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NOVEMBER 2004
ISSUE #144

Popular Woodworking

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Lonnie Bird's Tips for Better Glue Joints

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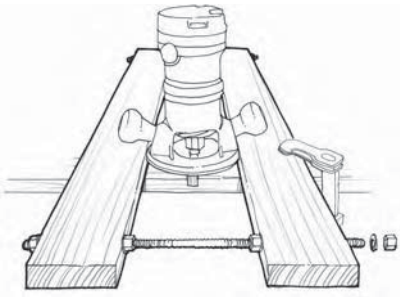

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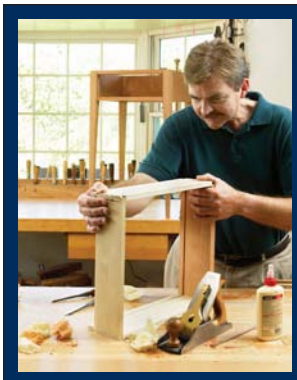

ON THE COVER

Good glue joints are essential to a durable project. Lonnie Bird gives you the facts on where you should apply glue, how much you should apply and what to do with the squeeze-out.

Cover photo by Al Parrish

DEPARTMENTS

PROJECTS, TOOLS AND TECHNIQUES

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SAFETY NOTE

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

Buyer Beware: Tool Prices Heading Up

Woodworkers have enjoyed relatively stable prices on almost the entire range of woodworking tools, be they electric powered or hand tools, for years. But all that's about to change – and in some quarters, the change has already begun.

So let this serve as a warning: Those planning a power tool, hand tool or machine purchase in the near future would be well advised to act now, certainly before year's end.

Don't blame manufacturers for the price increases. They have all worked hard to hold the line on prices, absorbing increased production costs or the price imbalances caused by the sagging U.S. dollar compared to foreign currencies, most notably the Euro.

Another culprit is the increasing cost of raw materials and oil. The price of metal has been on a steady and constant climb. And I'm sure the price of gasoline hasn't escaped your attention lately.

So if you can, treat yourself to an early holiday gift. It'll be worth it.

Welcome Bob Lang

I'm pleased to introduce a new staff member. Robert (Bob) Lang is now working on the editorial team as a senior editor and we all are thrilled to welcome him aboard.

Like most of the *Popular Woodworking* staff, Bob comes with more than a strong passion for woodworking; he also has many years of professional woodworking experience. Over the years he's built furniture and cabinets, and produced architectural millwork. He's worked in big and small shops alike, and for years ran his own shop and marketed his woodworking on the craft fair circuit. As you can see, Bob has real woodworking "chops."

But that's not all. Bob also has authored a number of woodworking books – notably "Shop Drawings for Craftsman Furniture," "More Shop Drawings for Craftsman Furniture," and "Shop Drawings for Craftsman Interiors" (all published by Cambium Press). They're available through Bob's web site at craftsmanplans.com. He's currently finishing two more books, "Shop Drawings for Craftsman Inlays & Hardware" (to be published this fall) and "The Complete Kitchen Cabinetmaker" (which is scheduled for publication next year). He's also contributed articles to *Woodshop News*, *Woodwork* and *Fine Woodworking* magazines.

Adding Bob to what I already consider the best woodworking magazine staff in the business means even more depth to the articles we send your way each issue.

A Charitable Reminder

In my column last issue (October 2004) I introduced you to a new program we've undertaken that pledges us to make charitable contributions when you help us find new readers. Let me first say thanks to those who already have the ball rolling. For those who missed the column last issue, here's how the program works:

In a nutshell, when you provide us with the name and address of a person you think might enjoy receiving *Popular Woodworking*, we'll send them a free issue. If they elect to subscribe, we'll set aside $5 to be split between the American Cancer Society and The Nature Conservancy. You can read more about the program or send along names to receive a free issue by visiting our web site at popwood.com/charity.html. You will find printed forms to submit names in future issues as well. **PW**

Steve Shanesy

Steve Shanesy
Editor & Publisher

CONTRIBUTORS

DAVID CHARLESWORTH

It's hard not to be impressed when you see David at work with a hand plane. During his more than 30 years as a professional woodworker (and more than 25 years of teaching), David has devoted a lot of energy towards understanding exactly how these tools function. And he's developed a series of simple (but some would call non-traditional) ways of coaxing astonishing results from even meager tools. One of his favorite tricks for setting up a plane iron begins on page 82. When he's not writing or building furniture, David teaches small classes of students to build finely detailed furniture in his shop in the historic village of Hartland, which is near the north coast of Devon, England.

KERRY PIERCE

Although Kerry specializes in post-and-rung chairs and Queen Anne-style furniture, he doesn't do slavish reproductions. Rather he blends period elements and takes advantage of modern technology. By replacing the traditional sliding dovetail leg joint with a tenon in his "Shaker Tripod Table" (see page 76), he avoided unnecessary labor but still produced a sturdy joint. A high school English teacher for more than 30 years, Kerry has combined his passions for writing and woodworking in his 10 woodworking books and numerous magazine articles. A recent battle with cancer kept him out of the shop for months, which "just drove me crazy," he says. But today, he's making sawdust again.

Reader Takes Issue With a Chisel Review

Test of Lie-Nielsen Chisels Gives Short Shrift to Japanese Tools

Your opinion about the Japanese chisels (Tool Test, August 2004) is totally wrong. I assume that you were talking about the very expensive Japanese tools, not the regular blue or white steel ones. After struggling with regular occidental chisels and becoming tired of having to go to my waterstones every half hour, I bought a few blue steel chisels and now I can chop dovetails almost the whole afternoon with only a 30-second honing every couple of hours – and I did not pay $250 for them.

For the record I own a few Lie-Nielsen planes. I love them and I'm planning to buy more. I really like their tools.

But as the editor of a woodworking magazine you should be more impartial and do some research before recommending some brand and bad-mouthing another one.

Ricardo Druillet
via the internet

Editor's note: I think if you read my review again you'll see that I never said that the Lie-Nielsen chisels held an edge longer than the Japanese chisels. In fact, I wrote that the two Nishiki chisels, Barr and Lie-Nielsen chisels all "stayed sharp through tremendous abuse."

My only quibble with the Japanese chisels is that they are too small for my larger Western hands and that the Lie-Nielsens were more comfortable to use. I've been testing the Lie-Nielsens (from prototype to early production models to the final production models) for 18 months now. My test results were confirmed independently by a fellow editor here at the magazine and I stand by my review.

I have no doubt that your Japanese chisels go a very long time between sharpenings. And until the Lie-Nielsen tools came along, I used Japanese chisels almost exclusively for all my woodworking projects. But now there is a Western chisel that is made with the same care and quality as the Japanese chisels. If you try a set of Lie-Nielsens at a woodworking show, I think you might agree.

— Christopher Schwarz, executive editor

How do the Lie-Nielsen A2 Chisels Compare to High-speed Steel Tools?

In your recent review of Lie-Nielsen chisels, I was intrigued to read about A2 steel being used for the chisels for the first time. The A2 steel seems to have a high Rockwell hardness equaling those of Japanese tool steels, and I have no doubt they perform as well as any traditional Japanese laminated steel chisels.

Interestingly, from my past visits to Japan, I have also learned about the growing trend in Japan of using high-speed steel (HSS) for forged bench chisels. Apparently the advance of HSS technology has allowed blacksmiths to forge bench chisels with incredible strength and a slim profile. They hold a great edge against composite materials, and also endure the heat of powered grinding, much like HSS turning tools.

There seems to be several ways to incorporate HSS into the chisel, but the best method appears to be a chisel made entirely from HSS with no laminations. The best-known HSS chisel maker in Japan is Sukemaru (a fourth-generation blacksmith), and I have heard good

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WRITE TO US

Popular Woodworking welcomes letters from readers with comments about the magazine or woodworking in general. We try to respond to all correspondence. Published letters may be edited for length or style. All letters become the property of *Popular Woodworking*. How to send your letter:

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things about his chisels. A set of 10 Sukemaru all-HSS chisels costs about $400. I wonder if you have heard of them, and how they fare in durability. There seems to be a correlation between the American A2 steel and Japanese HSS steel chisels with how new technology improves upon traditional design.

Eiyo Baba
Honolulu, Hawaii

Editor's Note: I have yet to find any chisels from Sukemaru available in this country, and have found only a couple brands that incorporate high-speed steel. Contact Tools for Working Wood (toolsforworkingwood.com or 800-426-4613) or Dieter Schmid - Fine Tools in Germany (fine-tools.com). High-speed steel can indeed be made very hard (up to 68 on the Rockwell "C" scale, according to "The Tool Steel Guide" by Jim Szumera [Industrial Press]). And it can be quite durable if properly heat-treated. I have a HSS chisel on my bench and will be interested to see how easy it is to sharpen and how tough the edge is. I'll report back my test results in a future issue.

— Christopher Schwarz, executive editor

'Lap Desk' Knob Looks Too Fragile

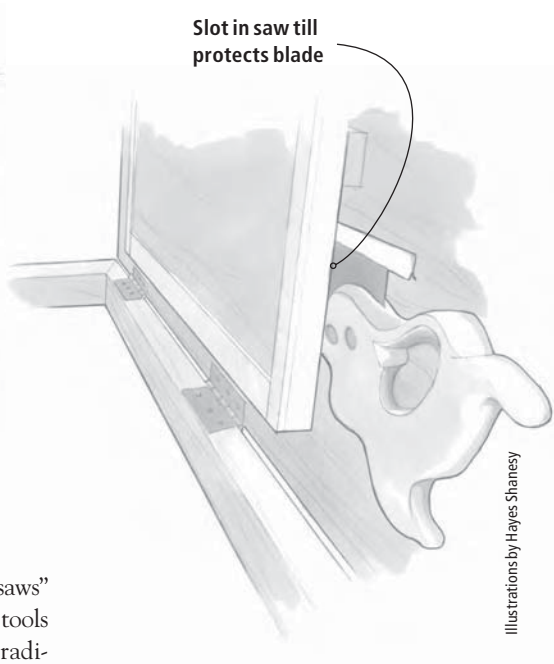
I've been self-employed since about 1992, doing all kinds of residential and commercial alterations and renovations. I have a concern about the "Shaker Lap Desk" (June 2004): The drawer knob looks too fragile sticking outside the front surface of the drawer front. I'm afraid it would break off accidentally. Can't you make the drawer front thicker so the handle might be recessed so the outside of it is flush? It also seems more pleasing visually.

Kerry Ness
Lillooet, British Columbia

Editor's Note: The knob is somewhat exposed to accident as you mention, but in building the desk we tried to work within a certain amount of material usage, too. By using 3/8"-thick cherry for the project, we could control the yield (by resawing and with grain match). But you're correct – the knob can be recessed in a significantly thicker (1" or greater) drawer front to accommodate the 5/8"-long knob. This would allow the knob to recess flush to the surface of the drawer. **PW**

— David Thiel, senior editor

Should I Drill a Hole in My Saw to Hang it?



Illustrations by Hayes Shanesy

How Best to Store Handsaws?

I loved your article "The Case for Handsaws" (August 2004). I love working with hand tools and believe that understanding how traditional tools were designed and how they work make me a better woodworker. I also believe that understanding how hand tools work helps me with my power tools.

I have a couple questions. What is the best way to store handsaws? Does it hurt to drill a hang-hole at the tip of the blade?

Joel Casto
Juneau, Alaska

In the shop I usually hang my saws by the handle over a peg or dowel. In my tool chest I store them on the underside of the lid by sliding the end of the blade into a slotted sleeve fixed to the underside of the lid. Some woodworkers also drop the handle over a piece cut to match the hand hole (also fixed to the underside of the lid), which is then secured by a turn block. Alternatively, saws may be stored lengthwise but upright in a narrow compartment fitted with a slotted piece at each end – saws are then alternated left to right and right to left with the blade end dropped into one slot and the handle end dropped into the slotted piece at the other end.

I also usually provide my saws with a blade guard: this can be as simple as a narrow piece of wood, as long as the blade, which is kerfed down the middle so it slips over the teeth. It may stay in place either by friction or, as with time the kerf becomes worn wider, by being held on to the blade

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WRITE TO US

Every day we get questions from readers on all subjects about their woodworking. Some are letters; many are e-mail messages. 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. In addition to the hundreds we answer privately every month, we want to share the best questions here with readers.

Send your questions via e-mail to popwood@fwpubs.com, or by mail to:

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with a rubber band. Traditionally it would have been held to the blade by a leather thong at each end. (The nib often found at the narrow end of handsaw blades serves to capture the thong at that end. The curved cutout invariably found in the handle of saws captures the thong at the other end of the blade guard).

As for boring a hole in the blade I doubt that it hurts (much), but I wouldn't bother; some saws are actually manufactured with a hang hole, but lacking such a hole you can always hang the saw by the handle.

— Graham Blackburn

What Wood is Best to Use When Making Featherboards?

I'm planning on making some featherboards but am unsure what wood to use. Does it make a difference?

Dwayne Crider
Austin, Texas

Just about any straight-grained hardwood will do. For my featherboards, I prefer ash, but maple and birch are good choices, too. Stay away from anything that has short grain or is brittle. These can break in the long term.

— Christopher Schwarz, executive editor

Are There Important Differences Among Premium Plywoods?

With some of the "premium" plywoods, what are the differences in finishing, screw-holding and workability among cabinet-grade plywoods such as Baltic birch, Appleply, Europly Okume and the others out there?

Some lumberyards say there are no differences. Others cite differences in facing, materials to fill voids, splintering, stiffness, finishing qualities, personal preference and a number of other answers. Please help. I would like to use some plywood for jigs, entertainment centers, shelves, shop cabinets and other projects but am not sure if I need to look at one type or another or just look at the cost.

Rick Shields
Portland, Oregon

The differences in premium plywoods are a lot like those between brands of masking tape. They're all very similar, some are slightly better, but they'll all do the job. The differences may include where the originating "tree" came from (the Baltic states, Sweden, etc.) and the type of glues that are used in the laminating process, interior grade or exterior grade. Plywoods go through a grading process (overseen by the American National Standards Institute, ANSI) and are rated as to quality of face and core materials. All premium plywood should be void-free, which means the voids have been patched, not that the facings are completely clear. Their working properties will be similar, and all are better than sheathing ply and similar three- or five-ply "utility" plywood options.

— David Thiel, senior editor

Can I Use a Bullnose Plane to Trim the Shoulders of My Tenons?

I thoroughly enjoyed your article on mortise-and-tenon joinery ("Mortise & Tenon Basics," April 2004). As a new retiree, I have just recently got into woodworking – shame on me for not discovering this great hobby much earlier in my life!

You mentioned in the article that Lee Valley Tools may be coming out with a wider shoulder plane. On the Lee Valley web site (leevalley.com), they show a "bullnose shoulder plane," which looks pretty versatile.

It is 1" wide, has a low bed angle of 15°, and, with the bullnose removed, can be used as a chisel plane. What are your thoughts regarding using this plane to trim tenons?

Jim Mattavi
Knoxville, Tennessee

The Veritas bullnose plane is a very good tool. I have one in my toolbox now. But bullnose tools (no matter who makes them) aren't much help with trimming tenons. The reason is that there isn't much sole in front of the tool's blade – like in a shoulder plane. This additional sole allows you to position the plane properly on the joint and keeps the tool steering straighter through the cut.

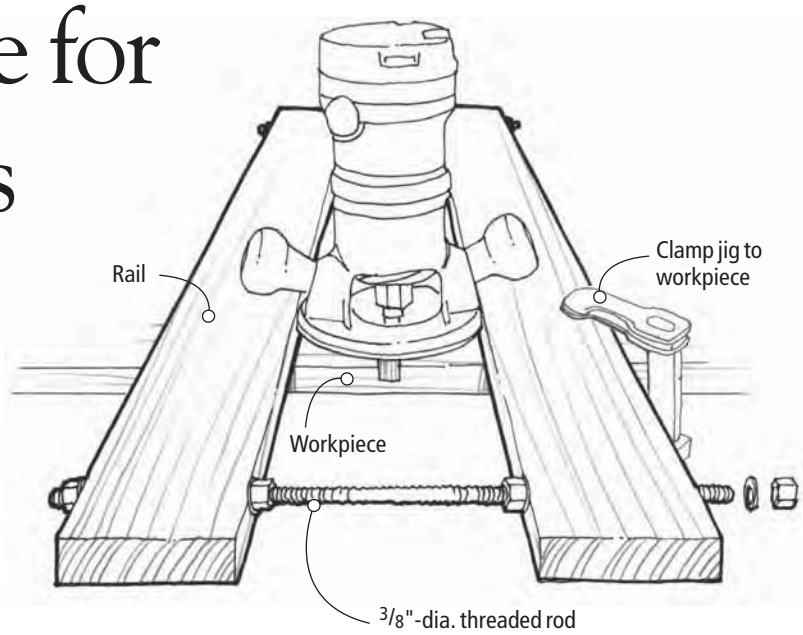
If you are looking for alternatives, I recommend the Veritas medium shoulder plane (a wider version is indeed due out this fall). For larger work I prefer the Lie-Nielsen 073 and the Lie-Nielsen rabbeting block plane.

If you're now wondering what bullnose planes are good for, they excel at cleaning up rabbets and making them bigger. I also use them for flushing up casework assemblies after everything is glued up. When configured as a chisel plane, they are great for cleaning out junk in corners. The Veritas plane is available from Lee Valley Tools (800-871-8158 or leevalley.com) for $129. **PW**

— Christopher Schwarz, executive editor

Compiled by Paul Anthony
Illustrations by Matt Bantly

Simple Guide for Straight Cuts



THE WINNER:

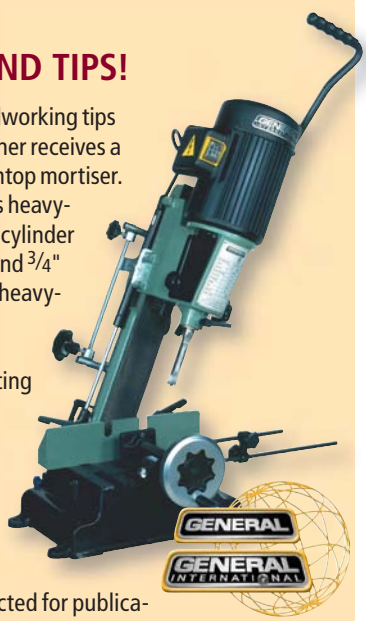
This simple, foolproof jig works well as a guide when routing dados and when cutting sheet goods with a jigsaw. Easy to build and use, the jig consists of two hardwood rails milled straight and square, and connected with threaded rod. The beauty of this guide is that the space between the rails is infinitely adjustable. Therefore, a saw or router can be held captive between the double rails to prevent a tool from wandering off course. Alternatively, the space can be widened to allow multiple router passes in order to create a dado of any width.

Of course, you can make the guide any length you like, but be sure to use hardwood. I made my rails 7/8" x 3" x 60". After making the rails, bore a 3/8"-diameter hole using a drill press from edge-to-edge through each piece near its end. Make sure the hole spacing matches on both pieces. Cut two pieces of 3/8"-diameter threaded rod 14" long, then use them to join the two rails together with flat washers and nuts. Tighten the nuts against one of the rails, and use the nuts on the other rail to adjust the rail spacing.

To use the guide, adjust the spacing of the rails to suit the diameter of your router baseplate or your jigsaw's foot. After clamping the guide to your workpiece at both ends, slip your tool between the rails and make the cut.

Steve Mazzoni
Wallkill, New York

CASH AND PRIZES FOR YOUR TRICKS AND TIPS!



Each issue we publish useful woodworking tips from our readers. Next issue's winner receives a General 75-050 tilting-head benchtop mortiser. This high-quality machine features heavy-duty, cast-iron construction, a gas cylinder for smooth 6" chisel strokes, 5/8" and 3/4" sleeves for multiple chisel shanks, heavy-duty rack-and-pinion gearing for smooth, accurate mortising and a TEFC 1/2-horsepower motor operating at 1,720 rpm.

Runners-up each receive a check for $75. 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.

Orienting Curl so it Looks its Best

When working with curly wood, it's important to orient the pieces of a project properly. Because light catches the curl differently from opposite directions, it can look more pronounced when viewed from a particular angle. Therefore, if you want visual consistency and balance, make sure to orient the pieces in a consistent fashion.

For example, when laying out the parts for a door frame, I lay each pair of stiles side by side and view them by looking down their length from one end, then the other. I'll flip the pieces end for end until the intensity of the curl looks the same. Then I make sure that all of the other doors' stiles on the piece are oriented in the same direction for consistency. Same goes for the pairs of rails. For that matter, edge-joined boards that form a panel should be consistently arranged. If it helps, you can temporarily accentuate the figure by wetting the wood with water or mineral spirits.

And don't forget that the look of the finished project will depend on which direction you're viewing it from. A low cabinet like a sideboard will be viewed from above while a tall wall cabinet will be viewed partially from below.

Paul Anthony
Riegelsville, Pennsylvania

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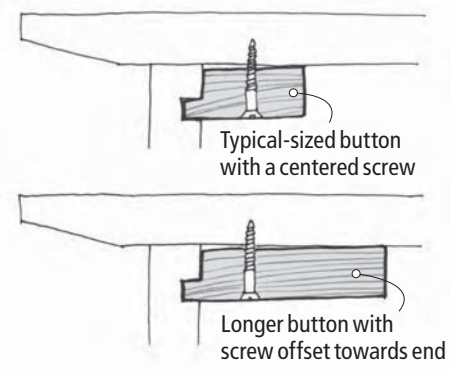
Stronger Buttons

Traditionally, a tabletop often is fastened to the table's aprons using notched blocks called "buttons" that insert into slots in the aprons. This allows the top to expand and contract with seasonal changes without cracking. Buttons are typically fairly short, with the screw centered along the length of the button (as shown below top). For most circumstances this is fine. However, if a top is warped, a button of normal size may not provide the leverage necessary to pull the top flat. When this happens, I make longer buttons, locating the screw as shown in the illustration below. In this case, tightening the screw applies much more pressure. In fact, it works so well that I regularly use longer buttons now.

Percy Blandford
Warwickshire, England



Preserving Unused Finish

I've lost many half-filled cans of oil and polyurethane that skinned over after sitting in a half-empty can for too long. I've tried crushing the cans and raising the level of the finish by adding marbles, but neither method works well with half a can of finish. Lately, I've discovered that the wine-preserving vacuum-pump devices sold in kitchen-supply outlets can do double-duty in your shop. You might already have the $7 pump (it won't get damaged if you borrow it for shop use). The rubber one-way valves that serve as "corks" cost less than a buck apiece.

To use, simply pour your finish into a beer or wine bottle, insert the cork and pump out the air. It works great. I have a bottle of wipe-on polyurethane that has not skinned over for six months (and counting).

Joe Wajszczuk
Platteville, Wisconsin

Getting Shellac to Dissolve Faster

To make your shellac flakes dissolve faster, grind them up first in a coffee bean grinder. This greatly increases the surface area of the raw shellac flakes and reduces the amount of time between mixing and finishing.

You'll want to purchase a dedicated blade-style grinder for this operation – no one likes lac bug parts in their morning cup o' joe. Inexpensive coffee bean grinders cost about $10 new, although they're also pretty common at yard sales. Grind the flakes no more than about 20 seconds, then pour them into a jar and add the alcohol.

Christopher Schwarz
executive editor

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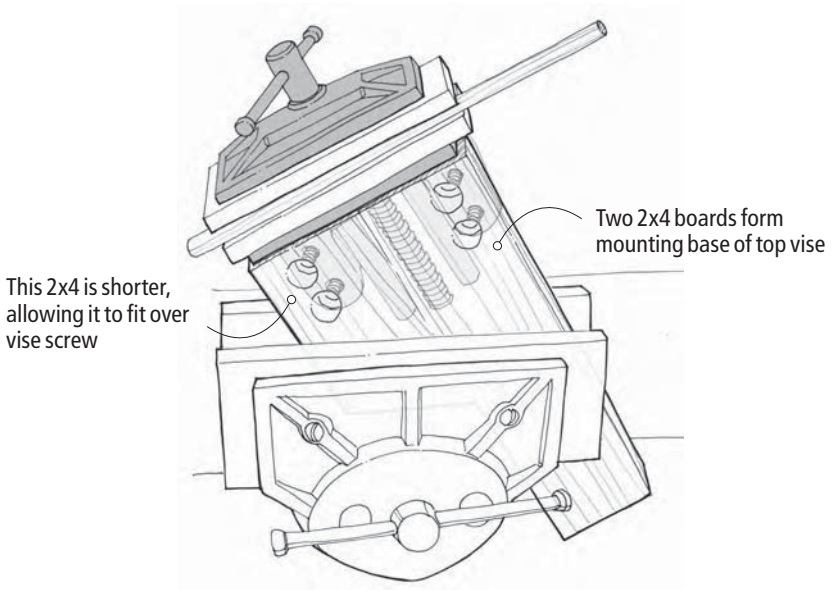
Versatile Vise-in-a-Vise

Patternmaker's vises manufactured by companies such as now-defunct Emmert have long been valued for their ability to twist and turn in any direction, allowing you to hold all sorts of work at different angles. Unfortunately, patternmaker's vises are expensive – when you can find them at all.

I've found that the next best thing is to mount a secondary bench vise on a stout "holder" that can be clamped in a main vise mounted to the bench. This setup is far cheaper than a patternmaker's vise, and it's almost as versatile. One simple example is shown here: When spokeshaving a hammer handle to fit its head, the secondary vise is mounted with its jaws perpendicular to the jaws of the main vise to better resist the downward forces of the tool.

My secondary vise is a small model, mounted on a couple of lengths of 2 x 4 stock – the longer of which is about 24" long. This creates a great variable-height, variable-angle work holder. The short "leg" of the holder typically sits over the main vise screw and bars for better grip. Chamfering the corners of the holder makes it a bit easier to insert it into the main vise. I bolted my vise to its holder, but you could use lag screws instead.



Paul Womack
Norfolk, England

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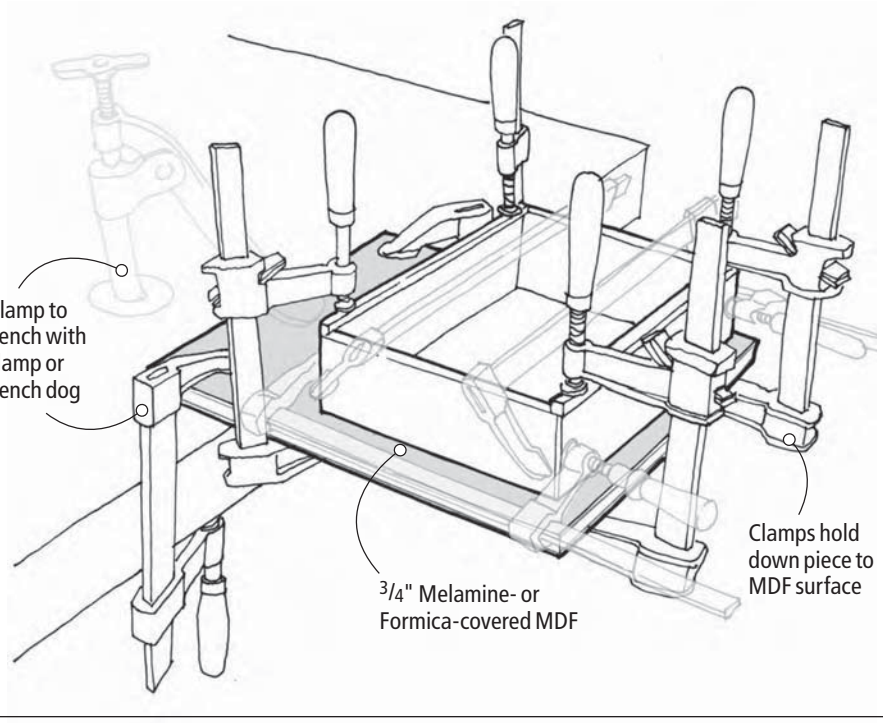
Glue-up Platforms

I keep several odd-sized pieces of 3/4"-thick melamine and Formica-covered MDF near my clamp rack for use as glue-up platforms for smaller projects. Ranging in size from 8" x 24" to 24" x 30", they can be clamped or screwed to my benchtop, cantilevered over the edge to allow clamp access to the underside while keeping the assembly flat. They're especially handy for gluing up small boxes and such. The platforms are dead flat and even dried glue can be easily cleaned from them.

George Rogers
Cleveland, Ohio



Create Storage Overhead

In my shop, storage space is at a premium, so I'm always looking for extra places to stash things. Recently, I realized that the space between the ceiling joists has a lot of potential for storing things that I don't use daily. Near one wall, I screwed a piece of 1/2"-thick plywood to the underside of the joists, creating a cubby into which I could slide my scrollsaw. I wanted to store my small 1"-wide benchtop belt sander in the same manner, but it's too tall to fit in the space between the joists. So instead of making another shelf, I improvised a couple of suitable cleats, which I screwed to a joist and to the ceiling to hold the sander base. You could also screw a pair of opposing cleats to a pair of joists, then mount the sander on a piece of 3/4"-thick plywood cut to fit between the cleats. My sander hangs upside down next the scroll saw, out of the way, but is instantly accessible. (Keeping the sander over near the wall prevents it from being a real head banger.)

Bentley Atkinson
Arlington, Tennessee

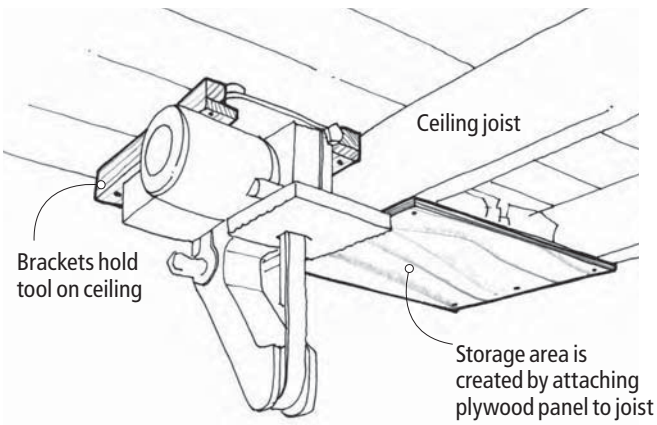


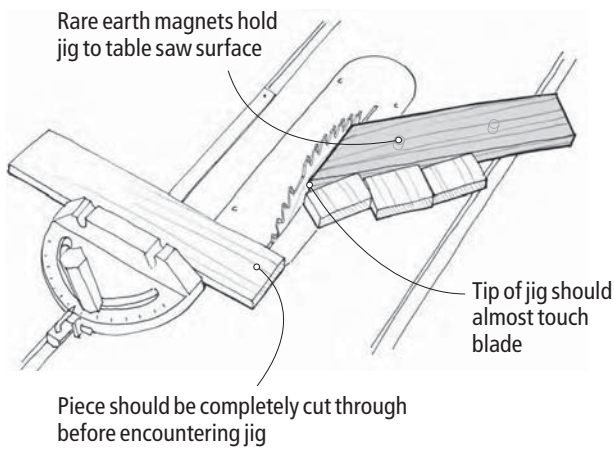
Table Saw Offcut Diverter

When crosscutting the ends of workpieces on the table saw using a miter gauge, the offcuts have a tendency to cluster around the spinning blade. If an offcut contacts the blade, it can be kicked back at the operator. This little gizmo is a diverter that channels the offcuts away from the blade. It's held to the saw table by a couple rare earth magnets that are epoxied into blind holes on the underside of the jig. *(Editor's note: It could also be screwed to a single-use throat plate.)*

When set up, the tip of the jig should be almost touching the blade and the jig should be placed far enough back from the front of the blade that the workpiece is completely cut through before encountering the diverter. Subsequent cuts push the falloff pieces up the angle. The sharper the angle the better.

I can't say this was my original idea but I've been using one for years and it sure does work great. **PW**

Steve Jenkins
Dallas, Texas



Veritas Low-angle Jack is Built for Serious Service

Though Lee Valley Tools describes this tool as a "plane" in its catalog, it actually has a lot more in common with another piece of military hardware: a tank.

This low-angle jack plane tips the scales at almost 6 pounds – more than a pound-and-a-half heavier than my old Stanley jack plane. It's also an inch longer and 3/8" wider than my jack. The cast sole of the Lee Valley plane and the iron are both a whopping 3/16" thick.

All this iron and steel creates a tool that has a lot more in common with a British-style panel plane than an American jack. Panel planes traditionally were used to take the final passes on large-scale work (think big tables) before finishing. So I've been using this plane mostly as an oversized smoothing plane, but I've also found it excels at other tasks, too.

The mouth of the tool is positioned further back than on traditional tools. This allows the tool to perform well at truing long edges. The sides of the tool are ground perfectly square to the sole, so it works well on a shooting board. And the easily adjusted mouth, which works much like the mouth on a block plane, permits you to switch quickly between coarse and fine shavings. Additionally, an ingenious small brass knob behind the mouth allows you to make the switch between a tight and open mouth without worrying about ramming the toe piece into your iron.

The model we tested was just about flawless. The sole was flat within .0015" in every direction and the iron required little work before use. Though the tool is heavy, it is well-balanced. And the Norris-style adjuster works smoothly and has little mechanical slop. This combination of traits allows the plane to plow through difficult woods and different tasks. Once you start planing, the inertia of the tool takes over and does the driving.

Lee Valley also sells a second high-angle iron with a 38° primary bevel as a $29.95 accessory. Get it. With these two irons you can tackle everything from end grain to figured woods without a problem.

— Christopher Schwarz

For more information, circle #179 on Free Information Card.

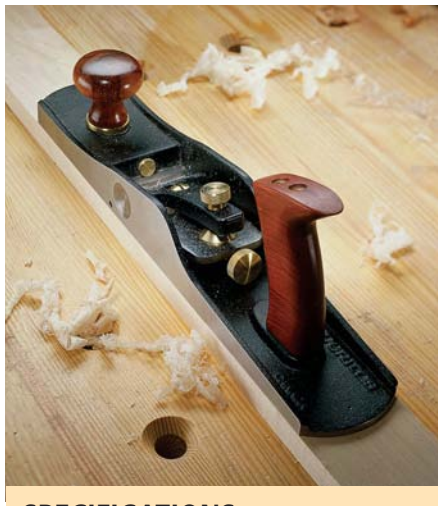


Photo by Al Parrish

SPECIFICATIONS

Veritas Low-angle Jack Plane
Street price: $179
Body: Unbreakable cast ductile iron
Iron: A2 steel, 3/16" thick, 2 1/4" wide
Handles: Rosewood
Performance: ●●●●◐
Price range: $$$$
Lee Valley Tools: 800-871-8158 or leevalley.com

Kreg Precision Miter Gauge

The Kreg miter gauge system is well designed and nicely made, but a few elements in its construction keep me from being enthusiastic about it. It was extremely accurate out of the box – I made perfect 90° cuts, as well as parts for an octagon, using the settings as they came from the factory. A loose brass pin drops in holes for preset stops at commonly used angles, and there is a vernier scale for accurately setting angles to 1/10°. It's possible to tweak the adjustments to 1/100° – well beyond what a typical woodworker needs to do.

Setup and assembly was minimal as the Kreg gauge comes from the factory with the head attached to the bar and precisely calibrated. The only adjustment I needed to make was to install five nylon screws to fine tune the way the bar slid in the miter gauge slot.

All of the parts were nicely machined, and the scales were clear and easy to read. The flip stop on the extruded aluminum fence works well both to set the length of cuts, and to secure short pieces.

While I was impressed with the overall design and construction of the gauge, I question some of the materials that are used. The aluminum bar that rides in the table slot is flexible, and can twist from the weight of the head, particularly when the head is pulled back beyond the edge of the saw table. Plus, if I didn't keep downward pressure on the head while cutting, the bar would sometimes be above the surface of the saw table. This isn't the end of the world, but it can get in the way when sliding a piece past it, and could raise the end of a short piece enough to throw the cut slightly out of square. This was a disappointment in an item designed for precision work in this price range.

As supplied, the fence is only 24" long, not quite enough in my opinion – you can't cut legs for a 30"-high table with it. A 48"-long fence extrusion is available at additional cost.

— Robert W. Lang

For more information, circle #180 on Free Information Card.

Photo by Al Parrish

SPECIFICATIONS

Kreg Precision Miter Gauge
Street price: $160
Description: Factory-calibrated miter gauge with 24" bar and positive stops at 0°,10°,22 1/2°, 30°, and 45°
Performance: ●●●○○
Price range: $$$
Kreg Tool Co.: 800-447-8638 or kregtool.com

Penn State Dust Collector Muffler

Every woodworker is aware of how important dust collection is for the safety of your lungs. But every one of us has spent time talking over the noise from a dust collector as well.

How about knocking five to 10 decibels off that noisy dust collector and saving your hearing? The Suppressor from Penn State Industries took seven decibels off the Delta single-bag collector in our shop. Seven decibels may not sound like a lot, but decibel increase and decrease is calculated as a logarithm, so this "slight" change is the difference between annoying and dangerous.

The Suppressor works a lot like the silencer on a gun, fitting on the dust collector at the intake connection. The metal cylinder is double-walled with acoustic insulation between the walls. In testing in our shop we saw a change from 82 dB to 75 dB with the device in place.

Installation is fairly simple (though permanent) using a bead of silicone caulk to seal one end to your machine. Then a hose is added between the 5" connector at the other end and the bag section on your machine. Connections may vary depending on your machine, and a side attachment may require a couple of rivets as well as silicone, but it really works. *— David Thiel*

For more information, circle #181 on Free Information Card.

SPECIFICATIONS

The Suppressor (SUP1000)
Street price: $80
Performance: ●●●◐○
Price range: $$$$$
Penn State Industries: 800-377-7297 or pennstateind.com

Splitter will Save Your Bacon

If you don't have a splitter on your table saw, put down the magazine when you finish reading this review and order a Micro Jig Splitter. For about $20 and 30 minutes of your time you can make your saw significantly safer.

The splitter – a small wafer of tough polycarbonate plastic – fits snugly behind your blade to greatly reduce the chance of kickback. And – most importantly – it's easy to remove and replace when you need to make dado, bevel or through-cuts. Because this device is so simple to remove and replace you'll actually use it (unlike the unwieldy stock splitters).

The Micro Jig Splitter works only with $\frac{1}{8}$"-wide saw blades and you need a zero-clearance insert to make it work. The package includes everything you need to install the jig (even the drill bit) plus excellent instructions.

Also worth noting is that the Micro Jig actually comes with two splitters, and each face exerts a different amount of pressure against your stock and the rip fence. This allows the splitter to function as a mini-featherboard, adding accuracy to your rips. Few products are for every woodworker, but this one is. I highly recommend it. — *CS*

For more information, circle #182 on Free Information Card.

SPECIFICATIONS

Micro Jig Splitter
Street price: $20
Description: Splitters included: 2; each face exerts different pressure in .003" increments
Performance: ●●●●●
Price range: $
Micro Jig: 407-696-6695 or microjig.com

AMANA IN-STILE & RAIL

Making a flat-panel door using plywood should simplify the door-making process, but plywood thicknesses can vary, complicating the process.

Amana's In-Stile and Rail system uses spacers and shims to adjust both the rail and stile cutters to perfectly fit the thickness of your plywood.

Each well-made, two-piece set will accommodate $\frac{1}{4}$" and $\frac{1}{2}$" plywood material. In $\frac{1}{4}$", the panel groove will adjust from $\frac{3}{16}$" to $\frac{9}{32}$". In $\frac{1}{2}$" the groove adjusts from $\frac{7}{16}$" to $\frac{17}{32}$".

Available in concave, bead or ogee profiles, each set is mounted on $\frac{1}{2}$"-diameter shanks and can shape door frames from $\frac{5}{8}$" to $1\frac{1}{8}$" thick.

Just as with a dado stack that uses shims, the bit sets will require some fine-tuning until the perfect thickness setting is achieved. Amana has made this easier by including detailed drawings of the bits and how they should be arranged, calling out specific thicknesses for each of the shims and spacers.

The In-Stile and Rail sets sell for about $155. This isn't a set you buy on a whim, but if your woodworking involves plywood panel doors, these bits will improve the fit and reduce the rattle.

For more information, visit the Amana web site at amanatool.com. *—DT*

For more information, circle #183 on Free Information Card.

ABOUT OUR 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

Testing Your Layout Tools

Is your square really square? Is your straightedge straight? Tools that have been trued make woodworking easier.

Accurate layout tools lead to accurate woodworking. Learning to test – or "prove" – your tools is a fundamental skill.

Photo by Al Parrish

A couple of years ago, while demonstrating edge jointing using hand planes, the shot edge appeared to be slightly convex when I checked it with my wooden straightedge. I don't usually have this problem, so after a couple of tries, it suddenly occurred to me that I hadn't recently "proved" my straightedge. Somewhat to my embarrassment, a quick check revealed that the problem was with my straightedge, rather than the shot edge.

I wish I'd been clever enough at the time to pass this off as a planned "object lesson" for the observers, but I'm just not that fast on my feet. However in the end, I think it did demonstrate the desirability of proving our layout and testing tools – especially when doing critical work.

The need for accuracy in woodwork is often discussed, but far less often do we demonstrate how to make and prove our layout and testing tools for when we need to get accurate readings on our work.

Why Make Layout Tools?

The question arises, of course, that given the fact that wooden straightedges can go out of true over time, why would one bother with them? For one thing, it's possible for you to avoid purchasing factory-proven straightedges, particularly long ones, which can be quite expensive. That expense can be hard to justify, especially if you don't frequently need a straightedge on that scale.

Secondly, if kept to an appropriate scale, wooden straightedges can be a lot lighter for ease of handling and won't mar your work if you accidentally bump the workpiece. Additionally, if made with a little thickness, the straightedge will stand, on its own, on the surface being tested, so that you can move freely around to get a good visual read of the fit between the straightedge and the work. Carefully selecting straight-grained, relatively stable, quarter-sawn stock can go a long way toward minimizing the tendency of a wooden straightedge to go out of true. Honduras mahogany is a good choice.

You will still need a shorter metal straightedge for knifed layout lines for critical cross-grain work, but your wooden straightedges will be suitable for any pencil layout lines and for testing surfaces.

by Don McConnell

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

It could be argued that you could avoid the need for proving your layout and testing tools by purchasing tools that have been factory proven (or calibrated) to certain tolerances. And that often can be a good investment. But even if their expense can be justified, we can't be absolutely certain they are accurate after being kicked around on the workbench for a while, or being dropped on the floor. A solidly built square may retain its accuracy after a fall to the floor, but wouldn't it be better to know for certain, rather than just hoping it to be so?

Prove Your Tools

How did I prove my straightedge? Well, I simply laid it on a smooth, light-colored surface and traced along its reference edge with a sharp pencil. I then rotated the straightedge around its longitudinal axis and checked that same edge against the pencil line. The beauty here was that any error, or deviation from straight, was doubled in magnitude, and the

continued on page 34

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very slight curvature of my reference edge became readily apparent.

If the straightedge has any thickness (say 1/4"), then it also can be turned end for end and the process repeated. If you can correct the straightedge so that the reference edge coincides with a single straight pencil line in all four orientations, it will be plenty accurate for most woodworking.

My preferred method of truing a straightedge is to use a lightly set try plane or jointer plane and a shooting board. Light shavings and slight changes of pressure to influence placement of the cut make quick, controllable work of truing it up.

There are more elaborate methods of proving straightedges, which may be justifiable in certain circumstances. For example, it's possible to borrow a technique from precision work and make up three straightedges, proving each of them against each other. Two straightedges may correspond exactly with each other, one being slightly concave and the other convex. But, if you introduce the third straightedge, then you can be assured they are all straight if all of them conform exactly.

However, very few situations make the extra time and effort worthwhile. So, in this column, the focus is on simple methods using a minimum of instruments – the idea being that proving of layout/testing tools will more likely be done if it is quick and convenient.

Proving a Try Square

So, how does one prove a try square? Following the same principle as that used to prove the straightedge, we need a flat, smooth and light-colored piece of timber. One edge needs to be dead straight – tested with our already proved straightedge. Simply hold the stock of the square against the trued edge and draw a line along the blade of the square, again with a sharp pencil. Then flip the square over and check the blade against the pencil line. Again, any deviation from square will be doubled and easily detected.

Correcting an out-of-true try square is not as straightforward as correcting a wooden straightedge. And it isn't the purpose of this column to give detailed instructions on this point. But, depending on the construction of the try square and the reason for the fault, some judicious filing of the tool's steel blade may be in order.

To prove your straightedge is indeed straight, first strike a pencil line along the tool's business edge on a piece of flat and light-colored wood. Here I used birch plywood.

Now place the straightedge on the other side of the pencil line. If the lines match all along the edge, your straightedge is true. If there are gaps, you have work to do to remedy the problem.

This might be a good place to briefly mention the possibility of making a wooden panel square. These can be made to be quite accurate (proving in the same way as the try square), and can be made with a small lug on the stock so that the square will sit securely on the surface of the material. Again, it's useful for pencil layout and for checking ends of panels for square.

Proving a Miter Square

Miters typically require a high degree of accuracy, so proving our miter squares is beneficial. One method of proving a miter square builds on the approach described for proving the try square, but it requires another couple steps. Though it doesn't involve the principle of doubling the error, it is accurate enough for most situations if carefully done.

First you need a flat, smooth and light-colored timber with one straight edge. Draw a pencil line perpendicular to that edge. You can erect a perpendicular from the straight edge one of two ways. One method is to use a proven try square. The other involves a marking gauge and a compass. Use the marking gauge to scribe a line that's parallel with the straight edge; this scribed line provides a place

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To test your try square, first scribe a perpendicular line off of a straight edge.

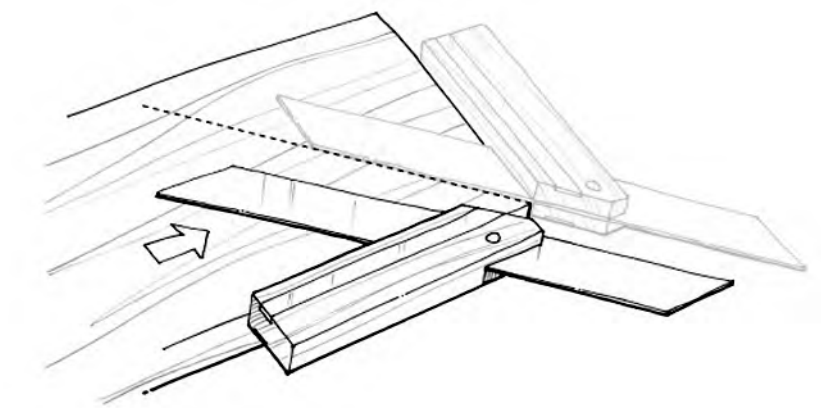
Now turn the square over and show its edge to the pencil line. Any deviation from 90° will be readily apparent.

continued from page 34

to set the compass point. Use the compass to erect a perpendicular, which many of us learned in high school geometry class.

With the perpendicular line established, you can bisect one of the right angles by swinging arcs and striking lines with the compass. The miter square is then checked against the line. You can double-check your square by bisecting both right angles and checking the miter square against both bisecting lines. If the square agrees with both lines, chances are fairly high that it's accurate.

If more demonstrable accuracy is required, it's possible to prove a miter square in a way that relies on the principle of doubling the error. But, it does require more time and effort. A test piece of wood can have one edge shot straight, then one end cut and planed perfectly square, as shown at right. This can be checked with a proven try square. Or it can be tested in the same manner as used to prove the try square, by registering the test piece against a straight edge, drawing a pencil line, and flipping it over to check for square.

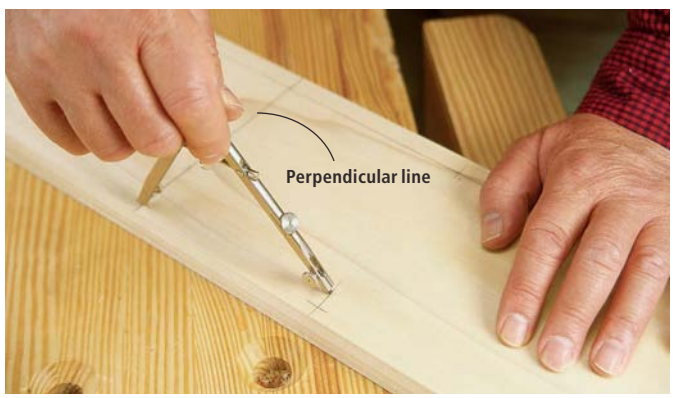


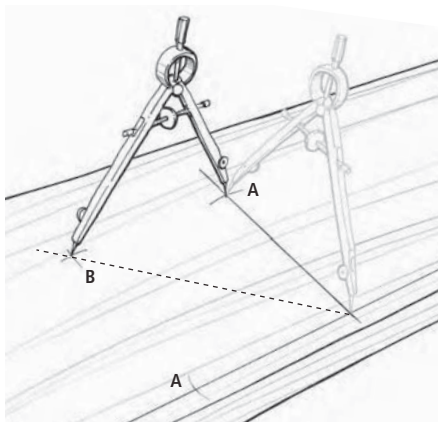
One alternative method of checking a miter square requires you to cut a perfect 90° on a board. Scribe a line with the miter square, then check your line from the adjacent edge.

When satisfied that the end is truly square, register the stock of the miter square against the edge, placed so that a pencil line can be drawn starting from the squared corner. Then reverse the miter square so that the stock is registered on the squared end, and check the blade against the pencil line. Once again, any error will be doubled and easily detected.

These methods for proving our layout and testing tools are derived from basic geometry most of us learned in school. Once we begin to grasp how these principles can be used to our advantage with these tools, we will be increasingly able to identify ways in which they can be used in a wide variety of layout and testing situations. **PW**

To test your miter square, first draw one line that is perpendicular to the edge of the board and one that is parallel. To bisect the perpendicular, scribe arcs "A." Then, from each of those points, scribe "B."





To create a line that is exactly 45°, line up your straightedge between the point where the arcs intersect and the point where the perpendicular and parallel lines meet.

Show your miter square to this line to determine if it's registering 45°.

Photos by Al Parrish

Better Glue Joints

Your joints will last for decades if you know how to apply your glue.

Much of woodworking is joinery: An edge-to-edge joint is used to join two or more boards to create a tabletop, dovetails are carefully cut and fit to create a box for a chest of drawers. And the corners of a door frame are joined with a mortise-and-tenon joint.

However, whether it's a simple butt joint or a complex interlocking joint, glue is typically used to hold everything together. And if you've ever been asked to repair a piece of cheap, factory-made furniture (it's often called curb furniture – it's used for a few years and then set out on the curb) you'll see that it's typically the joint that has failed rather than the wood (assuming real wood was used).

Yet modern glue is strong stuff. In fact, try this experiment: Glue two inexpensive poplar boards together edge-to-edge with ordinary yellow glue and allow the glue to dry overnight. The next day break the boards apart and you'll find that the wood will break instead of the joint. You see, when well-crafted, even a simple edge-to-edge joint is stronger than the surrounding wood.

Interlocking joints, such as dovetails, and the mortise and tenon, are incredibly strong even without glue. Add glue during the assembly and these joints can last for decades, even centuries.

So as woodworkers, how do we make certain that the joints that we carefully construct and glue together will not loosen and fall apart in just a few short years? Let's take a look at what makes a good glue joint.

Mating Surfaces Must Touch

Yellow glue won't add strength in a gap; the mating halves of a joint must make contact. Before gluing and clamping two boards to make a tabletop, I align them to see if the edges make contact. If the edges are convex (they touch in the middle and are open on the ends), a weak bond will result. Although you can squeeze the joint shut with clamps while the glue dries, the joint will always be in tension and will likely pull apart within a short period of time.

One theory is that an edge-to-edge joint should be sprung. In other words, the edges should be slightly concave. The idea is that as the tabletop experiences normal changes in relative humidity, the ends will shrink faster. (Remember, end grain absorbs and releases moisture at a faster rate than the other surfaces in a board.) A "sprung" joint will apply more pressure at the ends and keep it tightly shut.

My experience has been that a sprung joint isn't necessary. As long as the edges make contact, the glue bond will be strong. This holds true for other types of joints, too. The mating parts of an interlocking joint should be in close contact. In fact, dovetails and a mortise and tenon should have a "friction" fit. When expertly crafted, they should assemble with moderate hand pressure or light blows of a mallet. To test the fit, I assemble the joint without glue to see if it holds together.

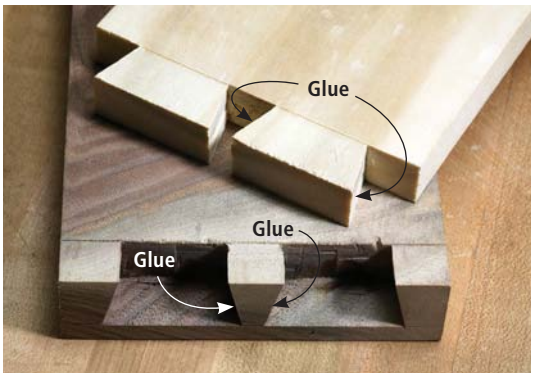
If you're using a lot of clamp pressure to close a joint, there's probably something wrong with the joint. Clamps should only be used to hold a joint in position until the glue sets; they shouldn't be used to close a poorly crafted joint. In fact, when assembling dovetailed drawers and casework, I typically don't use clamps. I just apply glue to the mating surfaces, tap the joints together with a mallet and set the assembly aside until the glue dries.

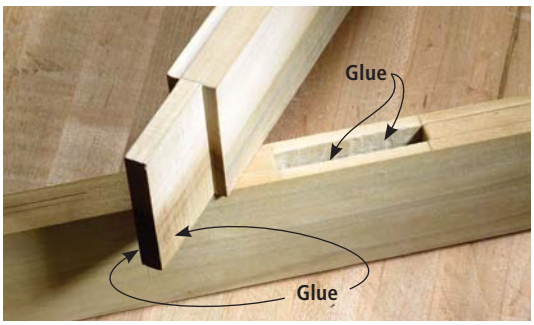
Grain Plays a Role

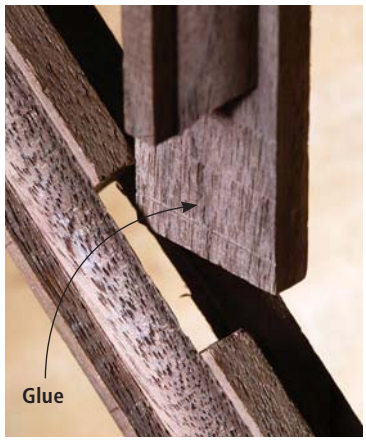
Glue bonds best to long grain; end grain will bond but the joint will be very weak. Simply put, you can join two boards edge-to-edge but not end-to-end. If you examine the end grain of a board under

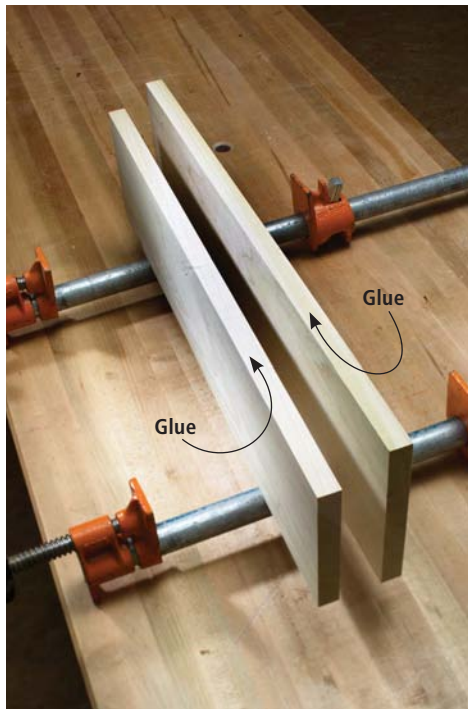
by Lonnie Bird

Lonnie is the author of "The Complete Illustrated Guide to Shaping Wood" (The Taunton Press) and teaches woodworking. You can learn more about his classes online at lonniebird.com.









Pictured is a dovetail joint (top left), a mortise-and-tenon joint (bottom left), a mortised-and-tenoned cope-and-stick joint (above) and a long-grain-to-long-grain edge joint (right). All four of these joints provide plenty of long-grain surfaces for gluing. Look closely at the callouts to see where you should apply glue to each joint.

magnification (use a jeweler's loupe or a photographer's slide loupe) you'll see that the wood resembles a handful of plastic drinking straws. Those straws served as the tree's plumbing to transport sap. Sliced lengthwise the straws will create a strong glue bond. But when sliced and joined at the ends, a weak bond is the result. The solution is to use construction that joins long-grain. Both the mortise and tenon and dovetail joints do just that, which is another reason that they're still used for the finest furniture.

In contrast, dowel joinery is weak because there is very little surface area for glue and most of it is end grain.

Cope-and-stick joinery created by matching router bits is another example of weak joinery. Although cope-and-stick joints make long-grain contact, there is very little of it. When a heavy wood or glass panel is added and the door framework is suspended from a pair of hinges, the joints undergo a lot of stress. A better solution is to use a mortise and tenon at each corner of the frame. The length of the tenon should be two-thirds to three-fourths the width of the stile to which it's joined. This provides plenty of long-grain surfaces for gluing.

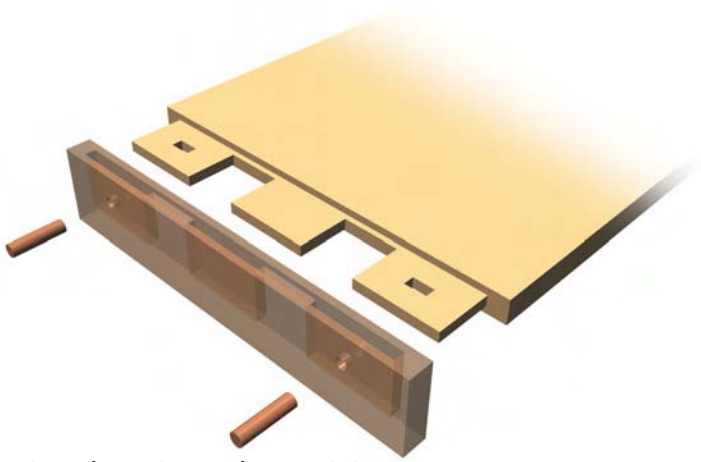
Too Much Surface Area?

Remember, joinery is often used to change directions such as when joining the sides of a box at 90°. This can often introduce cross-grain construction problems. When wood is joined and glued cross-grain, there is potential for one of the pieces to split. (Wood expands and contracts across its width during seasonal changes in relative humidity.) The solution is to reduce the surface area and/or to avoid glue application to certain areas.

For example, broad surfaces such as a tabletop or hinged lid of a slant-front desk are kept flat with breadboard ends. Tenons are cut on the tabletop, which are fit into mortises on the breadboard ends. But while this solves one problem, it creates a new one – cross-grain construction. The solution is to use an odd number of tenons and apply glue only to the center tenon. The remaining tenons are assembled without glue and held in place with a wooden pin. The hole in the tenon to accept the pin is slotted, which allows for expansion and contraction.

Another example of a potential cross-grain construction problem are tabletops. Tabletops shouldn't be glued to the base that supports them. The glue bond will hold tight and cause the tabletop to split. Instead, a mechanical fastening system that allows for wood movement should be used.

As a general rule, I put glue on any long-grain surface of a joint. For example, when gluing up a mortise-and-tenon joint, I put glue on every part of the tenon and mortise that is long grain. I don't put glue on the end-grain walls of the mortise. I also don't put glue on the bottom of the mortise. See



Pinned mortise-and-tenon joint

the pictures at left to see where I apply glue on my joints.

Use Fresh Glue

The glue most widely used by woodworkers is yellow glue. It's strong, inexpensive, doesn't require mixing and it's convenient – just squeeze it from the bottle. But yellow glue has a shelf life of only about 12 months. Have you ever squeezed old, outdated yellow glue from the bottle? It's thick and somewhat stringy. In contrast, fresh yellow glue is creamy and smooth. By the time you use the glue, you've spent hours or days carefully selecting stock, cutting it to size, crafting joints and shaping mouldings and curves. Glue is cheap; probably the least expensive part of the entire project. I don't risk spoiling all that work with an old bottle of glue. Instead, I discard it and spend two bucks on a bottle of fresh stuff.

The Work Should be Warm

Glue doesn't bond well to cool surfaces. Read the back of the bottle and you'll see that the manufacturer recommends surfaces that are at least 65°. During the winter I turn down the thermostat in my shop at night to conserve energy – except when I've just glued together an assembly.

Wet the Surface

For a strong bond you'll need to spread the glue evenly and thoroughly wet all mating surfaces. Any dry surface will not bond. Instead of relying on clamp pressure to spread the glue, I use a spreader. A thin stick works well for coating the walls of mortises and the sides of dovetails. For broader surfaces I'll use a stiff paint brush or roller.

When gluing up an edge-to-edge joint, make sure the coat of glue is really thin. It's easy to put too much glue on, which creates a very lubricated surface. Everything becomes slippery and suddenly very difficult to accurately align.

Don't Let it Skin Over

The process of gluing up can take time. After applying glue you must assemble the joints, apply clamps and check for squareness. If the glue begins drying during this time, it can weaken the bond. You can tell if it's started to dry; a thin dry "skin" of glue will have formed on the surface. To avoid this scenario, ask a friend to help with the process or just glue the project together in smaller, more manageable assemblies.

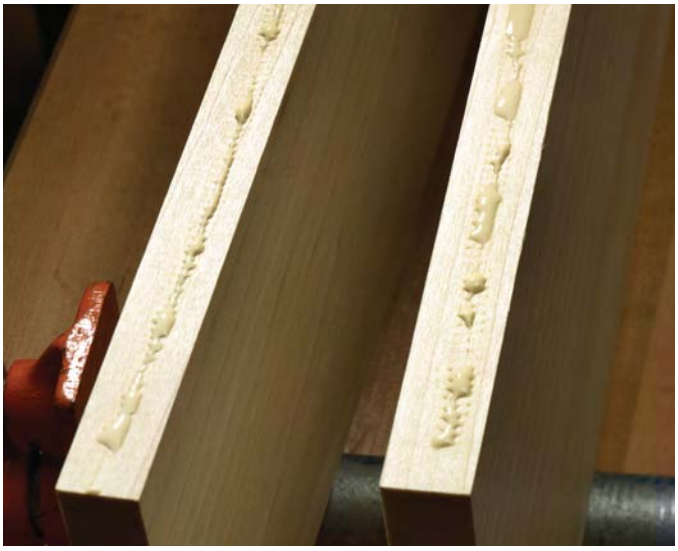
Don't Forget Squeeze-out

When gluing assemblies I like to see some glue squeeze-out. Not a running-dripping-sticky-mess-type-of-squeeze-out, but a few drops or a thin line of glue squeeze-out is good insurance that the joint is not starved of glue.

There are three ways to deal with the excess glue. You can let it dry completely, but this isn't a good idea. Dried glue is tenacious and when you chisel it away it will often take small fragments of wood along with it. Some woodworkers wipe it with a wet rag but the diluted glue gets down into the porous surface around the joint, which can create finishing problems. The easy solution is to allow the glue to dry until it is soft but no longer liquid. It then peels away effortlessly with a sharp chisel.

How Long Should it Sit?

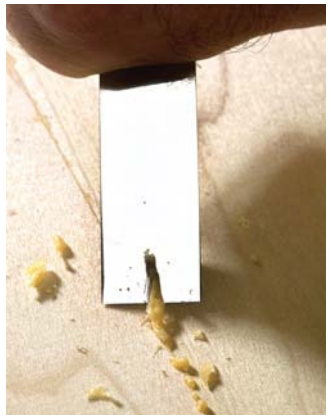
After I apply glue and assemble a part of my project (for example, a dovetailed drawer), I usually wait an hour before I begin working on it again. Typically, after 24 hours, the glue will be at full strength. When you apply glue, it comes into contact with the air, the wood or both. If your joint is enclosed, such as a mortise-and-tenon, the glue isn't exposed to air, only wood. So it dries slower than you might expect. **PW**



This is how much glue you should apply before you start spreading.

Here you can see a thin, dry "skin" of glue beginning to form on the surface. This will create a weak bond.

A thin line of squeeze-out ensures your joint is not starved of glue. Any more than this and you'll begin to have a sticky mess.



When the glue is soft but no longer a liquid, peel it away with a chisel. Make sure your chisel is sharp.

Building a

Photo by Al Parrish

Welsh Stick Chair

David Fleming, a former English teacher turned chairmaker, teaches the craft of building chairs on the edge of the Canadian wilderness.

After eight hours of a complete physical and mental workout, the seat of my Welsh stick chair is finally taking shape. What had started as a rough plank of gnarly elm that morning now looks like a perfectly shaped cradle for my now-aching behind.

I'd hacked out most of the depression in the seat using a primitive but powerful tool called an adze. Other traditional chairmaking devices – a scorp, travisher, scrapers and deltoids – smoothed out the furred and jagged elm seat into something that resembled a well-worn leather saddle.

As I reach for my spokeshave with one hand, I turn the workbench's vise screw with the other to secure the seat. Time for the easy part: chamfering the edges. As the bench dogs tighten their grip, a sickening sound seeps from my seat.

The whole thing – all eight hours of it – splits before my eyes.

Before my blood pressure can even shoot up a few points, the instructor of the chairmaking class, David Fleming, steps to the bench when he sees me deflate. To my eye the seat is wrecked, and I begin uttering a long string of self-loathing curse words. Fleming, however, is completely unfazed.

He removes a thin-kerf handsaw from the wall of the shop and shows me how he will fix the problem. He's going to rip the whole thing directly down the split, clean up the joint with a try plane and glue it back together. The tone of his voice is so calm, his manner so confident, that I almost believe what he suggests is possible.

by Christopher Schwarz

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

David Fleming turns a few spindles on the pole lathe as John Hoffman, the other student in the class, gets comfortable with the shaving horse and drawknife.

When class starts again the next morning, my seat is on the bench in one piece and as good as new. (Even to this day I cannot find the repair.) I'm amazed, but Fleming merely shrugs, smiles and resumes whistling a song as he keeps time on his foot-powered pole lathe, turning another spindle for a Windsor chair he's building for a client.

Most of the world has never heard of Fleming, a high-school English teacher who began making ladderback, Windsor and Welsh stick chairs in 1986. But he has started teaching some small classes (usually four students at most), and his reputation is beginning to spread. Several employees of Lee Valley Tools – including one of the company's tool designers – have made chairs under Fleming's tutelage. And Leonard Lee, the company's founder, owns some of his chairs.

Orders are coming from far-off places, and students are beginning to make the long journey to Gould Street in Cobden, Ontario, to spend five days making a chair, listening to Fleming spin stories and forgetting that the 20th century ever happened.

A Chairmaker's Shop

Located an hour and a half outside Ottawa, the village of Cobden and the nearby town of Pembroke are the last stops on Highway 17 before you penetrate the Canadian wilderness. Civilization falls quickly away on this highway until there's little left but river, sky and the occasional Tim Hortons doughnut shop. By the time you reach Fleming's shop, a tidy red building at the end of his home's driveway, its rustic contents seem perfectly natural.

Though it's only 25-feet square, the shop is roomy enough for three or four people to work comfortably because of the absence of woodworking machinery. The shop's entryway is reserved for a few of Fleming's finished chairs and a well-thumbed library of books on chairbuilding and traditional crafts. (Fleming read aloud several romantic passages about particular species of trees during my week there.)

Two shaving horses and a low workbench occupy the center of the room. The right wall is framed by shelves stocked with spindles and the timber for upcoming orders (Fleming is usually booked to the point where it takes him six months to fill an order).

A pole lathe squats in the back of the shop. Powered by Fleming's foot and a long springy tree branch secured to the ceiling, he churns out a spindle every three minutes or so when he is busy. The left side of the shop has a cabinetmaker's bench, a storage cabinet and one of the few 20th-century intrusions into the environment — a small benchtop band saw.

All four walls sport large windows (only a few electric bulbs are needed to light the shop) and dozens, probably hundreds, of well-cared-for traditional tools. Handsaws and frame saws hang on the back wall. They're not for show; at any moment Fleming will fetch one off the wall and blaze through a board. The large windowsill on the left wall is populated by a forest of chisels, carving tools and clamps. And the front part of the room houses his planes, bit braces and all the specialty tools of the chairmaker's trade.

It Starts With a Log

On the first day of class, we pull up in the driveway outside Fleming's shop, and he is sitting outside in the unusually warm March sun dressed in a starched shirt and vest with two ash logs propped against some sawhorses.

"This," he explains, "is some of the nicest ash I've ever had." He runs his hands over the perfectly straight, clear and white wood. The wood is still green and wet, and because ash dries quickly, we need to jump right in to make the spindles for our chairs. Once the wood starts to dry it will be more difficult to work. So we fetch a wooden club, called a maul, and a froe and start splitting the wood on a stump inside the shop.

At first glance the froe seems a primitive instrument, but it's a surprisingly effective way to split the 1" x 1" sections we need for the chair spindles. A froe has the basic shape of a framing square. One leg is a handle; the other is a slightly wedge-shaped length of steel. You balance the steel edge of the froe on the end grain of the log where you want your split to begin. Then, with all your might, you strike the back of the steel wedge to drive it into the wood. The ash splits true. Once the cut begins, it's simple work to push and pull the handle to drive the split to the bottom of the log.

We take the blanks to the shaving horse and learn to make the slightly irregular shapes into more regular square sections, which will be dried in Fleming's wood-burning stove in his kitchen. With a sharp drawknife the wood comes off in long wet ribbons that have an earthy, primitive and intoxicating aroma. Fleming shows us how to taper the spindle blanks so they'll be easier to shape round after drying.

Halfway through the morning, Sandy, Fleming's wife, brings a fresh pot of tea to the shop, a ritual they observe during every class, and one I became quickly fond of.

Hoffman and Fleming inspect the parts of the seat before gluing it up. After dressing each long edge with a try plane, students inspect the joint for a perfect fit by looking for gaps of light.

We take a break from the spindles and sit in Fleming's chairs at the front of the shop. There are a lot of different historical examples of chairs in his shop and home, and Fleming explains the subtle differences in each and helps us decide how our chair is going to look when we're done.

One of the advantages of Fleming's classes is he takes only a handful of students at a time, usually just two or three, sometimes four. The small class size allows each student to work on a slightly different style of chair and make changes to the legs, arms or crest rail and still keep things manageable. In any given month, Fleming will build chairs for three weeks and spend a week teaching his "apprentices."

"No one does a cookie-cutter copy of a chair here," he says. "It's like blues or jazz – it's different every time you do it."

Fleming's students come from all walks of life. Some are experienced woodworkers, but many have very little (if any) shop experience. Either way, Fleming makes sure that each student leaves with a chair that he or she built.

The other reason that Fleming's class is unusual is he is eager to teach students to build the Welsh stick chair, the genetic ancestor of the subtle and supple Windsor chair we're all familiar with. Windsor chairmaking is enjoying a remarkable renaissance in the United States thanks to Michael Dunbar and The Windsor Institute in Hampton, N.H. Dunbar has taught more than 6,500 students to build Windsor chairs, including many new woodworkers. And a surprising number of his students have opened their own chairmaking shops or begun teaching the craft themselves.

Dunbar's influence has even spread to the tool-making world. When he began teaching in 1980, it was difficult to find traditional chairmaking tools for sale, even in antique stores. But now there's an entire cottage industry that revolves around the craft. Plus major manufacturers are starting to take notice, too.

And while the Windsor has

Using a maul and an axe, Fleming shows how to split the ash log into the square lengths that will become our spindles, crest rail and legs. With the wood still wet, it's surprisingly easy to work.

ABOUT WELSH STICK CHAIRS

The Welsh stick chair is an uncommon form to the American eye. While it shares some of the features of the classic Windsor, it is in many ways less refined. Instead of elegant turned legs, Welsh stick chairs typically have octagonal or roundish hand-shaped legs. Many Welsh stick chairs also lack stretchers between the legs and were even occasionally made with three legs (which was better for dirt floors).

The seat, bow, spindles and crest are all similarly less refined than what you'll find on a typical bow-back or sack-back Windsor. Despite their humble origins, I have always had a fondness for these chairs. While the Windsor chair has an elegance and delicateness like a swan, the Welsh stick chair has an appealing aggressive demeanor – like a large cat that is poised to pounce.

Relatively little is known about individual chairs or their makers because they were peasants' chairs, made in a village by a carpenter, wheel-wright or coffin-maker. In fact, the form might be even more obscure if it weren't for the work of one modern chairmaker, John Brown. Brown began building chairs in Wales after losing his job as a builder of wooden boats to the modern business of building plastic hulls.

Brown began building Welsh chairs, selling them and researching what little history exists of this folk craft. He came to the United States and introduced the form to a few influential chairmakers. He began writing a column in the British magazine *Good Woodworking* that was titled "The Anarchist Woodworker." His 1990 book "Welsh Stick Chairs" (Lyons and Burford Publishers) is on the shelves of most well-read chairmakers.

With this book and Drew Langsner's essential work, "The Chairmaker's Workshop" (Lark), most woodworkers at home can puzzle out how to build a Welsh stick chair. Or, of course, you can take a class. Modern versions of Welsh stick chairs are much more refined than the originals. Few Welsh stick chairs have saddled seats or steam-bent crests or shaped arms. Most are very straight and quite severe.

Brown's book contains dozens of photos and line drawings of Welsh stick chairs, plus a short history of the region and how it influenced the chairmaking there. And then there are 40 pages that show how Brown makes his "cardigan" chair entirely by hand and usually with a cigarette dangling from his lips.

Perhaps the most alarming fact about Welsh stick chairs, according to Brown, is how many of them have been lost. Until recently the chairs were more valuable as firewood. And for every existing one today, there are probably 100 ones that have rotted or been burned or simply thrown away. *— CS*

enjoyed the spotlight thanks to these classes, the Welsh stick chair remains a bit obscure. There are fewer places to take classes in building this chair. Don Weber of Paint Lick, Ky., teaches this form regularly. And Drew Langsner's school, Country Workshops in Marshall, N.C., also regularly offers classes. So the student who wants to make this more primitive and aggressive form of chair, needs to do a bit more searching. After talking to dozens of chairmaking students, my search lead me to Fleming.

Meet David Fleming

Though Fleming taught high school for 20 years before becoming a professional chairmaker, working with wood has always been a part of his life. When he was 6 years old he carried a jack knife and whittled constantly. In his 20s, Fleming began making snowshoes and birch bark canoes – he and Sandy camp even in the winter. As a teacher, Fleming had summers off and spent the time learning green wood crafts from Algonquin Indians.

"With building canoes and snowshoes, a lot of the skills are the same with ladderback and Windsor chairmaking," he says. "You find the right tree, split it and work it with a drawknife and crooked knife."

One day when he was in a small bookstore he picked up a copy of John D. Alexander's landmark book, "Make a Chair from a Tree" (Pub Group West). And so, like thousands of other people who bought that book, Fleming began making ladderback chairs. A second event then launched him into abandoning teaching for chairmaking. A local doctor stopped by his shop one day, saw Fleming's chairs and ordered 10.

"The high school teaching was fine," he says. "But I needed a change. I thought I'd try something else."

So he started building chairs on the side and demonstrating at craft shows. About 1988 he purchased "Make a Windsor Chair With Michael Dunbar" (Pub Group West), a book that is now difficult to find, and Fleming added Windsors to his repertoire. Business was so good by 1991 that Fleming finally bid the high school a "fond farewell" and became a full-time professional.

Here I'm shaping the crest rail before steam-bending. The crest began as chunk of ash, but after less than an hour of work it was a perfectly flat piece of wood with two straight edges.

These days Fleming builds as many as four chairs a week – his business is about 40 percent ladderbacks and 60 percent Windsor-style chairs, including the Welsh stick. He builds them and Sandy finishes them.

Their 19th century home is filled with Fleming's work, which students experience first-hand as they gather around the wood-burning stove each day to eat a rib-sticking lunch that Sandy has prepared. I spent the week sitting in one of Fleming's Windsor chairs. Its comfortable contours (and my muscle fatigue) made it a challenge to stand up and begin the afternoon work. When the mood strikes him at the end of the meal, Fleming will pick up his guitar and sing a few jazzy songs.

Two examples of Fleming's chairs: a ladderback (left) in ash with a rush seat. And his "Buttermilk Creek Windsor," a chair of his own design in elm, ash and mahogany.

Photos courtesy of Robin Turner

Working Like a Chairmaker

After a couple days of this routine you fall into Fleming's daily rhythm. In fact, despite the fact that the work is strenuous, I've never felt as relaxed as I did during my five days in Cobden. Part of that is the nature of the work (no noisy machines) and part of it is Fleming's unbreakable calm.

After my disaster with the seat, the hours and days began to fly by. Though I had done turning on only one previous occasion, Flem-

The adze is a tricky tool to master. Finding the right angle takes practice. Removing material quickly takes a bit of strength.

After the adze work is done, the scorp cleans up the rough stuff. Of all the hand tools we used during the class this one required more strength and endurance than any other.

ing had me churning out spindles on the pole lathe after less than 30 minutes of instruction with the roughing gouge and skew.

The crest – or headrest – was also simple work. With a side axe, we dressed the green ash logs to rough size and then used wooden bench planes to reduce the stock to its finished dimension. After some time in Fleming's homemade steamer, we bent the crest in a jig and clamped it overnight.

Shaping the bow – or arms – was also straightforward. The bow of a Welsh stick chair can be made in several ways. You can bend it using steam, cut it out of one crooked piece of wood or piece it together using half-lap joints. I built my bow from three pieces of wood. After days of learning new techniques, it was refreshing to fall back on skills I knew to make these standard cabinetmaking joints.

And then came the holes.

Boring the holes for the legs and spindles was surprisingly demanding work. Fleming prefers to work with a bit brace and spoon bits for the most part. Add those unfamiliar tools with the odd angles needed in chairmaking and you quickly understand that chairmaking is a skill that demands repetition to master. All told there are dozens of compound angles in a stick chair, and nearly all of them are different.

Luckily, Fleming had some tricks up his sleeve. A couple jigs held our bow in position as we drilled through the bow and into the seat. (And here's my one confession: I used a powered drill for some of my spindle holes.) Plus Fleming showed us how a simple 5-cent washer can keep our bits aimed true – it's quite a trick.

One remarkable thing about making green-wood chairs is how your level of accuracy is different than when building frame chairs, which I'm much more familiar with. Green-wood chairmaking involves more eyeballing and relying on instinct and experience for good results – rather than a ruler and a shop drawing exclusively. It's not that you can be sloppy when making a chair, it's just that the rules are different.

The last evening was the most difficult. John Hoffman, the other student in the class, and I were

The travisher is essentially a spokeshave with a curved spoon-shaped bottom. It's a joy to use a tool for the operation it was designed for.

Boring the seat holes takes a steady hand. For the beginning chairmaker, having a person check your progress is invaluable. Here Fleming shows Hoffman the correct body position for this operation.

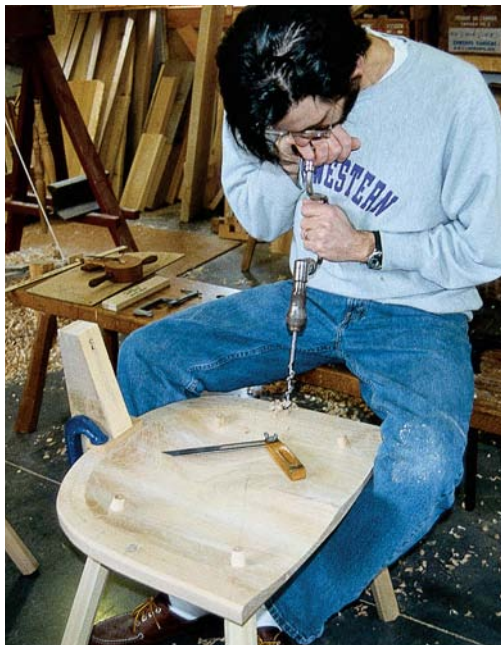
determined to get our chairs assembled before we packed up the parts to carry them through customs into the United States. Fleming was happy to oblige and we drove ourselves mercilessly into the evening, fitting each spindle as we listened to an avant garde piece of music that seemed to go on for hours (and still occasionally haunts my dreams).

In the end we both got our chairs assembled and sat in them for the first time – a magic moment. Fleming had some beer cooling in the basement and we bought a pizza to celebrate. The next day we walked our boxes of chair parts through tight international security. ("You say you have a chair in there, eh?")

When I got back to my shop I laid out all the parts on my bench. It was then I knew that I had been bitten by the same chairmaking bug as Fleming and thousands of other woodworkers. Once I got that first stick chair assembled I began making plans for my second one. And then I'll move on to replacing the hideous chairs in our dining room.

While I still have much to learn (this was my first green-wood chair after all), the lesson I'm mastering right now is to adopt the same steady patience that guides Fleming. As I take my scorp to a piece of tulip poplar that will be the seat of my next chair I wonder if I'm going to split this one, too. Or perhaps I'm going to saddle it too deeply. But then I stop and think about the class.

"Remember," Fleming says, "there is always a Plan B.'" **PW**



Boring the spindle holes in the seats. The sliding bevel on the seat and pencil lines guide the work.

Fleming positions the bow on one of the drilling jigs and the "horns" of the chair, which are the curved spindles underneath the arms at the front.

With all the spindles shaped and the holes drilled, Fleming tests the fit of the bow onto this assembly.

CLASSES & RESOURCES

Country Workshops, Drew Langsner
990 Black Pine Ridge Road
Marshall, NC 28753
828-656-2280 or
countryworkshops.org

Handcraft Woodworks,
Don Weber
P.O. Box 19
Paint Lick, KY 40461
859-925-9225 or
handcraftwoodworks.com

Spokeshave Woodwork, David Fleming
P.O. Box 192
Cobden, ON K0J 1K0 Canada
613-646-2356 or spokeshave.ca

The Windsor Institute, Mike Dunbar
44 Timber Swamp Road
Hampton, NH 03842
603-929-9801 or
thewindsorinstitute.com

For information on tools, more books and chairmaking sites on the Internet, also visit the Windsor Chair Resources at windsorchairresources.com.

WOODWORKING ESSENTIALS

BY NICK ENGLER

CHAPTER 2

Using the Saw Blade

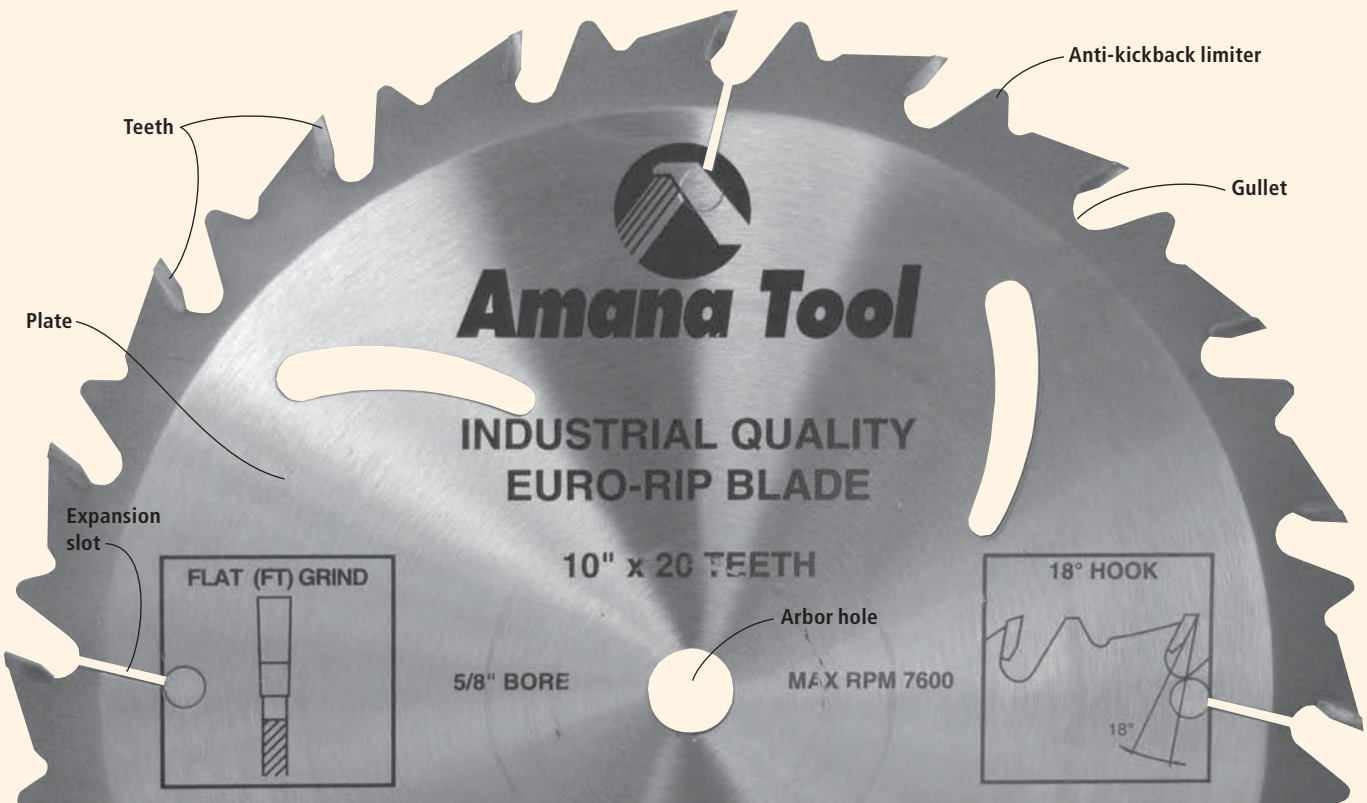
Your table saw is the central piece of machinery in your shop, and the blade (or more appropriately – blades) is a critical aspect of the ease and accuracy of your work. A top-quality blade mounted on a medium-quality saw will cut infinitely better than a mediocre blade mounted on the best table saw money can buy. The reason should be obvious – it's the blade, not the saw, that does the actual cutting.

How Blades Work

To choose a good blade, you need to understand a little about how blades are designed and how they work. Every blade has several important parts that are generic to all blades.

The plate is the steel center of the blade on which the teeth are mounted. The arbor hole is cut in the center of the plate, and that's where the blade mounts to the saw. The gullets are the spaces between the teeth that allow dust to escape. Often there are anti-kickback limiters between the teeth and gullets, which reduce the chance of wood lodging in the gullet and being thrown at you. Expansion slots are cut along the perimeter of the blade to both quiet and stabilize the cut. And the teeth are the part of the blade that actually does the cutting, but there are lots of teeth variations and arrangements.

Saw-blade anatomy

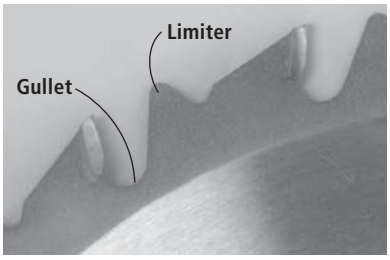


TIPS & TRICKS

GREAT TIP:

Safer by Design

Most blade manufacturers now offer blades with an "anti-kickback" design. In addition to the ordinary forward-facing teeth, an anti-kickback blade has backward-facing barbs or "limiters" that limit the depth of cut. This greatly reduces the chance that the blade will kick the work back at you, but it doesn't completely eliminate the risk. If you need a determining factor during your next blade purchase, look for this safety feature.



PRO TIP:

Straight Rip on Rough Edge

If your only choice is to rip a straight edge on a bowed, rough-cut or otherwise crooked board, fasten a straight board to it with finishing nails. Don't drive the nails home – you'll want to pull them out later. Rip the edge of the crooked board, keeping the edge of the straight one against the fence. When you've finished, separate the boards and rip the other edge.

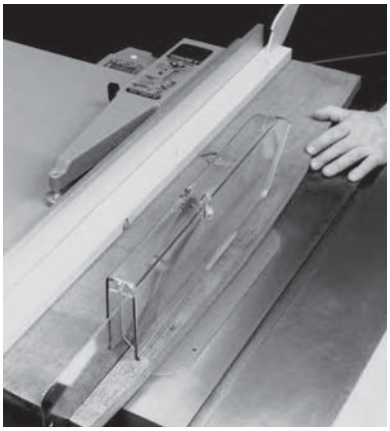


Plate and Arbor Hole

For the majority of table saws, the overall diameter of the saw blade (most of which is the plate) is 10". The plates are usually made of a good-quality high-strength steel so the saw blade will remain flat and true. Better saw blades are also machine tensioned to help ensure flatness.

Many manufacturers now offer coatings and polished finishes on the plate part of the blade to help reduce friction during the cut and also to reduce resin build-up and rust. In general, most table saws require a 5/8" arbor hole formed in the center of the blade that fits over the arbor on the saw.

Gullet

As a blade cuts through wood, dust is created and needs to be cleared away from the cut. The gullets (cut in the blade plate) are located between each tooth and allow the dust to be removed. Gullet designs vary by manufacturer and are much smaller today to reduce the chances of material being trapped in the gullet and "kicked back" at the operator. The gullet's size is a careful balance between safety and efficiency. While it's bad for the gullet to be too large, it's also bad if it's too small. Dust can build up during the cut and clog the gullet causing the blade to cut poorly.

Expansion Slots

Expansion slots are usually laser-cut into the plate. While their shape may vary between manufacturers, they all serve a dual-purpose of reducing blade noise and allowing the blade to expand and contract during use as the blade heats and cools. This, once again, helps keep the blade flat.

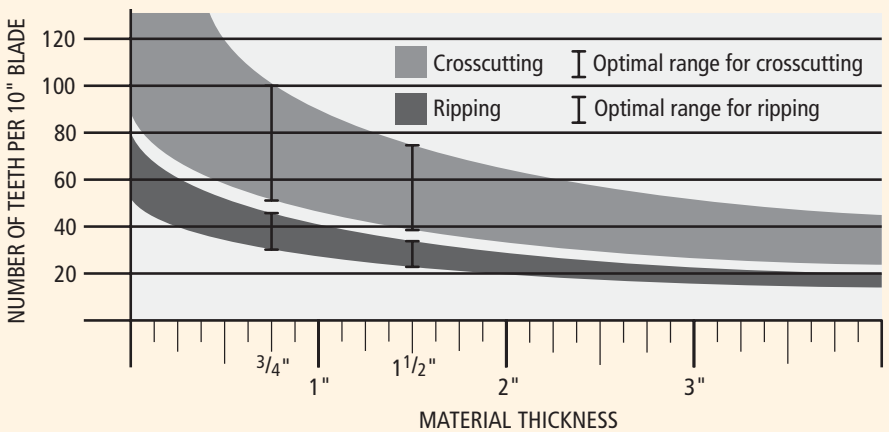
Teeth

Each saw tooth is ground and sharpened to a specific angle depending on the job it has to do. If you draw a radial line out from the center of the blade through the tooth, you'll find that the tooth is set on the blade at a slight angle. This is called the hook angle. The greater the hook angle, the more aggressive the cut.

On carbide-tipped blades, the teeth are wider than the plate (with the kerf traditionally 1/8" wide) to prevent the plate from rubbing in the cut. This offset is known as the tooth set.

In addition to hook and set, the cutting edge of every tooth has a profile. The edge can be flat or square, beveled left or right, or shaped in other ways to suit its job. Often, the teeth on a single blade will have two or more profiles alternating in a pattern called a grind. The profile determines how each tooth cuts, while the grind determines how the saw blade cuts as a whole.

Optimum teeth count for different sawing situations



Source: Freud; Illustration by Len Churchill

The crosscutting and ripping "swoops" in this graphic designate the optimal number of teeth you should have on your blade when ripping or crosscutting wood of a particular thickness. The areas outside the swoops designate situations in which you may experience a rough cut.

Two examples of alternative-geometry blades. The Porter-Cable (left) combines both rip and crosscut tooth spacing on one blade. The Leitz blade uses variable spacing of the teeth. Both are designed to cut more efficiently and quietly.

Types of Blades

The various aspects of the saw teeth – hook, set and profile – can be arranged to make different cuts or to cut different materials. There are three basic types of blades, (rip, crosscut and combination) each designed to make certain cuts:

• **Rip Blades** have a large hook angle (20°-25°) and, because it's much easier to cut with the grain (ripping a board), they can remove a lot of stock with each pass. Compared to other blades, they have fewer teeth and larger gullets to make room to clear out the big chips. The tooth profiles are usually all flat.

• **Crosscut Blades** have a much smaller hook angle (5°-10°) to remove just a little stock because it's much harder to cut across the grain. Because the chips are smaller, the gullets can be smaller too, and this makes room for more teeth. The profiles of the teeth alternate right bevel and left bevel in a grind called "alternate-top bevel" (ATB). An ATB grind allows each tooth to slice the wood at a slight angle to the grain, making the cut easier and smoother.

• **Combination Blades** will perform both rip cuts and crosscuts, and their design is a compromise between the two types of blades. The teeth are usually arranged in sets of five. The gullets in each set of five are the same size as on a crosscut blade; those between the sets are larger, like the gullets on a rip blade. The profiles of the teeth alternate in a five-tooth grind as such: right-bevel, left-bevel, right-bevel, left-bevel, flat. The large gullets are in front of the flat teeth.

In addition, there are several common types of blades intended for specific jobs.

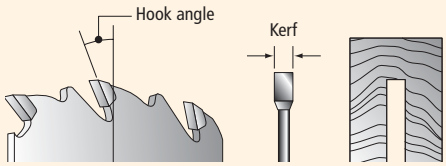
• **Triple-chip Blades** use a special double-beveled-tooth design combined with a raker tooth to reduce chipping in brittle materials. Triple-chip blades can be used in many applications, but are the best choice for work with laminates.

• **Plywood Blades** are designed to make smooth cuts in plywood without chipping the veneer. Cutting the alternating grain in plywood requires both rips and crosscuts. The blade of choice is an 80-plus ATB tooth design, but the hook angle is less than a crosscut blade's.

• **Thin-kerf Blades** usually are carbide-tipped and available in the same styles as ordinary blades (rip, crosscut and combination). However, the plate and teeth are about two-thirds as wide as an ordinary blade. Because the blade removes less stock, the table saw does less work and makes a smoother, quicker cut.

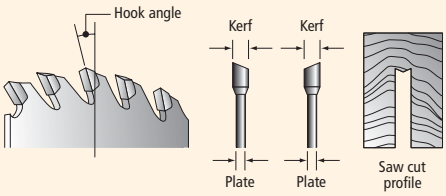
• **Alternative-geometry Blades** are just starting to make their way into the marketplace. They're new technology, and yet to be proven by the consumer market, but the concept has been around in industrial applications for a while. Rather than just changing the type of teeth, these new blades change the distance of separation between the teeth. In some cases the pattern is almost random, and in others it's mixing rip and crosscut teeth on the same blade. The payoff is more efficient cutting, less vibration and a smoother finished surface.

• **Dado Blades** mount on the saw arbor like a blade, but make a much broader cut. An ordinary saw blade cuts a narrow kerf (⅛") to reduce waste and the effort required to saw through the stock. A dado cutter isn't meant to saw



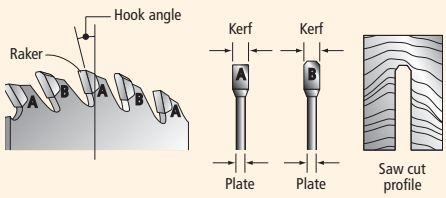
Ripping blade

Ripping blades are designed with flat-topped teeth and an aggressive hook angle to remove wood quickly and efficiently. The action is similar to that of a chisel cutting a groove. While this blade can be used for a variety of cutting actions, its best performance will be in rip cuts.



Crosscutting blade

Frequently referred to as an alternate-top bevel (ATB) blade, the beveled crosscutting teeth are designed to slice across wood fibers. It leaves a concave bottom in the cut. This blade's best performance will be in crosscutting, but can be used for other applications and is the preferred grind for cutting plywood.



Triple-chip blade

The triple-chip tooth design includes flat-topped and trapezoidal teeth. The trapezoidal teeth are taller and narrower than the flat teeth, making a scoring cut to reduce tear-out. This blade excels for work with laminate and brittle wood materials, including hardboard.

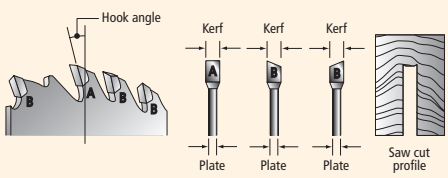


Illustration by Len Churchill

Combination blade

A combo blade uses both rip and crosscut teeth, and can be used reasonably well in either application. There are compromises in quality, but if you're looking for an all-purpose blade, this is it.

TIPS & TRICKS

PRO TIP:

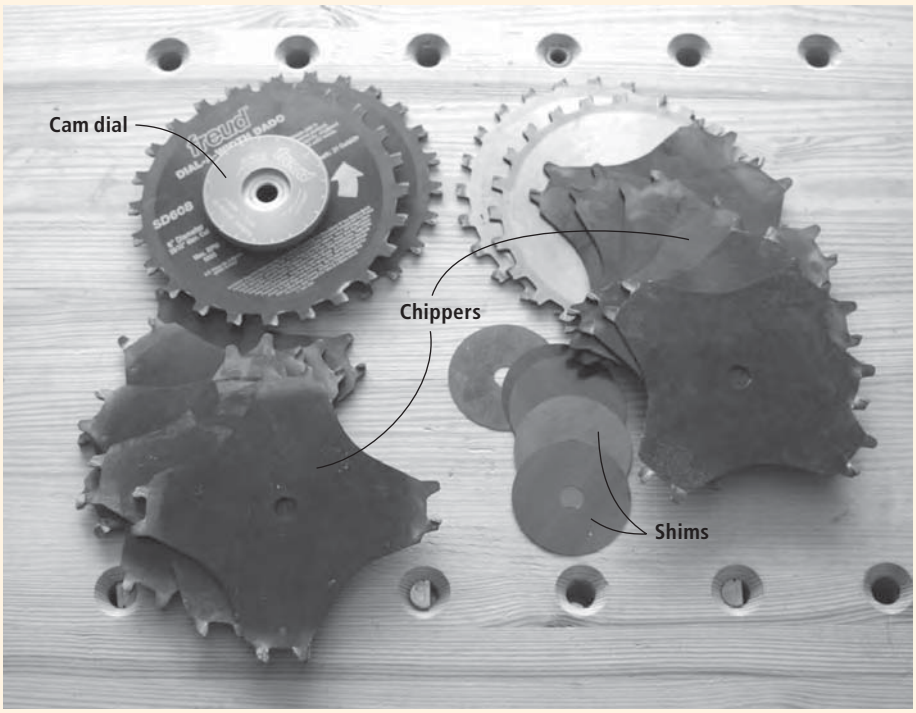
Tip to be Square

To make sure your blade is running square in your saw, you need two measuring tools – a true straightedge and an accurate try square. To check that a straightedge is straight, use one edge to draw a line along its full length. Flip the straightedge face for face and draw a second line on top of the first, using the same edge. Superimposed, the two lines should appear as one. If they diverge at any point, your straightedge is crooked. To check that a square is square, place the arm against the edge of a board and use one edge of the rule to draw a line. Flip the square face for face and draw a second line right next to the first (shown above), using the same edge. The two lines should be evenly spaced across the board. If not, your square isn't square.

GREAT TIP:

Dado Blade Crib Sheet

Every stack dado set is slightly different when the chippers are in place. Rather than measure each time to set up your dado set, make a sample board using each variation of blades, chippers and shims to make a series of shallow dados. Mark the block as to what combination of blades was used and also mark the resulting dimension of the cut. You may never have to measure your dado set again.



Two common dado sets are a standard dado (right) that uses shims to fine tune the spacing between the chippers. The dial dado (left) uses a cam dial to fine-tune the width, avoiding the need for shims and allowing for adjustment without removing the blades.

completely through a board. Rather, it cuts a wide kerf with a flat bottom and square shoulders, and it can create dados, grooves, rabbets and a number of other standard woodworking joints.

The most common dado set is a stack dado (above). These sets include two 6" or 8"-diameter outer blades (essentially smaller saw blades) and a number of inner chipper blades that may have four or six teeth per chipper. The outer blades are 1/8"-wide, but the chippers vary in width to allow adjustments of 1/32" by rearranging the number and type of chippers used.

What Blades do You Need?

With all the choices, what sort of blade should you choose? The answer depends on the type of woodworking you do. However, most craftsmen get by nicely with just three blades:

1. A combination blade for general work. You'll probably keep this on your saw 90 percent of the time. Because you're likely to use this blade more than any other, it should be a premium blade.

2. A rip blade for cutting stock to width. Often, at the beginning of a project, you'll find yourself doing a lot of ripping lumber to size. A rip blade will make this go faster.

3. A crosscut blade for cutting stock to length. A clean, tear-out-free cut when crosscutting makes joinery much easier.

In addition, special types of shop requirements or work will require specialty blades, such as thin-kerf or dado sets. But these can be added as the need (and the funds) occur.

For the Best Blade Performance

The table saw is a precision cutting tool. As such, it must be precisely aligned, operated and maintained if you're to get the best results possible.

Small problems can have large consequences. A rip fence that toes in slightly toward the blade, a miter gauge slot slightly out of line with the blade, a tendency to feed the work too quickly or too slowly, or a blade whose teeth have become coated with pitch – all of these seemingly insignificant problems can completely ruin a cut.

Before you make any cut, you must be sure that the working parts (blade, arbor, trunnions, table, fence and miter gauge) are properly aligned to each other. In Chapter One we covered these important initial adjustments.

Another important set-up step that isn't mentioned often enough is how high the blade should be. Most manuals

GLUING: Facts and Fiction

We debunk 9 gluing myths. How many did you believe were actually true?

At least five myths about gluing are debunked in this photo. Can you name all five?

In woodworking, myths abound in gluing techniques. Maybe it's because modern white or yellow glues are not well understood. Some myths may come from old-wives' tales going back to when glues were made from animal hides or fish guts. Here we debunk nine commonly held gluing beliefs.

1. Clamping time is overnight; 24 hours is best.

Not even close. Clamps can be removed from most kinds of work after 30 to 45 minutes if pieces are dry and well fitted, and if you're working at a temperature above 60°. Although glues require 24 hours or more to reach full strength, significant strength is achieved in a short period of time.

2. Rougher surfaces make stronger glue joints.

The truth is that smoother surfaces make stronger joints. While rougher wood has more surface, or tooth, from more exposed fibers, rougher surfaces are actually much weaker.

3. Squeeze-out should dry before it's removed.

Glue squeeze-out should be removed with a water-dampened cloth while it's still wet, and before it can cure or penetrate the wood pores. Any dried glue should be removed with a scraper.

4. Wiping glue from joints with a damp cloth weakens joint strength.

Water from a damp wiping cloth can't penetrate a well-fitted and tightly clamped joint enough to cause appreciable glue dilution.

5. Applying glue to one side of a joint is OK.

Partly true: Apply glue to one edge only on a small assembly. Such assemblies will be clamped quickly, allowing the wet glue proper penetration on the dry edge. On longer edges or more complex jobs, apply glue to both sides.

6. Over-clamping leads to a glue-starved joint.

You can't squeeze out too much glue from most joints by over-clamping. With short or end grain, like miters, glue starvation is an issue because glue can be wicked away from the surface before it dries. To avoid this, apply two coats to each surface with a few minutes of drying time between applications.

7. White or yellow glue is fine for bent laminations.

Because of "glue-line creep," most aliphatic glues are not recommended for bending laminations on tight curves. The resulting stress on the joint allows the wood to move at the joint and that can lead to joint failure. This is why laminated structural beams are not made using aliphatic glues.

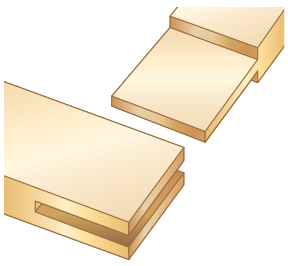
8. It isn't necessary to alternate clamps over and under when using parallel-jaw clamps.

Alternating clamps is always a good practice because edge joints may not be perfectly square and clamp pressure may cause the clamp jaw to lose some parallelism.

9. When gluing up panels, clamps should be spaced every 12" to 14".

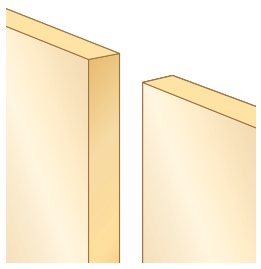
On most assemblies, recommended spacing is 8" to 12" with a clamp within 2" of each end. Because clamp pressure radiates at 45° angles from the clamp heads, wider glue-ups of well-prepared stock actually require fewer clamps.

Illustrated Guide to JOINERY



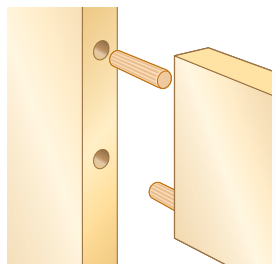
Corner Bridle Joint

Offers great strength and protection against racking. Improved gluing surface in a cross-grain application. Most easily produced on a table saw or band saw.



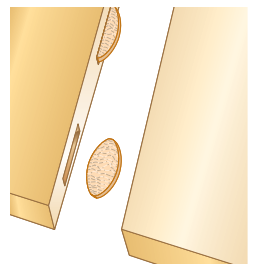
Long-Grain to Long-Grain Butt Joint

Woodworking's most basic joint. With properly prepared stock that's glued and clamped, stronger than wood itself.



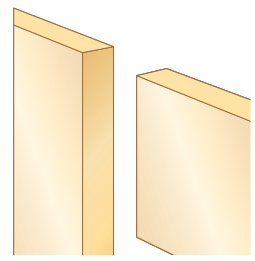
Doweled Butt Joint

Standard joint for frame work offers poor strength because of end-grain to long-grain setup. Adding dowels greatly improves strength and aids alignment.



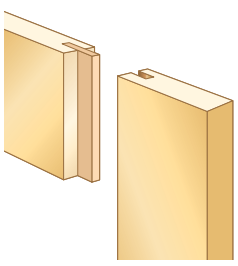
Long-Grain to Long-Grain Biscuit Joint

Biscuits aid alignment but add no strength to joint. Biscuits are helpful in aligning longer panels, i.e. a tabletop.



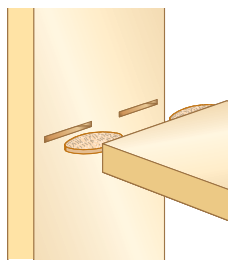
Butt, End-Grain to Long-Grain

This joint is structurally weak and should be reinforced to avoid failure, particularly in frame applications.



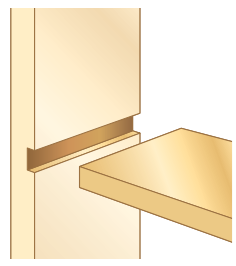
Butt Spline Joint

Inherent lack of strength in a standard butt joint is greatly improved with the addition of a spline. Alignment is also easier.



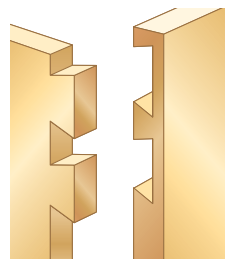
T-Butt w/Biscuits

Improvement over standard butt T, by adding biscuits strength is much improved and alignment simplified greatly during assembly.



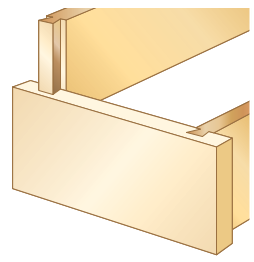
Through Dado Joint

Basic joint often used to join shelves to cabinet sides or dividers to cabinet bottoms. Moderate strength, aids alignment but exposes joint.



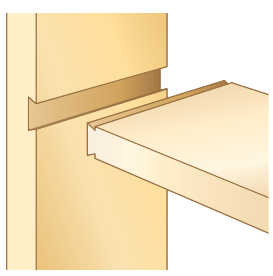
Half-Blind Dovetail

Classic drawer joint offers strength and beauty. Is more difficult to cut than through-dovetail, either by hand or machine.



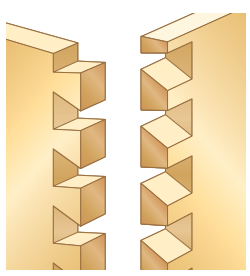
Sliding T Dovetail

This joint offers great strength for box work. In drawers, joins sides to front.



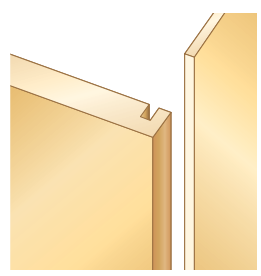
Straight Sliding Through Dovetail

Similar to previous, but the joinery is primarily used as shown for casework.



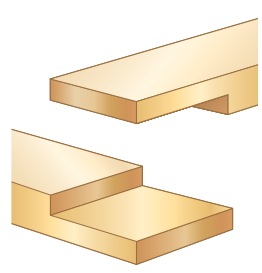
Through Box Dovetail

Easier to cut than half-blind, offers great strength and visible joints on both faces. Used in casework and back of drawer boxes.



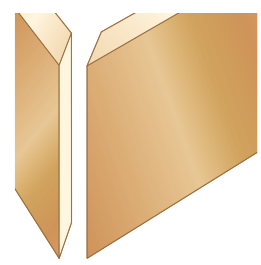
Groove Joint

A three-sided trench running with the grain (dados run cross grain). This joint has many uses and can be used with or without glue.



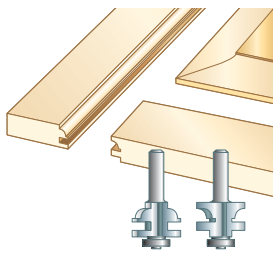
Lap Corner Frame Joint

Less strong than mortise and tenon but stronger than dowels or splines in frame corners.



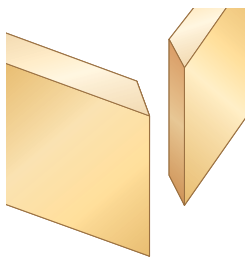
Long-grain-to-long-grain Miter Joint

Offers excellent strength. Often used in box building. Can be tricky to cut and align during assembly.



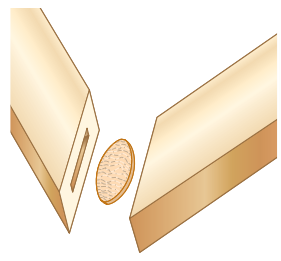
Cope and Stick Joint

A good joint for making small- and medium-sized cabinet doors. Essentially a tongue-and-groove joint with built-in moulding detail.



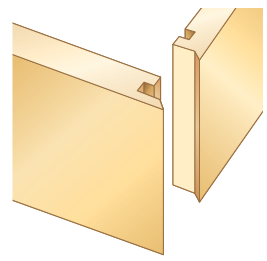
Short Grain Miter

Short-grain to short-grain application offers less strength than long-grain joint, and alignment during assembly is tricky.



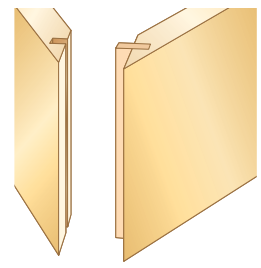
Biscuit Miter Joint

Biscuit greatly aids alignment and adds strength in short grain applications. Biscuit alignment is critical.



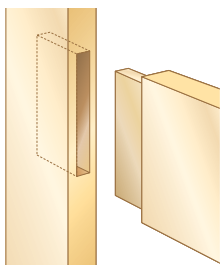
Lock Miter Joint

Improvement over standard miter and doesn't require spline or biscuit. Joint provides more glue surface, strength and aids alignment.



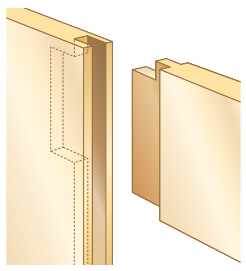
Spline Miter Joint

Alternative to biscuit-reinforced miter; improves strength and alignment but requires careful alignment and making a good fitting spline.



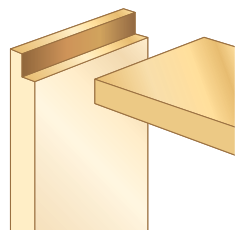
Blind Mortise & Tenon

Strong, invisible joint used in frame work. Joint can also be used at corners of frames. Can be further reinforced with decorative and structural pegs.



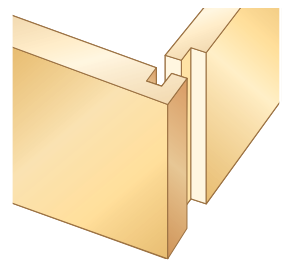
Haunched Mortise & Tenon Joint

Similar to blind mortise and tenon and used most often with frame-and-panel doors.



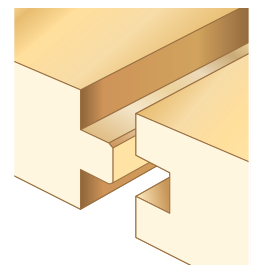
Rabbet Joint

A very basic joint for box building, the rabbet is an improvement over the butt joint for strength by adding more glue surface and helps prevent racking.



Rabbet & Dado Joint

The locking effect of placing a rabbet in a dado joint adds strength by providing additional glue surface and provides even greater protection against racking.



Tongue & Groove Joint

A mortise-&-tenon joint cut along the length of two boards, this joint is strong when joining long grain. Also useful without glue, as in case backs.

	BEST USE	ASSEMBLY TIME	REQ'D CLAMPING	ACHIEVES FULL STRENGTH	STRENGTH RATING	WATER RESISTANCE	WORKING TEMP. RANGE	CLEANUP	SHELF LIFE	COMMENTS
TITEBOND ORIGINAL INTERIOR	Interior woodworking projects	15 min.	1/2 hr.	24 hrs.	3,600 psi	POOR	50° F	Water	2 yrs.	Fast grab or tack. Best general purpose interior glue. Least expensive. Long shelf life. Good sandability.
TITEBOND ORIGINAL EXTEND	Interior woodworking projects where more open time is required. Recommended for larger, more complex assemblies.	20-25 min.	1/2 hr.	24 hrs.	3,510 psi	POOR	40° F	Water	1 yr.	Good sandability. Long open time.
TITEBOND II WEATHERPROOF	Outdoor woodworking projects where water resistance is important. Interior projects where contact with food or or water is likely.	15 min.	1/2 hr.	24 hrs.	3,750 psi	EXCELLENT	55° F	Water	2 yr.	Good sandability. Water resistance. OK for indirect food contact, paintable, and provides longer shelf-life.
TITEBOND II EXTEND	Outdoor woodworking projects where long open time is required. Good choice for interior projects where water contact is likely.	20-25 min.	1/2 hr.	24 hrs.	3,840 psi	EXCELLENT	60° F	Water	2 yr.	Long open time. Same characteristics as Titebond II above.
TITEBOND III WATERPROOF NEW!	Outdoor woodworking projects requiring longer assembly time and/or lower application temperature.	20-25 min.	1/2 hr.	24 hrs.	4,000 psi	EXCELLENT	47° F	Water	1 yr.	Waterproof, best option for most outdoor projects. Good sandability. Easy clean-up vs. polyurethane glues.

tell you it shouldn't be too high, but the number you need to remember is between 1/8" and 1/4" above the wood's surface. This leaves the teeth at an appropriate height to not only make the cut, but to clear the chips and dust from the cut, while not leaving too much blade exposed to pose a hazard.

Maintenance

An old woodworking axiom that is quite true is that your most dangerous tool is a dull one. This certainly applies to table saw blades as well. A dull blade will make you force the material past the blade, making your stance more awkward and increasing the pressure you need to exert toward a spinning blade.

To maintain your table saw in peak cutting condition – and safe – blades must be kept clean and sharp. As you make each cut, wood pitch builds up on the blade and the teeth lose their sharp edge. Here's how to maintain them:

■ Cleaning

Saw blades must be kept clean and sharp to cut properly. When a blade ceases to cut well, it's not always an indication that the teeth are losing their edges. Usually, the problem is caused by accumulated wood pitch on the teeth. To restore the edge, just clean the blade.

There are several ways to do this. Woodworkers swear by all sorts of solvents – ammonia, baking soda dissolved in water, turpentine, mineral spirits and even vegetable oil. My own favorite (and many saw blade manufacturers agree this is fine) is oven cleaner. The blade doesn't have to be warm, as the directions might lead you to believe. Just spray the cleaner on the teeth, wait a few seconds and wipe it off with a damp cloth. Then, after cleaning the blade, wax and buff the plate to help the blade run cooler and keep it clean longer.

There are also a number of "environmentally friendly" blade cleaners (often citrus-based) available that also do a good job. They take a little more time or effort, but they're less a danger to your skin and the environment.

■ Sharpening

If cleaning the blade doesn't restore the edge, the blade probably needs to be sharpened. Unfortunately, sharpening a carbide blade is not something woodworkers can do in their own shops. There are many facets to the teeth of modern blades, and special equipment is needed to accurately grind and hone these complex angles. It's best to find a good professional sharpening service and take your blades to them as necessary.

Most stores such as Rockler (800-279-4441 or rockler.com) or Woodcraft (800-225-1153 or woodcraft.com) have connections to a sharpening service in your area. Also Forrest (866-398-9336, or forrestsawblades.com) not only sharpens its own blades, but will sharpen other manufacturer's blades as well. If none of these options is preferable, head for the Yellow Pages and call a local cabinet shop. They can recommend someone in your area to do your blade sharpening.

Making Crosscuts & Rips

There are three basic saw cuts – crosscuts, rips and miters. Crosscuts are made perpendicular to the grain, rips are made parallel to the grain and miters are cut at angles. None of these require elaborate jigs or complex techniques; however, each type presents special problems you must deal with to make the cut safely and accurately.

■ Crosscuts

Of the three, these are probably the most troublesome to make on a table saw. To cut across the grain, you must move the board sideways, perpendicular to its length. The longer the board, the harder this is to do. To make an accurate crosscut, you must use equipment (such as miter gauges) and techniques that improve balance and control.

■ Rips

These cuts are the easiest because it's a lot simpler to feed a board parallel to its length. Unfortunately, table saws aren't as deep as they are wide, so you need to find a way to control the outfeed to maintain accuracy.

TIPS & TRICKS

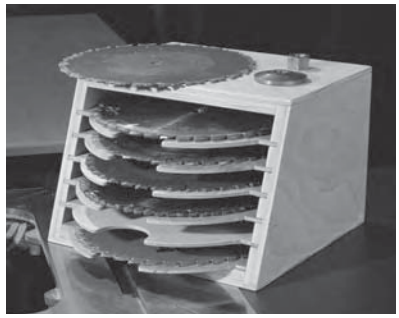
PRO TIP:

The Company You Keep

The type of blade you use on your table saw will determine the quality of the cut, but what's around the blade is important, too. A throat plate designed to fit close around a blade (known as a zero-clearance insert) will reduce tear-out on the underside of a cut and will also be much safer. With one, there's no chance of scrap getting trapped near the blade. You can make your own out of good quality plywood, or purchase a few (get one for dados as well).

PRO TIP:

Treat Your Tooling Well



This may sound a little simplistic, but it's still true. When a blade is not mounted on the saw it must be stored to protect the teeth. Even though the carbide is a tough cutting surface, it's still fragile. Teeth from other blades banging together, or blades inadvertently banging into any steel around the table saw, can easily chip and damage the cutting edge of your expensive blades. When storing or sending the blades out for sharpening, either keep them in their original packaging, or build a simple plywood box to protect your investment.

TIPS & TRICKS

SAFETY TIP:

One We Hope You Know

There is absolutely no reason for you to ever make a cut (crosscut or rip cut) on your table saw without some type of guiding mechanism. Whether that's a rip fence, miter gauge or miter sled, never make a cut on the table saw freehand. You will most certainly get hurt.

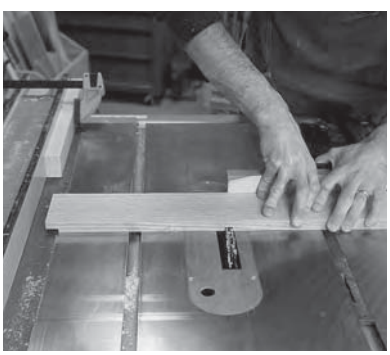
PRO TIP:

Crosscut Both Ends to Square

Cutting a board to length seems simple enough, but almost as important as getting the board the right length is making sure the ends are square to the sides. Don't worry, it's simple. First make sure your fence or miter gauge is cutting square to the blade. Before cutting the board to final length, trim $\frac{1}{2}$" off one end of the board, then flip it end-for-end and measure to make your final cut on the uncut end.

SAFETY TIP:

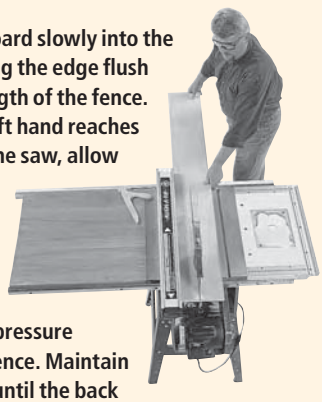
No Rip Fence For Crosscutting



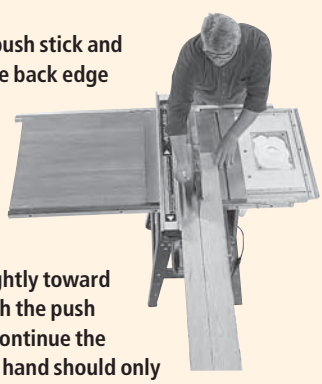
Never use the rip fence as a stop for crosscutting. The cut-off pieces will be pinched between the blade and the fence, and the saw will fling them back at you. Instead, use a stop block – sometimes called a "stand-off block" – mounted to the rip fence behind the blade location to gauge your length and safely make the cut.

Ripping Lumber

1 Ripping a piece of solid lumber is simpler than ripping plywood, but there is more potential for danger because the stress in a solid wood board can pinch the blade when it's ripped. Roller stands are recommended (you can't see mine in the photos) and should be positioned to support both pieces coming off the saw. To start the cut, you should be positioned at the rear corner of the board, supporting the back end with your right hand. Your left hand (at the center of the board) provides pressure against the fence, keeping it flush to the fence. The arrows indicate the direction I'm applying pressure.

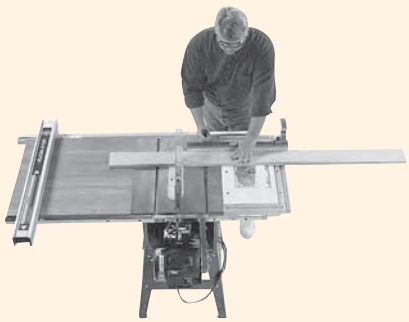


2 Walk the board slowly into the blade, keeping the edge flush along the length of the fence. When your left hand reaches the edge of the saw, allow it to slide backward along the length of the board, maintaining pressure against the fence. Maintain this support until the back end of the board reaches the edge of the saw table.



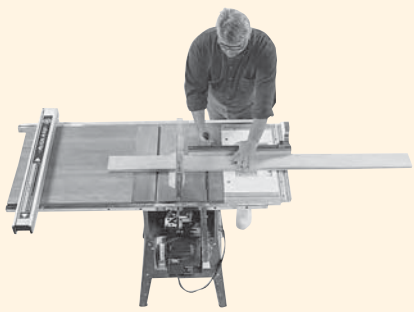
3 Grab your push stick and place it on the back edge of the piece between the blade and fence. Apply pressure forward and slightly toward the fence with the push stick as you continue the cut. Your left hand should only be used to apply minimal guiding pressure on the fall-off piece until the piece is separated, then move your left hand out of the way. Once the keeper board is clear of the blade and guard, turn your attention to the fall-off piece and push it safely forward, again using the push stick.

Crosscutting Lumber

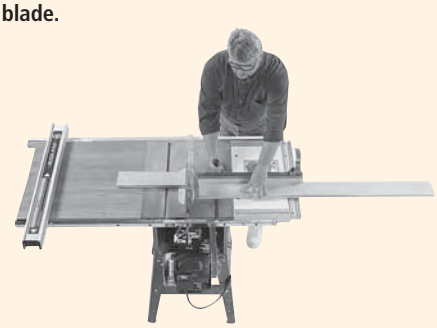


1 When crosscutting a board, the substantially thinner width of the piece (and not enough width to ride adequately against the fence) requires us to use a miter gauge rather than the fence. Note the gauge in our photos is not standard equipment. We recommend either adding a backing board at least 24" long to your stock miter gauge or purchasing an aftermarket gauge.

Start by checking to make sure your miter gauge is square to the blade. Then align your cut and support the board against the gauge with one hand on the gauge and the other stretching across the piece to hold it tightly against the gauge. If your piece is too wide to reach across, it's smart to clamp the piece against the gauge during the cut.



2 Guide the gauge and board into and past the blade.



3 Once the board is cut through, allow the fall-off piece to lie in place. With your left hand, push the board away from the blade, sliding it along the gauge. Then turn the saw off. Once the blade stops spinning, pull the fall-off piece away from the blade.

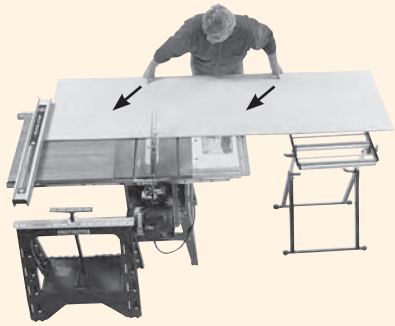
Ripping Plywood

1 Ripping a 4'x8' sheet of plywood on a contractor saw is possible, but requires finesse. Roller stands are a must, and they should be positioned to support the largest piece coming off the saw, or preferably both pieces. To start the cut, you should be positioned near the rear corner of the sheet, supporting the rear with your right hand while your left hand provides pressure against the fence and aligns the sheet flush to the fence. With the piece pushed nearly up to the blade, check the fit against the fence again, then slowly walk the sheet into the blade.

2 As you move forward, keep your eye on the fence to keep the sheet flush along the fence. As the balance of the weight of the sheet is transferred to the saw table you can shift your position to the rear of the sheet, supporting from the back, but still maintaining pressure against the fence with your left hand. Continue to push the sheet forward, paying attention to the point when the sheet contacts your roller stand (to make sure it's riding on the stand, not pushing it over), then continue the cut. My roller stand is not visible in the photos.

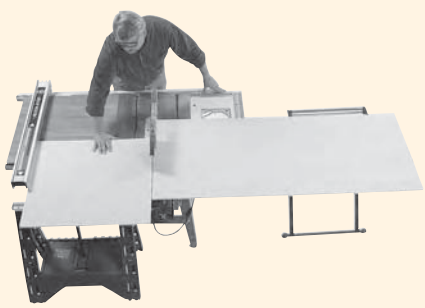
3 At the end of the cut, let the waste piece to come to a rest. Then push the piece between the fence and blade clear of the blade, careful not to extend your reach over the blade. Lift the piece up and over the fence. Then continue to push the waste piece forward and away from the blade until it clears the blade and guard.

Crosscutting Plywood



1 Crosscutting a sheet of plywood on a contractor saw is a task safely accomplished with the use of roller stands. Here you see one stand positioned to one side of the table saw and another positioned at the outfeed side. When using the rip fence, don't crosscut a piece less than 18" wide and more than 48" long. There is too much chance of the board shifting and becoming pinched. Start by standing in the center. Keep your eye on the fence and keep the board tight against it. Again, arrows indicate where my hands are applying pressure.

2 Maintain the center position as you push the board through the blade. Keep your eye on the fence. While your instinct is to control the whole board, the part between the fence and blade needs all your attention.



3 Once the board has cleared the blade, let the fall-off piece lay where it is and carefully push the piece between the fence and blade past the blade and onto the roller stand. Keep the piece flush against the fence until the piece is clear. Then lift the fall-off piece out of the way.

All About Carbide

Most woodworkers prefer a saw blade with carbide teeth. They cut cleaner and hold a sharp edge longer than steel. But let's take a look at what carbide is and how it's made.

Carbide starts as a fine blend of either tungsten, titanium or tantalum powder (or some combination), carbon powder, and a binding agent (usually cobalt).

Carbide is graded according to the grain size and the hardness. For woodworking, a softer grade of carbide is preferable (such as C-1 or C-2). If a harder grade (C-4) is used, it may be brittle and wear too fast.

The photo (below) shows a carbide edge at the microscopic level. While this is a sharp edge, the grains have a ridged appearance. Smaller-grained carbide gives a more precise (less ridged) edge.

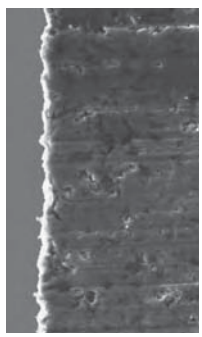


Photo courtesy of Freud

Wax and ethanol are then added to the powder and carefully mixed and blended for days. The wax holds the carbide slurry in shape before heating, while the ethanol is present only to help the powder mix evenly.

The slurry is then dried in a nitrogen atomizer. This evaporates the ethanol and by using nitrogen, there is no chance of oxidation (rusting) occurring in the powder.

The dried powder is then pressed (using tons of pressure per square inch) into the appropriate tooth shape, but the teeth are left oversized as carbide shrinks during heating. Even after this immense amount of pressure, the carbide shapes are very brittle and can be easily broken apart between your fingers. You can actually write with the carbide as with a piece of chalk.

The carbide pieces are then heated (sintered) at 2,700° Fahrenheit for 14 hours, and cooled using argon gas for another six hours. The carbide shapes are brazed to the body of the cutting tool and finally ground to their ultimate shape.

— David Thiel

Tapering Jig

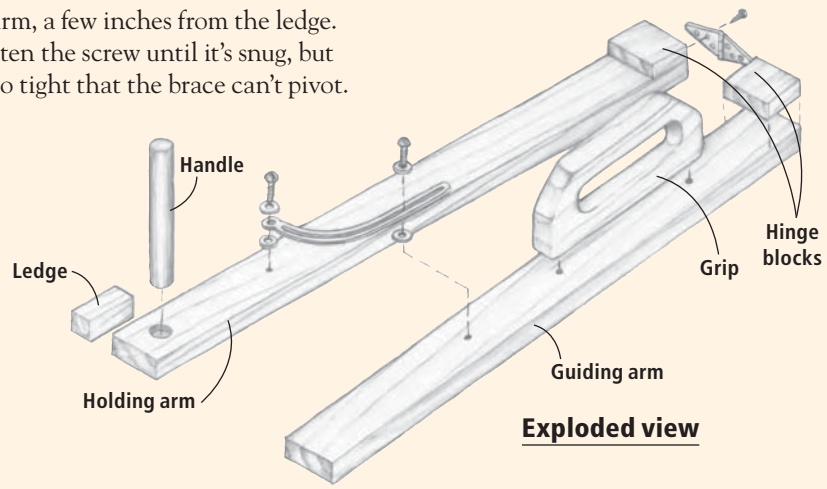
A tapering jig consists of two long arms, hinged together at one end. A ledge is glued to one arm near the end opposite the hinge. A metal brace lets you adjust and lock the angle between the two arms. The arm without the ledge guides the jig along the rip fence, while the other holds the stock at an angle to the saw blade.

To make the jig, cut the parts to size and drill a hole for the handle in the holding arm. Glue the ledge to the holding arm and the grip to the guiding arm. When the glue is dry, install the hinge that holds the two arms together.

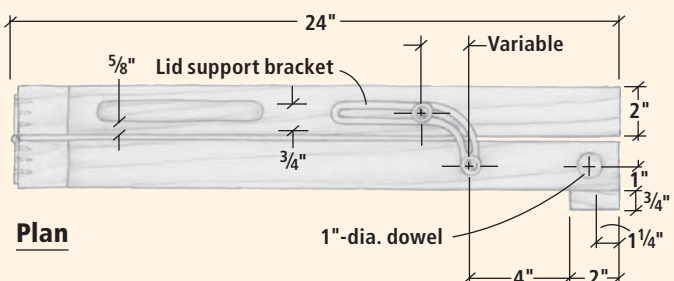
Purchase a curved box lid support and remove the metal mounts from the brace. Using a panhead screw, fasten the fixed end of the brace to the holding arm, a few inches from the ledge. Tighten the screw until it's snug, but not so tight that the brace can't pivot.

Insert another screw through the slot in the brace and drive it into the guiding arm. You may have to experiment with the placement of this second screw. Find the location that allows you to open the arms as wide as possible, but keeps the end of the brace from straying over the outside edge of the guiding arm when you close the jig.

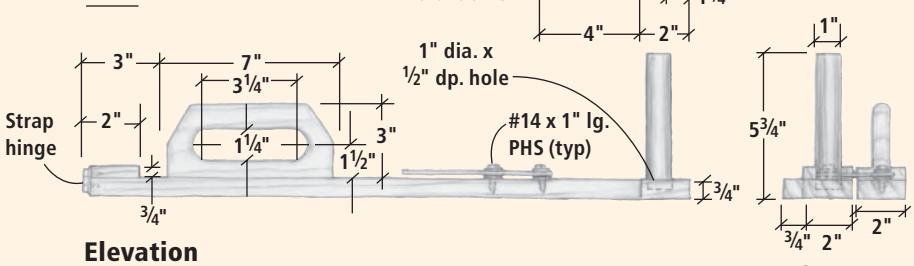
To lock the arms in place, open or close them to the desired angle. Then tighten both of the panhead screws.



Exploded view



Plan



Elevation

Profile

Illustration by Mary Jane Favorite

Queen Anne Side Table

Photo by Al Parrish

Part 2: Building the base. My detailed finishing techniques will allow you to complete this beautiful period piece.

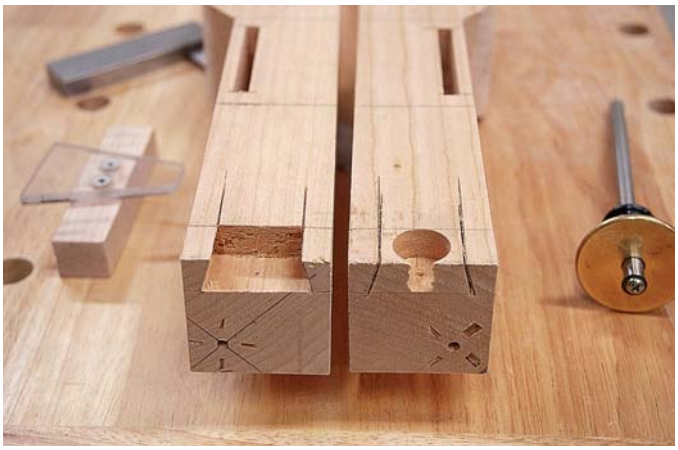
In the October 2004 issue I showed you the steps to create the cabriole legs for this classic Massachusetts Queen Anne side table. In this article I'll walk you through the steps to attach the aprons, build the drawer and apply a beautiful finish to complete the project.

If you missed the legs article, I've included an abbreviated version of how to build them on page 67. The necessary pattern to create the legs is available online at popwood.com. Click on the "Magazine Extras" link.

by Glen Huey

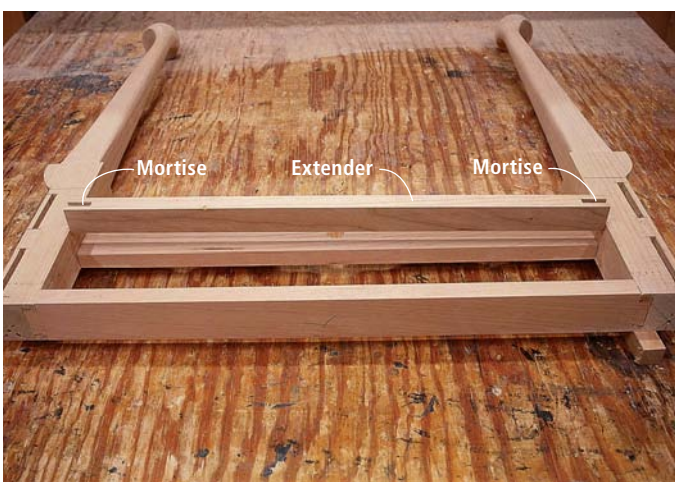
Glen builds custom furniture in Middletown, Ohio, for Malcolm L. Huey & Son, teaches woodworking and is a contributing editor for Popular Woodworking. *He also is the author of two books, "Building Fine Furniture" and "Fine Furniture for a Lifetime" (Popular Woodworking Books). See more of his work at hueyfurniture.com.*

Step photos by the author



Here you can see that I used a Forstner bit to remove the majority of the waste, then I hand-cut the dovetail socket. Transfer these shapes to the rail to complete the joinery on the top rail.

To make the double tenon, first form one complete tenon on the ends, then use a hand saw to divide the tenons. Then chisel out the center.



The front apron extender fits between the front legs and has a mortise on either end that will hold the drawer runners in position.

Dovetails, Tenons and Finery

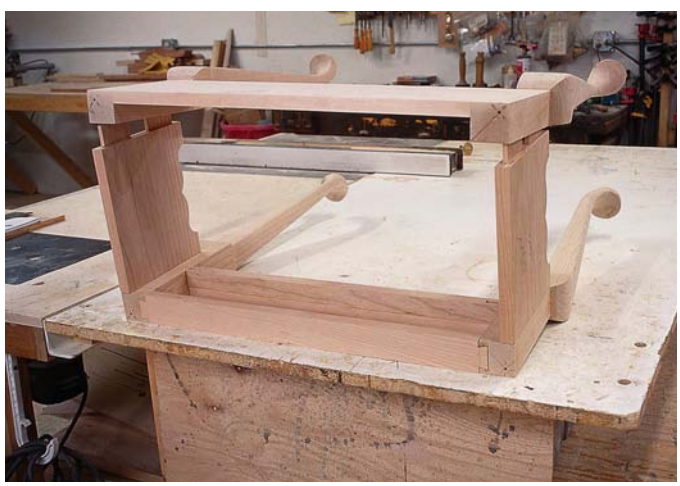
At the end of the cabriole legs article, we had completed the shaping of the legs and had made the mortises to accept the back, sides and lower front apron.

The front top rail is attached to each leg with a single dovetail. Lay out and cut a ½"-long x ¾"-deep dovetail into each leg for the front top rail. Then use the completed pin socket to create the tail on the two ends of the top rail.

Next, you need to cut tenons on the back, sides and front apron. Use the mortises cut in the leg posts to size the tenons. Notice that I used double tenons for the back and sides. Because these boards are so wide, the double tenon allows for wood expansion, and avoids cracks or splits in the aprons.

Once the tenons are cut, use the patterns at right to lay out the decorative details on the aprons. This is actually simple work and can be done using a band saw or, if necessary, a jigsaw. Take your time making the cuts, and then carefully sand the profiles to remove the saw marks. It's tempting to gloss over this step, but once the finish is on the table, any leftover saw marks will detract from the final appearance of the project.

After laying out the pattern for the apron details, use either a band saw or jigsaw to cut out the pattern, then sand the edges smooth.



The frame is glued together in stages. Install the sides in the front frame mortises, putting glue only in the front frame. Then place the back frame in position (without glue) to hold everything while clamping the front joints.

Careful Steps to Glue-up

With most tables it makes sense to glue things up in stages rather than trying to fit everything together at once. It makes it easier to check the fit of the piece without having to hurry.

This table is no exception. First, do a dry-fit on the table pieces to make sure everything aligns properly. Then start the glue-up by first assembling the back apron and two rear legs. Then assemble the front legs, the front apron and the top rail. Set these two assemblies aside and allow the glue to dry.

While the front and back assemblies are in the clamps, use the time to make the front apron extender. The front apron extender simply has 1/4" x 1" x 1/2"-deep mortises on each end to receive the drawer runners. It fits between the legs, extending the apron to make it even with the inside surface of the legs. Attach the front apron extender to the apron with glue as shown at left.

The next operation is to attach the side aprons to the front only. Do not glue the back assembly at this point. All you want to do is apply glue in the front mortises and to the front tenons. Slip the sides into place and then put the back assembly in position (without glue), and clamp and square the assembly.

Guiding the Drawer

The single drawer slides in the table on wood runners that have side guides attached to keep things straight and smooth.

After the glue in the sides/front assembly is dry, remove the back assembly and make the drawer runner and drawer-guide units. Cut 1/4" x 1" x 1/2" tenons on one end of the runners, which will fit into the front mortises in the front apron extender.

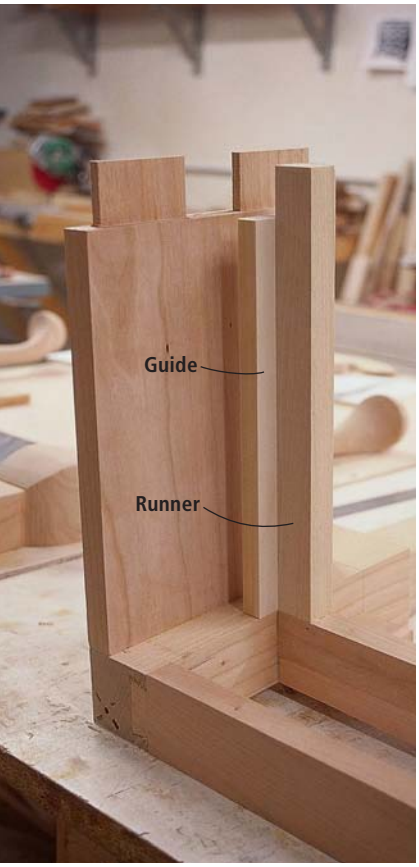
Then cut the drawer guide pieces to length and nail them to the outer side of either drawer runner. Check the fit.

Now glue the back assembly to the sides (glue the front of the drawer runners but leave the back loose) and clamp everything together, again squaring the case.

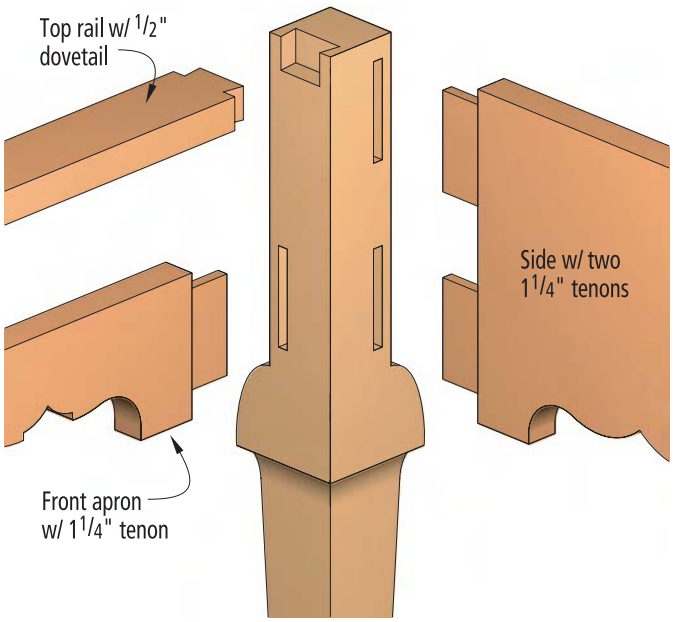
Let everything dry, then level the drawer runner units from the front to the back of the case on each side. It's also important that the drawer runners are parallel to one another. Otherwise the drawer will rock on its runners. Attach the drawer runners to the rear legs with reproduction nails, as shown on page 64.

Building the Drawer

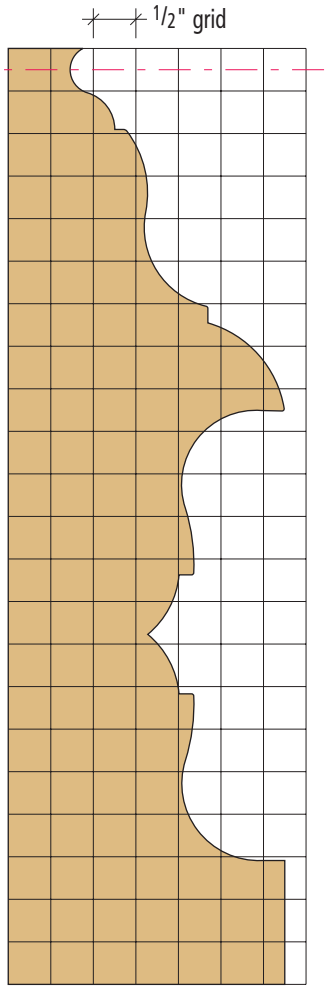
You're now ready to build the drawer. Start by milling and cutting the drawer parts. I use traditional half-blind dovetail joints at the front of the drawer and through-dovetails at the rear.



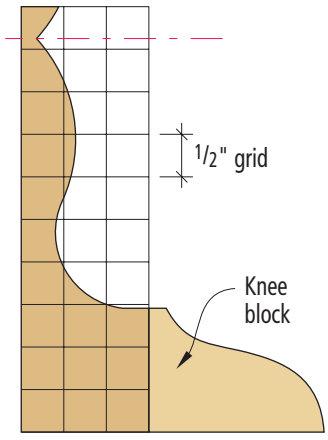
The two-piece drawer guides are installed next. The runner has a tenon on its front end sized to fit into the apron extender's mortises. The guide piece is simply nailed to the runner. Then glue the back assembly in place, leaving the runner/guide loose at the rear for now.



Inside-corner joinery

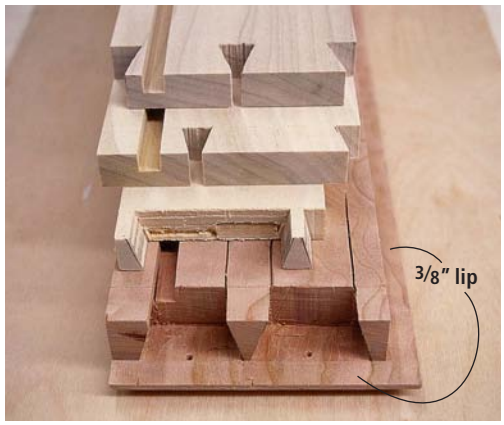


Half-apron pattern

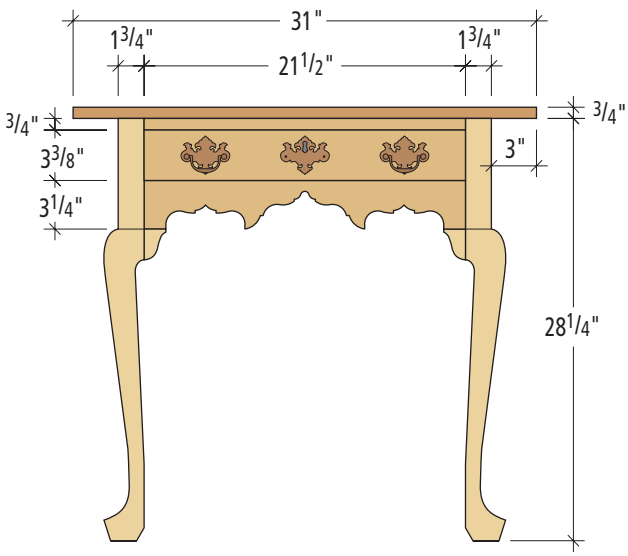


Half-side pattern

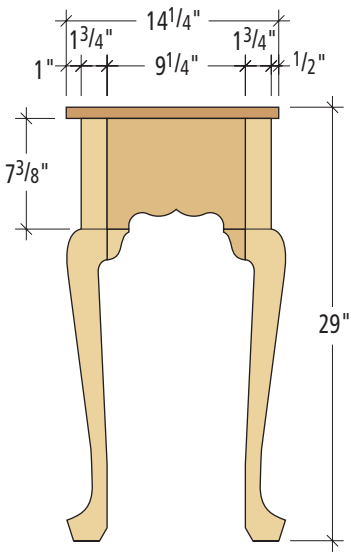
After the frame is complete, the runners can be leveled and nailed in place to the inside of the leg.



With the frame assembled, measure to double check your drawer dimensions, then mill the pieces. The drawer is assembled with through-dovetails at the back and half-blind dovetails at the front.



Elevation



Profile

QUEEN ANNE SIDE TABLE

	NO.	ITEM	DIMENSIONS (INCHES) T	W	L	MATERIAL	COMMENTS
❑	4	Legs	2 3/4	2 3/4	28 1/4	Cherry	
❑	6	Knee blocks	1 1/2	1 1/2	2	Cherry	
❑	2	Sides	3/4	7 3/8	11 3/4	Cherry	1 1/4" TBE
❑	1	Front apron	3/4	3 1/4	24	Cherry	1 1/4" TBE
❑	1	Top rail	3/4	1 7/8	22 1/2	Cherry	1/2" dovetail BE
❑	1	Back	3/4	7 3/8	24	Cherry	1 1/4" TBE
❑	1	Front apron extender	3/4	1 1/8	21 1/2	Cherry	
❑	2	Drawer runners	3/4	1	10 3/4	Poplar	1/2" TOE
❑	2	Drawer guides	1/2	1 3/8	9 1/8	Poplar	
❑	1	Drawer front	7/8	3 5/8	22 1/8	Cherry	3/8" lip, 3 sides
❑	2	Drawer sides	1/2	3 1/4	11 1/2	Poplar	
❑	1	Drawer back	1/2	2 1/2	21 3/8	Poplar	
❑	1	Drawer bottom	5/8	11	21	Poplar	
❑	1	Top	3/4	14 1/4	31	Cherry	
❑	5	Wood clips	3/4	7/8	2 1/2	Poplar	

TBE = tenons both ends; BE = both ends; TOE = tenon one end

The joinery on the drawer is actually one of the more complicated steps in the project, but because there's only one drawer, it's a great chance to practice your hand-cut dovetails. *(Editor's note: for detailed technique information, check out "Four Good Ways to Build Drawers" in our October 2004 issue.)*

The drawer front is lipped on three sides (all but the bottom) and overlays the front of the table, as shown above.

Once you have completed the dovetail joinery, cut a 1/4" x 1/4" groove into the drawer sides and front to capture the drawer bottom. Then assemble the drawer.

Now mill the 5/8"-thick bottom to fit the drawer by beveling it on three sides. This will allow the bottom to slide into the drawer groove. You will need to make a relief cut in the bottom (as shown above right), which will allow you to nail the bottom to the drawer back. Mark the height of the relief cut, slide the bottom out of the drawer and make the relief cut. Install the bottom using a single reproduction nail.

Add a Knee

The table base is essentially complete, but the legs are actually missing an important part – their knees. The knee blocks blend the cabriole legs into the apron. When making the legs there's no good way to incorporate the knee blocks into the original shape and material of the legs, so the knee blocks are traditionally added after the legs are shaped.

Even though the knee blocks are additions, it's still a good idea to try for a nearly seamless grain match to help continue the illusion. After selecting the best grain pattern for the knee blocks, there are three steps in making them.

First, cut the knee blocks to size. There are two knee blocks

The bottom is a traditional 5/8"-thick piece, beveled on three sides to fit the grooves in the drawer sides and front. The back edge overlaps the drawer back and is nailed in place through the relief cut.

per front leg and one for each back leg. No knee blocks are required at the rear of the table.

Next, align each knee block in place next to the leg and against the rail (or side). Mark each knee block where the curve of the leg terminates at the block, and also where the profile on the apron or sides meets each knee block. Each knee block may have a slightly different fit to the legs, so it's necessary to hand fit each and mark them accordingly.

Finally, trace the profile of the knee block from the pattern on page 63 onto the other side of the block, aligning the shape with the termination marks you carried over from the legs and sides. Then cut and sand to the final profile, and glue the knee blocks in place. The legs are now complete.

To finish off the case, I added square pegs in the legs to add strength and a traditional detail. Mark the peg locations (to intersect the apron tenons in the leg mortises) then drill holes for the 1/4" square pegs.

Make the pegs from a harder wood than your table. I used oak pegs for my cherry table and though the finished look is square, I rounded and tapered the leading end of the pegs to make them easier to insert. Apply a bit of glue to the holes and tap the pegs into place. When dry, final sand the entire surface to #180 grit.

Topping it All Off

The top is one of the last steps and while you've spent a significant amount of time getting the legs and aprons perfect, the top is the most visible part of the table.

Because you're likely making the top from more than one board, make sure your wood and grain selection offers the best pattern and color match.

Once the top is milled, glued and has been cut to final size, it's time to form the profile on the edge of the top. Use a 3/16" beading bit on the top edge and a 1/4" roundover bit on the lower edge to create the profile. Go ahead and sand the top to a finished smoothness with #180-grit sandpaper.

To attach the top to the case, I used wooden L-shaped clips (sometimes called "buttons") slipped into slots in the aprons. Use a biscuit joiner to cut the 1/4" slots into the sides and back, down 1/2" from the top edge. To make the slot wide enough at full depth, make two cuts adjacent to one another at each location.

Make the wooden clips to attach the top as shown on page 66. Screw the clips in place on the underside of the top, with the clips located in the center of each

The knee blocks complete the shape of the leg and tie the legs to the aprons. Pay particular attention to grain direction when fitting these pieces.

To continue the authentic details on this piece, square pegs reinforce the leg-to-apron joint.

SUPPLIES

Horton Brasses
800-754-9127 or
horton-brasses.com

3 • Nails, 1 1/2" reproduction #N-7, $2 per 1/4 lb.

2 • Drawer pulls #C-602S, $7 each

2 • Drawer escutcheons #C-602SE, $4 each

Woodcraft Supply
800-535-4482 or
woodcraft.com

1 • Behlen Wool-Lube, 16 oz., #18Y61, $6.99

1 • Hock Blonde Dewaxed Shellac, 1 lb. bag #143155, $19.99

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

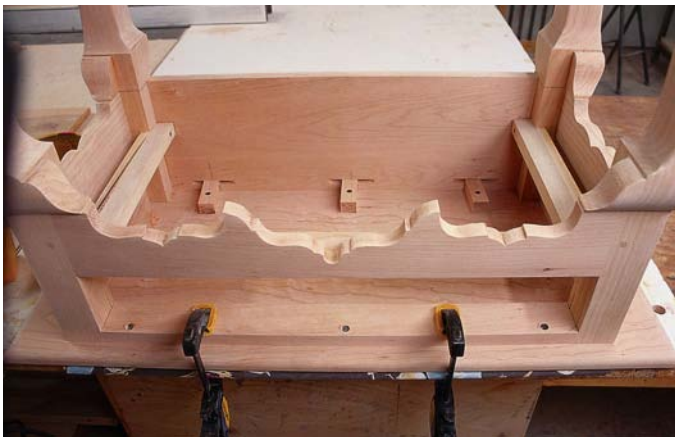
1 • J.E. Moser's Water Based Aniline Dye Stain, Early American Cherry , 4 oz., #W14304, $16.39

Rockler Woodworking & Hardware
800-279-4441 or rockler.com

1 • Sanding sponges, extra fine, #23163, $2.49 each

Prices as of publication deadline.

Delicate edge treatments with a router give the top a sophisticated profile. Use a 3/16" beading bit on the top edge and a 1/4" roundover bit on the bottom.



Attach the top to the table frame at the rear using L-shaped wooden clips. The tongue of the clip slips into 1/4" grooves cut in the aprons with a biscuit joiner.

slot. To hold the top in place at the front of the case, drive three screws through pre-drilled clearance holes up through the front top rail, as shown above.

Why Dye?

After spending so much time and care building your table, you want to make sure you devote the same care to your finish.

My preference for adding color to a piece is water-based aniline dye stains. They're much easier to mix and to clean up afterwards, and the water-based dye stains are more light-resistant (less likely to fade in normal sunlight) than the oil- or alcohol-based varieties. They're also easy to apply, whereas alcohol-based stains can sometimes leave streaking.

Water-based dyes can be applied by spraying or brushing with equally impressive results. The secret (if you can call it a secret) is to follow the correct procedure when using either method.

Sand and Water Treatment

Begin the process by sanding the entire piece to #180 grit. Don't go any further because it will be time lost and may actually affect the appearance of the finish. Why? Because water-based aniline dye stains will raise the grain on the wood. This makes the surface rough and also affects the absorption of the stain into the wood.

Rather than raise the grain while you're trying to apply an even finish, raise the grain prior to staining by wetting the entire piece with a cloth that is dripping wet. Then let the piece dry and sand a second time with #180-grit paper to knock down the "fuzzies" that the water raised.

Next, spend a few minutes "softening" any hard corners or edges on the table with a piece of #100- or #120-grit sandpaper. Sharp edges are a true sign of an "almost finished" project and will show wear quicker.

Puttin' on the Ritz

Now you're ready to mix and apply the stain. I use Moser's stains and mix them very scientifically – one ounce of powder to four cups of water. That's it. Heat the water until you see small bubbles rising from the bottom of the pan. Place the powder into an opaque container to minimize the reaction to sunlight and add the water when it reaches the proper temperature. Replace the lid and shake the mixture.

When the mixture is cool you can begin coloring the wood. The basic rule of thumb here is to saturate the entire piece. Apply the dye until it runs off of the table. You want to see pooling on the flat surfaces and sometimes this will require an immediate second application of the color.

Once you have given it a good soaking, let it sit for five to 10 minutes and wipe away any excess stain. If you don't have any to wipe away, you didn't thoroughly saturate the piece.

Let the dye dry completely, and sand the table with #320-grit wet/dry sandpaper. It's easy to sand through the stain around the corners and edges, so be careful sanding these areas.

At this point, if you're coloring a figured wood like the curly cherry used on this table, you may choose to apply a coat of boiled linseed oil. The oil sinks into the grain of the wood and adds depth to the finish. Simply apply a soaking coat of the oil with a foam brush. Let the oil steep for five minutes and wipe the surface dry. Remember to properly dispose of the used rags. Give the oiled piece 36 hours to cure.

Topping It Off

You're now ready to apply your topcoat. I used a sprayed-on blonde shellac finish. For use in my HVLP

All the fitting and sanding have created a nice piece of furniture, but it still needs a replica finish. Don't try and short-circuit this last step. Even though the piece is sanded, in order to apply a water-based finish, first wipe down the entire piece with a wet rag, then sand again before applying the stain.

spraying system, I mixed the shellac to a 2-pound cut then sprayed three coats, allowing each coat to dry thoroughly and sanding with #400-grit paper between coats.

Sand the entire piece again. Here, I like to use a #400-grit sanding sponge. They don't allow as much heat to build up at your fingertips. Then finally apply an additional two coats of shellac.

Shellac has a shiny appearance when it's applied. I prefer a softer satin finish, and this can be achieved by rubbing out the finish with #0000 steel wool and Behlen's wool lube.

Here's how: Let the piece dry for 24 to 48 hours, then mix a bit of the wool lube into water, dampen the steel wool and rub the surface in the direction of the grain. After a few minutes wipe the surface with a dry cloth. If the finish looks smooth and satiny, you're there. If not, repeat the steps again. Rub the entire table in the same manner and then give it a coat of good paste wax for added protection.

If you were to choose to brush on the shellac instead of spraying, I would adjust the shellac to a 3-pound cut. Use a good brush (in general, the better the brush, the smoother the finish) and apply two coats of finish. Sand the piece thoroughly and brush on a third coat. Repeat these steps for a fourth and fifth coat, then move to the "rub-out" steps.

A Job Well Done

If you've followed all the steps correctly, you now have one of the most pleasing examples of Queen Anne furniture sitting in front of you. You've accomplished a complicated piece of furniture in a fairly simple manner – and you've earned your bragging rights. Enjoy! **PW**

10 STEPS TO MAKING THE LEGS

1 Download the full-size leg pattern online at popwood.com. (Click on the "Magazine Extras" link.) Transfer it to a piece of 1/4" plywood. Cut the pattern out. Mark two connecting sides of each leg blank, knees touching, then cut the legs to length.

2 At the table saw, make two crosscuts per leg to define the top edge of the knee. Cut only on the two sides that are patterned and cut just deep enough (about 7/8") to reach the edge of the pattern.

3 Use the band saw to cut the pattern on one side, stopping in the middle to leave a small uncut bridge section so the piece stays attached. Turn the blank 90° and cut the second side. Then cut away the bridges and remove the waste on both sides. Repeat the process on the other three legs.

4 Mark the center of the top and bottom of each leg blank and mount the leg on the lathe. At your slowest speed, turn the foot to a 2 1/2"-diameter just to the top edge of the foot (1 1/8"). You will need to stop the lathe and remove the waste material at the rear of the foot with a chisel.

5 Define the curve of the top of the foot. Then cut the 1/8" pad to a 1 3/4" diameter. Finally, roll the foot edge to the pad to complete the shape of the foot. Now, turn the other three legs to match the first one.

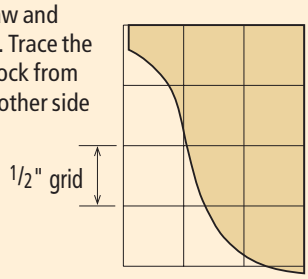
6 Flatten the top of the foot so that the foot transitions smoothly into the ankle of the leg. A spindle sander can speed the process along.

7 Shape the legs using a rasp. Round the ankle to a complete diameter and then gradually move up the leg by transitioning to a square at the knee. Follow the rasp with scrapers and sand the leg to #180 grit.

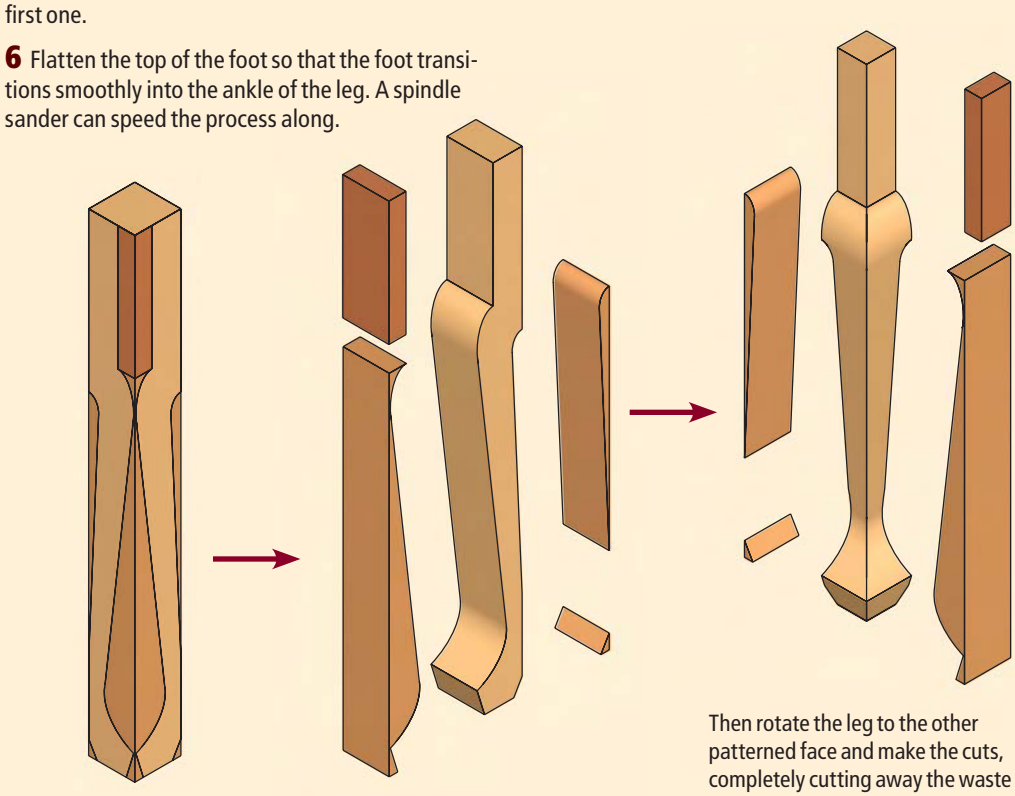
8 Locate, mark and cut the single and double 1/4" x 2" x 1 1/4"-deep mortises on the legs.

9 Head back to the band saw and cut away the waste at the leg posts. Spin the leg 90° and make the second cut.

10 Cut the knee blocks to size. Align the block in place next to the knee of the leg and trace the height of the knee profile onto the block. Cut that profile at the band saw and then sand it to shape. Trace the profile of the knee block from the pattern onto the other side of the block. Then cut and sand to the final profile. Glue the blocks in place and the legs are ready for the rest of the table.



Knee-block pattern



Trace the pattern onto perpendicular faces of the leg blank, choosing the best grain pattern.

Cut the pattern on one face, working in from either end, leaving the waste attached for now.

Then rotate the leg to the other patterned face and make the cuts, completely cutting away the waste pieces. Finally, go back and finish the stopped cuts on the first face to complete the leg.

A Bit of Heaven

A quick tune-up of your auger bits will produce astonishing results.

If you're like most woodworkers, an occasion has come up where you had to drill an odd hole but only the brace and bit will do the job.

These tools are so common that most woodworkers seem to acquire or inherit one with some accessories. So you pull your brace out of the bottom of your toolbox, but its mechanism is gummed up. After some judicious oiling, it finally turns. Next comes the great auger bit search, during which various piles of bits are made: The sawed-off tang pile, the bent pile, the rusted blob pile and the halfway-decent pile. (And don't forget the "what is it?" pile and the "I can't believe I bought that" pile.)

Eventually, with the bit secured in the brace, you attempt to drill a hole. Tension grows. Perspiration sets in. Muscles that haven't been used in years scream for mercy. Finally boards fly and the bit bends. Oh well, it's just another bit for the bent pile.

This kind of experience is enough to scare off most woodworkers, but it doesn't have to be that way. As I was learning to use hand tools in my work I was lucky enough to purchase a complete set of Russell Jennings auger bits that were sharp and perfectly set up for use. It was easy enough to find a decent brace at the local flea market, so I pulled a bit out and started turning.

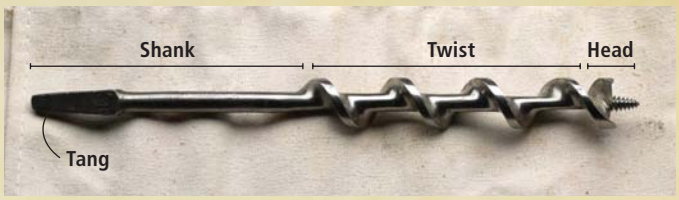
The experience was amazing.

With minimal effort I made a perfectly clean hole. At that moment I was in my special place. This is when I realized that this experience is available to any woodworker willing to buy good bits and learn to maintain them. In this article, I will show you what to look for in purchasing bits and a little about the different varieties out there.

Auger Bit Anatomy

At flea markets, garage sales, auctions and on eBay.com, auger bits are abundant and pretty inexpensive. But before you start your collection, there are few important facts to know.

Diameter – The first thing to understand is how auger bits are sized. On most bits there's a number stamped on the square section of the tang. That number represents the diameter of the bit in 16ths of an inch. So a "4" represents 4/16"; or, when properly reduced, 1/4". A typical set of bits will include 13 sizes, from 1/4" to 1" in diameter.



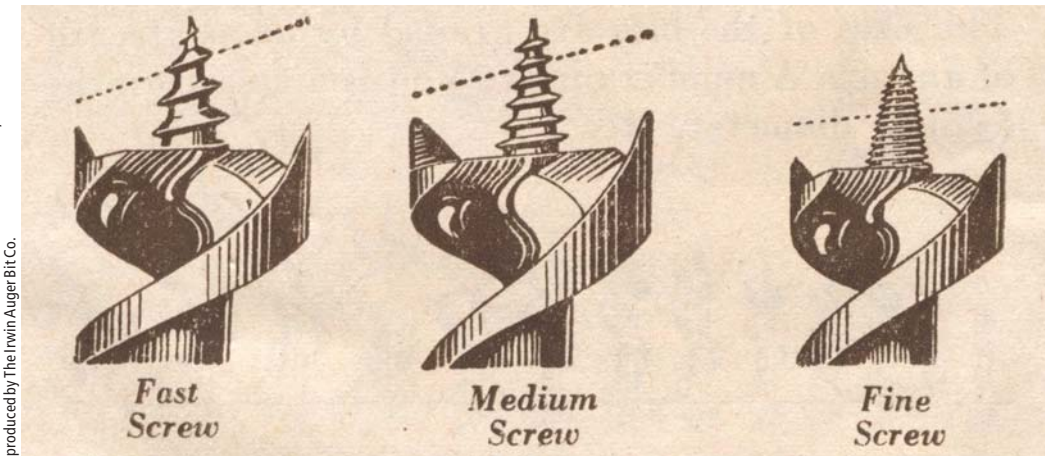
Shown is an Irwin-pattern auger bit. There are a few different patterns, but all auger bits have the same parts: the head, twist, shank and tang.

Lead Screw – The lead screw is the part of the bit that has screw threads and starts the hole. If you work mostly in hardwoods, a fine-thread lead screw is better because it doesn't pull through the wood so quickly and allows the rest of the bit to do its job. Bits with a coarse screw (sometimes referred to as a "fast screw") work best in softer woods such as pine. If you use a coarse lead screw in oak, for example, there's a greater chance of the bit clogging up or you having great difficulty in turning the brace's handle. This happens because one of the three things the bit does (pulling, scoring and cutting) is inefficient. But more about this later.

by Samuel Peterson

Samuel Peterson is a traditional woodworker who enjoys building period furniture the old way. His varied interests are brought out in the sometimes obscure topics he writes about.

Photos by Al Parrish



Illustrations from "How to Select Use and Care for Bits," produced by The Irwin Auger Bit Co.

In general, auger bits can be found with three different lead screws, fast, medium and fine. The fast screw is for softer woods and the fine screw is for hardwoods. The medium screw works well in both.

Tang – A sad fact of life is that many people have hack-sawed off the four-sided tang of many traditional auger bits to be able to chuck them into a power drill. Although this act is considered high treason by many hand-tool purists, it shouldn't stop you from purchasing the bit if the rest of the bit it is in good shape. These bits work well in power drills, easily outworking modern bits.

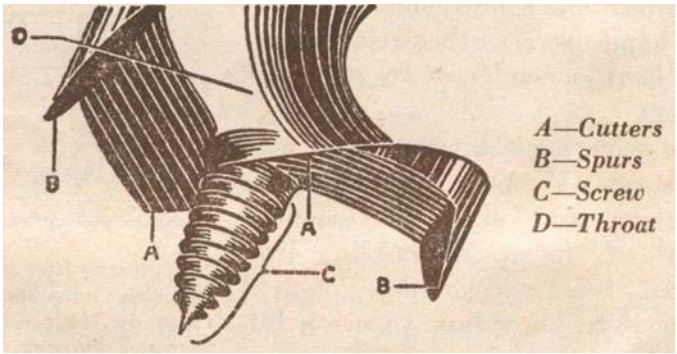
It's possible to use tanged bits in a modern drill without removing the square tang. Here's how: Salvage a two-jaw chuck from an inexpensive ratcheting hand brace. In the groove of the ratchet gear is a pin that secures the chuck to the shaft. If you carefully knock the pin out, the entire chuck and its shaft will slip off the brace. Now you can chuck this old chuck in your modern chuck, and any tanged bit can be used.

When buying used, avoid bits that are bent, badly rusted or mangled. (It will be better for your long-term mental health.)

Scoring Wings – Half-oval-shaped scoring cutters that are generally called wings, flukes or spurs are at the cutting end of the bit. These score the wood on the outside diameter of the hole, allowing the cutting lips in the center of the bit to remove the waste wood. The wings should be fairly tall, between one-third and one-half the length of the bit's lead screw.

Cutting Lips – The bit will have either one or two cutting lips, with two being the most common arrangement. These lips work like the blade in a hand plane. The scoring wings of the bit define the hole's edge, the lead screw pulls the bit into the work and chews up the center of the hole, and the cutting lips plane the waste wood between the center hole and outside diameter. Look for cutting lips that haven't been filed much and are free of major nicks or damage.

If you're looking for quality brands, I prefer to stick with the major players of the last century. Some of these are Russell Jennings, Irwin, Swan, Greenlee and Stanley. These manufacturers took pride in producing quality bits, and many times a wooden case is included to store and protect them. Complete sets are available on the Internet, often selling for less than it would cost to purchase the bits separately.



This classic illustration from an old Irwin publication shows the parts of the auger bit's head.

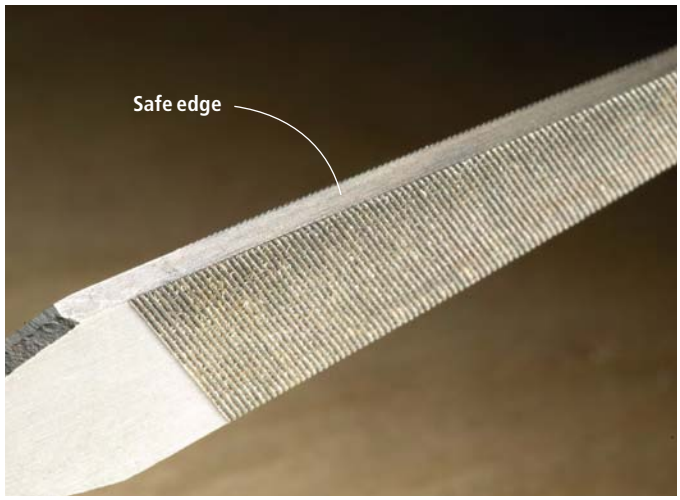
Auger Bit Maintenance

There are four steps to tuning up an auger bit. Before you tune up a nice example, it's best to practice on an old rusted one. Tuning them up isn't difficult, but excessive filing can ruin them.

Lead Screw – When an auger fails to cut, the lead screw is usually jammed up with wood that has been compressed and packed between the threads. Many bits are found at garage sales in this very condition. The screw threads need to be clean, both on the peaks and the valleys. Try wetting a strong length of thread and pulling it through a cloth filled with an abrasive household cleaner (such as Comet). Then use the thread like dental floss to clean between the bit's threads and use

Use an auger-bit file to sharpen only the inside edges of the spurs. Sharpening the outside of the spur can render the bit useless. Auger bit files are available from Tools for Working Wood (see the Supplies box).

Here's the right way to sharpen the cutting lip. File the cutting lip only on the side shown and try to maintain the same factory-set geometry of the lip. Your goal is a consistent burr on the other side of the cutting lip. Remove that burr with one pass of the file or with a small slipstone.



Auger-bit files are extraordinarily useful tools because they have so-called "safe" areas, or places where there are no teeth. Here you can see the file teeth on the face with none on the edge. The other end of the file has the reverse set-up.

the same cloth to clean the peaks of the screw.

Scoring Wings – Because the wings slice, it's important that they do their job before the cutting lips get to the wood. That is why it is important that they are tall enough to do this. Make sure that they are smooth and quite sharp. When you sharpen them with a file, you must only file the inside edge of the scoring wings, otherwise you'll reduce the diameter at the head of the bit. As your hole deepens, the remainder of the spirals won't fit. Ideally, the wings should make the bit somewhat larger at the bottom.

Cutting Lips – Finally it's time to sharpen the cutting lips. These are sharpened best with a special file, called an "auger-bit file," that has so-called "safe" edges. Safe edges are parts of the file that won't cut. In an auger-bit file, one end of the file has teeth on the faces of the file but not on the edges. The other end of this file has teeth on the edges but not on the faces. These safe edges and faces allow you to file exactly where you want, without accidentally filing somewhere you don't.

As with all sharpening, strive to remove the least amount of metal possible. Place the lead screw down on a scrap of wood and file the cutting lip as shown above. Maintain the lip's original cutting angle as best you can. Take a few strokes until you can feel a burr on the other face of the cutting lip. Stop filing. Remove that burr with a single light stroke of your file or a slipstone. It's also important that the spirals (commonly called the "twist") running up the bit can be cleaned and buffed to aid in chip removal during boring.

And Then to the Brace

Once you obtain a good set of auger bits, you are going to start thinking about upgrading your hand brace. There are many types and sizes. The "throw" is generally how a brace is sized. The throw is how far out the handle is from the chuck, measured in inches. The "sweep," another common term for sizing braces, is twice the throw. A brace with a 5" throw has a 10" sweep, for example.

Common sizes are as small as a 3" throw all the way up to an 8" throw. The most common size is the 10" brace, with 8" braces especially nice for cabinetwork. Many braces will ratchet, allowing them to be used in tight spots.

Tuning an auger bit is a quick operation, and the results last for many years under normal use. Once you start enjoying the simple brace and bit, just wait until you find out about the rest of the universe of boring tools: Ultimatum braces, ratcheting braces, spoon bits, expansive bits, hollow augers and lion chucks. It's a slippery slope; let me be the first one to give you a push. **PW**

Here's another vintage Irwin illustration that shows how the parts of the bit work together. The lead screw pulls the bit into the wood (left). The cutting spurs score the diameter of the hole (center). And the cutting lips remove the waste inside the score mark (right).

BIT BRACES TO LOOK FOR AT FLEA MARKETS AND SALES

Bit braces are among the most common old hand tools to be found at local sales and flea markets. And, they can also be among the least expensive tools to buy, running from 50 cents up to $10 in my part of the country (New England). But all braces are not alike, and with so many to choose from you should be able to separate out a genuine quality brace from the rusty dross category that most flea-market braces fall into.

What is a quality brace that will stand up to heavy use? First, it likely will be at least 50 years old. Braces made in the last 50 years pale by comparison with the best braces made from about 1900 to 1950. Next, it will have been made by one of four manufacturers. These makers were: the Millers Falls Co.; the Peck, Stowe & Wilcox Co. (later called "Pexto"); North Bros. Mfg. Co. (later acquired by Stanley); and The Stanley Rule & Level Co. (later, "The Stanley Tool Co.").

All but North Bros. made braces of lesser quality as well as top-of-the-line ones, so just the name on the brace is not a guarantee of a good one. The best old braces had wrist handles made of rosewood or cocobolo. The top handles ("pads") were fashioned using either rosewood or lignum vitae. North Bros. braces are unique in having handles made of a nearly indestructible brown composite material. Braces with handles made of stained beech, birch or maple are of lesser quality.

On the best braces the top handle is "fully clad." That is, the steel flange on the underside of the handle extends out to the full diameter of the wooden part of the handle. The pad will turn smoothly on the upper shaft, being equipped with ball bearings in a race within the "quill" – the stem that supports the handle.

The chuck will have a knurled shell and, near its lower base, may have expanded diameters, within which ball-bearing action makes tightening the jaws easy. The jaws (there are only two in the quality bit braces) are strong, held parallel to each other in the chuck, and are equipped with wire springs to hold them in the parallel position. The ratcheting mechanism will work smoothly and not have any "play" between it and the frame of the brace.

The best braces should not be rusty, but have much of their original nickel or chrome plating intact. The wood should not be chipped or cracked. The frame should be straight (not bent). It's well worth paying the premium of a few dollars to buy a brace that fit these criteria.

Here is my list of the makers and model numbers of the better braces you are most likely to run into while out hunting rust. There are lots of other good ones – but these are my favorites:

1. North Bros. Mfg. Co. Nos. 2100 & 2101 (the latter is often stamped, "Bell System").

2. Peck, Stowe & Wilcox (also branded as "Pexto" or "Samson") 8000 series (last two digits in the model number give the sweep).

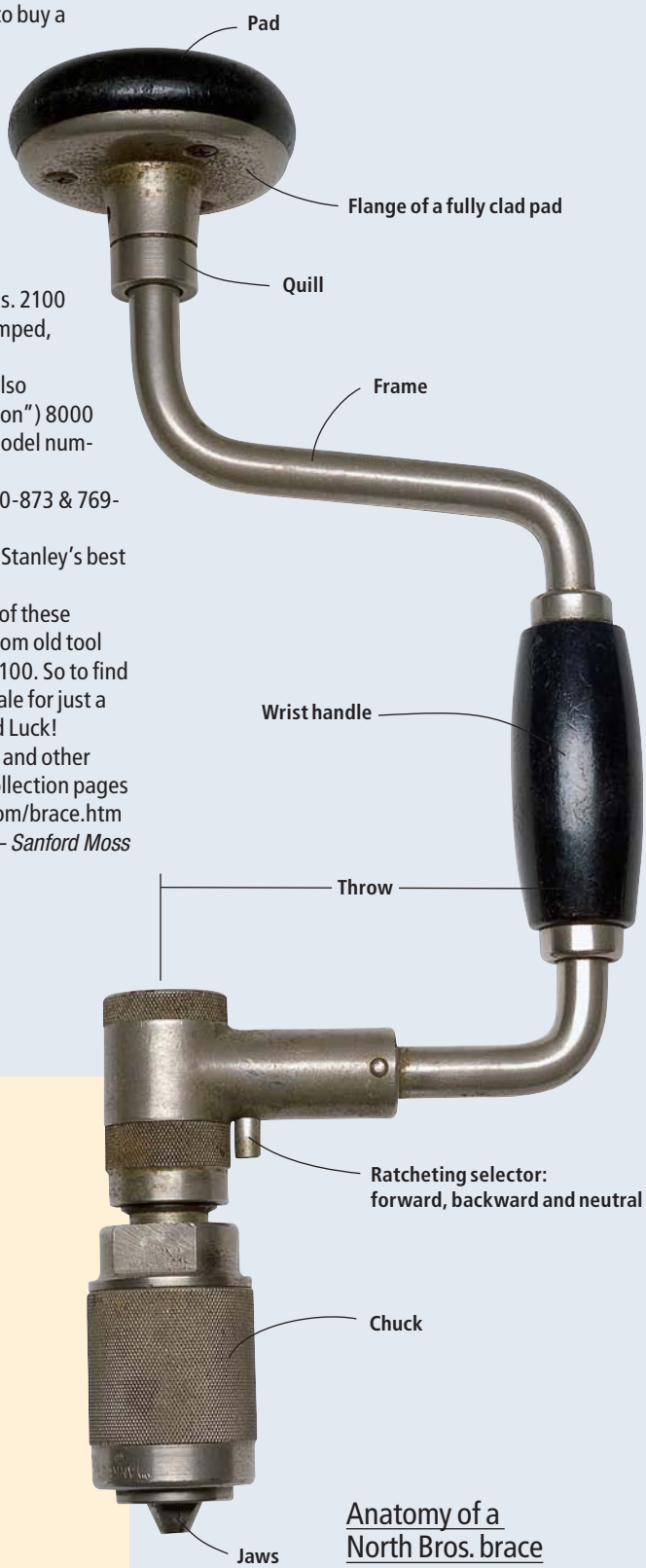
3. Millers Falls Co. Nos. 870-873 & 769-774. "Lion" chuck.

4. Stanley No. 923. One of Stanley's best and most frequently found.

In excellent condition any of these braces will command prices from old tool dealers of between $50 and $100. So to find one of them at a flea or yard sale for just a few dollars is a nice buy. Good Luck!

To learn more about these and other braces, look in on my brace collection pages at http://www.sydnassloot.com/brace.htm

— Sanford Moss



Anatomy of a North Bros. brace

SUPPLIES

Tools for Working Wood
800-426-4613 or
toolsforworkingwood.com

- Nicholson 7" auger bit file #ST-AUG, $8.04

Vintage User Braces

- **Sydnas Sloot**
sydnassloot.com or
sushandel@msn.com
- **Akbar 'n' Jeff's Tool Hut**
workingtools.biz or
tom@workingtools.biz

Price as of publication date.

Return of the RASP

Photo by Al Parrish

Shaping complex and compound surfaces – such as the bow to this Welsh stick chair – is child's play for a decent rasp. I can't imagine a router jig that could make these cuts.

Once available in dozens of patterns, the rasp has all but disappeared. But the stage is now set for a comeback.

One of the most useful wood-shaping tools – the rasp – is on my personal list of endangered tools.

Flip though any early 20th century hardware catalog and you'll be astonished at the variety of rasps that were once available to the woodworker, shoemaker, farrier and even the baker (for removing burnt crust from the bottom of a loaf).

For example, a 1922 hardware catalog from the Hibbard, Spencer & Bartlett Co. in Chicago lists dozens of rasps in lengths from 6" to 16", in three different tooth patterns and a variety of shapes.

But until recently, modern woodworkers had few choices when buying rasps. Nicholson makes a couple quality tools, the #49 and #50. There are imported rasps from Europe and China. And then there's the Microplane – a tool invented in 1990 that's really in a class by itself.

But 2004 is turning out to be a good year for rasps. Auriou, a French company that has been making rasps by hand since 1856, has begun importing its huge line of tools to the United

by Christopher Schwarz

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

States. These are premium rasps – a single cabinetmaker's rasp costs between $67 and $96. But the big bonus with the line from Auriou (pronounced "are-you") is it offers tools that haven't been sold new in this country for years.

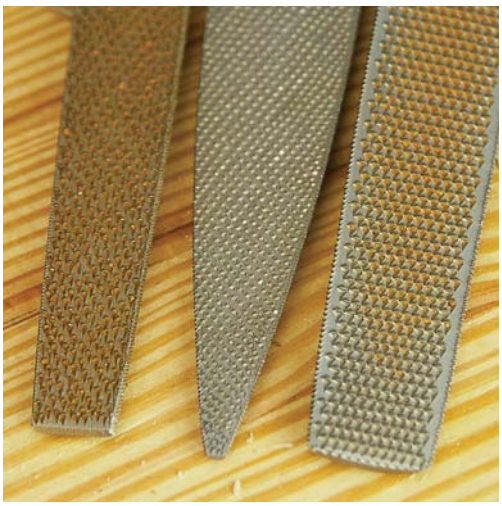
Because of this influx of high-quality tools, I decided to look at what's available today, compare the tools and try to reacquaint woodworkers with this historically useful class of tool.

Why Use Rasps?

Among some woodworkers, rasps have developed a bad reputation. For the hand-tool purist, rasps are viewed by some as cheating. Real woodworkers, the thinking goes, use edge tools, such as spokeshaves, for curved work. And among the power-tool crowd, rasps are seen as just another vestigial tool of the pre-router revolution.

Both groups are wrong. Rasps are an indispensable shaping tool that will greatly expand the scope of your work and the ease at which you can accomplish things that are difficult or impossible with other hand and power tools.

The true beauty of rasps is that you can create any shape or curve you desire without specialized cutters. The work proceeds quickly if you select the correct tool. And rasps are easy to master.



Here you can see some structural differences: The Blundell (left) has hand-cut teeth but a blunt point, the Auriou has hand-cut teeth but a sharp point, and the Belotta has machine-cut teeth with a blunt point.

Shown are a few rasps on the market. From left: an Auriou modeler's rasp, an Auriou cabinetmaker's rasp, a Microplane, the Blundell and the Belotta cabinet rasp with an aftermarket handle.

The Basics

While it's still possible to find vintage rasps at flea markets, most of the ones I've unearthed there are dull or damaged. The one excellent source of vintage tools I've found is Slav's Hardware Store in Chicago. Slav Jelesijevich haunts old hardware stores and buys up files and rasps that have been languishing in the basements of stores for more than 50 years.

The tools he sells have never been used (many are new in the box) and Jelesijevich's prices are reasonable. See the Supplies box on page 75 for details.

For the majority of us, however, we need to look at modern versions. Among the modern tools, there are two basic types: machine-made and hand-made. With the machine-made tools, the machine-cut teeth are quite uniform across the face and the point of the tool is blunt. With hand-made tools, the teeth are spaced irregularly across the face. And with the Auriou rasps, the tool comes to a point, which allows you to cut precisely into corners.

This makes a difference. With the lower quality machine-cut teeth, the perfectly lined-up rows of teeth plow perfectly lined-up grooves in your work. With well-made hand-cut teeth, the finish of the wood is much smoother thanks to the random tooth pattern. (Note that the high-quality machine-cut rasps have teeth that simulate hand-cut teeth.)

Rasps are available in a variety of shapes, but there are three basic shapes that are useful to most woodworkers: half-round, rattail and rifflers. The half-round tools have one face that is flat or just slightly convex and a second face that is curved. These two profiles allow you to shape flat edges plus concave and convex curves.

The rattail shape – essentially a long tapered cone – is useful for enlarging holes and shaping their rims. Plus the rattail is a mainstay of trim carpenters when cope-cutting inside miters.

The riffler is for detail work. It is a bar of steel with complementary shapes at either end. Sometimes a riffler is the only tool that can get into tight spaces.

With the exception of the rifflers, rasps have a tang for fitting a handle. A handle makes the tool easier to control and safer – the tang can puncture your palm.

In addition to the different shapes, there are different degrees of coarseness to the teeth. Most new rasps for sale are patternmaker's rasps, which have a fine tooth, are used for final smoothing and are needed for high-end work.

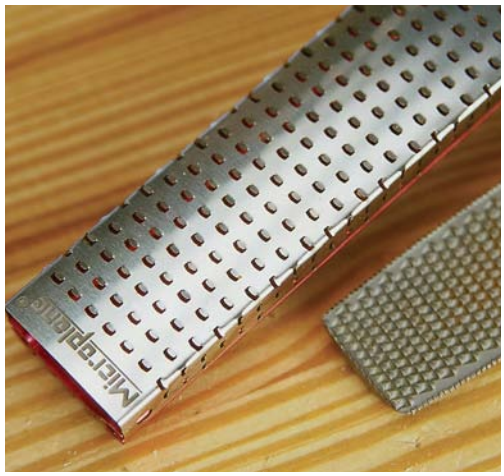
I also recommend you buy at least one cabinet rasp, which will quickly shape wood with a minimum of effort. (Cabinet rasps are further divided into those with bastard, second and smooth cuts – essentially really coarse, coarse and a bit coarse.) Then you come back with a patternmaker's rasp to clean up your work.

Think of this process like you would sanding. You wouldn't start sanding a rough board with #220-grit paper. Let the coarse tool do the heavy lifting and leave the finer tools for the finesse work. Your work will go faster and your tools will last longer.

When using a rasp, you should cut with the grain and approach the work with the tool at an angle. Some texts recommend a 40° angle, but I find that the angle varies with the user and the speed of the work. As with using a scraper, your body and hands will find the best position with a little practice.

Cut only on the push stroke. Applying pressure on the return stroke will dull the teeth. After a few strokes, tap the tool against the bench to dislodge shavings from

One side advantage to rasps is you can modify your tools to fit your grip. Here I'm shaping the bun and handle of a Norris-style smoothing plane kit from Shepherd Tool so it feels like an extension of my arm.



The Microplane is in a class by itself. The teeth cut like small razors instead of saw blades.

the teeth. Periodically clean the teeth with a stiff-bristled brush. Some recommend a wire brush, but I don't find it necessary.

Comparing Different Tools

For the last five months, I've been using a selection of rasps for a variety of tasks, from shaping the bow of a Welsh stick chair to cutting wide bevels on tabletops to forming the handle and bun of an infill smoothing plane.

Let's start with the tools that do the initial hogging of material, the cabinet rasps.

The Spanish-made Belotta cabinet rasp is reasonably priced, but it cuts slowly like a patternmaker's rasp. And its machine-cut teeth left a deep scratch pattern. I don't recommend it.

The inexpensive tool that surprised me was the Czech-made Blundell, which has hand-cut teeth and a black plastic handle. From the looks of it, I wasn't expecting much. However the tool impressed me. It cut smoothly and left a decent finish. My only complaint was the teeth required more cleaning than the other tools and I don't like plastic handles. If I were going to use this tool every day, I'd replace the black plastic job.

For rapid material removal, I preferred the Microplane offset-handled rasp. I was ready to dismiss the tool as a gimmick, but I found it in my hands constantly when I needed to remove material in a hurry. Because the tool's teeth are like razor blades instead of saw teeth, the resulting surface is different than with a traditional rasp. Though the resulting surface looks cleanly cut instead of abraded, it's faceted. After using the Microplane I'd follow up with a patternmaker's rasp and found the facets easy to knock down.

Microplanes come in a variety of profiles and have replaceable blades. After months of use, the Microplane has become my favorite modern tool for shaping.

With the cabinet rasp's work complete, the patternmaker's rasp gets its turn to finish the job.

For many woodworkers the Nicholson #50 rasp is the go-to tool. It cuts smoothly and leaves a pretty good surface behind. I've always thought it was a bit expensive, but it always outperformed the inexpensive imports.

But then there are the Aurious. These tools will spoil you. After working with the other rasps for a couple weeks I'd eventually switch back to the Aurious and never want to go back. They cut smoothly and leave such a nice surface behind that you don't mind paying the extra money (I paid it out of my own pocket).

Plus the sharp point of the tool allowed me to go places the other rasps wouldn't. My only complaint was the handle, which I considered to be rough for a tool that performs at this level and commands this price. You can, of course, finish the handle to your liking.

The only difficulty with the Auriou rasps is picking the right ones for your work. For general work, I used a 9"-long cabinetmaker's rasp with a rated 10 "grain." Unlike other brands, the Aurious are graded by "grain." The grain is the fineness of the teeth on a scale of 1 to 15, with the finer grades between 9 and 15 being common for woodworkers.

The other Auriou rasp that was useful was the 4" modeler's rasp with a 14 grain. This tool was great for getting into tight curves and difficult spaces, such as a saw handle, that the other tools couldn't deal with. I also tried out an Auriou riffler and a rattail rasp and those were equally nice.

If I were to purchase one additional Auriou for my toolbox, I'd get a 7"-long cabinetmaker's rasp with a 12 grain. There are many different shapes and sizes of tools available, including a selection for powered rotary tools. Also note that many of the tools are available with the teeth cut for either a left- or right-handed user.

The Verdict

If you've never used a well-made sharp rasp, you're in for a shock. And here's how to get started: Buy a Microplane for initial shaping tasks – be sure to get the one with the offset handle recommended in the Supplies box. Or call Slav's Hardware Store and order some vintage cabinet rasps.

And I recommend – without reservation – that you give the Auriou rasps a try. The high quality of these hand-made tools is a rare find these days. You'll cringe a bit when you pay the bill, but you'll quickly forget what you paid and just be glad you own a tool that works this well. **PW**

SUPPLIES

Tools for Working Wood
800-426-4613 or
toolsforworkingwood.com

1 • Auriou 9" cabinetmaker's rasp, 10 grain, $81.95

1 • Auriou 7" cabinetmaker's rasp, 12 grain, $69.95

1 • Auriou 4" modeler's rasp, 14 grain, $67.95

Slav's Hardware Store
312-455-0430 or
lunytools@aol.com

• an excellent source of cabinet and patternmaker's rasps in a variety of sizes and patterns

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

1 • Microplane flat rasp and handle
#27W05.01, $19.95

1 • Nicholson #50 patternmaker's rasp
#62W11.01, $46.50

1 • Belotta 8" cabinet rasp, smooth cut
#62W03.01, $10.95

1 • Blundell 8" half-round rasp, hand-cut
#62W25.08, $14.75

Prices as of publication date.

Photo by Al Parrish

Shaker Tripod Table

Although delicate, this graceful table should provide years of service in your home.

Several years ago while teaching a chair-making class at the Marc Adams School of Woodworking, I thanked Mario Rodriguez (who was teaching a hand-tool class at the school that same week) for writing a magazine article I had seen some years before in which simple tenons had been substituted for sliding dovetails to join the legs of a period tripod table to its pedestal. The article, I explained, had been a revelation, allowing me to simplify the construction of these tables without losing any real strength. Mario very kindly pointed out that he had not written the article, nor did he know who had.

Ouch.

Despite my confusion over its authorship, the article had been a revelation, one that changed the way I built these tables and one that caused me to take a long-overdue look at the issue of joint-making excess.

Complex mechanical joints (the very best examples can be found in period Chinese furniture) offer a high degree of strength even without the use of adhesives. This strength is achieved through the use of interlocking parts which – particularly when cut by hand – require skill, patience and time to create. They're often joints that are visually elegant and provide eloquent testimony to the furniture maker's skills.

What I had never really considered until reading the article I had mistakenly attributed to Rodriguez is that often these constructions represent joint-making excess. This is because the mechanical strength of a joint is limited by the resistance to breakage of the wood species from which the joint is cut. This very obvious truth is sometimes overlooked by those of us who fall in love with the joint-making process. In our zeal to create elegant joinery, we – perhaps willfully – forget that a joint cut in a fragile species will fail when the wood fails regardless of the mechanical complexity of the joint.

I work primarily in figured maple and cherry because these are the woods my customers prefer. They're not, however, among the strongest American hardwoods. This is a fact I put to the test many years ago using a collection of chairs I had made but had not

by Kerry Pierce

offered for sale because of unsightly blemishes in the material. Several were built from cherry, several from figured maple, several from straight-grained hard maple, one from walnut and one from ash. To test the strength of each species, I smashed each chair against the concrete-block wall of my shop. I threw each into the air and allowed it to crash onto the driveway. I tried to drive the heel of my work boot down through the front ladder of each chair. What I learned is this: Hard maple and ash are virtually indestructible; cherry, figured maple and walnut (which fared slightly better than cherry) are not. In fact, I was astonished to see how easily I was able to destroy chairs made from the two wood species with which I most often worked.

The message was clear: Cherry and figured maple are not the woods of choice in applications requiring strength. And further, they are not ideal species to use for furniture requiring complex mechanical joinery – like the sliding dovetail – because the cherry and figured maple are likely to fail long before the elegant joinery.

The Shaker original, on which this example is based, appears in John Kassay's magnificent volume of photos and drawings, "The Book of Shaker Furniture" (University of Massachusetts Press). As is the case with nearly all 18th and 19th century tripod tables, the legs of that original are affixed to the base through the use of sliding dovetails, this despite the fact that the original, like my reproduction, was made of cherry.

You could argue that a furniture maker would be foolish to forego a joint that holds the legs to the pedestal on the still-functional Shaker original, 150 years after its construction. However, I'd be willing to bet my wife's shiny new car that my table – held together with lowly tenons – will still be functional in the home of my great, great, great grandchild 150 years after its construction.

Preparing Materials

I have lots of thick cherry in my shop because I often buy 12/4 material, which I then resaw for chair post blanks, but I recognize that not every furniture maker is so lucky. If necessary, the pedestal stock for this table could be glued up from two pieces of carefully matched 5/4 material.

The top on my example was glued up from two pieces of edge-jointed 3/4" material cut from the same board. This practice – gluing up tops from two pieces cut from the same board – is one I employ whenever I'm making small tabletops because it results in much better color and figure matching than I can achieve by edge-jointing two pieces cut from two different boards. It takes a sharp eye to see where the joint is on this top.

Because one side of that board was marred by pitch streaks, I flattened the opposite face on my jointer. Then, as soon as I had a clear surface, I ran the material through my thickness planer, removing stock from the blemished side until it had been reduced to a 9/16" thickness.

Turning the Pedestal

With your roughing gouge and your lathe, reduce the pedestal blank to a cylinder. Then mark the various divisions along its length. (The measurements shown in the drawing on page 79 indicate the diameters at the marked locations.)

The 1"-diameter tenon at the top of the pedestal is created in two steps. First, use a fingernail gouge – 1/2" or 3/4" – to reduce the diameter so that its smallest diameter is just more than 1". Make frequent checks of that smallest diameter with a set of calipers. Then, with a sharp butt chisel laid bevel side down, square up the outside diameter of the tenon.

The butt chisel alone can be used to create the straight-sided 1 7/8"-diameter cylinder against which the legs will be fit.

Use a parting tool to set the diameter of the post where it meets the bottom of the cup. The cup can be shaped with the skew used as a plane or laid flat and used as a scraper. Then use a fingernail gouge to shape the long taper below the cup.

Marking Mortises

After you've sanded the pedestal, mark three equally spaced lines around the outside diameter of the base of the pedestal. These three lines will mark the centers of the three mortises you'll cut for the leg tenons.

There are several techniques you can use for dividing outside diameters into equal parts. If your lathe has an indexing head, like mine, the indexing head can be used to count off 10° increments of

MORTISE LAYOUT

The leg-tenon mortises are laid out with the aide of my lathe's indexing head.

An indexing head is a disk centered on a lathe's axis of rotation. A number of equally spaced holes are bored near the circumference of that disk.

On my lathe, there are 36 equally spaced holes, which divide the indexing head (and any object centered on my lathe) into 36 10° increments. Increments can be counted through the use of the spring-loaded pin shown here. By retracting the pin, rotating the disk and re-engaging the pin, I can count a 10° section of an object's circumference.

I wanted to divide the circumference of this tripod-table pedestal into three equal sections. To do that, I counted 12 stops on the indexing head, then, with my marking gauge, I drew a line along that section of the pedestal base. I repeated the process a second time, then a third time. This divided the circumference of the pedestal into three perfectly equal sections.

– KP

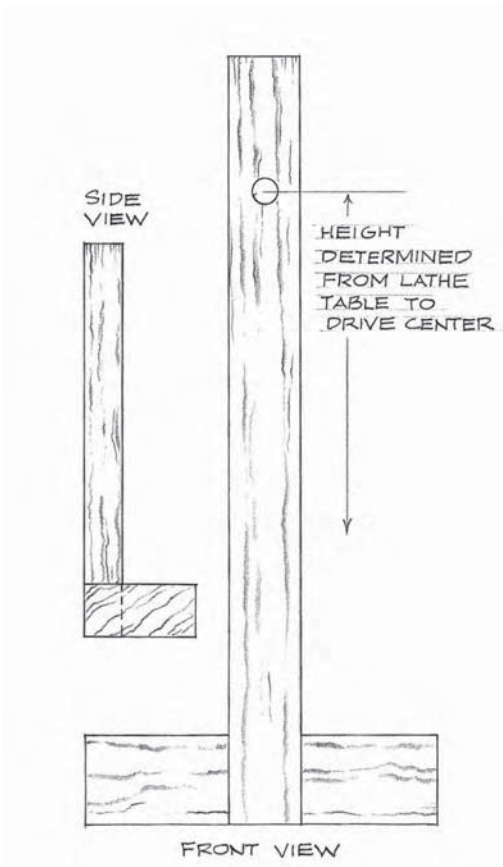
SHAKER TRIPOD TABLE

NO.	ITEM	DIMENSIONS (INCHES) T	W	L	MATERIAL	COMMENTS
❑ 1	Tabletop	9/16	16 1/4 dia.		Cherry	
❑ 1	Support disc	3/4	6 7/8 dia.		Cherry	Attached with four No. 8 x 1" wood screws
❑ 1	Pedestal	2 dia.		19 3/8	Cherry	
❑ 3	Legs	5/8	4 1/16	11 3/16	Cherry	Note grain direction on leg profile
❑ 1	Sheet-metal disc	1 3/4 dia.			Sheet metal	Attached with three No. 6 x 3/4" wood screws

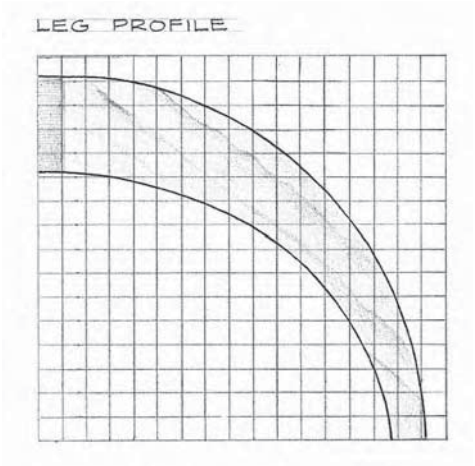
that outside diameter (see "Mortise Layout" at left). A set of 12 10° increments is equal to 120°, or one-third of the outside circumference of a circle.

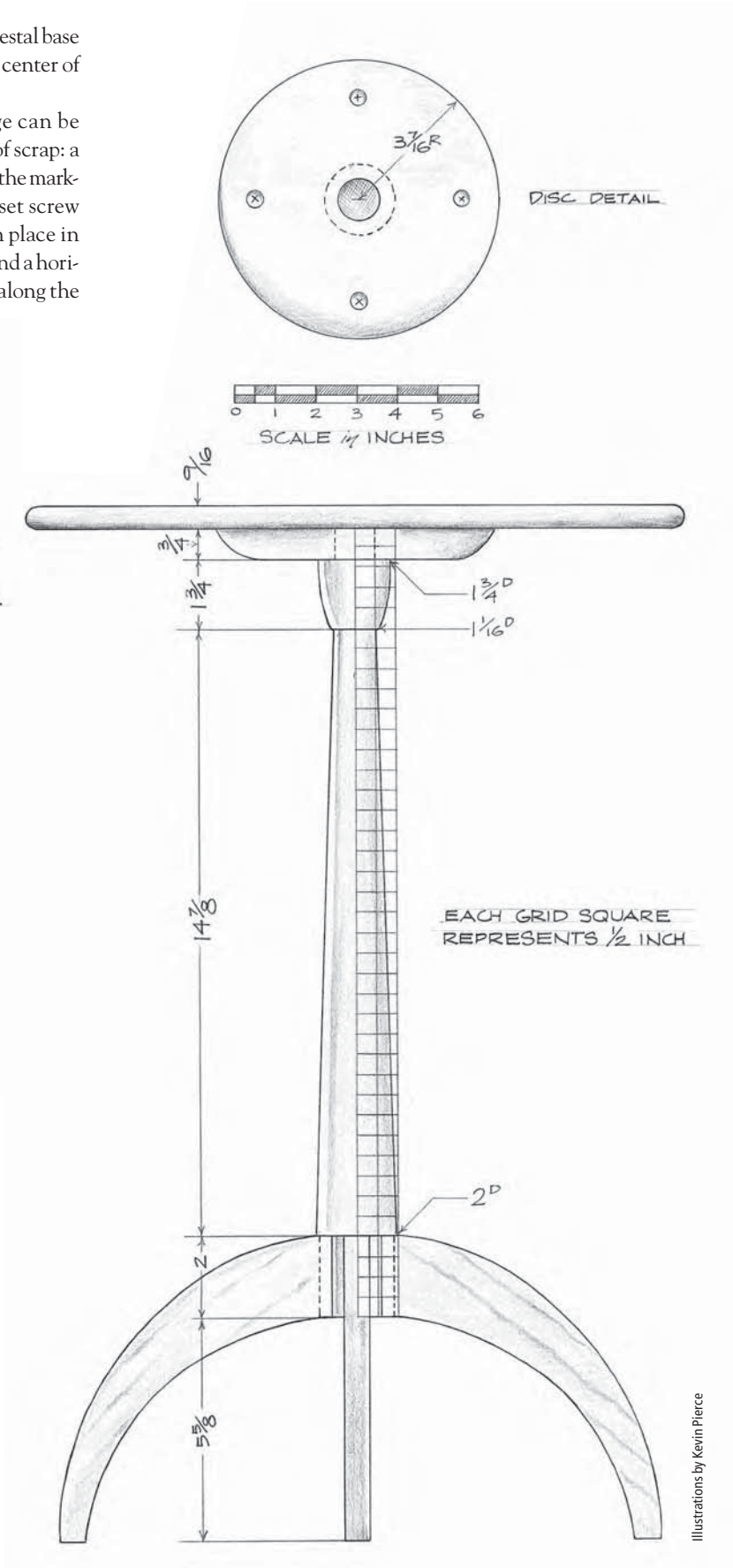
Once the outside circumference has been divided into three equal parts, use a marking gauge – like the one shown below – to create three equally spaced lines on the surface of the pedestal base running parallel to the center of the pedestal.

This marking gauge can be made from two pieces of scrap: a vertical piece that holds the marking pencil (notice the set screw that locks the pencil in place in the photo on page 80) and a horizontal piece that slides along the



Marking gauge





Illustrations by Kevin Pierce

lathe bed. My lathe bed is a deck of 2 x 6s, so all I need is a flat block of wood for my horizontal piece (see below). If your lathe bed is a tube or a piece of angle iron, you may need to construct a slightly different horizontal piece.

Next, mark a line 3/16" on either side of each mortise's center line. These lines delineate the 3/8" widths of the mortises you'll cut in the pedestal base.

Before removing the pedestal from the lathe, mark three more locations on the outside diameter of the pedestal base. These marks should be placed midway between each of the mortise center lines you created previously.

After removing the pedestal from your lathe, fix the pedestal on your bench with a pair of U-blocks and a clamp.

Draw lines on the end grain of the pedestal base connecting the intermediate marks with the center line of the mortise on the opposite side of the base. Complete the marking process by making lines 3/16" on either side of the mortise center line on the pedestal's end grain. The mortises are now completely marked.

(If you take a moment to study the photos, this marking process will quickly become clear.)

Saw and Chop the Mortises

With a fine-toothed backsaw, rough in the sides of each mortise. Be careful to keep the saw kerf from extending beyond the limits of the mortise. Then begin chopping out the waste with a mortise chisel. Follow this with a paring chisel and work up to the lines. Then use your mortise chisel to create the flat at the bottom of the pedestal mortise.

Creating the Tenons

Cut out each leg on your band saw. Then clean up the saw marks with a rasp and sandpaper.

Use a knife against a straightedge (I used an old flexible scraper) clamped to the work to mark the shoulders of each tenon. Then with a fine-toothed backsaw, cut each shoulder to depth. With the leg clamped in a vise – end-grain-up – rough in the tenon cheeks with that same backsaw.

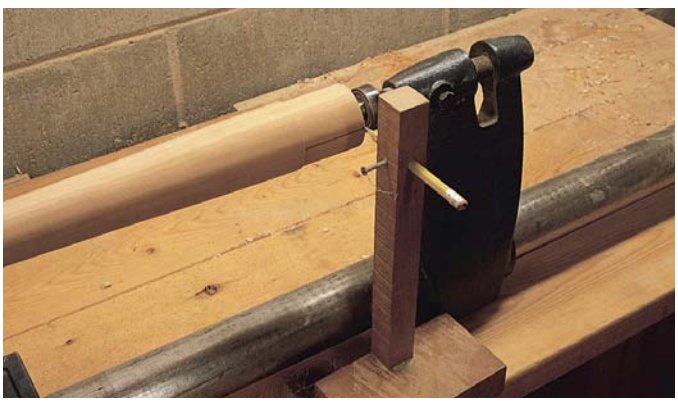
Reclamp the leg onto your benchtop and pare the cheeks down to the line.

Fitting the Tenons

In order for the tenon shoulders – which are cut 90° from the surface of the leg – to mate up tightly with the round pedestal, the top edges of the mortises must be beveled slightly with a paring chisel. Proceed cautiously, testing the leg tenon in the mortise many times as you make your cuts.

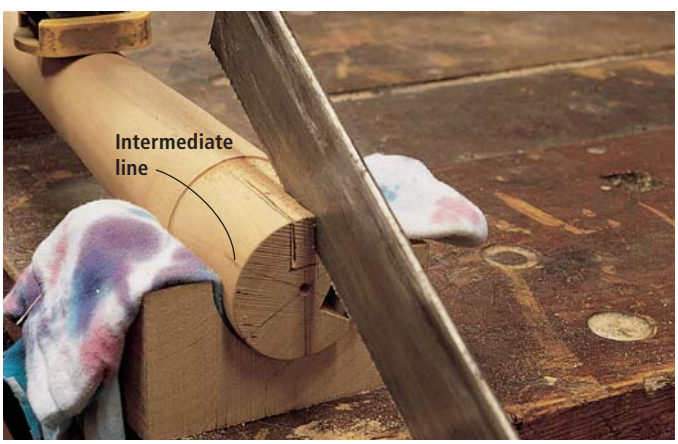
Making the Top

You can make a compass for drawing large circles with a length of scrap used as a beam, a nail and a pencil. Close to one end of the scrap, drive a 4d nail so that the

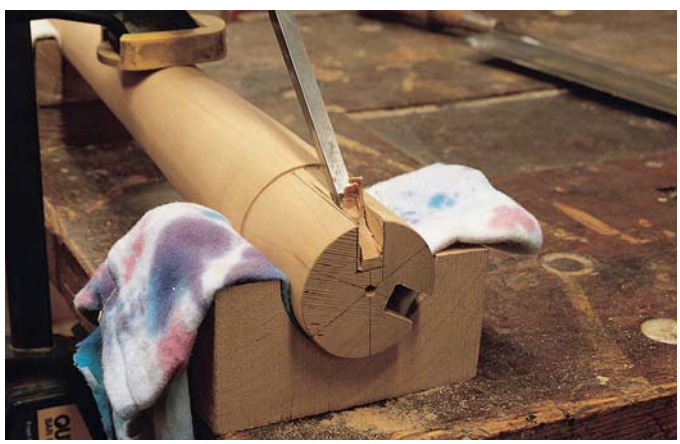


The lines being drawn with my marking gauge divide the circumference of the pedestal base into three equal sections. Each of these lines will become the center of a leg-tenon mortise.

Fix the pedestal on your bench with a pair of U-blocks and a clamp.



With a backsaw, rough in the sides of each mortise.



Begin chopping out the waste with a mortise chisel.

point extends through the thickness of the scrap. Bore a pencil-shaft-sized hole through the beam. The center of this hole should be a distance from the nail equal to the radius of the circle you're about to mark. Insert the pencil into the drilled hole, locking it in place with a set screw driven in one edge of the scrap.

To use the compass, set the nail in a shallow pilot hole that's drilled into the bottom of your stock. Then rotate the beam around the hole.

Now band saw the circle and clean up the edge with a rasp and sandpaper. Then use your router to cut a small radius on the top and bottom of the tabletop. Finish up with a rasp and sandpaper.

Making the Disk

The tenon at the top of the pedestal fits into a disk that is screwed to the bottom of the tabletop. By orienting the grain in this disk so that it runs perpendicular to the grain in the top, the disk acts to stabilize the thin top, reducing the likelihood of cupping.

The curve on the bottom edge of that disk is too large to form with a router; however, you can easily create that profile on your lathe with a fingernail gouge. Begin by fastening the disk to a faceplate with four screws. Then turn the faceplate on your lathe's drive center.

It's important that you work the fingernail gouge downhill, that you begin each pass on the edge face of the disk closest to you and work away from the disk's center point, toward the face of the disk closest to the lathe's drive center. If you work the other way, you'll be working uphill, against the grain. This inevitably results in significant tear-out. Working downhill won't eliminate tear-out, but it will make the tear-out that occurs much less significant.

Mark the shoulders of each tenon and then, with a backsaw, cut each shoulder to depth. Then rough in the tenon cheeks.

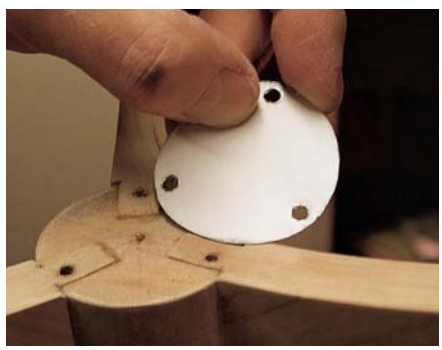
Bevel the top edges of the mortise with a paring chisel to mate accurately with the leg's tenon shoulders. Check the fit multiple times. You don't want to cut too far.

Orient the grain in the disk so that it runs perpendicular to the grain in the tabletop. This will allow the disk to resist the top's natural inclination to cup. When fastening the disk to the bottom of the tabletop, choose a screw length that will allow the screws to penetrate almost completely through the top when the screw head is recessed in the disk.

Fasten the disk to the bottom of the tabletop with four wood screws. Choose a screw length that will allow the screws to penetrate almost completely through the top when the screw head is recessed in the disk. Notice the pitch streaks on the bottom side of my tabletop. This is a common defect in cherry, but it can be placed, as I did here, on hidden surfaces.

The 'Spider'

The Shakers screwed a small disk of metal, called a spider, to the bottoms of the legs on the original to help hold the legs and pedestal together. On the Shaker original, the metal disk had three legs, extending out 1" or 2" along the bottoms of each leg. I opted for a simpler form – shown here – which still gives me enough reach along each leg to secure it. **PW**



Here is the small disk of metal, called a spider, that's screwed to the bottom of the legs to help hold them together. Use clearance holes in the legs to avoid splitting the tenons.

AUTHENTIC SHAKER

While books on Shaker furniture are common, this particular one is not. Kerry Pierce's book is different because he refuses to simplify the projects with biscuits and screws. Instead, he shows you how to build 10 pieces that are true to both the form and spirit of Shaker craftsmanship. The book is well-written, beautifully illustrated and quite inspiring. — *Christopher Schwarz*

The Ruler Trick

Radically reduce the time it takes to prepare and sharpen a plane iron with the help of a $5 steel ruler.

I have been teaching furniture making for more than 27 years and am convinced that most amateurs are not getting the best from their hand tools. Bench-plane blades are a good example. I can resharpen a blade in less than four minutes, which includes washing my hands and putting the stones away. This short break from the work at hand should be welcomed as it gives us an opportunity for planning the next stage and the pleasure of working with a razor-sharp tool when we resume. Struggling on with a blunt tool is both tiring and counterproductive.

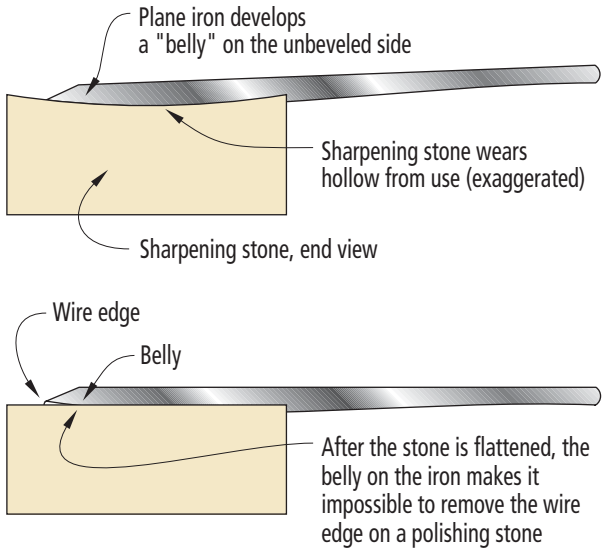
The methods I have developed to ensure that my students start with razor-sharp tools from day one are unusual (it involves a trick with a ruler). However, they are well-tested and guaranteed to produce the result we want. The techniques have been developed as practical solutions to issues that gave us trouble when we used a more traditional approach.

One of the main problems occurs as the surface of a sharpening stone wears hollow in use. The flat side of our plane blade develops a bump in its length. (See the illustration at right.) One day we flatten the stone and have a disastrous situation where the critical edge area no longer touches the stone at all. This makes it impossible to polish away the wire edge, which is a vital part of the sharpening process.

by David Charlesworth

David teaches fine-furniture-making classes in his shop near Devon, England. Visit his web site at davidcharlesworth.co.uk for more information. His first video explains the ruler trick and other sharpening techniques. Thanks to the Marc Adams School of Woodworking, where these photographs were shot.

Photo by Al Parrish



A Word About Waterstones

I've used Japanese waterstones for many years because they cost less and they remove metal faster than any other system. This fast cutting action is a result of the rapid wear of the surface. Fresh sharp particles of aluminium oxide grit are constantly being exposed as the friable surface breaks down. This is great for rapid removal of metal but it does dictate that we use a disciplined approach to keeping them flat. I probably do a little flattening about every four minutes of use.

The stones are easy to flatten, and I do this on wet and dry sandpaper on a piece of ½"-thick "float glass." Float glass is manufactured on a bed of molten tin. It's readily obtainable from glass specialists and is much flatter than toughened, laminated or plate glass. I fix the wet and dry sandpaper to the glass with a light spray of water from a plant mister. The surface tension of the water is sufficient to keep the paper from sliding about. The waterstones are simply rubbed to and fro until they are flat. I find #180 or #240 grit is suitable for an #800-grit waterstone and #320 grit may be used for fine stones like the #6,000 or #8,000 grit.

If you draw a pencil grid on the surface of the stone before starting it will give you valuable feedback about your progress. The pencil lines will be removed from the high spots first and the stone will be flat when the final traces of pencil disappear.

A coarse diamond stone such as a DMT or EZE LAP brand will also do a good job of flattening waterstones. Some people recommend rubbing two waterstones together, but this does not necessarily produce a flat surface. It is possible for the two surfaces to be spherical and still fit perfectly. To be certain with this method, one needs three surfaces to agree with each other.

There is endless discussion about the merits of different types of stones, but I am sure that the differences between brands are minimal. We use a King #800-grit stone for coarse work and either a King #6,000-grit or King #8,000-grit stone for super-fine polishing (King-brand stones are available from many suppliers.) These are the only stones required to produce a superb edge.

I have been testing the new Norton waterstones for some years and they are very good, wearing slightly slower than King stones. You will only need the #1,000-grit and #8,000-grit stone for plane-blade sharpening.

Arkansas oilstones cut rather slowly and diamond stones do not yet have grit sizes as small as the super-fine waterstones. In other words, the quality of polish is not so fine. Shapton stones are obviously liked by users but the price is significantly higher than King's.

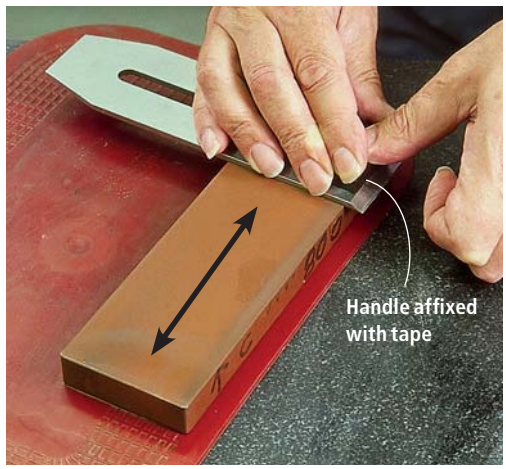
I will assume that you are starting with a new plane blade, as old blades, which have been sharpened on hollow stones, can be almost impossible to deal with. I would also advise anyone still using standard blades to consider changing to an A2 cryogenically treated replacement blade from Ron Hock (Hock Tools 888-282-5233 or hocktools.com) or Thomas Lie-Nielsen (Lie-Nielsen Toolworks 800-327-2520 or lie-nielsen.com). These are about .095" thick and will enable you to work about four times longer than with a carbon steel blade.

Flattening the Back

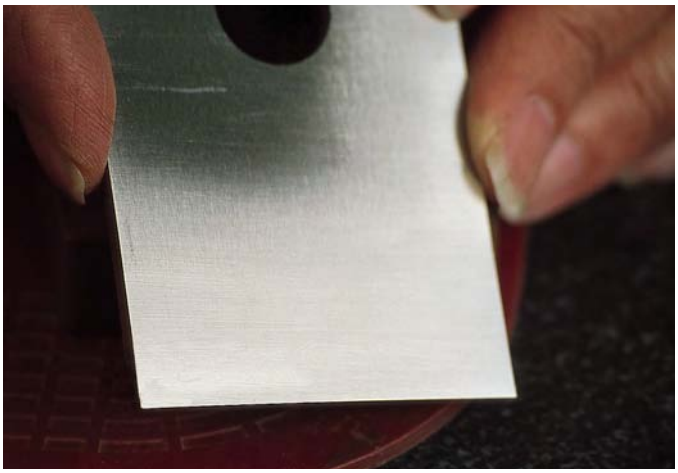
The first task is to flatten the back side (sometimes referred to as the flat side or face side) of the blade and remove the coarse scratches left by the manufacturer's surface grinding. I use a King #800-grit stone for fast metal removal, but a #1,000-grit Norton stone will also do. A flat back is important as the front edge of the plane's chipbreaker has to make a perfect fit here. I find it helpful to stick a small wooden or plastic handle to the blade with double-sided tape. This gives a better grip with less chance of grinding away your fingertips on the stone. The handle is fixed crosswise, just behind the top of the bevel. The grip of the tape is considerable if you clamp the handle for half a minute. We use two types of movement.

Movement 1:
Lengthwise Strokes

I start by laying the blade across the stone, so that the edge of the



Movement 1: Begin flattening the back of the plane blade with the cutting edge off the surface of the stone as shown. As you move the blade to and fro, allow the cutting edge to drift onto the stone.



After 100 strokes or so using movement one, the back of a premium blade should be covered in scratches across its width.

blade is hanging about 1/2" off the edge of the stone. Using considerable downward pressure on the handle, I move the blade steadily up and down the length of the stone. I call this the long stroke.

While making the long strokes I allow the edge of the blade to drift onto the stone and move just one third of the way across the width. This might take 10 to-and-fro long strokes. During the next 10 strokes, the edge of the blade is allowed to drift back to the starting position, 1/2" off the edge of the stone. The cutting edge of the tool spends half the honing time off the edge of the stone.

After about 50 strokes the surface of the stone will no longer be flat. The stone can be rotated 180° so that the other edge can be used for another 50 strokes.

It's now time to flatten the stone and notice the wear that has taken place. By drawing a pencil grid on the surface of the stone and rubbing it a few strokes on the diamond stone, you can see that the long edges of the stone have become hollow and that the width has developed a bump. This bump is infinitely preferable to the usual hollow created on waterstones. A bump promotes a slight hollowing in the length of the flat side of the tool. By keeping the edge of the tool off the edge of the stone for 50 percent of the working time, a hollow stone can be avoided.

However, the slight hollowing of the length of the stone could be causing a slight belly or bump in the width of the plane blade. To check for and eliminate this problem, I change to a second movement on the freshly flattened stone.

Movement 2: Crosswise Strokes

The blade is laid across the stone, at one end, with the edge of the blade about 1/2" off the edge of the stone. The stroke is crosswise, bringing the edge of the tool one-third of the way across the stone before returning to the start position. Considerable pressure is exerted on the center of the handle. During about 40 to-and-fro strokes the blade is allowed to drift up the length of the stone, and then back down to the starting position.

The stone is then rotated 180° as before, so that the other edge of the stone may be used. The stone should now be flattened again before doing any more work.

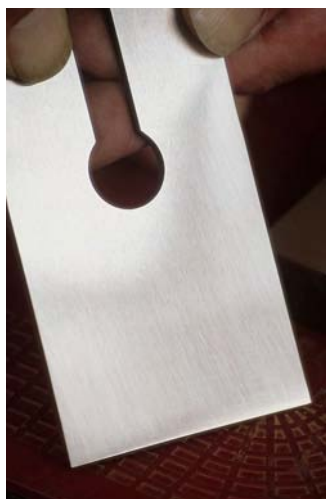
Observe the scratch patterns on the back of the blade. The scratches from movement one will lie across the width of the blade. You will have done enough of movement two when all those crosswise scratches have been replaced by lengthwise scratches. If a slight bump has been formed after movement one, you will see lengthwise scratches in the center of the blade only. This would be a signal to do more of movement two on a freshly flattened stone.

The objective is to remove all trace of the deep manufacturer's grinding scratches just behind the cutting edge of the blade. The two types of movement may have to be repeated several times. I don't worry about getting a band of lengthwise scratches more than about a 1/4" wide behind the cutting edge. With A2 blades and careful sharpening technique this will last a long time, and you can do more back flattening in the future when necessary.

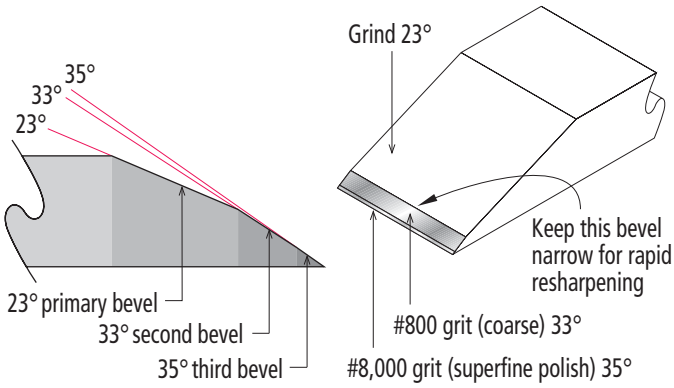
That's it for now. And thanks to the ruler trick, a few seconds work later on will be all that is needed to complete work on the back side – none of the mirror polishing of the whole surface, which is so time consuming.

Movement 2: With this second movement the blade is rubbed across the width of the waterstone.

As you move the blade, allow it to drift up and down the length of the stone. Note the pencil line I've drawn on the stone that helps guide the process.



After this second movement, the scratches across the blade's width will be replaced with lengthwise scratches.



I've drawn common sharpening angles onto cardboard. Once I've set the blade to the proper angle I'll measure its projection from the front of the guide and scribe that measurement directly on the blade for future reference.

With the blade set in the guide, I'll hone the bevel using two or three firm pull strokes on the #800-grit stone. Then I feel the back for the wire edge.

With traditional waterstones, you need to create a light slurry on the polishing stone to aid cutting. Rubbing the Nagura stone on the polishing stone creates this slurry.

Prepare The Cutting Bevel

For speed of resharpening I like to use three bevels. I first grind the blade at about 23°. I then create a wire edge on the #800-grit stone at 33°. Final bevel polishing is done on the #8,000-grit stone at 35°. This is my recipe for bench planes used on hardwoods. By honing at 35° the clearance angle under the polished bevel has been reduced to 10° (down from 15°), but I have found no problems with this arrangement. The 35° final polish seems to make blades last slightly longer between sharpenings. By keeping the grinding angle significantly lower than the honing angles, I can resharpen at least seven times between grindings. If you have a new blade ground at 25° there is no need to change to 23° yet. I am lucky to have a water-cooled grinder, so there is no danger of overheating the blade when grinding.

Honing a Straight Blade

I have a strong preference for the Eclipse-type honing guide with the narrow roller. It only takes a few seconds to clamp to the blade in the guide and ensures accuracy, repeatability and speed.

I determine my honing angles by squinting against a simple card, which has lines drawn with the aid of a child's math protractor. After setting the blade at the proper angle, I measure how far it projects from the jig. I then scribe these measurements on the top of the flat side of the blade. This prevents me from having to work the angles out every time I sharpen.

With the blade at 33°, I freshen up the surface of the #800-grit waterstone by rubbing it with a similar grade stone. This makes the stone cut fast. Worn wet-and-dry sandpaper can glaze the surface of a stone so that it will not cut fast after the first few minutes.

It should take only two or three firm pull strokes to raise a wire edge on the flat side of the blade. I have a bench light set up so that I can see light reflected from the finest of wire edges. You can feel for a wire edge by gliding a fingertip off the flat side surface. It feels like a tiny hook.

The blade projection is then reset in the guide, i.e. shortened a little, to give us 35°. Now clean the wheel of the guide and the edge of the blade to avoid contaminating the superfine #8,000-grit waterstone. That surface is prepared by spraying with a plant mister, and then rubbing a Nagura over the stone to create a little slurry on its surface. A Nagura is a smaller stone that creates a mud on a polishing stone that speeds polishing and cleans the surface of the stone. Three or four pull strokes with gentle finger pressure on the blade are all we need to polish the front end of the narrow bevel created on the #800-grit stone. The #8,000-grit stone is

a polishing stone and I caress its surface with the blade.

The Ruler Trick

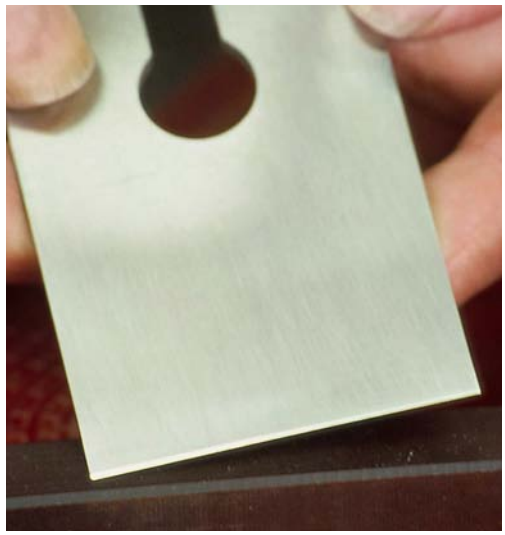
This is the radical part! I freshen the slurry on the #8,000-grit stone with the Nagura. It's important that the slurry isn't too sloppy and wet. If it is wet, I sweep the water away with a finger. I then stick a 6" inexpensive steel ruler, (about 0.5 mm thick) to the stone by sliding it to and fro a few times down one long edge of the stone.

The blade is placed in position on the stone for movement two with its edge off the stone. The middle of the blade is resting on the steel ruler. Using four fingertips, placed just behind the top of the bevel, I draw the blade's cutting edge onto the stone. You may feel a slight catch as the wire edge meets the edge of the stone. The blade edge is only allowed to come about 5/8" onto the stone before going back off the edge of the stone. This short stroke is repeated about 25 times for a new blade and about 12 times when re-sharpening.

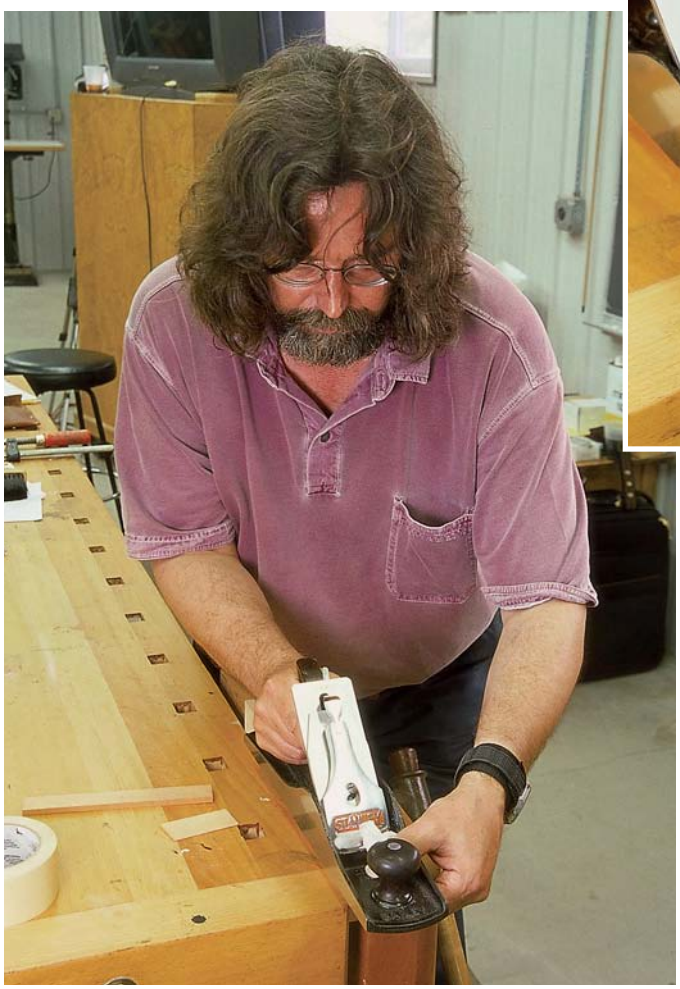
Because the flat side of the blade has been raised up by a degree or so on the ruler, you will see a narrow band of mirror polish across the tip. This need be no wider than 1/16", and will not get much wider with subsequent re-sharpenings. If examined closely, you should see that the mirror polish has replaced the #800-grit scratches at the edge.

I wipe the blade on a sponge cloth, dry it and apply a thin coat of Camellia oil. The job should be complete and the wire edge should have floated off on the stone, or sometimes on the sponge cloth. It should shave hairs from your hand without difficulty. **PW**

Place the steel ruler on one long edge of the stone – friction from the water will hold it in place. Place the blade on the stone with the cutting edge off the stone. With light pressure bring the blade about 5/8" onto the stone. This short stroke removes the wire edge and polishes the back of the blade.



A picture of success: The front of your cutting edge is polished and ready to go to work.



The ruler trick greatly speeds the time it takes me to prepare a new blade.

SUPPLIES

Lie-Nielsen Toolworks
800-327-2520 or
lie-nielsen.com

1 • **Hand Tool Techniques Part 1:** Plane Sharpening with David Charlesworth video, $25

1 • **Hand Tool Techniques Part 2:** Hand Planing with David Charlesworth video, $25

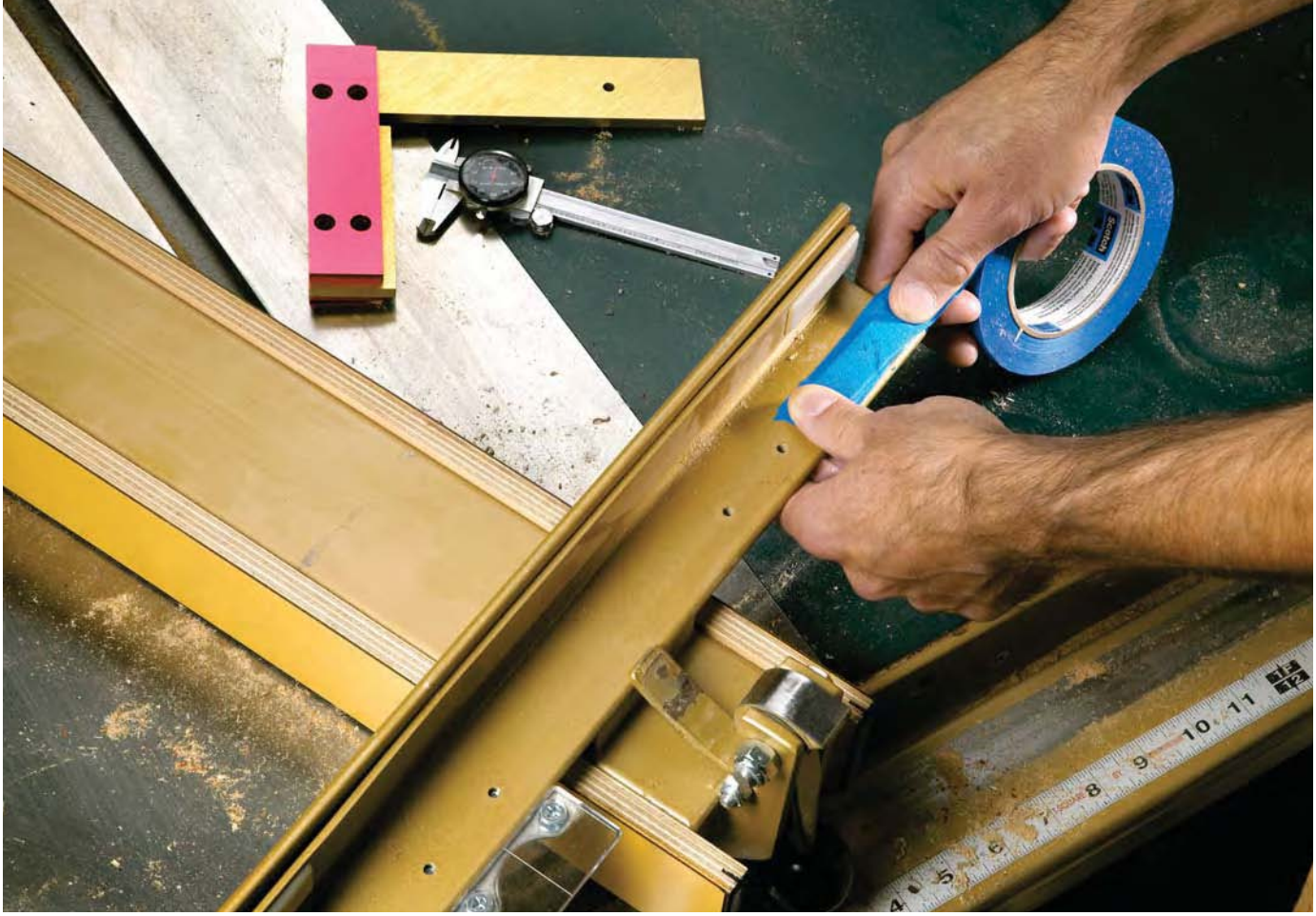


Photo by Al Parrish

The face of your table saw's fence must be 90° to the saw's tabletop. Otherwise your joinery and rip cuts will be inaccurate. On some fences, the only way to fix the problem is with some well-placed masking tape.

Insidious MISTAKES

There are many things we do wrong but we don't know they're wrong.

In woodworking there are two kinds of mistakes: There's the garden-variety gaffe where we simply cut a board too short or botch a dimension, and the kind of mistake that we make over and over again because we don't even know we have a problem.

This second kind of mistake is usually the result of having to teach yourself some operation or skill. When you don't get the desired result shown in the book, magazine or video, it's easy to blame the equipment or your lack of skill. But usually there's something else going on that may be difficult or impossible for you to detect.

by the *Popular Woodworking* staff

Editors Christopher Schwarz, Robert W. Lang, David Thiel and Steve Shanesy all contributed their mistakes and solutions to this story.

Mistakes are the best way to learn something because you remember that knowledge better. One mistake realized will stay with you forever. So the trick is to figure out what went wrong, and do it another way the next time.

After years of observing beginners, we've come up with the following list of subtle but critical mistakes that we see all the time. Be forewarned that some of our solutions or fixes may contradict what you've seen or read elsewhere. But do give them a try because they work for us and give us accurate results.

Mistakes in Work Habits

■ **You rush the work.** We all know that it's unsafe to work in a hurry, but rushing also hurts the quality of your work. Rushing a machine setup, skipping a trial fitting of a joint or just moving too quickly through a step causes many mistakes. When you make your first error because you acted without thinking it through, stop. Sometimes the fast fix will make the situation worse, and things will spiral out of control. A short (or lengthy) pause to think things through always helps.

■ **You work without a shop drawing.** Don't start cutting wood until you have a drawing (even a cartoon), and a cutting list that agrees with the drawing (even with simple jigs). Failing to do this is guaranteed to produce lots of firewood.

■ **You don't listen to the voice in your head.** There's a wise saying: "If you have to ask the question, then you already know the answer." Whenever you approach a machine operation and you ask yourself: "Hmmm. Is this really safe?" The answer is probably, "no." Or if you see a mistake on your project and you think: "Should I fix that?" The answer is almost always "yes."

Sharpening Mistakes

■ **You don't flatten your stones enough.** If you own any brand of waterstone, here's our best advice: Flatten your stones after every sharpening session. Waterstones will quickly dish in the middle when honing and they will wear at the edges when you're flattening the backs of tools. Even subtle amounts of wear will wreak havoc with your sharpening efforts. Certain parts of a bevel will never get sharp or polished, for example. Flattening your stones takes only a few minutes if you keep up with your efforts.

■ **You use too many strokes.** Whether you use waterstones, fresh sandpaper or diamond stones, you're probably working too hard at getting a keen edge. Properly maintained sharpening mediums cut fast. Next time you're honing an edge, try taking only four to six strokes and observing your progress under a 30x jeweler's loupe. That should be all you need for each grit. Making dozens of strokes increases the likelihood that you'll apply pressure in the wrong place, messing up your edge. It also wears your stone and tool faster than necessary. And it shortens the number of times you can hone an edge before having to grind it again.

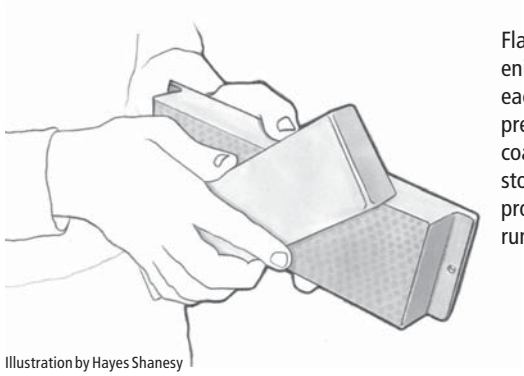
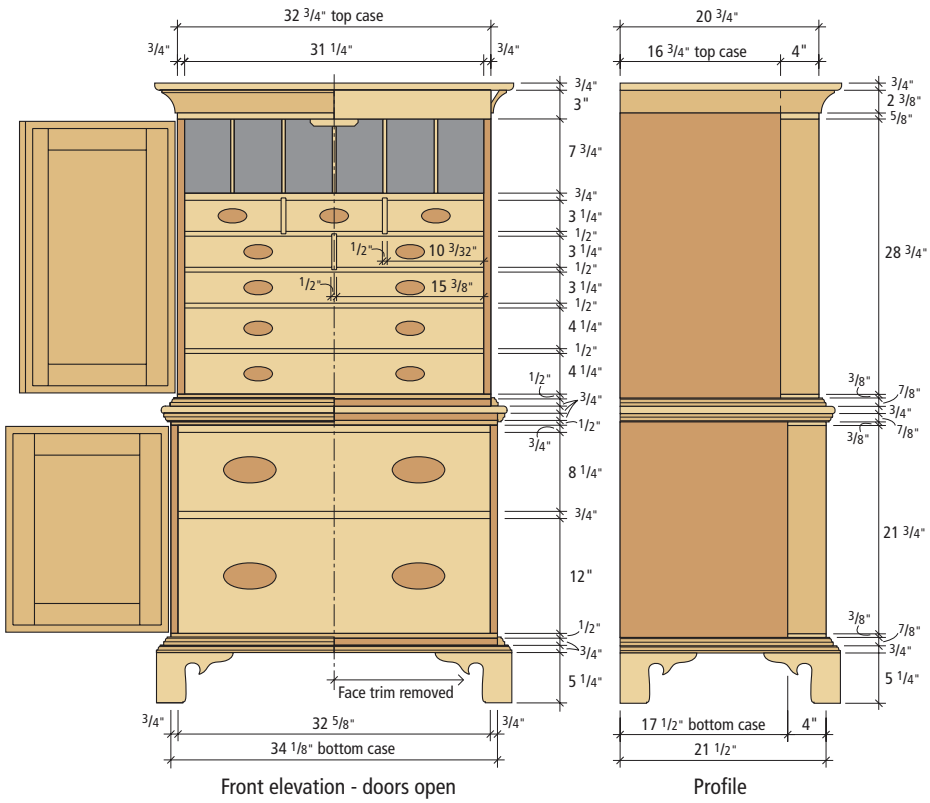


Illustration by Hayes Shanesy

Flatten your sharpening stones after each session. We prefer a DMT extra-coarse diamond stone and do the procedure under running water.

■ **You don't true a chisel side that's unbeveled.** The backs (sometimes called the "face") of your chisels must be flat – end of story. Otherwise your efforts to steer the tool through the wood will be stymied by the knife-like shape of your cutting bevel. You will not be able to cut straight consistently and the tool will wander as its pushed by hand or by mallet. Flatten the backs on a coarse diamond stone, then polish them up to as high as you can.

■ **You use many sharpening systems.** Learn one method of sharpening and stick with it. Each system has nuances. Learn them and your edges will improve.



No matter how complex or simple your project, make a construction drawing that agrees with a cutting list.

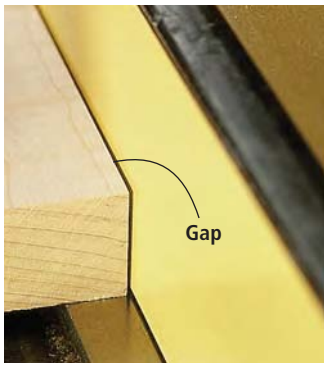
Machinery Mistakes

■ **You trust your machines too much.** We're always amazed at how many people don't check their work once it comes off the machine. They trust that it will be flat, true and the correct width. Sometimes it's not. Machines go out of adjustment, and so you can save yourself grief by confirming that the machine is indeed set to 90° or 8", or is making your boards' faces parallel. Finding out this problem before you push 100 board feet of wood through a machine is a good habit. When your first board comes off the table saw, jointer, planer, belt sander or whatever, quickly confirm that it's doing what it's supposed to.

■ **You make it easy for your work to tip.** Outfeed and infeed support is critical on the table saw, miter saw, band saw and drill press. Accurate and safe work is impossible with your workpiece tipping at a slight angle.

Table Saw Mistakes

■ **You don't joint before a rip cut.** If you want to rip boards to a consistent width, then the long edge that rides against your rip fence should be an edge you've jointed. This is especially important when you rip several narrow boards from one wide one. We frequently see woodworkers cut corners by making a first cut with the jointed edge against the fence, but then they use a sawn edge against the fence for subsequent rips. Boards can be loaded with tension that's released during ripping. Your sawn edge can be made convex or concave during ripping as a result. Running a bowed edge against your rip fence (as shown above) can result in a cut that is inaccurate or even a bit unsafe. It's always better to joint and then rip.



See the gap between the work and the fence? This board bowed as it was being ripped and then the sawn edge was run against the rip fence. You should joint this edge before ripping it.

Setting up your band saw involves the careful placement of the saw's guides above and below the table. A bit of misalignment will produce inaccurate results.

■ **You don't square the face of your rip fence to the saw's tabletop.** If you cut joinery with your table saw (and who doesn't) then your saw's fence must be perpendicular to the saw's tabletop. We're amazed at how many saws are out of whack in this area. If your fence isn't 90° to the top, then your joints will have a slight but sometimes fatal angle. Plus, when you rip thin or thick stock, your rip fence's scale will be inaccurate because the top edge of the fence will be closer (or farther away) to the blade than the bottom edge of the fence. Figure out how to adjust your fence. Sometimes it's a matter of turning a screw; sometimes it's a matter of shimming the interface between the rip fence and its rails.

■ **You don't respect the machine.** Saw's with a spinning blade are the No. 1 cause of workshop injuries. Stop and count your fingers before you start. Keep in mind the damage that can be done before you turn on the saw.

Outfeed support is critical to safe and accurate work. If your work cantilevers off the side, support it there, too.

Band Saw Mistakes

■ **You work with a saw that is poorly tuned.** Despite their simplicity, band saws are fussy. Even the best one won't perform well if the blade tension and the guides aren't quite right. There are entire books written about tuning your band saw. Get one and read it.

■ **Your blade is too wide or too narrow.** One blade is rarely enough. You need at least one

Filing the mouth of a plane is a good skill to learn, especially if you want to use a thick aftermarket blade in your tool. Take your time, check your work and you won't have problems.

blade for resawing and another for general curve-cutting.

■ **You don't mark your waste.** It's easy to get turned around on the band saw and cut on the wrong side of your guide line. Take the time to mark an "X" on the waste side so you won't get confused while making your cut.

Router Mistakes

■ **You ask too much of your router.** Many people bite off more than the router can chew. You'll get better results if you don't push your router and bits to their limits. Most routers and bits are designed to remove about 1/8" of material in one pass. Asking for any more than that can snap your bits, overheat your tool or result in a poorly machined surface.

Layout Mistakes

■ **You trust your layout tools too much.** Try squares aren't always square. Straightedges aren't always straight. Even a combination square will go out of true after being dropped or heavily used. Your layout tools are the truth sayers in a project. Make sure they've got the straight story before you change machinery setups based on their readings. Errors from layout tools will snowball.

■ **You don't do the math.** Double- or triple-check all of the numbers. Don't trust a cutting list (even your own) without checking the math or doing a full-size layout. The time it takes to do this will be more than made up when things go together right the first time versus redoing your work.

■ **Your lines are too coarse.** Making a mark you can see and follow saves lots of frustration. A mechanical pencil will give you a sharp line, but if the lead is too hard your line may not be dark enough to see. If using a regular pencil, don't let it get dull during layout or you'll be trying to decide where on that 1/16"-wide line you're supposed to cut. If a mechanical pencil line is giving you problems, switch to a marking knife.

■ **You always assume the largest dimension number is the length.** Dimension numbers refer to grain direction and should always be listed like this: thickness x width x length. So if you want grain-matched drawer fronts on a desk with the grain running vertically, a narrow upper drawer would be properly written as ¾" x 12" x 4" – with 4" being the length of the drawer because the grain is running vertically.

Hand Tool Mistakes

■ **You work with tools that are uncomfortable.** There are good reasons that tool handles are made of wood. One important reason is that you can modify the handle to suit your grip. Strip the awful dipped-in-lacquer finish from your chisels and give them a decent sanding and finish. And if the handles are uncomfortable, whip out your rasps and files and fix that. Modify (or at least refinish) the handles of your planes, saws, awls, mallets and try squares to suit you. Finish your tools by sanding the wood up to #400 grit and buff them out with a few coats of paste wax. It's a quick fix and makes the tools much more pleasurable to use.

■ **You work with tools that don't work.** Don't be afraid to modify your hand tools. In many cases you can improve their performance with a file. It's perfectly fine to file the mouth of a plane or spokeshave to accommodate an aftermarket iron (a common practice) or to correct a mouth that is badly out of square. Performance is only going to improve. Don't be afraid to file off burrs or bumps from the plane's frog. Or to remove flashing from any hand tool. Files remove metal slowly, so if you check your work as you go, you're unlikely to damage the tool. If you lack confidence, try working on a cheap flea-market special first to get the hang of it.

■ **You use the wrong tool for the job.** Contrary to popular opinion, hand tools are not slow. Some are designed for hogging wood (cabinet rasps, drawknives and axes) and others are designed to produce a finished surface (scrapers, smoothing planes). Don't do one job with a tool designed for the other job.

Assembly Mistakes

■ **You don't do a dry run.** Before you glue anything up, you should always assemble it first and put it under clamp pressure. Then check for gaps and make sure the assembly can be easily squared. This takes just a few minutes for most assemblies, but it saves endless frustration.

With any assembly you should put it together without glue and under clamping pressure to check the fit. Small fixes here can save big headaches later.

■ **You assemble too many parts.** Don't try to assemble an entire project at once. If you do a dry run you should discover when you're trying to do too much in one chunk. Assemble in stages to save frustration. It will improve your accuracy and (on more than one occasion) save your back.

■ **You don't square your assemblies or panels.** After your door or panel is out of the clamps, you may need to square the assembly, usually with a saw or a plane. Parts that are square may not create a square assembly. Plan on making your doors a little oversized and then square them up after assembly.

When Finishing

■ **You don't make a sample board.** If you are working with a finish and/or wood that are unfamiliar you must make a sample board. Sand or plane your sample board just like you did every other surface of the project. Then finish the board using the procedure you've settled on. Finally, before you finish the project, try looking at the finish under florescent, incandescent and daylight. Finishes can change color under different lights.

■ **You rush the drying time.** If you don't let the first coat dry, or otherwise get ahead of yourself, you won't save any time. In fact, you'll spend more time undoing the damage from your "Christmas Eve" finish.

When Buying Hand Tools

■ **You buy too many planes.** When many woodworkers first get into hand tools, they tend to buy way too many planes (or chisels or saws) before they even know what each one of them really does. As a result, they end up with tools that are redundant or useless for their work.

To get started we recommend woodworkers buy a smoothing plane (a No. 4), a jointer plane (a No. 7), a low-angle block plane and a shoulder plane. These four planes are the most common ones used in a shop that works with both power and hand tools. After you get comfortable with these tools, start looking around at the other planes. Your work and your experience will lead you to the next tool you need. Don't buy a plane until you have a specific and repeated need for it. If you're on a budget, you don't want to buy something you won't use.

Planes and other hand tools can be addicting. Before you buy "one of each," get the four most essential ones (smoother, jointer, block and shoulder) and learn those. Your work will guide your future purchases.

When Buying Power Tools

■ **You buy the wrong machine.** It's easy to buy too small or too big a machine for your needs. You can either blow your budget or end up with an inadequate tool if you don't honestly assess your needs before you buy.

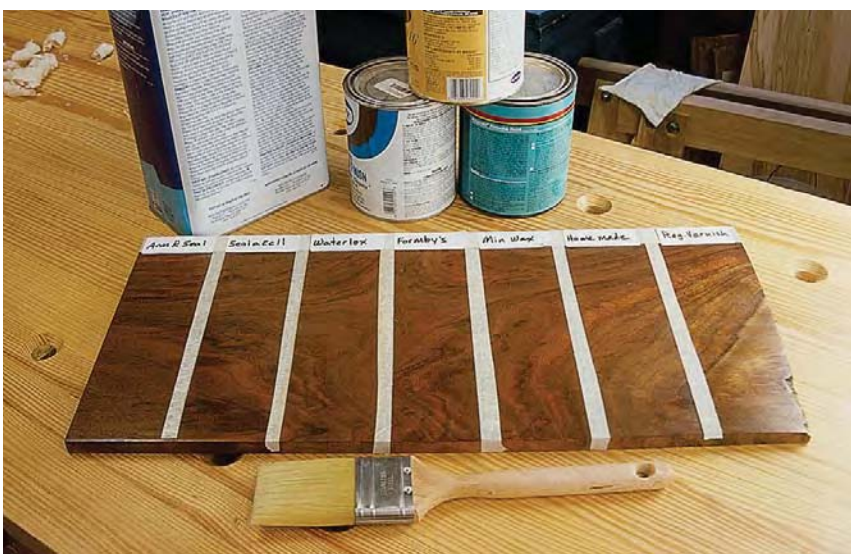
Power tools and machines are where we spend much of our money when woodworking. It's a capital investment, so take the time to physically evaluate (and use whenever possible) the tool or machine you're thinking of buying. What looks good in a picture may feel completely different in your hands. Recommendations are helpful, but don't give in to the allure of catalog and internet prices unless you know the tool you're buying.

■ **You expect a tool to make you a better woodworker.** Time – not technology – will make you a better woodworker. Spend less time looking at catalogs and more time in the shop.

■ **You don't know the limits of your machine.** A planer won't make bowed, twisted or warped boards straight – it will make a smooth surface parallel to an existing surface. A table saw will make a cut parallel to the edge against the fence – it won't make a straight cut, unless you have a straight edge for a reference. Expecting one machine to do the job of many is folly.

When Deciding to Go Pro

■ **You decide to go pro.** Of course, some woodworkers do, and they work very hard at it. A few are actually successful. But don't lose sight of the fact that to be successful, it must first be a business. That fact can take all the joy out of the hobby you love so much. So when you ask yourself "Can I make a living woodworking?" ask this important follow-up question: "Do you call making $30,000 a year a 'good living'"? **PW**



A sample board is like a construction drawing: it's your road map for good results.

Table Saw Tenon Jig

A simple and inexpensive accessory that will cut accurate joints.

The mortise and tenon is one of those fundamental joints you're obligated to master. It's used for building frames of all sorts (including post-and-beam architectural frames), as well as tables and chairs.

Over the years, especially in the last decade or two it seems, a variety of substitute joints and alternative constructions have been contrived to circumvent the mortise and tenon. I don't know why. The joint can be cut many ways, using different tools. For every woodworker, regardless of tooling, experience and self-perceived skill level, there must be a method that can be mastered.

If you're still looking, here's yet another approach for cutting tenons. It's router-free.

If you want to saw your tenons, the band saw and the table saw are the obvious choices. Cutting tenons on the band saw has its devotees, but I'm not one of them. Of the two saws, I prefer the table saw for this job, primarily because the finish cut is better for the purpose. Cheeks and edges cut with a table saw blade are smooth and flat, while band-sawed surfaces tend to be finely ridged, and occasionally hollowed or bellied.

On the table saw, you can cut tenons with a dado head, or with a regular blade and jig. I favor the latter approach. (If you want to try the dado-head approach, refer to "Mortise & Tenon Basics" in the April 2004 issue.)

While you can buy a high-quality tenoning jig, I use shop-built ones that depend on the rip fence for positioning. (Plans for jigs that ride in the miter slot are common, too.) The one I'm currently using is shown above.

Obviously, the rip fence must be parallel to the blade, or the tenons won't be accurate. (If you're a woodworker who favors having the rip fence ever-so-slightly angled away from the blade, this arrangement won't work for you. Instead, use a tenoning jig that's guided by the miter-gauge slot in the table.)

In brief, my tenoning sequence is this: Elevate the blade to match the tenon length, set the tenoning jig on the rip fence, adjust the fence to position the cut, clamp the workpiece in the jig, and cut the cheeks (and, sometimes, the edges). This leaves the cheek waste attached to the workpiece. To form the shoulders and separate this waste, lower the blade to match the shoulder width, then use the miter gauge to guide the cuts.

Now, this may seem out of order. It's certainly not the way I sawed tenons at the start. When I cut the shoulder first, those wafers sliced away by the cheek cut were trapped between the jig and the blade, and would crunch disconcertingly. They would then either fire around the table or virtually explode. Now, the wafers of waste accumulate, harmlessly, to the right of the blade.

Photos by the author

A good tenoning jig, whether purchased or shop-made, must be accurate and easy to adjust. It should allow you to position, reposition, and swap workpieces without a lot of fumbling, especially with separate clamps. I use mine with a combination saw blade; a rip blade will work well, too.

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, Pa.

Set the Saw and the Jig

Setup is easy: Determine how long the tenon is to be and crank up the blade to that height.

Position the tenoning jig next. I make the cheek cut on the side of the workpiece that's against the jig. That way, I can turn the workpiece 90° between passes, and cut the cheeks and edges in sequence (assuming the shoulders are a uniform width). To make the coarse fence setting, measure from the jig to the outside of the blade with a metal rule.

The fine fence setting is made after cutting the cheeks on a test piece and seeing how it fits in the mortise. Just remember to trim both cheeks each time you adjust the fence, so the tenon remains centered on the workpiece.

With the jig straddling the fence, slide the jig up to the blade, and measure from the jig fence to the outside of the blade.

With the workpiece seated squarely against the table and the vertical work support, pull the cam clamp to secure it, and make the cheek cut.

Making the shoulder cuts after the cheek cuts simplifies accurate setting of blade height, and eliminates flying offcuts. A stop on the miter gauge ensures consistent cuts all around the tenon shoulder.

I micro-adjust my fence with a shop-made reference block I park on the fence rail.

• To move the fence closer to the blade (thus increasing the tenon thickness), I butt the block against the fence and clamp it. I shift the fence, insert a shim at the end of the block and move the fence back against the block. The new position is offset from the old by the shim's thickness.

• To move the fence away from the blade (thus reducing the tenon thickness), hold the shim against the fence, push the reference block against it and clamp the block. Remove the shim and seat the fence tight against the block.

The thickness of your shims controls the movement. You can use feeler gauges, shim stock or paper to make the adjustment.

Measure the test tenon with a dial caliper, and compare that measurement with the mortise-width dimension. You can nip off the waste on the band saw to expose the tenon for a test fitting, too. The shoulder need not be perfect for you to determine whether or not the tenon fits the mortise.

With the blade and jig set (proven through a test tenon that fits the mortises properly) cut the cheeks. Stand the workpiece on end, clamp it in the jig, and feed it through the cut. Use both hands to advance the jig. After cutting the first cheek, release the clamp, rotate the workpiece, reclose the clamp and cut again.

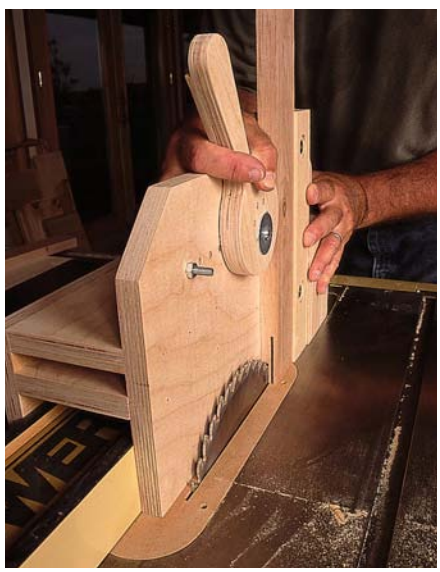
With the cheek-cutting done, set the tenoning jig aside, slide the fence back and lower the blade. Get out the miter gauge; all that's left is cutting the shoulders.

Clean and accurate shoulder cuts are important for final appearance and strength. Use a real tenon, one from which you've pruned back the waste to expose the cheek, as a gauge to set the blade height. At top dead center, the teeth should just graze the cheek.

Because you'll be severing waste from the piece, you shouldn't use the rip fence to govern the tenon length unless you use a stand-off block. I use a stop on my miter gauge to control the tenon length. You can set the stop at the far end of the piece, or you can use a miter-gauge fence that extends well beyond the blade to the right and locate the stop there.

Slip Joint

Years ago, before I mastered mortising, I used the slip joint instead of the mortise and tenon for frames such as simple doors. I could cut both halves of this joint on my table saw using the same jig. The joint is strong, but it doesn't look as clean as the mortise and tenon.



To cut the slip joint's halves, use a tenoned piece to reposition the rip fence. Cut the notch's inner cheeks and reset the fence to remove the waste. The added screw shaft on the jig fence keeps the cam-clamp handle away from the blade.

The slip joint, in case the name is new to you, is often called the open mortise and tenon. There's good reason for this. The rails have a tenon, and the stiles have a mortise that's open at the top, bottom and on one edge. Essentially, this open mortise is a notch.

A subset of the slip joint is one that joins the end of one piece to the middle of another. This is called a bridle joint.

A major advantage of the slip joint is the ease with which it's made. Its disadvantage emerges during assembly: In addition to clamping the tenon shoulder tightly against the mortise (as you do in all mortise-and-tenon glue-ups), you must clamp the mortise cheeks to ensure they bond to the tenon cheeks.

We were all beginners at some point. If you have a table saw, you can make this joint. If you have a table saw but no mortiser, no plunge router, and no desire to test your hand-tool skills, even with an assist from a drill press, don't fret. Use the slip joint for your frame constructions.

Plans for jig shown on page 96.

A slip joint features a tenon shouldered only on the faces (no edges) and notch, or an "open" mortise, instead of a regular mortise.

TABLE SAW TENON JIG

Saw accurate tenons with this shop-built jig. You simply drop it over the rip fence and use it with your table-saw's work-a-day blade.

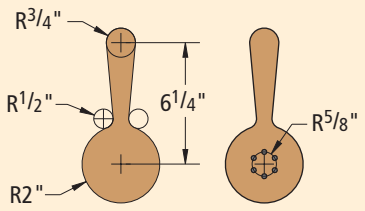
You can build one, including the cam clamp, from a small amount of 3/4" plywood, a couple scraps of hardwood, and some commonplace fasteners in two or three hours.

The jig isn't original. You've undoubtedly seen photos of it in magazines and books, and perhaps you've made one yourself.

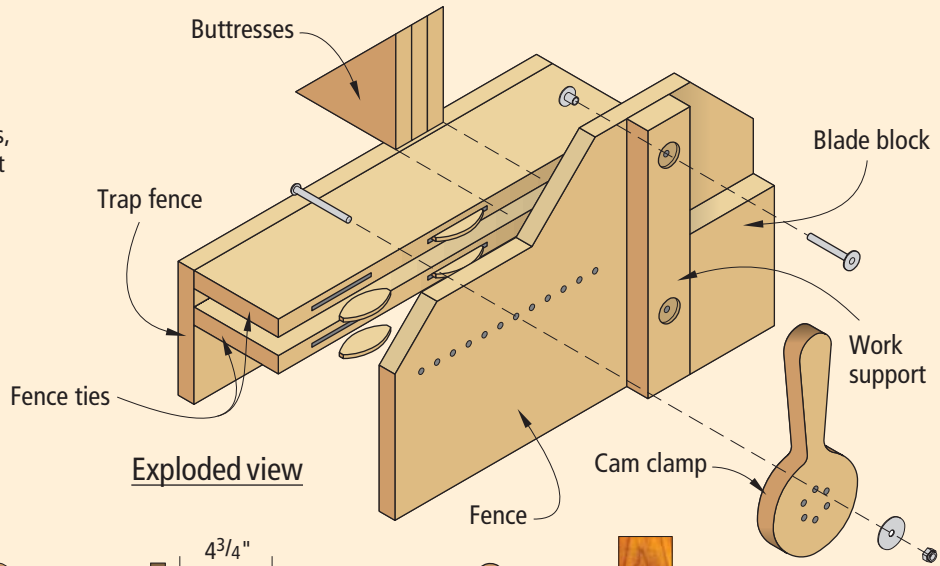
My iteration has a replaceable work support that's backed up by a blade-guard block. This work support may get chewed up. By backing out a pair of connector bolts, you can replace it. (Note that the lower bolt must be located high and clear of the blade.) The blade block will house the segment of the blade that passes through the work support.

To secure the workpiece, I opted for a shop-made cam clamp. The clamp is easy to make, and its location can be adjusted to accommodate different widths of stock. I oriented the clamp pivot so it tightens onto the work as you pull the handle toward you. If the workpiece wants to creep as pressure is applied, it will be pushed against the saw's table, rather than being pulled off the saw's table.

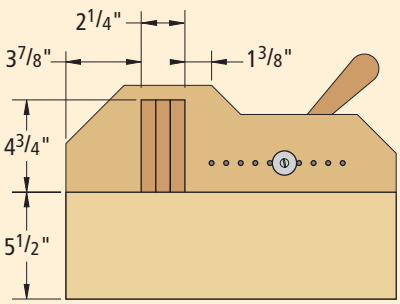
The exploded drawing and the cutting list should make the construction clear. The drawing shows biscuit joints, but you can use screws or nails. **PW** —*BH*



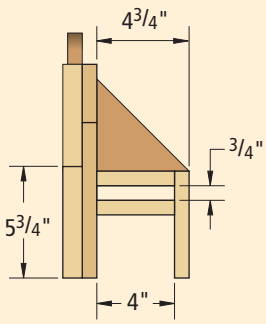
Cam layout



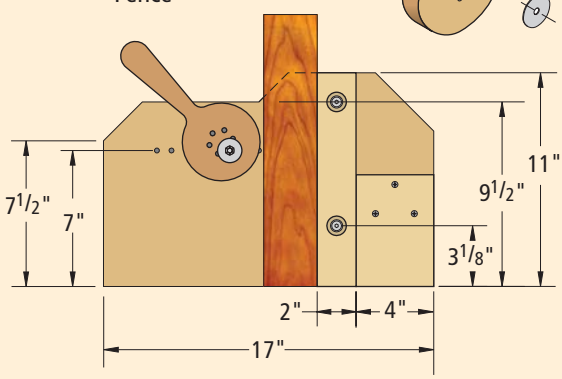
Exploded view



Rear elevation



Profile



Front elevation

TENON JIG

	NO.	ITEM	DIMENSIONS (INCHES) T	W	L	MATERIAL
❑	1	Fence	3/4	11	17	Baltic birch
❑	1	Trap fence	3/4	5 1/2	17	Baltic birch
❑	2	Fence ties	3/4	4*	17	Baltic birch
❑	3	Buttresses	3/4	4 3/4	4 3/4	Baltic birch
❑	1	Work support	1	2	11	Hardwood
❑	1	Blade block	1	5 3/4	4	Hardwood
❑	1	Cam clamp	3/4	4	9	Baltic birch

*width of rip fence

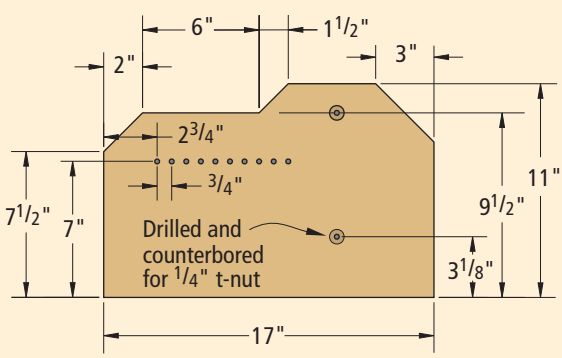
2 - 1/4" x 20 connector bolts, 2"

2 - 1/4" T-nuts

1 - Roundhead stove bolt, nut and washers, 1/4" x 1 1/2"

1 - Roundhead stove bolt, nut and washers, 1/4" x 2"

2 - Fender washers, 1/4" i.d.



Fence layout

Sharpening for Woodturners

Turning tools come in many shapes. Here's how to keep those shapes sharp.

Photos by Al Parrish

Practice at the grinder will pay off at the lathe. (Note that my hands are covering the toolrest.) Although my hands are close to the wheel, there is no danger as there is no pressure towards the wheel.

Many years ago, I was cooking with a friend who was home visiting his parents during a college break. He struggled with a dull knife until he finally threw it down on the cutting board in disgust and declared, "There's a $2,000 stove in this house and not one sharp knife!"

In cooking or in woodworking, keen edges trump just about everything else in importance. You may have a $5,000 lathe with all the bells and whistles, but without sharp tools it's just a big piece of metal. Obviously every woodworker, whatever type of work he or she is doing, needs to use sharp tools. What isn't always so clear is how to get them that way – or even how to recognize a dull or sharp edge in the first place. This is especially true of turning tools, because there are so many different shapes and sizes. Figuring out how to sharpen all of those can be a little confusing. But understanding a few basic principles will definitely help.

Basic Sharpening Tips

Sharpening is a skill; as with any other skill, learning it will require practice. This may seem obvious, but it's easy to forget. It's certainly not as much fun to practice sharpening as actual turning; no lovely shavings pouring off the piece and so on. There is just – well, the grind of grinding. But time invested here will pay off exponentially at the lathe.

Understand that sharpening is really nothing but dressing the tool's bevel. When you think about the edge instead of the bevel, the tendency (albeit unconscious) is to raise the handle of the tool in order to get that edge to appear more quickly. You can't grind an edge; but produce a good, clean bevel and you will have a good edge. You can see when that edge arrives by watching for the sparks dancing across the edge or shooting down the top of the tool. Don't try to hurry it.

Don't worry too much about the exact angles of the bevels. It's more important to develop an understanding of how the tool should work, and when and why you might want a longer or a shorter bevel, than it is to produce a precise, predetermined angle. If the tool is working well, simply try to reproduce that angle.

Let the grinder do the work. Pushing the tool into the wheel won't take the metal off any faster; it will only overheat the tool and wheel. Just enough pressure to keep the wheel cutting is all that's required.

Dress the wheel frequently to keep it flat and clean (more on this later).

Make sure you're comfortable at the grinder; you'll be less inclined to rush it. Be sure you have good light, and that the working area is at an appropriate height. I'm 5'2" tall, and most shops I've been in have the grinder

by Judy Ditmer

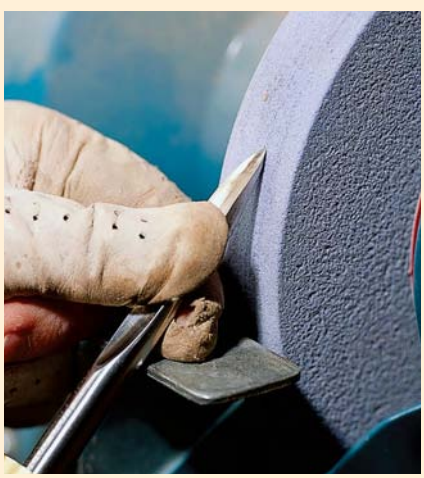
Judy, author of two turning books and many articles, has been turning since 1985. She teaches and demonstrates her skills throughout the United States and Canada.

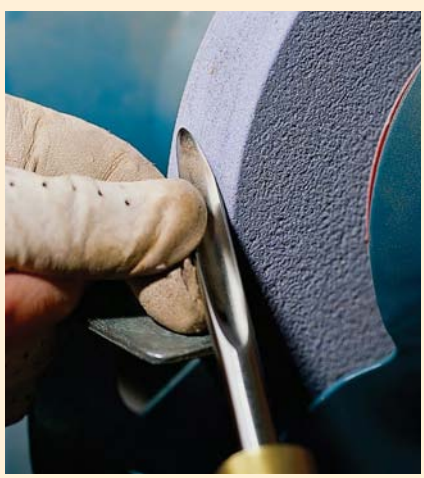
SHARPENING TOOLS: THE BASICS

Start with a parting tool; it's easy to sharpen. Just hold the tool so the bevel is all on the wheel and move it back and forth across the face of the wheel without moving it in any other way.

The roughing gouge (used in spindle work) is fairly straightforward to grind. Find the position for the bevel and twist the handle back and forth without raising, lowering or swinging it side-to-side.

This shallow gouge is one of my favorites for long curves on spindles. It's sharpened like the roughing gouge, but in addition to the simple twisting motion, you will need to move the handle up and sideways a bit on the right side and then the left side in order to produce the shape that is slightly swept back on either side of center.





This is a detail gouge used for spindle work and on the outside of bowls. Start at the tip (as shown at left) and lift the handle and swing it to the right (as shown at right) to produce the swept-back side.

mounted too low even for my comfort. The base of mine is 40" from the floor; get yours up high enough that you don't have to hunch over while using it. If necessary, build up a pedestal with 2x6 boards (and then fasten it all down for stability). Your back will thank you for this.

Remember: Tend to the bevel and the edge will take care of itself.

Grinders and Wheels

There are many sharpening accessories on the market: machines, attachments, jigs, wheels, abrasives and more. I can't hope to examine them all in a short article. I suggest you start with a simple bench grinder. You may already have one; if so, you might not need anything else. But if your grinder has only the gray wheels that came on it, you will need a new wheel. The gray wheels glaze over very quickly and they are often very coarse – the "fine" wheel may be #60 grit or even coarser.

For turning tools, #80 grit for rough grinding and #120 grit for finishing are usually good choices. Most major woodworking and turning catalogs at least offer white or pink wheels. These are aluminum oxide grit and work well for turning tools; the grit breaks away readily, which helps to prevent overheating and buildup of metal on the wheel.

I use the blue aluminum oxide wheels from Oneway Manufacturing (800-565-7288 or oneway.on.ca); the hard, sharp grit cuts well, and the wheels dress to a clean finish for fine sharpening. They don't load up and glaze over as quickly as other wheels I've used.

Bench grinders usually run at either 1,750 revolutions per minute or 3,450 rpm (or thereabouts), and take a 6", 7" or 8" wheel. I prefer a 1,750 rpm and an 8" wheel, although my trusty, old, no-brand grinder was a 3,450 rpm with a 6" wheel, and it served me well for many years. But I prefer the shallower hollow of the bevel from a larger wheel.

At the faster speed, it's easy to lose control and reshape the tool in ways you didn't intend. For small tools in particular, the slower speed makes it easier to stay in control. I like a 1"-wide wheel; it's easier to sharpen larger tools on it than a ¾"-wide one.

You need a wheel dresser to keep the surface of the wheel flat and clean. There are several available that are suitable, including a diamond point dresser, several versions of

a diamond-impregnated bar attached to a perpendicular handle, and my favorite, the dressing stone (shown at right), all of which work just fine.

Sharpening Machines and Jigs

When I started turning, I could barely afford my $25 grinder and a decent wheel, so more elaborate machines and jigs weren't really an option. I'm not sure there even were any jigs for sharpening lathe tools at that time; and to be frank, I was (still am, really) a little intimidated by machines that come with operating manuals thicker than about 1/16". These facts certainly influence my opinions on this topic.

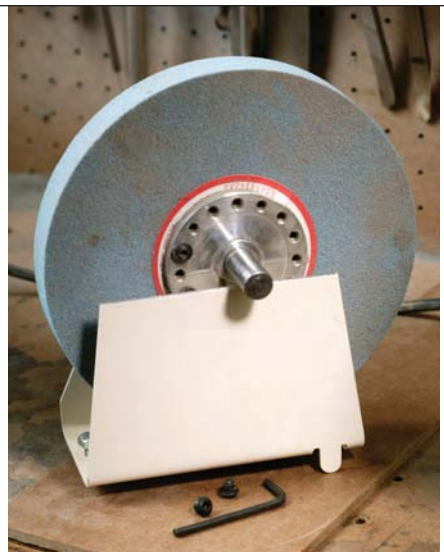
I think the more complex machines are more suited for sharpening things such as flat chisels, jointer knives and planer blades than turning tools. Jigs have a place, but I believe you should definitely learn how to grind by hand, primarily for the two following reasons.

First, let's say you're turning a bowl using three tools: a small bowl gouge, a detail gouge and a scraper. If you have to reconfigure a jig each time you need to touch up one of these tools, you probably won't sharpen as often as you should. You need to be able to go to the grinder and quickly touch up the edge of a tool whenever it's needed. This takes a few seconds once you have acquired some skill.

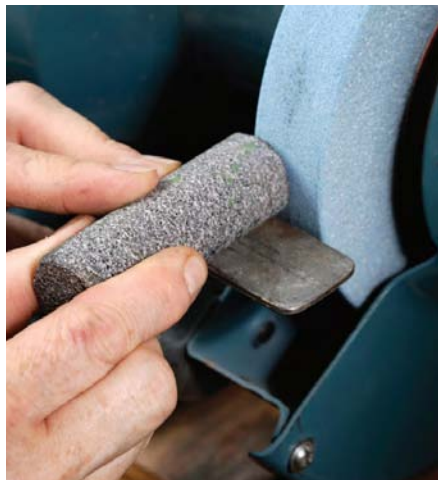
Second, sooner or later you will need to change the shape of a tool in a way the jig does not readily provide for. If you have the skill of hand grinding, this will be a simple matter; if you don't, you will be inclined to just keep using the edge the jig provides instead of reshaping it to do the job better.

What a jig will do very well indeed is dress the bevel perfectly. If you do use a jig, remember that it must be set up correctly, and you do still have to learn how to use it. Even when the jig is properly set up, if you spend too much or too little time on a given part of the edge, you can spoil it. You are still in charge of the shape of the tool.

Remember, woodturners are an opinionated lot, and I am no exception. The crucial thing about sharpening is that you learn to do it. Whatever works best for you is really fine. What matters is that when you put the edge to the wood, it's a sharp one. How it got that way is secondary. **PW**



It's a good idea to balance your grinding wheels. At high speeds, an unbalanced wheel can cause vibration. Oneway makes this system for balancing wheels.



The dressing stone is rolled or moved across the face of the wheel to level and clean it.

ARE WE THERE YET?

How do you know if it's sharp yet? Of course the real test of an edge is in the cutting, but here are some ways to help you evaluate the edge you're getting at the grinder.

Gently draw your thumb off the end of the tool as if you're scraping something off of your thumb (not side-to-side; that could cut you). It should feel rough rather than smooth (it feels rough because it's sharp enough to actually scrape cells off. If it feels smooth, the edge is rounded enough to just slide over your skin).

Gently roll the edge across the end of your thumbnail. Again, it will feel rough if it's sharp (because it's actually biting into the nail slightly), and smooth if it's dull (because it is sliding on the nail).

Pull the tool gently across a piece of wood (I use the base under the grinder – it's always handy) at an angle. It should pull a fine, clean shaving with almost no pressure. If you have to push to get a shaving, it's not really sharp yet.

Fixing Finish with French Polish

Sometimes it's a good technique for repairing damaged finishes.

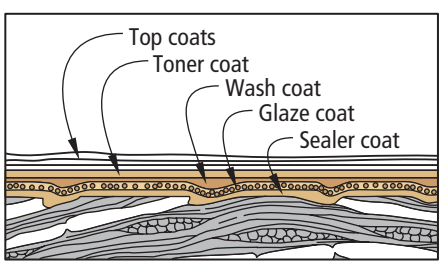
In the woodworking community, French polishing is usually thought of as a technique for finishing new wood. But in the repair community, French polishing is commonly used to renew worn or damaged finish surfaces, especially tabletops.

I was recently called upon to repair some serious damage to the finish on a high-end 1950s mahogany dining tabletop, and I thought you might like to see how I did it. So I took along my camera.

The owners had caused an alcohol-filled heating apparatus under a large chafing dish to explode, spattering alcohol across half of the tabletop. The alcohol cratered out hundreds of depressions approximately the thickness of a normal sheet of paper. The owners loved the color (patina) of the wood and didn't want it stripped and refinished.

The finish was a very sophisticated, multi-step finish involving numerous coloring steps as shown in the illustration below, and the color had of course aged and mellowed. It would have been very difficult to match the other pieces in the dining set anyway, and also very expensive. So the owner's wishes notwithstanding, the best procedure was still to try to repair the finish.

When diagnosing damage of this sort, it's critical to determine if there are color problems. For example, did the damage go so deep that it removed some of the glaze or toner in the finish or some of the stain in the wood? For one or two spots, it wouldn't be a problem coloring them in, but for the hundreds on this table, restoring the color would have been out of the question. It would have taken much too long, and it would have been much too difficult to disguise so many.



A complex finish requires many different layers.

Photos by the author

So I did a simple test. Using #600-grit sandpaper, I sanded back a small area of finish to see if I could sand to below the damage without affecting the color. I could. The damage was confined to the topcoats of clear finish. The first step, therefore, would be to sand out all the damage.

There were two possibilities for the next step. One would be to rub the surface with finer and finer grit abrasives until the desired sheen was reached. The other would be to apply more finish.

Rubbing increases the risk of abrading into color and requires protecting all the surfaces in the room if electrical tools are used. Rubbing is also less successful if the finish is old and somewhat deteriorated, as this one was. It can be impossible to bring up an even shine.

The way most tabletops are restored when working onsite is by applying more finish. Almost any finish can be used, but there are the following caveats.

- Working onsite makes spraying difficult. It can be done, however, using a turbine HVLP and hanging plastic sheeting to protect everything in the room. Although challenging, spraying has the advantage of producing an almost perfectly flat surface.
- The lacquer thinner in lacquer finishes

by Bob Flexner

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

has the potential of blistering any finish, even old lacquer. Begin by spraying light "mist" coats. Lacquer thinner also has a strong odor, and this has to be taken into account when working in an owner's home.

• Water-based finish can be sprayed without the risk of blistering and without the strong odors. Many refinishers use this finish, coating over desks at night and on weekends in offices.

• Varnish or polyurethane can be used, but there is a long drying time and strong odor that has to be considered, and the finish should be leveled and rubbed out afterward. To avoid the leveling step, the finish could be thinned at least 25 percent and wiped on, or a gel varnish could be used. Both still dry slowly and collect dust.

• Shellac can be applied successfully over any finish, and the French polishing method of applying shellac is perfectly suited to this type situation. This is the finish and the technique (as shown below) I commonly use when working onsite. **PW**

7-STEP GUIDE TO REPAIRING A FINISH WITH FRENCH POLISH

Following is a photo essay of how I restored the tabletop using the French polishing method.

1 Here is a close-up of the damage, which was spread over half the tabletop. The damage looks worse than it was, because it was confined to the clear topcoats. It didn't penetrate into the color layers in the finish.

2 The first step was to sand the surface to below the damage. There are several ways to do this: by hand or by machine, and with dry sandpaper or with a lubricant.

I always begin sanding by hand because there's too much risk of sanding through using a sanding machine. If I were to sand into the color layers and remove some of the color, the problem would be almost impossible to fix. This is also the reason I start out sanding dry. Wetting the surface to lubricate the sandpaper masks sand-throughs so they aren't visible until it's too late. When I begin to feel comfortable with the thickness of the topcoats, I add a lubricant.

The choice of grit is a judgment call. Always choose the finest grit sandpaper that will still cut through the damage efficiently. Coarser grits leave scratches that then need to be sanded out. Here, I began with #600-grit sandpaper. With shallower damage, I'd use a finer grit.

3 Grits above #400 are black, wet/dry sandpaper. Without a lubricant, this sandpaper clogs easily, so you need to change often to fresh sandpaper. Clogging causes larger-than-necessary scratches in the surface, which can be difficult to remove.

The downside of sanding dry is that you can go through a lot of sandpaper, and wet/dry sandpaper is fairly expensive. This is the reason to start using a lubricant as soon as you feel comfortable doing so. The lubricant I almost always use is mineral spirits – I choose the "odorless" type when working in someone's home. Sometimes, I add some mineral oil to lengthen the working time. I avoid using water because it may cause problems with an old finish, and it isn't as effective at preventing clogging.

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4 The first step in French polishing is to make a pad – a ball of absorbent cloth wrapped tightly within another cloth to create a smooth bottom surface. Typically, I use cheesecloth for the inner ball and an old, well-worn, handkerchief for the outer cloth. I fold the cheesecloth into a tight square, wrap the handkerchief around it and twist tight, as shown at right.

With the polishing pad made, I pour on some shellac. A plastic squeeze bottle works great. I make the cloth damp, not wet, and tap the pad hard against my other hand to disperse the shellac.

I use two-pound-cut, blonde shellac I've dissolved myself from flakes. Using freshly made shellac produces the fastest drying, hardest and most water-resistant finish.

5 I begin wiping the shellac onto the surface. At first, I'm just trying to get some build (you could even brush or spray the shellac). I usually just wipe the pad across the surface in straight strokes with the grain.

After covering the surface (or in this case one section at a time), I add some mineral oil to the bottom of the pad to lubricate it so it doesn't "drag" the shellac already on the surface. I find it easiest to remove the cap from the bottle of mineral oil and pour a little oil into it. Then I dip my finger into the oil and spread it onto the pad whenever I feel I need to add more, usually each time after adding more shellac.

Once I start adding oil, I begin padding in circles or figure eights. But there's nothing wrong with continuing to pad in straight strokes with the grain.

Here's the first trick to French polishing (whether on new wood or on an old finish). Have one squeeze bottle with shellac and one with straight denatured alcohol. Once you've applied enough shellac to the surface to cover the sanding scratches, begin thinning the shellac progressively with the alcohol until you're just rubbing with alcohol. The goal is to eliminate all the marks left by the cloth.

Thin the shellac right on the pad. Pour on a little shellac. Then pour on a little alcohol. Tap the pad against your other hand to disperse the liquid, then apply one or two finger dabs of mineral oil to the bottom of the pad. After you've been rubbing an area for a while, you won't need as much oil. There will be enough already on the surface.

Here's the second trick: As soon as you start adding oil to the pad, you want to see a vapor trail following the pad as you rub. The vapor trail is caused by the alcohol evaporating through the oil. This tells you that you have the right mixture.

You won't see this vapor trail if your pad is too wet or too dry. You will see just wetness or streaking. As you start padding, the vapor trail can be up to a foot long. It should tighten as the pad dries until it trails by only an inch or two.

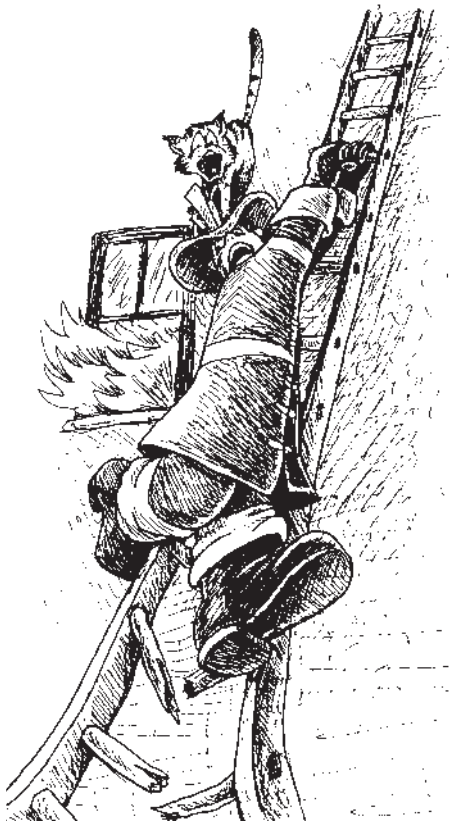
Any time you cause a problem in the finish (rag tracks too pronounced, a mark because you stopped moving the pad, whatever), you can always sand it out and keep going. Use the finest grit sandpaper that will remove the problem.

6 Here is a small section of the tabletop showing some of the damage (left) and the damage sanded out (right).

7 Here is the same section of the tabletop after having sanded out all the damage and French polished. The repaired table is shown at the beginning of this article. — *BF*

To Rip or to Split?

Sometimes sawing isn't the smartest solution.



Illustrations by Will McDonnell

When I lived in Pennsylvania, an Appalachian furniture maker I met gave me this mystery to solve:

"Back near the turn of the last century, the new fire chief of Cumberland, Md., decided to replace one of the station's old and fire-singed wood ladders. Seeing he could obtain the ladder quicker and at a better price by ordering it from a commercial outfit in Philadelphia rather than hiring the job out to the usual supplier – an old orchard ladder maker who lived way back up a West Virginia hollow – he requisitioned the funds and made the purchase.

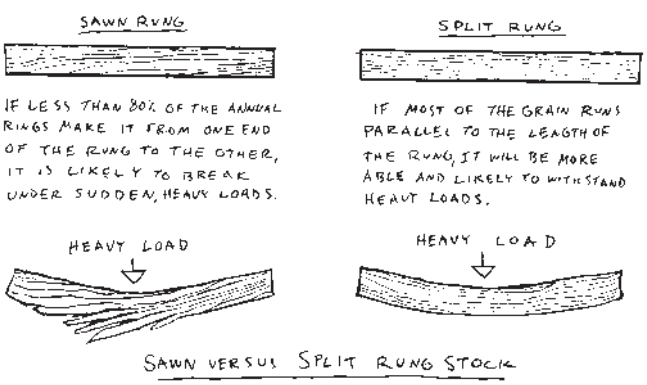
"When he brought the new ladder into the fire house, the lead fireman took one look at the ladder and said he would not set foot on it if his life depended on it. Which of course, it did in his line of work. The surprised chief looked closely at the ladder: the side rails were made of full length, defect-free white oak heartwood and the rungs were made of clear, hickory heartwood. All the joints were well done and securely fastened. Why, then, did the captain vehemently reject the chief's purchase?"

The answer, as the Appalachian artisan was happy to point out to this dumbfounded young dubber from New England, was summed up in two words: sawn rungs. The captain could tell by looking at the grain that the rungs had been ripped from a board rather than split and shaved from a wedge of green wood. That was the ladder's fatal flaw. The power saw, no more than its operator, could care less if the grain of the board ran parallel to the length of the rung. The captain knew that the strength of a rung is directly proportional to the percentage of grain (or, to be technical, the cellulose fibers) that run full length from rail to rail. If more than 20 percent of those fibers exit the rung before they reach the rails, that rung – under the load of a fully outfitted fireman and a damsel in distress slung over his shoulder – would very likely fail. The chief should have known better – as should have this woodworker.

My obvious prejudice against ripping stems from a stint of timberframing that saw me doing an awful lot of ripping with a handsaw. All too often, our big circular saws wouldn't cut deep enough to complete the joints. It wouldn't have been all that bad, but I was a greenhorn and didn't know that you had to hone the teeth nearly daily if you wanted to keep a hand rip saw working to its potential. I did learn to keep spraying kerosene on the blade, and that helped some. I also eventually learned to hold the rip saw correctly when cutting – nearly upright rather than at the 45° I was used to holding handsaws when crosscutting.

Of course, I opted for the powered circular saw every chance I got. But the question is: why rip at all when you can split? Back in the mid-1970s, under the tutelage of Vermont chairmaker David Sawyer, I learned to make farm implements and chairs from green wood. I'll never forget my amazement at first seeing David produce a 4'-long, nearly hexagonal chunk of white oak the size of my wrist from a tree stump in less than a minute with only minimal effort. I'm still amazed today when I look at the Pacific North Coast Indian Longhouses that feature walls fashioned from huge, uniformly sized planks of cedar that never saw the teeth of any saw. At some Canadian museums, one can observe native craftsmen demonstrating the aboriginal house-building technology of wedging planks out of logs. The only sound is the clump of wood on wood – not the scream of an electric motor and its spinning metal teeth. The only smell is the sweet aroma of cedar shavings – not the acrid, irritating dust spit out by a hot, spinning, cutting saw blade. And the speed at which they get these planks to emerge from the huge parent logs is almost breathtaking. It's almost enough to make me want to build houses again – at least those kinds of houses with those kinds of tools. **PW**

by Jim Tolpin



SAWN VERSUS SPLIT RUNG STOCK

This article is adapted from Lesson 46 in "Jim Tolpin's Woodworking Wit & Wisdom: Thirty Years of Lessons from the Trade" (Popular Woodworking Books). To obtain your copy, visit your local bookseller, call 800-448-0915 or visit the Bookstore at popwood.com.