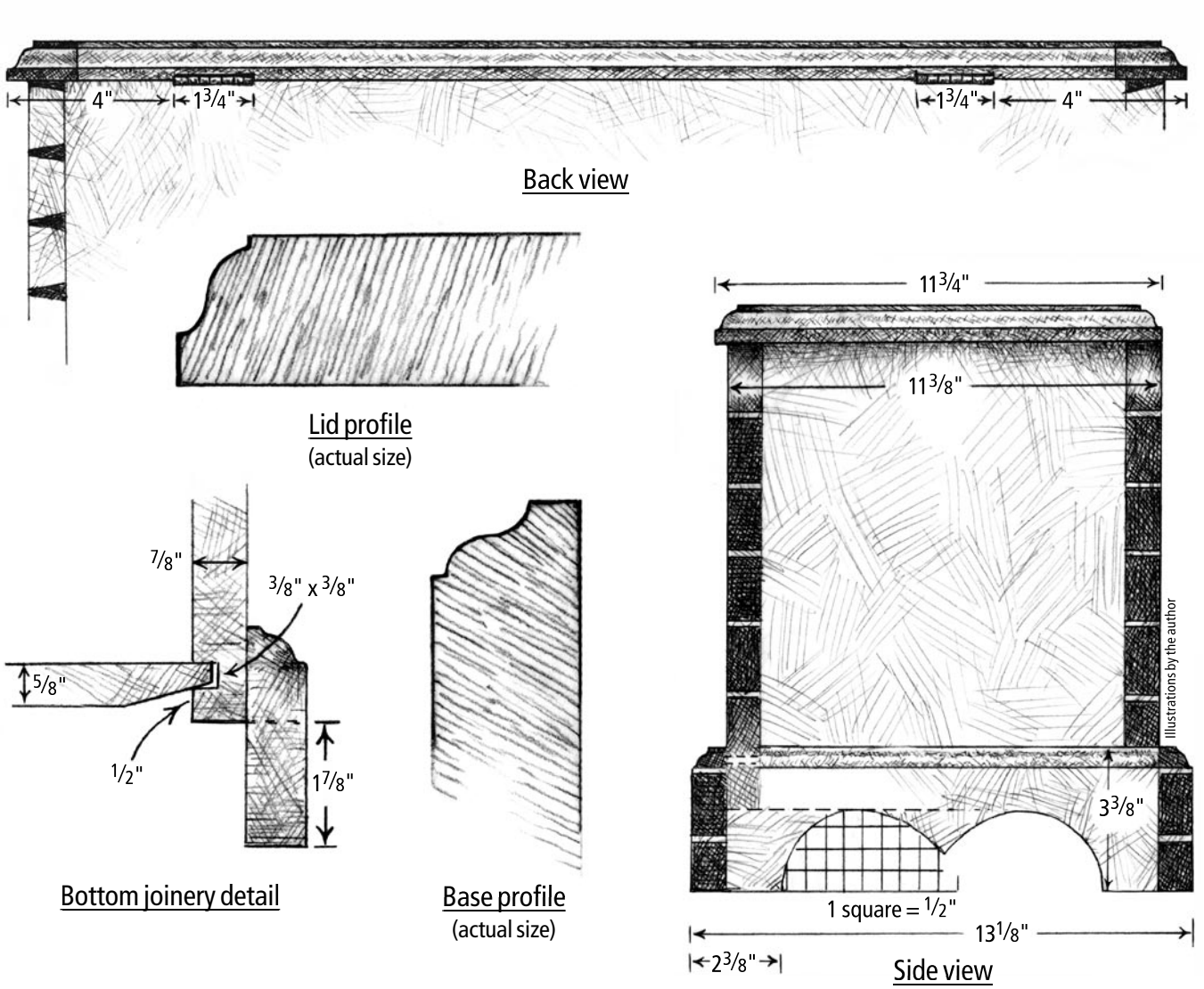
Kerry is the author of "Authentic Shaker Furniture" (Popular Woodworking), "Making Shaker Woodenware" (Sterling) and numerous other books. He teaches Shaker chairmaking at the Marc Adams School of Woodworking.

You joint one edge, set the table saw to the desired width, then rip off what you need. That's an efficient use of time and material, but it doesn't always result in the most visually pleasing arrangement of material. My method is to draw rectangles anywhere on the boards that have the kind of color, figure and absence of defects I'm trying to attain. Then I band saw the first long edge of the piece, joint that edge, and cut the other side on the table saw.

I consciously look for opportunities to employ material exhibiting a mix of heart and sapwood, particularly in the cases of walnut and cherry where the contrasts are so dramatic. However, the use of sapwood places on me the obligation to use that material in some kind of aesthetically coherent manner. In the case of this blanket chest, I decided I would use sapwood only on the lid and only in a very controlled context. Specifically, I would create two swaths of light-colored material running the full length of the lid, stopped and held visually in place by breadboard ends cut from heartwood.

To create these two swaths of light-colored material, I aligned the material so that the joints

When you apply significant clamping pressure to a glued-up panel, the pressure can cause the panel to cup. Cleats can be clamped to the panel as shown to eliminate that cupping.



between boards would occur only in the sapwood where, I knew from long experience, they would disappear, leaving the arresting appearance of a board cut from a three-hearted tree.

The moulded edges on the original chest are battered. They were not, I suspect, very cleanly cut in the first place, and they have been abused by a century-and-a-half of use at Pleasant Hill and elsewhere. The result is that it was difficult to tell exactly how they were originally intended to look. The drawing represents my best guess about the original maker's intentions, but the moulding I used for my reproduction is the profile cut by a stock router bit I picked up at Lowe's – a 5/32" Roman ogee on a 1/4" shank – a bit that cuts a profile that's reasonably close but not exactly like what I think the original maker intended.

PLEASANT HILL SHAKER MINIATURE CHEST

	NO.	ITEM	DIMENSIONS (INCHES) T	W	L	MATERIAL
❑	2	Front and back	5/8	11	26 3/8	Cherry
❑	2	Ends	5/8	11	11 3/8	Cherry
❑	1	Bottom	5/8	10 5/8	25 7/8	Pine
❑	1	Lid main panel	5/8	11 3/4	24 1/4	Cherry
❑	2	Lid breadboard ends	5/8	1 5/8	11 3/4	Cherry
❑	2	Lid cleats	5/8	2 1/2	9 3/4	Cherry
❑	2	Plinth front & back	5/8	3 3/8	27 3/4	Cherry
❑	2	Plinth ends	5/8	3 3/8	13 1/8	Cherry

Note: All measurements are finished sizes. Add extra lengths, particularly to dovetailed parts. Also, the illustration shows the original piece in 7/8" material; the cutlist shows the piece in 5/8", as built by the author.

Build a Box and a Half

This chest consists of two boxes: the case and the plinth. The front, back and sides of each box are assembled with dovetails.

After you've glued up the panels from which each of the primary box's elements will be cut, level and smooth the panels with your planer or a set of handplanes. Then joint one edge of each panel and rip it to width (leaving a little surplus width to remove when you remove the saw marks). Then cut each panel to length.

Before you start cutting dovetails, plow the grooves on the inside surfaces of the chest's larger box in which the box's bottom will be housed. You don't need stopped grooves for this particular chest because the grooves will be hidden by the plinth so the through grooves that would otherwise show on the ends of the chest are concealed.

Then begin cutting dovetails. I cut my dovetails by hand because that's the only way I know how, but I understand they can be cut just as easily with a jig and a router. Apply glue to all mating surfaces

SUPPLIES

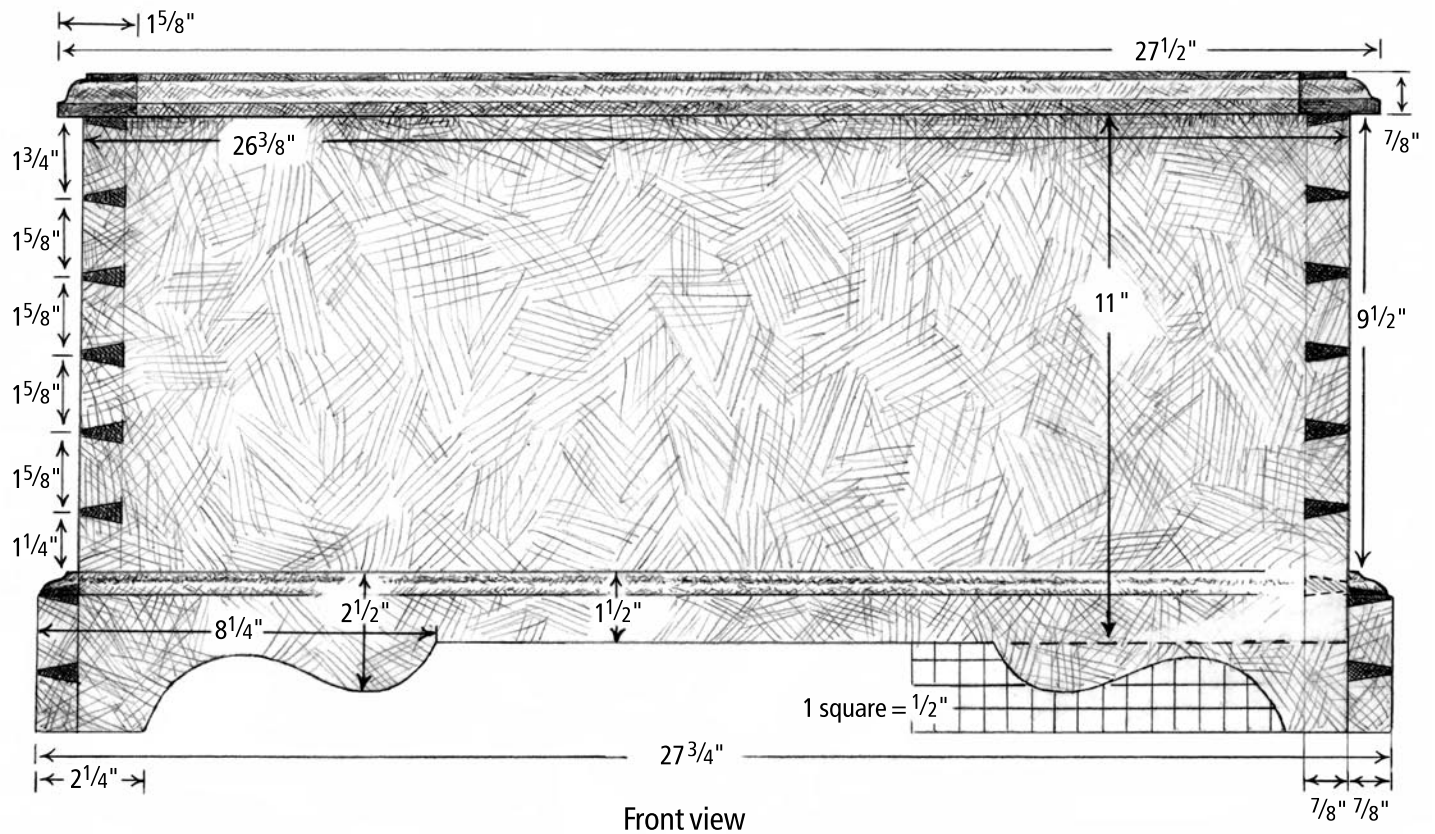
Woodcraft
800-225-1153 or
woodcraft.com

1 • brass escutcheon
#02U04, $7.50

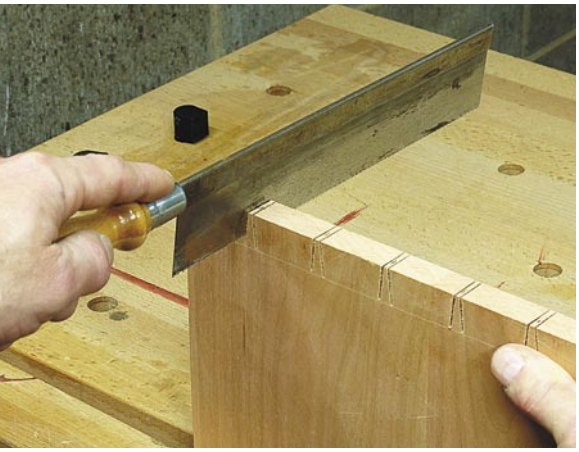
Woodworker's Supply
800-645-9292 or
woodworker.com

1 • cigar box lock
#115-841, $19.99

Prices correct at time of publication.



Front view



After squaring lines across the end grain, I cut the tails freehand, without first marking their angles. This gives me joinery that is certifiably handcut, with each tail just a little different than the one beside it.

Because I cut the pins and tails a little long, I use cleats to apply clamping pressure behind these elements when I'm bringing a case together.

of the dovetails and assemble the larger box around the chest bottom (which you have already raised so the edges of that bottom will fit in the grooves you've plowed for its edges). Check the case for square by measuring the diagonals. If there is an error, correct that error by racking the longer diagonal until the two measurements are the same (within maybe 1/32"). Then wipe away all the glue squeeze-out on the inside and outside of the chest.

Once the glue has cured, fix the chest to your bench and, with a plane, pare down the surplus length from the pins and tails of your joinery. Prior to cutting a set of dovetails, I set my marking gauge so that there is at least 1/32" of extra length on these elements so I can plane the surplus flush without retaining the end grain tear-out that is part of every saw crosscut. This work could also be done with a belt sander.

I believe this planing is the most difficult part of the joinery process because it takes a fair amount of force to power even a sharp, well-tuned handplane through the joint's end grain. That means the case must be securely fastened to your workbench.

Next, assemble the four parts of the plinth using dovetails here as well. I chose to cut the joinery before I shaped the moulding because I wasn't sure how I would mark the dovetails on an edge that had already been shaped.

Check the fit against the case dry to ensure there are no gaps. Then run the stock past the bit on your router table to create the moulded edge. Before you glue up the four parts of the plinth, dry assemble them one more time, and mark the shape of the bracket feet at the corners. You can very quickly remove most of the waste on your band saw.

Then glue up the plinth and, while the glue is still wet, attach the plinth to the case using 1 1/4" x #8 drywall screws from inside the bottom. (I probably could have gone with 1" screws because the two pieces I'm joining here have a total thickness of only 1 1/4", but I wanted the holding power of the longer screws, so before I used them, I touched the tip of each to my grinding wheel to reduce the length to a bit more than 1 1/8".)

The moulded corners of the plinth will require a little fussy work with hand tools in that end section. I used a shoulder plane to extend the little fillet at the base of the moulded edge all the way to the corner. I then formed the rest of the moulded edge with a paring chisel and a carving gouge. And a little sandpaper.

I couldn't really tell how the original lid's breadboard ends were attached. What I can say

Check the fit of the plinth elements around the case before you glue them together. Notice that I haven't yet cut the moulded edge on the top edge of the pieces to the plinth.

I used a Skil 5/32" Roman ogee bit to cut the moulded edge. I used the same bit with the same set-up to cut the moulded edge around the assembled top.

is this: There's no evidence of a tongue-and-groove joint (the joinery I would have expected). That is, there is no tongue visible on the front edge of the lid. It's conceivable, however, that the tongue and groove were stopped, but that's a level of joinery sophistication I found nowhere else on this piece. In fact, for the most part, the joinery on this chest is simple and straightforward – very Shaker. I chose to use a 20th-century standby, the lowly dowel. As you can see in the picture at right, I applied glue only to the three center dowels. My thinking is that might permit a bit more movement across the grain of the center panel. While you might normally drill elongated holes for the dowels, I've found that their location and slightly undersized fit allow plenty of room for wood movement.

All lids/tops cup. It's a natural law with results as predictable as gravity. It doesn't matter how you align the grain when you're gluing up the lid/top. It doesn't matter how carefully the material is seasoned or whether you've finished both the top and bottom surfaces. All lids cup, and I have dedicated a good part of my woodworking life to finding ways to interfere with the expression of this natural law. In most casework, you can fasten the sides of the top to the sides of the case with good results, but you can't do that with a lid like the one on this chest. Many years ago I began installing cleats on the undersides of unsupported lids, and they do work, but they must be wide enough to resist cupping, and for best results you have to cheat with your cleats. Before I install them, I plane a 1/16" crown on the edge that will contact the underside of the lid. This gives me some leverage in my war on cupping. I may not use it all at once. If for example, there isn't much cupping on the day I install the cleats, I may install them with either end just a bit above the surface of the lid. Then later, if I need to, I can draw them down.

Before you glue up the plinth, mark and cut away on your band saw the surplus stock at each corner.

But I should point out that these cleats are not on the original lid, which is, I should also point out, cupped.

Haste Makes Slop

Take your time when installing the hardware because a little haste here can ruin an otherwise handsome project.

Begin with the hinges. In the finished piece, the back side of the lid is aligned with the back side of the case. Next attach the two lid stays. These nifty bits of hardware were not on the original, but I think it's a mistake to attach any lid without also attaching something to prevent the lid from accidentally flopping all the way back and maybe pulling out the hinge screws.

Woodcraft sells an escutcheon almost exactly like the one on the original (Part#02U04 $7.50). The lock, however, I bought from Woodworker's Supply (Part# 115-841 $19.99). I like this little lock because the post on the strike plate simplifies the installation process. Lock-and-strike-plate alignment can be frustrating.

Use clamps (and protective clamping blocks) to bring the plinth together and – this is important – screw it to the case before the glue in the dovetails cures. (If you look closely, you can see the bevels around the field of the raised panel on the chest bottom. These bevels were cut freehand with a jack plane.)

I applied glue only to the center three dowels, thinking that might allow a bit more movement across the grain of the center panel.

There is little room for error, and if you do make a slight mistake or if there is a slight mistake in lock manufacture, you may find yourself muttering in the shop.

Finishing

Unfortunately, finishing is all about sanding. Lots of sanding. Use a sanding block to keep the surface level and start with #100 grit, progress to #150, then #220, and finish-sand twice with #320.

In a small shop like mine, without a dedicated finishing room, I think woodworkers are much better off with wipe-on finishes. I've used many different brands, and all performed well. In the case of this chest, I tried Minwax Wipe-On Poly for the first time, and two coats built up enough surface to lay a foundation for my paste wax. I sanded with #400 grit wet/dry paper after the first coat of poly. I sanded with #600 grit wet/dry after the second coat. I then applied the wax. **PW**

Almost-forgotten Handsaw Tricks

How to clear your line of sawdust without blowing yourself dizzy. Plus, learn how to mark accurate 90° and 45° lines without a square.

You can use the reflection in the sawplate to mark an accurate 90° line across the face of your board. Once you're comfortable with this trick, you'll use a square much less for marking.

Photo by Al Parrish

About 35 years ago I was using a handsaw in what I considered the usual method: Cut, blow the sawdust off my pencil line and then cut some more.

The foreman on the job was watching me work and he came over and stopped me. He said he was told many years ago of a way to cut with a handsaw so you didn't have to blow the dust off the line. He didn't show me the method because he said he'd never been able to do it himself, but the basic idea was as follows:

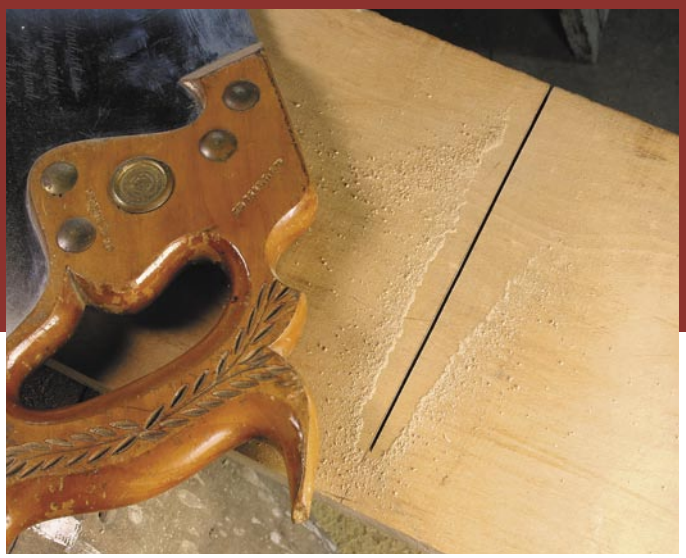
You cut on the down-stroke and lift the saw a bit out of the kerf on the up-stroke. By developing this slightly orbital stroke, most of the dust falls on the floor.

After practicing this orbital stroke for a while I noticed something else that my foreman had not mentioned. The small amount of dust left on the surface of the work was pulled away from the cut line, like the wake of a boat in water.

This is really neat to see, and I think it is caused by the regular, rhythmic vibra-

by Carl Bilderback

Carl is a lifelong professional carpenter in LaPorte, Ind., and a tool collector.



Using an orbital sawing stroke, the dust falls away from your line as you cut, much like the wake of a boat. No more stopping to blow your line after every few strokes.

Here's how to develop the orbital rhythm in your sawing: With Western-style handsaws, the blade cuts the work on the push stroke, as shown in this photo.

As you pull the saw back to prepare to make another cutting stroke, lift the saw up a little (as shown here) so the teeth aren't dragging against your cut. This orbital sawing action sounds different, feels different and works brilliantly.

Use the reflection of your work to draw a square line across a board. Here you can see how the reflection doesn't line up with the board. The saw plate is not square across the board.

When I rotate the saw a bit, the reflection lines up with the board. The saw is square across the width. Now I simply draw a pencil line along the back of the saw and I have my cut line.

tion within the workpiece that is created by this type of saw stroke. Try it – you will like it!

At one time there was a product available that was designed to blow dust away with a hand saw called "Clear-Line." It was attached to the bottom of the saw handle and directed a puff of air onto the surface of the board with each stroke of the saw.

As a tool collector for the past 35 years, I have looked at thousands of handsaws and have never seen one with a Clear-Line unit attached to it. Could it be that most woodworkers of the time knew how to cut without the need to purchase such a device?

One more neat (and sometimes useful) trick is to use a saw as a square. This is done by placing the saw in a vertical position across the face of a board. Observe the reflection of the board in the side of the saw blade. When the reflected edge is straight and in line with the edge of the board, the saw blade is set at 90° to the board's edge.

If you want to mark a 45° angle, move the saw until you see a 90° corner formed by the reflection and the edge of the board. **PW**

You also can draw accurate 45° angles this way. When the reflection appears as a perfect 90° (as shown), your saw is at 45°; draw your line.

Draw-leaf Game Table

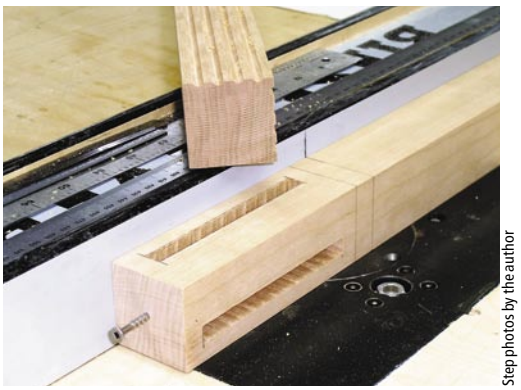
This two-for-one table adds space for extra players without disturbing anything on the tabletop.

Photos by Al Parrish

I was asked to design and build a gaming table. For me that is a table for playing pinochle or euchre, or a comfortable table for working a jigsaw puzzle with family members. So I set about working to accomplish my task by designing toward card-table dimensions when I stumbled across a television show of the extremely popular "Texas hold 'em" card game. As I looked at the players spaced around the table I questioned the direction I had chosen.

I needed a design that could expand into a larger table. I needed leaves! But table leaves are a constant nuisance. If you need to store them away from the table they take up too much closet space and are always getting dents and dings. If the leaves store in the table, you need to open it completely to install them.

Then I remembered a seldom-used design that could provide me with exactly what I was searching to find: the draw-leaf or Dutch pull-out table. In this design, the leaves store directly under the main top of the table and extend outward from each end when pulled from the table's base. The main top floats upward as the leaves are extended and will fit flush with the leaf when it is fully brought out. The fascinating aspect of this design is that the leaves may be extended even if the table is being used for the family puzzle. No need to remove anything from the top – just slide the leaves out!



Step photos by the author

Cut the four flutes at the router table. The screw in the end of the leg blank helps to raise the blank from the bit to end the cut or to plunge into the correct position to begin the cut.

Grab Your Scratch Pad

I began knowing I wanted the table to be 38" wide x 38¾" long and I wanted, for design purposes, a small amount of overhang – 1¼". This works because the smaller the overhang of the table, the wider the leaves will be. Next, I wanted to use a standard 24" for the distance from the floor to the bottom edge of the apron. This allows enough room to get one's legs comfortably under the table. Finally, knowing that the strength of a table is in the aprons, I wanted to use a 5½" apron to provide additional support. This would mean that my table would be 31" high while using two ¾"-thick tops – one for the leaves and one for the main top.

Given these measurements, I determined the sizes of my table's main components. Two ¾"-thick aprons along with the 1¼" overhang on both ends yields a total of 4". If you subtract that from the length of the top when closed, you have 34¾" remaining, which is the measurement of the inside of the base. From that you need to subtract the thickness of the stops (1") and the thickness of the center support (¾") and you have 32", which is the total that the table will extend. Divide that number by two to get the width of each individual leaf (16"). Finally, subtract the 32" from the closed length of 38¾" to get the fixed-top size of 6¾". With the numbers figured, we're ready to build.

A Base From Which to Build

The base is the place to begin with the construction of our table and I always begin with the legs. Not wanting to simply taper these legs, I opted to add flutes to the face sides. First, mill the leg blanks to size and mark the locations of the ⅜"-wide x 4½"-long x 1¼"-deep mortises. We are using a bare-face tenon joint, which means there is a shoulder only on one face of the apron. These mortises are located ⅜" in from the face of each leg.

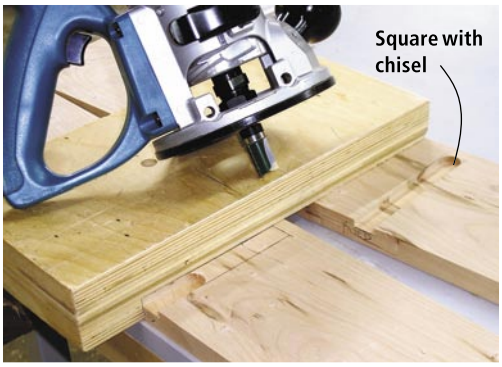
With the mortises complete, install a ¼" fluting bit into the router and set it so the bit makes only a cut 3/16" wide. Place a line on your fence that is exactly centered with the middle of the fluting bit. I like to use the center of the bit to begin and end each cut rather than setting a line on each side of the bit to use as a starting or ending point.

Now draw a line at ⅞" below the spot where the apron meets

by Glen Huey

Glen is a contributing editor to Popular Woodworking. *You'll find more information about Glen, his books and his DVDs at woodworkersedge.com*

Because one cheek of the apron's tenon is barefaced, make a shoulder cut only on the apron's tenon face side of the piece.



Use a square platform jig made from a few pieces of plywood and a pattern bit to cut the 1/4"-deep dado for the center support.

Use a tapered countersink and #8 x 1 1/4" screws to attach the center support, then fill the holes with matching face-grained plugs.

the leg. This line will be used to determine the top edge of the fluting. Next, you will need to lay out the locations of the flutes so they are evenly spaced across the face of each leg. Line up the bit with either of the middle flutes and set your fence.

Make two passes on each outside face of your legs. The first starts at the layout line and continues through the bottom edge of the leg. A second pass is made by reversing the leg and starting at the bottom edge, then stopping as the layout line matches with the line on your fence. This will create the two flutes on the inside of each leg. Next you need to reposition the fence to align the bit with either of the outside flute locations and repeat the steps. Afterward, the faces of each leg should have four flutes evenly spaced as shown in the photo on the preceding page. While I've included ample photos in this article to show how to build this project, I've also posted additional photos on my web site that may prove helpful (woodworkersedge.com).

Work on the aprons begins by creating the tenons on the ends. Set the blade height to 3/8" and position the fence to cut a 1 1/4"-long tenon. Because we're using bare-faced tenons you need to make the cut only on the face of the apron. Cut both ends of all four of the apron pieces. Then, without moving the fence, raise the depth of cut to 1/2". Roll the aprons onto their edges and make the two cuts at each tenon to define the edge shoulders of the tenon.

Remove the remainder of the waste material on the tenons using the table saw, leaving the 3/8"-thick tenon. At the band saw, set a straightedge fence in position to remove the 1/2" of material on each side of the tenon. Because these tenons will touch in the center of the leg if left as-is, we need to cut a 45° angle onto each tenon. Make a single pass to cut the back edge of the tenon. Leave the length as long as possible.

The center base's support fits between the long aprons. To install the center support you need to create a 1/4"-deep stopped dado located directly at the center of both aprons, into which the center support will slide. The dado is cut leaving 1/2" of material at the bottom edge of the aprons. This will help you position the piece in the right location and also adds strength by adding support beneath the piece. Square the dado with a chisel to finish.

Now you are ready for some assembly. Add glue into the mortises and on the tenons and slip the joint together. Assemble the base in steps, but remember that your mortises open into each other and the glue can run out the opposite mortise. Allow one set of rails and aprons to dry, then complete the assembly with the other set. Finally, slide the center support into the aprons and attach.

Continuous Grain Tops it Off

Cut the pieces for your top, leaves and the fixed top from a single sheet of plywood. It will look best if you make the grain of the leaves continuous with the main top. Rip the sheet to 36" in width, and then cut (in this order) one leaf, the main top and the second leaf. This will allow you to arrange the pieces so that when the table is fully extended, the grain will run the entire length of the table. Don't forget to cut the fixed top, while you're at it.

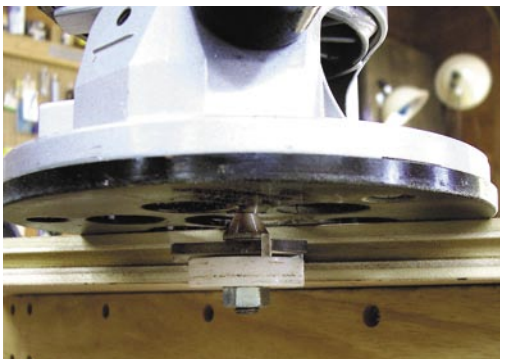
DRAW-LEAF GAME TABLE

	NO.	ITEM	DIMENSIONS (INCHES) T	W	L	MATERIAL	COMMENTS
❑	4	Legs	1 3/4	1 3/4	29 1/2	Cherry	
❑	2	Long aprons	3/4	5 1/2	35 1/4	Cherry	1 1/4" tenon both ends
❑	2	Short aprons	3/4	5 1/2	34 1/2	Cherry	1 1/4" tenon both ends
❑	1	Center support	3/4	5	34 1/2	Cherry	
❑	1	Main top	11/16	36	36 3/4	Plywood	Nominal 3/4" plywood
❑	2	Leaves	11/16	36	14	Plywood	Nominal 3/4" plywood
❑	1	Fixed top	11/16	36	4 3/4	Plywood	Nominal 3/4" plywood
❑	5	Long edging	11/16	3	40	Cherry	Ea. makes 2 pcs.
❑	3	Short edging	11/16	3	20	Cherry	Ea. makes 2 pcs.
❑	4	Slides	7/8	1 1/2	36 3/4	Cherry	Cut to fit for length
❑	1	Pierced brackets	9/16	3 1/4	20	Cherry	Makes 8 pcs.
❑	2	Apron moulding	7/8	2	40	Cherry	Ea. makes 2 pcs.
❑	4	Stop blocks	3/4	3/4	1 1/2	Poplar	
❑	1	Locating dowel	3/4			Poplar	For top
❑	1	Pinning dowel	1/8			Poplar	For brackets

Now we need to add the solid-wood edging to the plywood. I elected to run a simple tongue and groove to improve the joint. Use a router bit with a three-wing cutter (Eagle America, 800-872-2511, #199-4622) to make the 1/4"-deep groove in the plywood. To ensure that the groove is centered, I like to make a complete pass from both faces of the plywood.

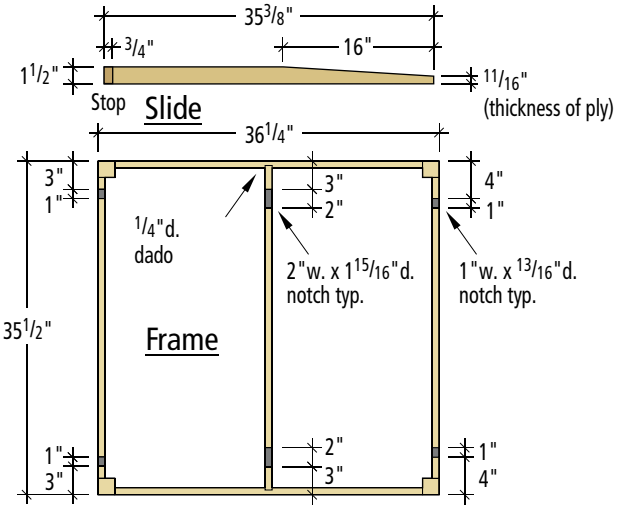
Create the tongues on the solid stock edging pieces in a series of two-step rabbet cuts on the table saw. Make sure to check the fit. Because I ran the groove cut from both faces, it is likely that the groove will be more than the 1/4"-wide, and you want a snug fit for your table edging. To make things easier, I ran my edging more than double the needed width, then ran the tongues on both edges. I then rip those pieces to the finished size for the edging. I use a 1" finished size (1 1/4" including the tongue) because it takes the guesswork out of sizing the top plywood pieces.

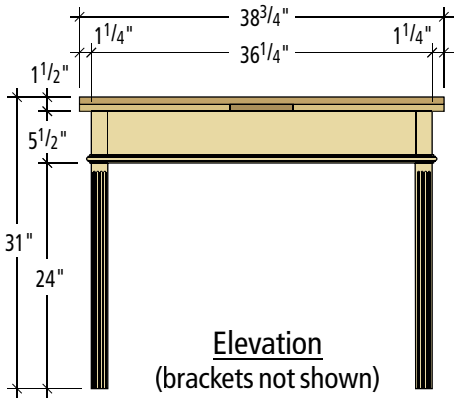
Carefully fit the edging around the plywood panels, mitering the corners. Slide the edging into the grooves and match the corners of the two pieces. Hold them in position and mark the opposite miter length at the exact corner. Repeat these steps for all four sides of the panels and for all four panels.

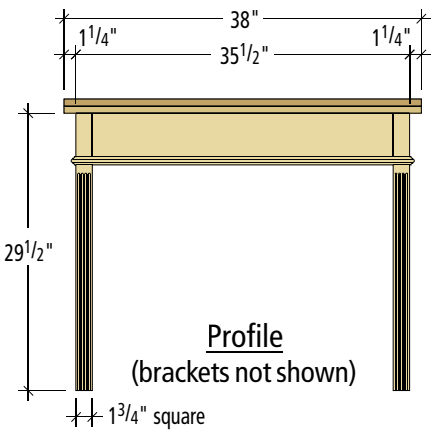


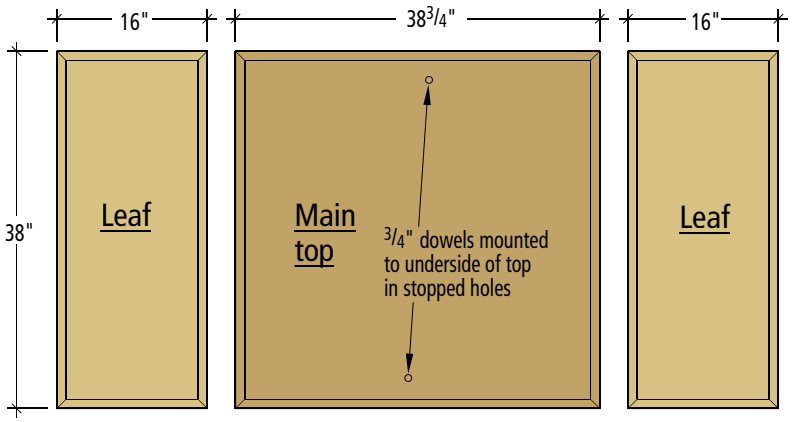
Create the 1/4"-deep groove with a router bit and three-wing cutter. Run the cut from both faces of the plywood to ensure that it is centered.

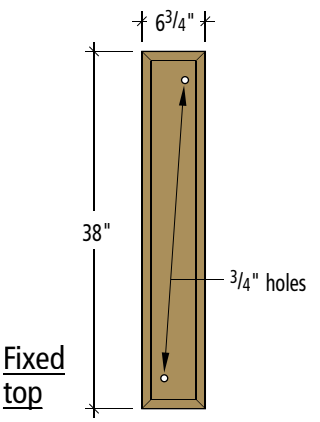
Cut one end of your long edging stock at 45° and use the falloff, cut to the same angle, to find the exact position.



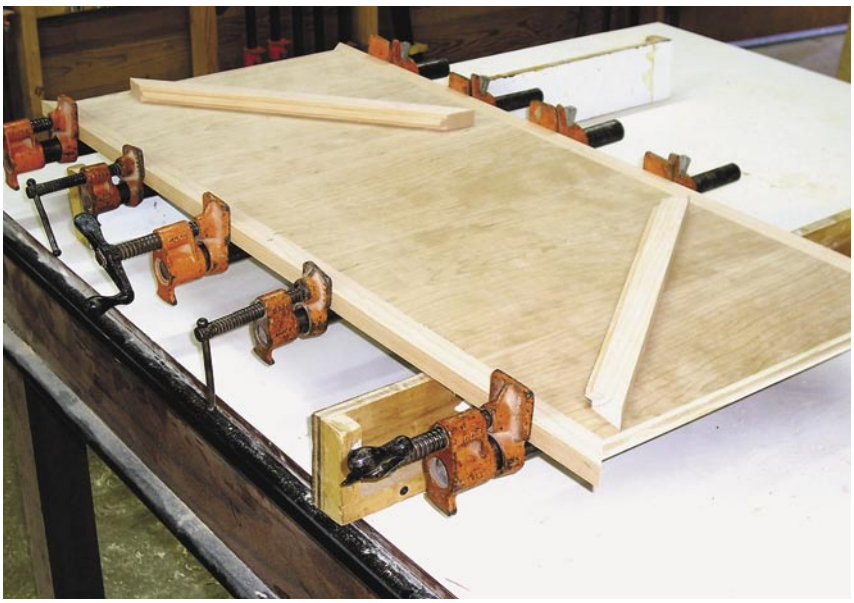








Add glue to the groove and to the tongue on the edging, slide the long pieces in place while checking the position, and add clamps until the glue is dry. Next, assemble the final two pieces of edging per panel in the same manner. Elevate the panel onto a few pieces of scrap lumber to make placing the clamps easy. When the glue is dry, you will need to sand the edging flush to the panels, taking care to not sand through the veneered surface.



Place the clamps on the bottom face of the plywood pieces to help protect the panel from damage or staining.

The Slides are the Secret

The success of your table rests on the slides. They need to be milled accurately and must be identical for the leaves to slide smoothly and correctly. Mill the stock to rough size and allow the wood to acclimate for a day, then complete milling the slides. This will help keep the pieces stable after cutting them to the final size.

Begin the layout for the slides by making a mark at the top of the side, 16" from one end. At that same end mark the exact thickness of your top (plywood is slightly less than $\frac{3}{4}$"). This is the amount that the slide has to rise in order for the leaf to be on the same plane as the top when the leaf is fully extended. Draw a line connecting the two points. The small wedge is the waste and can be removed with a tapering jig, but a few years back I began making my tapers at the jointer.

The trick to accuracy and getting the four slides identical at the jointer is in the layout work. First draw a line that is half of the total length of the taper, in our example 8". Next, set the cut of the jointer at exactly half of the total of the taper cut ($\frac{11}{32}$"). Don't rely on the tool's gauges for this setup. Make the cut on a scrap piece of lumber and measure for accuracy.

With the layout complete and the machine set, it is a two-step process. Make a normal pass at the jointer up to the 8" layout line and remove the piece. This cuts one half of the taper. Reverse the slide, cut the area away from the knives, then "wheelie" down the previous cut. As you carefully pass the piece over the knives, it is important that you maintain downward pressure on the back edge until the piece makes contact with the outfeed table. Any drop into the knives could ruin your slide. Continue the cut through the knives to complete the tapering of the slides.

Next we need to figure and cut the notches in the aprons and the center support in which the slides travel. Position one slide with the tapered cut down flat against your bench. Measure $1\frac{1}{4}$" in from the tapered end and measure the height of the slide at this location. This is the depth of the notches that you will need to cut in the aprons. Take another measurement 19" in from the tapered end that will be the depth necessary for the notch in the center support. In my case the depth was $1\frac{15}{16}$". It's OK to be a bit deeper because it's the fixed top that holds the slides when fully extended.

To sand the pieces flush, add pencil lines to the joint of the plywood and edging and when the lines disappear – the surface is level.

Locate the notch locations using the illustrations on the preceding pages. Note that the 1"-wide notches are in different locations at opposite ends of the table, so the slides nest side by side. The center support notches are 2"-wide to capture both slides.

Cut the notches by sawing two outside lines to define the cut, then make multiple cuts to the bottom layout line. A jigsaw or handsaw will work. Stop short of the bottom line, then break the waste material out with your chisel and pare to the bottom line. Repeat these steps for the four locations in the apron as well as the two areas in the center support.

At this point, the slides are still too long. Position the slides in place on each leaf, with the tapered end flush to the outside edge of the leaf. Mark and then trim each slide where the solid wood meets the plywood leaf, then check the fit. When closed, the leaf will lay flat on the apron and the slide will extend approximately $\frac{1}{4}$" beyond the apron.

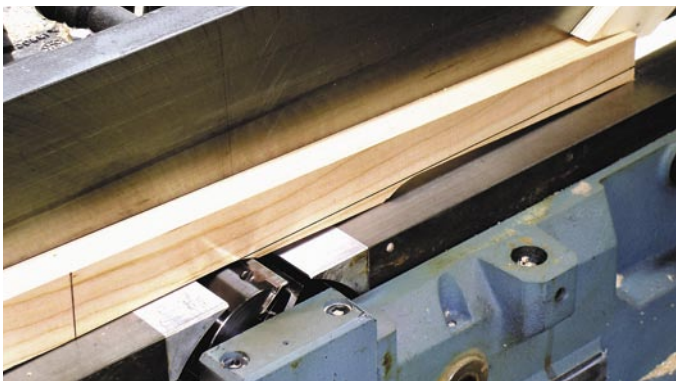
SUPPLIES

Woodworker's Supply
800-645-9292 or
woodworker.com

1 • Moser's Early American Cherry aniline dye
#844-624, $17.99

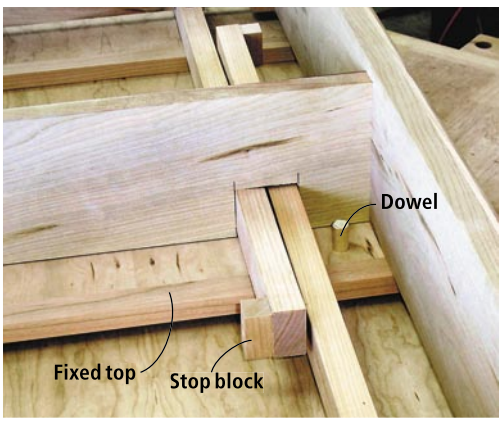
Price correct at time of publication.

Layout is the key to the slides and the tapers. First, make a regular pass at the jointer stopping as the cut reaches the 8"-layout line.

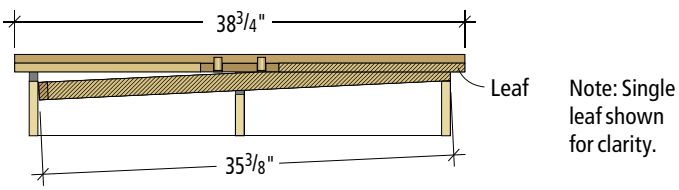


Second, reverse the cut and "wheelie" down the area of the first cut while passing the piece over the knives. The cut will not make contact until the 16" line, and will taper the cut the final dimensions.

Set the depth stop at the drill press to leave 3/4" and drill the 5/8"-diameter holes into the tapered portion of the slides. Use a tapered countersink centered at each hole to attach the slides to the leaves with #8 x 1 1/4" screws.

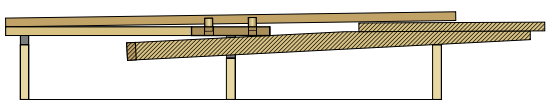


The 2 1/4"-long dowels extend down from the top and through the fixed top. The stop blocks at the ends of each slide need to be removable in order to disassemble and finish the table.

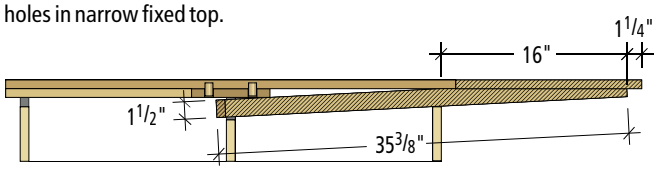


Note: Single leaf shown for clarity.

In closed position, extension leaf with attached slide is fully housed beneath floating main top.



As extension leaf is pulled outward, floating main top pivots upward. Main top is held in alignment with base by attached dowels that ride in holes in narrow fixed top.



When extension leaf is fully extended, it is flush with floating main top. Main top returns to rest on beveled edge of slide. Stop block, attached to side of slide, contacts center support and prevents overextension.

Fitting the Top

Set the fixed top, leaves and main top into position on the base with the slides loose, but in position. Get the overhangs set to the correct size, then mark a line on either side of each slide. It helps to center the slide in each notch. To attach the slides to the leaves, use a square to extend the lines of the slides' positions across the leaves.

Use a Forstner bit to countersink the three holes for the screws. Use a tapered countersinking bit to pre-drill for the screws. Add a small amount of glue onto the slide, reposition in place and attach using #8 x 1 1/4" screws.

Set the leaves and fixed top back onto the base and temporarily attach the fixed top to the base with screws into the aprons. Place the top into position and use a number of spring clamps to hold the top to a leaf on one end of the grouping. Carefully slide the opposing leaf out until the top fits down flush with the leaf. The drag should be snug but if it is too tight, adjust the depth of the notch in the center support. Check the fit of both leaves. Trim the slides for length as necessary and attach the stops that will keep the leaves from being overextended to the slides with screws. These will need to be removed when we begin the finishing steps.

The main top remains loose but is held in position by dowels. Install the dowels by first drilling two pilot holes between the apron and the slide areas (offset them from the center to allow the top to only fit one way) and through both the fixed top and into the main top. Remove the two tops and drill a 3/4" hole through the fixed top. Drill a 3/4" hole into, but not through, the main top. Slightly taper the exposed end of the dowels with sandpaper to allow an easy fit in the fixed top. Attach the dowels into the main top with glue. As the leaves are extended the top will ride up off of the fixed top. The dowels will keep the two tops in line.

Details Make the Difference

Make the moulding at the bottom edge of the aprons using a

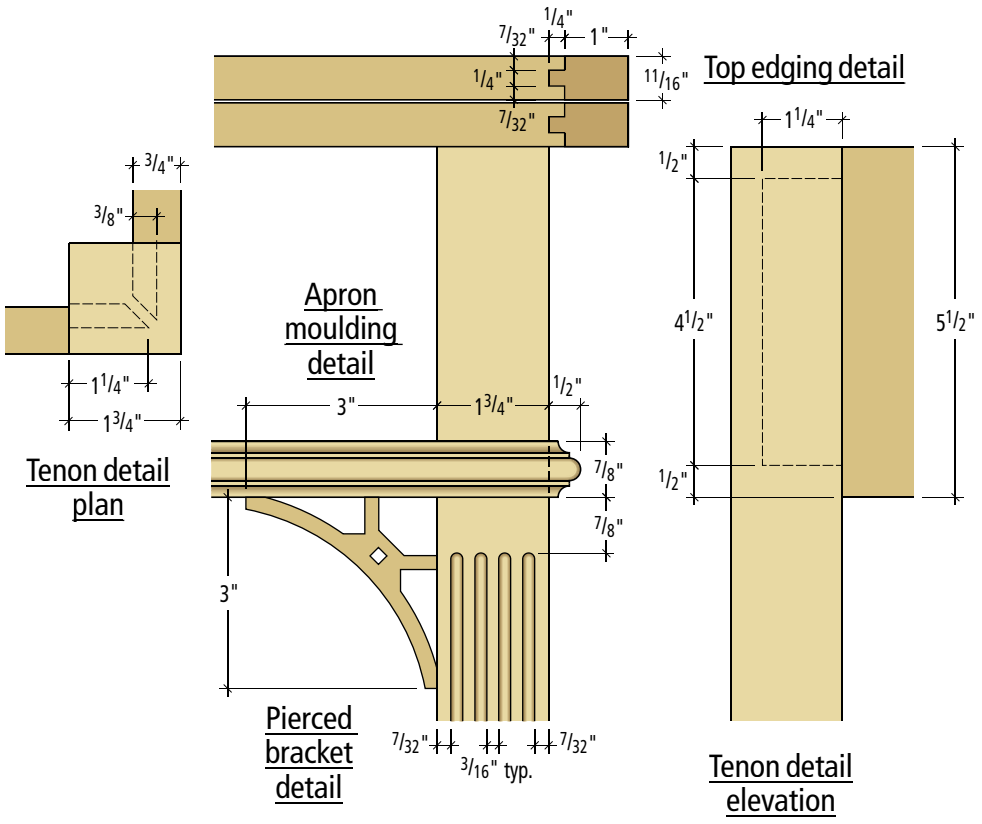
profile bit (#841.285.11, cmtusa.com) in the router table. You will need to make two passes per edge to complete the profile. Run the profile on a larger piece, then rip the moulding from the larger piece at the table saw. Sand the apron to #180 grit and miter the moulding corners to fit around the base. Use a thin bead of glue and brads to attach the moulding.

Cut the stock for the pierced brackets into eight triangles so that each leg is 3¼" in length. Set a fence at the band saw that is 3" away from the blade and run each leg through the blade, cutting a small flat area at the ends.

Transfer the pattern from the plans onto the piece. At the mortiser, set up to cut the square hole in the center of the layout by placing the long side of the triangle against the fence. Make sure to place a scrap piece under the cut to keep from blowing out the back side of the cut. Finish the profile at the band saw, then sand or rasp to clean the edges. Dowel and glue the pieces in position where the aprons meet the legs.

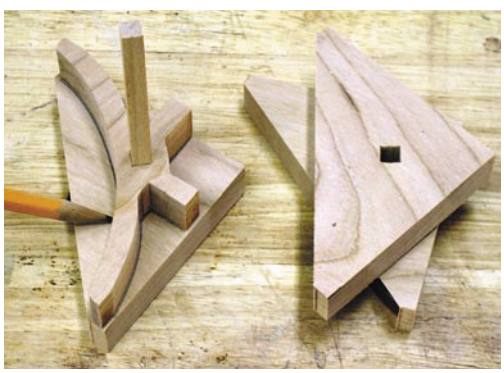
I used Moser's Early American Cherry water-based aniline dye to color the wood. Soak the table with dye, allow it to stand for five minutes, and then remove any excess. Once the dye is dry, lightly sand the piece to remove any raised grain or "fuzzies." I sprayed a coat of sanding sealer, sanded the piece thoroughly, and followed that with three coats of lacquer for extra protection.

Because the top slides on the surface of the leaves as they are extended, add a piece of felt to the underside of the main top to prevent scratches. Start that puzzle with the family or invite your woodworking friends to a poker tournament. You might not come out ahead in winnings, but at least you will be able to show off your new table. **PW**



Miter the corners of the moulding and use a thin bead of glue. Too much glue and the result might squeeze out onto the aprons, causing finish problems.

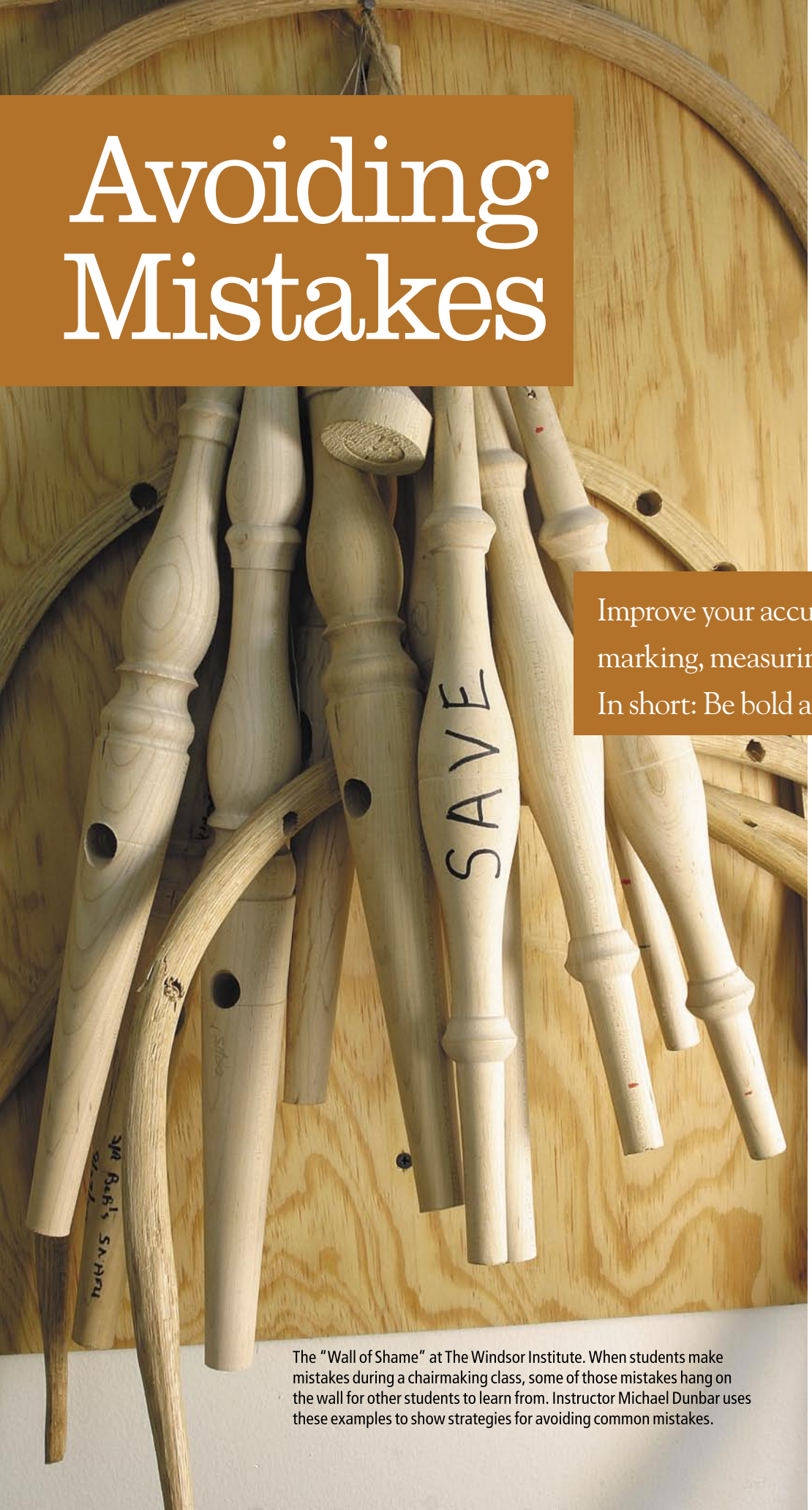
Locate the first bracket for the square hole and mark the edgeson the scrap below in order to position the remaining brackets for this step.



With one pierced bracket complete, fit a scrap into the 1/4" hole to locate the position for the remaining brackets. Transfer the design onto the remaining pieces.

The pierced brackets fit into the corners where the aprons meet the legs. Use a small amount of glue and 1/8"-diameter dowels to secure.

Avoiding Mistakes



The "Wall of Shame" at The Windsor Institute. When students make mistakes during a chairmaking class, some of those mistakes hang on the wall for other students to learn from. Instructor Michael Dunbar uses these examples to show strategies for avoiding common mistakes.

After seeing me help a student recover from a mistake while building a chair, someone in the class will usually take me aside and say, "You know, you need to write an article on fixing mistakes." I always explain that I prefer to teach how to avoid making mistakes.

While my staff at The Windsor Institute and I have a lot of experience fixing things that have gone wrong, I have really compelling reasons for focusing our attention, and that of our students, on avoiding mistakes in the first place. When they happen, mistakes have four very undesirable consequences for me.

Improve your accuracy by changing your marking, measuring and working habits. In short: Be bold and consistent.

First, mistakes cost expensive materials. We cannot tell the student: "Too bad you ruined that piece of wood. The class is over for you." We have to replace it. Second, I have on my hands a student who is angry with himself. Everyone is aware of his funk and it is a drag on the class morale. Third, fixing the mistake will take time. The student will fall behind and it will be more difficult to keep the class on schedule. Fourth, I have to fix the problem, increasing my workload. If the mistake is really bad, I will have to cut a staff member loose to help me. As a result, other people who may need help do not have it as readily available.

by Michael Dunbar

A chairmaker since 1971, Michael is the founder of The Windsor Institute in Hampton, N.H., where he teaches hundreds of students each year to build Windsor chairs. For more information, visit thewindsorinstitute.com.

These are the same four reasons that you, too, want to avoid mistakes when working on your own. At home, it is you who has to replace expensive materials. It cuts into your woodworking budget – or if you are a pro, into your bottom line. You are now angry with yourself. Your satisfaction with woodworking is diminished and your ego takes a pounding. It will take you time to fix the mistake or remake what you have ruined. You lose precious shop time, and if you're a pro, your hourly rate just took a hit. Finally, like me, you're the one who has to fix it, and fixing mistakes is no fun.

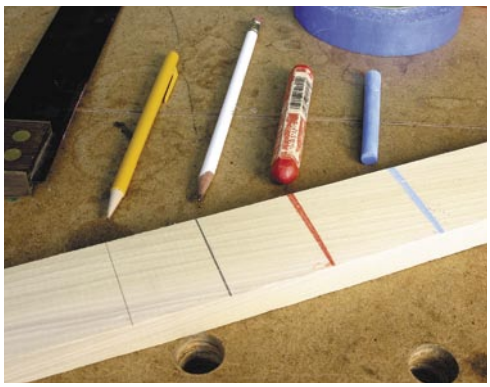
As you can see, mistakes are expensive in several ways other than simply wasting materials. They adversely affect your efficiency by cutting into productivity. While this is a tangible problem for a pro, it is equally annoying for the hobbyist. The hours you are able to set aside for shop time are limited and precious. You want to leave the shop at the end of the day with something to show for your efforts.

Mistakes also are tied into safety. You are more likely to get hurt if you are rattled or angry.

Few of us will tackle a project that we know is beyond our capabilities. So we do not usually make mistakes because we are overwhelmed. Most mistakes occur in repetitive operations, and much of the work in any piece of furniture is repetitive. Seldom do you cut one mortise or one tenon. We generally mess up when we become distracted or confused. This most often happens when we are doing something more than once. We get into a working mode and as our mind wanders or we get mixed up, we make a mistake.

In my shop our mistake-avoidance methods divide into three categories. I recently compared notes with three professionals for whom mistakes are not an option because the consequences are so disastrous. They were a surgeon, an airline pilot and a nuclear power plant technician. The mistake-avoidance techniques they use are all remarkably similar to ours.

You will also note that a lot of folk wisdom is woven through our mistake avoidance. You will be reminded of such sayings as "A stitch in time saves nine." Or, "An ounce of prevention is worth a pound of cure."



Make layout marks that are bold and difficult to overlook. Here you can see the fine line left by a mechanical pencil (which I don't like), a No. 2 pencil, a lumber crayon and school chalk.

Though some people use a triangle, I prefer to mark the top of a bundle of legs with a square. This square helps me keep the legs oriented and shows me where the mortises should go.

Layout: Use Bold Marks And Lots of Them

This is your first shot at avoiding mistakes. While good layout is no guarantee that mistakes won't happen later, incomplete or poor layout will make errors more likely.

Most woodworkers are reluctant to make a lot of marks on wood. Perhaps it is because they know they will have to clean them off later. Thus, their layout marks are small and light. Layout that is hard to see is only slightly better than none at all. While I tell my students I appreciate their frugality, pencil lead is cheap. I urge them to be wildly extravagant.

When doing layout, make big dark marks and notations that can be seen across the room. This way, they are obvious and clear when you pick up a piece of stock. I prefer a No. 2 pencil because the lead is soft and dark. I have no use for mechanical pencils. They make very thin lines that are too hard to see. Laying out rough stock, I use a red marking crayon because it can be seen and read at a distance. Chalk, too, is good. All these marks remove very easily with a sharp plane, a scraper or sandpaper.

Mark all surfaces, not just the ones you are going to work. Knowing where you don't want to cut is as important as knowing where you do. For example, if you are laying out table legs, bundle them together as they will be oriented in the piece and draw a square on the top. The square will orient the outside and inside corners for you. However, also identify the other surfaces by writing "front" or "inside" on them. Indicate top and bottom. When working, all those legs are going to look alike and a complete layout will make it easier to orient them correctly.

Of course you must check your work. After you are done with the layout, arrange the parts again as close as possible to how they will be oriented in the completed work and be sure you have not made a layout mistake.

For example, in a set of table legs, make sure all the mortises will align by placing the laid-out joints against each other.

When parts look alike, or when you have multiple marks, color coding is a good idea. In laying out shoulders and tenons, we teach our students to mark shoulders in red and the final lengths of the tenons in green. The red mark is visible at a glance and says, "Danger! Warning! Do not cut here!" The green mark reassuringly says, "It is safe to cut here." When a student ignores this technique and uses a pencil, or two marks of the same color, he usually cuts off at least one tenon by cutting at the shoulder.

You can also use color to code different parts that look alike. In making a door or a carcase with several panels, the top and bottom rails can look a lot like the center rails, but they have a groove only in one edge, not both. Colored

painter's tape effectively identifies the various parts. When you are done, it easily peels off without leaving any mastic that will affect the finish. If you need further identification, you can write notes and reminders to yourself on the tape with a Sharpie.

Painter's tape is equally good for telling you where not to cut. Put a piece over a place where you might mistakenly cut an extra mortise, or trim a piece of stock. In a Windsor chair the medial stretcher can be confused with the side stretchers. We put a strip of tape around the center to identify it and to prevent anyone from drilling a hole at that location.

Sometimes layout is best done during the first test assembly. For example, if you are making a table with tapered legs, dry assemble to test the joinery. With the legs all in their proper locations it is clear which surfaces need to be tapered. This is a good time to mark them – clearly and obviously.

Organization: Make Meaningful Piles of Parts

With the parts all laid out it is almost time to go to work. Almost time, but not quite. You first want to organize your work, because working in an organized, systematic and orderly manner will avoid a lot of mistakes.

Don't try to work from a jumbled pile of parts. Arrange all the same parts in an orderly manner. Cluster all the parts with space between clusters of other (especially similar) parts. Orient the parts all the same way. For example, when working with a set of table legs, have all the top ends going the same direction. This way, when you pick up a part you know where you are going to work and you can quickly confirm it by checking your layout. Not only do you avoid confusion by being orderly, you save a lot of time trying to figure out which end or surface is which.

Have as few parts on hand as possible. Put away parts that will not be involved in this operation. Extra pieces on your workbench or at your station create visible clutter at a time when you want things crystal clear.

Do not co-mingle parts. Work from a "To-do" pile to a "Done" pile. After you have performed an operation, do not return the part to where you got it. Start a separate pile. As you work, the To-do pile should shrink and the Done pile should grow. This way, you do not have to keep picking up parts to find the ones you have not already worked. Also, by doing this you won't think you have finished the operation and disassemble your set up, only to later discover that you skipped a part. Avoiding these scenarios also saves you precious working time. The picture we draw for students when describing the problems of poor organization is a fish flopping on the deck.

Process: Develop Working Habits and Stick to Them

Layout and organization are done and it is time to cut wood. After all the work you have invested in layout and organization, you don't want to confuse yourself now. You are a lot less likely to make mistakes if you practice good woodworking habits.

When you perform a repetitive operation, do all of it at once. Don't jump back and forth between different operations. For example, cut all your mortises and then cut all your tenons. We have a limited capacity for retaining information. The more you are juggling in your mind, the more likely you are to make a mistake. If you stick to an

When marking out parts that require a tenon, I employ a system that uses red and green marks. The green is the ultimate length of the overall piece and says: "It's OK to crosscut here." The red is the location of the tenon's shoulder and says: "Stop, don't crosscut here."

When making a frame assembly, such as a door, I use painter's tape to remind me where to cut grooves and where not to. I place blue tape on the exterior rails that require one groove and green tape on the mediary rail that needs grooves on both long edges. I also identify each part by writing that on the tape as well.

I always use my large bevel square for one measurement on a chair leg and the small square for a different measurement. I never vary this routine.

When working with different angles, I identify the angle to which the bevel square is set with tape and a marker. The difference between 14° and 16° is difficult to discern by eye alone.

operation and complete it, you can then erase all the information it required from your mind and focus only on the next step.

As you perform a repetitive process, always work the same way. Just as you don't want to jump back and forth between operations, you don't want to use different techniques. For example, if when dovetailing you start out cutting tails first, keep doing it that way.

This advice does not apply to just the job at hand. To avoid mistakes whenever you are working, develop working habits. By doing a process the same way every time, you can take advantage of muscle memory. Eventually, your body remembers how it felt when you were performing this operation before. It not only speeds you up, but when something doesn't feel right, it probably isn't. Learn to listen to your body.

Also learn to listen to the little voice in your head. Besides always working the same way, a good technique for avoiding mistakes is to always use the same tools. For example, in making chairs there are times when we have to use two bevel squares set to different angles. You can see the potential problem. Confuse the bevels and you have a mistake to fix, or a new part to make.

All my working life I have owned two bevel squares that are easily distinguishable. One is much larger and its handle is made of a much darker wood. I always use the bigger square for certain angles and the smaller square for certain others. I never vary, and I never will. When I am distracted and pick up the wrong bevel the little voice starts screaming. When I pause to figure out what set him off, I find I have picked up the wrong bevel.

If you use more than one marking tool (such as bevel squares or marking gauges) only once or occasionally, you will not be able to develop a habit. In this case, find a temporary way to distinguish them.

Again, painter's tape with a notation written on it indicating the setting or the job will avoid confusion. Remember to peel it off when you put the tool away so it doesn't confuse you next time.

Here's another good tip to avoid confusion. When you are done with an adjustable marking or layout tool, collapse it. You can't use it mistakenly if it is closed up. Every one of my students has watched me collapse a bevel square when I am done with it, and holding it up for them to see proclaim: "The only safe bevel square."

When I am helping a student learn an operation, I will use his tools so he can see how they should work. However, if the student has made a mistake that I need to fix and things are a bit tense, I change gears and follow the rule of always using the same tools. I only fix things with my own tools. They are comfortable in my hands and I know them intimately.

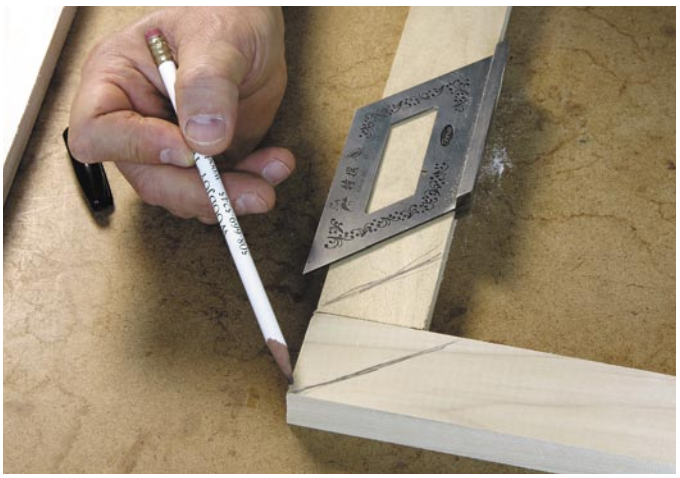
Here is another example of how I avoid mistakes in process. I am obsessive about using my tape measure only. I will walk across the shop to find my tape measure with numerous students offering me theirs. All my life I have used a Stanley 10' Powerlock and I know and recognize its blade.

We teach students to stay as much as possible in the same relationship to their project. In our case, this means staying in front of the chair as much as possible. We call it the Chairmaker's Position. Try to do the same in your work. You are more likely to become confused if you keep changing your body's orientation to the piece.

Also, as you work, try envisioning the completed piece in front of you. Being able to see what is not there helps make sense of what you are doing. Before you cut, hold the part as it will fit into the piece, or place it as it will go into the partially assembled work. I do this with miters. I hold the piece and then I draw angled lines the way the miter will go.

They are rough lines, so they cannot be confused with the exact line I will make with the miter square. Checking the line I drew with the part held up in position, I do not trace the angle the wrong direction. I learned this one the hard way, but it has since saved me a lot of grief.

When you get to my age you talk to yourself a lot. While this is not desirable in social situations, it is a good woodworking technique for avoiding mistakes. Your mind is less likely to wander if you are describing to yourself what you are about to do.



Before I begin mitering parts, I show the parts to each other as they will be assembled and mark rough miters.

When working, my airline pilot, my surgeon and nuclear plant technician all have someone else who describes for them what they are about to do, often by reading a procedure to them. Most woodworkers, however, work alone. To help keep you focused, talk to yourself. Turn off the radio so all you hear is your own voice as you do this.

If you foresee the possibility of confusion looming, work out a mnemonic to keep you on track. If it works once, remember and make it a habit. Every student who has ever studied with me recognizes "Top of leg, to top of leg." and "Front is back, back is front." I suspect you can easily figure out what mistakes we are avoiding with these little ditties.

Similarly, before you actually cut your wood, pose to yourself the question, "What is the result of what I am about to do, and is the answer believable?" You will sometimes find that you are about to do something backward or in the wrong direction by imagining the result.

If you are about to undertake a complicated process, write out a procedure in advance. Use the procedure. Read each step out loud rather than trying to remember what comes next. Check off each step as you work.

Take Notes for Next Time

If a project was worth making once, chances are good you will end up doing it again. Take notes on what you did so you do not have to figure it out all over again next time. It is a bummer to make a mistake the second time through that you managed to avoid the first time. Especially, take notes about the mistakes you did make. If you wrote a procedure, make corrections or additions while the process is fresh in your mind. Taking pictures is another good method for keeping a record of how you did things last time.

When Mistakes do Happen

No matter how seasoned a woodworker you are, you will make mistakes. When they happen, follow the advice we give our students, "You can't get out of a hole by digging." By this we mean, call one of us for help rather than trying to fix it by yourself. However, at home it means take a break. You are at the greatest risk for making another mistake or getting hurt when you are upset. Put down your tools and take a walk. Come back to the job with a clear head and you will be more able to dispassionately assess the situation.

Learn from your mistakes. Your first reaction when you discover a mistake is to snap the piece in two and throw it in the burn barrel. Don't. While you may want to get your mistake out of your sight, remember that out of sight is out of mind. You are more likely to learn from a mistake if you look at it frequently.

This can literally mean, hang it on the shop wall. In our shop we avoid a lot of mistakes because of our "Wall of Shame."

We save mistakes students have made in the past, and as we are teaching a process, we show the current class the applicable mistakes. Why? Because humans learn better by seeing than by hearing, and knowing that a mistake can and has happened helps avoid it.

Treat a near miss as a mistake. Just because you got away with something this time does not mean you will be so lucky the next. Use a near miss as a reason to take a break from the work, and to contemplate what nearly happened. Decide how you can avoid that problem in the future.

Finally, do not let the fear of mistakes paralyze you. Mistakes will happen, and you will have to fix them. However, by paying attention to layout, organization and good working habits, you will avoid a lot of them. **PW**

This armbow was miscut by a student who used faint marking lines and incorrectly drew his centerline on the bow. Bold marks would have pointed out the mistake before making the cuts.

My students know that I am passionate about stamping out mistakes, and so they played a practical joke on me. One student carved this detail on the wrong side of the crest rail and slipped the part into the mix when we bent the rails. When I first saw the part, all I could think was, "How am I ever going to fix this one?"

Breadboard Ends Keep Tops Flat

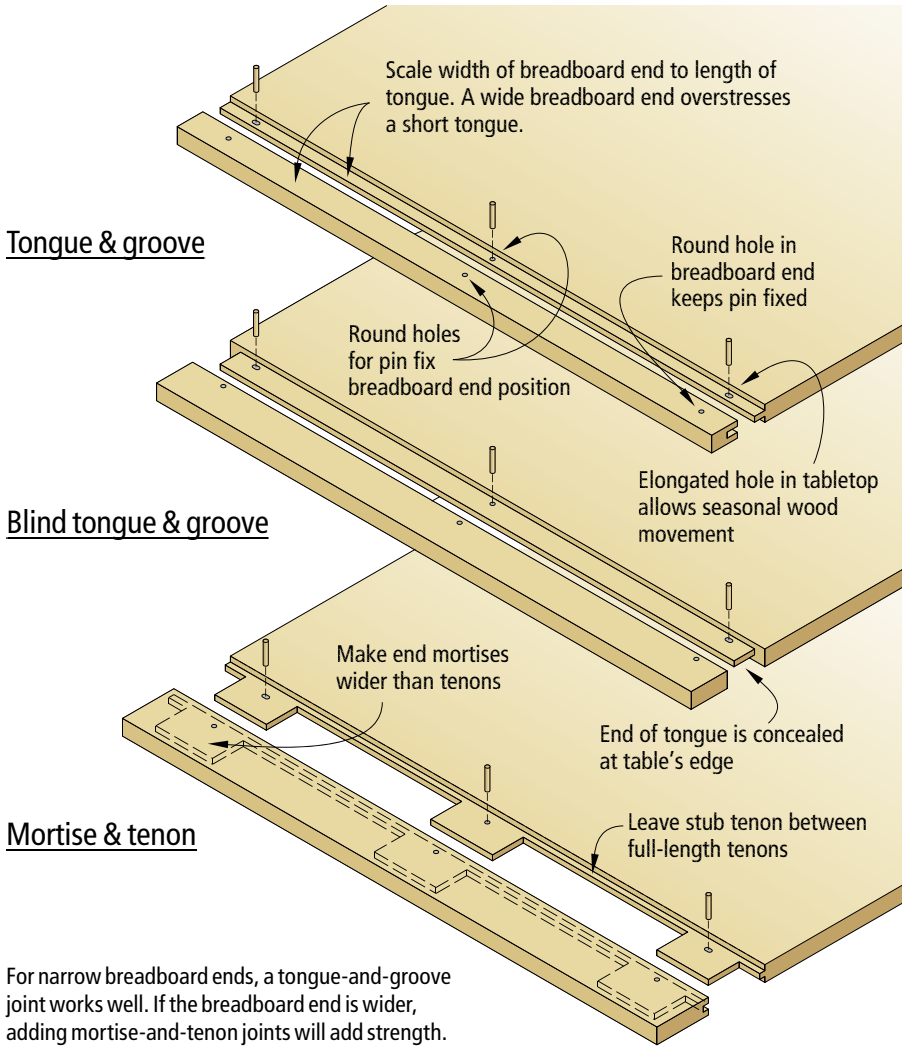
This traditional joint ensures the only cup on your tabletop will have coffee in it.

The breadboard end is a traditional device for preventing a broad panel such as a tabletop from cupping. It is a narrow strip of wood that runs across the end of the main panel. Obviously, it must be attached in a way that allows the panel to expand and contract. But it also must be attached in a way that won't allow the panel to cup without forcing the strip to bow. This means there's got to be some form of interlock.

You should be aware of the aesthetic. The breadboard's length won't vary, but the width of the panel will. It may turn out that the only time the two dimensions match is when you construct the tabletop. Thereafter, you'll have an endlessly varying difference. Get used to it. (If you want the look but can't accept this quirk, use plywood for the panel and glue on the breadboard end!)

There are quite a few ways to attach a breadboard end. The drawing at right shows several that are particularly good if your intent is to keep the top flat. In assembling any of these joints, glue is used sparingly, if at all. Most often, wooden pins are used to lock the breadboard, so it can't pop off.

A single pin in a round hole at the center secures the breadboard but allows the top to expand and contract. If pins are added anywhere else along the joint, the holes for them in the tabletop must be elongated to allow for seasonal wood movement. Remember, the top itself will expand and contract, but the length of the breadboard won't change.



For narrow breadboard ends, a tongue-and-groove joint works well. If the breadboard end is wider, adding mortise-and-tenon joints will add strength.

Establish the Proper Size

The width of the breadboard end and the length of the tongue, tail or tenon need to be in good proportion. A wide end multiplies the stresses placed on the joint. I think a good rule of thumb is to make the end no more than 1/2" to 3/4" wider than the longest element of the joint. In other words, if you use a 1/2"-long tongue, the breadboard end should be held to a 1" to 1 1/4" width. If the breadboard end needs to be 2 1/2" to 3" wide to look right to your eye, use mortise-and-tenon construction with tenons 1 3/4" long at minimum.

The construction method you choose should be influenced, I think, by the use and size of the table. If the tabletop is wide, and if people are likely to lean on the end itself, the joinery between the panel and the end needs to be particularly strong. In this case, think mortise-and-tenon joint.

The simplest joint is tongue and groove. It can be through, in which case it is visible at either edge, or be blind. I wrote about tongue-

by Bill Hylton

Bill is the author of several books about furniture construction and router operations. When he isn't writing about woodworking, he's doing it in his home shop in Kempton, Pennsylvania.

and-groove joinery in the April 2005 *Popular Woodworking* (issue# 147). Depending on the size of the top, you can cut both the tongue on the tabletop and the groove in the breadboard on the table saw with a dado cutter. Any size top can be machined with a portable router and slot cutter.

Mortise and Tenon

Attaching the breadboard end with mortises and tenons is the strongest construction. The typical design features a stub tenon extending from edge to edge, with a full tenon in the center and one a couple of inches in from each edge, as shown in the drawing at left. You can design a joint with only one tenon or with more than three. The mortises and tenons can be through or blind.

There's no one "best" way to do the job. "Best" varies with the particular tabletop, with your tools, and with your experience. Here's how I do the job.

Rout a wide rabbet across each face to make the tongue. To guide the router, make a double fence. It provides a fence across each face, and the guiding edges of those fences are in the same plane, so the tenon shoulders will line up. You slide it onto the tabletop, align one fence and clamp it. Both fences are aligned. Rout one side, turn the tabletop over and do the other side.

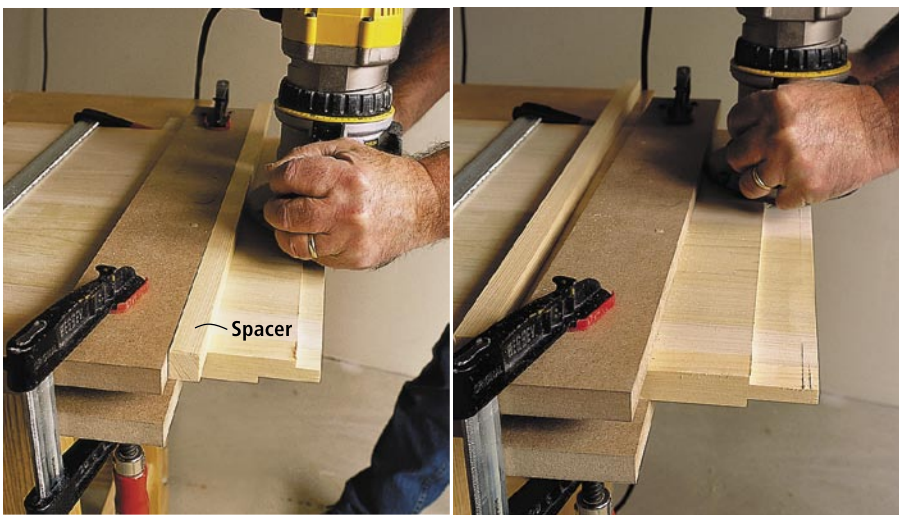
Lay out the tenons next. Use a marking gauge to scribe the end of the stub tenon. With a small square and a pencil, mark the edges of the full-length tenons. Cut to the lines with a jigsaw.

Making the breadboards is next. Crosscut them 2" or 3" overlong; you can trim them to final length just before pinning them to the tabletop. Rout (or saw) the groove for the stub tenon first. A through groove can be produced on the table saw or the router table, but a blind one (stopped on both ends) is done most safely on the router table.

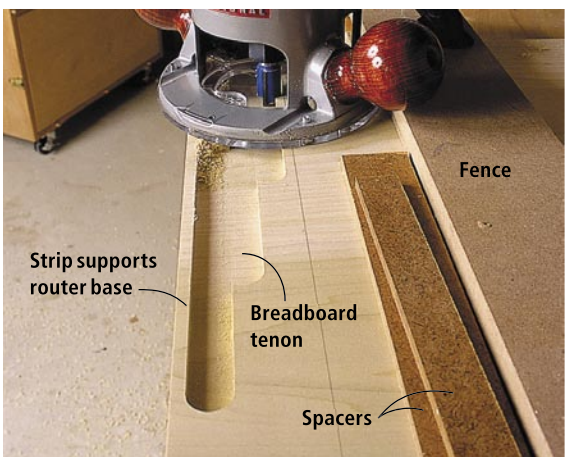
Lay out and cut the mortises next. I transfer the margins of the actual tenons to the breadboard. For the center mortise, I'll offset the marks about 1/16", for the outer mortises 1/8" to 3/16", depending upon the species of wood and the width of the top. This offset allows the top to expand. I use a plunge router, edge-guide and shop-made mortising fixture to cut the mortises, (see issue #140 for a plan) but you can use a hollow-chisel mortiser.

Photos by the author

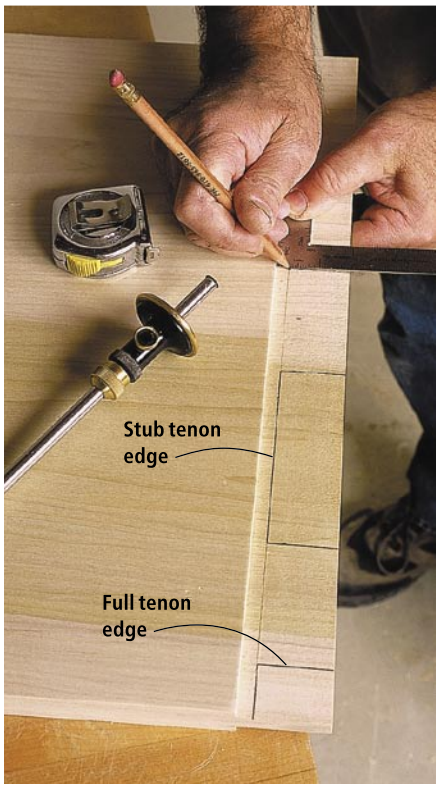
This simple fence ensures the shoulders of your tenons align when you make a breadboard end. Stand two straight strips of medium-density fiberboard (MDF) or plywood on edge on a flat surface, and clamp scraps of the tabletop stock between them. Drive screws through the fences into one of the scraps.



Stage any cut that's wider than a single diameter of your bit. Protect the work by clamping backup scraps (hidden by the router) to the outfeed edge. Slide the fence onto the tabletop, position and align it, then clamp it at both ends. Fit a spacer between the router and fence for the first pass (above left); remove it to make the second pass. Turn the tabletop over to cut the second face.



To stabilize the router for a wide cut, leave a full-thickness strip along the end of the tabletop. When the cut is completed, you can pop off the waste with a chisel, or simply crosscut the tabletop to remove it. (This four-pass cut is being made with the wide spacer for the first pass, the narrow spacer flat for the second and on edge for the third pass. The final pass is accomplished with the router directly against the fence.)



Use a marking gauge to scribe the edge of the stub tenon. Mark off the edges of the full tenons with a small square.

Cut the tenons with a jigsaw. Use a scrap of 1/2" MDF to support the saw when you cut the edges of the tenons and saw an arc into the waste between the tenons. You can rest the saw on the tabletop to cut along the stub tenon.

Fit the breadboard and secure it temporarily with a couple of pipe clamps. Lay out and drill holes for the pins that will permanently secure it, one pin per tenon. I locate them about 1" from the shoulder of the joint. Remove the breadboard end and elongate the holes in the two outside tenons. I think it's important not to enlarge the holes, since that would allow a gap to open between the breadboard end and the tabletop. Remount the breadboard ends and drive the pins. **PW**

First groove an edge of each breadboard end. To lay out the mortises, fit the breadboard end onto the tenons and mark their edges on the end.

I rout the mortises in the ends with a plunge router, edge guide and a shop-made mortising jig (see issue #140 for details on the jig). Rout the center mortise slightly wider than the tenon (1/16"), but cut the flanking mortises wider than the tenons (1/8" or more) to accommodate expansion and contraction of the tabletop.

The holes for the pins in the outside tenons must be elongated to allow the tabletop to move. If the end is to be held tight to the tenon shoulders, the elongation must be parallel to the shoulders. So use a marking gauge to scribe tangents to the drilled hole, and stay within the marks as you extend the hole.

Fit the breadboard ends without glue (or with only the center tenon glued). Apply a couple clamps to hold the ends in place while you drive the wooden pins that secure the ends on the tabletop.

Lathe Maintenance Techniques

Regular attention to a few simple procedures will keep you turning smoothly.

Photos by Al Parrish

A few simple tools and supplies, used regularly, will help keep your lathe functioning smoothly so you can concentrate on your turning. A file, rubber-bonded abrasive blocks such as Klingspor's Sandflex hand blocks (or sandpaper), paste wax, machine oil and some clean cloths are all you will usually need.

A lathe, like any other piece of woodworking equipment, is exposed to wood shavings, dust and other substances as well as general wear and tear. The bed, toolrest base and toolrest especially require regular attention for easy functioning. I can't count how many times I've watched people huffing and puffing, trying to slide a toolrest around on a lathe bed that is as rough as sandpaper (or as sticky as flypaper). Not to mention the number of times I've had to face such a lathe myself while doing demonstrations.

A poorly maintained lathe is no fun to use and can easily frustrate your efforts to achieve those lovely, clean cuts and smooth curves you so want your work to have.

Some very simple procedures, regularly done, will prevent such frustrations. How often you need to do these things will vary according to how much you turn and what kinds of things you are doing with the lathe. I generally clean and wax the bed, toolrest base and tailstock base; and I file, polish and wax the toolrest itself about once a week when I'm using that lathe every day.

If you are turning a lot of green wood, however, you should probably at least clean, polish and wax the bed each time you are done turning for the day. (A gunked-up bed is bad enough, but a rusty one is unforgivable.) If you turn only small items of dry wood and don't finish them on the lathe, you may need to do this only occasionally.

Less often, you will (or may) need to clean out electrical switches, adjust the alignment of the head and tailstock, make sure there is even pressure on all four feet of the machine, balance the handwheel and so on.

You should always read and make sure you understand any information or directions that came with your particular machine. There may be specific maintenance recommended for that machine that isn't mentioned here.

And last but definitely not least, don't forget to perform regular maintenance on your face shield. This essential tool isn't something you can buy and then use forever without further attention. The shield will become scratched, spotted and smudged over time.

While regular cleaning will certainly add longevity to your face shield, you'll need to replace it occasionally, so you can actually see all those wonderful things you are making as you turn them.

by Judy Ditmer

Judy, author of two turning books and many articles, has been turning since 1985. She teaches and demonstrates her skills throughout the United States and Canada.

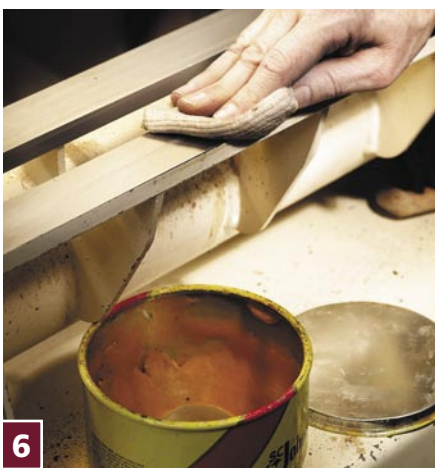
I use this white board to provide a clean visual background while I am working, as well as to prevent any item I don't catch (as I part it off) from dropping behind the lathe where it would be harder to retrieve. The board is laminate glued to hardboard. Finish materials, paint and sometimes moisture from wet wood are all flung onto the board during turning, so it needs to be cleaned regularly. After cleaning, I apply a coat or two of paste wax to keep things from sticking to it.

The toolrest is subject to considerable abuse, and regularly develops scratches, dings and grooves. These irregularities interfere with the movement of the tool as it slides along the rest, and this will make turning accurately and cleanly more difficult.

Place the toolrest in a convenient position and lock everything down. Cover the bed to protect it from metal shavings, and file the top of the toolrest to remove the irregularities. Run the file along the front edge a couple of times too, or it will become quite sharp over time. I use rubber-bonded abrasive blocks to further smooth the rest; you can also use sandpaper. Then coat the toolrest with paste wax, allow it to dry and buff with a clean cloth.

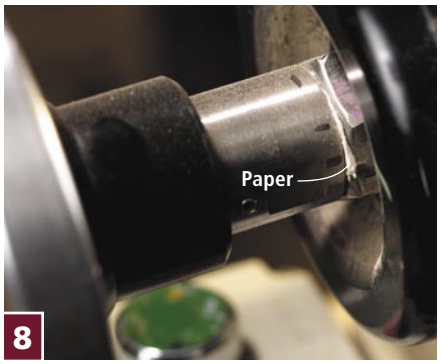
The bed of the lathe quickly becomes scratched and covered with sap residue and finish materials, making it more difficult to move the toolrest.

Remove the tailstock and toolrest base. Polish the bed with rubber-bonded abrasive blocks or sandpaper (#180 grit is good, unless the bed is badly scratched or dinged) until it is clean and smooth.



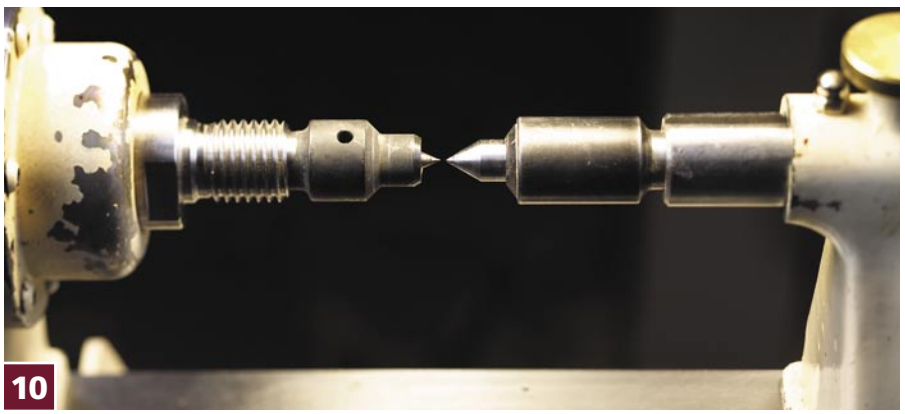
Apply a thin coat of paste wax, allow it to dry then buff it smooth with a clean cloth. Two or three coats won't hurt, particularly near the headstock, where buildup tends to be heavy.

Clean out the Morse taper whenever you are going to insert a drive center (or live center, in the case of the tailstock). This plastic taper cleaner is available from Packard Woodworks (800-683-8876 or packardwoodworks.com). If you don't have one, you should at the very least blow any dust or other particles out of the opening.



If your lathe has a handwheel on the outboard side of the headstock, be sure it is running true; an unbalanced handwheel causes vibration while you are turning. This one was slightly off; a sliver of paper in the right location between the wheel and the flat it tightens against solved the problem.

Run the quill feed on the tailstock all the way out, clean off any debris and place a drop of oil on the spindle before retracting it.



Check to make sure the centers on the headstock and tailstock align properly. If they don't, follow the appropriate procedure for your particular machine to adjust them.

Keep belts properly tensioned. If they are too loose, the belts will slip too easily during turning; if they are too tight, the belts will wear out faster. Check for any unusual wear or fraying on the belts; if you see any, determine the cause and correct it before further damage occurs.

Some lathes provide a means for leveling. While it isn't necessary to have the bed of the lathe level, all four feet must have the same pressure on the floor to prevent wobbling. I do keep the bed of my large lathe level; it's handy sometimes to have a clean, flat surface in the shop that I know is level.

The bottom of the toolrest and the tailstock pick up debris and scratches, although not as quickly as the bed. Sand or polish, then wax as with the bed and toolrest.

This is the remote switch on my small lathe. It sits under the handwheel on the outboard side of the headstock, a location which is very convenient for me while turning, but which exposes it to a lot of dust. I find I need to clean it out occasionally. Don't forget to unplug the machine before opening the switch. **PW**

Some Reflections on Sheen

Understanding how sheen works allows you to control the gloss on your finishes.

One of the most important qualities of a finish when it comes to appearance is sheen. A finish can vary from a gloss so high it reflects the sharp outline of an image to a sheen so dull that nothing is reflected. In determining how you want your project to look, you need to take its sheen into account.

In the last issue of *Popular Woodworking* (issue #156) I explained how you can control sheen by rubbing it with abrasives of various grits. The coarser the grit the lower or flatter the sheen. The finer the grit the higher or glossier the sheen. The problem with rubbing is that it is a lot of work.

An easier method of controlling sheen, and the method most commonly used, is to choose a finish with the sheen already built in. Then all you have to do is brush or spray the finish onto the wood and the sheen will come about automatically.

A hundred years ago, before electric lighting, people preferred a gloss sheen because gloss reflects a lot of light and makes rooms appear brighter. Today, most people prefer a flatter sheen.

Manufacturers offer a variety of choices. Unfortunately, the words they use to describe these choices are vague: gloss, semi-gloss, satin, eggshell, rubbed effect, matte, flat and dead flat. There are no fixed definitions for these terms; so one manufacturer's satin may be another's flat.

To be successful in getting the sheen you want on your projects, you need to understand how the sheen-creating elements in a finish work and how you can manipulate them.

Flatting Agent

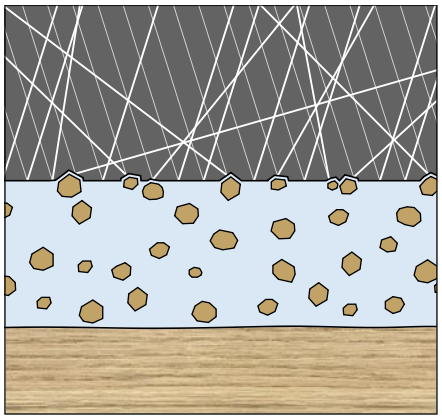
The stuff in a finish that creates all the sheens lower than gloss is called "flatting agent." It is a very fine silica product that settles to the bottom of the can and has to be stirred into suspension before using. Gloss has no flatting agent added and therefore nothing to stir.

Though silica is a more complex material than fine sand, it's often helpful to think of it as fine sand for the impact it creates at the surface of a finish. Here's the way silica works.

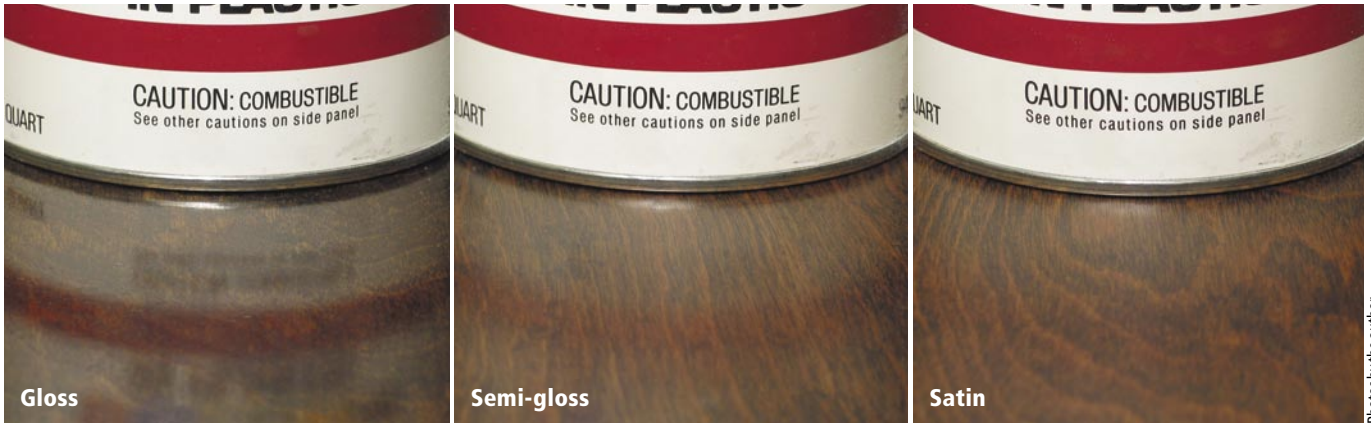
The manufacturer adds the amount of silica necessary to create a given sheen to a polyurethane varnish, standard varnish, lacquer, catalyzed finish or water-based finish. All film-building finishes except, unfortunately, shellac are available with silica added. (It's not true, as you sometimes hear, that lacquer is always glossy.)

by Bob Flexner

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



A finish with flatting agent added appears dull because of light being scattered off the microroughness at the surface of the film. This microroughness is created as the solvent evaporates by the finish "shrink-wrapping" around the particles of silica that lie at the surface.



Photos by the author

A finish can have an infinite number of sheens depending on how much flatting agent (silica) is added. Above are examples of how the sheen, and resulting reflection, changes when flatting agent is added to a gloss finish.

All the sheen is created in the last coat of finish applied. Previous coats have no impact. Here's the proof. On the left half of this board, I brushed on three coats of gloss water-based finish. On the right half, I brush on three coats of satin water-based finish. Then I brushed satin water-based finish onto the right half of the gloss side and gloss water-based finish onto the left half of the satin side. The resulting glosses and satins are the same irrespective of what's underneath. The same would be the case no matter what type of finish I used.

To easily create a sheen not available at a store, pour off some of the gloss from a satin or flat finish after letting all the silica settle to the bottom of the can. Then mix the two (gloss and very flat) until you get the sheen you want.

Just before using the product, you need to stir the silica into an even suspension throughout the finish. You can also shake the can, but this may not be as effective unless you have a mechanical shaker like those in paint stores.

With the silica in suspension, you brush or spray the finish onto the wood. You may notice that the finish goes on glossy. That is, it has a high reflective quality. But there will come a point within a short time (depending on the drying rate of the finish) when this gloss sheen flattens quickly across the surface.

The flattening is caused by the finish "shrink-wrapping" over the particles of silica that lie at the very surface of the film. This occurs as the solvent evaporates and the finish shrinks. The shrink-wrapping creates a micro-roughness at the surface that scatters light so the gloss is reduced. The higher the density of silica at the surface, the flatter the sheen of the film finish.

It's important to emphasize that the flattening is not caused by the silica particles embedded deep within the film as is commonly believed. Because of its nature, silica doesn't hinder the travel of light; it's as if the particles weren't even there. As a result, successive coats of a satin or flat finish don't make the finish flatter.

Because all the flattening occurs at the surface of the film, it's easy to rub a satin finish to a gloss using fine abrasives. Begin by removing the micro-roughness with very fine sandpaper, then rub with fine abrasive compounds.

Manipulating Sheen

As mentioned, manufacturers aren't very informative about the sheen of the products they sell us. First, their terminology is vague. (Among themselves, they use a more exact numbering system from 1 to 100, with 100 being perfect gloss; but they rarely share this information with us.) Second, they often give us only two choices.

What if you want a sheen that is flatter than anything offered in the store, or you want a sheen that is in between the two choices offered?

To create a flatter sheen, let the flatting agent settle to the bottom of the can (tell the paint clerk not to shake the can). Then pour off some of the gloss finish at the top into a second container. You will then have some gloss in one container and some flat in another. Blend these two until you get the sheen you want.

Of course, you'll need to experiment by applying some of your blend to wood to see the sheen you are creating. Be sure to apply two coats because it's only the second coat that will produce an accurate sheen. It doesn't matter, of course, what you use for the first coat.

It's even easier if you want a sheen in between those of two products offered. Simply stir the flatting agent to put it into suspension and then mix the two.

Sheen Problems

Once you have determined the sheen you want and have a product that will produce it, problems are rare. The most common is not keeping the finish stirred. More rare, but also possible, is white specks appearing in the dried finish film.

It's not necessary to continually stir a flatted finish while brushing or spraying. But it is necessary to stir between coats.

If you are brushing, some of the flatting agent will have settled and the finish you are pulling off the upper level of the container will be glossier than you intend. If you are spraying, some of the flatting agent will have settled and the finish entering from the lower part of the spray-gun cup will be flatter than you intend.

Though it is rare, you may find tiny white specks in your dried finish and wonder where they came from. Unless you are using a dirty finish, it's most likely you have broken some clumps of dried silica away from the lip of the container. These clumps don't break up in the finish so they show up as white specks in the film.

There's no way to effectively strain these clumps because they are very small. It's best to toss the container and all the finish in it and begin again from a fresh can. You'll have to sand out the white specks from the dried film to remove them. **PW**

Coming next issue: Making sense of dyes: Don't let the packaging confuse you!

Sawdust in the Soup

Get your daily fiber requirements with just one crosscut.

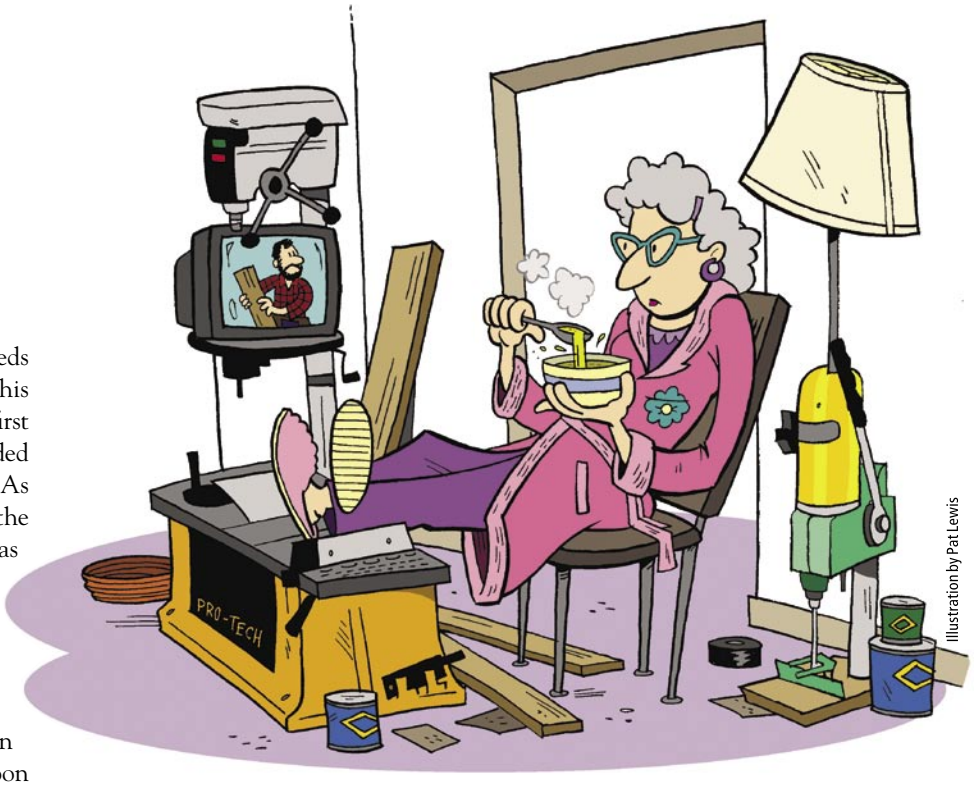


Illustration by Pat Lewis

The ad read: "3 bdrms, 1½ baths, needs TLC." More than a fixer-upper, this house was a down-and-outer of the first degree. My mom, my son and I needed something cheap. The price was right. As derelict as the rest of the house was, the kitchen was the *pièce de rèsistance*. It was the knotty pine so popular in the 1960s. Mostly rotted through, black with grease and grime, and home to a thriving population of cockroaches. Now I am not the squeamish sort but that kitchen made even my intrepid soul cringe. My son Rob, made of sterner stuff than I (and soon to escape to college) stepped to the plate. Armed with a crowbar, respirator mask and a tetanus booster, he went to work. The kitchen was gutted to the studs. As there was no other place for my woodworking tools, I claimed this area as my own.

Three long years were spent on the necessity of home repairs. The frog prince (aka the kitchen) slowly metamorphosed into a thing of beauty. But the tools still had no place to call their own. And still there were scads of projects from kayaks to living room furniture that had to be built . . . .

You know, I'm still not exactly sure what became of my mother's good sense and balanced judgment. I don't think it was my router bits coexisting peacefully in the drawer with the cooking utensils. Nor was it finding my handsaws wrapped in her table linens to protect their fine edges, or storing the sandpaper in the napkin holder to keep the grits organized.

No. On reflection I think it was the day she found sawdust floating on her soup. It wasn't much, mind you. More of a garnish really. Somehow my observation that the extra fiber would be good for her didn't seem to help. She became totally unreasonable. Really worked up over it. She wanted the tools out of the kitchen. Yesterday.

We woodworkers are a creative lot and the solution came quickly to me. I decided to use my tools as furniture in the living room. My mom's soup would be safe. Two birds, one stone. Domestic harmony once again.

My floor-model drill press does an admirable job as an end table beside the couch. The table was lowered to a comfortable height and it's a great place to rest cold drinks. It even has a built-in reading lamp. Care must be taken, however, that condensation doesn't leave rust rings on the cast-iron surface.

The Pro-Tech benchtop table saw was a little more challenging. It was rehabbed as a library desk. The school-bus yellow does clash somewhat with the overall color scheme. To counter this, the Woodtek mortiser was rewired into a lamp. Combining its bright green body with the cheerful yellow knobs helped to tie in the golden yellow of the saw. Now the colors vibrate and bring life to the otherwise unimaginative room.

It was most difficult finding a schizophrenic new self for the radial arm saw. This is my favorite machine. And while it doesn't fetch my slippers for me at the end of the day, it has provided good company throughout countless projects. It made much more sense, I patiently explained to my mother, to keep this tool in the kitchen.

I won this fight because experience quickly proved: No matter how dusty the soup, it is still easier to vacuum the dishes than to clean the living-room upholstery.

So now when Rob brings his buddies home from college, I am thrilled with their speechlessness as they admire our charming décor. My son recommends they try the soup *du jour*. He informs them they can meet their daily fiber requirements in just one bowlful. **PW**

by Kate McDonald

Kate recently moved to West Virginia where she's contemplating a new career as an interior designer.