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The Best of Christopher Schwarz

5 of our Favorites!

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The Bench Plane System

Monticello's Stacking Bookcases

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This traditional chest provides great shop storage in a small footprint – and it's even better on the road. Plus, it's quick to build.

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Monticello's Stacking Bookcases

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BY CHRISTOPHER SCHWARZ

EDITOR'S NOTE

Always Room for Improvement

When I started to put together this "Best of Christopher Schwarz" collection of articles, I contacted Christopher and asked him what he thought was his best work.

His reply? "I really hope my best stuff is in the pipeline."

That's really what everyone's goal should be, in woodworking and other endeavors – striving for something better, be it learning a new technique or doing something altogether new.

These articles, first published in *Popular Woodworking Magazine* and *Woodworking Magazine*, exemplify Christopher's approach of taking a deep dive into woodworking history to learn old ways that are new to him, coupled with his love of hand tools and traditional techniques for working wood.

His "Dutch Tool Chest," for example, is a traditional form of traveling chest – but Christopher sized the one presented here to fit a "must-have" kit of tools – and he shares options for building it big or small, depending on your needs.

"Coarse, Medium & Fine" looks at what each of the three traditional bench planes is meant to do, then compares those uses with machines meant for the same. Armed with this knowledge, you'll know what tool is right for what job, and when to consider plugging in.

In the stacking bookcase article, Christopher turns to history for the form that housed Thomas Jefferson's books – but shows you how to make in ways practical for use in the modern home.

Plus, you'll discover how the simple hammer and nail can be the right joinery for your project, and learn how to use a handsaw like a master

Good projects and good techniques – coupled with the desire to learn – with that mindset, no doubt the best stuff in the pipeline for all of us.

Michael Wallace

PHOTOS BY AL PARRISH

Dutch Tool Chest

BY CHRISTOPHER SCHWARZ

This traditional traveling chest is faster and easier to build than a floor chest.

Large or small. *To safeguard your tools, both versions of the Dutch tool chest feature fall-fronts with a resourceful and simple locking mechanism.*

Not everyone has the time, materials or skills to build a full-scale traditional floor chest, which can have as many as 100 dovetails and banks of precisely fit sliding trays.

And while I'm a fan of my large English tool chest, I've always been intrigued by the Dutch form, which I first spied in Jim Tolpin's "The Toolbox Book" (Taunton) years ago. And after studying an authentic Dutch example owned by Roy Underhill, I decided to build a pair of these chests, try them out and see how they worked.

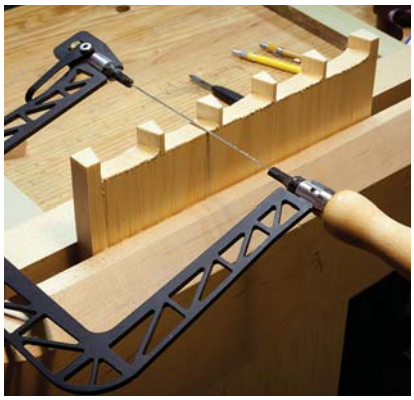
The Dutch chests turned out to be a surprise at every turn. They are simple to build – each took me only two days of shop time, compared to the 40 to 60 hours needed to build a full-size English chest. They required much less material. And, most surprising of all, they were great chests both for the shop and on the road.

Now I won't lie to you, these Dutch chests aren't as sturdy or as good-looking as a quality floor chest. But they are stout enough. And if you are short on time, materials or skills, they might just be the option you are looking for.

Built for Speed

These Dutch chests – one small and one large – are built identically. The only difference is the

PHOTOS BY THE AUTHOR, ILLUSTRATIONS BY ROBERT W. LANG FROM THE AUTHOR'S MODEL



Five easy pieces. *I think five tails on each side will be enough to hold the bottom, even with 100 pounds of stuff in the chest. Cut the joint however you please. I first gang-cut the tails on the sides and cut the pins second.*

Can't miss. *With a batten clamped to the work, even the longest dados (and sliding dovetails) are easy to cut with a handsaw or – shown here – a panel saw.*

Flat, smooth & fit. *A router plane ensures that the bottom surface of the dado is flat. Be sure to remove the bulk of the waste with a chisel. Router planes take small bites.*

large chest has an extra lower compartment. If you have a lot of tools – and I mean a lot – then build the large one. Otherwise, build the small one; it holds plenty.

Made from dimensional pine, the sides of the chest are 1x12s. These are dovetailed to the bottom board. The shelves are dadoed into the sides and then nailed with cut nails through the outside for good measure.

The front and back pieces are all attached to the carcase with screws and glue – if you use a dry softwood, then the wood won't move much in service and wood movement won't be a problem.

The lid is attached to the carcase with strap hinges and falls at a 30° angle. Some written accounts say this angle is to keep rain off the chest; others tout the angled lid as a place to do some paperwork on the job.

The fall-front is the most unusual part of the chest and bears some explanation. The fall-front has two battens that lip behind the bottom lip of the carcase – kind of like a primitive hinge. The front is held in place by a sliding piece of wood that threads through the carcase, through catches on the fall-front and back into a notch in the bottom of the chest.

The result is that when the lid is closed and locked, the fall-front cannot be removed. It's a clever precursor to the locking mechanism of machinists' tool chests.

Start with the Hard Part

After cutting the chest's sides and bottom to length, begin the joinery by dovetailing the sides to the bottom. Cut the tails on the sides and the pins on the bottom – this will make the chest stronger overall – even if the glue fails.

After cutting the tails on the sides, transfer the layout to the bottom and cut the pins on the bottom board, then fit the joints.

Dados for the Shelves

The shelf or shelves for the chest are held in place with 1/4"-deep dados in the sides of the chest. Lay out the shelf locations using the drawings as a guide. I typically cut this joint by hand without a guide for my saw. However, if this is your first handmade dado, this is the easy way to do it:

Clamp a stout batten to the work and your bench that sits right on the line of your dado. Use a crosscut handsaw or panel saw to saw one wall of the dado by pressing the sawplate against the batten.

Don't remove the batten yet. First place the shelf against the batten and scribe the location of the other wall of the dado. Now reposition your batten onto that line, clamp it down and saw the second dado wall. Remove the bulk of the waste between the walls with a chisel and finish the bottom of all the dados with a router plane. Make sure all your dados are the same depth, which will keep your chest square.

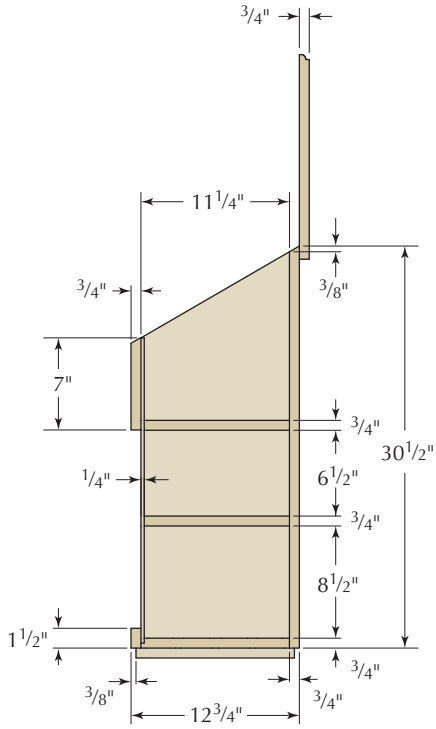
Once the dados are cut, plane the shelves to fit the dados, if necessary.

Saw the Top

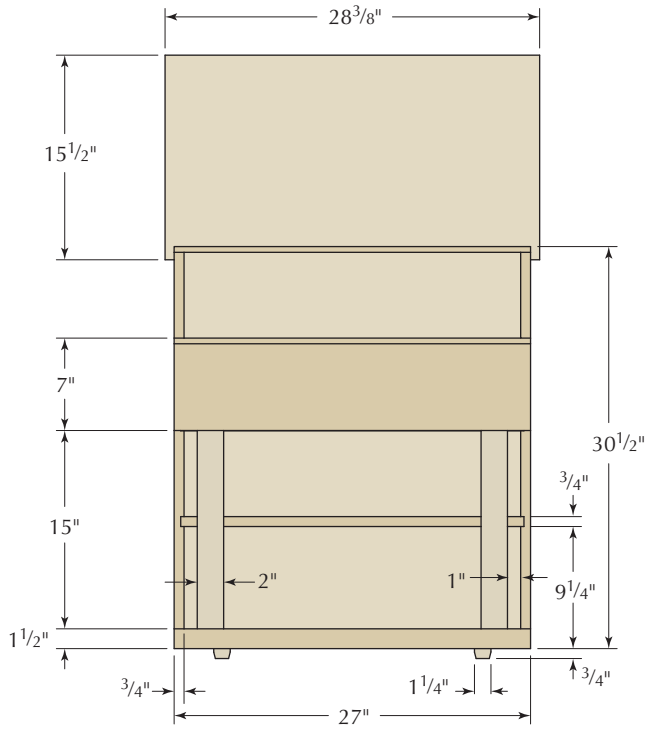
The sides of the chest are cut at a 30° angle. The best way to cut them is to clamp the sides together, lay out the angle and then saw the angle with the pieces sandwiched together. I used a sash saw to make the cut, though any crosscut saw will do the trick.

Once the sawcut is complete, keep the sides clamped together and plane away the sawblade marks. Confirm that your cut is 90° to the faces of the sides – adjust the cut with a plane if necessary.

Keep the rain out. *You can make this saw cut with a batten – like you did with the dados. But try it freehand. This is an easy cut if you start at the far corner and nibble a kerf back toward you – then proceed with power strokes.*



LARGE CHEST – SECTION



LARGE CHEST – FRONT

Lock hardware? *These notches receive the sliding locks that thread through the carcase and the fall-front. Make the notches in the shelves as clean as you can – you'll be looking at them for a long time.*

A screw job. *The backboards, front and bottom lip are all attached to the carcase with screws. This greatly speeds construction.*

Assemble the Carcase

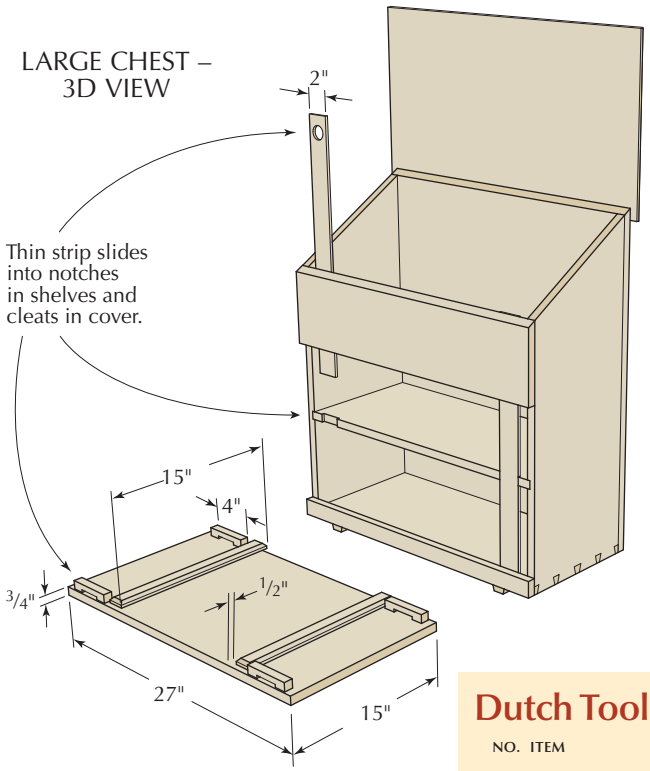
After a quick dry-fit, apply glue to the dovetails and knock those corners together. Then put glue in the dados and drive in the shelves. Apply clamps across the shelves until the glue sets up. Then nail the shelves in place by driving 4*d* (1½") cut nails through the outside of the case and into the shelves. Set the nails. Confirm the carcase is square.

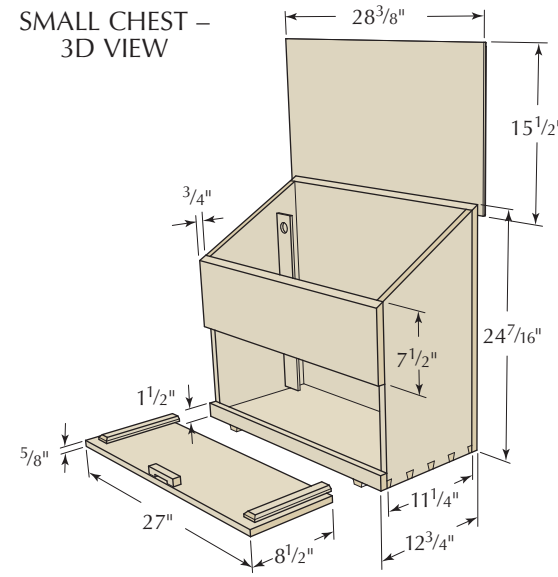
While the case is clamped up, cut the notches that will receive the sliding lock. I used two sliding locks for the large chest and one for the small one. The notches in the shelves are ¼" deep and 2" wide. The notches in the bottom are ¼" deep, 2" wide and cut halfway through the thickness of the bottom. All the notches need to line up vertically for the locks to work.

Saw out as much waste as you can, then chop away the remainder with a chisel.

Once the notches are cut, screw the front, lower lip and back onto the carcase. The lower lip is easy – just glue and screw. The front piece needs a 30° bevel on its top edge to match the 30° on the sides. The backboards should

> "The woodworker can make himself a first-rate craftsman, he can persevere in spite of present difficulties, learning all the time, and enjoy a sense of personal achievement in surmounting them. Because personal achievement is the only answer to the cipher business and the one which a man owes his soul."
>
> —*"The Woodworker," February 1947*





be shiplapped at the least (tongue-and-groove would be better). Then the top board of the back requires a 30° bevel on its top edge. Use No. 8 x 1 3/4" screws for the job.

The last bit of work on the carcase is to add the skids to the underside of the bottom. These disposable strips of wood prevent the bottom from becoming rotten or worn quickly away. Screw the two skids to the bottom about 3" from the ends of the carcase. Bevel the corners of the skids to make the chest easier to drag.

Make the Fall-front

The removable fall-front of the Dutch chest is a cool feature. To make it work, you need to first fit the fall-front in its opening. Then you screw the battens to the backside of the fall-front. The battens do two things: They keep the fall-front flat through the long haul, and they grab onto the lower lip of the case to help keep the chest locked tight.

Screw the battens to the back of the fall-front so they protrude 1/2" beyond the bottom edge of the fall-front. Be sure to ream out the clearance holes for the screws in the battens to allow for a bit of seasonal wood movement.

Dutch Tool Chests

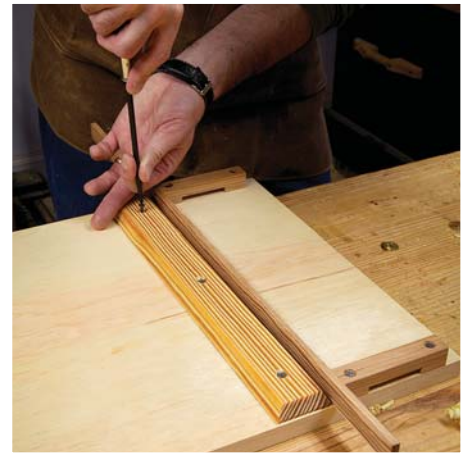
NO.	ITEM	DIMENSIONS (INCHES) T	W	L	MATERIAL	COMMENTS
LARGE CHEST						
❑ 2	Sides	3/4	11 1/4	30 1/8	Pine	
❑ 1	Bottom	3/4	11 1/4	27	Pine	
❑ 2	Shelves	3/4	11 1/4	26	Pine	in 1/4"-deep dados
❑ 1	Front	3/4	7	27	Pine	
❑ 1	Bottom lip	3/4	1 1/2	27	Pine	
❑ 1	Lid	3/4	15 1/2	28 3/8	Pine	
❑ 2	Skids	3/4	1 1/4	12	Pine	
❑ 1	Back	3/4	30 1/2*	27	Pine	
❑ 1	Fall-front	3/4	15	27	Pine	
❑ 2	Panel battens	1/2	1 1/2	15	Pine	
❑ 4	Catches	3/4	3/4	4	Pine	
❑ 2	Locks	1/4	2	23 1/8	Pine	

*Width is composed of several tongue-and-grooved or shiplapped boards.

SMALL CHEST						
❑ 2	Sides	3/4	11 1/4	24 1/16	Pine	
❑ 1	Bottom	3/4	11 1/4	27	Pine	
❑ 1	Shelf	3/4	11 1/4	26	Pine	in 1/4"-deep dados
❑ 1	Front	3/4	7	27	Pine	
❑ 1	Bottom lip	3/4	1 1/2	27	Pine	
❑ 1	Lid	3/4	15 1/2	28 3/8	Pine	
❑ 2	Skids	3/4	1 1/4	12	Pine	
❑ 1	Back	3/4	24 7/16*	27	Pine	
❑ 1	Fall-front	3/4	8 1/2	27	Pine	
❑ 2	Panel battens	1/2	1 1/2	8	Pine	
❑ 1	Catch	3/4	3/4	4	Pine	
❑ 1	Lock	1/4	2	17 1/8	Pine	

*Width is composed of several tongue-and-grooved boards.

That's catchy. *These little wooden bits receive the sliding locks as they slide down through the carcase. The more catches you have, the more secure the fall-front will be.*



Batten down. *The battens are attached with No. 8 x 1" screws. Note how I chamfered the corners of the battens to make them more friendly to fingers.*

Smaller bits. *Here you can see how the fall-front is simpler on the smaller chest.*

Next you need to add the catches to the back of the fall-front that will receive the sliding locks. The catches are 3/4" x 3/4" x 4" and have a 1/2" x 2" notch cut in them to receive the sliding locks. You can add as many catches as you like, though one or two per sliding lock is sufficient.

Once you have the battens and catches screwed in place, you can make the sliding lock pieces. These are 1/4"-thick x 2"-wide pieces of material (I used old pieces of heart pine). Thread them through all the notches and catches to make sure they fit. Cut them to final length so they are flush with the top of the front edge of the carcase. Then bore a 1"-diameter hole near the top of each sliding lock to make it easy for you to slide it out.

Details & Paint

You can trick out the chest as much as you like. I added a bead to a couple long edges. On the front of the fall-front, I planed a 1/8" deep, 1/2"-wide rabbet. On the lid I added a thumbnail moulding around three edges. There really are no hard-and-fast rules.

The lid itself can be fancy or plain. On the large Dutch chest, I screwed battens to the inside of the lid to keep it flat. On the smaller chest I used breadboard ends to help keep the lid flat.

The traditional finish for the exterior is paint. Most of the Dutch chests I've seen have been a chalky blue. I like black chests, so I used a black milk paint – not for its historic correctness but for its durability.

Strap hinges and a hasp will make the lid open and shut – and stay shut if you like. You can make your own wooden chest lifts to attach to the sides or buy metal ones.

Interior Details

The real genius of the Dutch chest is how efficient the interior space is. The bottom compartments are sized perfectly for moulding planes, rabbet planes, plows and generally piling stuff. I don't recommend you break up this space into little compartments. Some Dutch chests would put a shallow drawer in this area, so that's an option to consider.

The top compartment is where you should have a tool rack for your chisels and other pointy tools – these racks are *de rigueur* on Dutch chests. I've experimented with lots of different racks through the years. What I prefer is a rack made from a 1" x 1" stick that is bored with 1/2"-diameter holes that are

For security. *A hasp will keep the lid down and the sliding locks in place. Skip the hasp if you don't travel.*

Fancy or plain. *I made these mahogany lifts from scraps left over from another job. You also can buy simple chest lifts from the home center. You need lifts. Don't skip them.*

on 1⅛" centers. You'll have to widen a few of the holes for your wide chisels, but otherwise, it will hold many of your tools as-is.

The floor of the top compartment is ideal for holding your three bench planes – jack, jointer and smoother – and your three joinery backsaws – dovetail, carcase and tenon. You can divide up the space with ¼"-thick walls that are tacked in place, or use an open floor plan.

The lid of the chest is a great place for holding two panel saws and, with a little creative leatherwork – all your marking tools.

How do you use this chest? I like to park it on a sawbench or chair by the workbench. I lift the lid and let it stay open. This setup give me easy access to all the tools in the chest without stooping.

What is most surprising about the chest is how easy it is to move around by myself. Unlike my English floor chest, I can lift this one easily by myself – it's only 130 pounds when fully loaded. And it fits in any car (even a two-door coupe). The only question mark in my mind about this chest is how long the whole thing will last. And I can promise I will find out – I use this chest almost every week when I'm on the road. **PWM**

Christopher Schwarz is the editor of Lost Art Press (lostartpress.com) and the author of "The Anarchist's Tool Chest."

The open plan. *The lower compartment is typically left open so you can stack or pile tools in as you see fit. I have been happy to leave it wide open because I can get more in there.*

Planes above. *The top compartment is large enough to hold your three bench planes and more – with ample space to add thin walls to keep the planes in place if you care to, and perhaps add a till for backsaws.*

Lid business. *You can cram a lot of stuff onto the lid if you think a little creatively. The saw till is simply made from bits of scrap that are glued together to allow the saw to slide in and out. Then I screwed them to the lid.*

A CASE FOR BLACKSMITH HARDWARE

You can build this chest with almost any strap hinges – new or vintage. It's not a fussy project. But if you want to go all out, I suggest you look in your area for a blacksmith to make strap hinges and a hasp for you.

I used hardware from John Switzer of Black Bear Forge (blackbearforge.com). Yeah, they cost more than the off-the-rack stuff, but they look incredible. — CS

Worth it. *These strap hinges look about 2,000 times better than machine-made hinges. Once you use blacksmith-made hardware, it's difficult to go back.*

ONLINE EXTRAS

For links to all online extras, go to:
- **popularwoodworking.com/oct13**

VIDEOS: *Take a video tour of both the large and small Dutch tool chests.*

BLOG: *Read a comparison of Dutch and English tool chests.*

ONLINE: *Download SketchUp models of the Dutch chest in both sizes.*

TO BUY: *"The Anarchist's Tool Chest," by Christopher Schwarz.*

IN OUR STORE: *"Two-day Tool Chest," a DVD by the author on building an English chest using home-center materials and screws.*

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

Coarse, Medium &

Using bench planes with your machinery will speed your work. But first you must understand how the bench plane system works.

by Christopher Schwarz

Photos by Al Parrish

Too often we hear that hand tools are slow and power tools are fast. Even people who love hand tools talk about how they enjoy handwork because it forces them to slow their work on a project, to ponder the details, to enjoy the smell of the freshly cut lumber and to labor in quiet harmony with the wood.

That's all very bucolic – but it's also a bit ill-informed.

Fine

To my mind, people who think hand tools are slow are either using the wrong tool for a task, or they are people who will work slowly no matter what tool is in their hand. I have found that to become truly efficient at woodworking is to first ignore whether or not the tool in your hand has a power cord or a finely honed blade. Instead, you should make sure that you know whether that tool is a coarse tool for hogging off material, a medium tool for refining and truing the work, or a fine tool that's the last to touch your work.

This classification system – coarse, medium and fine – works for many of the tools of the craft, from sandpaper to hand planes. And putting each tool into its place is the first step toward knowing its true use at the bench.

Once you know what each tool is used for, you'll also be able to figure out which tools (if any) should be used before it and which tools (if any) should be used after it. Plus you'll know – in general terms – how long you should be using that tool before you switch to a finer one.

The net result of this is you will become much faster because you'll always have the right tool in your hand.

To show how this approach works, let's look at surfacing lumber. This coarse, medium and fine system will first help you understand what bench planes are for and then show you how bench planes can be blended seamlessly with powered jointers and planers and other surfacing tools.

First Understand the Bench Plane System

Bench planes are the mainstay of a shop that uses hand tools or blends hand and power tools. Bench planes were designed to make lumber smooth and true before any joinery operations (and before applying a finish).

To surface wood with bench planes, you need three planes: a fore plane, a jointer plane and a smoothing plane. It sounds simple, but the problem is that over the years, hand-plane manufacturers have designed bench planes in many lengths and widths (too many, really), and they have given them misleading numbers. Stanley, for example, numbers its bench planes from the diminutive No. 1 up to the massive No. 8. And there are more than just eight planes in that numbering system (there are Nos. 4½, 5¼, and 5½, too). Do you need all 11 planes? No. Do you need to start working with the No. 1 then progress to a No. 8? Absolutely not. So which planes do you need? Good question. Let's hit the books.

Ignore Some Numbers

What's more important than the model number that's cast into a plane's bed is the overall length of the tool – that's the key to unlocking its function.

And once you understand the plane's intended function, then you'll know how to incorporate it into your shop, no matter what set of tools or machines you own.

In a nutshell, the fore plane is the tool for coarse work, and it does a job similar to a powered jointer and power planer. The jointer plane is the medium tool, and it works like a random-orbit sander, drum sander or belt sander (in the right hands). And the smoothing plane is the fine tool; it does the detail work performed by powered pad sanders, hand scrapers and sanding blocks. So let's first take a close look at these three planes.

Fore Planes: Rough & Ready

Fore planes are between 14" and 20" long and are so named because they are the planes that are used "before" the other hand planes. They are the "coarse" tool – the roughest of the bunch. They require more strength and stamina to use than any other hand tool, and I use mine as little as possible now that I own a powered jointer and planer.

In the Stanley numbering system, the No. 5 (14" long and commonly called a jack plane) and the No. 6 (18" long) planes qualify as fore planes.

The fore plane is used to rapidly take a bowed or cupped board to a state where it's reasonably flat. Fore planes don't take a fine shaving. They take coarse curls of lumber so the work gets done quickly. Their middling length is an advantage. They are long enough so that the sole touches a lot of the surface of the board. This helps you true the face of the board more easily and prevents you from overshooting your mark – turning high spots into deep valleys by accident. (Why are scrub planes so short, then? I think these 10"-long tools were used more for hogging wood off edges or for localized work – but that's another story.)

Like a powered planer, the fore plane produces thick curls so it can rapidly reduce a board in thickness. Shown is my crusty-but-trusty Stanley No. 5 (some people call this a jack plane) and my sweet Scioto Works 16" wooden-stock fore plane.

If the length of the fore plane is an asset, why not make them really long? Working with fore planes is strenuous, so having them shorter and lighter makes them easier to handle than a longer plane. Whenever I use my fore plane, I marvel at its perfection of design. It's exactly long enough – but no more.

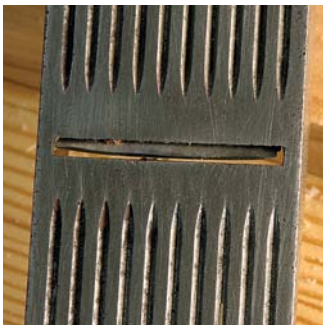
Once you know that the fore plane is for roughing, this also tells you how to set up the tool for use. The flatness of the sole isn't a concern for rough work. If the sole looks flat and the tool won't rock when the tool is flat on your bench, you're in good shape.

I wouldn't recommend you spend hours flattening the sole of your fore plane so you can take .001" shavings. Save that drudgery for another plane (or avoid the drudgery – more on that later).

My metal fore plane is a sorry old Stanley No. 5 with a handmade tote that looks like it was fashioned by a blind beaver. The tool is rusty in spots. The sole's flatness is questionable – but it works like a dream.

Back to set-up. Because you want to remove thick shavings, open up the mouth of the tool and make the tool easy to push by cambering the tool's cutting edge. A fore plane with a blade sharpened straight across (like you would with a chisel or block plane) can be quickly immobilized by a tough patch of wood. And the cambered iron (I like an 8" radius) helps reduce tear-out because there are no corners digging into the wood. If your plane has a chipbreaker, set it so it's back at least 1/16" from the corners.

Fore planes are pushed diagonally across a board's face. Work diagonally one way across the face, then diagonally the other. Check your progress with winding sticks. Working diagonally will generally get you where you need to be, but if there's a persistent high spot, work at it selectively with the fore plane. The goal is to get the board flat and almost to your finished thickness – as close as you dare.



Fore planes need a wide-open mouth to pass the thick shavings they produce. A tight mouth will clog and slow you down.

Working diagonally is the key to using the fore plane. The diagonal motion reduces tear-out and assists in truing the face.

A silhouette of the shape of my fore plane's cambered iron. It's an 8" radius, which allows me to take an almost 1/16"-thick shaving in softwood.

Cambering the iron on a fore plane is a task best handled on a bench grinder.

Jointer Planes: Join the Flat-World Society

When the work is nearly flat and nearly to finished thickness, fetch your jointer plane – sometimes also called a try plane. Jointer planes are tools with soles 22" long or longer. Longer is better in the world of jointer planes. In the Stanley system, the No. 7 (22" long) and the No. 8 (24" long) are the jointers. Wooden-bodied jointer planes can be much longer.

The jointer plane is the "medium" tool. It brings the surface of the board to a state where joinery can be performed. Jointer planes take a finer shaving than the fore plane, but nothing that would be called gossamer. I generally go for a shaving that's about .006" thick. That's about the thickness of two or three sheets of typing paper. The length of the jointer plane is its greatest asset. When you can push a jointer plane across the entire surface of the board and remove a full-width, full-length shaving from every point, the board is quite flat (flatter than most machinery can

Winding sticks (I like aluminum angle) exaggerate any warp or high spots on the board's face. View the winding sticks so they are in line with one another.

A jointer plane's major asset is the length of its sole. The longer the sole, the flatter your board will become. Shown is a Lie-Nielsen No. 7 plane (left) and the Veritas bevel-up jointer. The jointer I covet (not shown) is the Clark & Williams jointer, which can be as long as 30".

get it, I've found). The plane's sole rides over the valleys of a board and flattens the hills. When the hills are the same level as the valleys, you're done.

If this tool is so accurate, why not begin work with a jointer plane and skip the fore plane? Though a .006"-thick shaving sounds like a lot, it's not. With rough-sawn wood, you could work one face all day with a jointer plane – a fore plane can remove much more wood in a hurry. And the jointer planes are more unwieldy. I'd much rather push my fore plane, which weighs less than 5 lbs., for a lot longer than my No. 8, which weighs 10 lbs.

Because the jointer plane is a precision instrument, it requires more attention than its coarser, shorter cousin. The sole should be reasonably flat. There's been a lot written about this topic, but the bottom line is that the tool must work – that's its true test. Can you flatten the sole of an old metal jointer plane yourself? Perhaps, but I can't. Though I've flattened the soles of many planes, I end up making jointer planes worse. There is too much cast iron to work with there.

And that's why I recommend you spend a little money when buying a jointer plane. In fact, if I had to buy only one precision plane, it would be a toss-up between the jointer plane and the smoothing plane. There's a good argument for buying a premium metal jointer plane and a vintage wooden-soled fore plane and smoothing plane. Then you could use the metal jointer to true the soles of the two wooden planes.

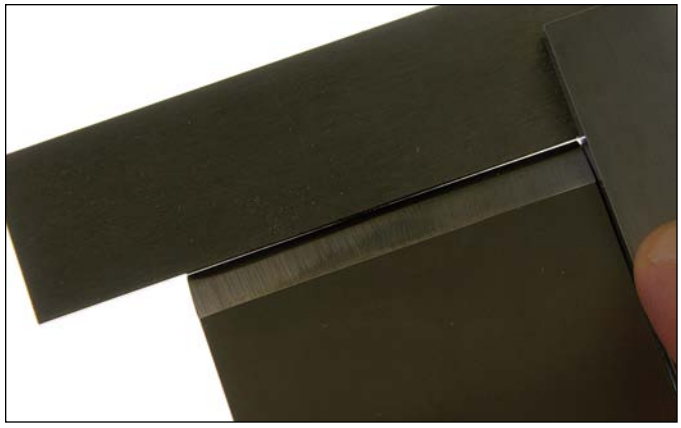
No matter which jointer plane you acquire, the setup is similar. Some historical texts recommend an iron sharpened straight across, but I prefer a slight camber to the cutting edge, which is also historically correct – it depends on who you read. The camber should be much slighter than the curve on your fore plane. I like a curve that allows a .006"-thick shaving that's almost the entire width of the iron. Practice will get you where you need to be.

The mouth needs to be fairly open to pass this shaving, but there's no need for a gaping maw. Keeping the mouth fairly tight can reduce tear-out. And though the jointer plane isn't generally a finishing plane (that's the job of the smoothing plane), reducing tear-out will make less work for the smoothing plane. The chipbreaker needs to be somewhere between 1/16" and 1/8" from the cutting edge in my experience.

When I work a board's face with a jointer plane, I tend to work in the direction of the grain – not diagonally like with the fore plane. However, when I'm flattening a

There are lots of ways to get the proper camber on the iron for a jointer plane. Shown is the Odate crowning plate from Powell Manufacturing – essentially, it's a diamond sharpening stone that's concave in the middle.

The mouth of the jointer plane is a fine balance. You want it open enough to pass a fairly thick shaving, yet tight enough to limit tear-out as much as possible.



A silhouette of the shape of my jointer plane's cambered iron. I placed a feeler gauge on the end to see how far back the corners were swept: it's .005".

On narrower cabinet components, the jointer plane works along the grain. Skewing the tool slightly during the cut makes it easier to push and does assist in flattening. One wider panels – say 14" and wider – I'll begin with a few diagonal passes before switching to long-grain ones.

Smoothing planes are the elite (and most demanding) planes in your shop. Shown is a Lie-Nielsen No. 4, a Veritas bevel-up smoother, a wooden-bodied Clark & Williams smoother, and my most guilty pleasure: a custom-made plane by Wayne Anderson (bottom right). Yes, it's a smoothing plane, too.

Smoothing planes remove wispy shavings and prepare a surface for finishing.

big tabletop, a largish panel or my benchtop, I'll begin with diagonal strokes. This helps keep a larger surface in true.

As you start to work, the first pass or two should produce irregular shavings as you remove the high spots left by the fore plane. After a few passes, long and wide shavings should emerge from the mouth. When this happens all the way across a board's width, you are ready to work the other face of the board.

If you're surfacing the board entirely by hand, use a marking gauge to scribe the finished thickness on all four edges of the boards and work that rough face with the fore plane almost to the scribe line. Then true the second face with your jointer plane.

This is the point at which I'll typically perform joinery on the piece (with some exceptions). If you proceed to the smoothing plane before you cut your joints, you can make more work for yourself in the end.

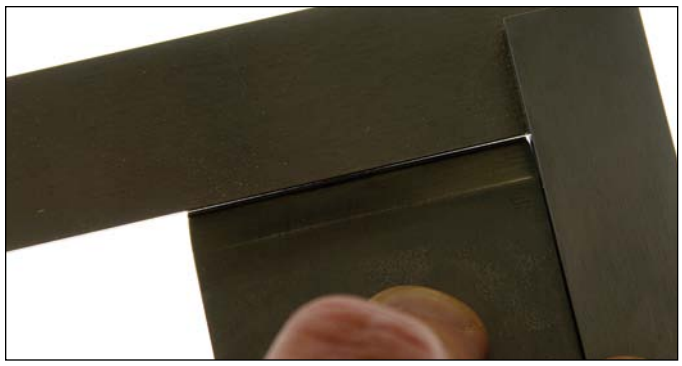
That's because joinery can be hard on a board. You'll mark it up with the typical shop bruises from cutting and clamping. When the joinery is complete, I'll generally assemble the project and then smooth the exterior – if possible. Sometimes you have to go to the smoothing plane before assembly. Experience will be your guide.

Smoothing Planes: An Addiction for Some

The smoothing plane is the tool that usually hooks woodworkers into hand tools. They're the "fine" tool in the troika of hand planes and they produce gossamer shavings and leave shimmering surfaces. I like my smoothing planes, but if I've done a good job with my other planes, the smoothing plane should see only a little use.

This is a good thing because it saves you on sharpening and setup. Fore planes are the easiest

The mouth of a smoothing plane should be as tight as possible. This requires tweaking and experimentation. Once you get the mouth set, however, you shouldn't have to change that setting.



A silhouette of a smoothing plane iron. The camber is slight: .002" or maybe a little more.

tool to set up and sharpen (they don't have to be surgically sharp), jointers take a little more work in both departments and smoothing planes are the trickiest tool.

Smoothing planes require a cutter with a gently curved super-sharp cutting edge, a fine mouth, perfect alignment of the cutter in the center of the mouth and a lot of other fine tweaks that demand fussing, fussing, fussing. So if you're using your smoothing plane as little as possible, then you're also spending less time tweaking and more time woodworking.

There are a lot of sizes of smoothing planes, but in general they are 7" to 10" in length. The Stanley No. 4 is the most common size at 9" long with a 2"-wide cutter. The bigger planes, such as the No. 4½, are suited for larger-scale work, such as dining tables. The smaller planes, such as the No. 3, are suited for smaller work, such as narrow door stiles and rails.

The smoothing plane needs to take a fine shaving, anywhere from .002" thick down to stuff that cannot be measured. So you need the sole to be as flat as possible to consistently take this shaving. You can try to tune the sole of your smoothing plane, or you can do what I do – let someone who knows what they are doing handle this job with a surface grinder. If you purchase a nice hand plane from Veritas, Lie-Nielsen or Clifton and the sole is out of whack, then send it back. You shouldn't have to flatten the sole if you pay more than $175 for a plane.

The powered jointer (above) and planer (right) are faster than a fore plane (though they won't burn as many calories during use).

Other considerations: The mouth needs to be as tight as you can get without it clogging with shavings. The chipbreaker needs to be set near the cutting edge. I like less than 1/16" – as close as I can get without clogging. And the iron needs to have the slightest camber, just a couple thousandths at the corners. I achieve this by applying selective finger pressure at the iron's corners while sharpening. I also find that smoothing planes are the place to lavish your sharpening skills. To get the edge as perfect as you can, polish it up to the highest grit you have available. In my experience, sharper edges reduce tear-out as much as a tight mouth or the pitch of the blade (higher pitches reduce tear-out but make the tool harder to push).

When working with a smoothing plane, make passes parallel to the grain of the board, making sure that your strokes overlap slightly. Work from the edge of the board near you across to the far edge. Your first strokes will remove the high spots left by the jointer plane and your shavings could look inconsistent. Once you make a couple passes across the face, you should be able to get full-length shavings that are as wide as your blade allows. When this occurs and the board looks good, put down the plane. Clean up any localized tear-out with a hand scraper.

If necessary, I'll make a few strokes with #220-grit sandpaper to blend the planed surfaces with the scraped ones. This should take only a few strokes.

Hand scrapers and sanding blocks are an accepted and historically accurate way to prepare a piece of wood for finishing.

What This Means: Blending Hand and Power

Armed with this understanding of hand planes, you can now unlock an important secret. Almost all of our power tools can be classified as coarse, medium or fine tools – just like the hand planes used for surfacing wood.

Think about your powered jointer and planer as coarse tools, like the fore plane. Their job is to remove lots of stock in a hurry. But their surface needs to be refined before finishing (unless you build only chicken coops).

What are the medium tools? I classify large random-orbit sanders, belt sanders and drum sanders as medium tools. They remove the marks left by the coarse machining process and can indeed true a board when wielded by a skilled user. Some people are satisfied to stop at this phase – and truth be told, I'll sometimes stop after using my jointer plane when building something intended for the shop or for pure utility.

But most power-tool woodworkers go a step further. They scrape and hand sand to remove the scratches left by random-orbit

A drum sander (left) can level and true a panel much like a jointer plane. A random-orbit sander (above) is ideal for removing machining marks in a power-tool workshop.

sanders and pad sanders – the so-called pigtails you see on so many furniture-store pieces. In the power-tool world, these hand tools are the "fine" tools.

Once you classify your power tools, you can use them in conjunction with your hand tools. Let's say that the only bench plane you own is a smoothing plane. When should you use it? First joint and plane your stock (a coarse operation). Get it as true and flat as possible with your drum sander or belt sander (that's medium). And then finish things up with the smoothing plane, scrapers and sandpaper (fine).

This information can also be used to guide your tool purchases. What plane should you buy at the flea market if you don't own a powered jointer or planer? (A fore plane.)

Here's how I personally blend power and hand tools in my shop. My coarse tools are my powered 8" jointer and 15" planer. Though I own two fore planes, I use them only when a board is too wide for my powered equipment.

Once the coarse stuff is over, I use my jointer plane to true my stock before cutting my joinery. This medium tool removes snipe and machine marks, and makes the boards flatter than my power equipment can. Finally, my smoothing plane is my primary fine tool, although I scrape and hand sand, too.

It's important to use the tools in the right order (start with coarse; end with fine) and that you don't skip any steps between. Skipping wastes time. It's frustrating to use a fine tool right after a coarse tool. Try using a smoothing plane on a larger board that's fresh from your powered planer. Then use a smoothing plane on a board that you first dressed with your jointer plane. You'll notice a significant difference.

The other important idea is to work as long as you can with the coarse tool. You wouldn't remove 1/16" of a board's thickness with a random-orbit sander. So don't use your jointer or smoothing planes to do that, either. This is a common error and is one way hand tools get a reputation as slow.

One last thing: I don't use hand tools because of a romantic obsession with the past. Once I adopted this system of coarse, medium and fine, I became faster, my joinery became tighter (because my boards were perfectly true) and my finished results looked better.

And once you understand how coarse, medium and fine works with surfacing lumber, you can apply the idea to other workshop processes. Here's a hint at the possibilities: When cutting curves, the coarse tool is the band saw, the medium tool is the rasp and the fine tool is the spokeshave. And there's more. A lot more. **PW**

SOURCES

Anderson Planes
763-486-0834 or
andersonplanes.com

Old Street Tool
479-244-0734 or
planemaker.com

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

Veritas (Lee Valley Tools)
800-871-8158 or
leevalley.com

The concept of coarse, medium and fine works with other operations as well. For cutting curves, think of your band saw as the coarse tool, your rasp as the medium tool and your spokeshave as the fine tool.

Monticello's Stacking Bookcases

BY CHRISTOPHER SCHWARZ

Thomas Jefferson's book boxes became the foundation of the Library of Congress.

I like to think of Thomas Jefferson's personal library as America's first "bookmobile."

When the British burned down the nation's capitol in 1814, the inferno took with it many of the books owned by the government of our young nation. Lucky for us, Jefferson had a personal library of about 6,700 books – an astonishing accomplishment for the time.

And after some negotiations, Jefferson agreed to cede his entire library at Monticello to Congress for the sum of $23,950. The question was, how to transport 6,700 books from Virginia north to Washington, D.C., with horse-drawn wagons.

Lucky for us, Jefferson was a clever man. He stored his precious library in pine boxes that were designed specifically to travel. While it isn't known if Jefferson designed the book boxes (or "book presses" as they are sometimes called), they do bear the mark of his cleverness.

For when the day came to transport this massive chunk of knowledge, the process was straightforward. Scrap paper was stuffed among the books to protect them, then a lid was nailed over the front of each unit and it was loaded onto a wagon and carted to Washington.

Jefferson's collection of books (which continues to make headlines even today) was the foundation for our Library of

Stacked to move. *This modular system of stacking book boxes allowed Thomas Jefferson to easily expand and move his enormous library.*

LEAD PHOTO BY AL PARRISH; STEP PHOTOS BY THE AUTHOR; ILLUSTRATIONS BY ROBERT W. LANG

Congress. His method for organizing his books (memory, reason and imagination) pushed us into a more modern classification system. Until that time it was common to organize books by height or color.

But What About the Boxes?

While a good deal is known about the books in Jefferson's collection that he sold to Congress, far less is known about the stackable boxes that he used to store his library at Monticello. By examining the written records, officials at Monticello built six bookcases for the museum in 1959 that are a good guess at what would have housed Jefferson's library (though he could have had as many as 20 of these units, if you do the math).

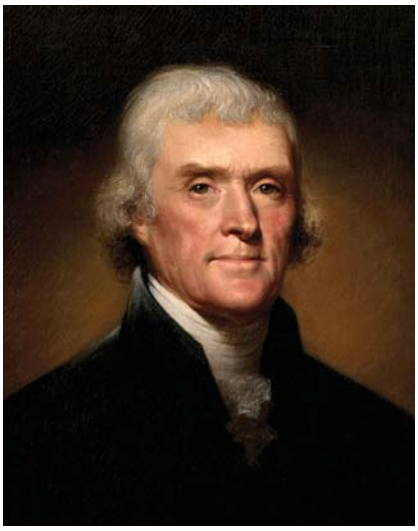
Since the day I started woodworking, I have been concerned about amassing information on the craft. For me, the written word enhances my personal experience in the shop, and it is a way to stay in touch with the craft while I am on the road, in bed or sitting on the couch.

As my library got out of hand sometime about 2005, I decided I needed to build something to store all my woodworking books. I also wanted something that would allow them to be easily transported when my wife and I leave our house after the kids are off to college, and we launch the next phase of our lives.

And so I became interested in Jefferson's book boxes. I read the original letters that describe how the books were transported. I used the standard measurements for books of the day to help fill in the blanks when it came to designing the three different case sizes Jefferson describes in his correspondence.

Oh, and what was the joinery on these boxes? Who knows. Perhaps the boxes were nailed together, as there were as many as 150 individual book boxes to hold the nearly 6,700 books. But I prefer to think that our third president, who was familiar with the principles of joinery, would insist on something more substantial.

And so, despite the fact that no surviving examples of these book boxes exist, I built each of these units using through-dovetails with mitered shoulders at the corners. The backs are shiplapped and nailed on to the carcases. This approach to building a box is typical for the time, and I bet that my modern book boxes would easily survive a wagon journey from Monticello to Washington, D.C.



The designer? *While we might never know if Thomas Jefferson designed these book boxes, he designed many clever devices at Monticello.*

"I cannot live without books."
— Thomas Jefferson (1743-1826)
in an 1815 letter to John Adams

A Discussion of Sizes

After researching Jefferson's book boxes and the history of 18th-century publishing, I found that these original book boxes would not be as friendly to the modern library. The largest book box is taller than necessary, and the smaller two boxes are shallower than necessary for some modern titles that are squat. But I decided to build my book boxes to suit old books – you can alter yours as you see fit.

Here are the old dimensions. Jefferson said the bottom cases were 13" deep, the middle cases were 6¾" deep and the top cases 5¾" deep. As to the heights, we can turn to the standard sizes of books at the time (according to the American Library Association). The lower cases were designed to hold "quartos" and "folios." A folio is 15" high x 12" deep. A quarto is 12" high x 9½" deep (the typical size of a modern woodworking book).

The middle cases were designed for "octavos," which are 9" high x 6" deep. The top cases were for "duodecimos," which are 7⅜" high x 5" deep.

So I designed the three different book boxes around these three sizes. As I mentioned above, the lower cases are a little taller than necessary, and the middle cases are a little shallow. But it actually works, and I like the way the boxes step gracefully up my wall.

About the Joinery

I chose to use through-dovetails with mitered shoulders at the corners. This was the same joint the joiners at Monticello used in the 1959 reproductions of the book boxes. I like this joint because it dresses up the front edge of each box with a miter. Also, it is strong and easy to make. Yes, you read that right: easy to make.

You might be wondering if you can cut a mitered through-dovetail joint. The answer is: Yes. It is as easy as a regular through-dovetail, once you let go of your fear of miters and cut the joint freehand and use the joint's natural compression to help you fit it so it's airtight. Of the 24 mitered dovetails in this project, only one is less than airtight. And it was the first one I cut.

The rest of the joinery for these boxes is cake. The ½"-thick backs rest in ½" x ½" rabbets cut into the end pieces and are nailed to the top and bottom of the boxes, which are ½" narrower than the end pieces.

The only other thing to build is the plinth that supports the book boxes. Jefferson's papers don't mention a plinth, but the joiners at Monticello in 1959 built plinths for their cases, and I think it's a fine idea.

The profile I chose for the plinth is a typical late 18th-century foot that you can find on furniture made in both the North and South of the United States. Feel free to select another profile for your plinth, especially if your bookcases will reside in a more modern setting. After all, when old furniture started to look unfashionable, the owners would change the plinth and the hardware to update it. So you can alter your plinth to reflect Shaker, Arts & Crafts or even Scandinavian aesthetics. It's your library.

Worth the effort. *I dressed the concave face of my wide boards with my jack plane then ran them through my powered planer. By jacking one face before planing the other, I avoided having to rip the boards down and re-glue them.*

Building the Shelves

These shelves are 48" long without any center supports. This sounds like a recipe for sagging. But if you nail in your back pieces (which add strength) and use beefy, 7/8"-thick stock, you will find that your book boxes are nigh on indestructible.

You could get away with 3/4" stock throughout without too much of a visual compromise, so don't think that you have to find 4/4 rough stock to build these shelves.

Begin by dressing all your stock to thickness. I was lucky enough to score some Eastern white pine boards of unreasonable widths. So I had to dress the boards for my bottom cases by hand before I could run them through my powered planer.

After dressing my stock to size, I cut a shallow rabbet on the ends of the tail boards. This rabbet is 1/16" deep and the width of the mating pin board. This shallow rabbet makes it quite easy to mate up the two pieces when transferring the marks from my tail board to my pin board.

If I had only a couple boxes to build, I'd make this rabbet with a moving fillister plane. But because I had 28 of these rabbets to cut, I set up a dado stack in my table saw and cut them all using the table saw.

While this might seem like a no-brainer technique, it requires finesse. You need to really press the top of your work hard against the table when making these rabbets. Anything less, and the rotation of the cutterhead will lift the work off the table. No lie.

Under pressure. *Press the stock down hard to ensure that the cut is consistent across the width of your boards. The dado stack will try to turn your board into a hovercraft. Don't let it. Press down.*

With all your shallow rabbets cut, you can cut the 1/2" x 1/2" rabbets in the inside back edge of the end pieces. I again use a dado stack for this.

Now you can begin to lay out your dovetail joints. This is tricky to explain, but once you cut one mitered dovetail joint, you will laugh loud and hard. It's flipping easy. If you are skeptical, then please give it a try using some scrap first, then you can come crawling . . . .

Tail Layout

When you lay out a traditional through-dovetail joint, you will lay out a number of full tails on the tail board. The pin board has full pins – plus half-pins at the ends. Not so with this project.

Because of the miters, the tail joint at the front of the case has one of its corners that mutates into a miter. It looks like a half-pin in one direction and a full tail from another. I know, I know. It seems confusing. Stick with me.

At the rear of each case, I used a half-tail at the back edge so that I could easily conceal the backboards with simple through-rabbets. The half-tail conceals the 1/2" x 1/2" rabbet on the inside back edge. As a result, the completed end pieces look a little weird to the traditional eye. But you'll get over it.

So here's how you should proceed: Figure out a tail width at the rear of the case that will hide the backboards and remain strong. Lay out that tail.

At the front of the case, things are a little more complicated. The miter should begin 3/8" from the front edge. So mark a line 3/8" from the front edge of your tail board. Make this mark on the end grain. But don't mark it down the face grain of the outside face of your tail board, which would be typical. Instead, make this sloping tail mark on the inside face of the board. It's weird, I know. But do it.

Lay out the rest of your tail cuts between these two tails, leaving a gap between your tails that is about 1/8" wide at the top.

Now make your tail cuts with a dovetail saw. When you are done with one face, it should look like you have a board with two half-tails at either end. Turn the board around so the rabbeted face is facing you. Take your dovetail saw and make the compound cut at the front of the case that defines the face of the miter. This cut is 45° to the front edge. It looks tricky. It ain't. If you can see the line, you can cut the line.

Now position the board so the front edge of the corner faces the ceiling. Take a miter square (or your combination square) and use it to lay out the miter from the tip of the case to the baseline. When I mark this miter, I use a thin-lead (.3mm) mechanical pencil.

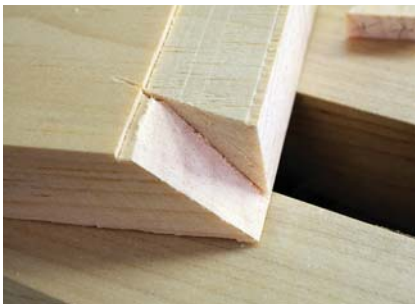
Cut this miter freehand to free the waste at the front of the corner. You'll need to angle the saw at 45° to make this cut. Again, try this once on scrap and you will be a pro.

When that waste has fallen away you can clear out the waste between

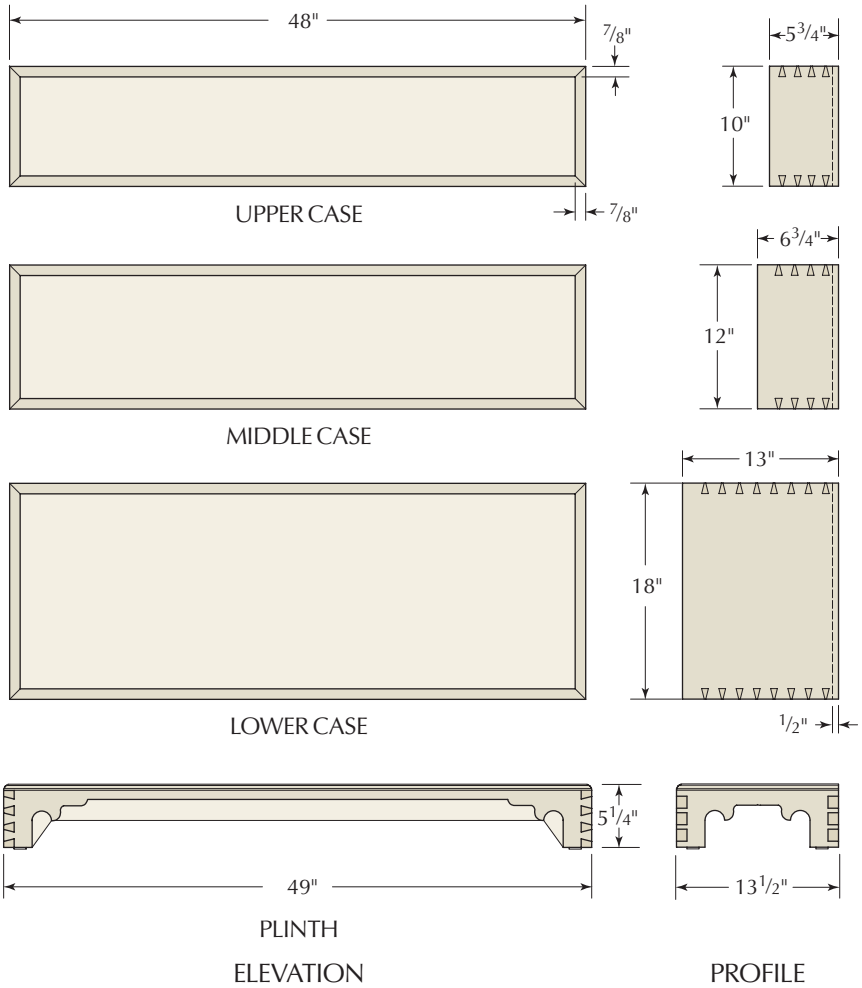
Here's the deal. *You can see almost all the trickiness here. Note how the tail on the left doesn't go through the face of the board, so it looks like a half-tail. On the right, you can see how the half-tail conceals the rabbet for the back.*

An inside job. *Turn your tail board around and cut the front tail on the inside of the corner. It's a 45° cut.*

Slice the wacky waste. *Then turn the board on its side and saw the miter on the front edge. This looks like a complex cut, but just follow the line. It makes sense when the waste falls away.*



The result. *See? Here's the miter at the front, which intersects the sloping tail. Once you see it, you'll get it.*



Monticello Book Boxes

NO.	ITEM	DIMENSIONS (INCHES) T	W	L	MATERIAL
LOWER CASE					
❑ 2	Ends	7/8	13	18	Pine
❑ 2	Top & bottom	7/8	12 1/2	48	Pine
❑ 1	Back	7/8	18	47 1/2	Pine
MIDDLE CASE					
❑ 2	Ends	7/8	6 3/4	12	Pine
❑ 2	Top & bottom	7/8	6 1/4	48	Pine
❑ 1	Back	7/8	12	47 1/2	Pine
UPPER CASE					
❑ 2	Ends	7/8	5 3/4	10	Pine
❑ 2	Top & bottom	7/8	5 1/4	48	Pine
❑ 1	Back	7/8	10	47 1/2	Pine
PLINTH					
❑ 2	Ends	7/8	4 3/4	13 1/2	Pine
❑ 2	Front & back	7/8	4 3/4	49	Pine
❑ 1	Interior support, front	3/4	3	47 1/4	Pine
❑ 2	Interior support, ends	3/4	3	11 3/4	Pine
❑ 4	Glue blocks	1	1	4 1/8	Maple
❑	Moulding	1/2	1/2	72	Pine

the other tails. I use a coping saw. But feel free to bang it out with a chisel.

Pin Layout

When the waste is clear, you need to transfer the pattern of the tail board onto the pin board. The shallow 1/16"-deep rabbet makes this a cakewalk. Clamp your pin board upright in a vise. Place the tail board's rabbet on top of the pin board and press the two together. When the two are mushed together, trace the shape of the tail board onto the pin board with a marking knife.

The little mitered section at the front is tough to get a spear-point knife into. Depending on the acuteness of the tip of the knife you can do a fine or a lousy job. Do your best and then "infer" (read: guess) the remainder of the slope with a ruler and a knife.

With the lines marked out on the end grain of the pin board, I take the extra step of dropping those lines down the face of my pin board to my baseline. It slows me down, but it's a habit I have yet to break from my first dovetail class.

Slice all the pins with your dovetail saw. But before you remove the waste between the pins, cut the miter at the front of the pin board.

Clamp the pin board on its side and lay out the miter from the tip of the board to the baseline – just like you did with the tail board.

Saw the pins and remove the waste between the pins using a coping saw and chisel. Then saw the miter (on the waste side) freehand. If you are sloppy, clean up the cut a bit to the line with a shoulder plane.

Tails, meet pins. *I have my tail board resting on a scrap to keep it in position as I press its shallow rabbet against the pin board. Knife in the joint. Use light strokes at first, followed by heavier ones.*

Fit & Slice

When you have the pins and tails cleaned up to your satisfaction, it's time for the fun part: fitting the miters.

Drive the tail board onto the pin board. What is likely to happen is that the tails will seat everywhere but up by the miter. The miter is what is preventing the tail from landing home at the bottom of the pin socket.

When the parts are driven together, they will generate some pressure right at the miter – a good thing. Place the joint on your workbench so the miter faces the ceiling. Take a thin-kerf saw and cut through the miter freehand.

Yes, you read that right. Saw through the miter freehand.

The set of the teeth will remove the excess wood on either side of the saw plate. As you saw, you should feel the wood pinch the blade. Keep sawing. When you reach the bottom of the joint, slide the saw out and the miters should draw closer together. The evidence of this will be that the tail will seat more deeply in the pin socket.

If the miter is tight and the tail is fully seated, you are done. If the tail isn't fully seated, saw through the miter again.

Sometimes the pressure from the joint isn't enough to pull the miters together as you are sawing. If this happens, clamp the joint and then saw it.

Make all the boxes using these techniques. Yes, it takes some time, but by the end you'll be able to make this joint without hesitation, and it's a fine one to have in your arsenal.

Needs a fit. *You can see how the tail isn't fully seated in its socket. The way to fix that is to saw through the miter.*

Saw right through. *Use a thin-kerf saw and cut right through the miter. The joint might pinch the blade a bit. That's OK. It means the process is working.*

More wacky miters. *Here's the completed pin board layout, with the waste marked with "X"s. Clear out the waste between the pins, then cut the miter.*

The pin board result. *This board looks a little more straightforward than the tail board. It's basically a standard-looking pin board with a miter cut on its front edge.*

The Backs

The backboards for these boxes are nothing more than 1/2"-thick pine boards that are shiplapped, beaded then nailed on the back of the boxes after the bookcase is finished. You can make your backs now or later.

The Plinth

A traditional plinth looks delicate but will support the entire weight of the book boxes above without any problem. The trick is to design it correctly.

The corners of the plinth should be dovetailed before you cut the scroll-

work to create the feet. If you cut the scrollwork first, the plinth boards will be too fragile for dovetailing.

After dovetailing the corners, trace your foot design onto the front, back and ends. I drew my shape freehand and it was based on a typical design of the period. Once the shapes are laid out, cut the scrollwork and clean up the saw cuts with rasps or an oscillating spindle sander.

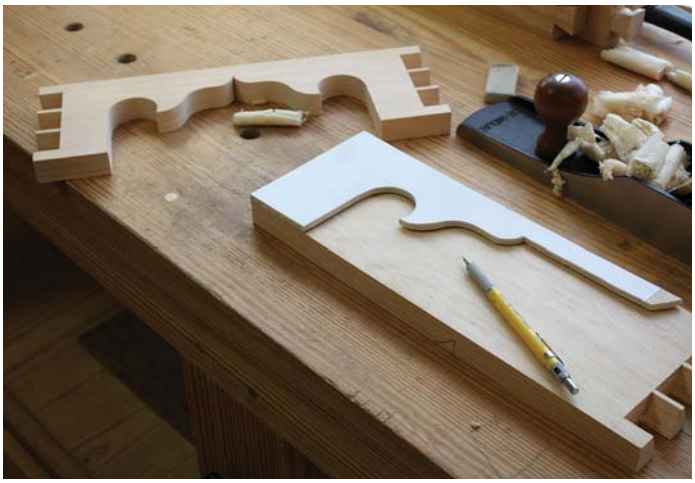
Assemble the four plinth pieces with glue, clamps and lots of care. This is when the pieces are fragile. I destroyed one foot while clamping things together. Luckily, I was able to glue it back on.

With the outside of the plinth complete, work on the inside guts that offer brute strength. I glued a mitered three-sided frame inside the plinth to give it strength. I used 3"-wide boards that were scrap. Really, anything wider than 2" will be fine here.

Once you glue in the mitered frame, flip the plinth over and glue in 1" x 1" maple blocks in the corners. These glue blocks reinforce the corners of the plinth and carry the weight of the entire bookcase. When made properly, the maple blocks should extend 1/8" from the bottom of the plinth.

Moulding & Finishing

Trim all the dovetails and prepare the plinth, backs and book boxes for finishing. When that is done, place the lowest book box on the plinth and glue and nail a small moulding around the lowest case. I use a small square ovolo profile here, which matches the period.



Trace, cut, shape. *The plinth design is where you can alter the design to suit your house. Like Shaker stuff? Look at Shaker feet and draw something similar on your feet.*

Clean the corners. *I use a block plane to dress the long straight run on the front. But when it comes to the corners, a chisel plane is handy for getting right up against the scrollwork.*

To finish the bookcases, I applied two coats of orange shellac, followed by one coat of dull-sheen lacquer. The versions at Monticello are dark brown.

After the finish was dry, I nailed on the backboards using clout nails then stacked the book boxes in place on top of the plinth. To keep the boxes from sliding around, I screwed each box to its neighbor using #8 x 1 1/4" wood screws. And to keep the bookcase from tipping forward should a toddler attempt to scale it, I attached the whole thing to the wall with an anti-tipping kit.

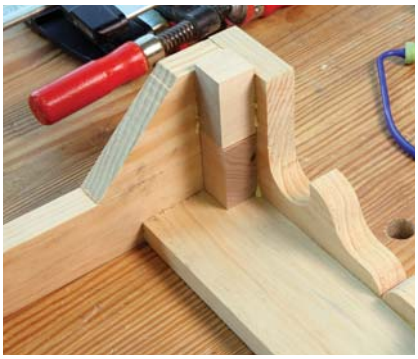
Then came the best part—loading the bookcase with my woodworking books. These book boxes added 24' linear feet of storage for my books, which have been piling up in my office.

But joy turned to defeat. I have more books than I thought. When loaded, this case holds only half my books. I need to build a second set.

Hmmm, perhaps Jefferson's book boxes were just nailed together. PWM

Chris is editor of this magazine and the author of several woodworking books, including "The Workbench Design Book" (Popular Woodworking Books). He also writes a daily blog for our web site and spends entirely too much time with his nose in books.

Miters that won't show. *This will be covered by the lower case and moulding, so it doesn't have to look pretty. It just has to be strong.*



Glue blocks. *These maple blocks do almost all the work. They are 1/8" proud of the foot of the plinth and support all of the weight of the book boxes. They also strengthen each corner to protect them from swift kicks.*

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Build Furniture With a Hammer

Far from a crude implement, a good hammer is a wonder of subtlety and an asset for many kinds of joinery.

PHOTO BY AL PARRISH

Hammers and cut nails are proper and useful when building fine furniture. The trick is to choose the right-sized hammer and the correct nail for the joint at hand.

Most woodworkers, and woodworking publications, regard the hammer as a crude implement. Everyone has a hammer or two on the wall, but it's almost always the shop's redheaded stepchild. In some shops it has the same status as a crowbar – a tool for when a rare radical or violent act must be performed. In other shops the hammer is seen as a tool that must be endured only until one can afford a compressor and pneumatic nailer.

Also maligned in all this is the hammer's partner in joinery: the nail. Quality woodworking, the thinking goes, uses nails only when nothing else will do, which is usually when installing moulding, building quick jigs or temporarily securing parts to be worked with other tools. Nails are seen as weak joinery.

The truth about hammers and nails is actually quite different. If you have the right hammer, the right nail and the right technique, you actually can build furniture that assembles quickly and ends up plenty strong.

But to understand how a hammer can help your woodworking, it helps to first understand a bit about glue, and how it can sometimes fail you.

Relying a Lot on Glue

The first thing to remember in all this is that glue – any glue – can be weakened by stressing a joint (tipping back in a chair or wracking a case when moving it) or by changing its environment (such as with moisture or heat in an attic). And this stress can lead to joint failure. Treated carefully, glue can be tenacious. Conservators and restorers I've talked to say a rule of thumb is to expect a lifespan of about 70 years for a hide-glue joint in a household item that sees regular use. Well-cared for antiques can have hide-glue joints that have lasted much longer – indefinitely, really.

Likewise, modern yellow glue (polyvinyl acetate or PVA) was invented circa World War II, and there are sample joints that have survived since then with zero sign of degradation.

Of course, furniture suffers stresses in real life. Hide glues are sensitive to moisture and heat. PVAs are sensitive mostly to heat (things start to really weaken at 150° F, but a 110° attic isn't good for the adhesive, either). And all glues and all joints will weaken if stressed regularly.

So if you build for real life and you build for tomorrow, then you need to design your furniture with this fact in the back of your mind. One way to reinforce a joint is to use interlocking components – dovetails, some locking miters, and pegged or wedged tenons are all ways of building for the longer-term. These are all valid and time-honored strategies, but they also require advanced hand skills or complicated power-tool jigs and cutters to execute well.

Not everyone can cut and fit sliding dovetails, and not every project should require it.

And it's at this point where some woodworkers make a potentially disastrous mistake. They build their casework using joints that involve a lot of end grain or don't fully interlock – rabbets and dados mostly – and they choose to rely heavily on the glue strength alone to keep their parts stuck together.

They don't use nails or screws or another mechanical fastener because they are told that's "cheap" joinery. But what's going to hold things together if the glue joint goes south?

A 1,000-mile Lesson in Casework

This point was made clear to me when recently I drove to Maine to give a demonstration of case-

"By Hammer & Hand, all Arts do stand."

— Motto of the New York Mechanick Society in the 18th century

work construction. I brought along two examples of the cabinets shown on the cover of this issue. One was assembled entirely with yellow glue and cut nails. The other one I assembled mostly during the demonstration. I got the carcase together with glue and nails, but I didn't have time to glue and nail on the face frame or to attach the shiplapped back. Some of the joints were glued with yellow glue, some with liquid hide glue. After letting the glue cure for a couple days, I wrapped up the partially assembled project in plastic, moving blankets and more plastic – much like any careful moving company would do. Both cabinets were tied down firmly in the back of my truck.

When I got home, I unwrapped everything and found that all of the dado joints in the partially assembled case had given up. At that point, the case was held together only by the nails.

My assumption is that the road and engine vibration damaged an assembly that was (at that point) weak. I was frankly surprised that the glue had given up, and I was glad that the nails were there to hold things together. As I pulled out the nails to re-glue the carcase I made another discovery: These old-style cut nails, unlike modern fasteners, did not let go easily. It was time to take a close look at cut nails.

Right Nail; Wrong Nail

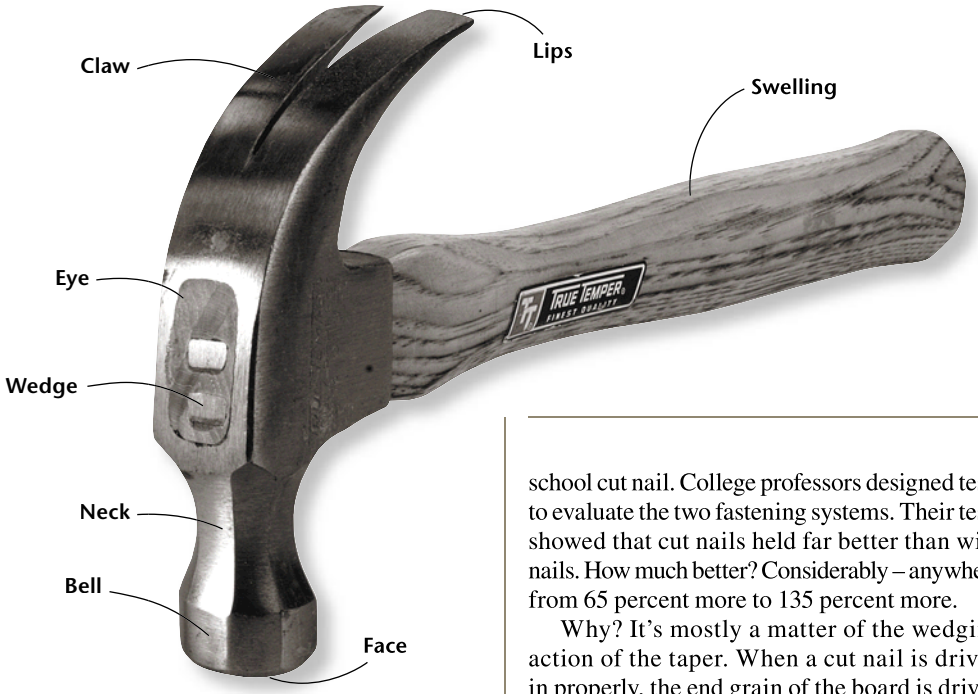
What we call nails today were not the fasteners that built furniture and homes in the early days of the Colonies. Here's a brief history: The nail is generally hailed as a Roman innovation, although small nails and tacks cast in copper and other precious metals have been found in ancient Egyptian work, according to Geoffrey Killen's scholarly research into early woodworking. These Egyptian nails were used to hold furniture coverings – from upholstery to metal foil – in place.

The Roman iron nail was essentially the pattern for all nail-making from 3000 B.C. until the early 19th century. Indeed, photos of Roman nails recovered from a seven-ton cache dating to 87 A.D. look identical to nails recovered from Thomas Jefferson's Monticello.

These Roman-style nails were made one at a time by hand, had square-shaped shanks and they tapered on all four sides to a point.

Beginning circa 1800, machine-made nails began to replace these handmade Roman-style fasteners. These machine-made fasteners were revolutionary because they could be made quickly and cheaply by cutting them from a flat iron plate. And that's how they earned the name "cut nails." These nails are square or rectangular in cross section. And – this is important – they taper on only two sides of the shank.

These were the fastener of choice in the 19th century, but they too were doomed for obsolescence, thanks to the next manufacturing innovation: wire nails. This is the round-shanked nail we're all familiar with today and it can be made with astonishing speed by machines that clip round metal wire, file the point and pound a head on the top. Wire nails also have the advantage of being faster to install – they rarely require a pilot hole, unlike cut nails.



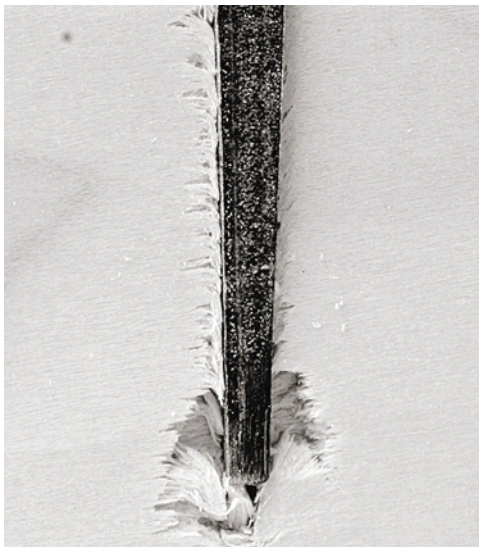
Hammer Anatomy

Although lightweight wire nails first appeared in France about the time of Napoleon I, production of wire nails cranked up considerably when Father Goebel, a Catholic priest, formed the American Wire and Screw Nail Co. in Covington, Ky., in 1876. As the cut-nail industry went into steep decline, there was a bit of a doomed public relations battle to prove the superiority of the old-school cut nail. College professors designed tests to evaluate the two fastening systems. Their tests showed that cut nails held far better than wire nails. How much better? Considerably – anywhere from 65 percent more to 135 percent more.

Why? It's mostly a matter of the wedging action of the taper. When a cut nail is driven in properly, the end grain of the board is driven against the nail's taper, making the joint quite secure. Also, the rough surface finish of a cut nail is a feature, not a defect – it also adds holding power to the cut nail.

So where do you get cut nails? Luckily, they are still available. One popular source is Tremont Nail Co. of Wareham, Mass., which has been in the business of making cut nails since 1819 (call 800-842-0560 or tremontnail.com). Other sources include Lehman's (877-438-5346 or lehmans.com) and VanDyke's Restorers (800-558-1234 or vandykes.com).

Cut nails (left) taper on two long edges and have rectangular cross-sections; wire nails (right) are straight and round.



Here is an inside look at a nail hole made by a cut nail. Note the way that the end-grain fibers are bent downward by the tapers on the nail. This, and the rough finish of the cut nail, increases the holding power.

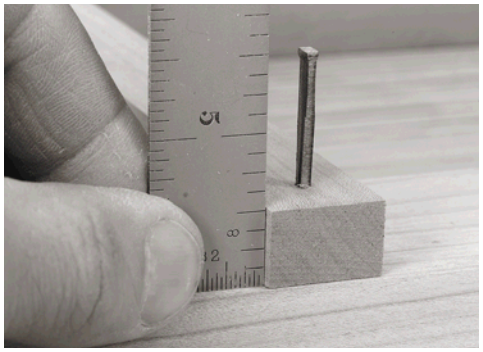
There are a wide variety of styles of cut nails (Tremont offers 20 or so different types). For carcase construction, I like to use a cut fine finish nail. For moulding, I like a cut headless brad. Other styles are useful for cabinetwork, but these two nail styles are the most versatile.

How long should your nails be? Most places denote the length of a nail using the English pennyweight system. The origin of "pennyweight" is a mite murky, so let's stick to the facts. Pennyweight is denoted by "*d*." So a two-penny nail is 2*d*. And a 2*d* nail is 1" long. For every penny you add, the nail gets 1/4" longer. So a 3*d* nail is 1 1/4" long. A 4*d* nail is 1 1/2" long. A 5*d* nail is 1 3/4" long. And so on.

You select your nail's length based on the thickness and density of board you are fastening in place. Here's how the old rule works:

1. Determine the thickness of your board in eighths of an inch. For example, a 1"-thick board would be eight-eighths. A 3/4"-thick board would be six-eighths. And so on.

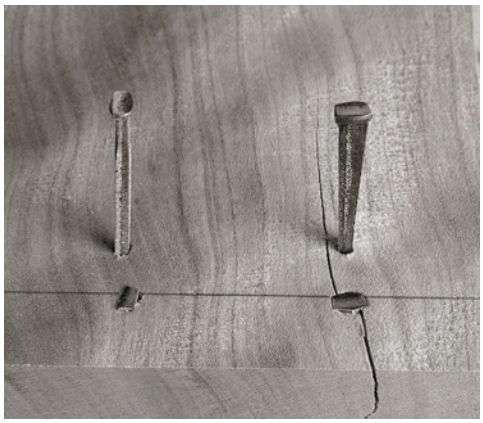
2. For a wood of medium density (walnut or cherry, for example), pick a nail where the pennyweight matches that thickness – a 8*d* nail for 1" stock. A 6*d* nail for 3/4".



Here's how to determine the right nail length. Measure the thickness of the board you are fastening and convert that to eighths (e.g. a 1/2" board would be four-eighths). Select the nail based on that thickness (e.g. a 4*d* nail for four-eighths material).

Nail Lengths

PENNYWEIGHT	ACTUAL LENGTH	THICKNESS IT FASTENS
2*d*	1"	1/4"
3*d*	1 1/4"	3/8"
4*d*	1 1/2"	1/2"
5*d*	1 3/4"	5/8"
6*d*	2"	3/4"
7*d*	2 1/4"	7/8"
8*d*	2 1/2"	1"
9*d*	2 3/4"	1 1/8"
10*d*	3"	1 1/4"



The taper of a cut nail can work for you or against you. If you align the taper so that the two tapered sides bite into end grain (left) then your nail will hold well. If you align the taper so that the two tapered sides bite into face grain, your wood is likely to split – even with a pilot hole.

3. For softwoods (white pine), select a nail that's one penny larger. For harder woods (maple), use one penny smaller.

This seems complex at first, but it quickly becomes second nature. Use the chart "Nail Lengths" at left as a cheat sheet. Note that this is just a rule, not the gospel. The bottom line is that you should use the longest nail that can be driven easily – let your work and experience be your guide.

Pilot Holes Pave the Way

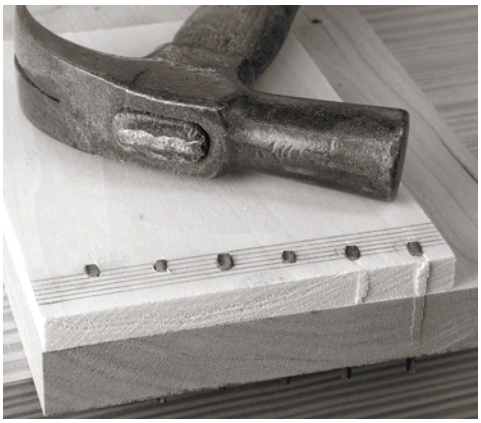
Once you get the right nail, you also need to bore the correct pilot hole. The wedging action of a cut nail can split your wood, particularly when you are working near the end of a board.

For the cut fine finish nails, I use a 3/32" pilot hole that goes almost the full depth of the nail. For the cut headless brads, a 1/16" pilot works quite well for me without splitting the work.

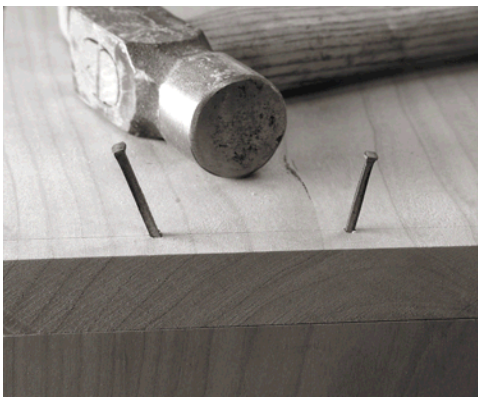
The other consideration is where this pilot hole should go – this is important when working at the end of a board. If you are too close to the end of a board, it will split your wood, even if you've made an appropriate pilot hole. However if you position the nail too far away from the end, you could end up driving the nail through the inside face of your work, which is almost as bad as a split.

In general terms, when joining 3/4"-thick stock, perhaps the most common carcase operation, I like to position the nail 1/2" in from the end of the board. This is a good place to start.

Whenever you encounter a new species of wood or a new kind of nail, you should make a few pilot holes in some scrap pieces and pound in some of the nails you have picked out for a project. This will let you see how big the hole should be and how close to the end of a board you can place it before disaster strikes. This is really not as tricky as it sounds, but being aware of these things will make sure your first encounter with cut nails is a good one.



As you get closer to the end of a board, the risk of splitting the work increases. A couple test joints will quickly reveal the optimal location for your fastener.



Angling your nails left and right increases the overall strength of the joint. Do this wherever you nail, including when you're toenailing.

One last and important detail on pilot holes: When joining furniture components, I rarely drive nails straight into the work. Usually I angle them about 7°. Half are angled left; the rest are angled right. Angling the nails increases the wedging power of the nails in two ways. One, the nail is more likely to cross more grain lines when it's driven at an angle. And two, it makes the board and its mate much harder to pry apart because the angled nails will work a bit like dovetails do to hold the pieces together.

"Apart from panel and veneer pins the furnituremaker has little use for nails except for softwood work etc."

— Ernest Joyce
"Encyclopedia of Furniture Making"

Choosing a Hammer

Now you're ready to drive a nail – once you have a good hammer. This detail would seem to be a simple matter, but there's more to hammers than meets the eye. A good hammer acts like an extension of your arm. You can swing it with remarkable precision; and after a few hours of use, you'll be able to drive nails perfectly flush with your work and without damaging the surrounding wood (those dents are called "French marks" by the way, though I don't know why).

The first consideration is the weight of the head. A hammer that is the wrong size won't drive the nail easily. A too-light hammer will require too many blows and will result in a lot of bent nails. A too-heavy hammer is hard to wield accurately and tires you. You'll find hammers in sizes from 3 ounces up to 28 ounces. The sizes for woodworking are generally accepted to be between 10 and 20 ounces.

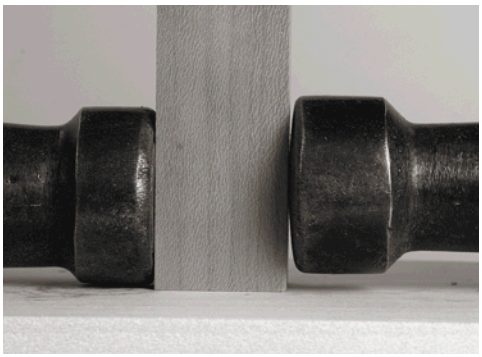
Most woodworking texts tell you to start with a 16-ounce hammer, and that's good advice. My two favorite hammers (out of the too many that I own) are 16 ounces and 19 ounces. One quick tip on weights: Some of the best (and worst) hammers can be found used. How can you determine the weight of a hammer head based on a fuzzy photo on the Internet or while browsing an antique store? Have the seller put the tool on a postage scale. Take the total weight of the tool and subtract 6 or 7 ounces for a standard 13"-long hammer. That will be pretty close.

The face of the hammer is critical. It must be smooth and free of chips. You'll also find faces that are flat and those that are slightly convex, which is called a "bell-shaped" face. I prefer the bell face. It allows you to drive the nail head closer to the work; I also think it reduces mis-strikes.

For claw hammers, you're going to find two basic patterns to the claws. Generally I don't use the claw to remove errant nails (I use pincers). But if you are going to remove nails with the claw then it should have a pretty fair curve to it and point almost straight down. The other common pattern is what's called a "ripping" hammer. Ripping hammers have claws that don't curve much at all – they mostly stick straight out. These claws are used for ripping woodworking apart – removing trim moulding or studs that were improperly nailed. I've found little use for them in the woodshop.

Beyond the head, there are other factors. The handle must be secured to the head without any wiggling. Sometimes you can drive in the metal wedges up at the tool's eye to tighten things up, but just make sure there's no wiggling in use.

Look for a hammer that has the original handle or one with a handle that has been carefully replaced. It's astonishing how poorly some people have rehandled their hammers. The head must be perfectly aligned in both directions on the handle or the tool will verge on useless. For this reason, I generally stick with hammers that had their handles installed at the factory.



Here you can see the difference between a hammer with a flat face (left) and a bell-shaped face. The bell-face hammers allow you to drive a nail flush to the surface without marring it.

Finally, I like a handle that has a slight swelling in the middle of its length. As you'll soon see, there are (at least) two grips for a hammer, and the swelling assists one of those grips.

Most handles are elliptical in cross-section, though there are a fair number with octagonal handles. Either one is fine; pick one that feels good in your hands.

One final note on hammers: There are hammers designed for almost every craftsman out there, from cobblers, to farriers, to masons, to people who install slate roofs. They all have hammers designed for the profession. These hammers might drive a nail once you get accustomed to the their quirks, but I think you're better off sticking with the common-as-dirt claw hammer. You'll never have problems finding one of those.

A poorly rehandled hammer (right) will be difficult to wield accurately. Look for a head that is secured tightly and squarely to the handle.

Speaking English

In addition to the claw hammer, there's another sort of cabinetmaking hammer you might encounter in catalogs and from antique dealers. It's predominantly an English hammer and has a short wedge where you would expect to see a claw.

The cross pane on these English hammers allows you to start small brads and tacks without smashing your fingers.

This hammer is commonly called a "cross-pane" hammer – sometimes you see it referred to as a "cross-pein" or a "cross-peen." That flat little wedge of metal is actually used to start short brads or tacks. The pane allows you to hold the brad between your fingers and start the fastener without hitting your fingers. Once you've started the brad, you turn the hammer's head around and drive the brad the rest of the way with the face.

These cross-pane hammers have a lot of trade names, although the one that seems to come up the most is the so-called "Warrington" hammer. I like having a cross-pane hammer around in a smaller size. I have one that's probably 3½ ounces that starts brads and is great for adjusting plane irons and driving in small wooden wedges when chairmaking. A 6-ounce hammer is also nice for starting small brads.

Grip and Drive

There are two common grips for hammers for cabinetmaking. By grasping the hammer at the end of the handle you'll increase your pounding power but slightly decrease your accuracy (although your accuracy will always improve greatly with practice).

The second grip is where you choke up on the handle and grasp it at the swelling at the handle's midpoint. If your handle has a swelling you can move your hand there effortlessly. Choking up decreases the power of the blow, which is good for detail work. And it can increase your accuracy.

One other way to increase your accuracy with either of these grips is to extend your thumb out along the handle. Try it. It works.

Position the tip of the nail on the pilot hole and twist it so the tapered sides are in line with the grain of the wood. Start the nail with a light tap. Because cut nails are irregular, some will try to twist on you during the first blow, so hold the nail firmly.

With the nail started, remove your off-hand and drive the nail. When everything is in sync – right-size hammer, nail and pilot hole – you should be able to drive the nail flush to your work in four blows. Feel free to take it a bit easy at first as you get comfortable.

Setting the Nail

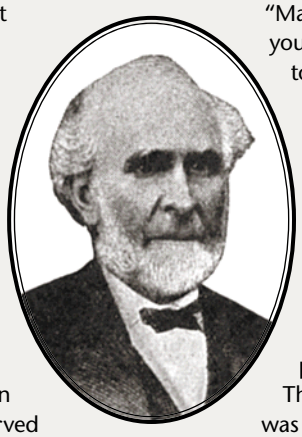
If the face of your hammer is bell-shaped, you'll be able to reliably set the nail flush to the surface of the wood without marring the wood. While this sounds like a difficult goal, it's a fairly simple skill with a little practice.

All that's left to do now is set the nail. Nail sets come in a variety of sizes – the common ones have tips that are 1/32", 1/16" and 1/8". Some have a flat tip; others have a dimple, which helps keep the nail set in place when you strike it. Choose a nail set that is as large as possible without enlarging the hole made by the fastener.

Gripping the hammer at the end of the handle (at top) increases the power in your stroke. Gripping it up at the swelling (below) reduces your power and can increase your accuracy. Note the extended thumb on both grips – this will also improve your accuracy.

David Maydole: Father of the Modern Hammer

Up until 1840, hammers hadn't evolved significantly since the Roman times. They were your basic claw-type of hammer with a wooden handle. They worked, but they had one major defect – the heads would tend to loosen or even fly off the handle after a certain amount of use.



Inventors had developed many unusual ways to keep the head on, from iron straps running down the handle (a common English pattern) to a claw that curved back onto the handle, grabbing it (this is called the Solomon Anderson Patent hammer). But it was David Maydole, a blacksmith in Norwich, N.Y., who changed hammers forever when six carpenters came to his town in 1840 to build a new church, and one of them needed a new hammer, according to the book "A Captain of Industry."

"I can't make a pretty good hammer. I make the best hammer that's made."
— David Maydole

"Make me as good a hammer as you know how," the carpenter said to Maydole.

After some thought, Maydole made a simple change to the design of the hammer that made a stunning improvement. He lengthened the hole through the head (called the "eye") for the handle. With this longer and tapered hole, the handle could be wedged in place and stay put a lot longer. This was similar to how a handle was secured to an adze, and so his hammers were called adze-eye hammers. Soon everyone wanted his hammers so Maydole went from a village blacksmith to a major manufacturer in 1845. He never patented his innovation, and soon every other claw hammer was made exactly the same way in the United States.

When Maydole died in 1882, the David Maydole Hammer Co. was the largest hammer manufacturing business in the country. It left family hands in 1931 and shut down in 1957 after a devastating fire.

Maydole hammers are fairly common, though some of the patterns are particularly collectible. I've paid between $10 to $15 for the few that I have (though I've seen nice ones sell for a lot more). They are without a doubt one of the most delightful hammers to use. With an original handle, a Maydole is a supremely well-balanced, durable and accurate tool. And it's a connection to an important event in history that anyone can afford.

— *CS*

The handles of Maydole hammers were almost always secured with three wedges, one of the hallmarks of an original handle to look for.

PHOTO OF DAVID MAYDOLE FROM "A CAPTAIN OF INDUSTRY" BY JAMES PARTON

Hold the nail set between your thumb and forefingers on the knurled section of the tool's barrel. Always strive to have the edge of your hand resting on the work, which helps steady the nail set as you strike it. Sink the nail head so it's 1/16" to 1/8" below the surface of the wood. Sink it to the shallower depth when joining thin pieces or when the wood you are fastening is ready to finish. Sink it to the deeper depth when you are going to have to remove more material through sanding and planing.

Nailing Tricks

There are a few common tricks to improving the strength or accuracy of your nail joinery. One trick is to always drive the nails in at a slight angle, as mentioned earlier. Another trick is toenailing. This also involves angling the nail, but is a bit different because it's typically done from inside a carcase and is a way of concealing the nail. See the photo at right for how this works.

Nails can also be used in other surprising ways. Some cut nails are called "clinch" nails. These extra-long nails are generally more malleable than brad nails for a special reason. Clinch nails are designed to be driven all the way through the work and then the protruding tip is bent back into the wood. Done properly, this is a remarkable way to fasten things. In general, clinch nails are installed with two hammers: One to drive the nail, and the other held in place against the nail's tip to turn it around.

This is the proper way to hold a nail set. Resting your hand on the work helps reduce mis-strikes.

Here's a tip for trimwork: With the moulding unattached and on your bench, drill your pilot holes and drive your nails into the moulding so their tips just peek out from the other side. Now position the moulding on the case or on the wall. Tap the nail nearest the miter that is the most critical or visible a couple times to start the nail. If everything looks good, tap the other nails, remove your hands and check the work. If the moulding fits you can drive and set all the nails in coarse work. Or, for fine work, remove the moulding (it should come off easily), drill your pilots, add glue and reinstall the moulding.

Toenailing allows you to nail joints from the inside of a project and to conceal the nail head in carcase construction.

Or, quite honestly, this might be the case for your 18-gauge brad nailer. Although I really like cut nails for carcases, backs and the like, nothing installs moulding like a brad nailer. WM

— Christopher Schwarz

Pull Your Wandering Nails Without Making Things Worse

Removing nails from your work requires as much care as driving them. As you probably already know, the claw on the backside of your hammer won't always pull a nail meant for furniture-scale work. Many of these small fasteners have slender heads or are made with such a fine gauge of wire that they are impossible to grab with the claw's lips.

There are some traditional tools, however, that can assist you. Hand-forged pincers are an excellent addition to your toolkit. These old specimens lurk in the bargain bins at flea markets and auctions. I have yet to pay more than $1 for a pair. Look for examples that have well-formed lips that close tightly and are free from chips.

Contemporary versions are available at hardware stores, but generally the handles will be shaped more like those found on needlenose pliers. I don't find these new pincers as comfortable to grip, plus the protruding handles prevent the tool from getting into tight spaces and corners.

The other indispensible tool in my nail-removal arsenal is my Tiger Claw, a Japanese carpentry tool that works quite well at pulling nails without damaging the surrounding wood. The narrow profile of the lips on one end allow you to sneak the tool into places that no claw can venture. The Tiger Claw also excels as a cabinet-scale pry bar. The thin, flat lips pull moulding off of cabinets and can disassemble things that have been wrongly assembled. (They are available from Japan Woodworker, 800-537-7820, item #01.456.02, $14.65).

And if you need to use the claws on your claw hammer, be sure to put a thin piece of wood under the head to prevent the hammer from marring your workpiece. *— CS*

Traditional and contemporary pincers are better at pulling the nails used in furniture-scale work. I wish the handles on the pincers made by Crescent (left) were a bit straighter, but they're far better than most. The Tiger Claw (right) is another useful tool for taking things apart.

When using the claws of a hammer to extract a nail, always place a piece of scrap under the head to protect your work. Both hardwoods and softwoods can be damaged easily by the prying action of a claw hammer. And if you need more leverage, use a thicker scrap.

How to Saw

Practice won't help if you are practicing a poor method. Here are 10 rules and 3 tricks to improve your sawing.

Sawing intimidates many woodworkers because one mis-cut can ruin the workpiece. But if you know how to stand and know how to start the cut, your accuracy will quickly improve.

Let's begin at the end: dovetails.

If you don't cut dovetails by hand, chances are that you aspire to. That's because to the modern woodworker, dovetails are like teeth. A couple rows of tight and tidy dovetails make a good first impression – just like a mouth full of pearly whites. (Similarly, furniture mouldings are like our lips. We use these to hide our snaggle-tooth dovetails and orthodonture.)

And so for many woodworkers, their first handsaw purchase is a dovetail saw. Then they read every magazine article ever written on all the different methods of making the joint. (Well, they attempt to read every article. It's actually impossible to do this in just one lifetime.) And perhaps they take a class in cutting the joint by hand at a local woodworking store.

Despite all this effort, their dovetails still look like a mouthful of gappy teeth from a dental hygienist's darkest nightmare. Why is this joint so difficult? Here's my theory: I think most woodworkers go about learning dovetails all wrong.

I'm not talking about cutting pins-first or tails-first, I'm talking about tenons-first. Or how about cutting straight lines first? Then maybe cutting some slanted lines? Cutting dovetails, you see, is all about learning to saw. If you saw correctly, the chiseling part is easy.

The problem is that most woodworkers don't know how to saw. We make sawing harder than it has to be. We hold the saw incorrectly. We work too aggressively. We stand in the wrong place. And we don't know (or don't use) the tricks to make straight and clean handsaw cuts.

Once you master these details, you'll be on your way to cutting dovetails. But you also will have achieved something far more important: freedom. Being able to cut to any line – angled, compound, you name it – is the most liberating experience I know of in the craft. Suddenly, you can escape the tyranny of 90° – the always-right angle encouraged by our machines. Chairs, with their compound angles, won't seem so daunting. Plus, you'll build fewer jigs for your machines.

10 Rules of Sawing

There's a lot to learn about sawing, from the tools themselves to the techniques for using them. I think the place to begin is to understand how to wield the saw in any cut, whether you are making joints or just breaking down rough stock to get it in your car in the Home Depot parking lot. Here are the 10 principles I've compiled from books, other woodworkers and my own experience.

1. Use a relaxed grip on the tote of the saw. Clenching the handle will push you off your line.

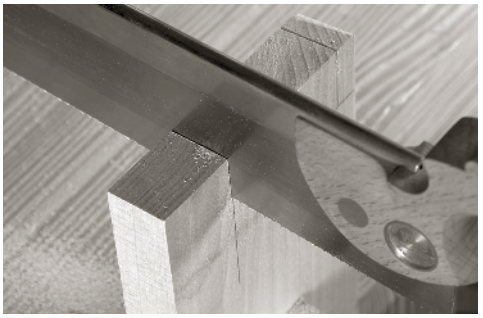
On a Western saw it's always best to extend your index finger out along the tote. Saws are designed for a three-fingered grip.

On Japanese saws, the advice is mixed. Some people saw with their index finger out. Others extend the thumb.

One of the most common mistakes beginning sawyers will make is they will keep their elbow tucked against their torso when sawing.

Constant vigilance is required here. As you saw, if you feel your elbow touching your torso, you're doing it wrong. Stop and adjust.

This is what a good sawing stance looks like. All the parts of my body are lined up so my sawing arm swings freely. The rest of my body is positioned in such a way that it encourages me to saw straight. Note how my toe touches the bench.



If you can see the line you can cut the line. So never let the sawblade obscure your line. Sometimes this involves moving the saw (or planning how to hold your work). Sometimes it involves moving your head without violating the rules on proper body stance.

Someone once told me that when you hold your saw you should pretend you are holding a baby bird and that you are trying to keep it in your hand without crushing it. You want to hold your tool with just enough force to keep it from flopping around and getting away from you. And this is something that you will be reminding yourself of for the rest of your life. It's easy to forget.

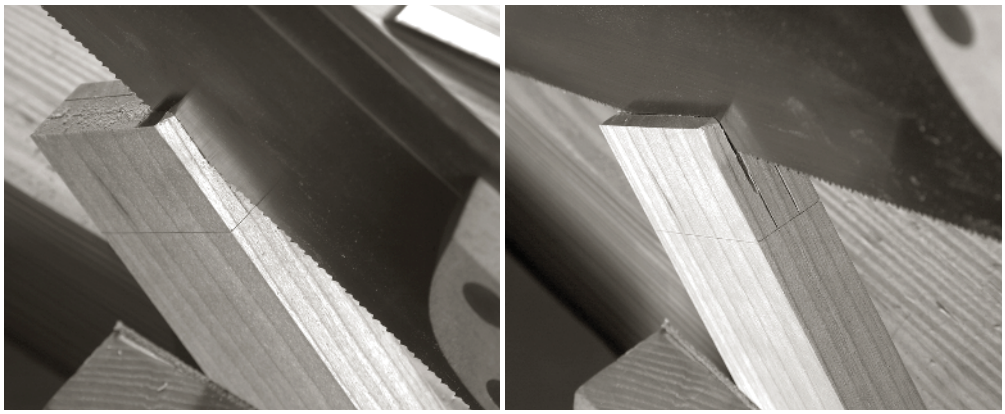
2. Extend your index finger out on the tote. A good Western saw handle is designed for a three-finger grip. Mashing your four fingers into the tote will make sawing difficult and your hand sore. Extending your index finger is good to do with any user-guided tool because it is a reminder to your body to perform that operation in a straight line. Try extending your index finger on your cordless drill, your jigsaw, your handplane.

That said, this rule is somewhat troubling when it comes to Japanese pullsaws. I've seen grip recommendations that violate this rule from people who get tremendous results. In fact, I grip my dozukis with my thumb extended out along the straight handle of the saw. I suspect that extending my thumb has the same effect as extending an index finger. In fact, early writings on hammers – which have a straight handle similar to that of a dozuki – offer the same advice about extending the thumb for precision nailing. (Yes, there is such a thing.)

3. Always work so your sawing elbow swings free like a steam locomotive. Now we're getting into body position – a critical point. Don't ever work with your arm rubbing your body. And don't move your arm at an angle that's not in line with the back of the saw – your arm and the saw should all be one straight line. This involves positioning your body so all your parts line up with your cut and all your moving parts swing free.

4. Use proper footwork. This rule works in conjunction with the rule above. If you position your feet correctly, chances are your sawing arm will also end up in the right place. Here's the drill: If you are right-handed, stand so your left foot is forward and your right foot is behind you. (Reverse this if you are left-handed.) Your feet should be almost perpendicular to one another, as shown in the photograph above. I like to place my left toe up against the leg of my workbench because I can then feel how my workbench is behaving when sawing. If my workbench is unstable, then I'll feel it in my left foot.

5. Whenever possible, work so you can see your line. First, position your work so that the line is visible throughout your entire cut. If you are right-handed, this means you should try to have the sawblade cut on the right side of the line whenever possible. (Again, reverse this if you're sinister.) If you cannot position your saw this way, you need to move your head and peer over the sawblade so you can see the line. Never

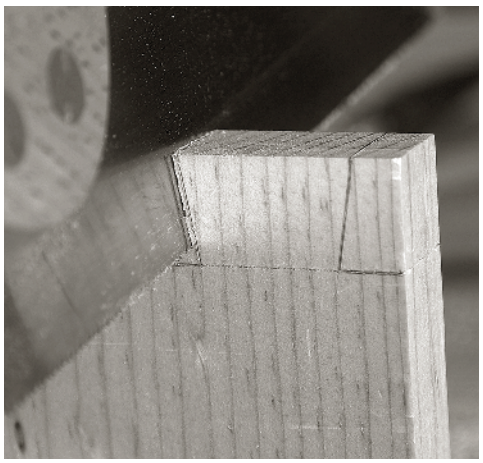


Here, I'm cutting a tenon cheek. I begin with a diagonal cut, then tip the saw to extend the kerf down the edge of the board (left). Then I use that kerf to guide the sawplate to extend the kerf along the end grain (right). Note that I'm peering over the saw's back to watch my lines.

let the blade of the saw obscure your line. If you cannot see the line, you cannot follow it.

6. Use minimal downward pressure when sawing. Western backsaws have a heavy back for two reasons: One, to stiffen the blade. Two, to give the saw some weight to carry it down into the cut. A sharp and well-tuned saw should require almost no downward pressure during the cut. When teaching the act of sawing, I tell students that their job is to move the saw forward and back. Gravity takes it down into the cut.

Using excess downward pressure almost always will drive you off your line. It is impossible (for me, at least) to force the saw through the cut with accuracy. Don't worry about the speed of your cut if it seems slow. As your skills pick up your strokes will be faster. Plus, remember this: It takes a lot to effort to correct a cut that has gone awry. So rushing a cut will only slow your overall progress.



This cut leaves behind too much waste. People are timid about sawing, so they saw far away from the line and leave some waste to pare away with a chisel or plane. Be bold (it's easier, too). Saw right up on the line or split the line.

7. Always imagine the saw is longer than it really is. I picked up this mental trick from a book a long time ago, and it has served me well. This bit of self-deception will fool you into using longer strokes, which will allow you to saw faster and wear your saw's teeth evenly. Most beginners use about half of the teeth in their saw, mostly the teeth in the middle. You should aim to use 80 to 90 percent of your teeth.

8. Whenever possible, advance your cut on two lines. This trick always increases your accuracy when sawing. There are lots of ways to make this trick work to your advantage. For example, when cutting tenons, I like to start the cut diagonally on a corner. Then I extend the kerf a bit down the edge of the board. Then I use that accurate kerf to guide my sawplate as I extend the kerf along the end grain. I'll work back and forth this way, using the existing kerf to guide my saw.

9. Always work right against a line. This rule is true with all saws, whether they are powered by electricity or by Ding Dongs. Try to avoid sawing a certain distance away from a line. It's hard to saw a consistent distance away from a line. Sawing on a line is always easier. Sometimes you will want to leave the entire line intact and sometimes you will want to split the line, depending on the joint you are cutting. But what's important is that you are on the line at all times.

10. Lifting the saw a tad on the return stroke clears your line of sawdust. This isn't a rule as much as it is a tip for catching your breath. If you lift up your saw on the return stroke, less sawdust will sprinkle onto your cut line and obscure it. As a result, you don't have to huff and puff your line clear with every stroke (there will always be some huffing, however).

This also relates to the proper rhythm and sound that result from efficient sawing. You can always tell a veteran carpenter from a newbie by listening to them saw. New sawyers drag the tool back through the kerf, making an unpleasant sound. Plus, they use short strokes because they are using only the teeth in the middle of the sawblade. The old pros make most of their noise on the cutting stroke only. Plus, their strokes are longer. And, as a bonus, they're not out of breath from puffing the line as well.

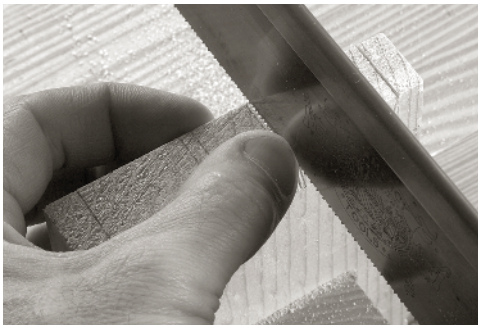
How to Start a Sawcut

While those 10 rules above will help you make a sawcut, they don't help much with the hardest part of sawing: Starting a kerf with your saw. In sawing (as with most things in hand tools) how you begin the cut is critical to how well the rest of the cut proceeds.

If you start correctly, you are much more likely to hit your line all the way down. If you start poorly, you'll spend your first few strokes trying to correct your cut, making your kerf unacceptably wide and fighting the saw the entire way.

There is a good deal of advice on how to begin a cut, some of it conflicting. One old chestnut is to begin a kerf with a few strokes of the saw that are in reverse of the tool's normal cutting action. That is, if you have a Western saw that cuts on the

Here, I'm about to break down some rough stock with a full-size 26"-long handsaw. Unlike when you use a backsaw, it's good practice to begin this cut with a few strokes of the saw that are the reverse of the tool's normal cutting action. The small notch shown in the photo is a boon to starting a cut with a large handsaw.



The thumb positions the work. Nudge the saw to the right by pinching your finger and thumb, which swells them both a bit. Move the saw to the left by relaxing your fingertips a bit and scooting the sawplate against your thumb.

push stroke, you should begin your kerf by making a few strokes on the pull stroke. These strokes make a little notch for the saw to ride in.

This is how I was taught to use a full-size handsaw on sawhorses as a boy. The advice shows up frequently in old texts on carpentry, and I think it's good technique when working with the big 26"-long handsaws or rip saws.

However, the older texts are mostly silent on beginning a joinery cut with a backsaw, such as a dovetail, carcase or tenon saw. So many modern woodworkers have assumed that the same rules for carpentry apply to making furniture cuts.

I'm not so sure they do.

For many years I used this trick with my backsaws, and many times it didn't seem to help much. Yes, it made a notch for the saw to begin in, but the notch wasn't the shape I wanted. This trick made a sizable V-shaped cut, with part of the V chipping across my line and into the part of the work I wanted to keep.

After I abandoned this trick when using my backsaws, my results were more consistent. So here's how I start a backsaw cut when I'm cutting to a pencil line.

After I draw the line, I place the sawblade on a corner of the work so I can see the line. With my off-hand (which is my left), I pinch the edge next to my cut line and use my thumb to nudge the sawplate left or right until I am exactly where I want to begin.

(A quick aside: Determining exactly where to begin requires you to instinctively know how wide your saw's kerf is. Once you have a gut feeling for that, you will place the tool right where you want it. This is also a good reason not to work with six different dovetail saws with six different-size kerfs – you'll never master them all.)

Now check the position of your sawplate in the reflection of your sawblade (assuming you have a shiny saw). If you are sawing a line that is square and plumb, then the reflection of your board should line up perfectly with the actual board. This trick works no matter where your head or eyeballs are located.

Correct a Wandering Cut

How do you get back on your line when you stray? There are two techniques that I employ. If the correction is needed early in the kerf, I'll twist my wrist for two strokes (and no more) to English the tool back on line.

Most people botch this technique because they twist their wrist for too many strokes so the saw wanders across the line in the other direction. Then they twist their wrist to correct that mistake and they wander back over the line again. After a couple cycles of that foolishness, the kerf looks like it just failed a drunk-driving test. If the error is particularly bad, the sawplate can jam in the wobbly kerf.

Remember: Just like working with a band saw, handsaws have a bit of delay when steering them. So make a couple strokes with your wrist twisted, then relax to your normal sawing position. Make a couple more strokes and see if you are moving back on line.

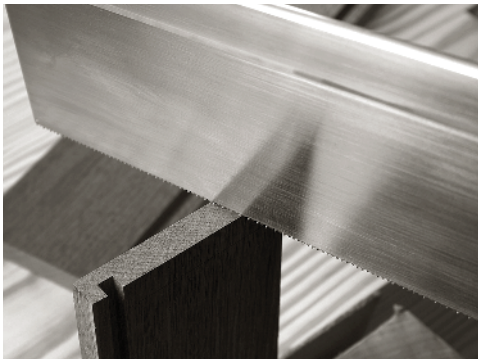
If the error occurs deep in the cut and I've done a good job up to that point, I'll use a different trick: I'll "lay down" the saw. When I do this, I lower the angle of the sawblade to about 20° to so I can put as much of the blade into the good kerf as possible. Then I take a few strokes. The good kerf guides the tool back on line. — *CS*

Here I'm laying down the saw into its previously cut kerf to correct a saw cut that is starting to drift across my line. Make a few strokes with the saw in this position and then return to your normal sawing position.

Trust your eyes here. We have an innate ability to sense plumb and square, which is perhaps why we like our houses and furniture made that way (instead of something out of a surrealist painting). If it looks square, it probably is.

This is a good argument for keeping your saws shiny and free of rust – the reflective qualities of the sawplate are an important feature. Also, a shiny saw tends to move more smoothly during a cut, and a rust-free saw will be easier to resharpen – you'll never lose a tooth to a bit of pitting on your sawblade. That's why I wipe down my saws with an oily rag after every use.

Now check your body position and ensure your sawing arm will swing free. Push the saw forward with your fingertips still on the board and against the sawplate (you won't get cut, I promise). After two strokes or so like this, you should begin angling the saw to start laying a kerf all along one of your layout lines. Now let all the other rules above kick into full gear as you make your cut.



You can judge if your saw is plumb and square by looking at the work's mirror image in your sawplate. Here you can see a cut that is slightly off square (left) and one that is slightly off plumb (right).

And here is the sawplate positioned correctly.

The Three Classes of Saw Cuts

The above advice and techniques are good for fairly accurate work, but not for high-precision sawing – such as cutting the shoulders of tenons. Most beginning sawyers ask too much of themselves and of their tools, sort of like expecting to be able to cut dovetails with a chainsaw.

There are lots of techniques to improve the accuracy and appearance of your saw cuts. But Robert Wearing's book "The Essential Woodworker" (now out of print and quite hard to come by) organizes all those tricks in an orderly fashion and shows you how to apply them to your work in a way that makes sense.

In his book, Wearing divides all saw cuts into three classes:

- Third-class saw cuts, where speed is more important than either accuracy or the final appearance of the work. This is a rough cut designed for sizing stock before processing it further.
- Second-class saw cuts, where accuracy is more important than speed or the final appearance of the work. This is for joinery cuts where the joint will not be visible in the end.
- First-class saw cuts, where both accuracy and appearance are critical.

Each type of saw cut has a different set of procedures to prepare your work for sawing. Let's begin with third-class saw cuts for rough work. For me, the interesting thing about third-class sawcuts is that the technique for this lowly saw cut is a lot like what modern woodworkers use for all their sawing – so it's no wonder people love their table saws.

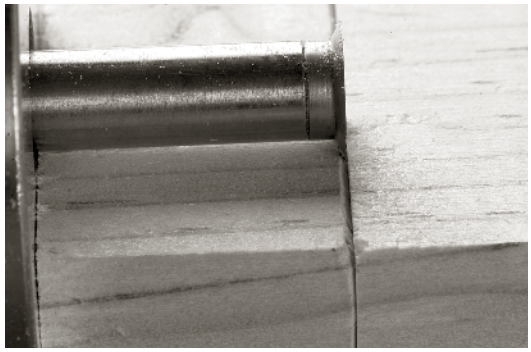
Third-class Saw Cut

The third-class saw cut is fast, rudimentary and useful when breaking down rough lumber into manageable pieces. I use it only when the board is going to be refined further by shooting the ends with a plane or crosscutting the board to a finished length with a powered saw or finer handsaw.

Begin by marking the cut line on the face and edge of your board with a sharp pencil. I like a carpenter's pencil that has a sharp chisel edge on its lead when working on rough stock, or a mechanical pencil when working on boards that have been surfaced.

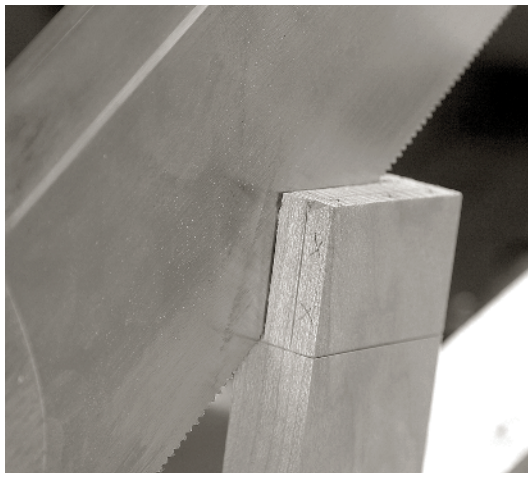
Place the teeth of your saw on the waste side of your line and use your thumb to keep the saw positioned as you make your initial strokes to define your kerf. Advance on the face and edge

This is the most common third-class saw cut in my shop. Here I'm breaking down rough stock into manageable lengths to work (either by hand or by machine). If I stray from the line, it's OK because the stock will be refined further during construction.



Here, I'm making a second-class saw cut. You can see how a cutting gauge incises a line that has one flat face and one beveled face. Try to put the sloping part of the V on your waste side.

Here you can see the notch I've made with a chisel to begin my second-class cut. The flat side of the notch helps funnel the sawblade into the waste side of the work.



Tenon cheeks are an ideal place to employ a second-class saw cut. The cheeks must be sawn as closely to the line as possible without going over. If you saw too wide, you'll have a tenon cheek that requires a lot of work with a shoulder plane, chisel or rasp. If you saw over your line, you'll have made some pretty firewood.

of your board simultaneously to increase your accuracy. Saw rapidly through the board until you get near the end of your cut. Then use lighter and shorter strokes to cut the waste away cleanly.

This is the sort of cut I'll use with a full-size handsaw on my sawbench. Or when cutting wooden pins to rough length before pounding them into a drawbored joint.

Second-class Saw Cut

A second-class saw cut is used when accuracy is important, such as when sawing the cheeks of a tenon or a lapped dovetail joint inside a case piece. The results of your cut will be buried in the mortise or in the dovetail socket, so appearance isn't of primary importance. But if you wander too much in the cut, your joint won't fit its mate.

Begin a second-class saw cut by marking your cut line with a knife all around your work. You can use a marking knife and a try square; some woodworkers use the corner of a chisel to make this mark. When marking tenon cheeks I'll use a cutting gauge – essentially a marking gauge with a knife in place of a pin. One common commercial example is the Tite-Mark.

All of these types of marking devices make a line that is almost V-shaped. One edge drops directly down at 90°; the other comes in at an angle – the result of the bevel on the tool.

Now, you can get a little too fussy here, but I try to always put the sloped part of the V on the waste side of my line. This fine point is more important when it comes to first-class saw cuts, but it's a good thing to be thinking about as you make second-class ones as well.

Now, at the corner where you will begin your cut, place a chisel in your knife line with the bevel of the chisel facing the waste. Press the chisel into the work, remove the chisel and then come back and pare a triangle of waste that leads up to that corner.

Now place your saw in this notch and begin cutting. The notch ensures you begin the cut correctly. One of the nice things about this notch is that it actually is just like the little notch made with a full-size handsaw when you draw the tool backward for a couple strokes. The cutting begins at the bottom of the V. The difference here is that the V is shaped differently to guide your saw more accurately.

I use a second-class sawcut whenever I'm working on a joint that won't see the light of day. Nobody cares if the corners of your tenon are a bit ragged as long as the joint fits tightly.

First-class Saw Cut

First-class sawing is reserved for parts of the joint that will be visible on the finished piece, such as the shoulder cut on a tenon or half-lap joint. It requires a couple of extra steps, but the results are worth it.

First mark your cut line with a marking knife on all surfaces that will be cut, just like you did for your second-class saw cut. Then take a wide chisel and place the tool's edge into your knife line with the bevel facing the waste. Rap the handle of the chisel to drive it into the knife line all around the joint. It only takes a couple raps. You don't want to drive too deeply.

The chisel here is deepening the line made by my marking knife for a first-class saw cut. You might be concerned about the chisel walking backward when you rap it, like what happens when chopping waste from a dovetail. However, the shape of my knife line and the shallow depth of the chisel cut keep your line in the same place.

Remove the chisel, then pare away a wedge-shaped piece of wood on the waste side, working up to your now-widened knife line. The second chisel cut must be deep enough so that the set of your saw's teeth falls below the surface of your workpiece.

Secure your work to the bench. Place your saw into the chiseled notch and make the cut. By using a chisel to define the kerf of your saw, you eliminate the common problem of the saw's teeth tearing up the surface of your work.

Here's why: You actually used your chisel to cut the part of the joint that will show; the chisel cut created the tenon shoulder. The saw cut began below the surface thanks to the trench you chiseled out. That's how you get crisp shoulder lines with a handsaw – you use a chisel instead.

"The highest reward for your work is not what you get for it, but what you become by it."

— John C. Maxwell (1947 -)
author

With a first-class saw cut you remove a wedge-shaped piece of waste all along your cut line. The chisel ends up making the critical part of the joint that shows.

What About Dovetails?

So which class of cut is the dovetail? That's a tough question. The 18th-century woodworker would argue that the dovetail is probably a third- or second-class saw cut because the resulting joint would be covered in moulding. The goal (then, at least) was to remove material quickly with some accuracy.

But many modern woodworkers like to show off their dovetail joinery in a piece of handmade furniture. So the dovetail really encompasses more aspects of the first-class saw cut. Yet no one I know would ever chisel out the marked lines of a every pin and tail.

Instead, we work this joint more like it is a third-class saw cut. What allows us to do this is the dovetail saw, which was developed specifically for this joint. Its teeth are finer than other joinery saws. And the small scale of the saw allows us to get our eyeballs on our work to see what we are doing.

So while I still treat the dovetail like a third-class joint when marking it, I use a first-class tool. (And sometimes, when things get hairy, I'll even use some second-class notches to start a critical cut or two.)

So here we end where we started – still vexed about dovetails and how to cut them correctly and with skill. And while I cannot tell you everything about how to cut dovetails, I can tell you this: If you use the above techniques to saw and practice the three classes of saw cuts, then dovetails will suddenly become much easier.

Sometimes practice counts. WM

— Christopher Schwarz