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WOODWORKING MAGAZINE

Shaker Hanging Cabinet

Two Better Ways to Cut Accurate Rabbets

Stub Tenons: The Secret to Simple, Good-looking Doors

Wipe-on Finishes – What You Must Know To Get Good Results

Why Most 6" Rulers Don't Measure Up

Simple Cabinet Organizes Your Most-used Tools

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SPRING 2004

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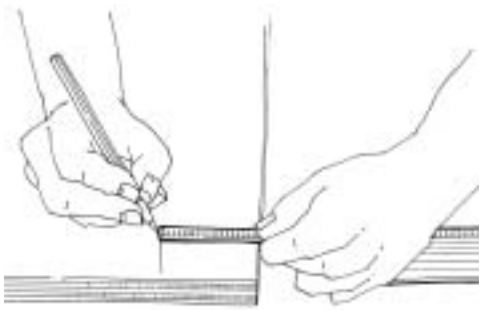
— John Brown (1932 –), Welsh stick chairmaker



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IMPORTANT SAFETY NOTE

Safety is your responsibility. Manufacturers place safety devices on their equipment for a reason. In many photos you see in *Woodworking Magazine*, 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!

Highly Recommended

"Reverence for Wood" by Eric Sloane, a landscape painter and chronicler of early American life, is a portrait of the United States when Americans were more intimately connected to wood. You'll learn how lumber fueled early life, how early Americans knew a lot more about wood than we do and how they used that knowledge to survive. The book is full of surprises (ash entryway doors kept out evil spirits) and it will help you connect and understand the material we use in unexpected ways.

This short volume was printed in 1955 and is still available in hardback ($15) and paperback ($9) from Ballantine Books.

— Christopher Schwarz

On the Level

Listen to Your Lumber

You should hear what your pile of project wood has to say. It has all sorts of suggestions about how to make the best use of it. What? You say your wood pile doesn't talk to you? Well, you must not be listening. Pay attention and you'll be a better, safer woodworker.

Each piece of lumber is like a relative who has a story to tell – some stories are really interesting, some are downright boring and some are cautionary. And there are some that have secret tales that have to be pried out, slowly.

Let me explain. Here's a hardwood board with a tight, hard knot and I'm going to saw right through it. That board is telling me I ought to be careful – danger lurks around knots. Between the crazy grain that's full of tension around a knot and the sudden change in density, that board stands a real good chance of binding up on the saw blade and kicking back.

"Each plank ... can have only one ideal use. The woodworker must find this ideal use and create an object of utility to man, and if nature smiles, an object of lasting beauty."

— George Nakashima (1905 - 1990)
woodworker, author of "The Soul of a Tree"

That same board also has a loose knot and it's warning me, too. "Better wear your safety glasses because I'm just bound to come flying out. Oh, did I mention I'll make a sudden, loud noise and startle you?"

Thankfully, most boards aren't dangerous. They may be "plain Jane" or drop-dead gorgeous. That wallflower of a board is telling you "make me a drawer side" or "use me for the inside of a cabinet." Just look at the grain pattern. It could be too boring (or too wild) to be featured on the outside in plain view. One piece of this ugly board may be so bad that it says, "Send me to the burn pile. I am not worthy."

Of course, there's that one board you might call "Monday's child." It stands out in the pile, all sassy, wide and "fair of face." It says, "Hey, look at me! Put me front and center. I'm the centerpiece for this project."

Then, once in a while, you will come across a special board, so precious it screams, "Don't you dare waste me on this project. Just stand me in the corner until you come up with the perfect project that I deserve."

I'm sure you get the idea. I don't mean to make light of the importance of wood selection and how you machine it in your woodworking. For nice pieces, it will make or break a project you'll spend hours building with the hope it will last a lifetime, maybe even become a family heirloom.

It's important to choose grain patterns wisely to match color in side-by-side boards in a glued-up panel. If you have "cathedral" or "V"-shaped grain patterns, make sure all the "V" patterns point in the same direction. Don't glue one piece of straight-grain wood adjacent to wild grain. When choosing wood for table legs, select stock that has straight-grain on all four sides. (Hint: Look to the edges of wide boards with end grain that's running close to 45°.)

When selecting your project wood, be mindful of which pieces will be positioned adjacent to each other. If you have three drawers running horizontally, choose a single board, whenever possible, to make all the drawer fronts. Keep the sequence of the boards in order so they "line up" when the project is complete. Make sure door panels have a uniform appearance.

Think of your project materials as an unrehearsed orchestra and you will act as the conductor. Lead your project through thoughtful wood selection. By doing so, you will bring harmony – literally – to all your projects.

Even though the cost of wood can be high, don't be penny-wise and pound-foolish. Don't just cut boards to get the most possible parts. Be willing to waste some to make your project the best it can be. Your enjoyment of a well-composed project will last years and you'll soon forget those extra pieces that landed in the scrap pile.

So listen to what your wood has to say. It's not crazy – unless you start talking back. WM

Steve Shanesy

Steve Shanesy
Editor & Publisher

Letters

ILLUSTRATIONS BY MARY JANE FAVORITE

If Your Benchtop Saw isn't Making You Happy, Then it's Time to Move On

I am looking to upgrade my current benchtop table saw and would appreciate any recommendations you might be able to give. I have a small Craftsman 10" benchtop saw, which has served me well up to this point. But I am beginning to realize its limitations. The size of the Craftsman saw works well because I house my tools and machines in my garage, and I don't have a lot of room for large woodworking equipment.

I have been looking at larger benchtop models with more and better features, as well as entry-level contractor saws, but I need to be mindful of the space they will take up.

Tony Vierra
San Jose, California

Tony,
If you're recognizing the limitations of your saw, a new benchtop model isn't going to make you happy. There's a significant difference, and once you switch you'll never look back. My recommendation is to look at a few models and factor in a good-quality mobile base. My favorite mobile base right now is from Jet. It's affordable, adjustable, stable and easy to assemble. To maximize your space further, put a router table in the left wing of the table saw. It may not actually give you more space, but it makes it easier to justify the saw taking up as much space. The table saw is the most important machine in your shop. It deserves a little extra room.

– David Thiel, senior editor

Ambrosia Beetle Gives us Ambrosia Maple, a Popular Secondary Wood

My wood supplier has wormy (ambrosia) maple kiln-dried for sale for $1.15 a board foot. My question is: How does this species machine? And what sort of finish would be best used on it? Is it even worth considering for use?

Bob Porter
Celestine, Indiana

Bob,
"Ambrosia" maple has become popular during the past couple of years because it's cheap and plentiful. This type of maple features small worm holes that were made by the ambrosia beetle (hence the name "ambrosia maple"). It has been used for years as a secondary wood for cabinet interiors and the like – somewhat similar to poplar but not quite as stable.

Ambrosia maple should machine OK, but I suspect it will blotch if it is stained, just like regular hard maple, birch, pine, cherry, etc. You can get around this by using gel stains or washcoats before staining. I'd suggest you test any stain on sample boards before planning a project you think you might want to stain later.

– Steve Shanesy, editor & publisher

A Home Remedy for Removing Saw-blade Gunk

Is there a suitable household substitute for removing the gum from saw blades? I know kits are sold in woodworking stores, but I have a sneaking suspicion that they may consist of something very common and less expensive.

Bob Graham
Olathe, Kansas

Bob,
Any brand of oven cleaner is very effective for cleaning gunk off saw blades. But don't get it on your skin for long, as it's a caustic substance. Apply, let it penetrate for a few minutes, wash it off and dry the blade. You may need an old toothbrush to scrub the worst areas.

– Steve Shanesy, editor & publisher

Scraper & Sandpaper are Key to Making Knots Look Good

I've been woodworking for about one year. I like the appearance of some knots in my wood projects. However, I've yet to find an easy, effective way to smooth the knots out. I mainly use oak and poplar for my projects. Does anyone on your staff have any suggestions?

Edward Relyea
Marion, North Carolina

Edward,
Hand-planing knots often results in tear-out. Your best bet is to smooth the surface with a sharp card scraper and then sandpaper. Start with #100-grit and finish with #220.

– Kara Gebhart, associate editor

Butcher Block Needs a Little TLC

I have an oak butcher-block countertop that I've neglected. Because of the heavy use, I can see some of the raw wood surface. I was going to sand it with a belt sander and I'm not sure what to finish it with. Do you have a better method?

Julie Jiacoppo
Massapequa, New York

Julie,
A belt sander can be used but I would caution that it can be very aggressive and might damage the surface if you aren't careful. A safer way would be to use a random-orbit sander. Start with #80-grit. Once the finish is removed, move to #100, #120, #150 and then #180.

The finish you choose depends primarily on how you intend to use the countertop. If you want a film-building finish that can take some abuse (but won't allow you to cut on it directly), use polyurethane. If you will be cutting on it and getting it wet, I'd suggest mineral oil. You can reapply the oil once or twice a year to replenish the finish and the look. However, the oil finish will not give you the luster or shine that the film finish will. The oil finish will always look dull, so it's ultimately up to you.

– Steve Shanesy, editor & publisher

Finish the Backs of Drawer Fronts; the Rest is Up to You

This is the age-old question of whether you should finish (apply stain, varnish, etc.) to a drawer. Presently I am finishing a dresser for my wife. I will apply finish to the fronts of the drawers, but I'm not sure if I should apply finish to the insides and remaining outside of the drawers. Also, if you were to apply finish to your drawers, what type of finish would you use?

Bruce MacEachern
Ottawa, Ontario

Bruce,
I finish my drawers. No stain, just finish. But it's a personal preference. At the very least you must finish the backside of the drawer front; otherwise, your drawer front will warp because of uneven humidity absorption inside and out.

I finish my drawers because it looks better and offers some protection if anything is ever spilled in there. But I won't argue with anyone who opts to leave the drawers bare.

As far as what type of finish to use, any film finish is fine. Oil will take forever to dry, especially in an enclosed space. Plus, it can smell like oil inside the drawer for years. Shellac, varnish, lacquer and polyurethane all will cure quickly and none of them will leave a smell for long.

– Christopher Schwarz, executive editor

Help for a Crooked, Old Saw

I recently dug out an old Disston #4 backsaw that was my grandfather's. I went to vintagesaws.com and got some great information on sharpening. I got a saw vise, some files and a saw set. I have one problem, though. The saw needs to be straightened, too. I would rather have this done professionally. Can you recommend someone who specializes in this area?

Roderick Jensen
Brimfield, Massachusetts

Roderick,
You can send it to Tom Law of Smithburg, Md., (301-824-5223). Give him a call and explain your situation. He's also an excellent sharpener.

I've straightened a few myself; it's actually straightforward work. Put the handsaw or backsaw on an anvil and push the blade so it's flat against the striking surface. Then tap the bent area a couple of times with a hammer. It's a good idea to practice on a saw you don't care about, but it's not very tough to do.

– Christopher Schwarz, executive editor

Are Japanese Chisels Worth It?

After years of using off-the-shelf "junky" tools, I now own a few quality products such as Lie-Nielsen planes. I would like to buy high-quality chisels and have considered something from the Japan Woodworker catalog. Are these largely handmade chisels really worth the money or would I be better off with something from the usual suspects, such as Marples, Two Cherries, etc.?

Don Rader
Huntington Beach, California

Don,
Chisels are strange animals. You definitely can spend far too much money if your goal is merely to get a tough, useable tool. For the Japanese tools, you are paying as much for the beauty, history and provenance behind the tool as you are for its edge-holding ability. I've had the honor of handling a good number of Japanese chisels from private collections and they are indeed spectacular. Are they 10 times as durable as Western chisels? Of course not.

Buy the Japanese chisels if they will make you happy. If you want a chisel that will hold an edge long enough for you to chop out the dovetails for some drawers, I can recommend chisels that we have tested: Ashley Iles, Two Cherries and Matsumura Blue Steels. Marples and Stanleys also are good bargain options.

If you want the ultimate chisel set, I recommend the Lie-Nielsen chisels, which are due out sometime this year. I've been testing preproduction models and find them to be as good as any exotic chisel with a price only slightly higher than the fancy European ones.

– Christopher Schwarz, executive editor

Two Tricks for a Warped Table

I need some advice. My mom has a very old Queen Anne dining table. A couple of the leaves have warped, and she has asked me to fix them.

The only idea I have is to put them on the concrete floor with a lot of weight on them and hope the moisture from the floor will remove the warp. Hopefully someone has more experience with this and can come up with a better solution, as I don't think my idea would really work.

Mike Grawvunder
Oshkosh, Wisconsin

Mike,
Your solution might actually work, for a period of time. The problem is that wood is hygroscopic and the leaves will try to reach the same moisture content and state they are in now.

Has the table ever been refinished? If so, did the finisher actually finish the underside of the parts – not just apply a stain, but a protective topcoat? If not, that is likely causing the warp. The underside is absorbing moisture more rapidly than the top. You can remove warp by putting the top on sawhorses out in the sun (to reduce moisture) and then adding weights. Once the top is flat, you can finish the top and bottom.

If that's not the problem, add a couple of battens across the grain of the wood that straighten out the warp. These usually are 2"-wide lengths of a stout hardwood (such as maple) installed in a sliding dovetail housing on the underside. They aren't glued in, just built to have a tight press-fit. A professional furniture restorer will have more ideas for fixing your leaves.

– Christopher Schwarz, executive editor

Get the Smoothing Plane and Spend $8 on a Card Scraper

I am interested in buying a smoothing plane, but have noticed all the scraper planes offered as well. I can't seem to figure out why you would use one over another as they both appear to be for final surface preparation, in lieu of sandpaper. Can you offer a little insight?

Brian Dickerson
Mound, Minnesota

Brian,
Smoothing planes do a lot of other chores that a scraper plane can't do, such as leveling joints, cleaning up edges of boards, fitting drawers and doors, and the like. A scraper plane is good for one thing only: preparing a surface for finishing. Scraper planes also require considerably more effort to push than smoothing planes.

Smoothing planes and scraper planes are both good tools to have and well-equipped shops have at least one of each. If I had to buy only one, it would be the smoothing plane. You can come back and clean up any errant tear-out from a smoother with a card scraper, an $8 item.

– Christopher Schwarz, executive editor

Where to Begin My Woodworking?

I never went to technical school to learn about all the basic things you need to know before you pick up a hammer and begin your project. Is there a book for sale with all the basic principles of measuring so I can begin to work on projects?

Sherwin Croes
Fort Lauderdale, Florida

Sherwin,
I'd like to tell you there is one all-encompassing book that has all the answers, but no one has managed to publish it. I can suggest a few books that, when used in combination, will have many of the

answers you seek. In fact, think of these books as a woodworker's essential library.

■ *"Encyclopedia of Furniture Making" by Ernest Joyce (Sterling): A daunting title, but one great reference book about woodworking. It covers terminology, materials, joinery, tools, design, fasteners and even finishing. It's indispensable.*

■ *"Illustrated Cabinetmaking" by Bill Hylton (Reader's Digest): This book, which is about furniture styles and design, covers standard furniture dimension and Western joinery – not how to cut or assemble joints, but what to use and where.*

■ *"The Complete Illustrated Guide to Joinery" by Gary Rogowski (Taunton): This fills in where Hylton's book leaves off. Learn how to cut and assemble joints using power tools and hand tools.*

■ *"Measure Twice, Cut Once" by Jim Tolpin (Popular Woodworking Books): Primarily about design, this will help you understand why a chair is comfortable and how deep drawers need to be – important ideas for any woodworker.*

■ *"Seven Essentials of Woodworking" by Anthony Guidice (Sterling): These skills include measuring, marking a line, sharpening, sawing to a line, planing and mastering one finish process. All will make you better at what you do.*

■ *"Understanding Wood Finishing" by Bob Flexner (Reader's Digest): This book covers everything you need to know about finishing in a no-nonsense manner. It takes the mystery out of one of the most important project steps.*

– David Thiel, senior editor

"The expectations of life depend upon diligence; the mechanic that would perfect his work must first sharpen his tools."

– Confucius (551 B.C. - 479 B.C.)
philosopher

Where to Find Replacement Parts for Old Hand Planes

Last year I read an article on hand planes and have since purchased two old Stanley planes off eBay – a No. 4 smoothing plane and a Type 11 jack plane. Both planes are in pretty good condition, but both needed extensive tuning.

My problem is this: I can't find parts for either of them. I have contacted several antique dealers and tool companies to no avail. For the sake of the integrity of the planes, I would like to purchase the original parts. But, if that's impossible, I'll be using these planes for real work in my small workshop so I can use new parts instead.

Donald Mitchem
Deltona, Florida

Donald,
Have you tried Bob Kaune at antique-used-tools.com? Drop him a line. He has saved my pants with parts several times. After that, your next best bet is to buy a new replacement part for the planes by contacting Highland Hardware (tools-for-woodworking.com). Or, buy a "donor" plane on eBay that has the missing parts you need.

– Christopher Schwarz, executive editor

Can I Use My Kitchen Knife Sharpener on My Scraper?

I just purchased some hand scrapers after I saw some in use on the "DIY Woodworks" show. My question is this: Is the burnishing tool basically the same as a steel used to sharpen kitchen knives, or do I have to buy the smooth burnishing tool itself? I would like to start using scrapers instead of the sander all the time.

Doug Duncan
Roy, Utah

Doug,
The steels used for sharpening knives won't work. These are designed to put a slightly jagged edge on a tool, which is ideal for slicing through soft foods found in the kitchen.

You really need some sort of smooth burnisher in your shop. Some people salvage an old valve rod from an engine, which is hardened and smooth. Other people cough up the $10 to $15 for a proper tool. Either works.

– Christopher Schwarz, executive editor

A Hand Plane Shopping List

I'm looking to get a couple of hand planes for the shop, including a low-angle block plane. Can you recommend other models that are used most often, such as a smoothing plane, shoulder plane, jack plane, jointer plane, scraper, etc.? I have a powered planer and jointer, but want to incorporate hand planes in my work, too.

Todd Marshall
Ashburn, Virginia

Todd,
Ah, the first steps into a larger world. When buying planes, deciding which ones you need really depends on your work and the joinery you use. For almost every woodworker, a smoothing plane should come first. It sees more work than any other kind of plane. It handles the final surface preparations of any board and general planing chores, and it can trim edges of boards.

Second, I'd buy either a card scraper or a card scraper plus a scraping plane – especially if you work with difficult figured woods. These tools clean up any tear-out left over from your smoother. You can get by easily with a card scraper and get the scraping plane (Veritas makes an excellent version) later on down the line.

Next, get a good block plane. The Lie-Nielsen 60½ can't be beat. This trims joinery flush after it's assembled and is fantastic for removing saw blade and jointer marks from edges. It also has about 10 million other uses.

If you cut a lot of tenons, a shoulder plane should be next. No tool makes fitting tenons easier or more straightforward. Get a big one so you can trim long face cheeks.

After that, I'd buy some kind of jack plane for rough work. This doesn't have to be a premium brand. I use mine for flattening tabletops, removing material quickly and fitting drawers.

Then it's personal preference. If you want to shoot long edges for gluing, you'll need a No. 7.

– Christopher Schwarz, executive editor

Sealing Off Pet Urine on a Hardwood Floor

Can I use shellac under polyurethane? I am trying to seal off animal urine on a hardwood floor. I will sand it, but I also need to seal this floor.

J.A. Kutscher
via the internet

J.A.,
Yes, you can use dewaxed shellac under polyurethane without any bonding problems. It should be dewaxed – that is, having had its natural wax removed. You can dissolve your own dewaxed shellac or buy it already dissolved, made by Zinsser and sold under the brand name SealCoat. It should be available everywhere in paint stores and home centers. For a large area, I would suggest the SealCoat. WM

– Bob Flexner, author of "Understanding Wood Finishing"

HOW TO CONTACT US

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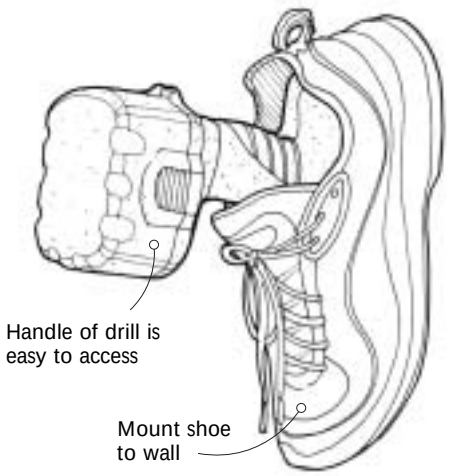
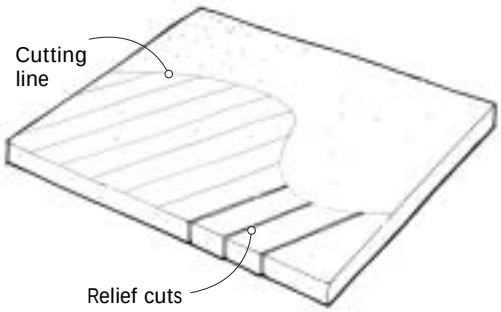
Shortcuts

Handy Drill Storage

I don't know about other woodworkers, but I really appreciate having my drills, corded and cordless, at hand and ready to use. I solved this by mounting a ready-made "scabbard" on the wall right over my bench where most of the drilling takes place. Just be sure to air it out first.

Albert Beale
Littleriver, California





Relief from Awkward Fall-off

When cutting a circle or an odd shape from a square piece of lumber on a band saw, you've probably dealt with the annoying corners that try to pull the material out of your hands as they catch on the saw's table. Then there's the additional annoyance of the blade binding in a weird curve. A few extra cuts can almost eliminate this problem. Make relief cuts in from the edge of the material right up to the edge of the finished shape. Space the cuts about an inch apart and parallel to one another. Then, as you make the cut on the shape itself, the falloff will do just that – in small, manageable pieces and without binding the blade.

Woodworking Magazine *staff*

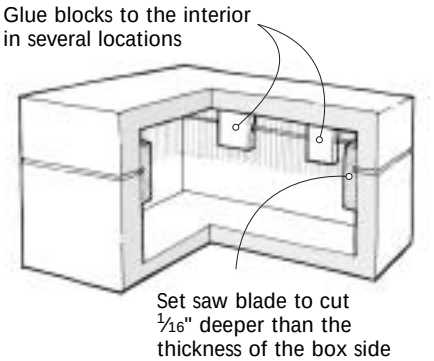
Non-binding Box Lid

Lots of woodworkers who enjoy making boxes prefer to build the box and lid in one piece and then cut the lid off on the table saw after the glue has cured. This offers a good grain match and eliminates any alignment problems.

Unfortunately, when the box is separated from the lid, the blade will sometimes bind on the last cut. Wedges can be placed in the saw kerf, but this is often awkward and possibly dangerous.

A better idea is to use dabs of hot-melt glue to attach blocks to the inside surface of the box over the location of the lid joint during assembly. When the box is cut apart, set the saw blade to cut about 1/16" deeper than the thickness of the box side. The box itself will be parted, but the blocks will hold the kerf open. The blocks can then be knocked off and the surface sanded.

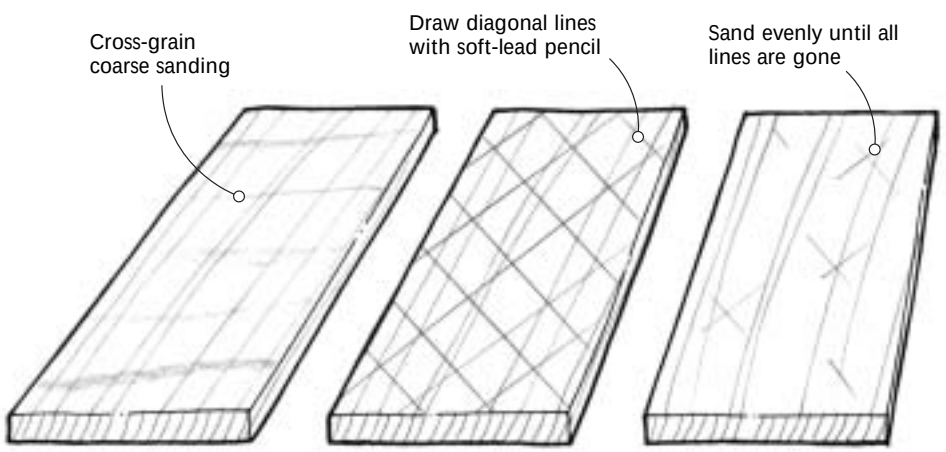
Woodworking Magazine *staff*



Eliminate Sanding Dips

I build many projects using wide panels of glued-up cedar 1x6s, and I used to have difficulty detecting and eliminating dips left by my belt sander. Here's one solution: After initial cross-grain coarse sanding, draw dark diagonal lines across the surface with a large, soft-lead pencil. Then sand evenly until all the lines are gone. Repeat the procedure, but draw lighter lines as the sandpaper grit gets finer.

C.A. Conway
Benton City, Washington



Two Pegs Place Sandpaper on a Sander in a Second

I really like my random-orbit sander that uses hook-and-loop disks because I can quickly switch through three or four grits of paper while finishing a project. The problem I had was keeping the disks in order, convenient and clean. So I built a holder that hangs on the wall when not in use, and when laid down flat has two little pegs that locate the disk on the sander's hook pad. These gadgets now being sold with eight pegs are nonsense. Two pegs are all you need, and one should be longer than the other so you can engage them one peg at a time. Too long a peg will get up into the fan blades and cause problems.

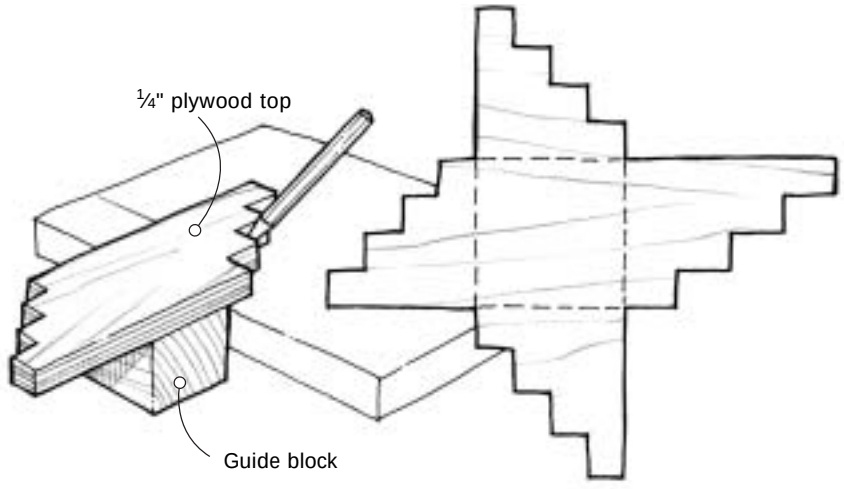
Don Dickens
Vancouver, Washington

Measure for Measure

I've been using notched pieces of wood as pencil gauges for years. I found there were some measurements I needed frequently when working on projects, so I made a block with several sizes, and eventually made a single gauge to incorporate all the sizes I commonly use.

I first made a two-way gauge with four marked distances on each side. The top is ¼" plywood attached to a 1" square strip that is 2" long. This gives me eight settings. I then went a step further and made a four-way gauge attached to a 2"-square guide block, which gives me 16 settings. So with the two gauges, I am able to draw pencil lines at 24 different distances from an edge. I rubbed the gauges with wax to make them look nice and to help them slide easily.

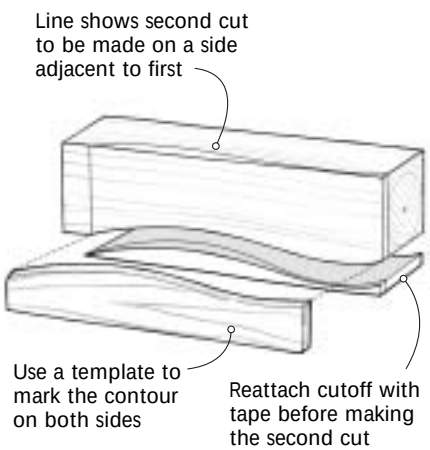
Percy W. Blandford
Stratford-upon-Avon, England



The Ghost in Your Lathe

Here's a great way to make duplicate parts on the lathe. Lay out the pattern on two adjacent sides of each piece. Carefully band saw to the pattern lines on one side, then tape the sawn pieces back onto the stock with masking tape so you can cut out the pattern on the other side. Discard the waste and mount the stock on the lathe. When the wood is spinning, the outline of the pattern will show up as a "ghost" line against the squareness of the stock. Carefully turn the pattern. This works best on thicker spindles, but it can be used on any diameter.

Don Kinnaman
Phoenix, Arizona



"A determined soul will do more with a rusty monkey wrench than a loafer will accomplish with all the tools in a machine shop."

— Robert Hughes (1938 –)
Australian art critic

Fix Wobbly Tables and Chairs with One Saw Cut

No matter how hard we try, by the time we get done with any four-legged piece of furniture, one of the legs somehow has "grown" a little longer and the darn thing wobbles.

Then, when we try to shorten the offending leg, we discover that suddenly the other three legs have "grown" longer. A little while later the table is finally sitting flat, but it's an inch shorter.

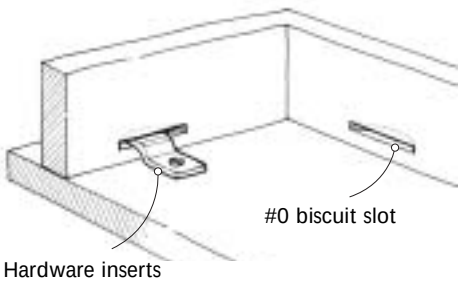
A simple and foolproof way to solve this problem is to place the piece of furniture on a flat, elevated surface with the longer leg hanging over the edge. The other three legs will sit even and the fourth leg can be marked flush with the elevated edge, then cut or sanded to that mark. Voilà – a flat project in just one cut.

Woodworking Magazine *staff*

Biscuit Slots Hold Tabletops

I use my biscuit joiner to cut neat slots for metal tabletop fasteners. The #0 setting is perfect. The normal procedure is to cut a full-length groove, but that weakens the apron.

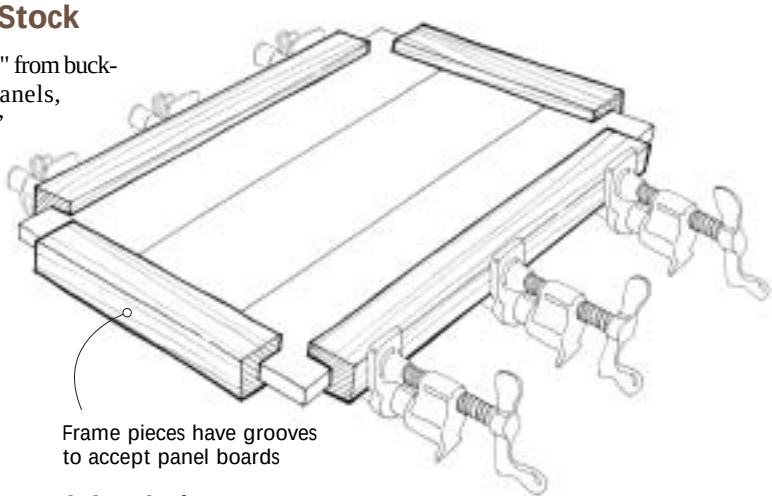
Dick Dorn
Oelwein, Iowa



Gluing Up Thin Stock

To keep stock as thin as ¼" from buckling when gluing up panels, make a "picture frame" around it. Cut four pieces a bit shorter than the panel dimensions from 1x3 stock. Cut a groove in each just wide enough to accept the panel boards. Apply glue to the boards' edges, slip the "frame" end pieces on, then the side pieces, and clamp. Be sure to cut your panel boards longer than needed, as the frame end pieces may get stuck to them.

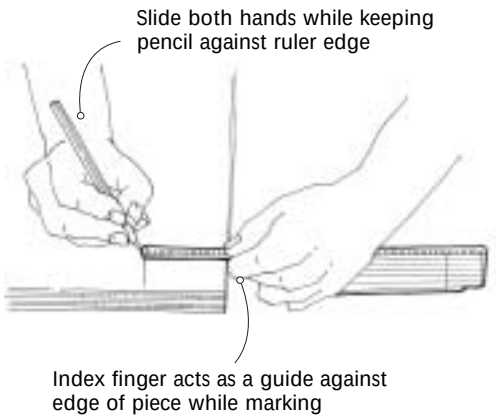
William Nichols
Ravenna, Ohio



Quick and Dirty Combination Square

When you don't need an absolutely accurate line drawn on a piece (say for a shooting/nailing line or layout line) all you need is a wooden folding rule, a pencil and your two hands. Lay the rule on your piece the proper distance in, then hold the rule in your left hand with your index finger against the edge of the piece. With your pencil against the tip of the rule, slide both hands the length of the piece, using your left hand as a guide against the piece's edge.

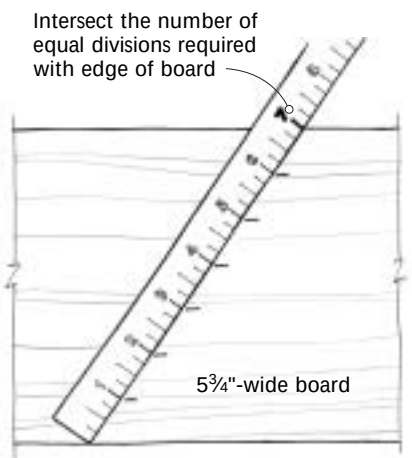
Woodworking Magazine *staff*

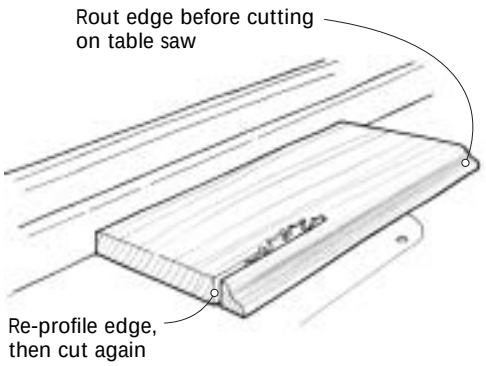


Simple Rule for Simple Division

Finding the center of a board or dividing it into equal parts is as easy as grabbing a ruler – and there's no math required. It's an old trick but still a good one. Lay the ruler diagonally across the board. For seven equal widths, align the ruler on the 0" and 7" marks across the board and mark off the intervening inches. Need to find the center? Keep the rule at 7" diagonally and mark at the 3½" location. It's that simple.

Woodworking Magazine *staff*

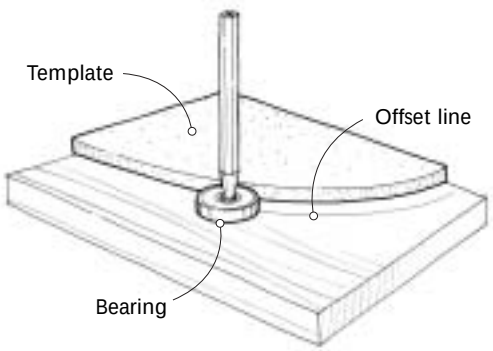




Routing Narrow Mouldings

Rabbets and moulded edges are difficult to cut safely and accurately on small frames for pictures when using a router. I make moulded frame sides without trouble if I do the router work on the edge of a wide board, then rip that piece off on the table saw. Then I repeat my router cut on the new edge and so on until I have enough pieces for my frames. This wide board gives me a good bearing surface for the base of the router so I can cut the rabbet from one side and my moulding from the other without fear of the router wobbling and spoiling a good piece of wood.

John Clarke
Venice, Florida



Keep a Direct Bearing On Your Workpiece

I've done a lot of template and radius work over the years and often need to band saw a shape out, leaving just a bit of wood for the shaper or router to clean up in the final milling. Well, it gets a bit challenging trying to keep a nice, even offset just by eye (especially as my eyes are changing with time). This works beautifully: Put your pencil in the hole of an old router bit bearing and just slide the bearing around your form. This gives you a perfect, even offset line to cut to. It also works great for scribing a fit to a wall. And you can use different bearings for different-sized offsets as needed.

Sangeet Henry
Fairfax, California

Permanent Gauge Sizes

If you're like me, you find yourself frequently setting marking and mortise gauges to the same sizes repeatedly, but perhaps you don't get them exactly right each time. Well, I decided to stop this from happening and make a fixed marking gauge for sizes I use most.

I often need to gauge centerlines, as well as mortises and tenons, in ½" and ¾" material. You can pick sizes to suit your needs. My gauge has a stop that's 2½" square x 1" thick for a comfortable grip, and a hole cut squarely through it. The stem is 1" square x 6". The pins are fine nails driven into the stem, then cut off at about 3⁄16" long and filed to chisel-shaped points.

At one side of the stop are pins to mark centerlines. On the other side are pairs of pins for mortises. If your scratched lines are not exactly right the first time, you can correct them by filing more off one side of a point.

You can arrange up to four settings on each side of the stock.

Percy W. Blandford
Stratford-on-Avon, England

Perfect Glue Joints

No matter how often you square up the fence on your jointer, that perfect 90° angle still can manage to elude you. And when you're using that jointer pass for an edge glue-up, you need it to be perfect. We have come up with a method for use in our shop that will guarantee a perfect 90° angle each time we need one.

First match your boards for best appearance and mark the faces and the joints. Run one piece with the good face against the fence, then flip the mating piece so that the good face is away from the fence. When you test the glue joint – even if the fence is off by a fraction of a degree – the edges will be complementary angles to one another and form a perfect glue joint.

If you're gluing up more than two pieces to form a panel, alternate your board orientation against the fence and you'll get a panel with perfect joints that's as flat as can be. WM

Woodworking Magazine *staff*

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Cut Accurate and Clean Rabbets

When I was taught to cut rabbets in my first woodworking class, we made them with two cuts on the table saw. You've probably seen this technique in books and magazines before. For the first cut, the work is flat on the table. For the second cut, you stand the work on edge and press it against the fence as you move the work over the blade. The waste falls away and your joint is complete.

I've always struggled with this technique. It never seemed to produce a perfect rabbet every time. The technique does have its strengths: Most woodworkers have a table saw and a rip blade to make the cut; when it works, it does produce a nice smooth joint. But after years of doing it this way, I concluded that this technique has several serious weaknesses:

- Standing the work on edge requires a tall rip fence, perfect balance on your part and a zero-clearance insert in your saw's throat plate.
- The joint is time-consuming because it almost always requires two saw setups and several test pieces to get it just right.
- You have to move the saw's guard out of the way for the second cut, no matter which brand of guard you have on your saw.

So we decided to look for a better way to make rabbets. We found two good methods. The first uses two scraps and a dado stack. The second is an improved two-step process that's virtually foolproof. But before we get to that, a quick explanation on why other methods aren't as great.

Rabbets by Hand Take Great Skill

Rabbets are one of the first joints woodworkers learn. Try building any sort of cabinet or shelf without it and you'll know immediately how essential this simple open trench is.

The perfect rabbet should have square shoulders and a flat bottom. And the cut should be smooth. You shouldn't see marks from the tooling on the joint except on close inspection. If any of these elements of the joint are off, you can be in trouble at assembly time.

If the joint's shoulders aren't square, you likely are going to have an ugly gap between the rabbeted piece and its mate. Or worse, you will close the joint but the case will not be square.

If the cut is rough, has burn marks or is inconsistent, it will be difficult to completely close the joint with clamps. Plus, a rough rabbet isn't going to be as good a glue joint as a smooth one.

Before power tools, woodworkers made rabbets with hand tools, such as a rabbeting plane.

PHOTO BY AL PARRISH

Story by Christopher Schwarz, executive editor

I've done it this way, and it works great – once you master a couple of skills. Before you can cut this joint with a rabbeting plane, you need to learn to tune the tool and sharpen the iron. This is no small feat for a beginning woodworker. Then, once you have a tool that works, there are two settings that are paramount: the depth stop, which limits how deep the rabbet is, and the fence on the side, which controls the joint's width. With these two set, you then make passes until the tool stops cutting – then your joint is complete.

I consider this a technique that's best for the hand-tool enthusiast; it does take some skill. Most woodworkers are going to opt for an electron-eating solution with an easier learning curve, such as with the router or table saw.

Routers Aren't for Everything

The router table was my first choice for a couple of reasons: Router cuts are exceptionally clean and maintaining the squareness of the joint's shoulders is no problem.

But after cutting a lot of rabbets on my router table, I concluded that routers are not the best choice for all-around casework rabbeting. It sounds like blasphemy, but here's what I concluded: Most routers actually are quite underpowered for the job, so you end up cutting your projects' joints in small, time-consuming nibbles.

A 1½-horsepower router does not deliver the same sustainable torque that a 1½-hp contractor saw does (no matter what the tool's label or packaging says). Part of the problem is marketing hype among the router manufacturers, and part of the problem is in the way a universal router motor is built compared to a traditional induction motor on a contractor saw. The bottom line is this: Ask a typical router to hog out a ¾"-wide x ⅜"-deep rabbet in one pass and it will bog down or even stall in the cut.

A router also is noisier than a table saw, and large cabinet pieces become unwieldy when you try to maneuver them on the router table. You could cut smaller rabbets on small pieces on the router table (drawers are about the right scale for most router tables). But here's how I feel about that: Learn the rabbeting process on one machine and then do it over and over the same way so you become an expert at that process. Jumping around from technique to technique will only slow your progress as you learn the subtleties of each.

Some people use their jointer and its rabbeting ledge to cut this joint. The jointer is a powerful machine, and this technique actually works pretty well for narrow stock such as face frames and door parts. But try to rabbet the end of a 30" x 20" cabinet side and you'll see why this isn't the way most people prefer to cut rabbets.

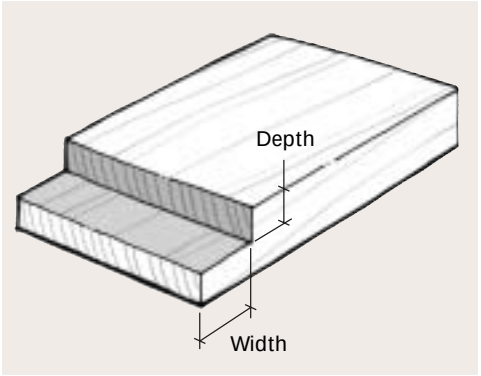
So I went back to the table saw, which has guts galore and a big table, to see if I could find a different way to skin this wily animal.

Single Setup with Stack Dado Set

One nice thing about making a rabbet on the router table is that you can (within reason) do it with a single tool setup. You can control the width and depth of the joint simultaneously, tweaking the height of the bit and the fence (which exposes the tooling) until the joint is just right.

To do this same thing on the table saw you need two things: a stack dado set and a long length of plywood you can clamp over the working surface of your rip fence. The wood allows you to "bury" the dado stack in the fence so it will work like the fence on a router table.

This accessory fence should be straight, at least ½" thick and as long as the table saw's rip fence. Plywood is a logical choice of material because it doesn't tend to warp.

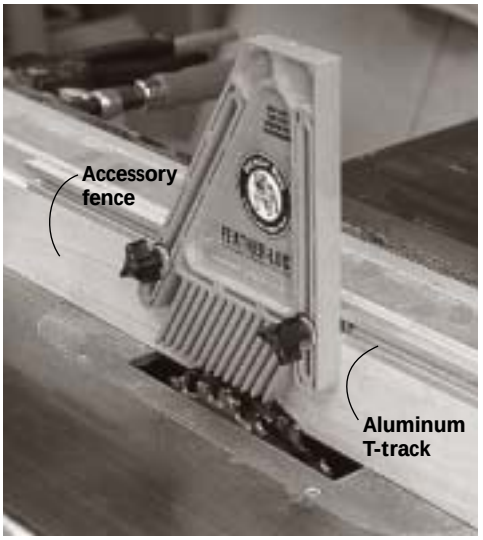


Rabbets can be cut with the grain or across it.

The first time you use this accessory fence, lower the dado stack below the surface of your saw's table. Next, clamp the accessory fence to your rip fence and then position it so that about ⅛" of it covers the blades below. Then, turn on the saw and slowly raise the blades into the fence until you've cut away about ¼".

Another necessity to ensure an accurate and safe cut is to use a featherboard that presses the work against the table. There are lots of commercial featherboards available, or you can certainly make your own. As you can see from the photo at right, I also added an aluminum T-track (in a rabbet, no less) that allows me to quickly adjust the featherboard's position. That's mighty handy when dealing with project parts that are of different thicknesses.

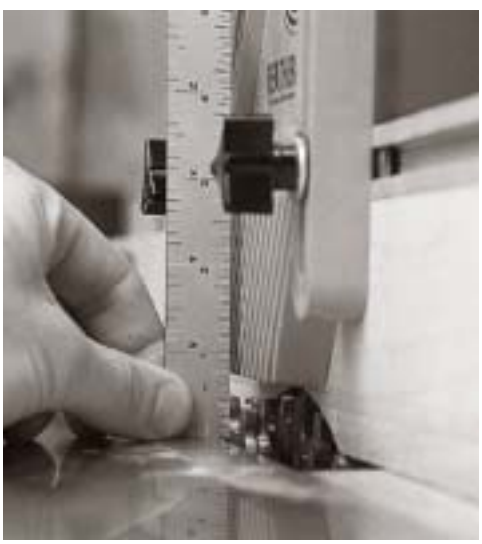
Now you're ready to make rabbets. Using a 6" rule (see "Almost-perfect 6" Rulers" on page 25), set the height of the dado stack to equal the depth of the rabbet you want to cut. (Tip: Spend some time finding the point where your blade's teeth are at their highest. When you've found that sweet spot, mark it on your table saw's throat insert; I use a scratch awl. In the future, you can just set your ruler on that mark and measure. You'll be amazed how much time this saves you.)



An accessory fence on your table saw's rip fence allows you to make perfect rabbets with one machine setup and almost always in one pass. Put enough chippers on the arbor to make your cut and add one more. So if you're making ⅝"-wide rabbets, install enough chippers to make a ¾"-wide cut. Bury the last ⅛" in the accessory fence.

Next, set the saw's rip fence to expose enough of the dado stack to make the width of your rabbet. With practice, you can almost always hit that measurement exactly on the first try.

Lock the height of the arbor on your saw. This is especially important if you own a benchtop or contractor saw. In smaller saws, the mere force of the cut can cause the arbor to creep downward.



The height of the dado stack determines the depth of the finished rabbet. This is ½".

The distance from the top of the left tooth to the fence determines the width. This is ¾".

If it creeps just a bit, that's the worst. You might not find out about the problem until assembly.

Turn on the saw. Follow the same rules you do when ripping or crosscutting. If it's a ripping operation, you can simply press the work against the fence and push it through the blades. The same goes for work that is square or nearly square (such as the side of a base cabinet). After your first pass, check the depth of cut with a rule or dial calipers all along the joint to make sure your featherboard is pressing down hard enough to prevent the work from rising during the cut. If the joint is inconsistent, increase the tension on your featherboard or push the work a little harder against the saw's table.

Sometimes taking a second pass will fix your problem. While that's not ideal, it's worth a try if you are stuck and out of options.

Remember: Any cup or warp in your workpiece can ruin the accuracy. And plywood is not always as flat as we would like it to be. If you're having trouble getting a consistent joint, check the work to see if it's cupped or warped.

When crosscutting rabbets across the grain, you have two choices: Use a miter gauge if the stock is narrow or, for pieces wider than 8", use the rip fence and a backing block behind the work. A backing block will stabilize the part during the cut. You don't want to use a backing block to cut narrow pieces because the work could slide right into the cavity in the accessory fence. And that's when you'll find out how tough the anti-kickback fingers on your featherboard are.

To rabbet the ends of large case sides you'll definitely have to forego the miter gauge. Using a backing block here will reduce the chance that you'll tear out the grain when your work exits the dado stack. As with ripping operations, making a second pass sometimes helps ensure your cuts are more consistent.

As a bonus, you can cut rabbets this way with an overarm guard in place. Because the guard obscures the blades, we've removed it for these photos, but it is an important part of the setup.

As much as I like this technique, it isn't perfect. When crosscutting against the grain, the cut is a bit rougher than if you used a router, though I can't report any gluing problems with the joints cut using a dado stack. Cuts with the grain, on the other hand, are quite smooth.

Another cause for concern is your saw's motor. Benchtop saws don't really have the guts to make casework rabbets (plus many don't have a mechanism to lock the height of the arbor – a major problem). In fact, the fences of benchtop saws usually are too inaccurate to cut the joint using the two-step process mentioned earlier. If you own a benchtop saw, you should consider cutting your joints on a router table.

However, larger saws, such as contractor- and cabinet-style saws, usually breeze through these joints in one easy pass over the dado stack.

All things considered, I found that maneuvering workpieces on the larger table of the table saw is easier than cutting the same size pieces on the router table. Plus, the power of the table saw made the cuts easy to accomplish in one pass without taxing the machine or the tooling.

Fixing the Two-step Process

There also is a way to modify the two-step method on the table saw to make it work well for begin-

The same rules for ripping and crosscutting apply to rabbeting. For ripping cuts with the grain, use the fence to guide your cut.

For crosscutting across the grain, use the miter gauge for narrow pieces or use the rip fence and a backing block (to prevent tear-out) for larger pieces.

ners or people uncomfortable with balancing pieces on edge. The trick is a featherboard. (The word "featherboard" doesn't really do it justice. In our shop, we call it the "motherboard.")

The "motherboard," shown in the photos below, needs to press the work against the rip fence right over the blade, so it looks a little different than the one used with the dado stack. This "motherboard" is used only on the second pass.

The first pass defines the width and the depth of the rabbet. Use a saw blade with teeth that are flat on top, such as a ripping blade. A crosscut blade has teeth that score the work like a knife to cleanly remove the wood fibers; this will produce "V"-shaped channels in your work. Other blades, such as those with a triple-chip grind, will create even more problems, so stick with a rip blade.

To set the rip fence, measure from the outside or left edge of the teeth to the rip fence until you get the desired width of your rabbet. Lock the fence down. Then use your 6" rule to set the blade height so it equals the depth of the rabbet. Again, marking the highest projection of your saw blade's teeth on your saw's throat plate will save you hundreds of test cuts per year.

Make a test cut with the work flat on the saw's table, as shown in the photo below left. If you like, you can use a featherboard to hold the work flat on the table, similar to the way I did it with the dado stack setup shown on page 10.

With your first cut complete, set up your saw to remove the rest of the waste from the rabbet.

"One only needs two tools in life: WD-40 to make things go, and duct tape to make them stop."

— unknown; attributed to G. Weilacher

The critical dimension is the distance between the fence and the blade. In essence, this distance is the amount of wood you want to remain on your piece when the joint is complete. For example: You want to cut a rabbet that's ¼" deep in a ¾"-thick piece of wood. To make the second pass, you should set your fence so there's exactly ½" between the blade and the fence. When you set the blade's height, adjust it until it trims away the waste but no higher. Your first cut already defined the corner of the rabbet.

It's important that the waste falls to the outside of the blade. If the waste gets trapped between the blade and fence it will shoot back at you when it is cut. This can be less than ideal, depending on where you're standing.

The other important point here is that you should either make or invest in a zero-clearance throat insert for your table saw. When you balance your parts on edge for this second pass, you want them to ride on as much table surface as possible. The stock throat insert that comes with most saws is too wide for this job.

Set up your featherboard so it presses the work against the fence but above the blade. It should allow the work to pass through the blade but keep it firmly against the fence.

With the featherboard set, the cut is reasonably safe: The board will not tend to tip and the blade is buried safely in the work.

And the Winner is ...

I've cut hundreds of rabbets using both of these setups and I generally prefer using the dado stack method because it has one saw setup and the cut is made in a single pass.

I also like being able to use our overarm guard during the cut, as well as work with the parts flat on the table at all times. But if you don't have a dado stack (good ones start at about $90), the two-step method is a sound alternative.

We decided to find out which of these techniques some beginning woodworkers preferred – sometimes people who are new to the craft are more intimidated by a certain technique than veterans. After a day of cutting rabbets both ways, the two beginning woodworkers in our workshop were able to make amazingly accurate rabbets using both techniques.

The only notable difference was that the dado-stack method required a little more upper body strength to keep the work to the table – though the beginners were enamored with the simplicity of using just one pass. The two-step method required a bit more finesse, one more setup and a little math. I tend to avoid math when possible, so my preference was no real surprise. WM

Contact the author at 513-531-2690 ext. 1407 or chris.schwarz@fwpubs.com.

When making the cut in two stages, the first cut defines both the width and depth of your joint. Keep your work tight against the fence.

This featherboard, which holds the work steady and against the fence, is the key to rabbeting on the table saw in two steps.

The "motherboard" keeps everything in place during the second pass. The result is a clean and accurate rabbet.

Making Stub-tenon Doors

The stub-tenon joint will never be the superhero of your joinery arsenal because it doesn't have the stuff necessary to be a strong joint. The mating parts are short (hence the "stub" moniker) and it's housed on only two sides: the face cheeks of the tenon. There is sufficient glue surface, but the cross-grain orientation compromises the glue joint. In the pantheon of woodworking joints, the stub-tenon joint may be more accurately described as a 90-pound weakling.

But even so, this can be sufficient for smaller, lightweight doors that don't take a lot of abuse. For example, you wouldn't choose this joint for kitchen cabinet doors or built-ins for the kids' playroom. But it's OK to use a stub-tenon door for a vanity cabinet or for a project that's built as much for looks as it is for service.

Once a door weighs more than four or five pounds, or is larger than 18" x 24", you must abandon the stub-tenon joint for a more substantial one. Mortise-and-tenon construction, dowels, loose tenons and even biscuit joints are superior choices for larger, heavier doors.

So why use a stub-tenon joint? Well, it's easy to make because it requires a minimal amount of setup time regardless of the method you choose to cut the joint. It's usually cut with a router in a table or on the table saw using a stack dado set.

The ease of setup is because the same groove that's cut to receive the panel doubles as the groove for the stub tenon. Plus, the same cutter that makes the groove can be used to form the tenon after an easy adjustment, which I'll tell you about later.

Other advantages of the stub-tenon joint include the ability – make that the requirement – to make either flat or raised frame-and-panel doors, and the relatively low cost and multipurpose use of the tooling required. For the router, all you will need is a ¼" spline-cutting bit; for the table saw, all you will need is a stack dado set (both of which you will end up using in countless future projects).

A disadvantage, along with joint strength, is the inability to add a moulded detail, such as a roundover or an ogee, on the inside frame edges. Only a square edge works because of how the stile, or vertical part of the the frame, comes together with the rail, or horizontal part of the frame. The use of moulded edges requires special tooling to produce a cope-and-stick joint (where identically opposite male/female shapes nest together). Tooling for this joint can be expensive and usually quite fussy to set up.

PHOTO BY AL PARRISH

Story by Steve Shanesy, editor & publisher

Making the stub-tenon joint is straightforward regardless of which method you select. The method you opt for will be dictated by what equipment you have in your shop. If you have a table saw and stack dado set (a wobble dado is not recommended for this operation), you're equipped for that method. Choosing to use the router table may depend on what type of router and table you have available in your workshop.

If you use a router (one that is either fixed-based or plunge-style) that requires you to adjust the height of the bit from below the table, you may find that making fine adjustments to your bit's height is a problem. We'll cover this process later in this article. But if you have one of the so-called router-lift mechanisms, or if you own a newer router that allows you to adjust the bit height from above the table (which makes these fine adjustments a snap), you'll find very precise height adjustments a breeze.

Which method is easiest? My vote goes to the router-table method as long as you have a router lift (which is expensive) or a router with through-the-base adjustment. This method allows the user to raise or lower the bit by inserting and turning a tool right through the base. It's the ability to make fine adjustments easily that tips the scales in favor of the router for me.

Getting Started

Regardless of which method you use, start by preparing the wood for the stiles, rails and panels. To the best of your ability, use stock that's flat and of uniform thickness. And be sure your saw or jointer fence (if you use one) are set exactly 90° to the table. Any cut that is out of square will lead to a door that is cockeyed or twisted (also known as "in wind").

When preparing your stock, cut out a few extra pieces that can be used for making test cuts when setting up the router or table saw. Make your stiles and rails about ⅛" wider than your project plan calls for. Additionally, add about 1" extra length to the stiles so they have what are called "horns" when the door is assembled.

The extra width and length give you a fudge factor when it comes time to fit the door to the cabinet opening. Should the opening be slightly larger than planned or out of square, the extra width and length will help you accommodate. Also, if the door itself is out of square, the entire piece can be fixed after assembly.

Now choose stock with the best grain pattern for the door parts. Select straight-grain material for the stiles and rails. This grain pattern usually is found toward the outside edges of boards. Then select the wider grain material for the panel stock. This grain pattern usually is found in the center of a board. Make sure you select pieces that are uniform in color for all the door parts.

Arrange the straight-grain stile and rail stock so that any curves or bows "frame" the panel appropriately. Generally, this would mean the grain should "curve out" at the middle points of the rails and stiles. When satisfied, mark each piece to identify its location. Be sure you note which side will face out after assembly.

Stub Tenons with a Router

With ¾"-thick stock, you'll want to use a ¼" spline-cutting router bit. It should be equipped with a guide bearing that allows the bit to make a cut that's at least 7/16" deep.

Mount the bit in the router and then mount the router in the router table. Next, set up the fence so it is in line with the front edge of the bearing. This is easy to do by using a straightedge held against the bearing and then bringing the fence forward (to the straightedge) until everything is in line. Lock the fence in place. If your fence allows you to adjust the infeed and outfeed wings, move them as close to the cutter as possible without impeding the cutters.

First up is to cut the groove on the long edges of the stiles and rails. The groove should be centered on the edges. Make a series of test cuts on scrap stock that's exactly the same thickness as your good material. When satisfied, run the stile and rail parts, making sure you always place the outside face up and the designated inside edges along the fence. By running all the parts this way any minor error in centering the groove in the board's edge will be minimized.

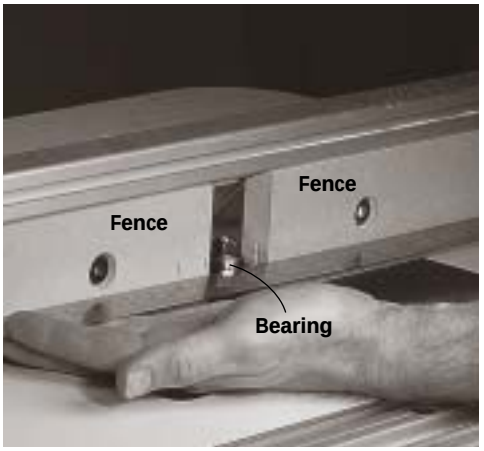
Next, form the tenons on the ends of the rails. The thickness of the tenon must match the width of the groove to make a good joint. The length of the tenon will match the depth of the groove automatically because, like the groove, the depth of cut is dictated by the bearing on the router bit.

First lower the router bit so that the top edge of the cutter is just a whisker below the groove. Before making a test cut, though, you'll need a back-up block to support and guide the narrow rail ends safely past the cutter. A back-up block also prevents "blow out" on the backside of the stock where the cutter exits.

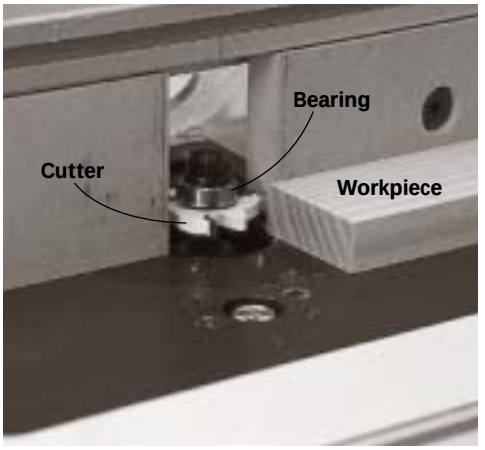
The back-up block can be a piece of ¾" plywood. But take care that the plywood you choose has truly square corners. If it is out of square, you will likely make your tenon cuts out of square, which will cause your door to become out of square when glued together. A handle for the back-up block, as seen in the top photo on page 14, is optional, as is the adhesive-backed abrasive sandpaper I added to help prevent the work from slipping during the cut.

To make the cut, place the back-up block against the fence and move the rail into position. Keep the face up and place the long edge of the rail against the back-up block and the rail end against the router-table fence. When moving the piece into the cutter, keep pressure on the rail down and against the back-up block. At the same time, be sure the block remains against the router table's fence. If it's your first time, make a couple of practice cuts on scraps to get comfortable.

Every step of making stub-tenon doors requires square cuts, whether on the table saw or router.



Set the router fence using a straightedge. The fence face should align with the front of the bearing.



The first step is to cut the grooves in both stile and rail edges. To set the proper height of the ¼" spline-cutting bit in your router, center it on the width of the stock as closely as possible. The depth of cut is determined by the bearing above the cutter – 7/16" to ½" is ideal.

After making test cuts for the groove location, run grooves on the inside edges of all parts. It's important to keep the parts organized and marked so that the good face is up. By doing this, you'll minimize any problems caused by minor inaccuracies in centering the groove precisely.

To form the tenon, the rail must be run past the cutter twice. Rather than readjusting the router bit height, just flip the part over and run the second side. This is where the centering of the groove becomes important. Test-fit the tenon and continue adjusting the bit height until the tenon slips into the groove using only slight pressure. When satisfied, run both ends of each rail. (The stiles do not get this cut.)

Stub Tenons with a Table Saw

Much of the process used for making stub tenons with a router apply to the table saw as well. In this case, however, a rip blade and stack dado set are used instead of the spline cutter.

Install the rip blade (used because of its flat-topped tooth grind) and adjust the saw fence. The fence setting will establish the width of the groove in the stiles and rails. You will make the groove in two passes, each pass with the opposite side of the piece against the fence. This ensures the groove will be centered on the edge. If the panel is ¼" thick, adjust the fence so that ¼" of space is between the blade and the fence. Now set the height of the blade to slightly less than 7/16". Make a test cut and check the depth of cut.

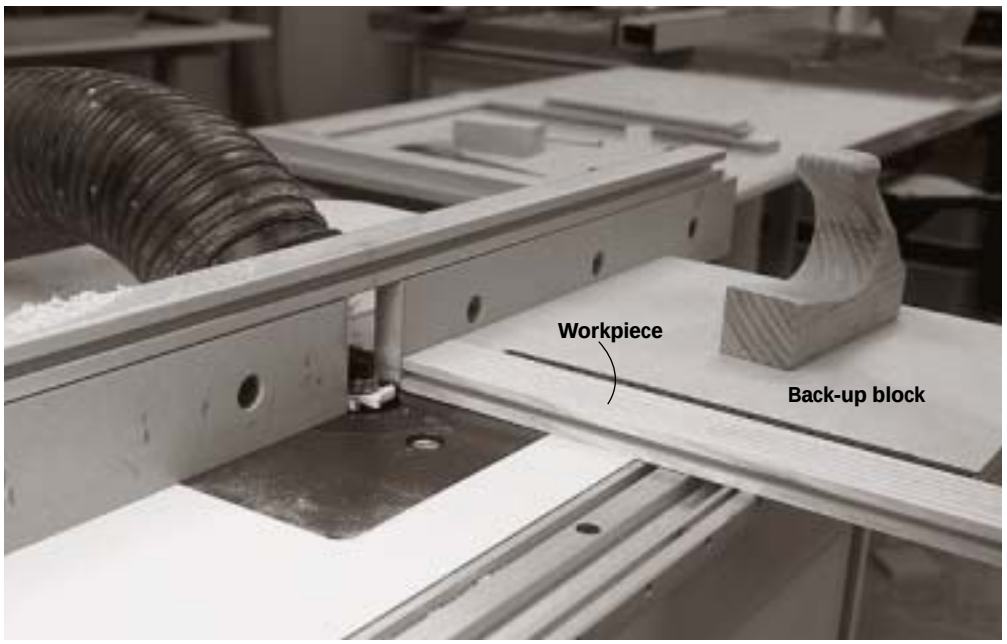
In setting the blade height, sneak up on the final height by adjusting upwards in small increments. You'll find that moving the blade down is not very precise – a function of the way a table saw works. When the blade height's set accurately, lock the adjustment, then make the groove on the inside edges of the stiles and rails.

To form the tenons you need to install a stack dado set that will cut at least ½". You also need to clamp a strip of wood, called an accessory fence, to your table saw's fence. This is to make sure part of the dado cutter is buried in the accessory fence. To bury it, lower the cutter below the table, move the securely clamped accessory fence slightly over the cutter, then slowly raise the cutter into the fence until it is about 3/8" high.

Now you can set the fence to make the cut that establishes the length of the tenon, in this case 7/16". Measure carefully and compare it to the depth of the groove you just cut. If the tenon is too long, it will bottom out in the groove and the joint won't close. It can be fine-tuned once the dado-stack height is properly set.

Just like you did when cutting the groove, start the height adjustment below the desired height and sneak up on the correct height. Make test cuts of both face cheeks of the tenon, then check the fit. When raising the dado stack, remember every amount of adjustment is doubled because you're taking material from both sides.

To make the cuts, use your table saw's miter gauge. Make sure the miter gauge is set square to the blade and fence. Place the rail against the miter gauge with the end tight against the fence.



A shop-made back-up block (with an optional handle shown here) helps you steady the rails when you're cutting tenons. It supports the part when the narrow width passes over the cutter. It also helps you make square cuts on the ends, an important aspect of making square doors.

When cutting the tenons, hold the part down firmly against the edge of the back-up block and tight to the router table fence. Guide the part using the edge of the block held firmly against the router table fence as well. After cutting one side, flip the part and cut the opposite side.

Three simple passes over a spline-cutting bit form the completed stub tenon and panel groove.

Push the rail over the blade with enough pressure so you can easily hold it down and against the fence. Check your tenon for proper fit and make adjustments to the fence and/or cutter height as needed. When satisfied, cut all the tenons.

Stub-tenon Door Panels

You can use flat or raised panels in stub-tenon doors. But remember, raised-panel doors add more weight because they require a thicker panel, usually ⅝" thick. With flat panels, you can make them ¼" thick to match the width of the groove exactly, or you can make them a bit thicker and cut a rabbet to fit the ¼" groove.

With flat panels, you can substantially increase the size of the doors and not worry about the weak stub-tenon joint by using plywood for the panel and gluing it in the grooves. By doing so, you gain tremendous strength and the stub-tenon joint does none of the work in supporting the door. With solid-wood panels, however, gluing all around is not an option because the panel will expand or contract with changes in humidity. It's acceptable to add glue at two places on a solid-wood panel – the top and bottom in the center of the panel. The panel will grow or shrink at its edges but not at its center.

When sizing the panel be sure to allow for wood movement as well. About ⅛" all around the panel is a good rule of thumb.

Before gluing the doors, you should dry-fit the doors without glue. You also should sand the panel before glue-up. Don't sand the stile and rail edges after assembly – do it before. Likewise, sand the inside stile and rail edges everywhere except in the joint location. This is very important to remember because sanding inside the joint can ruin the fit.

If you want to stain or color your project, you should do so before assembly. Not only is it easier, but you can stain up to the edges of the panel. If you don't stain up to the edges, it is likely that an uncolored part of the panel will be exposed when the panel eventually shrinks.

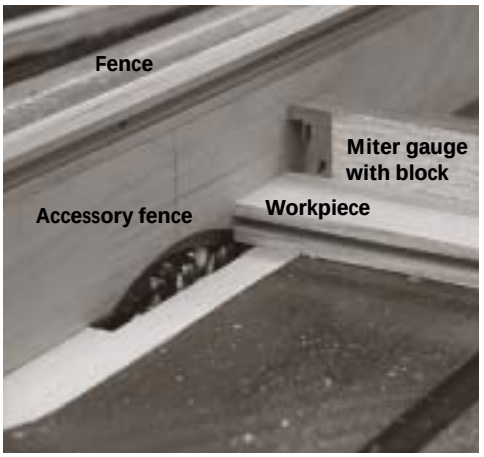
When it's time to assemble the project for real (called "final assembly"), add glue to the joint sparingly. You don't want squeeze-out to inadvertently glue the panel at the frame corners. Remember, the panel will need to move.

Clamp with moderate pressure, just enough to close the joint. Too much pressure can distort the door. Place the clamps in the center of the joint across the panel width. Also remember to place the rails in their proper locations, allowing for the extra-length "horns" at the ends of the stiles. Lastly, check the door for square.

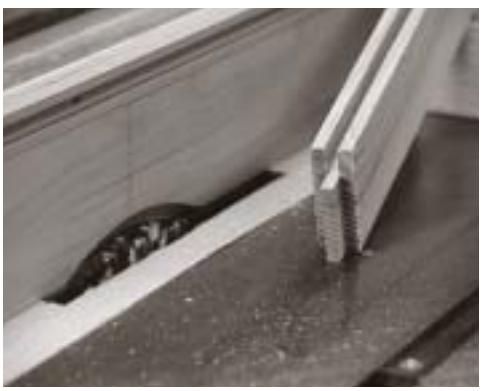
Used in the appropriate situations, stub-tenon joints can be an easy and painless way to make attractive cabinet doors. WM

Contact the author at 513-531-2690 ext. 1238 or steve.shanesy@fwpubs.com.

When making grooves on the table saw, a rip blade is used. With ¾" stock, set the fence ¼" from the blade. Make a ¼" groove in two passes, each with the opposite side to the fence to guarantee the groove will be centered on the edge.



Cutting tenons requires the addition of chippers to the dado stack and an accessory fence added to the table saw fence. Instead of a back-up block, the slot miter gauge is used. Sizing the tenon is done by adjusting the blade height and saw fence.



Proper alignment of the fence and saw height produces a tenon that's exactly as long as the groove is deep. The thickness of the tenon matches the width of the groove. Inserting the tenon in the groove should require just a little pressure.

"When I'm working on a problem, I never think about beauty. I think only how to solve the problem. But when I have finished, if the solution is not beautiful, I know it is wrong."

– R. Buckminster Fuller (1895 - 1983)
inventor, architect and engineer

Test the fit of the tenon and groove. The right fit will have both faces perfectly flush and the shoulders of the tenon should seat.

Select straight grain for the frame parts. The grain direction should sweep inward. Select "cathedral" grain for the panel. Note how the points, or "cathedrals," point in the same direction.

Shaker Hanging Cabinet

If you own any books about the Shakers or their furniture, you probably have seen a small storage cabinet like this one hanging in the background behind the more celebrated pieces.

I first spotted a close relative of this cabinet in William F. Winter's "Shaker Furniture" (Dover). After a long and glowing description of the chairs shown in the same photograph, Winter notes only: "This small, pine, wall cupboard (from the North family, New Lebanon) is a typical convenience of the sisters' shops."

When I visited the Shaker Village of Pleasant Hill (shakervillageky.org) in Harrodsburg, Ky., I saw a similar cabinet hanging on a peg in one of the second-floor rooms. While eating sweet-potato casserole in the Trustees' Office Inn that evening, everyone else at the table was raving about the built-in cabinets; I was smitten with the little hanging cabinet (and the casserole).

Then, years later, I noticed that Thomas Moser published a more refined version in his seminal "How to Build Shaker Furniture" (Sterling).

The way I see it, this small cabinet has what few woodworking projects can truly lay claim to. It is both simple to build and exceptionally well-proportioned. For that, it deserves center stage.

PHOTO BY AL PARRISH

Story and project by Christopher Schwarz, executive editor

4 Important Lessons

When building this hanging cabinet there are four important things to pay attention to:

■ **Rabbet joinery:** This cabinet – in one way or another – is built using mostly rabbets. Become familiar with this joint before you attempt this project. A good place to begin learning about rabbets is by reading "Cut Accurate and Clean Rabbets," which begins on page 8.

■ **Wood selection:** This cabinet will not look right if you choose the wrong boards for the front. The rails and stiles must have the straightest grain possible. Curvy, diagonal or irregular grain will distract from the simple lines of the piece. Save the most dramatic grain patterns, such as a cathedral grain, for the door's panel.

One common mistake many beginners make is that they try to make a project with as few boards as possible. While no one likes to waste wood, the bigger sin is to build a project that could have looked a lot better in the end. So buy some extra wood and save the scraps for the interior pieces that won't show on a future project.

When picking boards for the two side parts, choose pieces that have straight grain at the edges. This grain pattern will match the straight grain on the case stiles, making the sides look pleasing and – if you're lucky – almost seamless.

■ **Fitting a door:** Beginners hate fitting doors. Experts know there is a trick to making them right with little fuss. Follow the directions carefully and you'll see how straightforward it can be.

■ **Wood movement:** The back is made from a solid-wood panel, so it will expand and contract about ⅛" with changes in humidity. This means you have to attach the back in a special way to prevent it from splitting or wrenching your cabinet apart as it answers nature's call.

Making a Strong Case

Once you select your boards and joint and plane them down to the correct thickness, you should mill all the parts for the carcase. Joint one long edge of each board, rip them to width and then crosscut them to finished length. Leave the door parts and frame stiles long for now – you will cut them to fit the assembled carcase.

The first joints to cut with this project are the three rabbets in each side piece. Set up your table saw to cut a ¾"-wide x ¼"-deep rabbet using the instructions provided in "Cut Accurate and Clean Rabbets." Make a test cut in some scrap that's the same thickness as your sides. Check your work with a square and some care. If this joint does not have a dead-on 90° corner, your carcase won't have one either. If it is square, check the dimension of the rabbet using a dial caliper. This might sound like overkill, but it's not. Here's why: If this joint is just a little off, then all the joints that follow it will have to compensate for this small error – especially when you start building the door and fitting it to the case. Small errors like this tend to add up during the course of a project.

When you're satisfied with the setup of your dado stack and rip fence, lock the height of the arbor. This is important for a couple of reasons. With some less-expensive table saws, you can actually force the arbor to creep downward during a cut with a dado stack. I've seen it happen – your dado will look like a ramp for skateboarders instead of a properly made joint. Also, you will be keeping this exact height for the next two joinery operations, so locking in your setting is a good idea. With your saw set, cut this rabbet on the ends of the two side pieces. This joint holds the top and bottom of the case in place.

Next, cut the rabbet in the sides that will hold the back panel. To create this rabbet, you need only adjust your rip fence to make a ½"-wide x ¼"-deep rabbet and cut that rabbet on the long back edge of each side piece.

After that, cut the dados in the side pieces that will hold the two ½"-thick shelves in place. To make your life easier, make sure you do not change the height of the dado stack you just used to cut the rabbets. Remove the dado stack from the arbor and install the correct number of wings, chippers and shims to produce a perfect ½"-wide dado.

The dados for the shelves are ¼" deep. By leaving the height of the blades alone, you ensure that the shelves, top and bottom will keep your case square. If you change the height of the blades even a tiny bit before cutting the dados, one of two bad things will happen. If your cut is too deep, your shelves won't seat all the way down into the bottoms of the dados without some extraordinary clamping pressure. (If you manage to close this joint, your carcase will end up with an hourglass shape and the rabbets at the top and bottom will be gappy and weak.) If your dado cut is too shallow, the shelves will cause the sides to bulge out in the center and the rabbets at the top and bottom will be gappy, unattractive and weak.

To make the dados in the sides, use your table saw's miter gauge (set to 90°) and a gauge block clamped to your rip fence, as shown in the photo below. Mark on your side pieces the locations of both dados. Sure, it will take an extra minute, but it prevents mistakes. Also mark the top and bottom of each of the sides so you don't get the right and left sides confused – a common mistake that even professionals make.

With the dados cut, you are almost ready to assemble the basic carcase. It's always a good idea to prepare your interior surfaces for finishing before assembly. Finish-sand the inside faces of your pieces (start with #100-grit paper and work up to #220), or plane and scrape the surfaces to your liking.

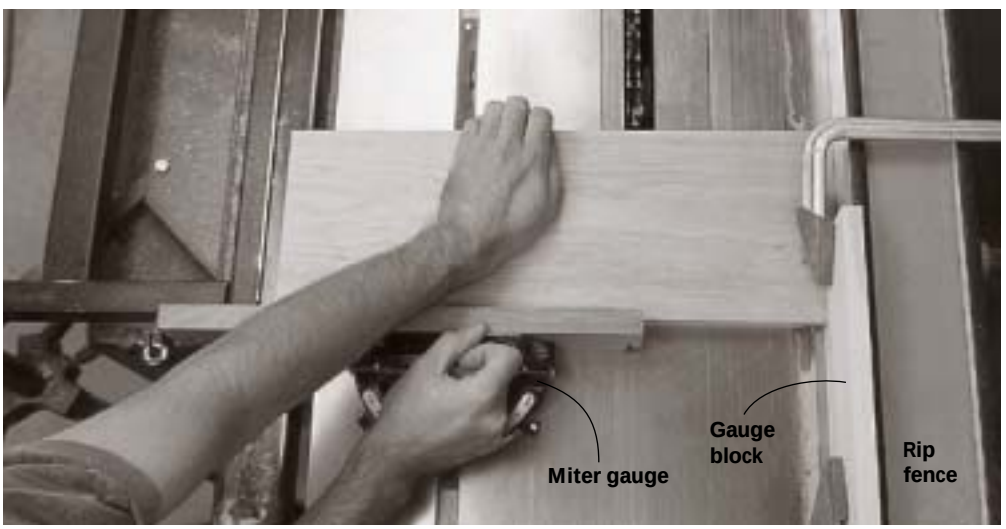
Test the fit of the joints and clamp the case together without any glue. Do not skip this step. A rehearsal is worthwhile for several reasons: You'll figure out exactly how many clamps you need so you don't have to go rushing across the room for more as the glue sets up. You'll also figure out the best procedure for clamping the case without your parts flopping around. And you'll make sure your rabbets and dados fit soundly.

As you make this milk run, make sure you keep the front edges of the top, bottom and shelves perfectly flush with the front edge of the side pieces. The top, bottom and shelves, if you haven't noticed, are ½" narrower than the sides.

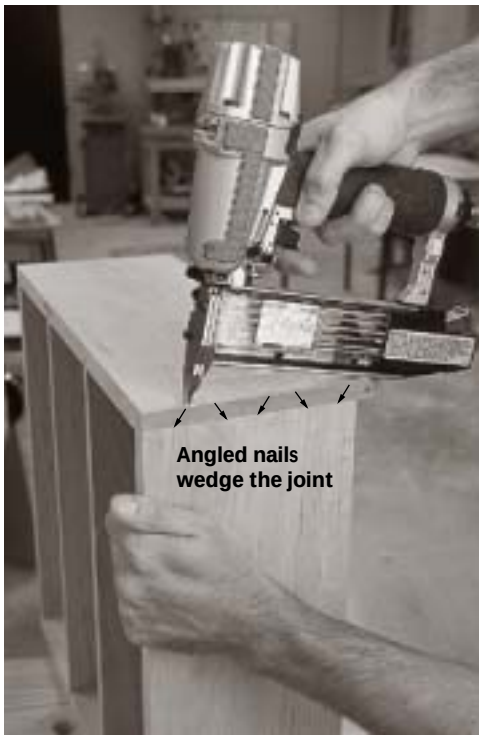
Before you take the clamps off, pay particular attention to the squareness of the case. Measure the case from corner to corner and compare the two dimensions. If they're the same, everything's square. If they're not, put a clamp across the two corners that produced the longer measurement and apply the tiniest bit of clamping pressure. Compare the corner-to-corner measurements again. Repeat until everything is perfect. I like to check the squareness now because the cabinet usually behaves the same once you add the glue.

Now add glue in your rabbets and dados. If you are new to woodworking, I recommend a slow-setting glue for casework. There are several varieties, the most common being Titebond Extend. The glue's extra "open time," which is when the glue is wet and your parts can move

I recommend using a dado stack for cutting rabbets because it requires only one setup. The featherboard makes the operation safer and more accurate by keeping your work pressed firmly against the saw's table.



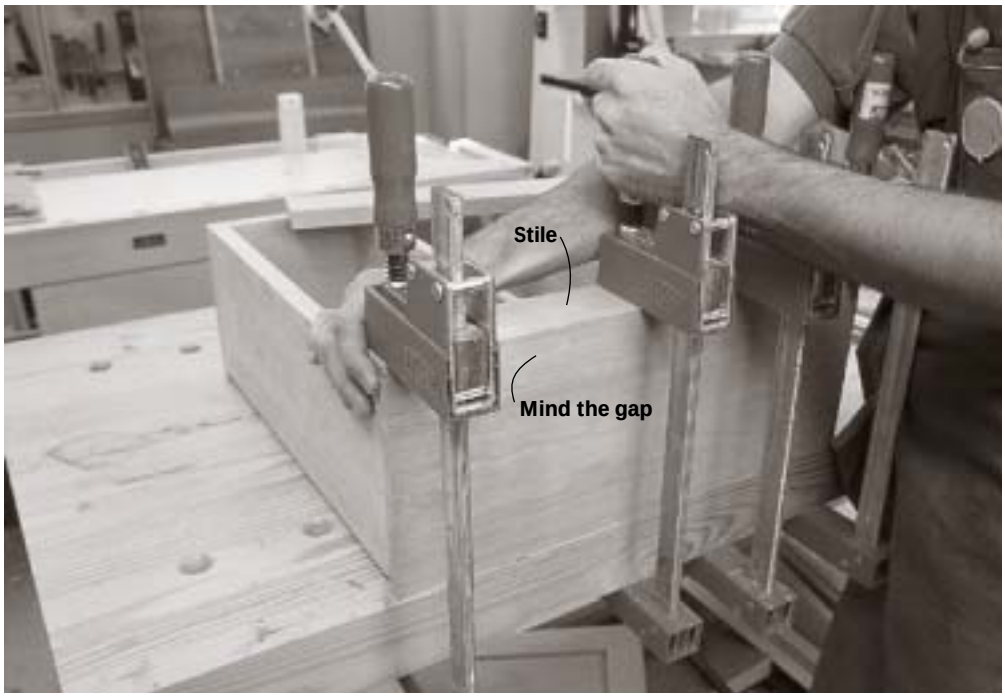
The gauge block, which is clamped to the rip fence, sets the location of the dado on the side pieces. But because the gauge block sits in front of the saw blade, there's no danger of trapping your side piece between the rip fence and the blade while making this cut – a major source of kickback. If you have a stock miter gauge, this would be an excellent time to add a piece of adhesive sandpaper (I prefer #100-grit) to its smooth metal face to improve grip during this operation.



Nails are not an act of the devil. Someday the glue will fail, and it's the nails that will hold everything together. Make sure you angle your nails (18-gauge brads are good) as shown so that the fasteners wedge the side piece against its mates.

around, will allow you to tweak the position of your parts. When applying the glue, a thin but consistent film will bond your joints without making a big mess. When you apply the clamps, a little glue squeeze-out is good – it means you haven't starved your joints of glue.

After 45 minutes, take the case out of the clamps and nail the sides to the top and bottom pieces, using the above photo as a guide.



This is a highly visible joint, so make extra sure you watch out for gaps between the stiles and the sides.

World's Simplest Face Frame

Traditionally, face frames are built using both vertical pieces (stiles) and horizontal pieces (rails). Not so with this project, which has only stiles. This makes things a lot easier.

Cut your stiles to finished width and length, and finish-sand or plane them. If you're handy with a block plane, it's wise to cut your stiles about 1/32" long and trim them flush to the case at the top and bottom after affixing them to the carcase. If you're not so confident, just take extra care in cutting your stiles to length.

Attach the stiles to the carcase using glue and clamps. Nails aren't necessary here. Make an effort to ensure the long edge of each stile is perfectly flush with its mating side piece; otherwise the opening for your door will not be square.

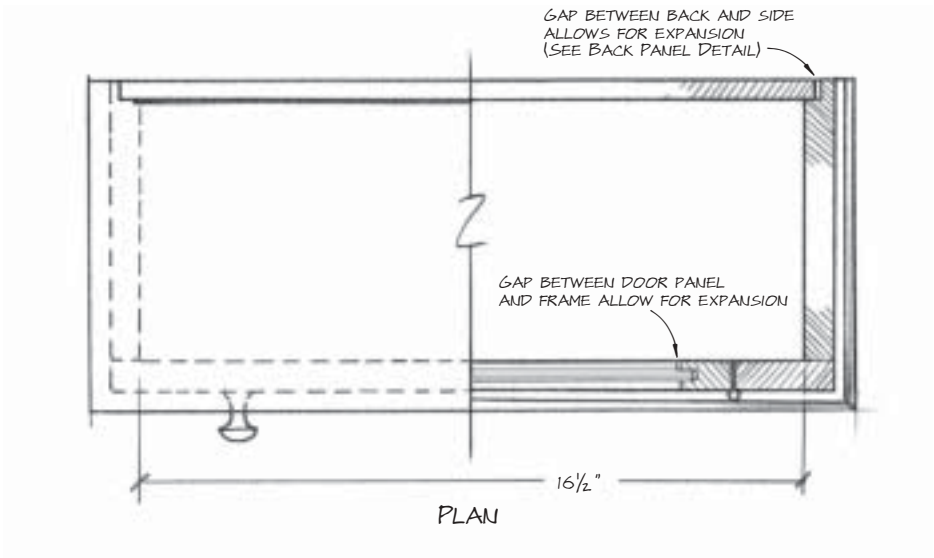
To complete the opening for the cabinet's door, you need to attach the additional 1/2"-thick top and bottom pieces that have the decorative cove cut milled on them, which is easy to do.

As you study the cutting list below, you'll notice that the outside top and bottom are different widths – the top is 1/2" wider than the bottom. That's not a mistake. It's actually a clever way to create a notch in the back edge of the outside top piece (cutting stopped notches is no fun). Let me tell you what you're going to do to that top piece:

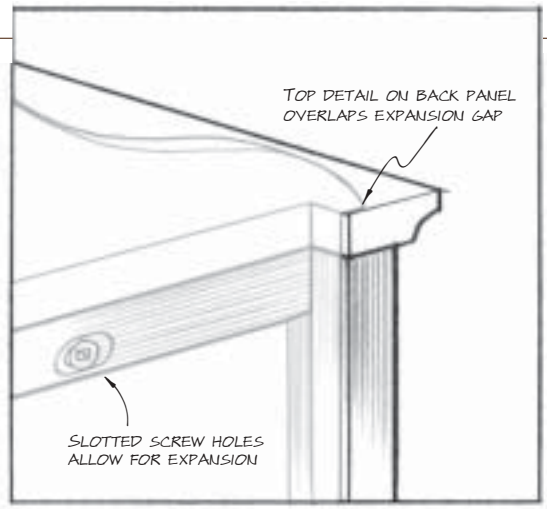
Shaker Hanging Cabinet

	NO.	PART	SIZES (INCHES) T	W	L	MATERIAL	NOTES
Carcase							
❑	2	Sides	3/4	7	19	Cherry	3/4"-wide x 1/4"-deep rabbets on ends
❑	2	Inside top & bottom	3/4	6 1/2	17	Cherry	
❑	2	Shelves	1/2	6 1/2	17	Cherry	In 1/2"-wide x 1/4"-deep dados
❑	2	Stiles	3/4	2 1/2	19	Cherry	Glued to carcase
❑	1	Notched outside top	1/2	8 3/4*	19	Cherry	
❑	1	Outside bottom	1/2	8 1/4	19	Cherry	
❑	1	Back	1/2	18*	24 1/2	Cherry	
Door							
❑	2	Door stiles	3/4	1 1/2*	20*	Cherry	1/4"-wide x 1/2"-deep groove on one edge
❑	2	Door rails	3/4	1 1/2*	11 1/4	Cherry	1/4"-wide x 1/2"-deep groove on one edge, 1/2" TBE
❑	1	Door panel	1/2	11	17	Cherry	1/2"-wide x 1/4"-deep rabbet on four back edges

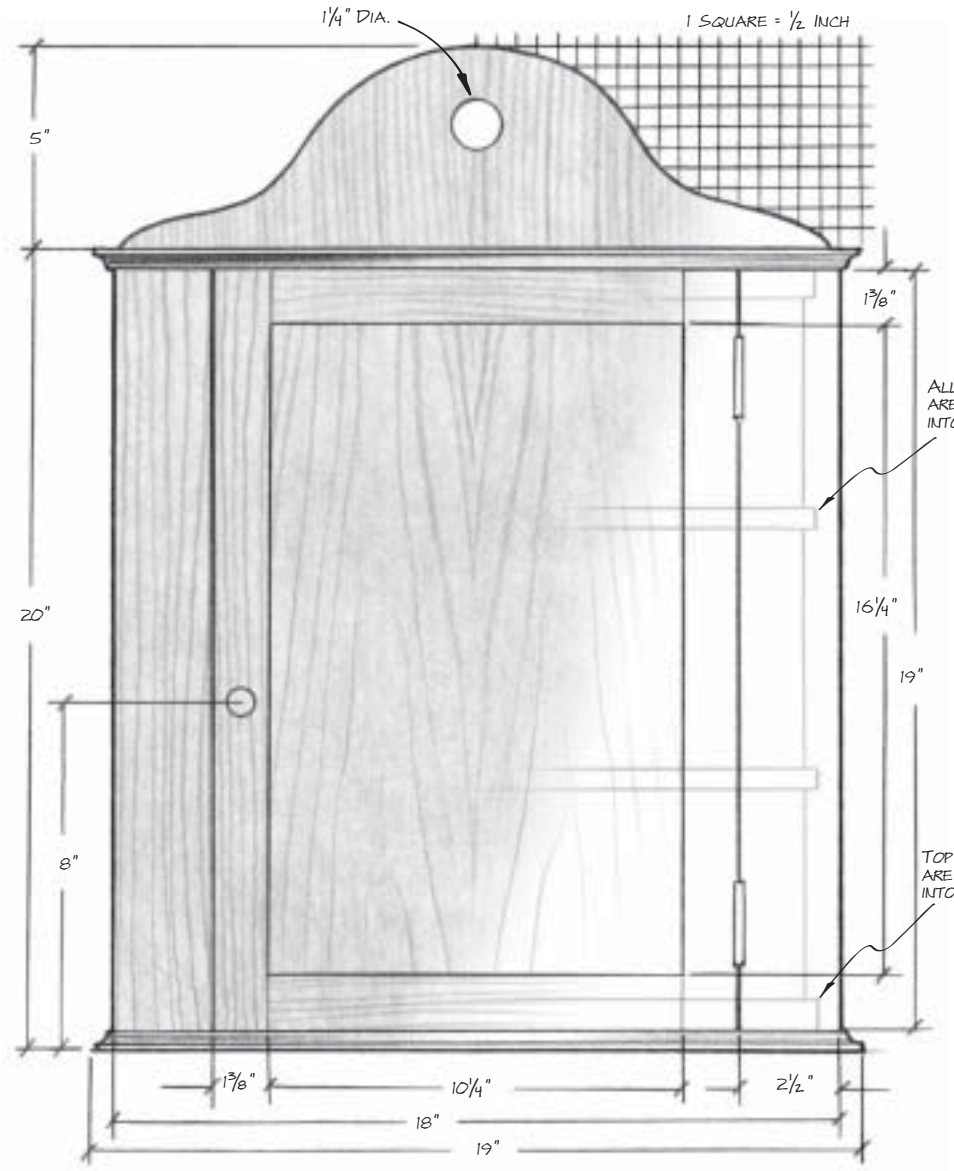
* Dimensions listed are oversized. See the text for details. TBE = tenon both ends



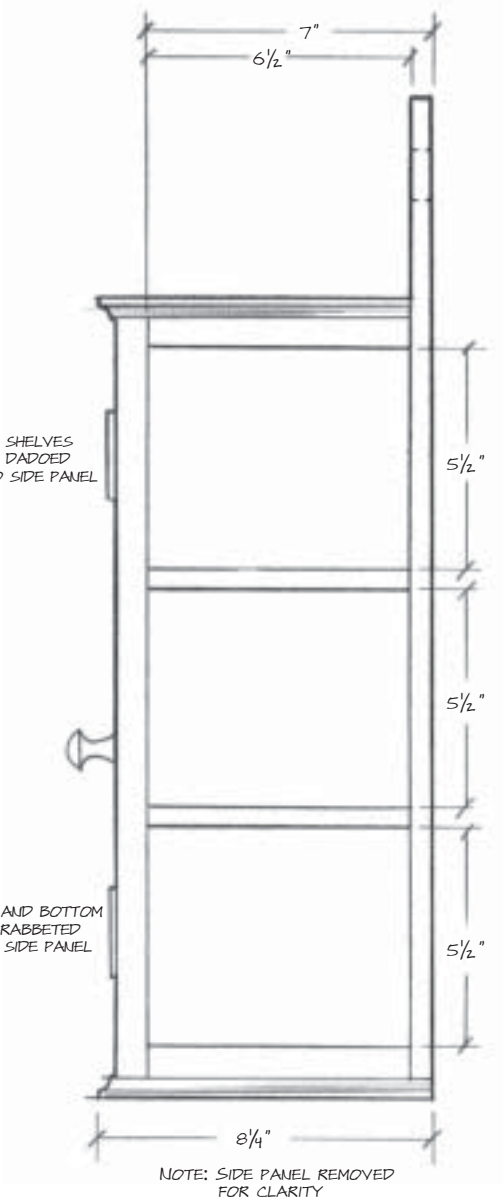
PLAN



BACK PANEL DETAIL



ELEVATION



NOTE: SIDE PANEL REMOVED
FOR CLARITY

PROFILE

SHAKER HANGING CABINET

Cutting an accurate stopped notch like this is a pain. By ripping the oversized top down and regluing smaller blocks on the ends of the top, you create the perfect notch for the back piece.

Centering grooves on your work is child's play if you cut them in two passes. Here you can see that I milled one half of the groove and have turned the piece around to mill the other half.

Make the tenons by cutting a rabbet on both sides of the rails. Use your miter gauge and fence to make this cut. It's a safe operation because you can't trap your work between the blade and fence.

First you're going to rout the cove detail on three edges of both the top and bottom.

The best way to do this operation is on a router table that's set up with a ⅝" cove bit, though you can do it hand-held in a pinch. Either way, make sure you rout the detail on the ends first, then come back and rout the long edge. This will clean up a good deal of splintering that occurs when you exit the cuts on the ends.

Next take only the top piece to the table saw and rip the back edge off the board so it's 7¾" wide. Take the fall-off strip and rip it so it's ½" wide. Crosscut 1" off each end of that falloff piece and reglue each end to the back edge of the top piece, making sure the cove detail matches. Voilà! You have an instant stopped notch in your top.

Attaching the top and bottom pieces to the carcase is easy if your case is square and your joints are flush. Before you attach the top and bottom, check their fit against the carcase itself. You want a tight joint at the front and the sides. If you don't get a seamless fit with only hand pressure, you'll need to tweak the carcase until you do. Relying on your clamps to close an imperfect joint is asking for trouble.

Sometimes this process takes a bit of detective work to figure out what's wrong. For example, the top of my carcase had an inexplicable but slight bulge in the center, so the top piece would rock back and forth on it. A sharp block plane made short work of the problem. As you remove material, try to stay away from the edges of the carcase. That's where you can create problems that will show in the finished piece.

When satisfied with the fit of the top and bottom pieces, apply a liberal amount of glue to the carcase and position the top and bottom in place. When you've got them where you want them, nail them in place through the inside of the cabinet. Use only a couple of nails in each; their job is to hold the top in place as you clamp it. Apply clamps around the cabinet to secure the top and bottom to the carcase and check for gaps.

"Skill without imagination is craftsmanship and gives us many useful objects such as wickerwork picnic baskets. Imagination without skill gives us modern art."

— Tom Stoppard (1937 –)
"Artist Descending a Staircase"

The Stub-tenon Door

Because this is a light-duty door, we can build what's called a "stub-tenon" door. Essentially, it's a traditional mortise-and-tenon door that uses short (some would say "stubby") tenons that are only ½" long. A bigger traditional door would use tenons at least 1" long. We've included a tutorial on this style of door starting on page 12.

The advantage to these short tenons is they allow you to build the door without having to cut mortises in the stiles. The ¼"-wide x ½"-deep groove you cut for the door's panel also serves as the mortise for the tenons on the rails.

While stub-tenon doors are a good trick, the real trick to making perfect doors is to learn about "horns." What are horns? Again, take a look at the cutting list and you'll notice that the stiles are 1" longer than they need to be to fit in the door's opening. And both the rails and stiles are ⅛" wider than called for in the drawing.

This extra length and width create what look like horns on the assembled door. These horns allow you to make a door that is slightly oversized when compared to the hole in the cabinet. Once the door is assembled, rip and crosscut it square to fit perfectly in the door opening. There is no easier way to fit a door.

So let's build the door. Cut your stiles, rails and panel to the sizes listed in the cutting list. Now mill the ¼"-wide x ½"-deep groove in one long edge of the rails and stiles. The best way to do this is with a rip blade set to make a ½"-deep cut. A rip blade is best because the top of its teeth are flat, so the bottom of your groove also will be flat. Crosscut teeth will leave "V"-shaped channels in the bottom of the groove. Position your saw's rip fence so there's a ¼"-wide gap between the teeth and the rip fence.

Cut the groove first with one face of your work against the fence, then turn it around and make the cut with the other face against the fence. This method ensures that the groove is perfectly centered on your rails and stiles. If there happens to be a thin scrap hanging in the middle (as shown in the photo above center), you can adjust the fence and make a third pass to eliminate it.

Next get your rails and prepare to cut the tenons on the ends. These tenons are made by cutting a rabbet on both faces of the board. Two rabbets make a tenon, as shown in the photo above right.

Set up your dado stack with an accessory fence just like you did when you cut the rabbets on the side pieces. Bury the dado stack in the accessory fence so that you're making a cut that is exactly ½" wide x ¼" deep.

Use your miter gauge to guide your rails across the spinning dado stack. Make a couple of test cuts on scrap that is the same thickness as your door stock. Test the fit of your scrap tenon in the grooves you cut in the rails. Fine-tune your fence setup and cut the tenons on the ends of both rails.

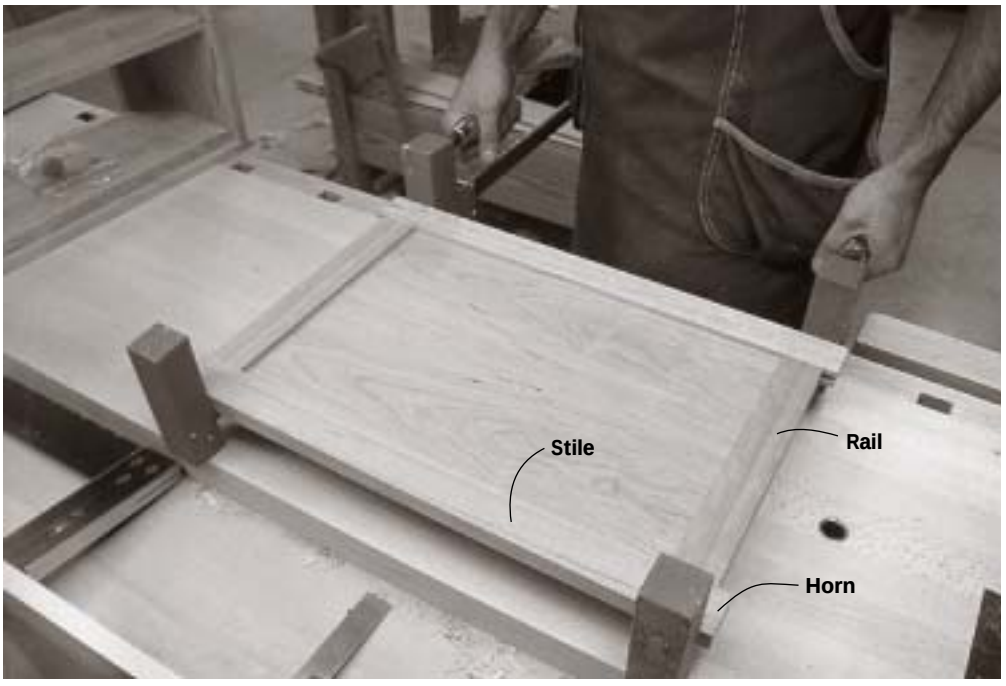
Now fetch your ½"-thick panel. To fit this panel in the grooves in the rails and stiles you must first cut a rabbet that is ½" wide x ¼"

deep on the panel's four back edges. Coincidentally (OK, it's not really a coincidence), this is the same setup you just used to make your tenons.

Now finish-sand your door parts and dry-fit the door. You'll notice how the stiles extend past the rails. These are the horns I told you about earlier. The tenons must close tightly with only minimal clamping pressure. If you are straining to close the joint you are almost certainly twisting your door so it's not flat. Take the joint apart and investigate the problem. Usually there's gunk that's preventing a good fit, or the tenon is too long for the depth of the groove.

Once you have a seamless door frame clamped up, take the whole thing apart and glue the tenons in the grooves. (Never glue a solid-wood panel in place in a door. It has to expand and contract with changes in humidity.)

After about 45 minutes, remove the clamps from the door. Measure your door opening and temporarily screw the hinges to the carcase. Now true one stile of your assembled door by running it over the jointer. Rip the door to its finished width on your table saw, trimming evenly from the left and right stile. Then crosscut it to the

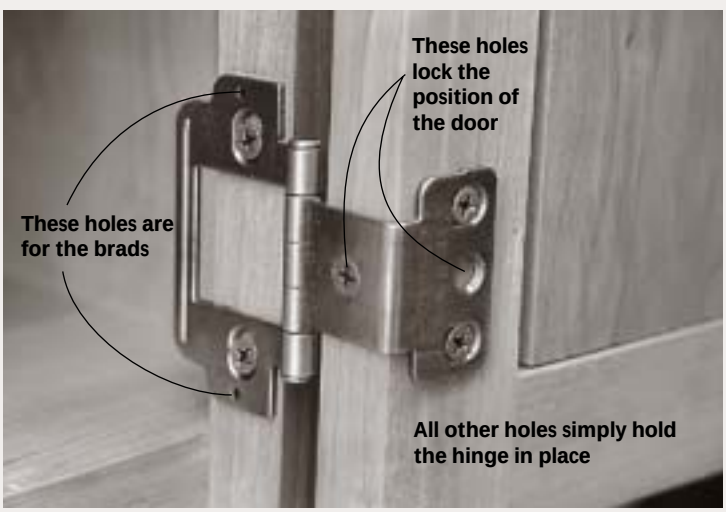


You can see here how the stiles stick out past the rails of the door. These are the so-called "horns," which you then trim off to make the door the perfect size.

A Better Hinge

Installing hinges for an inset door can be a brutal lesson in precision. Inset doors, as their name implies, sit inside the cabinet or the cabinet's face frame. The space between the door and the cabinet – called the "reveal" – has to be perfectly equal all the way around the door or it won't look right. Overlay doors, on the other hand, are much more forgiving to install because a rabbeted lip on the door covers up the gap between the cabinet and the door. If you're a little off – or sometimes even a lot – no one will ever notice. But overlay doors don't generally have the look of a fine and refined piece of furniture. They say "kitchen cabinet" instead of "prized possession."

So if you want to install inset doors, you're going to have to wrestle with mortising a butt hinge into both your cabinet and door, right? Wrong. During the last five years we have become huge fans of a hinge made by Amerock that is remarkable for three reasons: One, it lets you install the hinge without cutting a mortise. Two, once you install the hinge you can tweak its position until the door is perfect and then lock in your final setting. And three, these hinges look great on traditional cabinets.



If you struggle with installing hinges for inset doors, this can make it easier.

The secret to these remarkable hinges is that they have oval-shaped holes for screws that allow you to shift the door slightly up and down in its opening and even cock it deliberately out of square to match a door opening that's not perfect. Once you get the door just right, you secure the hinge permanently with either a final screw or a brad – depending if the hinge is designed for a face-frame cabinet (which uses what Amerock calls a "full back-to-back wrap-around hinge") or a frameless cabinet (which uses a "partial wrap-around hinge").

In the hinge pictured at left, you can see the holes for the brads in the leaf that attaches to the case. Curiously, you have to supply your own brads to lock this leaf in place; my only gripe with this hinge is that they aren't included.

On the leaf that attaches to the door you can see the two screw holes that lock in that setting. (One of the holes has a screw in it; the other does not.)

The Amerock hinges are available in a variety of finishes, including wrought iron, brushed nickel, dark antique brass, antique brass and polished brass. Plus they are available in a variety of styles that match many styles of furniture with a finial tip, a ball tip or just a plain button. These hinges aren't cheap – about $6 per pair no matter where you go. But that price includes high-quality screws for installing them. Once you try these hinges, we don't think you'll go back to traditional mortise hinges unless you have to. WM

– Christopher Schwarz

Amerock Corporation
4000 Auburn Street, P.O.Box 7018,
Rockford, IL 61125-7018,
800-435-6959 or amerock.com

correct length. Test the fit in the door's opening and fine-tune things until the door has a perfectly consistent gap all around. You can use a table saw to do this, but I prefer a hand plane because I mess things up in a much slower fashion than with a power tool. Once your door fits, you can tweak its position in its opening if you use the hinges we recommend in the Supplies box below. Add the knob of your choice and a catch (the magnetic ones are the easiest to install).

More Notches in Your Back

As I designed this project, I tried different ways to make it so the back was not one piece of 17½"-wide solid wood. The solutions were more complex than I liked or they didn't look right, so I decided to stick with the original wide back.

To make this work, I first had to calculate how much the back would expand and contract in a typical Midwestern environment (which has some pretty radical humidity fluctuations, I can tell you). Using the formulas in R. Bruce Hoadley's "Understanding Wood" (Taunton Press), I figured out how much movement to expect. According to Hoadley's formulas, the panel will expand about ⅛" when the humidity fluctuates between 8 percent and 14 percent. This is a reasonable range to expect in our climate.

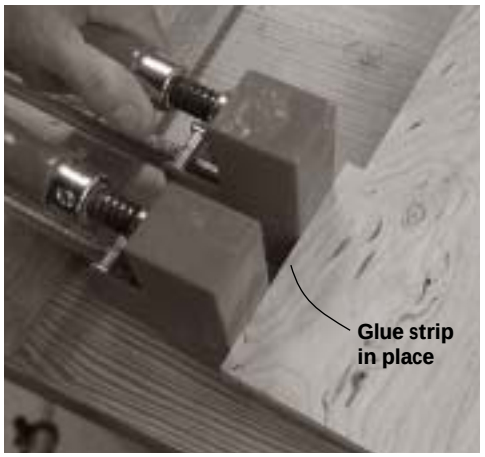
So now you need to measure the space between the two rabbets on the backside of your assembled carcase. It should measure 17". So the lower part of the back piece should measure 16⅞" wide. That's simple enough. The real difficulty comes when dealing with the curvy top part of the back. It's 17½" wide. That extra width overhangs the top of the cabinet. Once again this means you have to create a stopped notch on the two long edges of the back.

The simplest procedure is to use the same trick you used for creating the notch on the top piece: Gluing small pieces on the back to make a notch. And that's a fine way to do it as long as you pay close attention to matching the grain. This is a very visible part of the cabinet.

Make your back piece a bit wider to start with: 18" is about right. Rip two strips off each long edge so the back ends up 16⅞" wide. Keep track of which edge each strip came from because that will make it easier to match the grain when regluing the blocks in place. Now take those narrow strips and crosscut 5" off the top of each. Reglue these blocks to the back.

After the glue dries, mark the curvy shape on the back and cut to that line. A band saw, scroll saw or coping saw will do. Just make sure it's a fine-tooth blade. Clean up the rough saw-cut edges with sandpaper, files or a spokeshave. Then drill the 1¼"-diameter hanging hole in the location shown in the drawing. Finish-sand your back.

Attaching the back is easy if you pay attention to the issue of wood movement. The back is attached by screwing through it into the top and bottom pieces. You want to secure the back in the center of the cabinet so it expands equally on either side. Here's how to do that: Drill six screw holes in the back, three along the top and three along the bottom. The middle hole should be a standard round clearance hole. But the holes to the left and right should be elongated left-to-right. It's these elongated holes that allow the back to expand and contract with changes in humidity.



To make this notching operation go smoothly, make sure you rip the narrow strips from the back using a sharp rip blade. This will ensure that you'll get a clean cut and the blocks will be easier to reglue and get a seamless joint.

I've seen people make a template to rout perfect elongated ovals. Then they make the countersink using a template and a chamfer bit. This is not necessary. All you really need to worry about is allowing the shaft of the screw to pivot as the back moves. The screw's head can remain basically in the same place.

Here's how I make elongated holes: Drill a standard clearance hole for your screw that allows the screw's shaft and threads to pass through without biting into the wood. Next, angle your drill 45° one way and drill out a bit of one side of your clearance hole. Then angle the drill 45° the other way and drill out the other side of your hole. Finally, come back with your countersinking bit and countersink your clearance hole. Once done, then you can screw the back to the case using some #8 x 1"-long screws.

Finishing Cherry

Before you apply a finish to this project, take a few minutes to break the sharp edges with #120-grit sandpaper. This will make your project more enjoyable to touch and less likely to get damaged. Now remove the back and door.

Because cherry darkens nicely with age, I prefer not to add much coloring. In any case, staining cherry can be difficult because it blotches.

But new cherry with a clear finish looks a bit anemic until it gets a couple of years of coloring, so I like to help the process along. Begin by wiping on a coat of boiled linseed oil that's thinned down to a water-like consistency with paint thinner. Wait about 30 minutes and wipe off the excess. Then take your project outside and let it bask in the warm sun for an afternoon or two. This will jump-start the coloring process.

This elongated hole allows the back to expand and contract and still stay tightly secured under the screw. I make these holes by wiggling my drill bit. The other option is to drill a round hole and elongate it with a small rat-tail file.

After a couple of days of letting the oil cure, you can add a protective top coat. The simplest finish for this is a wiping varnish – essentially a thinned-down off-the-shelf varnish. For more details on mixing and using this finish, check out "Understanding Wipe-on Finishes" on page 30.

If you want to hang this project like the Shakers did, you'll need to build and hang a board with Shaker-style pegs. The length of the board is up to you and the scale of your room. We've included a supplier of cherry Shaker pegs below.

The last trick is to find a place in your home that really shows off the proportions and workmanship of this fine piece. You don't want this project to ever languish in the background. WM

Contact the author at 513-531-2690 ext. 1407 or chris.schwarz@fwpubs.com.

Supplies

Rockler
800-279-4441 or rockler.com

- 2 ■ Amerock ball-tip, full wrap-around hinges in antique brass, #31300, $5.99/pair
- 1 ■ Cherry Shaker ⅞" knob, ⅜" tenon, #78493, $2.59/pair. (Also available in oak, walnut and maple.)
- 1 ■ Narrow magnetic catch, #26559, $1.49 each
- ■ Cherry classic Shaker pegs, #23382, package of eight/$6.48 (Also available in oak and maple.)

Prices correct at time of publication.

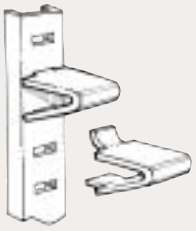
Shelf Support Basics

Storage doesn't do you much good if you can't divide it to suit your needs. That's what shelving is all about and there are a number of ways to put your shelves in just the right position. We've gathered the best of the pack here with quick explanations of their best applications.

Though there are a number of good choices listed, the most common support with the best price and function is the spoon pin, with or without the sleeve. We also appreciate the invisible application found with either the low-profile pin or the hidden shelf wire. When using any of the supports that require carefully located holes in your cabinet sides, we recommend cutting a piece of ¼" hardboard or plywood to about 3" wide and nearly the height of your opening. Drill a single line of shelf holes in this piece and use it as a template for all the holes. WM

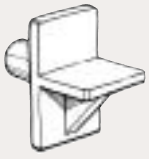
– David Thiel

Standard with Clip



One of the most common, inexpensive, versatile and ugliest shelf supports ever manufactured. While you can easily adjust shelf locations in 1" increments, the metal track is always visible and requires a groove machined in the sides. This support looks best in office furniture – not a project you spent hours building. Available in ugly nickel or zinc plate, ugly white and uglier brown.

Reinforced Support



An economical option, this plastic support slips into a hole (or multiple holes to allow for adjustment) that you drill in the cabinet sides. Like the metal track above, these are also common in office furniture and are not attractive. They also hold the shelf away from the side by as much as ⅛".

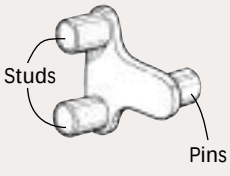
Locking Support

This support also fits into holes drilled in the cabinet sides. As an added feature, it locks the shelf in place from above, avoiding accidental tipping. Economical, but still rather unsightly, it also holds the shelf away from the cabinet sides. Use this for commercial furniture or for shop cabinets where you don't want a shelf to ever come crashing down – not for that Queen Anne highboy.

Right-angle Support

Slightly less unsightly, this support is almost invisible (with the shelf in place). The optional rubber pad keeps the shelf from sliding off, but it still leaves an unattractive gap between the cabinet side and each shelf. This is a good choice for furniture in a child's room or in a rumpus room.

Adjustable Support

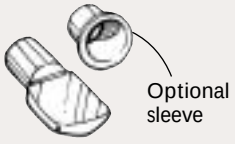


This support compensates for sloppy drilling. By trapping the shelf between the studs, the pin can rotate in the hole to find a balance between the four holes. A nice feature, but the ugly gap is still there, and now you've got a stud showing above the shelf. Save this support as a last option if (or when) you've messed things up.

Straight Pin

This is a true pin. Although low visibility, it has some problems. If the hole is slightly oversized, the pin can work loose, dumping the shelf. If the holes are not drilled perfectly, the shelf will wobble. On the other hand, if small notches are cut on the underside of the shelf, the pin can nestle in the notch, holding the shelf firmly.

Spoon Pin



A refined version of the straight pin, this pin can be used with or without the sleeve. It's then slipped into a hole or holes drilled in the cabinet side. The pin allows the shelf to fit all the way against the cabinet side without any visible gap, but still has a shoulder to hold the shelf in place.

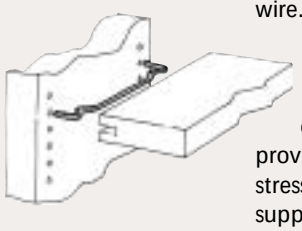
Screw-in Spoon Pin

Taking the pin and sleeve concept a bit further, this pin screws into its sleeve. It's a nice idea, but ultimately a little like gilding the lily, and best reserved for high-end glass casework. These pins are pretty darn expensive because you have to buy a threaded sleeve for every shelf-pin hole.

Low-profile Pin

The most invisible and still very economical, this support requires a little extra machining. The plastic pins are still slipped into holes drilled in the cabinet sides, but the shelves themselves have stopped saw kerfs along the ends that accept the blade of the pin. The shelf fits around the pins (in place) and the support disappears.

Hidden Shelf Wire



Another invisible variation is a hidden shelf wire. Rather than using two independent pins that slip into grooves in the shelves, this system uses a wire support. Essentially requiring the same amount of machining and drilling, this actually provides a more stable support and puts less stress on the shelf. The wire spreads the support over the depth of the shelf rather than focusing it on two bearing points.

Smart Ways to Hang Cabinets

Once you've completed the Shaker Hanging Cabinet, you can sit back and enjoy it. Well, almost. You still need to hang the cabinet – and it's been our experience that this final step can take minutes or hours, depending on your planning.

The hanging process should actually begin with the design phase of the project. With the cabinet shown here, we've followed the Shaker tradition and mounted a peg board to the wall, with the cabinet hung from a peg.

Other methods (more common today) are to mount the cabinet to the wall through the back of the cabinet (either with just the back or with a hanging strip) or to use a French cleat, which is invisible and convenient.

Screwing Through the Back

Depending on the size of your cabinet, you may have used a ¼"-thick back or thicker (½" or ¾"). With a thicker back, mounting the hanging cabinet to the wall is simply a matter of finding a stud and marking that stud location on the inside of the cabinet. Then you drill a clearance hole for the screw (usually 3/16" diameter), hold the cabinet in place and level on the wall, and screw the cabinet to the stud with a #10 x 3"-long screw. If the cabinet is wider than 16", you'll be able to put a second screw through the back and into a second stud. This should be enough to support most cabinets that aren't going to be holding your grandmother's fine China.

If your cabinet is less than 16" wide, you'll need a drywall "molly" to reinforce the second screw. Mollys are sold in the picture-hanging section of your local hardware store and allow you to put a screw almost anywhere in a wall. There are half a dozen different kinds of mollys that are suited to hold different weights. Check with your local hardware store for a good selection.

If you're hanging a large cabinet and want to use a ¼"-thick back (to make it less expensive and lighter in weight), a hanging strip will make mounting the cabinet easier. This strip (shown below left) can be built into the design of the cabinet or simply applied to the back. It goes inside the cabinet and below the top. Actually building the strip into the sides adds some strength, but it also adds an extra step or two to the project.

Screwing through this strip instead of just the thin back will give you more strength and reduces the chance of tearing through the thin back material with the screw.

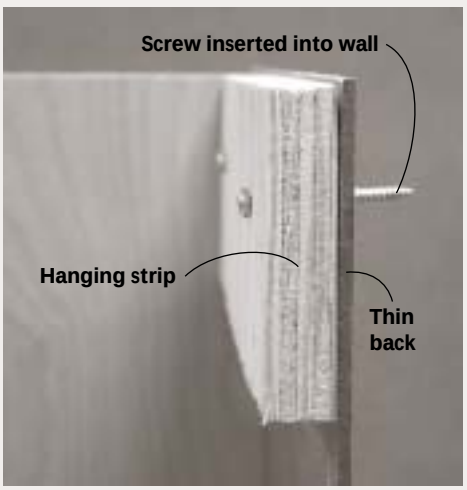
Using a French Cleat

French cleats offer invisibility and incredible strength, but they do steal some storage space from the inside of the cabinet. These cleats can be purchased (made from aluminum or steel) for the truly lazy, or made from simple ¾"- or ½"-thick scrap. The cleat is in two pieces, each with a 45° bevel on one long edge. One goes on the back of the cabinet; the other attaches to the wall. When you nest the 45° bevels together, the cabinet hangs firmly on the wall. You should be able to do pull-ups on your cabinet if it is properly installed this way – no kidding.

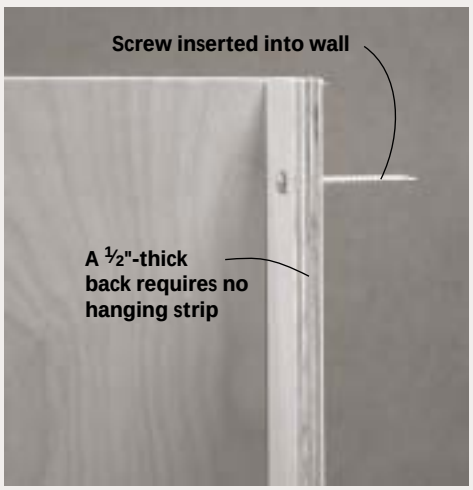
To use a French cleat, you have to design a gap behind the back of the cabinet to house it. Essentially the cabinet is built with the back recessed into the cabinet, so the top, sides and bottom still touch the wall.

Beyond the strength gained by using a cleat (as long as you catch a stud or use mollys), cleats are easy to level. The wall section of the cleat is attached with one screw and that section is leveled and fixed in place. Then the cabinet is simply slipped in place over the wall cleat. It's pretty cool. WM

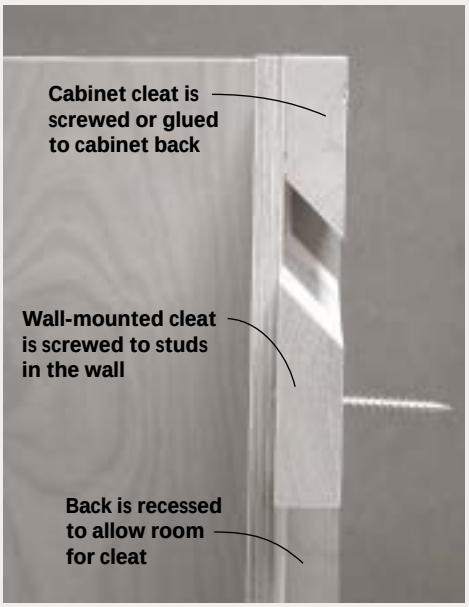
– David Thiel



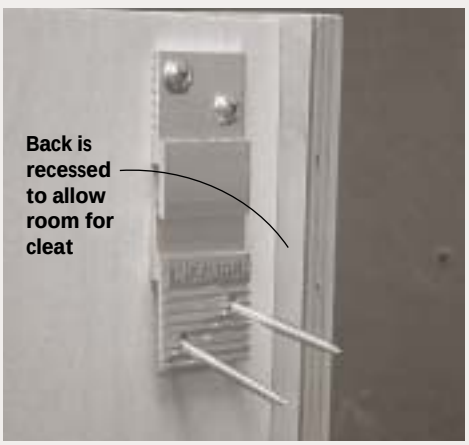
With a larger cabinet, a thin back makes more sense but will not be sufficient to secure the cabinet to the wall. By adding a hanging strip, the weight of the cabinet is more evenly transferred to the cabinet box.



With smaller cabinets, a thicker back (usually ½" or more) can be used without any major weight concern. This thicker back also allows you to simply screw through the back of the cabinet directly into the wall and stud.



The shop-made French cleat in action. This French cleat is made for a board ripped at a 45° angle, but the cleat also could be made with interlocking rabbets. Either way, you get some amazing strength and convenience.



This store-bought version of a French cleat takes up less room behind the cabinet and is priced at about $13 for 10 sets. Place one hanger every foot to hold heavy cabinets.

Almost-perfect 6" Rulers

Accuracy is an important skill to develop when woodworking. A tape measure keeps track of the big stuff and dial calipers let you check your small-scale work. But for everything in between you should have a proper 6" steel ruler – commonly called a "rule" in woodworking parlance. It's the right tool for checking mortise depths, tenon widths, material thickness while planing, and it's indispensible to set up routers and saws.

But finding a perfect 6" rule has proven to be an elusive goal in our shop. We took a close look at the 10 most common 6" rules and found that none is perfect, but two come close.

Readability: Avoid Shiny Objects

The readability of a rule is the result of the steel's finish and the engravings' quality (or lack of engravings). Reject any rule that doesn't have a satin finish or has the scale merely applied to the steel, rather than engraved. All the rules in this test have a satin finish, which reduces glare. Also, all the rules tested have engraved markings.

Scale: When Imperialism is Good

While the metric system is important for measuring soda volume and the wrenches for your Italian band saw, most woodworkers in the United States have stuck with inches. A decent rule should have separate scales for 1/64, 1/32, 1/16 and 1/8.

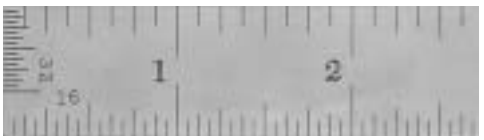
Also useful is a scale on the end of the rule – usually it's only 1/2" long. Hold the end scale up to a bit or blade to measure its height.

Conclusions

After comparing and using the 10 rules, only two – Shinwa and Starrett – fulfilled our needs. Both rules are thick enough to be durable and offer end scales and proper scales that are easy to read. The Starrett is thicker than the Shinwa (.045" compared to .032"), and if your eyes are at the age where small lines are getting fuzzy, the 1/64" scale on the Starrett is easier to read. However, the Shinwa is one-third the price of the Starrett – a significant savings. Our choice for best rule is a tie between the Starrett and Shinwa. Both earn a "Recommended" rating. None earn our "Highly Recommended" rating – the Starrett is too expensive and the Shinwa is too thin.

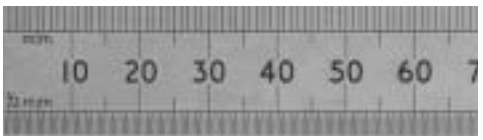
We can't recommend any of the other rules in our test. They've devoted space to metric scales, the scales are too convoluted to decipher or the scales are unusable in woodworking. Who needs 1/100 of an inch? WM

— David Thiel, senior editor



Good Features

The Starrett is graduated in 1/32" and 1/64" on the front (top) and 1/16" and 1/8" on the back (bottom). Four very usable scales are presented in a very readable fashion. The 1/2" end-scale (graduated in 1/32") on the back is an amazing help in tool set-up.



Bad Features

The Rabone is graduated in 1/32" and 1/10" on the front (top) and millimeters and half-millimeters on the back (bottom) – only one useful scale to woodworkers, and it's presented in a nearly unreadable fashion. And there's no end-scale.

Recommended

Shinwa #60N47.01

Starrett #061511

Not Recommended

Bridge City #SR-6

General #CF616

Hartville Tool #13394

Highland #063020

Incra #39091

Lee Valley #06K20.06

Rabone #39N10.01

Woodcraft #129207

6" Steel Rulers

BRAND	PRICE	MATERIAL	RULE SIZE	FRONT SCALES	BACK SCALES	CONTACT INFORMATION
Bridge City #SR-6	$9.95	SS	.042" x 3/4"	1/16"; 1/32"; E	.5mm; 1mm	800-253-3332; bridgecitytools.com
General #CF616	$6.99	SS	.021" x 15/32"	1/10"; 1/100"	1/32"; 1/64"	amazon.com
Hartville Tool #13394	$9.99	STS	.042" x 3/4"	1/8"; 1/16"; E	1/32"; 1mm	800-345-2396; hartvilletool.com
Highland #063020	$9.99	SS	.042" x 3/4"	1/32"; 1/64"	.5mm; 1mm	800-241-6748; tools-for-woodworking.com
Incra #39091	$13.99	SS	.010" x 1 5/8"	1/16"; 1/32"	None	800-279-4441; rockler.com
Lee Valley #06K20.06	$1.40	SS	.024" x 9/16"	All	None	800-871-8158; leevalley.com
Rabone #39N10.01	$8.95	SCF	.018" x 3/4"	1/32"; 1/10"	.5mm; 1mm	800-221-2942; garrettwade.com
Shinwa #60N47.01	$4.95	SHS	.032" x 3/4"	1/32"; 1/64"	1/8"; 1/16"; E	800-871-8158; leevalley.com
Starrett #061511	$16.99	STS	.045" x 3/4"	1/32"; 1/64"	1/8"; 1/16"; E	800-241-6748; tools-for-woodworking.com
Woodcraft #129207	$11.99	STS	.044" x 3/4"	1/32"; 1/64"; E	.5mm; 1mm	800-225-1153; woodcraft.com

SS = stainless steel; STS = stainless tempered steel; SCF = stainless chrome face; SHS = stainless hardened steel; E = end scales

Hanging Tool Cabinet

A cabinet full of tools is physical evidence of a deep, ever-growing investment. If it's not the first project you build, it should come soon after.

This project is based on the "Shaker Hanging Cabinet" (page 16) minus the doors, the solid-wood back (this one is Baltic birch plywood, which doesn't expand with changes in humidity), the curved top and a shelf.

Before you start working with wood, you need to first work with cardboard. To decide how to best arrange your tools, draw a 19"-high x 16½"-wide rectangle on a piece of cardboard and arrange your tools until you find a good fit (Check out "Storing Your Tools" on page 28 for some ideas).

Choose wood for the sides, tops and bottoms that's no less than 9" wide and has straight grain.

Next, joint and plane your boards. We chose maple, but yellow birch works, too. Cut all your parts to size, except the back and stiles.

Now cut a ¾"-wide x ¼"-deep rabbet on the inside top and bottom of each side piece. Next, cut a ½"-wide x ¼"-deep rabbet on the long back edge of each side piece. Then cut a ½"-wide x ¼"-deep dado on each side piece for the shelf, located 6½" from the bottom.

Next, drill the tool holes in the shelf. For my chisels, I made a mark 9/32" in from the front edge of the shelf and, using a drill press and fence, bored six ⅝" holes with a Forstner bit. These holes allow my chisels to hang on the shelf's front lip without falling. You also can drill a matrix of holes two rows deep to hold hand tools if you like.

Sand the inside faces of your pieces and test the fit. Once you're happy, glue it up. Check for squareness before tightening the clamps. Once the glue has cured, add nails for extra strength.

Attach the face-frame stiles and rout the cove detail on the three edges of the outside top and bottom pieces. Glue and nail these pieces on.

Measure the opening for the plywood back, cut it to size and screw it in place with #8 x 1"-long screws. Don't use nails – with screws you can remove the back for finishing.

Read "Wipe-on Finishes" on page 30 for detailed instructions on finishing. Sand, scrape or plane everything before applying your finish. Once the finish has dried, attach a magnetic strip or blocks of wood to hold your tools.

For information on hanging this cabinet, read "Smart Ways to Hang Cabinets" on page 24. WM

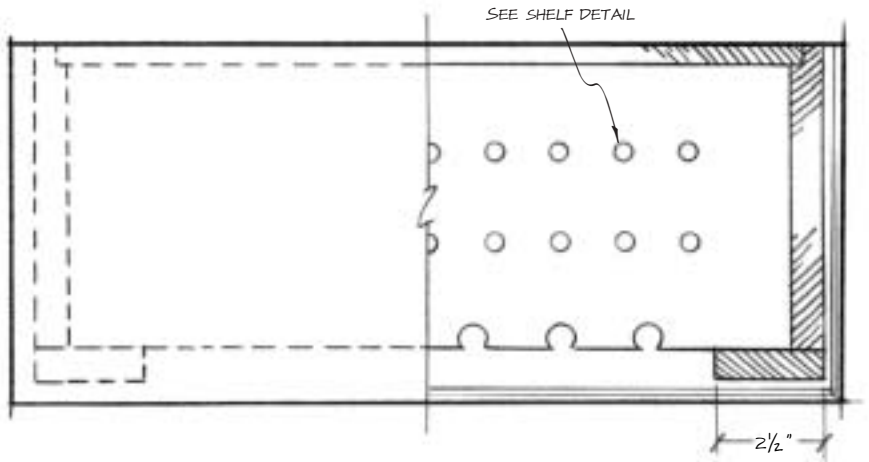
Contact the author at 513-531-2690 ext. 1348 or kara.gebhart@fwpubs.com.

PHOTO BY AL PARRISH

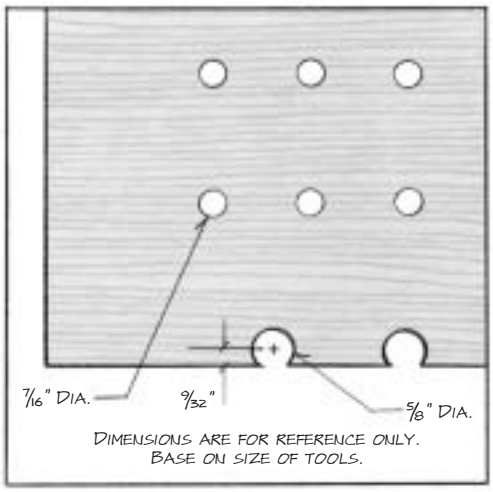
Story and project by Kara Gebhart, associate editor

Hanging Tool Cabinet

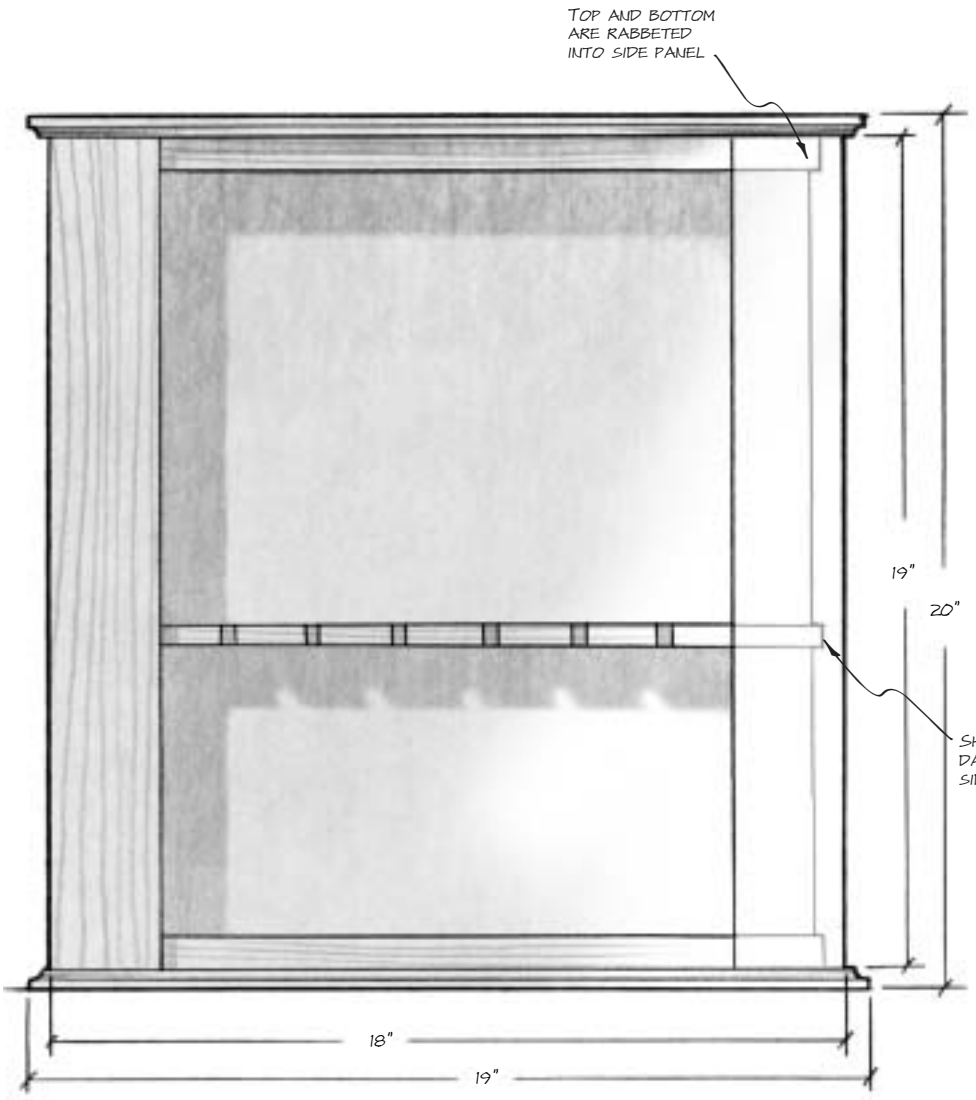
	NO.	PART	SIZES (INCHES) T	W	L	MATERIAL	NOTES
❑	2	Sides	¾	7	19	Maple	¾"-wide x ¼"-deep rabbets on ends
❑	2	Inside top & bottom	¾	6½	17	Maple	
❑	1	Shelf	½	6½	17	Maple	In ½"-wide x ¼"-deep dados
❑	2	Stiles	¾	2½	19	Maple	Glued to carcase
❑	2	Outside top & bottom	½	8¼	19	Maple	
❑	1	Back	½	17	19	Baltic birch	



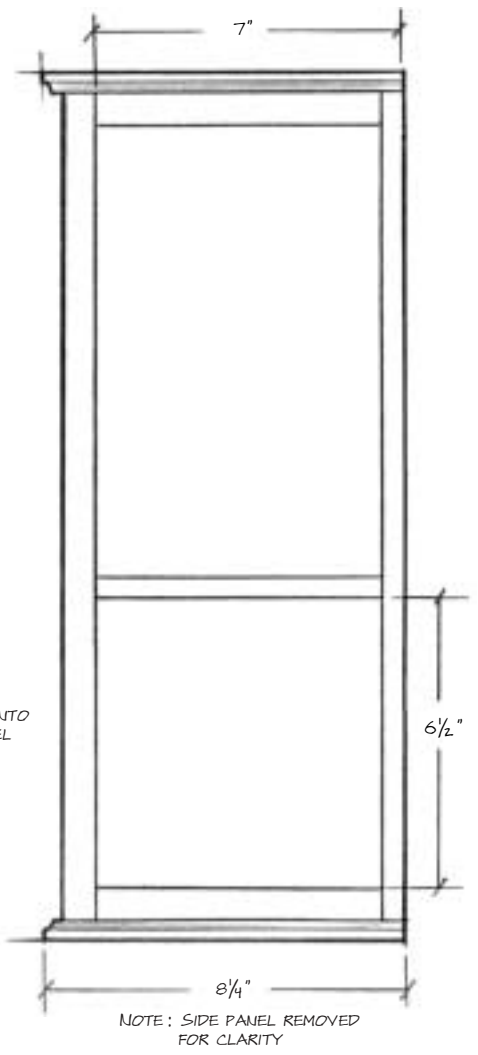
PLAN



SHELF DETAIL



ELEVATION



PROFILE

HANGING TOOL CABINET

Storing Your Tools

There's a bit of romanticism associated with a tool cabinet. Many of us can remember sorting through our parent's old tool box, eyeing everything in it fondly or quizzically, then carefully putting each tool back in its place to avoid getting in trouble.

On page 26 we show you how to build a simple, utilitarian tool cabinet. Following is a list of clever tool-storage tricks. Hopefully this will give you ideas so you can design your tool cabinet to best suit your tool investment.

■ Before you begin, use a piece of cardboard cut to the size of your cabinet to lay out your tools. Here you can play with organization to determine the best placement for shelves, cubbies and drawers.

■ Rare-earth magnets, either buried in strips of wood or attached bare to the cabinet, are great for storing metal tools, but be careful. Magnetized screwdrivers can be very handy – even the tiniest of screws will cling right to them – but magnetized chisels and files can be problematic. Swarf (the metal particles that are created during sharpening) will cling to a magnetized chisel, as will metal filings to files. These tiny bits of metal can scratch both the tool and your work, a disheartening experience.

■ Appropriately sized holes or slots drilled or cut into wooden shelves can hold all sorts of tools including chisels, screwdrivers, router bits, drill bits, awls, files and pliers.

■ Shelves are a great way to store hand planes. Contrary to what some people believe, storing a plane on its sole on a clean wooden surface won't dull the blade.

"The pioneers cleared the forests from Jamestown to the Mississippi with fewer tools than are stored in the typical modern garage."

— unknown; attributed to Dwayne Laws

■ Hand planes also can be hung. Drill a hole into the wall of your cabinet and tie a piece of leather string, forming a loop. The string's knot holds it in place. Put your plane's front knob in the loop. Whatever you do, don't drill a hole in the sole of the plane to hang it. This hole destroys any potential value the plane had to the next generation of collectors.

■ A few appropriately sized and placed blocks of wood allow you to hang certain tools in your cabinet, such as the rule part of your combination square. Some people will even shape their blocks of wood to fit the inside of specific tool handles or the heads of hammers. This is for the ultra-organized only.

■ Deep-set doors, such as those shown on the cabinet at left, give you additional storage space that you can use for a variety of tools.

■ Store your precision instruments, such as straightedges, so they are completely flat and supported along their lengths. These instruments actually can be warped by their own weight. Dial calipers should be stored in their original plastic cases for the same reason.

■ Avoid the standard pegboard hooks. Yes, they are inexpensive. But they fly off the pegboard if you just look at them wrong. Spend a few extra dollars on the pegboard hooks that lock in place. You will save yourself years of bending over to find the little things.

■ If you're looking for the ultimate tool-storage technique, some people try "French fitting." This involves making different scroll-sawn depressions in the wood that will fit each tool precisely. But we don't recommend it. Spend your time on the projects you'll display proudly in your home.

■ Although it's best to keep your safety glasses and ear protection in your shop apron or next to your machines, designating a drawer for safety equipment is a good way to keep extras on hand – great for when family members or friends visit your shop. WM

— Kara Gebhart

This tool cabinet, built by Malcolm and Glen Huey (owners of Malcolm Huey & Son, a custom woodworking shop in Middletown, Ohio) marries hand-tool and power-tool storage with drawers, deep-set doors, magnetic strips, cubbies, brass hooks, Shaker pegs and Shaker boxes.

Inside your cardboard representation, draw where you will want to place the shelves, blocks of wood and magnetic strips for holding specific tools.

Glossary

Woodworking's lexicon can be overwhelming for beginners. Following is a list of terms used in this issue. Check out woodworking-magazine.com for a complete and searchable glossary.

arbor (n)
A motor's axis or rotating shaft to which a tool is attached, such as a table-saw blade or a router bit.

Baltic birch (n)
A high-quality birch plywood made from veneer of equal thickness. It has no voids. Widely used for furniture, it's also known as "Finnish birch." Unlike domestic plywood, such as "apple ply," which comes in 4' x 8' sheets, Baltic birch is made in 5' x 5' sheets.

bevel (v, n)
To cut an inclined or sloping angle on a workpiece that is other than 90°; also, the angle itself.

block plane (n)
A small plane for trimming joints or end grain; the bevel on the cutter always faces up. Low-angle versions excel at trimming end grain.

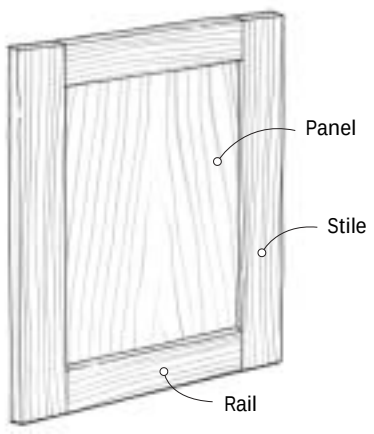
carcase (n)
The frame or structure of a cabinet.

chamfer (n, v)
A beveled or grooved edge that is 45°.

clearance hole (n)
A hole for a screw that allows the shank and threads to pass through without biting the wood.

combination square (n)
An all-metal, adjustable square that can measure 90° and 45° angles. It is perhaps the most-used (and most dropped) tool when marking out joints.

countersink (n, v)
To cut a cone-shaped recess in a pilot or clearance hole that allows a flat-head screw to seat flush or below the surface; also, the hole itself.



crosscut (n, v, adj)
A cut perpendicular to the grain of a board.

dado (n, v) **dados** (pl) **dadoing** (v)
A three-sided trench cut across the grain of a board.

featherboard (n)
A safety device comprising of flexible fingers that hold a workpiece against the fence or table during a cut; often constructed by cutting a number of slots in the end of a board.

Forstner bit (n)
A type of bit used to bore clean, flat-bottomed and generally larger holes.

glue-up (n) **glue up** (v)
The act of assembling parts with glue and clamps.

grain pattern (n)
The visual appearance of the wood grain; types include flat, straight, curly, quilted, rowed, mottled, crotch, cathedral, beeswing and bird's eye.

"When the only tool you have is a hammer, you tend to see every problem as a nail."

— Abraham Maslow (1908 - 1970)
psychologist, philosopher

groove (n)
A three-sided trench cut with the grain of a board.

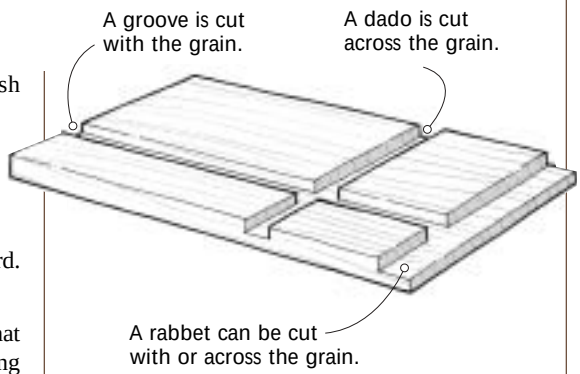
kerf (n)
The wood removed by a saw blade between the piece you keep and your offcut.

kickback (n) **kick back** (v)
The action of any number of woodworking machines to throw the workpiece back toward the operator. It usually occurs when wood gets caught between the rip fence and the blade. Splitters – and a dose of common sense – can prevent these.

offcut (n, adj)
A waste piece of lumber.

outfeed (n, v, adj)
The point where the workpiece exits a machine.

panel (n)
A large wood surface, sometimes made out of several boards glued edge-to-edge.



pilot hole (n)
A hole drilled to receive a screw's threads that reduces splitting and increases accuracy.

predrill (v)
To drill a hole before driving a nail. This decreases the chance of splitting the wood.

push stick (n)
A hand-held safety device used for pushing wood past a cutter to keep the hands away from the blade.

rabbet (n, v)
A two-sided trench cut on the edge of a board.

rail (n)
The horizontal member of any frame, such as a door, window or face frame.

rip (n, v, adj)
A cut parallel to the grain of a board.

rip fence (n)
The movable guide on a table saw that's parallel to the blade against which boards are referenced when making a rip cut.

sheet good (n)
Man-made wood product, such as plywood, particleboard or medium-density fiberboard (MDF).

stile (n)
The vertical member of any frame, such as a door, window or face frame.

straight-grained (adj)
The grain pattern that results when annual rings are perpendicular to the face and run parallel to the edge.

tear-out (n) **tear out** (v)
The chipping of an edge along the kerf.

wood movement (n)
The tendency of wood to expand and contract across the grain as its moisture content fluctuates in response to changes in relative humidity. WM

Understanding Wipe-on Finishes

The moment of truth for many projects comes long after the shop is cleaned, the tools are put away and the work is sanded. Applying a finish stops many woodworkers dead in their tracks.

Finishing is the chore almost all woodworkers fear most because it has the greatest potential for spoiling the project. So it's only natural that woodworkers would seek a risk-free finish. For this reason, many choose a finish that's wiped on. Finishing manufacturers have capitalized on this fear and have developed rag-on finishes – that's the good news about many products today.

The bad news is that the finishes you find on the shelves at your home centers have similar names but aren't alike – and you can't figure out what each one does by simply reading the can.

This is what they all have in common: You wipe them on, allow them to dry and then add more coats for additional protection.

But the real questions for us are: Just how many coats do you need? And how much protection can you expect? To get these answers you first have to have some knowledge of the finishing product's contents. Because the actual contents aren't listed on most products and the names can't always be trusted, you can do a simple test at home to get some answers.

With the exception of pure oil finishes (such as boiled linseed oil) most wiping finishes are either a varnish that's thinned with a reducer (like paint thinner or mineral spirits) or a combination of oil and varnish. To see which one you have, pour a small amount on a hard surface like glass or metal to form a small puddle. Let the puddle dry for a couple of days. If the puddle dries hard and smooth, you have a thinned, or true, wiping varnish. If the puddle dries wrinkled and soft, it's an oil/varnish blend.

When a thinned or wiping varnish dries on a nonporous substance, such as this piece of glass, it is smooth and hard (left). Oil/varnish blends, on the other hand, will cure soft and wrinkly on a nonporous surface (right).

Why is it important to know what kind of wiping finish you have? When it comes to protecting the wood, varnish wins because it dries hard.

The reason has to do with the way the products are manufactured. A typical oil-based varnish is made by cooking alkyd resins with an oil (usually modified soybean oil). To make a wiping varnish, the finish is simply thinned with paint thinner or mineral spirits. Oil/varnish blends go further, adding more oil and thereby further reducing the quantity of varnish in the finish.

Still confused about what to do? Well, the surefire way to get what you want is to make your own wiping varnish. It's easy. Buy a can of oil-based varnish and thin it with paint thinner or mineral spirits. Add either one part thinner to four parts varnish or, for a slightly thinner mix, one part thinner to three parts varnish. If you make your own, select varnish with the sheen you prefer. Usually a mid-level sheen such as semi-gloss or satin is best for furniture finishing.

With your finish mixed, actually applying it is mostly foolproof. First, make sure you have adequately sanded the project. I prefer to use a random-orbit sander for flat surfaces. Start with #120-grit sandpaper. Sand out all the imperfections: scratches and marks left by your tools and glue. Then move progressively through finer sandpaper grits: #150, #180 and #220. Brush or blow off the dust between each grit. Remove as much dust as possible before applying the finish.

To apply the wiping varnish, use a clean cloth rag. T-shirt material works well, rivaling cotton cheesecloth, which is touted as being especially lint-free. You can purchase cotton cheesecloth at most home centers or paint stores.

Wipe on the finish equally on all surfaces. The surface should look wet but it should not pool. This is especially true for the first coat, which soaks into the wood. The subsequent coats don't penetrate and will look wetter.

After the first coat has dried, lightly sand using either #320- or #360-grit coated sandpaper. The coating helps prevent the finish dust from clogging the sandpaper. Norton Abrasive's 3X brand and 3M's Tri-M-Ite are good options. This light sanding should substantially smooth the finish surface. Wipe clean all the dust and recoat. In all, three to four coats should be enough.

If you colored your project beforehand with an oil-based pigmented stain, you need to be careful. The application of a wiping varnish using a rag could cause the stain to redissolve and smear. Instead, lightly brush on two coats and don't brush over areas with wet finish. After the second coat dries, sand the wood to smooth the surface. Be sure to sand lightly, however, especially near edges or on moulding details. These areas are susceptible to sanding through the finish and then through the stain color, which will expose the natural color of the wood. WM

Story by Steve Shanesy, editor & publisher

Contact the author at 513-531-2690 ext. 1238 or steve.shanesy@fwpubs.com.

A Finishing Experiment

We conducted a couple of simple experiments with five wiping varnishes readily available from local home centers, plus our own homemade version and a full-strength varnish. Two products (Minwax and General Finishes Arm-R-Seal) are wiping polyurethanes, which technically are varnishes but use urethane resins instead of alkyd resins.

In the first experiment, we applied all the finishes to a walnut plank and compared the looks, as seen in the photo. We applied four coats, with light sanding after the first coat.

For the second experiment, we placed equal amounts of the finishes (measured to the thousandth of a pound) in identical open containers and allowed the finish to evaporate, leaving the dried resin on the bottom. We then weighed the dried material. The result told us how much of each finish was solids (which protect the wood) and how much was solvent (a carrier of resins that evaporates, leaving a dry, solid film finish on the wood). The dried samples also gave us a better understanding of the hardness, flexibility, clarity and color of each finish when cured.

As a reference, these characteristics can be viewed in a variety of ways. For example, an amber color in the dried film could be good if you want to add warmth to the look of your wood. But a finish with little color may be preferred if you're finishing a white wood such as maple or ash. Hardness is a good attribute but it's a trade-off with flexibility, an equally important attribute that allows the finish film to move with the wood during seasonal expansion/contraction cycles.

Of the seven samples tested, only one dried notably differently – Waterlox. All of the other products showed minor differences.

■ General Finishes Arm-R-Seal and Sealacell looked about the same. Both were among the clearest with a mild yellow color – Arm-R-Seal was a bit more orange. Arm-R-Seal's film was less flexible and harder. In measured characteristics, it had the highest percent of solids (34 percent) of all the commercial products except unthinned regular varnish. Arm-R-Seal is considered a sealing coat, with Sealacell used as a finishing top coat. Sealacell tied for the lowest percent of solids (29 percent).

■ The Minwax Wipe-On Poly sample dried to a tough, brittle, clear film that was amber in color. On the board, it produced an attractive protective film without appearing thick or plastic-looking. It was less clear than other products and had a 32 percent solids content.

PHOTO BY AL PARRISH

We tested seven wiping varnishes to see how they performed when rubbed on a walnut plank, shown here. At the bottom are the dried films that remained when the liquid dried in the open containers.

■ Formby's Tung Oil produced one of the most pleasing-looking finishes of the group. While it tied with Sealacell for the lowest solids rating (29 percent), the film on the wood had a more natural look. The dried film was yellowish and flexible, yet tough. It was almost as clear as the two General Finishes products.

■ Waterlox, as previously noted, appeared as a dried film more orange and far less clear. The dried sample actually was translucent and had a solids content of 31.5 percent. On the board, it appeared duller and slightly less clear than any other product. The dried film was softer and more flexible than the other products, making us wonder about its suitability for use in demanding circumstances such as tabletops or countertops.

■ The unthinned varnish, a McCloskey product, and our home-brew wiping varnish made from it produced clear, flexible yellow-tinted films that were as tough as any in the group. As expected, the varnish directly from the can had the highest solids content at 39.5 percent. Our thinned wiping version equalled the highest of the commercially prepared products at 34.5 percent. On the wood, the straight-from-the-can varnish was too thick to produce a smooth finish by applying with a rag. The thinned version did not appear to produce a thick-looking finish. Rather it appeared clear and natural, but was a bit more dull than the others in the group. WM

— Steve Shanesy

Look through the shelves at your local home center and you'll see many products with similar names. But how do you know what the products really are? Our list will help.

Common Wiping Varnishes

- Daly's ProFin
- Formby's Tung Oil Finish
- General Finishes Arm-R-Seal
- General Finishes Sealacell
- Gillespie Tung Oil
- Hope's Tung Oil Varnish
- Jasco Tung Oil
- Minwax Wipe-On Poly
- Val-Oil
- Waterlox
- Zar Wipe-On Tung Oil

Common Oil/Varnish Blends

- Behlen Danish Oil
- Behlen Salad Bowl Finish
- Behlen Teak Oil
- Behr Scandinavian Tung Oil Finish
- Deft Danish Oil
- Maloof Finish
- Minwax Antique Oil Finish
- Velvit Oil
- Watco Danish Oil
- Watco Teak Oil

ILLUSTRATION BY PAT LEWIS

Bad Treehouses & Good Medicine

I don't know what was most badly bruised – my thumb, my backside or my ego.

It all started out innocently enough. I mean, what better way to bond with your son than by building a treehouse together?

I remember sharing the same experience with my father when I was a kid, and there was something truly special about being nestled up there amid the pines, just the two of us, hammering away at the floorboards of what was sure to be the best treehouse ever built.

Who could blame me for wanting to recreate that same "Kodak moment" with my own son 30 years later, in the very same stand of pines behind our family's summer cabin.

The thing is, my Dad knew what he was doing. I, on the other hand, did not.

And my son – all of 10 years old at the time – sensed this immediately.

"Are you sure you want to do this, Dad?" he asked, looking up skeptically at the battle-scarred remains of my old treehouse.

"We'll just clear away the rotted wood and start from scratch," I said, hitching up my tool belt knowingly. "You'll see, Ryan – it'll be great."

I set up an extension ladder against one of the pines and handed him a hammer.

"Up you go son," I said, holding my breath as he scampered up to the top of the ladder. "Don't worry – you can do it!"

I watched, somewhat in awe, as he began to expertly pry out the rusty nails and fling down one piece of rotted, old treehouse after another. "The boy's a natural," I thought to myself. "It must skip a generation."

"That was fun," he declared as he leapt off the ladder when he was done. "Can we start the new one now?" he asked eagerly.

"Sure thing," I said, smiling at his enthusiasm.

We manhandled a second ladder into position alongside an adjacent pine and worked our way to the top of our respective ladders, with a 2x6 straddling the span between the two trees.

"Hold your end up nice and steady and I'll hammer in this side, OK?" I called across.

"OK," he hollered back, but I could tell the big board was getting heavy, fast. Using my shoulder to pin the wood against the tree, I pulled a 3" spiral from my trusty tool belt, positioned it between my thumb and forefinger, let fly with my hammer and struck the nail dead on.

My thumbnail, that is.

A screech of pain leapt from my lips, the hammer flew from my grasp and I went into a backwards free fall off the ladder.

As I watched the 2x6 follow me slowly yet faithfully to the ground, I wished I could do or say something to erase the look of shocked panic on my son's face, which, oddly, seemed to be in picture-perfect focus at the tail-end of the beam.

I landed flat on my back with a hearty splat. The last thing I remember before the plank planted itself into my face was the smell of fresh wood.

And a fading cry of "Are you alright, Daddy?"

I woke up later in the local hospital, suspended completely in one of those traction contraptions, with my jaw wired shut.

I was laid up for weeks and, to this day, I can't sit in the same place for too long. But at least Ryan and I got to spend a lot of quality time together.

He'd visit morning, noon and night, and read to me – "how-to" books mainly, which he took a liking to that summer. He even lent me his Game Boy, which I was actually able to use during the latter half of my hospital stay. Talk about father-son bonding – it doesn't get any closer than that.

Later, when I had regained most of my upper-body mobility, he gave me a hug and said he was sorry he dropped the beam on my head.

I swallowed my pride and set him straight.

I told him I was glad he hadn't been hurt, and that it was my own ineptness with hammers, ladders and tools that was to blame for what is still referred to in our family as "The Mishap."

In case you're wondering, the treehouse finally did go up. Ryan helped a lot, and the end product was every boy's dream – complete with roof, walls, windows, trapdoor, rope ladder – the works.

Sometimes it pays to hire a professional. WM

Story by Gary George. Happily married for 25 years and a proud father of two, George is an aspiring home handyman who is almost making a living as a freelance writer in Montreal, Canada. His philosophy of life? Just keep pounding away.

Resources

"One machine can do the work of 50 ordinary men.
No machine can do the work of one extraordinary man."
— Elbert Hubbard (1856 - 1915), author and teacher

Questions about *Woodworking Magazine*?

What is *Woodworking Magazine?*

Woodworking Magazine teaches the fundamental knowledge necessary for good craftsmanship. Our goal is to make you an independent, mindful and competent woodworker by filling the inevitable knowledge gaps left by teaching the craft to yourself. To ensure our magazine is of the highest quality, we challenge woodworking's conventional wisdom to find the techniques, materials and tools that work best. Every operation and tool in *Woodworking Magazine* has been tested time and again by our staff of professional and enthusiastic amateur woodworkers in our shop in Cincinnati.

Why is there no advertising?

To ensure that *Woodworking Magazine* is free of bias – or merely the perception of bias – we don't accept any outside advertising from the manufacturers or sellers of woodworking tools and equipment.

Who publishes this magazine and who are the editors?

Woodworking Magazine is owned by F & W Publications Inc., in Cincinnati. We publish a wide variety of magazines and books for the enthusiast on topics that include hunting, scrapbooking, gardening, writing and woodworking. The editors include a staff of professional journalists and woodworkers who also work on a sister publication, *Popular Woodworking*. Their names, phone numbers and e-mail addresses are listed on page 1.

How often do you publish and can I purchase a subscription?

In 2004, we will publish two issues of *Woodworking Magazine*. The second issue will come out in late July. You will be able to purchase it from your newsstand or you can preorder an issue by calling 800-258-0929. We are not offering subscriptions at this time. However, you can sign up to receive information about the magazine – including a reminder of when our next issue will be out and when we will offer subscriptions – by visiting our web site and signing up for our free e-mail newsletter.

COMING IN JULY:

- Plans for a classic cherry side table.
- The safest (and best) way to cut leg tapers.
- Choose the right glue for your woodworking: yellow, white, hide or polyurethane.
- Complete instructions on how to make the most important table joints.
- Don't spend too much on chisels. Buy a lifetime set without needing a second mortgage.
- Glue-up perfect, seamless panels for your projects.
- Simple, sturdy knock-down sawhorses.
- Everything you need to know about drill bits.
- And plenty of great Shortcuts!

CONTACT US

We welcome letters from readers with comments about this magazine, or about woodworking in general. We try to respond to all correspondence. To send us a letter:

- E-mail: letters@fwpubs.com
- Fax: 513-891-7196
- Mail carrier:
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  Cincinnati, OH 45236

Good resources available online at woodworking-magazine.com

- Search through our Woodworking Glossary – a comprehensive list that explains all the jargon related to the craft.
- Get the latest information about upcoming issues of *Woodworking Magazine*.
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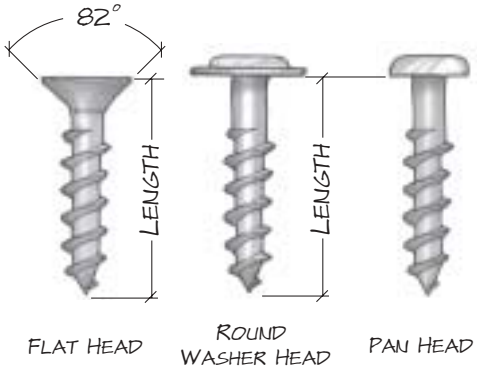
- Have a question about the magazine? Need some advice about a woodworking project or buying your next big tool? Head online and find contact information to talk with the experienced staff of *Woodworking Magazine*.

FLAT HEAD: Specifically designed to set the screw head flush or below the surface of the wood. Requires countersinking to hide head.

PAN HEAD: Provides excellent holding power against the wood surface (better than beveled flat head, which can add stress to hole sides).

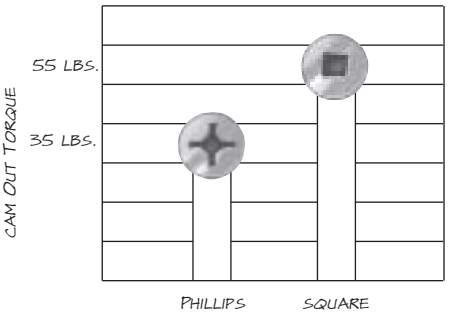
TRIM HEAD: Similar to a flat-head design, the head diameter is significantly smaller and less conspicuous, but the small size reduces holding power and can make these difficult to drive without stripping the head.

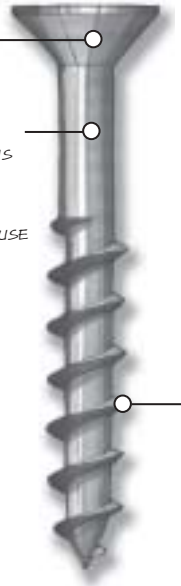
ROUND WASHER HEAD: Similar to the pan-head design, this head adds a built-in washer to increase holding pressure. Can be used in slotted hole applications.



USING A CLUTCH WHEN SCREWING

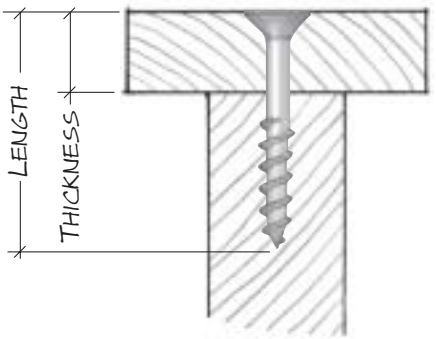
Cordless drill/drivers have clutches that limit the torque to make setting screws easier. Whether yours has six or 26 settings, it's best to start low and work up to determine the best setting for each screw type. With brass screws, we suggest avoiding electric or battery-powered drill/drivers altogether.





This part of the shank is unthreaded to prevent joints from "bridging," which occurs when the joint won't close because the threads are biting into both workpieces.

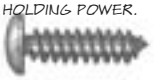
In choosing length, try to have about 2/3 of the screw threaded into the "secondary" piece, as shown below. As the thickness of the lumber or fastener length increases, though, this ratio can be reduced so that only 1/2 of the shank is threaded into the secondary piece.



DEEP THREAD: Deep-thread screws provide bite and holding power in wood and require smaller-diameter pilot holes (or none in some cases). These are most similar to drywall screws.

WOOD SCREW THREAD: Available primarily in flat-head style, the wood screw thread is rather "blocky" and designed to provide thread strength in soft screw materials such as brass.

DOUBLE LEAD: Designed for speed, double-lead screws advance more quickly at the expense of reduced holding power.



TAPPING THREAD: Available in a variety of head styles, tapping-thread screws are designed to form their own threads when driven into sheet metal or soft materials. The hardened threads tap the wood, forming complementary threads.

TAPERED WOOD THREAD: The shank diameter tapers toward the point. This is the traditional screw design and is usually available only in brass or silicon bronze. Generally cut threads vs. rolled threads.

COMMON SCREW APPLICATIONS

All dimensions in inches

Screw Size	Flat ☆	Trim ☆	Pan ☆	Round Washer ☆	Driver Sizes	Pilot Hole Softwds.	Pilot Hole Hardwds.	Clearance Hole	Plug Dia.	Common Uses
4	13/64	3/16	7/32		0	1/16	5/64	1/8	1/4	Box Hinges
5	15/64	13/64	15/64		1	5/64	3/32	1/8	1/4	
6	17/64	15/64	17/64		1	3/32	7/64	9/64	3/8	Piano Hinges
7	9/32		9/32		1	3/32	7/64	5/32	3/8	
8	5/16	17/64	5/16	23/64	2	7/64	1/8	11/64	3/8	Cabinetry
10	23/64	5/16	23/64	27/64	2	1/8	9/64	3/16	1/2	
12	13/32		27/64		3	9/64	5/32	7/32	1/2	Carpentry

☆ Head diameter

Special thanks to McFeely's square drive screws for technical assistance

Illustration by Matt Bantly