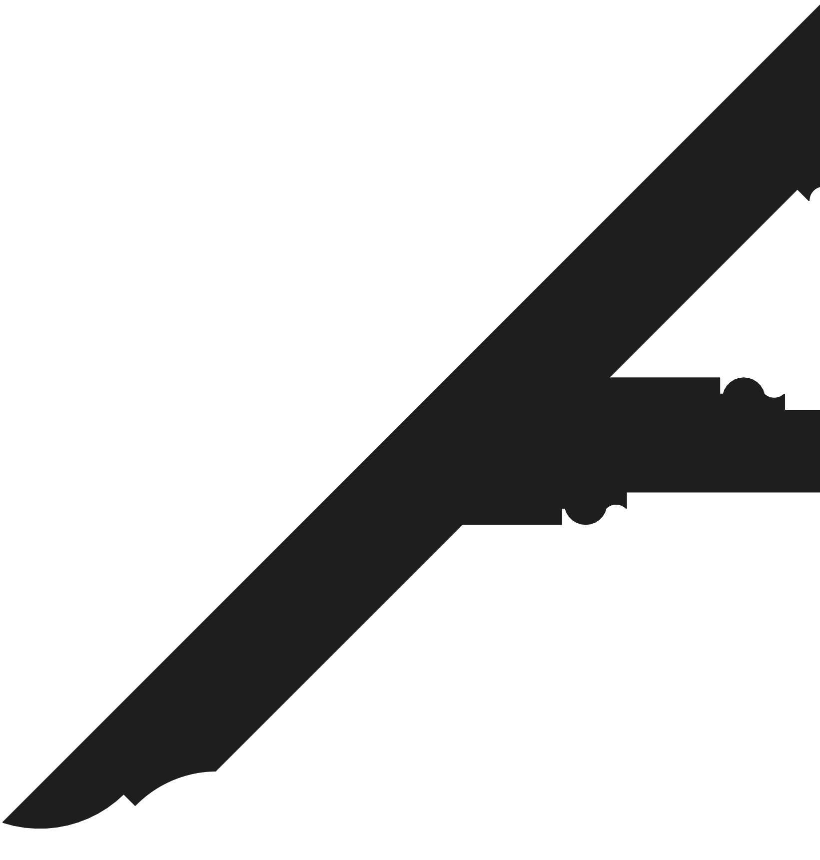
THE ANARCHIST'S TOOL CHEST



THE ANARCHIST'S TOOL CHEST

by Christopher Schwarz

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Title: The Anarchist's Tool Chest
Author: Christopher Schwarz
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Fourteenth printing.

This book was printed and bound in the United States.

For Roy Underhill.
Without him, my ideas about woodworking
would never have taken root.

And for John Brown,
the genius who first put together the words
"woodworking" and "anarchism."

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ME

When I am too exhausted, ill or busy to work in my shop, I will shuffle down the stairs to my 15' x 25' workshop and simply stand there for a few minutes with my hands on my tools.

To be sure, I thought I was a touch nuts because of this personality quirk. But after reading oral histories and diaries of craftsmen from the last 300 years, I found it's actually a common trait among artisans. I am drawn, married or perhaps addicted to the things that allow me to coax wood into new shapes. At the same time, my relationship with my tools is like a tumultuous combination of an Italian family drama, a bigamist's decision about whom to sleep with and a careful gardener.

My wife, Lucy, suspects that I form closer relationships with inanimate objects than with people. And she might be right. I can't remember the last time I raised my voice in anger or became emotional in dealing with friends and family. But I did grab a table leg once and beat the living hell out of a paper-folding machine that I had cleaned, lubricated and generally babied – and it still would only chew up my work.

On the other end of my stunted emotional spectrum, I have three tools that are so reliable that I have feelings for them that I should probably discuss with a therapist. These tools – a smoothing plane, a dovetail saw and a combination square – have become worn in the places where I grip them. They are always at arm's reach when I build something, and they are the tools I reach for to help me diagnose and fix problems when things go awry.

This book is the result of my experiences with tools for the last 30 years, from the time I acquired my first coping saw at age 11 until the day I decided to sell off many of the tools I'd amassed as an adult. It is the tale of my sometimes-rocky relationship with my tools and how these hand-held pieces of iron, steel, brass and electrical wire have changed the way I approach my work and my life.

And I hope that this story will help guide you in acquiring a set of tools that will stick with you for the rest of your life. And when you are too old to wield them, I hope you'll still wander down to your shop in the evenings and lay your hands on their warm and worn wooden totes.

I chose the title of this book with care – it wasn't the decision of some cynical marketing department. Each of the three important words in the title "The Anarchist's Tool Chest" has a part in the story beyond this page. And when you put the words together, my hope is that the result is greater than the individual components.

The "anarchist" in the title is me. I dislike that word quite a bit, but it is the right one. I hope to make the case that most woodworkers I've met are "aesthetic anarchists" – people who work with their hands, own their tools and seek to live in a world where making something (anything) is the goal of each day.

Woodworkers generally labor alone, producing objects that are the result of just our tools, our minds and our hands. And the objects that we build are a slap in the face of the chipboard crap that is forced down our throats at every turn.

So though woodworking might seem a traditional, old-time skill, it is quite radical in this consumerist age where buying stuff is good and not buying stuff is considered fringe behavior.

The "tool" in the title is the heart of the book. Tools allow us to shape the world around us. But buying the wrong tools is a monumental waste that could drain your bank account, slow your progress as a woodworker or even sour you on the craft. In the last 14 years, I've studied and used more tools than most people see in several lifetimes. Though that sounds like boasting, it's not something I'm particularly proud of. And you don't have to make the mistakes that I made.

And the "chest" is the logical result of the first two words. After realizing that I was an aesthetic anarchist and that I didn't need every tool in the store, I built a chest for the tools that I really needed (using the tools I really needed) and stocked it with this essential set. If the tool doesn't fit in the chest, then I probably should get rid of it.

In addition to fulfilling the promise of the three magic words in the book's title ("Klaatu, barada...") I also hope to convince you of one radical notion that has seeped into my life and I hope will infect yours, too:

The mere act of owning real tools and having the power to use them is a radical and rare idea that can help change the world around us and – if we are persistent – preserve the craft.

We'll begin this story with the purchase of my first tool. I still own it, but right now it is in a cardboard box filled with tools that I just might sell.

1 - LASTMAKERS

"(Tools and skills), in
the dawn of the world were
a man's first, best friends.
They remain his best friends
still in a world grown old and
infinitely complex. By means of
them he can unlock the doors to a
life of creative activity that is
full of interest. Without them he
is mere shadow of the man he might be."

— *Charles H. Hayward,*
The Woodworker, *May 1954*

As a kid, my weekends consisted of two things: fishing in the lake near our house and riding my bike to Ace Hardware and Sears to ogle and fondle the tools.

I was, in short, obsessed with killing both all aquatic and deciduous life in my neighborhood. And I would spend hours farting around in my dad's workshop – he forbade me from using his machinery – and devising new ways to catch fish that didn't involve expensive gear.

Eventually I grew tired of fishing. The lake was the preferred hangout of copperhead snakes and my hometown's sexual deviants. The hardware stores, on the other hand, were filled with all manner of things that I couldn't touch – tools that I coveted but couldn't afford.

Somehow one summer I scraped together enough money to buy a coping saw. I fretted (excuse the pun) over the decision because Ace Hardware and Sears both carried coping saws, and I can remember traversing the parking lot between the two stores as I made my choice. I settled on the Craftsman coping saw.

What a piece of crap. I regret that decision to this day.

The saw is still in my basement, and it is still a shining symbol of garbage. It won't tension anything except my nerves. The blade rotates sickeningly like a dislocated shoulder. But it does have a nicely finished hardwood handle and a chromed frame.

This was my first experience with what I like to call "tool-shaped objects" – things that look for all the world like tools but don't really do the job required of them. At the time I should have tried to fix the saw with lock washers, a welder or chewing gum. But instead I did something far more modern and stupid: I bought another coping saw.

It was the beginning of a pattern. I bought tools believing the claims on their packages. And when they didn't work I'd look for a different tool that would promise more. In other words: I tried to spend my way into good craftsmanship. I ended up spending hours of shop time messing around with tools when I should have spent that time practicing basic skills.

I came out of this fog of brass and iron addiction with the help of a lot of dead guys, both well-known and nearly anonymous – Joseph Moxon, André Roubo, Randle Holme, Charles Hayward, Benjamin Seaton, Robert Simms. Their books, their inventories of their tools and their actual tool chests tossed a large rock into my brainpan several years ago, and I can still feel the ripples as I write this.

As a result, I have a lot fewer tools now than I did five years ago. But while I sold several piles of tools in 2010, I got to hold onto my hard-won knowledge about those tools, how tools are made and what makes them tick as I spent 14 years amassing what I like to call "an enormous working set of tools," which is a nice way of saying "a crazy stupid collection."

None of these events would have happened if I hadn't gone to a Lexington, Ky., grocery store one Sunday morning in 1996 on a whim. Back then I was your basic home woodworker. I was taking night classes at the University of Kentucky and using my grandfather's tools and machines to build furniture on the back porch of our 1899 Victorian home.

I still had my crappy Craftsman coping saw and its slightly less-crappy replacement from Ace. Most of my tools were at the phytoplankton end of the food chain. Chisels and a block plane from Walmart. A Black & Decker drill. The rest of my hand-held power tools were from the 1960s and 1970s and were all chromed and weighed as much as a Christmas ham in the can.

But I didn't know any better, so I liked my tools and the redolence of their rotting electrical insulation.

That Sunday morning was a little different than most. My wife and I had decided the night before to move to Northern Kentucky outside Cincinnati, Ohio, which is where she grew up. We had a 5-month-old girl who didn't like sleeping, and we had no family in town to help us resist the urge to smoke pistols.

So that morning I went to the grocery store and bought a copy of the

Cincinnati Enquirer for the want ads. And lo and behold there were a couple ads in there that interested me: the director of publications for the Cincinnati Art Museum and the managing editor job at *Popular Woodworking* magazine.

I applied for both jobs the next morning. I got a nice rejection letter from the museum, but I got a phone call from F&W Publications, which owns *Popular Woodworking*. They interviewed me twice, gave me two aptitude tests and offered me an entry-level job.

The salary was a 30-percent pay cut. I immediately accepted it.

My first year there was an enormous education in how woodworking is really done. Until that point I had never seen a shaper, a spray booth, a hollow-chisel mortiser or an abrasive drum sander. I had never used a rip fence on a table saw that actually locked square (Mr. Bill Biesemeyer became my new best friend). I had never used a cordless drill that had a clutch and that didn't smoke or spark when it spun.

Almost every day, some new tool showed up in the mail for us to use. Let me say that again so you might actually believe me: Almost every day, some new tool showed up in the mail for us to use. It could be anything, from a cabinet saw to a package of plastic 18-gauge brad nails that worked in air tools.

And this flood of tools to our office continues to this day. For the most part, we never ask for these tools to be sent to us, and we sure don't get to keep them. But they do come, even sometimes if you say, "No thank you, tool person." Here's how ridiculous it can get: Once we wanted to test a new biscuit joiner from Porter-Cable. The public relations guy asked if we also wanted to test the company's new jigsaw. "Nah," we replied. "We just need the biscuit joiner."

A few days later a box showed up from Porter-Cable. It was the biscuit joiner. And they had included two (two!) jigsaws to fill out the box. The jigsaws were ballast.

To be sure, this massive flow of injection-molded plastic and steel is all about the tool companies looking for low-cost advertising. A short and positive review in a magazine for 200,000 woodworkers can do wonders for a tool's sales – so throwing a few tools around to the magazines is no big deal to a big tool company.

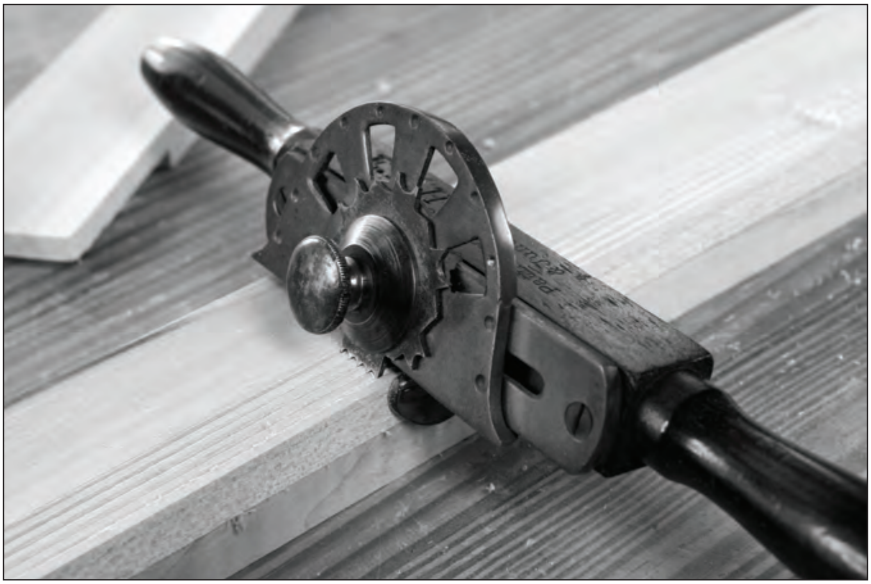
But before you think we were/are totally depraved, let me give you a little reassurance. We didn't take these tools home with us. In many cases we sent these tools back to the manufacturers when we were finished with them. If the manufacturer didn't want them back we would sell them to the employees of our parent company (at a discount) and send the money to the tool maker. Sometimes the manufacturer didn't want the money (it would be an accounting nightmare) so we put the money into our shop's fund that bought the glue and wood we used to build stuff.

In journalistic terms, this wasn't the purest of ethical situations, but it was the best we could do with our limited resources. There was no way we could afford to buy 10 cabinet saws to test them – small magazines like ours have annual gross revenues that are similar to your neighborhood McDonald's. We're a small business.

I never liked this set-up. So when I started reviewing hand tools for the magazine, I vowed to purchase the tools outright. Our magazine's limited tool budget couldn't handle this, so I bought most of these tools with my own money, which is how I somehow ended up with about a dozen marking knives. In some cases I couldn't personally afford to buy the tools (especially when it came to infill handplanes), so I'd borrow them from the makers or an owner who had bought one and then send them back when I was finished testing them.

The net result is that I started amassing more hand tools than I (or anyone) needed. I ended up with several complete sets of bench planes, vintage and new. I had drawers of chisels, combination squares, spokeshaves, block planes, dovetail saws and on and on.

At the same time, I was becoming deeply interested in the history of toolmaking. So I ended up buying vintage tools to see how they worked or



Compared to a scratch stock. My tool obsession knew few limits. This Windsor beader is a bit of a crazy multi-tool compared to a shop-made scratch stock. But I really wanted to try one out.

to compare them to their modern equivalents. I joined the tool-collecting groups and started attending meetings.

But it wasn't just hand tools. I also spent way more than necessary on power tools. My problem with power tools wasn't about amassing five drills or three miter saws all in one shop, though. The problem was my desire to upgrade to something better.

My Black & Decker drill gave up after drilling no more than 200 holes. The thing literally flamed out in my hands and melted from the inside. I needed a new drill. So I started looking at the cordless drills in our shop at the magazine and began using them at work on projects. I immediately fell in love with a Bosch 12-volt cordless drill. I had never held a power tool that felt so solid and precise. Everything about the drill reminded me of my grandfather's old Mercedes-Benz.

I bought a Bosch drill and instantly became more picky about my power tools. I took a second look at my Craftsman table saw from the 1970s. It had one of those infamous Jet-lock fences that never locks parallel to the blade. Every rip cut involved three measurements of the distance from the sawblade to the rip fence, then tapping the fence with a dead-blow mallet.

So once I used a Powermatic 66 5-horsepower three-phase cabinet saw with a sliding crosscut fence, I was hosed.

I had a tiny personal workshop at home and decided that I needed to find a small saw with a great fence. The solution seemed to be a DeWalt job-site saw with a rack-and-pinion fence. It had a better fence than my Craftsman, but this tool had a universal motor – like the loud screamers on routers. It lacked in the guts department.

I replaced it with a Delta contractor saw. This was a step up, and I was happy with that saw for many years. But once you use a cabinet saw every day at work, they are hard to resist. I ended up buying a Delta Unisaw.

This upgrade path happened over and over again. I've had three surface planers, two jointers, three miter saws, more than five drills, four band saws, four sanders and seven routers (at least). If you do the math and you know how quickly power tools depreciate in value, you can see how this was an expensive upgrade path that drained my bank account but helped the tool companies.

Then there were the jigs. I've owned more slot miter gauges for my table saws than I can remember. Plus dovetail jigs, at least five things named "Rout-R-Something" and another six called the "Something Something 2000." They clogged up the shelves of my basement shop. I built a bigger shop, and those shelves got bloated, too.

So where is rock bottom in this world? For me it was one day when I considered purchasing some winding sticks from Highland Hardware that were made from a solid-surface material and were accurate to .001" or some such. Somehow, I resisted buying them.

The Good Books

The funny thing is that it was my mad obsession with acquiring woodworking stuff that helped me find a balanced approach to the craft. You see, I became as obsessed with acquiring woodworking books as I was with the tools. I've always been a voracious reader, so consuming books on woodworking and tools was natural. (And add to that the fact that I was freelancing at the time as a contributing editor for the WoodWorkers' Book Club newsletter. That job was a five-year-long force-fed diet of woodworking writing.)

Read enough modern woodworking books, and you might just want to gouge out your eyes with a melon baller. They are all so similar and shallow and filled with idiosyncratic information. I can't tell you how many times I read the following phrase: "This might not be the right way to do this, but it works for me."

Something inside my head made me wonder about that "right way" the author rejected.

It just so happened that at about that same time I had a short phone conversation with Graham Blackburn, one of my woodworking heroes. I had a few of Blackburn's books from the 1970s, and I knew he had a command of woodworking history. So I interviewed him about the origin of the word "jack" in "jack plane" for a short piece I was writing for the magazine.

We then started talking about saws.

During the conversation, Blackburn said I could find the answer to one of my questions in the book "Grimshaw on Saws."

Huh? I replied.

I'll never forget what he said next: "You don't have a copy of Grimshaw, and you're an editor at a woodworking magazine? Hmmm."

I was ashamed. So ashamed that I went down to Cincinnati's public library that weekend to check out Robert Grimshaw's 1882 treatise on saws. It was sitting on the shelf next to a bunch of other old woodworking books I'd never heard of. I wondered which of those books were also "required reading" in Blackburn's world. I checked out as many of those cloth-bound books as the library would let me. I went home. I started reading, and I haven't stopped.

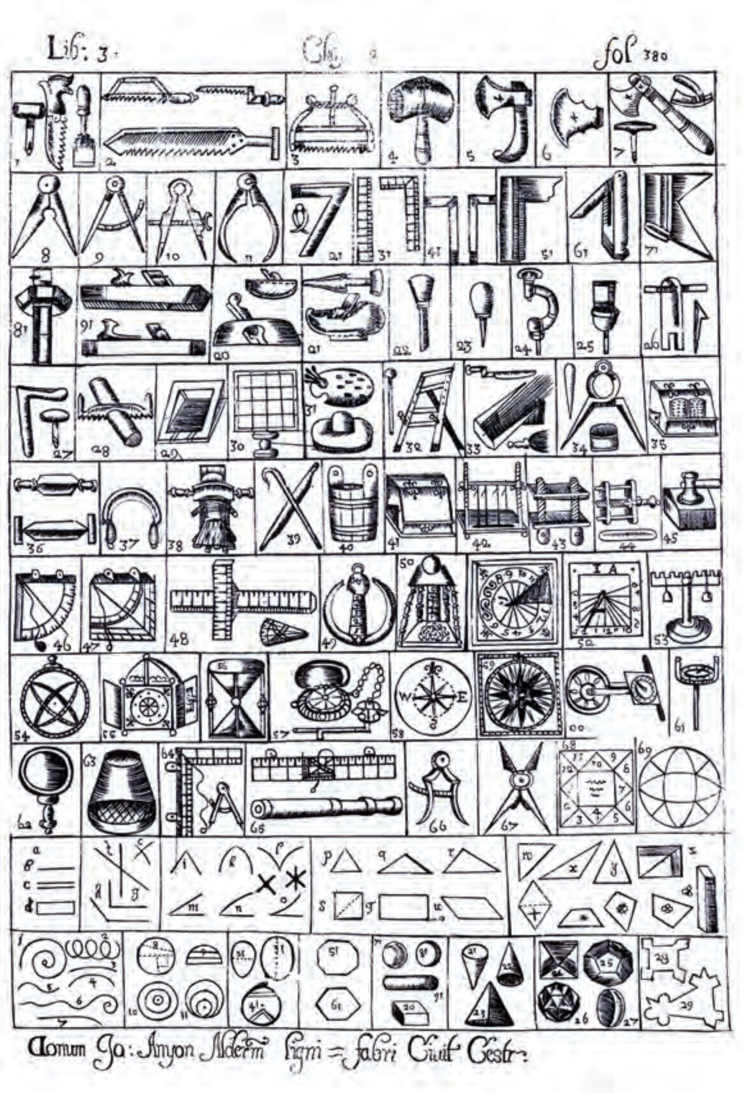
The things I learned from the old books were different than what I expected to learn. I actually expected the shop practices to be different – you know, they had different ways of cutting a mortise, a tenon and a dovetail. But really, not much has changed in the way that steel (usually) defeats wood.

While there are a wide variety of ways to perform every standard operation, the pre-Industrial craftsman didn't seem to have secret tricks as much as he had lots of opportunities to practice and become swift.

Instead, what surprised me was the small set of tools that were prescribed for a person who wanted to become a joiner or a cabinetmaker.

Joseph Moxon, the earliest English chronicler of woodworking, describes 44 kinds of tools necessary for joinery in "Mechanick Exercises" (1678). For some of these tools, you'd need several in different sizes (such as chisels), but for many of the tools that he described, a joiner would need only one (a workbench, axe, fore plane etc.).

Randle Holme's "Academie of Armory" (Book III, 1688) has approximately 46 different joinery tools explained in his encyclopedia. An exact number is hard to pin down because some of the tools are discussed twice



Academy of Sanity. Randle Holme's 1688 book outlined a small tool kit that could be used for building lots of furniture forms.

(for example, mallets, smoothing planes and hatchets) and some tools seem shared with the carpentry trade.

If we jump forward more than 150 years, not too much has changed. The list of tools required by the rural joiner in "The Joiner and Cabinet Maker" (1839) isn't all that much different from the tool list described by Moxon and Holme. "The Joiner and Cabinet Maker" gives a significant description to about 40 tools used by a young apprentice during his climb to journeyman.

As the Industrial Revolution begins to crank out mass-manufactured tools, the basic list of tools recommended for basic joinery starts to expand. There are more kinds of boring bits available, new kinds of metallic planes (such as blocks, shoulders and routers), plus some new saws, including the coping saw.

By the 20th century, the basic list of tools for joiners stands at about 63, according to books by Charles Hayward, the traditionally trained dean of workshop writers. Still, when I looked at Hayward's list it seemed rather paltry compared to what was in my shop. (See this book's appendix for a comparison of these tool lists.)

At first, I attributed these short lists of essential tools to three things:

- Everything in the pre-Industrial age would have been more expensive because it was made by hand.
- The general level of economic prosperity was lower.
- Technological innovation had yet to produce the fantastic new tools shown in the modern catalogs.

But all that was just denial kicking in.

Judging from the descriptions of the nature of work before mass production ruled the earth, there were two things going on that were related, but that are easy for moderns to miss. One, artisans didn't require as many tools because the basic skill level was higher. Descriptions of hand work support this fully. (Don't believe me? Read Moxon's description of making an eight-sided frame in section 19. Try to build one yourself that way – I did – then let's chat. If that doesn't convince you, then read André Roubo's descriptions of Boulle work – then go back to making woven stretchy potholders.)

Also, the structure of the economy in the 17th, 18th and early 19th centuries was different – it was still basically a pre-Capitalist culture. Large portions of the population were self-employed. Modern consumerism – for better or for worse – had yet to take hold.

To be sure, there were early craftsmen with huge tool sets. There are always going to be a few tool whores in the guild. (I'm looking at you, Duncan Phyfe.) But tool inventories and other published accounts indicate that the pre-Industrial woodworker could use fewer tools to make furniture that was equal to or better than what we make today.

But here's the other thing that's important: Their tools were different. To the uneducated eye, the tools of the 17th and 18th centuries look crude. But have you ever examined an 18th-century moulding plane that wasn't dogmeat? I have. They are refined to a level that exceeds many modern tools.

Everything extraneous has been taken away. Everything necessary is right where you need it and is easy to manipulate.

I have a few early tools, including one particular strapped hammer for the upholstery trade, and I simply cannot imagine how any aspect of the tool could be improved. It is utter simplicity, yet it has a graphic beauty that surpasses everything I've seen from the Victorians.

After reading enough accounts of early tool sets, it began to sink in that I didn't need as many tools to build the furniture on my long to-do list. But then I found out that you can't buy a chili dog without the bun.

Once the idea of a smaller tool set took hold in my brain, the logic and beauty of its surrounding pre-Industrial economy became as beautiful as my early strapped hammer.

Anarchy from a Woodworker's Perspective

I hesitated to use the word "anarchy" in the title of this book because it means so many bad things to so many good people. In my high school, the "anarchists" wore "Bad Brains" leather jackets, black make-up (that was the boys) and had questionable hygiene.

They weren't anarchists. They called themselves anarchists, but they knew as much about anarchism as they did about flossing.

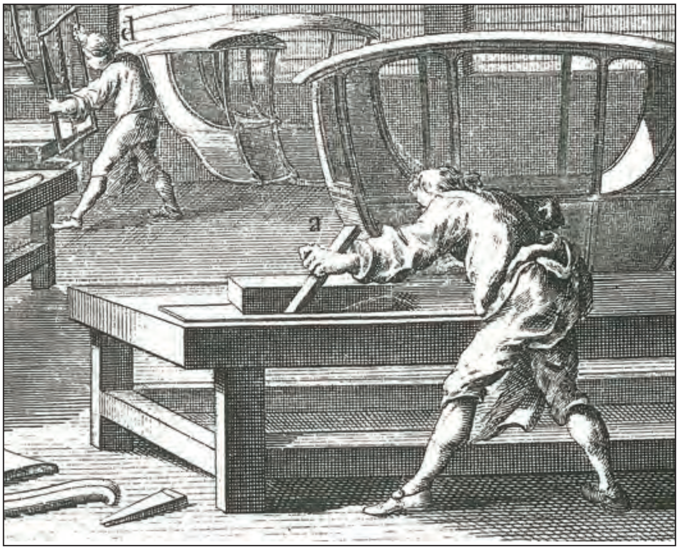
Anarchy is the precise and correct word for my situation. And if you'll bear with me, I think you'll understand why a boring guy from the suburbs who likes blue jeans and button-down shirts is a quiet anarchist.

For me, it's quickest to explain what anarchy isn't: It's not about violence, the overthrow of governments, the dismantling of corporations or even the smoking of a mild hallucinogen made from boiling banana peels (actually, I tried this. I don't recommend it). Instead, anarchism is the realization that all large institutions – governments, corporations, churches – have divided up the tasks we do in our jobs to the point where these institutions do wasteful, dehumanizing and stupid things.

Eunice Minette Schuster states in the book "Native American Anarchism" that American aesthetic anarchy is "the isolation of the individual – his right to his own tools, his mind, his body, and to the products of his labor."

It's a desire to work for yourself and to run in social and economic circles made up of other individual artisans.

Hey, that's me. Heck, I have to believe that Schuster's description applies to most woodworkers I know. We generally labor alone, producing objects that are the result of just our tools, our minds and our hands. These objects are a slap in the face of the cheap, mass-manufactured termite-diarrhea furniture in the discount stores. And we're proud of the fact that our furniture is better than the stuff force-fed to the masses.



Though woodworking might seem a traditional, old-time skill, it is rare and radical stuff in this age.

So when all these ideas came into focus in my head, I realized that I wanted to build furniture using fewer tools that were of good quality. I wanted to build things that couldn't be bought in a store. I wanted to build things requiring more skill than wallet. And I didn't want to support the system that encourages endless consumption.

All these utopian urges also made me realize that my shop was a miserable place to do all these things, especially compared to the shops drawn in the early books such as Roubo's, André Félebien's "Des Principes de L'Architecture" and Denis Diderot's "Encyclopédie" (and those shops were all probably sweatshops).

My shop is in my basement. Its concrete floor torqued my spine after a few hours of trodding upon it. Its three cinderblock walls would depress Aleksandr Solzhenitsyn. And the fourth wall was open studs, wires, insulation and vents.

So one night I hatched a plan that would pull together all the threads that had been running loose in my head. I would make do with fewer tools. I would make everything our family needs. And I would make my shop as nice as the rest of the house.

Here is my seven-step plan.

- Make a list of the basic tools and machines that I need to build furniture. Base this list on my research into the historical record and my 17 years of practical experience.
- Sell off every damn tool and jig I don't need that has been cluttering my shop.
- Use that money to turn my dungeon of a workshop into a comfortable and inspiring place.
- Build a tool chest that is based on historical forms (a-ha! The third part of this book's title). A tool chest was of critical importance to the pre-Industrial artisan.
- Fill the chest with the tools on my list and forsake any tool that won't fit into the chest.
- Write a book about the experience.
- Build stuff until I croak.

Though these are selfish goals, I hope that my pitiful personal example can help you make the right decisions when getting started in the craft. I hope that you will consider my list a starting place for your personal tool kit. With the following tools you can build a lot of stuff, and my recommendation is to start with this list (or even a few tools from the list), then stop buying tools and do something crazy.

Build stuff. Build a lot of stuff.

That experience will point out what (if any) other tools you need to buy. You might just surprise yourself and find that you are perfectly content with this workable tool set – like I was before I got sucked into my job at *Popular Woodworking* magazine.

But even if that doesn't happen, perhaps this list will help you spend your money wisely so that you have plenty of cash left over to buy nice wood and well-made hardware.

Let's begin by making a list of the tools you really need.

2 - THE TOOL LIST

A list of essential woodworking tools is like a checklist for the things you must do to enter heaven. On the one hand, it's nice to have a road map to guide you. On the other hand, there's no way to know if your road map is the right one until you reach your destination.

The following list is designed for people who want to build high-quality furniture. It is not a list for people who make musical instruments or (at the other end of the spectrum) plywood silhouettes of little boys urinating.

This list is culled from written sources from 1678 to the present that I own. Yet, it is not a pure historical survey. This list describes the working set of tools in my tool chest in my shop at home. I do own more tools than this, but those are for other aspects of the craft. I have a 15-gauge finish nailer for installing trim in the house. I have a scorp and travisher for building Welsh stick chairs. And so on.

Use this list as a starting place to show you which tools are important and which tools are for tool collections. You should buy a plow plane and a rabbet plane before you even think about buying a Stanley No. 113 circular plane or a framing slick.

And it is these tools that you should pick with particular care. Buying low-quality chisels and hardware-store saws isn't frugality. It's stupidity.

Handplanes

Jack plane
Plow plane
Rabbet/shoulder plane
Block plane
Router plane

Marking & Measuring

Cutting gauge(s)
Panel gauge*

6" Combination square, which has a removable 6" rule

24" folding rule or 24" steel rule

12' tape measure

Marking knife

Wooden winding sticks*

36" wooden straightedge*

Wooden try square, 12" blade*

Sliding bevel

Dividers, two to four pair

Essential Cutting Tools

Bevel-edge chisels: 1/8", 1/4", 3/8", 1/2", 3/4" and 1-1/4"

Mortise chisels: 1/4" or 5/16"

Spokeshave

Cabinet, modeling and rattail rasps

Card scrapers

Striking & Fastening Tools

Chisel mallet*

Cross-peen hammer

13 oz. to 16 oz. claw hammer

Dead-blow mallet

Nailsets*

Nail pincers

Set of slotted screwdrivers

Screw tips for drill/drivers

Sawnut drivers (if you have split sawnuts)

Countersinks; counterbores

10" brace

Hand drill

Set of 13 auger bits

Brad points: 1/8", 3/16", 1/4", 5/16", 3/8", 7/16" and 1/2"
Birdcage awl
Dowel plate*

Saws

Dovetail saw
Carcase saw
Tenon saw
Panel saws (rip saw, crosscut saw, fine crosscut saw)
Flush cut saw
Coping saw

Sharpening

Sharpening stones (honing and polishing)
Strop* (if you use oilstones)
Grinder
Oilcan or plant mister
Burnisher

Appliances

Bench hook*
Sawbenches*
Miter box
End-grain shooting board*
Long-grain shooting board*
Miter shooting board*
Cork-backed sanding block*
Workbench*
Cabinet clamps (at least four)

Good-to-have Tools

Dial caliper
12" combination square
Dovetail marker*
Jointer plane
Smooth plane
Large shoulder plane
Carpenter's hatchet
Drawknife
No. 80 cabinet scraper
Beading plane
Small complex moulder, such as an ogee or square ovolo
Half-set of hollows and rounds
1-1/2"-wide paring chisel
Fishtail chisel*
Drawer-lock chisel
Mortise float
Drawbore pins
12" bowsaw
Sawfiles
Mill file
Saw vise
Saw set
Side-clamp honing guide
Trammel points*
* *Tools that can easily be made or should be made by the woodworker.*

I wish I'd had this list when I started woodworking. I also wish my dad had had this list when he started building furniture and, later, houses. His tools, which I have tried to upgrade for him, are on the low end of the quality spectrum. His handsaw gives me blisters just to look at it. His plastic-handled brace is slippery and itchy in use.

But those are the first hand tools I used. So their story is worth repeating.

3 - DON'T THINK OF A WHITE BEAR

"It can be hard to tell a crank from an unfamiliar gear."

— *Leigh Van Valen, evolutionary biologist*

I'm in my father's red Dodge Ram pickup truck. I am, oh, about 13. And I am miserable. The Boston Mountains fill the windshield like a low-rent nature poster as he winds through the backroads of Northwest Arkansas. It's Saturday morning and, as on most weekends, he is headed to our farm outside Hackett.

It's an 84-acre plot of cliff sides and bottomland that my parents purchased with the hope of building a new life – it was outside town and off the grid, with composting toilets, a solar shower and no air-conditioning.

The farm was really my father's dream, and the rest of the family played cameo roles in it as he spent every free moment digging, building, drafting and reading, reading, reading – about everything from wood stoves to water witching (which, by the way, does not work).

That particular Saturday we were framing something in the kitchen-to-be, but I wanted to be back in town with my geeky friends – not cutting studs on the mosquito coast.

My father tried to cheer me up.

"Someday," he said, "you are going to want to do this yourself. I can feel it. And when that happens you are going to be glad for all the days you worked on the farm."

I didn't say a word in reply. In my head all I could think about was moving as far away from Arkansas as possible where I could live in a city with air-conditioning and a desk job, maybe doing something with computers.

Though I've never told him, my father was at least partly right that day. My efforts to become urbane and sophisticated didn't pan out. I moved to Chicago for college. I did everything I could to banish the word "y'all" from my lexicon. I stopped holding doors open for women. I got a half-Japanese girlfriend, drank gin and tonics and went to Ethiopian restaurants.

But after all that posing turned to naught, I ended up marrying a woman from Kentucky, and when we bought our first house in Lexington, Ky., I started building furniture and fixing up our Victorian cottage in earnest. My every effort to endure a desk job failed, and I took a job at *Popular Woodworking* where I could be on my feet and work with my hands and wood and tools for at least part of every day.

And though I've never felt the urge to buy a farm and live the sweaty life amongst goats and strawberries, I definitely felt the pull of my father's prophecy when in 2009 I sat in our comfortable sunroom in the Morris chair I built – beer in hand. That's when I hatched my plan for this book and decided to sell every excess tool I owned and create a little utopia in my basement shop.

But there would be air-conditioning. And flush toilets, too.

My workshop is a 15' x 25' space in an addition that we built onto our house in 2000. It had a raw concrete floor and walls that were cinderblock and open studs. When I moved my first machine in there, the room didn't have electricity or windows. It was the most miserable shop I've ever worked in, and I was blissfully happy.

During the next 10 years I made only minor improvements to the place. I added a couple windows and covered some of the open stud walls with 1/2"-thick oriented strand board (OSB) that I painted white.

All the while I focused on acquiring all the tools I thought I needed to be a "complete" woodworker (whatever that is) and hardly noticed that my shop was filling up with stuff that I didn't need.

After 10 years of this, my shop was cramped. I had upgraded my planer, jointer, drill press and band saw, and all those machines took up so much space that I had to put my band saw and planer on wheels so I could rearrange everything just to process rough stock.

The other big difference was that I had gotten older. When I finished the addition on our house I was 32. After 10 years of standing on concrete floors at work and at home, my back spoke up. After a long day in the shop, I would wake up stiff and a little sore.

I also noticed that when I taught classes at Kelly Mehler's woodwork-

Before. Here is my shop before I decided to gut it. Concrete floors, open stud walls and tools everywhere. I barely had room to move, much less build anything.

ing school in Berea, Ky., my back was much better during the class, even if I was teaching a six-day class in building workbenches, which had a lot of heavy lifting.

Kelly's school was the first shop I'd worked in that had wooden floors. When I made that connection, I knew that the next improvement I was going to make to my shop at home was a wooden floor.

I certainly have the skills and tools to lay a wooden floor (I've done it before). But I was missing one key component: the time to do it.

If there was one sad lesson I learned from my father's farm it is that starting a project is easier than finishing it. He never completed the huge house he designed and built himself – and ended up selling – in 2008.

So I started selling my tools and socking the proceeds into our savings account until I had enough to pay for a new floor – I needed about $4,000. I

Farewell communist debriefing room. When I removed all my machines and tools, I was delighted that I had a lot more space than I remembered. But I was disheartened by the gray concrete and cinderblock.

wanted a surface that was tough and grippy – the only downside to the floor at Kelly's school is it can be a bit slick, especially when you get a little fine sawdust on it.

For toughness, I chose white oak. Not the engineered stuff that was particleboard covered in veneer or – even worse – a color photograph of white oak. I wanted 3/4" solid white oak with tongue-and-groove edges.

When I got a quote for the floor, I told the guy that I wanted him to sand the floor but leave it unfinished. He looked at me funny. I explained that I didn't want a slick floor; I wanted a floor that my feet could grip while I was planing and sawing.

He said that the raw oak floor would quickly become stained when I walked over it in my wet boots. I replied: "I don't care."

"You might not care," he said. "But the next owners of the house might."

Good point. We compromised: One coat of water-base clear finish. The flooring guy said that the first coat is always rough and will provide excellent traction. He was right.

With the floor complete, I considered moving my tools into the shop and getting started. But the nice floor made the cinderblock walls and stud walls look even uglier. It was time to sell more tools.

The subfloor. First a vapor barrier. Then the flooring guy shimmed the floor to make it level. Then a thin particleboard subfloor.

I was surprised by how easy it was to get rid of tools to which I thought I had a sentimental attachment. Once I had a plan to improve the shop, every tool sale put me one step closer to a space that was well-lit, comfortable and as nicely finished as any room of our house.

The next step was to put drywall over the open studs and to cover the cinderblock with beadboard, which would match my other work room in our house – the kitchen. I also decided to change the electric service to my shop. I had plenty of outlets, but I started hatching a plan to do something radical: I decided that the table saw was no longer going to be at the center of my shop.

Like most woodworkers, I'd planned my machinery layout around my table saw. I plopped the saw down in the middle of the shop and positioned it carefully so I could comfortably cut a 4' x 8' sheet of plywood on the saw and not hit the furnace or another machine. All the other machines, tools and benches orbited the table saw and were in service to it.

Wood is good. With the floor done, the rest of the room looked even uglier than before. I decided to keep improving things.

This system works fine – if you actually cut full-size sheets of plywood on a regular basis. I don't know about you, but I've developed a hate-hate relationship with sheet goods. On the one hand, they are a great material for down-and-dirty projects needed for a growing family, like the 13' run of floor-to-ceiling cabinets I built for our playroom.

But on the other hand, plywood has become so awful – warped, wet, full of voids – during the last decade that it is hardly worth the trouble. The most wretched stuff comes from China, but I don't blame the Chinese – Americans ordered the stuff from them.

In 2008, I built a 10' run of open shelves for some friends using this junk, and I was relieved and grateful when they told me that they wanted the project dyed black. The black dye was the only thing that was going to make this junk look anything like fine furniture.

When I installed the shelves in their home, I drove back to our house and decided I wasn't going to ever work with plywood again.

Once you forsake plywood, your shop can change its shape. Instead of putting the table saw in the center, I pushed it against a wall. Instead of looking for 9' of infeed and outfeed, I decided on 5', and I could go to 6' if I pushed my band saw out of the way (it's still on wheels). This small change opened up a dance floor in the center of my shop.

Emboldened, I decided to completely change the back wall of my shop. That's where I had my planer, chop saw, router table and stationary belt sander. This glut of machinery and tools was the reason I had to wheel my machines around to process rough stock. No more.

The miter saw and router table went up for sale. I have a hand-powered miter box that I actually prefer to my electric miter saw. The miter box is more accurate (especially for miters), safer, doesn't throw little pieces of scrap around the shop like bullets and can easily be stored under the bench when I don't need it.

Selling the router table was a hard decision. If I ever want to run custom moulding for another home improvement, I'm going to want a router table (or a shaper). But that was my only qualm. I make a lot of mouldings with moulding planes now, and I had to blow off a thick blanket of sawdust from the router table every time I used it, which was rare.

The belt sander was also a hard call – not because I used the beast. The thing never worked right. But it was my grandfather's, and it's the last piece of major machinery of his that I owned. But it was taking up a lot of floor space for something that was never used and was always in the way. Goodbye sander.

Those changes left my planer alone on the back wall. I parked it in the center of that wall (giving me about 7' of infeed and outfeed) and put my jointer off to the side. With just a few changes I had reworked my machines so they are always set up and ready to go, they afforded me enough space to

Drywall and beadboard. Adding drywall and beadboard was surprisingly inexpensive because I volunteered to do all the painting and trimwork.

work with standard furniture-sized pieces of solid wood and they gobbled up less floor space.

So in the new world order, what is the center of the shop? The workbench, naturally. My workbench is actually in the same position that it was when I began – it's up against a north-facing pair of windows and under my now-emptier tool rack.

But I now have ample room for two sawbenches – knee-high traditional benches designed for breaking down stock with handsaws, assembling projects on and just about anything else you can think of.

My other machines are pushed to the walls for now, awaiting judgment.

The band saw isn't in any danger. I'd probably get rid of my table saw before I scrapped my band saw. It's nothing special, a 1970s-era Rockwell/Delta model with only 14" wheels and a half-horsepower motor. That motor, however, is also from the 1970s, when they didn't exaggerate horsepower the way they do now. My saw has plenty of power. What I love about my band saw is that it has only one plastic part – everything else is metal. And the plastic part is the only thing about the machine that gives me trouble. It's the guard that envelops the blade as it snakes its way up the cast-iron post.

No matter what I do, the blade rubs against the inside of this plastic part. The saw makes an annoying scraping noise because of the crappy plastic. But despite this one flaw, the saw is fantastic. I have no other complaints.

The band saw is almost always on in my shop. I rip stuff down on it, resaw small pieces, rough out some joints and (of course) cut curves. I paid $375 for this saw years ago and would gladly pay twice that amount for this machine that was made in Tupelo, Miss.

A little less secure is my drill press, a 17" model that I bought from Grizzly Industrial years ago. The drill press has plenty of power, is accurate enough for woodworking and has never given me a minute of trouble. Still, I use it so rarely that I feel like it doesn't pay the rent. But when I do need it, I am incredibly thankful that I have it.

Recently I bought a hand-cranked drill press for $50 that I have been restoring. And I wonder if this machine, which mounts to the wall, could replace my electric drill press. I have the wall space. The only question at this point is if my spindly arms can provide the torque to turn a 2-1/2" Forstner bit. I won't know until the restoration is complete. Stay tuned.

Still less secure is my hollow-chisel mortiser. It's a Powermatic and is the bee's knees as far as mortisers go. But it's almost too nice for a home shop. When I use it, I feel guilty that I'm not bashing out my mortises by hand. I know how to do that operation. It's not difficult for me. So why can't I just put this machine up for sale?

Well the answer is that I just might build some more Morris chairs. I bought this mortiser to make the 200-something mortises required in a run of spindle-sided Morris chairs that I made in the 1990s. And if I build another one (and I want to), then the mortiser will definitely pay its way. Plus, the machine is on wheels and doesn't take up much space at all – less than any other machine I use.

I also have a small lathe. It's not on the chopping block because I haven't mastered it yet. I want to know what I'll be missing when I kick something to the curb.

No matter what is ahead for these machines and for me, in the end, the most important thing is that I actually and truly reach the end. That was something my father couldn't manage.

His dream took years to realize, years to atrophy and years to wither. His drive to complete the home at the farm and move us there took an enormous hit when my parents divorced. When my parents split, my father moved into an awful apartment, and I thought that might finish him. Here was a man who was carving the Arkansas wilderness into an image in his mind, and he was in a 900-square-foot apartment in a complex that had "singles night."

The farmhouse he had designed was huge – about 5,000 square feet with an enormous and gorgeous stone fireplace, a greenhouse attached to the kitchen (my mother loves to cook and garden) and a wall of windows facing off a cliff into a stunning view of the Boston Mountains.

Something about the marital split took the wind out of his sails. He bought an old farmhouse in town and began fixing that up. His trips to the farm became less frequent. He stopped talking about it on the phone, except to comment that he felt bad that it was sitting there, unused.

Believe it or not, I began to worry about the farm myself. I couldn't really talk about it with my wife except in an abstract way. Otherwise she would worry that I wanted to move there and finish the job. When talking to my dad, I would occasionally offer to come down for a week or two and get the farmhouse into shape. Hang some drywall. Lay some floor. Get it ready for whatever he had in mind.

But he demurred.

And one day when I was visiting him in Arkansas, I found out why. One of the other neighbors on our road outside Hackett had told my dad that the gate to the farm had been torn down. It was probably the work of some kids who were looking for trouble.

We made the long and familiar drive to the farm, passing from the arrow-straight I-540 into a series of never-ending curves and switchbacks to make it to the farm.

We pulled up. My heart broke.

The gate was ruined, just like the neighbor said, but that wasn't the worst part. The house itself was in serious entropy, and showing it. The foundation by the storm cellar (you have to have one in Arkansas) had buckled. All the brickwork on top of it was leaning at a sickening angle.

The vegetation was climbing up the beautiful redwood siding. Rats had left droppings everywhere. The sleeping porch my father had built for my mother (to escape the oppressive Arkansas heat) looked about to topple.

I don't know why, but I wanted to cry. I had seen so much of this dream come together. I was there as every wall was lifted into place, usually with the help of ropes, pulleys and a handful of friends. I watched the father-and-son masons piece together the intricate fireplace that dominated the center room. And I was there, hammering fascia, or decking or rafters in place. In the grand scheme of things, I did almost nothing. But I was there, if only to begrudgingly mark my father's progress, week after week.

And I was there to see the dream fall apart. My dad was a little distraught that day, and his partner in his medical practice had come down to see the farm, too. They made small talk while standing in the middle of our gravel road. I hung the new gate to the farm. It wasn't a difficult job.

As I finished that job, I watched my father and his partner talking, then I poked around the homestead, a half-finished ruin of open studs, skylights and rotting redwood. I wanted to fix that mess.

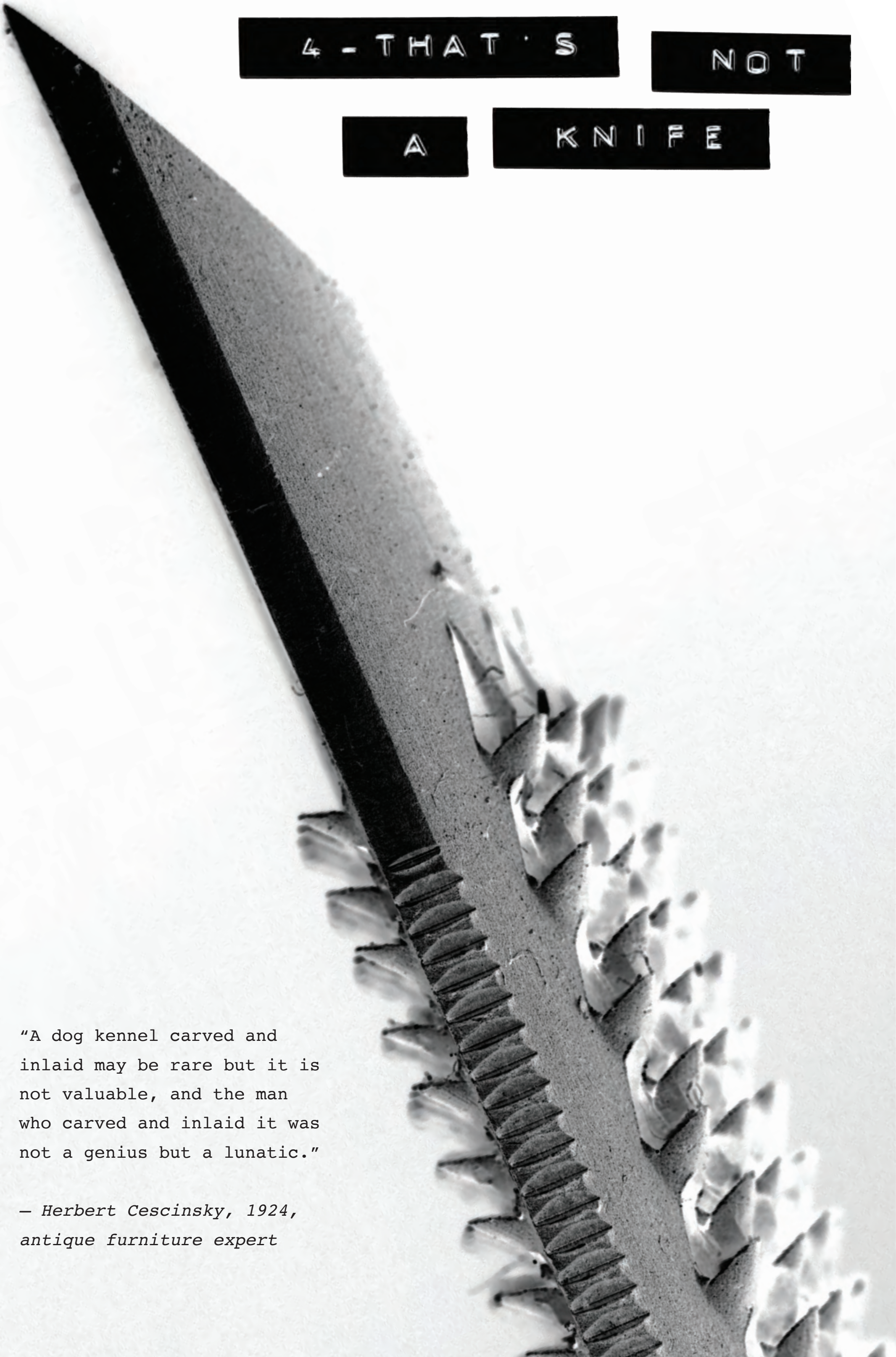
That's when I finally understood that day when I was barely in puberty and my dad and I had driven to the farm.

Room for more. The changes in my shop did more than just make the room a more pleasant place to work. It also made room for my daughter's bench.

I wasn't destined to have the same dream as my father. I am a different person with different DNA. But between us the urge to build is undeniable. In the driver's seat in 1981, he knew that. I didn't.

But I do now.

4 - THAT'S NOT A KNIFE



"A dog kennel carved and inlaid may be rare but it is not valuable, and the man who carved and inlaid it was not a genius but a lunatic."

— *Herbert Cescinsky, 1924, antique furniture expert*

In my opinion, if you make tools and you can't make a proper chisel, then maybe you should take up a new profession.

Chisels are made from just two to five pieces at most. None of these parts move. None of the raw materials are particularly expensive or rare. All the difficult manufacturing challenges to make a perfect chisel were conquered lifetimes ago.

In fact, an industrious home woodworker with a grinder, a MAPP gas torch and a household oven can turn out a respectable set of them.

So why the hell are so many modern chisels in the catalogs and stores so bad?

Do they use bad steel? Actually, no. Modern steels are excellent.

How about the wooden handles? Do they skimp and use a wood that's too soft? Again, no. Many modern chisel handles are made from hornbeam, hickory or something else that takes a beating.

It can't be the stupid ferrules, can it?

The truth is that most chisels look good on paper. And they look good hanging on your shop wall. But they are a sadly degraded photocopy of what a real chisel is. The important details have been lost. Important decisions about how the tools should be manufactured have been made by people who have no idea how the tool will be used.

If I were a conspiracy theorist, here's how I would see it: Big corporations make tools that don't work so that you have to buy replacement tools. The tools can't really build anything so you are forced into buying manufactured furniture, which also doesn't last. So you can never escape the cycle of consumption, destruction and consumption.

But I'm not one for conspiracies when the simpler explanation is either pure greed or stupidity.

I mean really. Take a look at the chisel/rasps at the beginning of this chapter. If the person who designed them is part of the Trilateral Commission then I am a Chinese jet pilot.

Two Choices: Vintage or New

So buying your tools from a big manufacturing concern is generally a bad idea. That means you have two choices when you buy chisels: Get a quality vintage set and restore them (which takes time), or purchase a quality set from a modern manufacturer that hasn't forgotten how to make them (which costs more money). There is no middle ground.

Either way you go, you have to learn to separate the chisels from the chisel-shaped objects. There are vintage tools out there that are just as awful as the modern dreck. (The following section of the book discusses what sort of features a real tool should have, no matter when it was made.)

But before we explore the important details of the tools, I want to give you some overall advice on buying tools after doing it myself for many years, handling thousands of tools and having hundreds of regrets.

Buy the best tool that you can afford. And always – always – buy tools from someone who lives and breathes tools and will allow you to return the tools if there is a problem. These sorts of sellers will always have higher prices than the flea market, garage sale or Internet auction website. But their services and knowledge are worth it.

Though I get a tingling in my bathing suit area when I buy a gem of a tool for $1 at a junk sale, I have to kiss a lot of warty toads to get to that magic moment. And no matter how good you are at inspecting tools in the field, you are going to make mistakes. The education process at auctions and flea markets burns up valuable time that you could be spending in the shop.

A good tool seller will end up saving you money that you can then spend on wood and time that you can spend in the shop. A list of some of my favorite sellers is in the appendix, though it is not exhaustive.

Once you find good vendors the task of filling out your tool inventory will be easier and faster. If the seller deals in vintage tools, tell them what you are looking for and that you want to buy high-quality user stuff.

User-grade tools are (usually) different than the stuff that tool collectors want. Collectors want rarity – users should avoid it. If a tool is rare, that usually means that it was made in small quantities and wasn't successful in the marketplace. Plus it's going to be hard to find parts for a rare tool if you need a depth stop, a screw or a chuck spring.

Common vintage woodworking tools are not like the lowest-common denominator sort in stores today. A Stanley No. 5 plane from the turn of the 20th century is one of the most common vintage planes out there. Stanley made tons of them, and they are some of the finest user tools that Stanley ever made. My No. 5 is from this era, and I paid $12 for it. I wouldn't trade it for 20 times that money. Same goes with Millers Falls No. 2 hand drills. You can buy one for $20, and you'll never sell it or want more from a drill.

Also good to know: Collectors want all-original examples – users want tools that work, even if some parts aren't original. A so-called "harlequin" tool with mismatched but functional parts can be a real find. For example, Stanley's Bed Rock planes are desired both by collectors and by users. A collector wants all factory-original parts, or at least parts that are from the same era. Users don't care if the lever cap, iron and chipbreaker are all of different vintage. Or if someone drilled a "hang hole" in the plane's sole (collectors hate this). Or if the horn is broken off the tote (you can make a new tote).

If you don't compete with collectors, you will save money. A collector-grade vintage Bed Rock will go for three times as much as a harlequin. Both cut wood just the same.

Good dealers will help you search out the quality user stuff. And you will find that some dealers tend to specialize in certain tools. I have a dealer, Slav, for files and rasps. Walt can always find amazing chisels and early Stanley planes. Sandy always has good braces. And Patrick can find almost anything.

Before I discuss buying new tools, I do need to say something to a certain demographic that is reading this chapter. There is a certain part of the population that flat-out refuses to buy used items, whether it's tools, clothing, guitars or a house. I've never been able to figure out the root cause of this emotional urge, but it is real.

If you are one of these people, consider that tools are different than a used Nehru jacket or a fixer-upper house. Unlike an old house, an old tool isn't a maintenance nightmare. Once you restore a tool to working condition, you're set for life (unless you drop it on the concrete). And unlike used clothing, vintage tools aren't going to wear out or fall apart. Most vintage tools from the 19th and early 20th centuries still have several lifetimes of use left in them.

Buying vintage tools is actually similar to buying quality antique furniture. Many vintage tools look better and feel better in your hand after their decades of hard labor. I find the patina on the steel and the wear on the totes to be attractive, and this gentle wear is actually an indicator that the tool is of high quality.

You should actually be suspicious of a vintage tool that looks like it is new from the factory. In general, these tools will be more expensive than a tool that looks worn because collectors fancy the factory-condition tools that are in their original box. But also, a shiny vintage tool could be a clue that the tool is defective. Perhaps the purchaser tried to use it, but the plane's sole

was warped, the frog didn't fit well, the sawplate was too soft or it had some other critical defect.

On the other hand, a shiny vintage tool could just indicate that the original buyer never got around to using it, or perhaps lost interest in the craft. In that case, if you are willing to fight the collectors for it, you might have a special tool on your hands.

How to Buy New Tools

Speaking of shiny, the other option is to purchase new tools from a small-scale modern manufacturer. In general, this path will be more expensive than hunting vintage tools, but the advantage is that you can get everything you need for your shop with just a few mouse clicks or phone calls.

After many years of supporting small-scale tool manufacturers, I can tell you that there are some things to be wary of when purchasing newly made tools.

First, don't purchase tools that are too new. This warning is the same for automobiles. It's never a good idea to buy the first model year of a car because the company has yet to work out all the bugs in the manufacturing process and hasn't received feedback from the customers on the car's glitches.

I know this it true in the world of tools because I end up testing many tools that are first off the assembly line. It's not that these tools are bad; it's just that in a year or so they will look better and perhaps work better than the early tools.

A couple quick examples will show you what I mean. I was one of the people who tested the Lie-Nielsen Toolworks chisel prototypes for more than a year before the tools became available. And I purchased one of the very first sets the company made. They are great chisels.

A couple years later I purchased a second set for my shop at home and was astonished by how different the new set was compared to my early set. The side bevels of the new tools were much smaller. The handles were more crisply turned. And the overall surface finish of the steel was superior.

Sometimes the improvement relates to just one person in the factory. The Gramercy dovetail saw was good when it first hit the market. A few years later the skills of the person who sharpens and sets the Gramercy saws had improved to the point where the difference was quite noticeable.

So don't be an early adopter like me.

Another thing to be wary of are tools that really shouldn't exist. The makers aren't trying to pull the wool over your eyes. They are usually just responding to the needs of tool collectors or their (sometimes ignorant) customers.

The list of tools that you don't need to build furniture is longer than the list of tools that you do need.

Some examples: Lee Valley sells aluminum winding sticks. These were made after numerous customer requests. Don't buy them. You should make your own from wood. They'll be longer in length and more accurate as a result.

Lie-Nielsen sold socket chisels with rosewood handles. Socket chisels are designed to be struck with a mallet. But rosewood will split if struck.

And, in general, many reproductions of specialty handplanes and rare gizmos (such as the much-copied Stanley Odd-Job) are more aimed at the needs of collectors who cannot afford or find an original example.

A good example: The much-copied No. 1-size handplane has limited use in a hand-tool shop. But every collector wants one, even if he or she cannot afford an expensive original tool. I bought a reproduction No. 1 plane after many people told me they used them like a block plane. I tried it out. I went back to my block plane and put the No. 1 on the shelf. It is a cute sucker.

And finally, you probably need to change the way you decide between different brand names when you shop for new tools. The American impulse is to compare the features of Brand A with the features of Brand B, then decide which item offers the most features for the money.

Tools do not work that way.

The things that are important on tools are rarely highlighted on the marketing copy. You'll never see:

- Balanced!
- Not too heavy!
- Totes that won't raise blisters!
- Steel that is a good balance of hardness and ease of sharpening!
- Arrises that won't slice your palm!

And so on. Choosing a tool should be like picking out a prosthetic arm or leg. It must feel like an extension of you. It must do everything you require of it in a typical day. And using it must not wear you out too early.

You probably will notice that I tend to use smaller tools than is "fashionable" among many modern users. (I like a No. 3-sized smoothing plane where many people seem to like the monster No. 4-1/2.) This is not because I'm small or weak. (I'm neither.) It is because smaller and lighter tools offer some advantages. They can be used for longer periods. And they can go places that bigger tools cannot – a distinct advantage that is rarely discussed.

If, however, the furniture you build is larger than usual – say, 8' armoires – then you probably will want bigger tools. But for the rest of us, tools that are sized more like a set from the 18th century will be less expensive and less fatiguing.

So let's take a look at the important functional characteristics of every tool in my inventory. I'm not going to discuss different brands. Brands come and go. Instead, I'm going to focus on the things that separate an honest tool from a tool-shaped object.

5-ESSENTIAL PLANES

For me, the biggest frustration when working for big companies is how they restrict the tools you're allowed to use. At the factories where I've worked, the tools were locked in a crib, like handwritten Bibles. (Need a socket set? Be prepared to leave a kidney as a deposit.) In technology and media companies, you're restricted in similar ways with the computers, software and communication tools you are allowed to use.

The craziest example of this was at my first job out of college at *The Greenville News*. Because the managers were so cheap, they had a policy one year where in order to get a new reporter's notebook, you had to turn in a full one (pages filled, front and back). To get a new pen, you had to turn in an empty one. To make a long-distance phone call, you had to ask permission from your manager.

As a result of these crazy policies, you could spend hours chasing your tail. Want to make a long-distance call to interview a source, but your manager isn't around? You better start calling all the other managers at home. And what if they are out of town, and it's a long-distance call to reach them to ask permission to make a long-distance call?

Since that job, I've always bought my own pens and notebooks. And I've come to the conclusion that having my own set of good tools – hand tools, power tools, computers, whatever – is a good personal policy. So every tool I discuss here is one I have bought with my own money.

The Five Planes

When it comes to planes, you probably will end up with more than five planes in your toolkit. But if you start with the following five, you can build an awful lot of stuff. And the experience of working with these planes will teach you everything you need to know to purchase your next plane. Here is the bare-bones set:

- A jack plane with a couple extra irons, which will allow you to do all three important jobs of a bench plane: remove material, straighten the wood and prepare it for finishing.

- A plow plane, which is essential for cutting grooves and is useful for removing excess material when making mouldings.
- A rabbet plane, which makes rabbets, raised panels for doors and also removes excess material when making mouldings.
- A block plane. Though traditionalists might scoff at this plane, I find it to be one of the most useful small planes for trimming chores, leveling joints and cutting end grain.
- A router plane. Some people might be surprised by the fact that I think this plane is essential. I wouldn't work without it. Router planes can fine-tune a wide variety of joints, including dados, rabbets, tenons and half-laps. They also are excellent planes for cutting mortises for hinges.

The Jack of Your Trade

The first plane to buy is a jack plane, which is a plane about 14" long with a 2"-wide cutter. The jack plane is part of a large family of planes called the "bench planes." There is a bewildering array of types of bench planes, different materials, sizes and styles with all manner of gizmos on them.

Bend me, shape me. A jack plane can be easily pushed to do the jobs of longer and shorter planes. A couple extra irons for the plane make this a simple switch.

Because bench planes are the core of the traditional shop, I'm going to give you a full explanation of the family of bench planes, which is divided into three categories of tools.

1. The jack plane (sometimes called a "fore" plane), which can have a wide variety of uses but is usually used for rough stock removal. (In Stanley's numbering system, this is a No. 5 or 6.)

2. The try/jointer plane, a long plane used to make accurate surfaces. (In Stanley's numbering system, this is a No. 7 or 8.)

3. The smoothing plane, which is designed to make a wooden surface ready for finish. (In Stanley's numbering system, this is a No. 1 to 4-1/2.)

So before we dive into the important characteristic of the jack plane, let's talk about what's important to know about all bench planes.

The conventional wisdom states that these planes are called "bench" planes because they are always on (or right below) your workbench. I'll buy that. When I work, I always have three bench planes close at hand: a fore/jack plane, a try plane and a smoothing plane.

Bench planes are the tools that take wood from a rough state and process the faces, edges and ends into something presentable as a piece of furniture.

All bench planes do three things to a stick of wood: They remove material, they flatten it and they make it look good. Each type of bench plane has been tuned to focus on just one of these tasks. The jack plane (some people call it a fore plane, including this person) is designed to remove material in a quick fashion – if the blade is shaped and set correctly.

The try plane makes surfaces as flat as possible. Some people call this plane a jointer plane thanks to the nomenclature of the 19th century. I think the term "try plane" is more apt. In early English parlance, a jointer plane was designed to produce an edge that could be used to create an edge joint. The slightly shorter "try plane" was used to make a wooden surface "tried and true." Because "try" can apply to edges and faces, I prefer the term "try."

And smoothing planes are self-explanatory. Though all the bench planes smooth the wood somewhat, the smoothing plane produces a surface that is ready for finish.

More than any other hand tool, modern woodworkers tend to get obsessed with bench planes and will go on a gluttonous purchasing rampage, usually before they have learned to use the planes.

After buying a half dozen planes or more they usually settle in to find out exactly what it is they bought. That is when they figure out that they should have read a book before they went tool shopping.

Of course, it's not entirely their fault that they bought so many different sizes of redundant planes. You see, Stanley made the bench planes in sizes from the cute No. 1, which fits in your palm, up to the monster No. 8, which is almost big enough to register with the DMV. Plus there are some sizes in between, such as the popular No. 4-1/2 plane, which is an oversized No. 4.

Our "hunter and gatherer" genes work against us. It's a thrill to hunt every size of bench plane, and gathering a complete set has incredible appeal.

This next sentence can save you hundreds of dollars and fruitless hours of metalwork: You don't need all the bench planes. Heck, you don't need half of them. You can get by with only a jack plane with a couple extra irons. (I worked this way for many years.) I have used every single size of bench plane, and I find that I use three of them about 95 percent of the time. What about that other 5 percent of the time? Those are the times that other woodworkers ask me about what it's like to use a No. 5-1/2 or No. 1 or some other uncommon size.

Lucky for your pocketbook, the historical record agrees with me.

Four Kinds of Bodies

When selecting any bench plane, most woodworkers choose from four basic body styles. You can mix and match body styles without too much trouble, but there are some subtleties that will become evident as I describe them. I think that one of the primary considerations of a handplane that gets overlooked is that it should be comfortable to use for long stretches at a time – this actually applies to all hand tools. If at all possible, try to handle the tool before you buy it – or make sure you can return it if it's not a good fit.

Let's start with the garden-variety types of handplanes and work up to the exotics.

Metal-bodied Bench Planes: These planes are typically entirely metal, except for the front knob and the rear handle (called the tote). No matter what brand name is cast into the body, woodworkers usually call these "Bailey" or "Stanley-style" planes. Leonard Bailey and Justus Traut are considered the parents of the metal bench plane, and Stanley is the company that put everyone else out of business who tried to compete with them. So Stanley's numbering system is the one that everyone uses.

The primary advantage of these planes is that old ones are eminently restorable. Metal parts that have gone out of true can be corrected by the owner. Missing or broken parts are available everywhere. And you can soup up the tool with a new chipbreaker, iron or both from a modern manufacturer.

More pluses: Metallic planes

work well with taller workbenches unlike the wooden-bodied planes. The metallic mass of the plane helps keep the tool in the cut, and the orientation of the tote and knob allow you to use the tool without getting your entire upper body over it, which is a necessary body position when using wooden planes.

Most metallic planes have precise adjusters that let you dial in the depth of your cut and the position of the iron in the mouth of the tool. And speaking of the mouth, with most metallic planes, you can shift the frog forward and back to tighten up the mouth – a big plus when you are faced with reversing grain or curly woods.

So what are the downsides? Metallic planes are heavier than wooden ones and can tire you out faster. Because all their components are metal, truing them makes a mess of iron and steel filings and takes a lot more time than with wooden planes.

They have a lot of moving parts, so getting everything lined up and working right can be daunting for the beginner, though it becomes second nature after a short time. Metallic planes rust. Most of the vintage ones will break or chip if dropped on a concrete floor. Some woodworkers don't like the way that a metallic plane feels while moving across the wood (not me, however).

About the Bevel-up Metallic Planes

Also note that some people further divide the metallic bench planes into "bevel-down" planes and "bevel-up" planes. The biggest difference is the way the iron is placed into the tool – either with the bevel facing up or the bevel facing down.

There are some other functional differences that will become apparent once you start investigating them. They are simpler, it's easier to achieve high planing angles with them and their controls are in a different place. However, the wood doesn't know or care which way the bevel faces, and the cutting principles of these two varieties of metallic planes are the same, except when dealing with blades that have a considerably curved cutting edge. Anyone who tells you different is trying to sell you something.

Wooden-bodied Planes: The body of a wooden plane is called the "stock," so wooden planes are generally called "wooden-stock planes." Their primary advantage is their simplicity. They have far fewer parts than a metallic plane, so diagnosing problems can be straightforward.

The planes are taller, so they work best when used on a low workbench. You have to get your upper body over the plane to keep it in the cut. This relies more on your upper body's mass than on your arm strength.

Wooden-stock planes tune up fairly quickly. Because the stock is made of beech instead of iron, you can quickly true a sole (sometimes with another plane) and get to work in short order.

Also, many woodworkers like the feel of the wooden stock on the wood they are working. Their light weight makes them easier to push around for long periods. The stock of a wooden plane is a few inches thicker than the casting of a metal plane. As a result it can be tricky to mix wooden planes with metallic ones in your shop. Because wooden planes are grasped from the top and you need to get your body over them, you will choose a lower workbench than you would with metallic planes. I'm not saying you can't make it work, just be aware that it might crop up as a problem for you.

However, the wooden-stock planes do have disadvantages. Because

wood is cantankerous, diagnosing problems with wooden-stock planes can vex beginners. Is the problem with the sole? The wedge? The abuttments? Experienced woodworkers can hone in on the problem in short order, however. And once revealed, the problem usually is quick in the fix, though sometimes it involves a fireplace and making beech-smoked s'mores.

There are some issues with wooden-stock planes that are not quick fixes. Some vintage ones have cast or checked to a point where they should be in the s'more pile instead of your tool chest. And there is no easy way to close up the mouth of a wooden-stock plane that has been opened due to wear. You need to cut a mortise in the sole and patch the mouth then re-cut the mouth aperture. It's not a huge deal, but it's not loosening two screws to move a frog, either.

Speaking of adjustments, some woodworkers are flummoxed by the way that the irons of wooden-stock planes are adjusted with mallet taps. This process, which is fairly easy to pick up as long as no one is watching you, can make you feel like you are in an endless cycle of taps and test-cuts. That's something you don't get into with the metallic planes.

Finally, the principal downside to wooden planes is they require more maintenance than metallic planes. When the seasons change, the plane changes with them. So your plane might work great on Monday and not at all a few days later until you tend to it.

Planes from the Far East

Also in the family of wooden-stock planes are Japanese and Hong Kong-style planes. These planes have their adherents, though Western-style planes are far more common in North America.

The Japanese planes are actually quite different. They are used on the pull stroke, they have a longer toe and their soles are not typically dressed flat. Instead the soles are intentionally shaped to contact the work only at certain points. The planes also are typically used on a different kind of low bench or on trestles, especially on job sites.

While other Japanese tools have made significant inroads in North America (chisels and saws especially), Japanese planes haven't been widely adopted in the West.

Another style of Eastern wooden-stock plane is what tool catalogs call a Hong Kong-style plane. I've seen these planes operate on the pull or the push stroke. The planes typically have a dark wood for the stock (the catalogs say it is ebony) and can have "handlebars" – for lack of a better word – that pierce the stock. The woodworkers I know who use these planes tend to dress the soles flat, like a Western wooden-stock plane. Though there is no reason you couldn't condition them like a Japanese plane if you prefer.

Like the Japanese planes, the Hong Kong-style planes have made some inroads into the West, but the other styles of planes are far more common in North America.

'Transitional' Handplanes

In the 19th century, planemakers made a style of plane that offered the sweet wood-on-wood action of a wooden-stock plane with the precise blade and lateral adjustments of a metallic plane.

Or put another way, the so-called transitional planes offered all the disadvantages of having an elastic wooden sole with almost none of the advantages of a moving metallic frog.

Transitionals have a hard time finding love.

In essence, a transitional plane (Stanley didn't use the word "transitional," by the way) has a wooden sole and metal guts that adjust the iron. The advantage is, of course, that the sole is easy to true. I, a card-carrying blasphemer, have used a powered jointer on wonky examples. And you have the precise depth and lateral adjustment of the metallic plane's iron.

But you give up some things in this wacky marriage.

Closing the mouth of the tool is a laughable exercise. There is usually a partial frog (a tadpole?) that moves back and forth. Simple, right? Buzzzz – Wrong! The metal moves, but the wood below it does not. So the iron doesn't get the full support of the metal and wooden frog surface when you try to open or close the mouth.

The solution offered by some woodworkers is to pack the open area between the wood and steel cutter with cardboard. To me, stuffing cardboard everywhere is too much work unless I need to stay warm living underneath a highway overpass.

As a result, the transitionals can be difficult to use when you want a fine mouth and a fine finish. You can treat the plane's stock like a wooden-stock plane and patch the mouth. Or you can buy a different plane.

The last disadvantage of this form of tool is that the rear totes tend to come loose with ease. The solution is to add a screw to connect the bottom of the tote and the wooden stock (you might have to drill through the cast iron frame).

With all these trade-offs, I think that a transitional plane can be an excellent choice for a jack/fore plane. And not as ideal for a smoothing plane – not without some significant effort on your part.

I will say that, once tuned up, transitional planes can be a joy, especially if you do house carpentry. My longest bench plane is a transitional with a 30"-long sole, and it does an excellent job at truing edges. But I don't try to push it into working cantankerous grain on hardwoods. On softwoods and mild hardwoods, it's a great plane.

Infill Planes

These planes earn their name because they consist of a metal shell that has been "infilled" with wood. And they also have been "infilled" with a fair amount of mystical hooey. Don't get me wrong, I like infill planes for what they are (well-made, beautiful and functional tools), but I haven't chugged the infill Kool-Aid that makes one believe they have superpowers.

I can say this because I have worked with many infills during the last 12 years. I've used $100 pieces of clap-trap garbage and a $10,000 masterpiece from the shop of Karl Holtey (pronounced *Hol-tie*, FYI), the grand master of custom planemaking.

They are just planes, and they face many of the same trade-offs that the metal, wooden and transitional planes do. Wood moves. Metal can be difficult to work.

So here are their advantages: They have a metal sole that may or may not

Can I touch it? The infill planes are the most expensive, rare and myth-laden tools in a chest. They are beautiful (to many eyes) and they do a fine job. But do they really have harmonic properties that absorb potential chatter before it occurs? Uhhh....

need truing when you get the tool. After the sole has been flattened, it rarely goes out of true unless the tool is dropped, run over by an automobile, or the wooden infill inside the shell distorts the metal significantly when the wood moves.

Infills have scads of mass, which some woodworkers prefer. The weight really can keep the plane in the cut with less effort. Most infill planes have a screw-powered lever cap (though some infills secure the iron with a wedge). The screw-powered lever cap is both an advantage and a disadvantage. Its advantage is that you can screw down the iron with almost superhuman force. This creates a stable cutting environment and can close up a slight gap between your iron and chipbreaker that would spell curtains for other types of planes.

It also can make your plane's iron difficult to adjust or – in some cases – be plane suicide. Most infill planes lack mechanical adjusters that control the depth of cut – you use hammer taps. However, infills that have adjusters use a mechanism that's usually called a "Norris-style" adjuster. These are sometimes, but not always, fragile.

So if you cinch down your lever cap with lots of force then adjust the iron, you will wear out the adjuster quite quickly, and perhaps even strip the threads.

One of the other advantages of infill planes is hard to quantify. Most woodworkers (me included) find them fetching. So as a rule they are better cared for (like a sports car) and rarely abandoned to rust (like a Vega).

The disadvantages of infills are real. Because the iron is bedded on both metal and wood, you can encounter some problems with this marriage of materials. The metal won't move, but the wood will. The result is the iron won't be bedded securely, so you get chatter or inconsistent results until you file the bed flat.

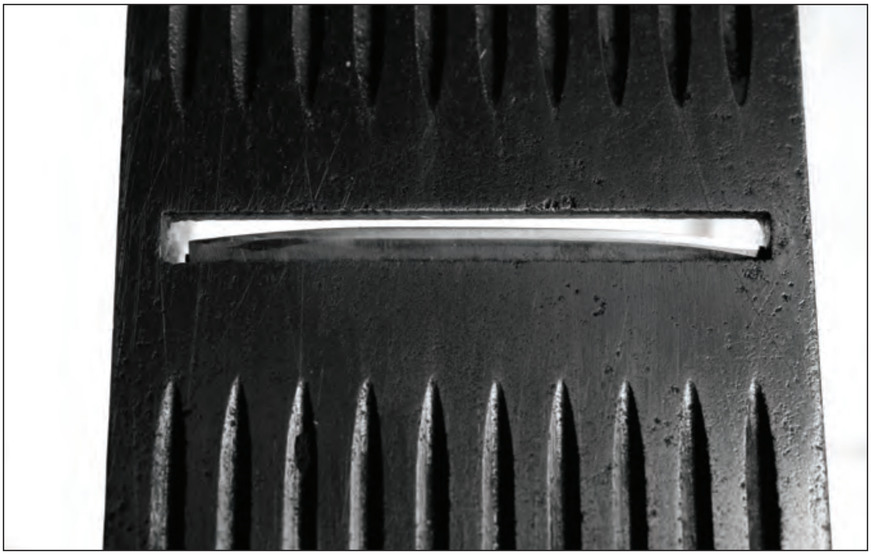
Also, be wary of new infills that are filled with exotic wood. Exotics are notoriously hard to dry properly. And if your infill isn't dry it could distort or crack as it acclimates to your shop. Always ask the seller or the maker about the moisture content of the wood. If he or she is not sure, you should be on your guard for possible problems ahead.

Infills don't have movable frogs, and I know of only one infill that has an adjustable mouth. As a result, the mouth aperture is fairly immutable. You can open the mouth with a file. But to close up the mouth, you are going to have to invest in a thicker, custom-made iron or in a welding class to patch the mouth.

Bottom Line: Making Them Work

Even with all the trade-offs listed above, you should take heart. Almost any plane can be made to work well with enough care and effort. Stay focused on achieving these goals: A fairly flat sole, a sharp iron that is well-bedded in the plane's body and a secure and stable connection between the cutter and the body. If you have all those things, you have a good plane that will work on easy woods.

And if you have a plane that allows you to tighten up the mouth and you can achieve cutting angles higher than 45°, you'll have a plane that can deal with reverse, curly or interlocked grain. We'll discuss these angles when we get into the individual planes below.



The most versatile plane. The jack plane usually has a curved iron so it can hog off wood with extreme prejudice. But the plane, like me, has a more sensitive side, too.

If I had to have only one plane, it would be a jack plane. That's because jack planes (commonly the No. 5 in the Stanley numbering system) can be pressed into service for almost any planing operation. They excel at hogging off material, which is what they were designed for.

But if you close up the mouth and use a straight or slightly curved iron, you can use the plane as a jointer plane and handle edges and faces that are shorter than 28" with ease. A rule of thumb is that a plane will straighten reliably a piece of work that is twice as long as its sole. Skill will stretch this distance.

And if you close up the mouth and use a very slightly curved iron, you can use the tool as a smoothing plane. Because it has a long body it will make it difficult for you to get into the small low-lying places on a board that a shorter plane would handle. So you'll have to take more strokes – that's the trade-off.

The sole in question. The sole of a jack plane can be ragged out if you are going to use it only for rough work. But if you want to use it for critical tasks, it needs to be dead flat.

And if you close up the mouth and use a perfectly straight iron, you can use the jack on a shooting board to dress edges and ends with ease.

Important Parts of the Jack

The sole: If you use the jack plane for rough work only, then sole flatness is not an issue. Does the plane in question have a sole? Does it look "flat" from a few feet away? Then it's good for rough work. If, however, you are going to use your jack plane for jointing or smoothing boards, then the sole needs to be flat enough to handle those more accuracy-critical tasks. How flat? Depends. If you are going to use your jack plane for jointing and smoothing, then its sole has to be as flat as that on a smoothing plane (which is really flipping flat).

Because sole flatness isn't a concern with tools for rough work, I usually recommend people purchase a vintage plane for this job. My No. 5 is a whopping $12 plane that I bought from a pot-smoking hippie at an antiques fair. In other words, don't spend lots of money on planes for rough work. Buy vintage. Vintage, vintage, vintage.

Don't, however, buy a new Stanley, Groz or Anant jack plane. They are 1) More expensive than vintage tools and 2) Barely usable even for coarse work. I hate to say it, but it's true.

Short but fast scrub. The longer the sole, the flatter it wants to make your work. The trade-off is that the longer tools are slower and heavier.

Another thing to consider with the sole is its length. Longer soles make it easier to true your stock. A very short sole (such as that on a 9"-long scrub plane) will make it difficult for you to true a surface if you are unskilled. (Skill fixes almost everything.) A 14"-long sole is a good length. An 18"-long sole is better, but you reach a point of diminishing returns because of weight.

To sum up: If you are going to use your jack plane for jointing and smoothing, you should either buy a nice vintage plane (pre-World War II) and fix it up or drop a dime on some premium ductile iron.

The frog: The frog or bed of any handplane is always important. If the iron rocks on its bedding surface, then rough times are ahead for you. That means that either the iron is warped or bent, or the bedding surface is out of flat. If the bed/frog is wood, you can true it with a file and some trial-and-error. If the frog is metal, remove it from the tool and rub it on a coarse stone to flatten it as best you can. The second option (removing the frog) is easier, FYI.

This small act can do wonders for a tool.

Comfort: If your jack plane is uncomfortable to hold, you will be miserable. Most often the problem occurs at the rear tote – the front knob is usually easy to adapt to.

The rear tote needs to have enough room for your fingers, even if you have Vienna sausages sprouting from your palm. Hold the tote with a three-fingered grip and extend your index finger out. The index finger should never, ever go into the tote. Repeat that 100 times until you remember it. When you are holding the plane in a semi-comfortable position, examine your hand. Do you have lots of little bands of white or dark red (even purple)? That means that you might be clenching too hard. Relax your grip.

Still have some purple-ish places? Then your tote needs work. Something is pinching your flesh there and will become a problem after some work in the wood. You might get a blister or some chafing. You can deal with this problem in several ways. You can shape the tote with a rasp and open up some space for your fingers. You are, after all, a woodworker. If that doesn't do the trick you can have part of your hand surgically lopped off – or find a tool with a bigger tote. Your choice.

The tool needs to be an extension of your hand – nothing less. Sure, you will adapt a bit to the tool and the tool will adapt to you. But the bottom line is that the first impression must be pretty good when you pick up the tool for the first time.

The iron: The cutter is commonly called the "iron." In the distant past it was made of bronze, iron or steel-lined iron. But today most Western irons are solid steel. But calling them a "steel" would be confusing – that's the name of a knife-sharpening tool. So we call them irons, cutters, blades or bits. I'm going to stick to the words "iron" and "cutter."

For rough work, the iron isn't as critical as it is for jointing and smoothing. After all, the surface left behind by this tool will be cleaned up by other tools, or perhaps with this tool equipped with a different iron. So if the iron is less than perfect in your jack plane, you will be OK (yet another argument for purchasing a vintage tool).

Take the iron out of the tool and examine it. If this is a vintage tool, it should look like crap. Rusted, gummed up, misshapen. That's OK. Turn your attention to the unbeveled face of the tool (some people call this the "back"). Scuff off as much gunk as you can and try to get a good look at the metal.

Is it pitted? By that I mean does the surface look like the moon or the face of comedian Richard Belzer? If so, then you might have to replace the iron, even if the tool is intended for rough work. A pitted flat surface on your iron can make it difficult for you to get a sharp edge. Pits impede sharpness and create an edge that is jagged and weak.

The grind. The jack plane blade should have a cutting edge that is shaped like a thumbnail. The gentle curve allows you to remove lots of stock without the corners digging in.

If the pits are few, or far away from your cutting edge, then you probably can get away with using the stock iron for rough cuts. Carry on. Grind the blade so it has an 8" to 10" radius across its width, hone the sucker and get to work.

If you have to replace the iron, here is a word of advice. Jack planes do rough work. They take a lot of pounding. So buying a tougher grade of steel is OK. Most vintage jack planes come with an iron that is simple high-carbon steel or chrome vanadium. If you replace your iron, I'd recommend something tougher, such as A2. This modern steel alloy takes a little longer to sharpen compared to plain high-carbon steel, but it holds a working edge a lot longer, too. So the trade-off is worth it.

There are other, more exotic steels on the market (D2 and the powdered metals come to mind). These provide more shock-resistance and edge-life. But there's a higher cost. Exotic steels require different sharpening equipment. D2 and the powdered metals sharpen best with some sort of diamond plate or paste. If you are already using waterstones, you are going to have to buy more sharpening equipment in order to use the more exotic steels.

Weight: If you are going to use your jack plane for rough work only, then you should consider its weight. A heavier plane will wear you out faster than a lighter plane. So if you are going to process all your stock by hand from rough boards, then choose a lightweight wooden-stock or transitional jack plane. If you are going to process only the occasional board, then weight isn't as big of a deal.

Mouth: Open the mouth wide so you can allow a thick chip to escape.

Controls: Because a jack plane doesn't need to be set to take fine shaving, you don't have to get worked up about the controls for blade depth and lateral adjustment. If your plane requires hammer taps to position the iron, even beginners will be able to do this by eye. If you have mechanical controls for blade depth and lateral adjustment, then things will be even easier.

Cutting pitch: This is an important feature of planes for rough work. You want the cutting angle of the plane to be fairly low: 37° to 45° is optimal. This low cutting angle makes it easier to push the tool through the work. If you are working parallel to the grain of a board you might see some more grain tearing with such a low pitch, but you still have other tools in your arsenal to clean up the mess left by the jack.

A high-pitched jack plane (50° and higher) doesn't seem to help with

Thick is better. When you work across the grain, you can take a monstrous bite. In soft woods, I can rip 1/16" off in a single pass.

rough work. The higher pitch makes the tool hard to push. And, in my experience, the high pitch makes the tool's edge dull faster. So go for a low angle when you are trying to remove lots of stock.

Bottom line: If you want a plane for rough work only, buy a vintage metallic or wooden-stock plane that is in reasonable shape. I recommend a plane that's about 14" long – only because it is far more common than longer ones. Don't buy a premium tool.

If, however, you are going to use this plane for rough work, jointing and smoothing, then you need a high-tolerance tool that is capable of all forms of work. If this is the case, I'd recommend a premium No. 5 Bailey-style plane and a couple different irons. An A2 iron for rough work, and a high-carbon iron for jointing and a high-carbon iron for smoothing.

If you want a bevel-up tool (such as the so-called low-angle jack plane), then you have to make a choice. You can use a toothed blade for rough work, and a couple high-carbon (O1 or W1) irons for jointing and smoothing. Or you can use a 10" radius on your iron, which won't take as heavy a bite as an iron with an 8" radius on it. This a geometry problem. Either way – toothed iron or radiused iron – you can't take as heavy a shaving with a bevel-up tool as you can with a bevel-down one in my experience.

Using the Jack Plane

Jack planes take a thick shaving – up to 1/16" if you can believe it. The trick to this hog-tastic technique is to work across the width of a board. Not with the grain. Not against it. But across it.

Working across the fibers allows you to take a bigger bite with less effort. Why? Because you are cutting across the wood fibers (where they are weak) instead of trying to lever them up and overcome their beam strength. This is, in general terms, why crosscutting is generally easier then ripping.

If you are going to work across the grain, you do need to be cautious about a couple things. First: The wood will "spelch" or tear out at the far edge of your pass. This splintering is ugly and can be severe. The way to side-step this is to plane a chamfer across your far edge. Two or three strokes with a jack plane should produce a significant chamfer and reduce spelching.

The second consideration is if the board's surface is cupped across its width (like it usually is on the bark side of a board) or bowed (like it usually is on the heart side of a board). If you are working across a cupped surface, you should have an easy time. The jack will reduce the high edges until you reach the lower middle ground.

If, however, you are working the bowed side, the plane will tend to ride over the hill in the middle and not make the board flat at all. It will merely stay bowed. The solution is to work the center of the board only until the center is in the same plane as the long edges. Or to even reduce the middle of the board until it is slightly below the edges (cupped!). Then you can work across the board – historically called traversing – to bring those high edges into the same plane as the middle.

After you dress a surface reasonably clean and somewhat flat with your jack plane, you want to test it for "twist." A board is twisted when two diagonal corners are high and the two others are low – a common problem. You test for twist by sighting across "winding sticks" – straight sections of material that are much wider than your board and placed at the near and far end of it. When you sight across them, you can see if the sticks are out of alignment because the winding sticks exaggerate the twist. Mark the high corners (I use chalk) and work the high corners using short, diagonal thrusts with the jack plane. Then test your results again with the winding sticks. This procedure takes a little practice, but soon it becomes second nature.

Plow Plane

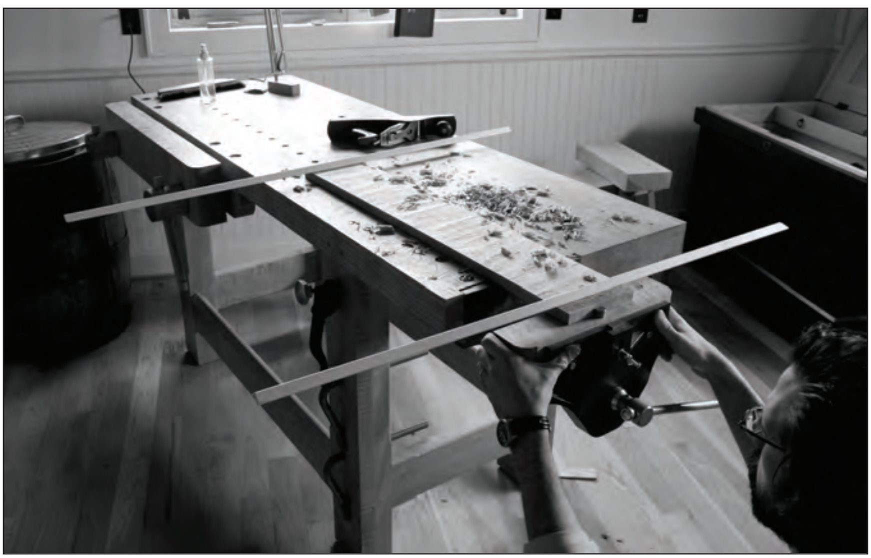
In the pre-Industrial woodworker's world, a nice plow plane was the status symbol of a successful craftsman. Plow planes were made using every imag-

The spelch stopper. A bigger chamfer on the edge of this board would have helped prevent the edge from splitting off when I traversed it.

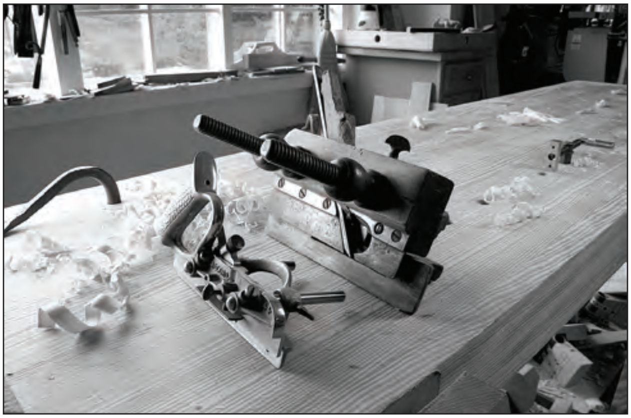
inable material – ebony, ivory, silver, rosewood, you name it. The tools could be utterly pedestrian and made from all beech. Or they could cost an astronomical sum and have inlay and silver fittings. (See "Wooden Plow Planes" [Astragal] by Donald Rosebrook and Dennis Fisher for a discussion of the evolution of the plow.) John M. Whelan called plows "objects of beauty that were a status symbol for the successful joiner or cabinetmaker" in his fantastic book "The Wooden Plane" (Astragal).

The Industrial Revolution ushered in the advent of the metallic plane. Wooden plow planes began to disappear and were replaced by metallic plow planes, combination planes and (of course) machines.

For a plane that is so important a symbol to the traditional craftsman, it does surprisingly few operations. For the most part, it cuts grooves in a variety of widths. You can use it to waste away excess material when you are making mouldings. You can press it into service for some other operations (fielding raised panels, cutting rabbets and dados), but there are other ba-



Jack's buddy. Winding sticks help you gauge your progress. You should make your own, which is discussed in the section on marking and measuring tools.



Brothers of different mothers. Wooden and metal plow planes are surprisingly different animals. The controls are different. Heck, they feel different. Even the shavings are tossed out differently.

sic tools that do these operations with a lot less fuss.

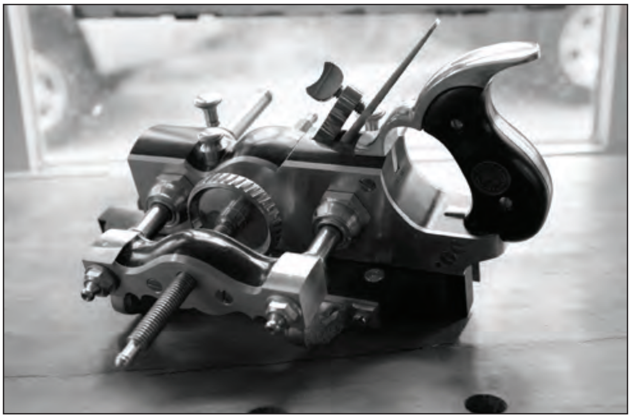
But you have got to cut grooves if you are going to build furniture. So a plow plane is an essential part of the traditional kit.

Wood or metal? The wooden plows and the metal plows are different tools with different controls and – honestly – a different way of accomplishing their goal. The metal plows are all quite similar. The tool's fence rides on two metal posts and locks down on the posts. The depth of the iron is usually controlled by a screw-feed adjustment mechanism. The depth stop is a small movable plate on the right side of the plane's body. When the depth stop contacts the wood, the tool stops cutting. One curious characteristic of many metal plows I've encountered is that the tool throws the shavings into the user's hand holding the fence (there are exceptions, such as the Miller's Patent planes).

Note that I also consider many of the metallic combination planes (such as the Stanley No. 45 and 55) to be plow planes. Though these planes have the capacity to do other chores, they end up doing a lot of plowing.

Wooden plows share some characteristics, but they are a diverse lot. The mechanism that controls the movement of the fence can be as simple as two wedges that wedge the fence on the posts (also called staves).

The most common mechanism for adjusting the fence on a wooden plow



Yup, it's mine. A fancy plow plane, such as this reproduction center-wheel plow, are the status symbols of the pre-Industrial age. This flashy example is like having a Ferrari in the driveway.

is to have threaded posts on which you jam the fence in position with two wooden nuts on each post. Many drill presses use this principle to control the depth of the machine's quill. While this mechanism is common, it's fussy. Getting the fence parallel to the tool's skate is not always easy.

Other wooden plows have exotic fence mechanisms that use crazy geared wheels to keep the fence parallel to the skate. The variety of mechanisms is astounding.

With wooden plows you adjust the iron's depth with taps from a mallet and hammer. It's fairly easy work because the iron locks into the skate. In other words, there is no lateral adjustment to worry about with wooden plows – only in and out.

The depth stop on a wooden plow is different than that on a metal plow. The depth stop on a wooden plow is between the fence and the skate. Also, it is almost always superior to the depth stop on a metal plow. The depth stops on metal plows frequently slip. That's a rare problem on a wooden plow.

And finally, one of the chief differences between metal and wooden plows is that wooden plows throw the shavings onto your bench – not into your hand. Because of this feature alone, I prefer wooden plows. Use a metal plow for three grooves and you will get tired of yanking the shavings out between the fence and the plane's body.

Wooden plows also typically have longer and deeper fences, which is a desirable feature. However, you can add an accessory wooden fence to a metal plow that is long and deep if you want (and you should).

So I know I'm making it sound as if all the metal plows should be melted down. That's not quite the case. To understand why, we have to consider the next part of the equation: Should you buy a new or vintage plow?

New wooden plow planes are terribly expensive (much like their ancestors), so buying one is a major investment. I made that investment. It hurt. But I'm glad I did.

Vintage wooden plows are a crapshoot. I've had a lot of them pass through my hands, and here's what I've found.

- The skates aren't straight and can be at odd depths. A wonky skate can wreak havoc with your groove, especially if the rear of the skate has descended a bit. That can cause some really inconsistent results. If the skate is a little out of parallel, you might be able to sneak by.

- The fence mechanism is shot. The screws are broken or the mechanism has been fouled by abuse. The fence's bearing surface that rides against the work can be bowed.

- The irons don't fit correctly. Sometimes a plow will come with a set of irons that was assembled from other sets. This can be fine, or it can be trouble. Sometimes the grooves on the irons won't quite mate with the tongue on the skate. That's trouble. The irons can chatter if not mated.

Metal plows are generally trouble-free, whether they are vintage or new.

The only problems I've ever had with a metal plow are that the depth stop can slip and sometimes the irons are soft (for some reason this is a problem with English-made metal plows, such as the Record 043 and 044).

So when you boil it all down, here's the unpleasant truth. You can spend a ransom on a new wooden plow that will work like crazy. You can spend just a little money on a used or new metal plow that will work OK. Or you can spend a little money on a vintage wooden plow that will work just fine – but you will have to do a lot of searching to find that vintage plane. Here are more details on the critical bits on a plow.

Important Parts of the Plow Plane

The irons: Plow planes should come with a variety of irons for a variety of grooves. If you are strapped for cash, just buy the 1/4" iron – that's the one you'll use most of the time for grooves in the rails and stiles of doors and for grooves in drawer parts to hold the drawer bottom. Plows usually come with a set of eight irons ranging from 1/8" to 5/8" – but beware of the occasional metric iron, which can foul you up.

The irons for the wooden plows are always tapered in their length – they are quite thick up at the bevel and taper until they are quite thin at the area where you tap them. This taper works in conjunction with the wooden wedge of the plow to hold the iron in place with just a light mallet tap. It's quite ingenious technology.

Irons for metal plows are not tapered. They are consistent in their thickness from the bevel all the way back to the end where they engage the mechanism that moves the iron in and out of the mouth.

The bevel of the irons for a plow (and most other joinery planes) is usually ground at 30°, which is 5° steeper than the bevel on a bench plane or block plane. The steeper angle gives you a slightly longer edge life. And you'll get even a little more edge life if you hone your secondary bevel at 35°.

The irons should be ground and honed straight across. No skew. No curve. The only problem you'll encounter with sharpening a plow iron is if it is too rusted or pitted, especially on its unbeveled face. That can produce a jagged or fragile edge. If the iron of your metal plow is rusted, it's easy to have new irons made by a custom toolmaker. But if you have a vintage tapered iron for a wooden plow that is rusted or pitted beyond the point where you can use it, you might be out of luck and have to find a similar vintage iron from the same maker. This could be easy or quite difficult.

The fence: The fence should be straight, with no curve to it. Plow planes with long and wide fences are easier to use than those with short and narrow fences. Most wooden planes have generous fences. Though they are more prone to warping, you can correct that problem with a block plane and make it tried and true. Most fences on metal plows are skimpy, though you can screw on a bigger fence if you like, and the fence is unlikely to be bowed.

The biggest problem you'll have with the fence is that it will be difficult to lock it down so it is parallel to the skate of the tool. If the skate and fence aren't close to parallel, the cut will be jagged and take a lot of effort because the iron will be skewed a bit and the side of the iron will rub against your groove on one side.

The fence on a metal plow is usually easy to lock down square. And if the posts aren't too slippery or shiny, then the fence should stay put – even if you end up putting a lot of sideways pressure on it while using the tool.

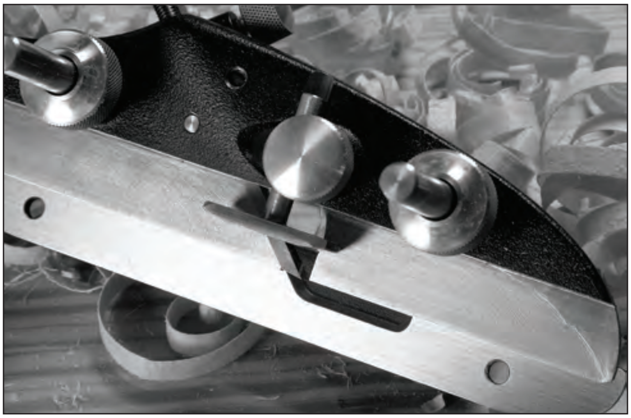
The fence on a wooden plow is a big question mark. It might be golden. It might be junk. The only way to know is to give it a try yourself and send it back to the seller if it doesn't work.

The skate: The skate should be flat along its bottom edge and should curl upward at the toe of the tool, much like an ice skate. Some vintage plows will have skates that are warped, either convex or concave along their length. Both situations can cause trouble, but both can be corrected by filing the skate and checking your work with a straightedge.

The wedge: If you have a wooden plow plane, the wedge can be a source of frustration if it doesn't fit well or has been mangled. If you buy a new wooden plow, this is not a problem. If you buy a vintage plow, ensure that the wedge will hold the iron in place without chattering while the plane is making a cut. Plus you need to make sure the pointed end of the wedge (which can be broken off) will eject the shavings properly onto your bench.

The only real way to find out is to sharpen it up and use it. So before you buy a vintage plow, make sure you can return it if the wedge ends up a stinker. Yes, they can be remade, but if you paid good money for your vintage plow (and I think you should), then the wedge should work.

The depth stop: The depth stop on a wooden plow is generally a thing of beauty. It can be as simple as a wooden block through the wooden stock of the plane that is locked down in some way (occasionally it is only friction-fit). Or it can be as complex as a brass screw-feed mechanism that locks the stop in place with gusto. I prefer a brass screw-feed mechanism, which you will find on many quality wooden joinery planes, such as dado planes and fillister planes.



Dives too deep. Depth stops that have a round post are usually easy to defeat in use. Then you end up making a groove that is entirely too deep.

On a metal plow plane, the depth stop is generally a thing of much frustration. No matter if the plane is new or old, expensive or cheap, the depth stop on a metal plow is generally too easy to defeat while you are working. The stop slips up and you end up making a groove that is deeper than you planned.

There are ways to improve the metal depth stops. The best way is to rough up the vertical post with a coarse file and remove any lubricant from the post. When you rough up the post, the idea is not to remove a lot of metal (that will make the post slip more). The idea is to provide a rough surface for the depth stop's thumb screw to grab onto.

The tote or the stock: Your plow plane needs to be comfortable to hold. If the metal tote is uncomfortable, you might end up being miserable when you cut a groove for three or four doors. The wooden totes are generally more comfortable (and can be adapted to your hand). Some people prefer the wooden plow planes that don't have a tote at all. You simply grip the rounded rear of the tool at the heel). This is a point of personal preference. If you can try a few plows before you buy one, that would be ideal.

Control of the iron: I think this is a minor issue because all plows are easy tools to set. Wooden plows use hammer taps. Metal plows use a screw feed. Both work well and I don't prefer one over the other.

Using a Plow Plane

The most important thing about using a plow plane has nothing at all to do with the tool. Instead, it's the wood you select for your project. When you choose your wood for the rails and stiles of a frame-and-panel construction you should go to great pains to get the straightest grain possible. Not only does this look better, but it will be far easier for your plow plane to deal with.

Same goes with your drawer sides and drawer fronts. Straight-grained boards make for better-looking drawer fronts and drawer sides as well. And your plow will have a much easier time.

As you've probably realized, plows work (easily) in only one direction (yes, you can go to strange lengths to avoid this problem). As a result, you are limited in how you can position the board on the bench so that your tool works with the grain.

You always want the fence of the plane to ride against the board's reference surface, which is flat, true and in line with the other reference surfaces of your frame-and-panel construction. This will ensure that all your grooves line up when you assemble the door.

These constraints can box you in a bit when plowing your grooves. Some-

Two hands; two jobs. Your dominant hand should push forward. Your off-hand should push the the fence against the work.

times you will have to plane against the grain. So in order to avoid tearing, the best strategy is to select boards with dead-straight grain that ideally can be planed in both directions without problems. Or, at the least, won't tear out horribly. If you have some tear-out at the bottom of your grooves that's no big deal; what is troubling is if the edge that shows gets mangled – that's the real problem.

Once you have the problem of grain direction sorted out in your head, the next challenge is figuring out how to hold the dang plane. To many beginners, where to grasp the plane can seem mysterious. Yes, you hold it at the rear of the plane with your dominant hand. But what about your other hand?

Well the short answer is that your off-hand goes on the fence. But the real story is more complex and useful.

When you use a plow plane – or any handplane with a fence – each of your hands has a distinct job (and there is no cross-training allowed). Your dominant hand grasps the heel or tote of the plane. Its sole job is to push the plane forward in a straight line. Your off-hand grasps the fence. Its sole job is to press the fence against the work. If you can master this basic separation of push and press, you will be most of the way home with these planes.

But wait; there are more differences to learn. Plow planes are not used like bench planes. Where you start your stroke and where you end it are different. With a bench plane, you start your stroke at the right end and end on the left end (reverse this if you are a lefty). Plow planes are used quite differently.

You start a few inches from the end of the board on the left (where you normally would finish a planing stroke). You take a short stroke to the end of the board. Then you start about 6" from the end and take a second stroke. With each stroke you back up a few inches until you are making strokes the full length of the board.

Why?

The simple answer is that you want to make a clean groove. If you really want to know why, read the following, more complex answer.

When you use a plow with the grain, the cutter will tend to follow the grain direction of the board. That is the path of least resistance. The grain direction might be perfectly straight, but about half the time the grain will push the fence and tool away from the work. This wandering iron can be a disaster, especially on a long stile. You can ruin the stile with the first pass of your plow plane.

So if you start near the end of the stile and take a short pass, the iron will not wander far. It can't. It is traveling only 3". Then when you back up another 3", that pause gives the iron a chance to correct any small error and dive deeper. By making the initial groove along the stile in small segments, you are reducing the chance that you'll make a big error if you make the first cut with one mighty swoop.

Rabbet Plane

Rabbet planes are so essential to the hand-tool woodworker that it is nothing less than shocking how hard it is to purchase a good one. Yes, there are tons of vintage examples available, both metal and wood. The ones that have survived in working order are (no surprise) the metal ones, which don't deal with hardwoods particularly well. The ones that work really well, the wooden planes, usually have problems, such as a warped wooden stock, an iron that needs an overhaul, a ragged-out fence and a wedge that won't fit.

A few small companies make new wooden rabbet planes (thank goodness), and there are some horrible new metal rabbet planes (and one really good one). But for the most part, rabbet planes are a lot harder to find than they should be.

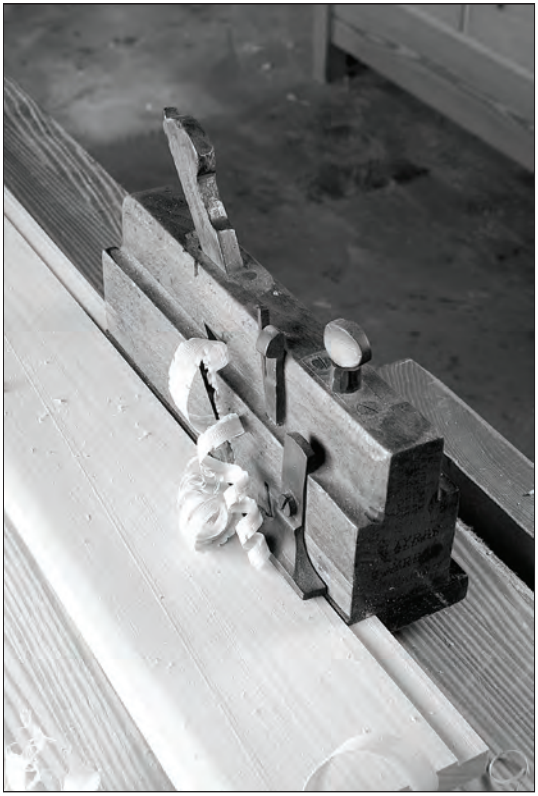
I don't know why this is the case, but I do know that if handwork is going to continue to flourish in this age, we all need rabbet planes. They are as essential as any plane on this short list. So Viva La Rabbet!

What can you do with them? Tons of important stuff. Rabbets are a foundation of Western joinery, and it's nigh on impossible to make casework without them, unless you are a total hack. Rabbets hold a cabinet's back in place. They are the joint between the backboards. They can be the joint between the two mating stiles of the doors of a high-quality piece. They can register the top and bottom to the sides. They can be integral to the way shelves fit into dados in a case's sides. They do most of the heavy lifting when it comes to making mouldings. And they are an essential first step to every raised panel.

And those tasks are just off the top of my head.

Because the rabbet plane is so important, there have been different forms of the tool that have emerged through the centuries. They have a lot of different names, but they all belong to the big rabbet family. Here they are.

- Straight rabbet. The simplest form of rabbet plane: a wooden stock, an iron sharpened straight across and a wedge. A versatile plane that requires a little skill to master.



Different animals. The wooden and metal versions of these tools are remarkably different. You really do need one, so they are worth close investigation.

- Skew rabbet. The same plane with a skewed iron, which reduces tearing when working against the grain. But they can be harder to steer because of the skewed iron.

- Standing rabbet. A rabbet plane with a fixed fence that allows it to cut a single width of rabbet, such as a 1/2"-wide rabbet.

- Standing fillister plane. Similar to a standing rabbet, but it has a small knife positioned in front of the cutter that allows the plane to easily be used across the grain. The knife severs the cross grain before the iron lifts it up.

- Moving fillister plane. Like the standing fillister plane, but instead of having a fixed fence, this plane has a fence that moves. This allows you to cut a variety of joints. This plane is usually equipped with a depth stop.

Choosing a rabbet plane involves a lot of personal preferences. The straight rabbet is so simple that little ever goes wrong with it. Yet it requires a little practice to use effectively. The moving fillister plane seems to do everything you need, yet it takes some serious tweaking to get the fence, iron, nicker and depth stop all working together correctly.

Simple but skewed. This wide skew rabbet doesn't have a fence to guide it, so it can be tricky to steer when you are learning the tool.

I think that beginners will migrate to the moving fillister plane, which seems to remove some skill from the equation. People with a little planing experience under their belts will have no problems learning how to use a simple rabbet plane. The "standing" rabbet or fillister planes are more for a production environment, or for someone who likes to have a set that is ready to go at all times without much fussing. So let's discuss the choices at hand.

Wood or Metal?

Aesthetics, politics and rust aside, the metal and wooden tools are different. Like the plow plane, metal rabbets throw the shaving into the fence (annoying). Wooden rabbets throw the shaving onto the bench (which I prefer). You can get used to either perspective.

Vintage wooden rabbets tend to need some attention to get them running again. Every critical wooden surface might need truing – the sole, bed,

Quite similar. Metal shoulder planes and wooden rabbet planes look like different tools, but if you do the math you see that they have similar cutting characteristics. You can blur the lines between the tools if you wish.

wedge and sidewall. The iron is likely to be a mess. If it has a movable fence, the screw holes could be stripped. New wooden rabbets have none of these problems, but they are expensive. These tools are tricky to make well.

Vintage metal rabbets are easy to get running. But some are poorly suited for hard woods. A typical rabbet plane (such as the Stanley No. 78) has a fence that grips a single rod. As a result, the fence is unstable. In softwoods and for carpentry this is not a big deal. In furniture work, it is.

Skewed or Straight iron?

Rabbet planes are made either with the iron sharpened straight across, or at about a 20° skew. Should you care? Yes. The skewed iron is harder to sharpen, but it helps when used with a fence. The skew pulls the fence of the tool against the work, helping it stay on track. Also, a skew cut makes the tool easier to push. And the resulting cut across the grain is cleaner than that with a straight iron.

I wouldn't kick a straight rabbet out of bed for eating crackers, but I always prefer a skewed iron if given a choice. But skewed rabbets without a fence are a royal pain to steer. Avoid those.

Fillister or Straight Rabbet?

Fillister planes are the more complex cousins of the straight rabbet. No one would argue that the difference between them is really the user's skill level. But which should you choose?

This is one question for which I really can't give you a firm answer. I like straight rabbets when I have only a few rabbets to make. The tools require little fussing to get them working, in comparison to the moving fillister, which has a fence, nicker and depth stop that all have to be adjusted with care in order for the joint to come out right.

But if I have a lot of rabbets of the same size to make, the moving fillister plane is a good friend. Get it set up, and the rest is just working until the tool tells you to stop.

What About Shoulder Planes?

Many beginning woodworkers make the mistake of calling a shoulder plane a metal rabbet plane. They sure look similar: Open sides, the same shape of body and a single iron. But shoulder planes are different. They have the iron bedded at a low angle (20° instead of 45°) and the planes are almost always used with the bevel facing up. They are metal so that the sides can be machined accurately to the sole and the area of the plane below the blade is robust (a wooden bed would be quite weak).

The planes are also used differently, though you do not have to follow the old ways if you do not want to.

If you do the math, you can see that a simple wooden rabbet plane and a metal shoulder plane are actually both capable of doing similar jobs. They both have similar cutting angles (usually about 45°) and have open sides to allow you to work on the left and right sides of the tool.

The only real differences are that the shoulder plane is machined a lot better and it has a different escapement. In other words, you can easily press a shoulder plane to do the job of a simple rabbet plane (I do it all the time). But it's not so easy to get the wooden tool to do the job of the metal one (though a sharp iron and a good set-up fix a lot of sins).

So consider buying a large shoulder plane (1-1/4" wide) and use it as both a shoulder plane and a simple rabbet plane. This is an excellent option if you don't have a lot of rabbets to cut. Then, if you get some money on down the line, invest in a moving fillister plane with a skewed iron (either metal or wood) so you have a tool that can be dedicated to the rabbets that are common to your work and is ideal for making raised panels.

One little thing to note is that shoulder planes don't really throw the shavings to the left or right of the tool. They tend to bunch up in the escapement. That's annoying.

Important Parts of a Rabbet Plane

The sole and boxing: If the sole is garbage, your work will be likewise. The sole of a rabbet plane should be flat. It's not too difficult to do in metal or wood – there's not a lot of surface there. If you buy a wooden rabbet plane you need to be aware of the "boxing" on the sole. That's a boxwood piece that has been inset into the beech stock of the tool to provide wear resistance on the tool's critical areas.

This boxing comes loose or gets broken. You need to ensure that it can be made sound and trued up. Otherwise you have a nice piece of firewood.

Once you get the sole trued up, you need to true any sidewall that is going to bear against the work. With simple rabbets and shoulders, you need to tend to both sidewalls. With moving fillisters, standing planes and metal rabbet planes, there is only one sidewall that bears against the work.

The mouth: Some wooden rabbets have been used so much that the mouth is an open maw. That's not ideal. As with any plane you want the mouth to be able to pass a working shaving without clogging, but little more. That will do the most to improve your surface finish. So pay attention to what the working mouth aperture is. Another reason for using a shoulder plane as a simple rabbet plane is the mouth of a shoulder is usually adjustable, so the mouth isn't an issue for this type of plane.

Chipbreaker: A few rabbets have chipbreakers. They can stiffen up an assembly with a thin iron, but you need to make sure they mate to the iron and work with the wedge when they are screwed onto the iron.

The skewed iron: If you buy a vintage skewed rabbet plane, you almost certainly are going to have to regrind the iron so the skew is proper and emerges from the mouth as it should. This can be a significant amount of work, as any grinding chore will be. Check the iron in the mouth of the plane so you know what you are getting into before you buy it. If the iron is off a lot, you might be able to argue for a lower price.

The nicker: The fillister planes have nickers with different shapes. European planes can have a knife shape. English and vintage American planes have a nicker shape that looks like a clover with three leaves. You file each leaf to a football shape so it will cut. And modern rabbet planes have a circular nicker, which is thin and easy to maintain. Nickers on all vintage planes are usually as dull as a documentary about dirt. So know that you have some file work ahead of you.

The fence: On metal planes, the fences are quite puny. On wooden rabbet planes the fences are merely smallish. Luckily on the metal planes you can do something about it easily. Most metal fences have a few clearance holes in them so you can add an accessory fence that is wider and longer than the crappy metal one. Add one. It makes a difference.

The bullnose setting: Many metal rabbeting planes have two beds: One for standard rabbet work and one for "bullnose" functions. That's when you move the iron forward. I can't say that I've ever seen the need to use the bullnose function of a rabbeting plane. So this is (to me) like having gill slits.

Fence posts: With metal planes especially, the fence posts are difficult to secure in the body of the tool so they don't come loose in use. Many posts have a hole through their diameter. What's that hole for? Put a carpentry nail though it and use it like a tommy bar to really tighten the post in the body of the tool. That helps a lot. Then again, metal rabbet planes need all the help they can get.

Using a Rabbet Plane

There are many ways to use a rabbet plane, and the technique you choose depends on the tool you have. With a simple rabbet plane, I generally use a marking gauge or cutting gauge to scribe the width and depth of the joint on my piece. Then I tip the tool about 20° and place the tool's edge (where the sole meets the sidewall) into my scribe line.

Then I gently push forward, removing a tiny sliver. After a few passes I've created a shoulder line and can begin tipping the body of the plane toward vertical. I use my fingers as a fence but really the shoulder of the joint does most of the guiding.

With the "standing" rabbet planes there is no need to scribe the width of the joint, only the depth. (Unless the rabbet is across the grain of the wood – then you need to scribe both.) You can begin this joint with the plane standing vertical. It's fairly straightforward. Just as when you use a plow plane, you should use your dominant hand to push the tool forward and your off-hand to hold the fence against the work.

With a moving fillister plane you don't have to mark any part of the joint on your work. Merely set your fence to the width of the joint you want. Set the depth stop to the depth you want. If you are cutting across the grain, drop the nicker so it cuts.

I find it's a good idea with any fillister plane to begin the joint by pulling the plane toward you, which makes the nicker scribe the width of the joint on your board. This confirms that everything is in order before you begin, and it makes your first stroke easier.

With fillister planes, there is one important troubleshooting tip to add. If you cannot get the iron of the tool to make a significant cut, then your nicker is probably set to make a cut that is too deep. A deep nicker cut prevents the iron from reaching the wood. Reduce the cut and (if necessary) sharpen the nicker. These two remedies fix many problems with this plane.

Block Plane

You can build furniture without a block plane. But why should you? The block plane is one of the greatest hand-tool inventions of the Industrial Revolution, in my opinion. With a block plane and a little skill you can accomplish almost any task. These tools trim end grain, face grain and whatever else you ask of them – and they do it even if the iron is a mite dull (thanks to their lower pitch). They are the most flexible plane ever manufactured. You can change the pitch of the tool with great ease and close or open the mouth with no special tools. And they are simple to set up.

Woodworking purists scoff at the tool, but I think that this is only because it doesn't fit into their narrow tool list. If block planes had been invented in the 18th century, you can dang well bet that every re-enactor would be spouting off about how the block plane was the savior of the age.

In fact, I have to say that the block plane is one of my favorite planes because it was the first hand tool I ever used with great success.

When making my very first piece of handmade furniture, a sitting bench, I realized that I needed a way to trim the bench's front and back pieces to the seat of the bench. I didn't have an electric sander – much to my chagrin – so I decided to go to Walmart and buy a block plane. I don't know where I got this idea; probably from my grandfather.

They had one block plane. It was a "Popular Mechanics" brand and was cheap and blue. I bought it, took it home and put it to work. It was not sharp.

A modern favorite. Block planes get a bad rap from the hand-tool purists, but they are the proletariat's favorite plane. They are simple to set up and use. And they are inexpensive.

I did not sharpen it. It cut the pine surprisingly well. I can remember being amazed at the curly shavings that emerged from the mouth. I knew at that moment how powerful hand tools could be, even if wielded by a moron.

If you look at the history of block planes, you should be prepared for some enormous diversity and confusion. It seems that toolmakers made more kinds of block planes than any other kind of tool. I'm going to try to boil down the major features here for you, but be aware that I cannot cover every kind of block plane ever made.

Low Angle or Standard?

Block planes come in two flavors: low-angle or standard-angle. Low-angle tools have the iron bedded on a ramp that is 12° off of the sole. Standard planes have a 20° bed. Low-angle planes make it easier to achieve lower planing angles, which are nice for end grain. Standard-angle planes make it easier to achieve higher planing angles, which are nice for reducing tear-out.

The reason I always use a low-angle block plane is two-fold.

1. The lower angle makes for a more compact tool that fits better in my hand. Your mileage may vary here.

2. With the low-angle plane you have a wider variety of planing angles available to you. You can achieve angles as low as 37°. Standard-angle planes can only go as low as 45°, if you want the edge to last more than a few strokes. Both planes can achieve high-planing angles. So the low-angle tools are more versatile.

So I see no reason to even own a standard-angle block plane. And I don't.

Adjustable Mouth or Not?

Low-rent block planes generally have a fixed mouth, though there are some nice small block planes with fixed mouths. I prefer an adjustable mouth. Why? When I am using a block plane to true end grain, I don't want the leading corner of the work diving into the mouth aperture. When I work in tricky grain, I will use every weapon available to me to attempt to reduce tearing – including an adjustable mouth.

And when I need to hog off material, I simply open the mouth as wide as it will go. Easy. If you have only one block plane, I recommend a low-angle tool with an adjustable mouth.

Lateral Adjustment or Not?

All block planes have lateral adjustment – you can tap the blade left or right to tweak the position of the cutting edge in the mouth. The question here is whether you need a lateral-adjustment mechanism, which can be as simple as a plate that shifts left or right to move the blade left or right, all the way up to a Norris-style adjuster that will control both the depth of cut and the lateral adjustment.

I find that all lateral-adjustment mechanisms that are supplied on a plane generally offer only coarse adjustments. The fine adjustments come from tapping the plane's iron with a hammer. So to me, it doesn't really matter if the plane offers some sort of formal lateral-adjustment mechanism. That's because of the way I adjust a block plane:

- Sight down the sole and extend the iron until it appears as a black line against the shiny sole.
- Use your fingers to shift the iron left or right until the black line protrudes consistently from the mouth.
- Retract the iron to take up the screw-feed mechanism's backlash. Then extend the iron a bit and use a small hammer to tap the iron left or right into its final position.

So do what you want to here. You don't have to have a lateral-adjust mechanism. But it won't hurt your efforts either.

Lever Cap, Knuckle-joint Cap or Screw Cap?

There are several ways to secure the iron in a block plane. One system uses some sort of screw mechanism that you turn to tighten the plane's cap against the iron. The screw can be above or below the plane's cap.

I want to be somewhat specific here, so please bear with me. Almost every block plane has a screw in the center of the bed that is the pivot point of everything that holds the iron in place. If the lever cap is also tensioned by a screwing mechanism, then that's the part that I'm talking about. It is usually a large screw if it is below the lever cap and a small screw if it is above. Both systems work fine.

If the lever cap is a two-part articulated piece of metal, it could be a knuckle-joint cap. With a knuckle-joint cap you drop it on the screw in the center of the bed and snap the rear of the lever cap down. This locks every-

The run-around. The lever cap can be locked down using a screw-feed mechanism, a lever or even other mechanisms, such as a wedge. I like the screw-feed mechanism, but the other ways work fine, too

thing. It is quick, but the downside is that you can only control the final tension on the blade by adjusting the screw in the center of the bed.

If the lever cap actually has a lever (how novel!), then the whole iron is locked in place with a cam action that is set in motion with the lever on the cap. Press the lever one way and the cap locks the plane down. Press it the other way and the cap is loose and can be removed. This relationship between the cap and the iron is regulated again by the screw in the center. Get it set right and the cap will lock and unlock like clockwork.

Personally I prefer the caps that are tensioned with a screw feed. They are easier to fine-tune. The knuckle joint requires some fussing to set it up.

Length & Width?

Block planes come in a variety of lengths. I prefer a plane that is about 6" long and fairly lightweight and maneuverable. Big block planes are not good for trimming – they are merely envious of the bench planes. Get something that fits in your hands, feels good and has the attributes above.

Machined or Linished Bedding?

When a manufacturer prepares the bed of the tool to hold the iron, the company has three choices.

1. The company can use the painted iron casting as the bedding surface for the iron. If you see this in a tool, put the plane down and walk away. No matter how miserly the price is, it is still not worth fooling with.

2. The company can "linish" the bed of the tool. Essentially it is sanding the casting to make a flat or semi-flat surface. A linished surface can be fine – I used a block plane with a linished bed for many years. But can you do high-tolerance work? The answer is never certain.

3. The company can machine the bed of the tool. This will look far finer and machine-like than linishing, which looks like using a belt sander. Get a block plane that has had its bed prepared by a milling machine. The toolmarks will be regular and the mating components will actually mate – instead of shaking like they are performing in an ancient fertility ritual.

How to Use a Block Plane

Unlike other traditional tools, pretty much anything goes when it comes to using a block plane. You can push it, pull it, hold it with one hand or two, work edges or faces or ends – even clamp it upside down in a vise and push the parts across the sole.

Just keep the mouth tight to reduce tearing – but not so tight that it clogs.

Because the tools are called on to trim end grain, many woodworkers discover a rude surprise when they plane end grain for the first time: spelching. Spelching is when the final bit of grain breaks off of the edge of a board

What you pay for. At front is what the bed will look like if it has been machined by a milling machine. This is the most accurate way of milling the bed for the iron. A small error in the bed of a block plane is disastrous.

when you plane its end grain.

You can avoid spelching in a variety of ways.

- Plane a small chamfer on the outfeed side of the board – the chamfer will strengthen the edge.
- Plane toward the middle of the end grain. In other words, don't take full-length passes on the ends. Work from one end into the middle; then work from the other end into the middle. You might end up with a little high spot that you have to trim away.
- Use hot hide glue to quickly scab on a piece of scrap to the outfeed edge. Then the scrap will spelch – not your work.
- Plan for spelching. Leave your pieces slightly over-wide and trim your end grain before you trim the board to its final width.

One last tip on end grain: Moisten it with something to make the end grain easier to slice cleanly. I use alcohol or a little camellia oil, but never water. It makes a difference.

Router Plane

Router planes need a new name. Because so many woodworkers associate the word "router" with the electric tool, I think it tarnishes the reputation of this workhorse. The word "router" has its root in the verb "to root" – like a pig roots for truffles.

Router planes do just that. They root beneath the surface of a board and remove material with great accuracy. They can root around in the bottom of a dado, groove or rabbet to make it perfectly true. They can root on the cheeks of your tenons to make them true, centered on your stock and a consistent thickness. They can root out the bottom of your hinge mortises so they are all the same depth, which prevents an ill-fitting door.

But what they don't do are the tasks associated with the electric router. They don't make moulding. They don't cut deep mortises. They don't perform all manner of trickery when upside down in a table.

I am one of the biggest fans of router planes. In fact, I gave up my electric router for this book. But I'd never give up my router planes.

Big or Small?

Among the manufactured router planes, there are essentially two sizes: pocket-sized and purse-sized. You need both. The small one is for hinge mortises, narrow dados and installing all manner of hardware (such as locksets) in tight places. Its biggest virtue is its small size. You will want to navigate the tool into areas where other tools can't go. So a little sole and a small cutter are just the thing.

The larger router planes are useful for carcase joinery. They true up your dados, rabbets, tenons and half-laps. They usually have more gizmos than

A break with tradition. Few traditional sources list a router plane as an essential tool. I cannot work without it. Perhaps I am too obsessed with accuracy. Perhaps my skills need improvement. Perhaps I should just accept that it's a great tool.

the small routers, so they get the most attention. But I think you need both.

Wood, Iron or Something Else?

Early router planes were usually shop-made tools. You would take a piece of scrap bannister rail and cut a mortise in it. Then you would shape a worn-out file and fit it in the mortise and tighten things up with a wedge. The cutter typically did not bend 90° like those on the modern router planes. Instead, it came straight down and would do more scraping than planing.

Later wooden routers, which are still made today, have an "L"-shaped cutter and a simple blade-adjustment mechanism – usually a thumbscrew. This was the style I used for years and it works well.

The downside to the wooden routers is that they are usually quite big. The wood is thick and the sole is wide. So they are fine when you are working on furniture components that are disassembled. But when you are trying to get inside a carcase, they are bulky. Plus the thickness of their body is a disadvantage when you are trying to peer into the mouth of the tool and actually see what you are doing.

The iron router planes are thinner and smaller, so they can go more places and are easier to manage. They also can be loaded with all manner of geegaws: depth-adjustment mechanisms, fences for both curved and straight work and depth stops. You don't need all these things to be a complete person. If you don't have them you will simply adjust the order in which you perform operations on your project's parts.

Some people prefer wooden routers to iron routers because it is easier to flatten the sole of the tool. I haven't seen too many manufactured iron routers with problems that warranted major surgery. The ones that have needed work were bronze ones made by individuals.

And that brings us to the third kind of router plane: those that were made by an individual, usually a patternmaker. These are common and run the gamut from gorgeous and functional to ugly and worthless. I don't have anything against this kind of tool (I own a few), but you do have to be a bit more cautious when buying one. As always, make sure you can send it back.

Irons: Their Shape, Their Width & Their Post

Router plane irons come in two basic edge shapes: straight and spear-shaped. The straight irons are for general work, when you don't have to worry much about the appearance of the surface after it is cut, or when you don't have to remove waste in acute corners, such as when making a butterfly spline.

The straight-edge irons are easier to sharpen. There are only two surfaces to tend to, while the spear-shaped irons have three surfaces. Most people use the straight cutters until they are – quite literally – driven into a corner.

The irons come in a variety of widths, from little 1/16" cutters for stringing on up to 3/8", typically. Just pick one that is smaller in width than the dado you want to cut. If you are trimming a tenon cheek, use a wide cutter.

With some router irons the post that mates to the body of the plane is an issue. If the post is completely round, there is a good chance that the iron will rotate as you are using the tool, which is annoying. You can rough up the post with a file or coarse sandpaper. But it still might rotate at times.

If the post is square or round with a groove milled into it, the cutter won't move unless you haven't secured it well enough.

One last detail on the irons. When you buy vintage routers, the irons can be fairly chewed up and the edge can be out of square. Because there is no lateral-adjustment mechanism on a router plane, the iron needs to be square in order to create a surface that is parallel to the sole. So you can regrind the iron, or failing that, purchase a new one from the manufacturer. Stanley, for example, still sells replacement irons for its routers.

Open Mouth or Closed?

The mouth of a router plane isn't like the mouth of a bench plane. It does nothing to press the shaving down to control tear-out. Instead, the mouth of a router plane refers to the section of the body's casting in front of the cutter. It can be flat, which is a closed-mouth router, or it can be humped, which is an open-mouth tool.

The closed-mouth tools allow you to work on the edges of boards. The open-mouth tools give you more visibility ahead of your cut so you can see what you are doing. There are some models of tools that have an open mouth that come with an accessory plate that allows you to close the mouth. These work fine. Most of the time, the mouth of the tool doesn't enter into the equation. But if you are cleaning up a bunch of stopped grooves on the edges of door components, then you are going to want a closed-mouth tool. Note that you can close the mouth of an open-mouth tool by adding a thin wooden sole to the tool – many routers have holes in their casting to allow for this.

Open and closed. An open-mouth router gives you more visibility during the cut. A closed-mouth router allows you to work on narrow edges. If I had to have only one, it would probably be the closed-mouth router.

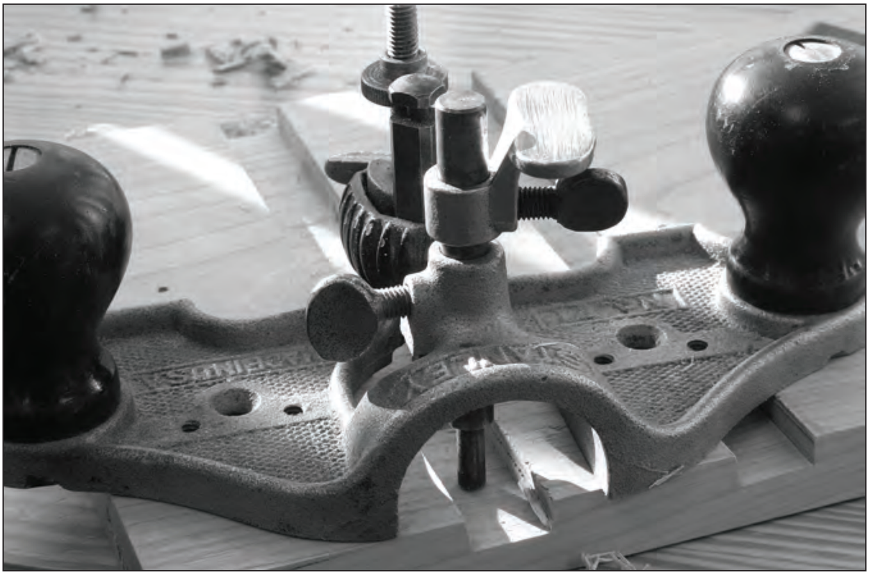
Types of Depth Stops

Most vintage routers don't have depth stops, which allow you to return to the same depth setting over and over again. Depth stops on the more modern routers are nice, but they can all be defeated fairly easily while you are working. So trust, but verify.

The typical depth stop on vintage routers that have one isn't really worth fooling with in my opinion. In fact, some people don't even know that the tool has a depth stop. The stop itself is the small plate of metal used to close up the mouth on an open-mouthed router. The plate is attached to a metal post, which passes through a hole in the iron sole of the tool.

If you place the plate on the underside of the tool and lock down the post, then you close up the mouth. If you instead drop the post into the hole through the top of the hole so the small plate is up in the air, then you have set up the tool to use the depth stop. You can adjust the position of the plate on the post (look at the photos here – it's not as complicated as it sounds). When the post is as deep as you want to go, lock it.

So here's how it works. When you are not to your final depth the post rides on top of the wood and the plate hovers above the base casting of the tool. When you reach your finished depth, the plate contacts the casting. It's



Yup, a depth stop. The plate and post that close up the mouth of the Stanley No. 71 can be turned upside down to serve as a depth stop. When the collar of the plate touches the base casting, you are done.

more of a depth "suggestion" than a stop.

The other types of depth stops are simpler. They are collars that ride the post of the cutter and prevent you from dropping the cutter any deeper. You cinch these stops down with a thumbscrew – or you might have two collars that you jam against one another.

These styles of depth stops are simpler. But they also can be easily defeated. So if you use them, make sure you keep your eye on the cutter's depth at all times. And when you reach your final depth, don't crank on the depth-adjustment wheel of the router. It takes a light touch.

Adjusting the Depth

The depth of cut can usually be adjusted one of two ways. Here is the simple method used on most smaller tools: You release the iron, place it in the position you wish then lock it down.

The other style of depth adjustment uses a wheel that rides on a threaded post. Release the iron, turn the wheel to move the cutter up or down. Then lock it in place. Both systems work fine, and you will get used to yours. I have yet to find one that is superior to all others in all cases.

Using a Router Plane

Router planes are rarely used by themselves to create a joint. Usually they are the great precision janitors that clean up the mess left by the other tools. You might cut a tenon cheek with a saw, but it is the router plane that ensures it is flat. You might saw out the walls of your dado and remove the gross waste with a chisel, but it is the router plane that ensures the dado is flat and the same depth as all your other dados.

Like any plane, routers can take a fairly heavy cut when used across the grain, such as when you remove the waste in a dado. Typically, however, you will want to set the router plane to take a light cut. This makes the tool easier to handle and generally improves the surface finish left behind on the wood.

Final Notes on Planes

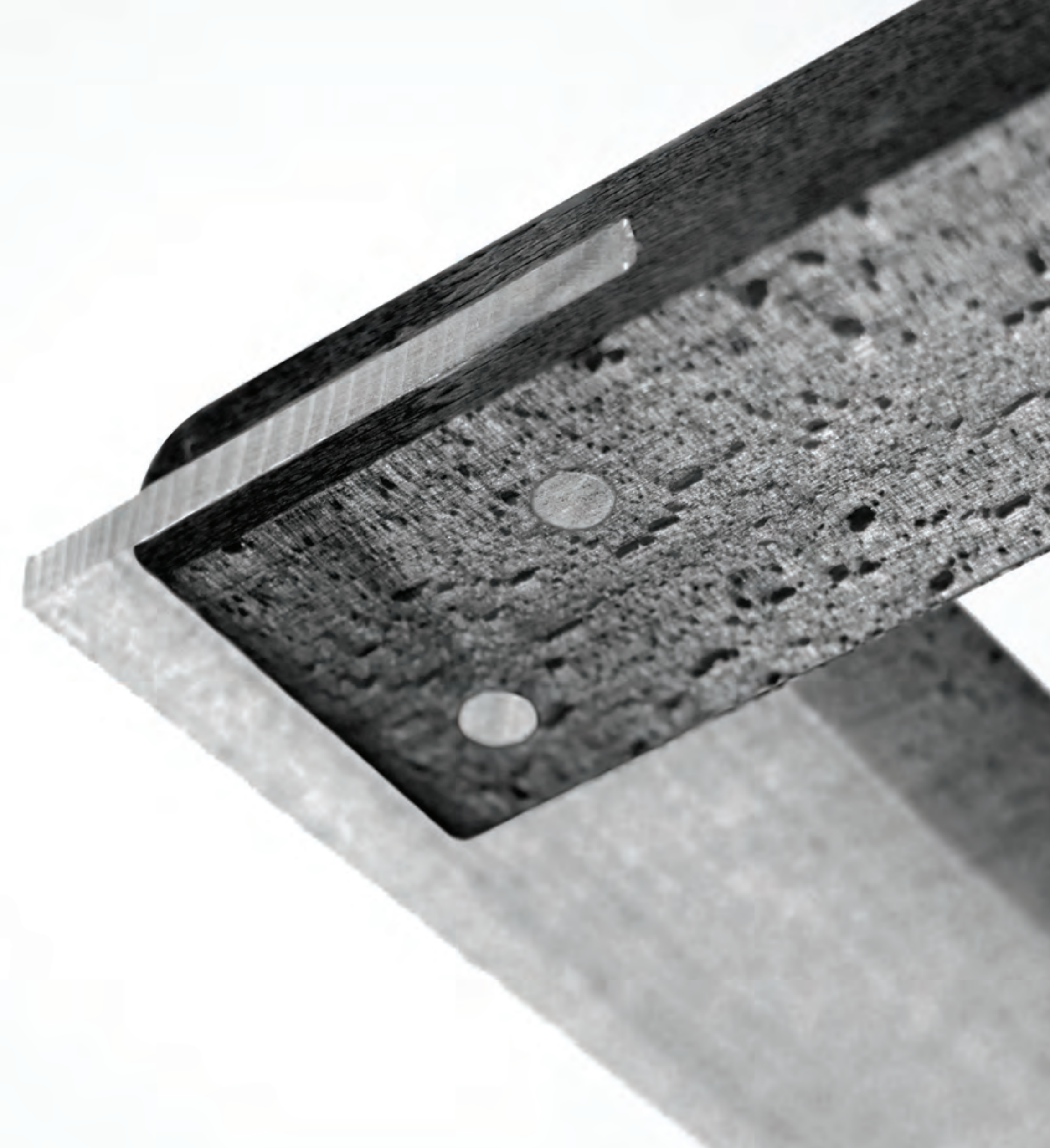
Learning to use a handplane is like learning to ride a bicycle. There is a steep learning curve at first. You must learn to sharpen the tool, set it properly and move it across the material in a way that gives you smooth surfaces instead of chewed ones.

With bicycles, you have to learn to balance, steer and pedal forward, all at the same time. When I taught my oldest child how to ride a bike, we had many evenings that ended with a tremendous wreck in the school parking lot, and skinned arms and legs.

Then one evening, it clicked and she could ride a bike. And she'll now be able to do it for the rest of her life.

The same thing happens with handplanes. You will struggle. You will have short bursts of success followed by spectacular failures, which is why it is good to practice on scrap wood. But one day the planets will align and everything will work. And at that moment you will also have mastered all the other planes – they all work using the same principles.

Don't give up – not after the first day, week or month.



6-ESSENTIAL MARKING AND MEASURING TOOLS

If you are a machinist or engineer, this chapter might cause you to rethink our country's dedication to free speech. I don't deal well with digital readouts. I rarely measure anything less than 1/16". And I prefer my measuring devices to be shop-made and from wood when practical.

Why wood? Well, it is lighter in weight so that my measuring tools can be longer. It is less expensive. And it can easily be trued with my hand tools.

Years ago our shop spent more than $100 on a precision metal straightedge from Starrett. During the course of the first year it was dropped and stored improperly at times. As a result it is not true along its length or its face. It is as useful for woodworking and setting up machinery as a banana.

I keep it in our shop at work to remind myself of the error we made in buying this expensive error-detecting mechanism.

But not every measuring tool can or should be made of wood. Tools that you run a knife along will last longer if they are metallic. And some metal tools are less likely to wear at critical points and therefore last longer. It takes a little common sense.

So what about the question of accuracy? Why shouldn't we use the best digital technology in woodworking? There is nothing inherently wrong with digital tools. They might make your results more precise, but they don't ensure accuracy. In other words, you might end up with a board that is precisely .6275" thick, but it still might be bowed or twisted, and ruin an assembly.

There also is a deeper issue here that is important to me. We do not experience finished furniture with calipers. Instead we experience it with our eyes, our fingers and the rest of our body that comes in contact with it.

All your lumber might be exactly 3/4" thick, but if the resulting project looks like crap or is uncomfortable, then it is a failure.

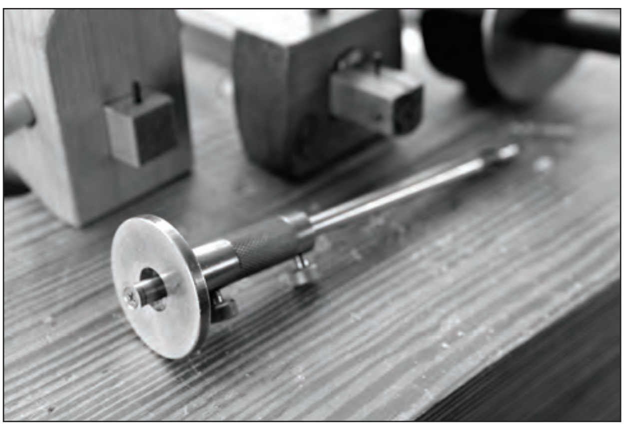
There are two important boatbuilding expression that I like to use when discussing measuring.

- "If it looks fair, it is fair." In other words, our eyes are better than our measuring instruments.

- "You don't need to make both sides of the boat look exactly the same because no one can see both sides simultaneously." In other words, you need to focus on what is important – a good look and a good fit – and relax when it comes to hitting some precise number or trying to achieve perfect symmetry.

One example of this in furniture-making will help. When you look at surviving antique furniture, you'll find patterns and some consistency when the maker set out the height and the width of dressers, chests and cabinets. But when it comes to the depth (the distance from the back of the piece to the front) you tend to see more variation.

That's because you can save time, labor and wood by allowing the depth of the carcase to be flexible. If you have an 18"-wide piece of lumber for a chest side but you need 20", what should you do? Glue on a 2" strip to make it wider? That will require ripping and fussing and gluing to make it look good. Or you could just make that part 18" wide and adjust the rest of the cabinet. That would make things look better because single panels look better than glued-up ones, and it will take less time.



Perfection. I am cautious to ever call out anything "new" as superior to "old" – that is usually folly. But this modern cutting gauge is a perfect update of old tools with a few modern tweaks that make it absolutely superior.

Or what if your board is 22" wide and you only need 20"? Again, I would adjust the dimensions of the project so I don't have to rip off 2" of perfectly good wood. Once again, common sense must prevail. You don't want a kitchen cabinet to be 13" deep. Let's begin by exploring the most important marking tool: the gauge.

Gauges

In handwork, gauges are the most important marking tool. You should start with one, but you might end up with several more in your chest, including ones that you have made, because it is handy to have several gauges set up to dimensions you will return to many times during a project.

I can work with one gauge, but I find that two gauges are better. And three is almost enough.

Gauges are the tools that guide other tools. They lay out the lines that you work to: the baseline of where your dovetails take wing from your board. The width and depth of a rabbet. The cheek of a tenon. The wall of a mortise.

There are so many types of gauges that it is impossible to discuss all the types and combinations. But they do have some common features that will help you select a good one.

Cutting or Marking?

The two major families of gauges are the cutting gauges and the marking gauges. The cutting gauge uses a knife to make the line. The marking gauge uses a conical pin. Both need to be sharpened and both forms should cut the wood – not just dent it.

Cutting gauges do a better job when working across the grain. The thin knife edge slices the fibers, even when the knife becomes a bit dull. The result is that you can mark dovetail baselines and the like for a long time between sharpenings. When working parallel to the grain, cutting gauges occasionally will follow the grain of the wood. This can occur with any gauge, and it is mostly a problem when you are dealing with a wood that has a significant difference in its density between its earlywood and latewood.

Marking gauges seem to do a better job when scribing parallel to the grain, but when used across the grain, they might not make as clean a cut as a cutting gauge.

Personally, I use a cutting gauge for everything. I keep it sharp and use light strokes, so I never have any problems. But when I'm forced to use a marking gauge, I never have any problems with that either. As long as the tool is sharp and you focus on keeping the tool's fence against the work, you'll be fine.

Wood or Metal?

Traditional gauges are nearly all wood – even the wedge that secures the fence on the stem of the tool is wood. I've made a dozen or so of these gauges and can report that they are superior to the typical commercial wooden gauge. Why? The modern wooden gauge became too complex and eventually inaccurate.

Here, diagonally. This shop-made marking gauge, modeled after early tools, uses a wedge that crowds the step of the gauge into a corner of the head, which makes the tool more accurate.

Modern wooden gauges have a knurled brass thumbscrew that is supposed to tighten the fence to the stem. However, these almost never work well. A typical gauge will secure the stem vertically but will allow it to shift horizontally. Depending on how tight the fit is between the stem and the fence, this can be a pain in the tuckus.

Better modern gauges made from wood push the stem into a corner of

Twice the chore. A mortise gauge seems like a good idea, until you have to set it over and over for different widths of mortises. I started using a single cutting gauge for marking mortises, and found it easy to do. The pins of this gauge are filed to mark tenons.

the mortise through the fence. These work about a million times better. And ancient wooden gauges did the same thing. The long wedge that secured everything crowded the stem into the corner of the mortise.

Because gauges see a lot of use, they can wear quickly – sometimes alarmingly so. The maple gauges I've made have worn fences, and the mortises through the fence are also a bit wallered out. These are rock maple gauges and the fit between the stem and fence was quite stiff when I made them.

As a result, I tend to prefer metal gauges that have a round stem and a metal fence. Some have controls to micro-adjust the setting. That's OK, but what I really like is just being able to adjust the gauge with one hand and have it lock down totally solid. And I never have to worry about the gauge slipping or wearing out.

If you are an occasional woodworker, almost any gauge will do. But if you work with your gauges constantly you have a serious choice ahead: Go traditional with the easy-to-make wooden gauge that can wear out, or try something a bit more modern (by which I mean the 19th century) and get an all-metal gauge.

Do You Need a Mortise Gauge?

Many tool inventories list a mortise gauge, which is a gauge with two pins so that you can mark out both walls of a mortise or both cheeks of a tenon simultaneously. I have one, but I don't use it as much as I thought I would. When I mark out mortises, I use a simple cutting gauge and define only one wall of the mortise. The mortise chisel itself defines the other wall of the mortise.

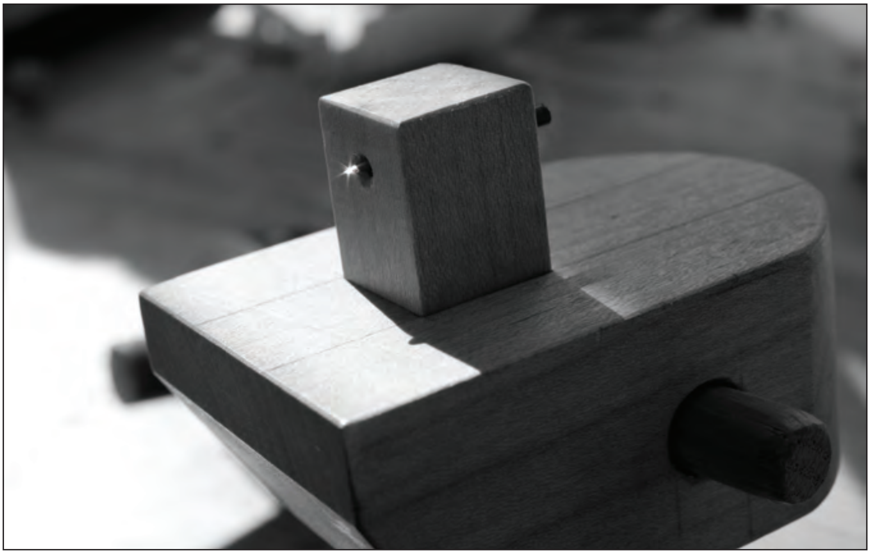
When marking tenon cheeks, I typically use two settings (or two gauges) to mark the cheeks. Yeah, a mortise gauge would be more convenient I suppose, but I never feel compelled to use one when marking tenons. Also, if you use machines to dimension your stock, I think a mortise gauge is a waste of time. Having four-squared stock allows you to use one setting of your cutting gauge to mark both cheeks of your tenons. That's because both faces of your boards are parallel, thanks to the machines.

So I'm not going to tell you to buy a mortise gauge. But I'm also not going to tell you to forsake one. Try one out in the store – they can be complex buggers. Some people like that trait. Others are turned off.

Using a Gauge

The most important thing about using a gauge is to pay attention to the cutter itself – whether it is a pin or a knife. Both the pin and the knife are wedge-shaped. But they are not perfect wedges. Instead, they each have a cutting surface that is 90° to the tool's beam and a second surface that is angled to the beam.

The flat side of the pin or knife should always face to the side of the wood



Get the point. Every cutter needs sharpening, even the pin of a marking gauge. Here you can see the flat I filed, which should always face the part of the wood that you are keeping, such as the mortise wall.

that you want to keep. The angled or sloped side should face the waste. Sometimes this means you need to turn the knife or pin around in the gauge to make the proper mark. If you can't do this in your gauge, it's time to get a new gauge (or a second one with a different cutter).

The key to all hand tools is to know how to sharpen them and start them in the wood. Gauges are no exception. The knife of a cutting gauge is just like any edge tool. You sharpen two flat intersecting surfaces into the tiniest possible intersection point – that is ultimate sharpness.

With a marking gauge you have a pin that has one flat surface and one curved one – it's like a cone that has been sliced vertically in two. The important surfaces are the corners where the flat part of the cone meets the curved part. The curved part of the cone needs to be filed smooth so the pin can pass easily through the wood.

No matter which type of gauge you use, the trick is to set the fence then use a light touch to define the mark you want. Four delicate marks are more

accurate than one mighty stroke. After a few strokes you can really bear down on the gauge's pin or knife to deepen the line. But don't do that on the first stroke.

Finally, because we're not getting any younger, I like to run a thin mechanical pencil lead through my gauge lines so I can see my marks.

Panel Gauge

Panel gauges are simply overgrown cutting or marking gauges. They can mark the wood with either a knife, pin or pencil. Why have a panel gauge? They are essential to your kit if you prepare your stock with hand tools. You prepare one face flat with your planes. Then you true one edge so it is 90° to that first face. Then you take your panel gauge and run the fence against that true edge to mark a parallel line to define the finished width of your stock.

Rip or plane the stock down to that line from the panel gauge, and you are almost home free.

Commercial, Vintage or Shop-made?

Panel gauges come in all flavors, but they usually are wooden, have a stem of about 12" to 36" long and a fence that has a wide bearing surface. Usually there is a rabbet cut into the fence to make the gauge easy to register on the top face of a board.

The commercial and vintage ones are both fine, as long as the fence can be firmly locked to the stem without the stem shifting all over the place. This is a big deal when the fence is so far away from the end of the tool that does the marking – small errors can become magnified by a little slop.

Shop-made panel gauges are nice because you can customize them. They are typically secured with a wedge, which crowds the stem into a corner of the mortise in the fence. This arrangement (like on the smaller gauges) seems to produce less error. Also, shop-made gauges fit your hands better and can use whatever marking system you prefer: a knife, a pin or a pencil.

My panel gauge has a pencil in one end of the stem for marking rough boards where a knife mark would be too hard to see. In the other end is a knife. I like knifing my boards' width because it is easy to see when you hit the line with your plane. The plane's shaving becomes ragged on its edges.

Stem Length

While it might seem that longer is better here, longer also tends to get unwieldy. Swinging 3' of wood around in a crowded shop is asking for awkward. Plus, you'll rarely use the full length much unless you build a fair number of dining tables. I like a panel gauge stem that is 18" to 24" long – enough to handle a typical case side.

Fence Details

Many panel gauges have a brass wear strip on the fence, which is handy. My first panel gauge was pretty worn when I got it and only got worse as I put miles on it. If your gauge doesn't have a wear strip, it's an easy thing to add.

Most panel gauges have a rabbet on the fence below the mortise for the stem. This rabbet rides on the edge of your board and makes it easier to hold the gauge against your board.

The Cutter

Panel gauges use a knife or a pin, and it needs to be a specific shape to work well. If yours has a pin, sharpen the pin with a small file and shape it so that the part that faces the fence is flat and the remainder is round. Likewise, when you install the knife in the stem, orient it so the flat face is toward the fence and the bevel faces away from the fence.

This setup makes a line that is convenient for hand-tool users. The line it scratches or cuts will be square toward the part you want to keep and beveled toward the waste.

Using a Panel Gauge

All the rules for using a marking gauge apply to panel gauges, except that panel gauges are two-handed tools. One hand guides the fence along the edge. The other hand guides the cutter or pencil and pushes it a tad into the work if necessary.

Begin with a light stroke followed by at least a couple stronger ones.

6" Combination Square

These tools are made for machinists. And while I would like to be all pure and stuff and use only a folding wooden rule, I cannot shake my love for the sliding combination square. They are so handy for marking and measuring out joinery that I always carry mine in my shop apron.

There is absolutely no good reason to buy a cheap and junky square. The vintage market is filled with old ones from Starrett, Brown & Sharpe and other great makers. I bought my Starrett for $20 at an antiques market but would gladly pay full price for a new one from a quality maker.

The list of stuff these squares do is as long as my arm. While many woodworkers use them for measuring, I mostly use mine more like a marking gauge. I transfer measurements from one part to another in a project. And I mark off measurements by sliding the head against my work and holding a pencil against the ruler. In fact, I probably would be almost as happy if my combination square didn't have any graduations on it.

I also use it like a traditional try square, and its small size is quite handy

Grudging respect. This is a tool I never wanted to like. But the thing is so handy and versatile, and with no downsides, that I am now a huge fan.

for checking if my chisel edges or plane edges are square. It also replaces my miter square and my torpedo level.

Usually when a tool does more than one job, it tends to do a universally mediocre job. But a good combination square is one of the rare tools that I think trumps many of the original traditional tools it replaces. When you buy one, here are the important things to look for.

Graduations & Finish on the Blade

I like a blade with a satin finish because it's easier to read. I already have enough challenges, such as old age and muddle-headedness. I don't want to add "glare" to that list. So I avoid the shiny stuff.

The graduations on the blade can vary. The most common (and useful) graduations are what is called "4R," which is 8ths, 16ths, 32nds and 64ths – all Imperial. I use the 8ths and the 16ths all the time, and I just marvel at the smaller graduations. The other useful graduations (for some) have Imperial on one side and metric on the other. If you have to live in both worlds, then this might be the rule for you. Avoid graduations that are Imperial but in decimal (i.e. 10ths of an inch). Who uses tenths of an inch? I guess if you measure rainfall it's handy. But mostly it will mess you up.

Head: Iron or Hardened Steel?

I'm agnostic on this point. The steel ones are more likely to survive a fall, but my iron ones have held up to a few bounces off the concrete with no ill effects. Usually the steel costs more and has a different black finish. But that is the only practical difference in my book.

About that Level...

People laugh about the level. After all, it's encased in only about 4" of metal, so its accuracy is greatly limited. I, however, find it quite suitable.

In furniture work, getting something level is rarely a problem. The only time I whip out the level is when I'm trimming the legs on a chair or a stool. I do this operation on a surface (my table saw) that I leveled. In this situation there is only a small surface that has to be level, and it is usually dished out for someone's butt. So I simply lay a piece of true stock (which is easy to find in a woodworking shop) over "buttocks canyon" and place the level on top of that. Problem solved.

Yes, I have a beautiful 24" cast-iron Davis level that I bought for a song. But I use it only for carpentry work. And to impress the ladies.

Some Tips on Use

The real beauty of a combination square is its ability to transfer measurements between components. I rarely use it to measure something. Instead I will place the stock on a rail, for example, drop the rule onto the attached

I'm not a machinist. No really, I'm not. The 6" rule, which comes with your combination square, is super-handy in the shop for checking and double-checking your work.

tenon then lock it. Then I can transfer that measurement to make a mortise.

In traditional shops, woodworkers would make a variety of pencil gauges for scribing lines that were parallel to an edge. I have never made a pencil gauge because the combination square is one with infinite settings. In fact, I use it a lot like a marking gauge and can run a knife against it (thanks to its rule made of steel).

If you do need to measure something with the ruler of a combination square, be sure to set the ruler on your work so its edges touch the area you want to measure. This brings the tool's graduations right up against the work. Otherwise parallax will mess you up big-time with this tool.

6" Rule

I know, I know. I'm starting to sound like a machinist. A 6" rule? Yes, I grew up using one and cannot shake the habit. These thin rules are great

for checking things over to confirm that you aren't about to make a big mistake when you begin mortising.

I bought mine at Aufdekamp's hardware in an old section of Cincinnati called Over-the-Rhine. It was an old-school hardware store. There was no stock on the floor of the store. They had one of everything attached to the wall or to a display. You walked around with a salesman and told him what you wanted. He made a list and retrieved the stuff from the back.

While most modern shoppers would reject this way of shopping, it was great for a beginner. I can remember buying a coping saw (yes, another coping saw) on the same day that I bought my 6" rule. I pointed to a red one on the wall and said that was the one I wanted. The guy didn't say anything. He just shook his head. I moved my index finger to point at the Olsen coping saw (which was cheaper). Then he wrote it down.

Maybe my love for the 6" rule is colored by my affection for that store, which is long gone. But I doubt it. Everyone in the shop at the magazine has one and can spot theirs from across the room. I know every scratch and discoloration on that rule and won't begin a project until it is in my shop apron.

Some people ask why I don't just use the 6" rule in my combination square? I probably could, but I like how the 6" rule is much thinner than my rule in my combination square. It's just easier to handle. But you don't have to buy one if you have a combination square.

Graduations & Finish on the Blade

Just as with a combination square, get a 6" rule that has 4R graduations and a satin finish. Stay away from the shiny ones that have the measurements printed on instead of engraved on. The printed ones are junk.

When you examine the graduations on a rule, pay attention to length of the lines. The lines get shorter as the graduations get smaller. The difference in the length should be dramatic and understandable at a glance. Too many rules have lines where the 1/4" graduations and the 1/8" graduations are almost the same length. That's useless. Just useless.

I really don't want to debate brand names in this book, but I suggest that you should look at all the brands, then look at the Starrett, which has been made forever in Athol, Mass.

Starrett perfected the 6" rule. And no one has yet to raise the bar higher.

24" Metal Rule or 24" Folding Ruler

The two- to three-foot rule is the gold standard in furniture making. Its length allows you to easily work out from the centerline on a 48"-long board, which is where most furniture components top out. Heck, there are poems written to the three-foot rule. It was typically the first tool an apprentice would buy. And many pieces of shop clothing – particularly pants – even had a special pocket for it.

I think you have two choices when it comes to buying your two-foot rule. You can get a metal one that is new or vintage, or you can buy a nice vintage folding one. If you want to buy a brand-new folding rule, take care. No one has made a nice one in my lifetime.

Also, I want to be clear that I think you should stay away from the so-called zig-zag rules – the thickish pivoting thing that looks more like a long and creepy bony finger. These don't lay flat. They are completely hopeless when accuracy is needed. The graduations are generally thick and poorly marked. But other than that, I love them.

Let's talk about the 24" metal rule first because it's the easiest to deal with.

The 24" Metal Rule

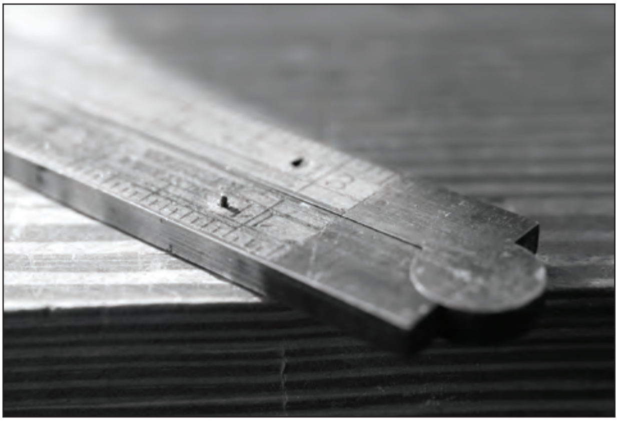
If you decide to take this route, it's going to cost you. This is a machinist's tool with machinist prices. Even used examples make me wince at times. The other downside is that they take up a lot of space because they don't fold. But if you decide to go down this path, read over the previous sections on combination squares and 6" rules. All the same guidelines apply: You want a satin finish, deeply engraved graduations and graduation lines that are clearly of different lengths.

I have one of these metal rules that we tested in our shop. It's not bad, but I wouldn't buy one for myself. Instead, I coughed up about $10 for a wooden folding rule made from boxwood that is fully bound in brass.

The Folding Rule

Vintage boxwood folding rules are as common as dirt. The problem with them is that many have been loved to death. The graduations are worn. The pivoting hinges are loose. The wood has cast. So before you rush out and buy a vintage rule you need to shop around a bit. The best user tools cost just as much as the loser tools in this category.

I recommend you buy a folding rule in person, not through the mail. Photos lie. People, likewise. The hinges should be tight, though you can peen the pin to tighten things up a bit. The graduations should be clear and the box-



Alignment pins. These small brass pins are usually missing from folding rules. These pins help keep the ruler from getting bent out of shape when stored.

wood should be light in color, though you can clean things up a tad. The rule should lay flat when it is open and closed. The alignment pins should be present. (Alignment pins are small brass pins in the edge of the rule that help the rule's segments line up when the tool is folded up.)

As always, if you can't buy it in person, buy it from someone who will take it back.

When I buy one of these rules, I look for one that has its edges bound in brass. These tools were the top of the line in a company's catalog and the brass binding seems to help keep the rule together during its long life.

I have my grandfather's folding rule and it is crap. It won't sit flat. The boxwood is dark. The graduations are faint. I had to tighten up the hinge. I'd give it away, but it would have to be to an enemy.

Graduations

This isn't usually a problem, but you need to keep an eye out on the graduations on a folding rule. Rules were made for every trade and were struck with scales that might not be suitable for woodworking. Look for the typical graduations and avoid rules that are bristling with a variety of scales. Woodworking is confusing enough without some odd conversion table sitting in front of your eyes all day.

Left- or Right-reading?

One more thing to be aware of: American rules start with zero at the right-hand end of the rule. English rules start with zero at the left end. You'll get used to either perspective, but if you have a table saw, the American rules are easier to use to help you set the distance between the rip fence and the sawblade.

Lightening the Boxwood

The boxwood on these rules tends to darken in time. So you'll find that the outside of the ruler is harder to read than the scales on the inside. You can fix this. Get some wood bleach, the oxalic acid type. Mix it up and apply the bleach with a gray pad and don't forget the nitrile gloves. This process usually lightens the wood but leaves the ink markings intact. I've made rules look as good as new with this technique. After a few minutes, wash the acid off with water. When the rule is dry, protect your tool with wax.

12' Tape Measure

Here we have another modern tool of convenience. You can use this for making furniture, but I find them to be a bit coarser and less trustworthy than a folding rule or even a ticking stick, which is a piece of scrap wood that is struck with a project's critical dimensions.

The tape is, however, handy in the lumberyard for gauging the thickness, width and length of wood you are interested in buying. And it's great for getting a rough idea of the space that a piece of finished furniture will occupy in a space in a house.

But if you use the tool for fine layout, watch out for the tab at the end of the tape. The tab gets bent and slides in and out to compensate for when you are making inside and outside measurements. For me, this tab rarely seems to be on the money.

Also a pain: The tab usually obscures some of the first graduations less than 1". So when you combine that fact with the fact that the tab is shifting all over the place, some woodworkers resort to starting their measurements on the 1" mark instead of zero. This leads to an error so common that it has a name: burning an inch.

You probably already have one of these tapes, so I'm not going to tell you to throw it away. Just use it wisely. Keep it in your car or truck – not your shop apron. There is no room for this tool in the Anarchist's Tool Chest.

Marking Knife

Like people, marking knives come in different shapes. Some are more pointed than others. Some are sharp. Some are dull. But they all leave their mark behind. Getting into a serious debate about the merits of all the different shapes of marking knives is a waste of ink. You might have many knives as you begin woodworking. Eventually, you will end up with one that suits you.

Point the way. This is one of the tools I cannot live without. There are lots of different kinds of knives. Pick one. Embrace it. Use it.

I started with an X-Acto knife. It was cheap and familiar to me after working four years as a production artist at a college publishing company. But marking wood is different than slitting waxed paper, so I tried a surgeon's scalpel on a friend's recommendation. It was too flexible and fragile for hardwoods such as oak. So I moved on to a stout Japanese single-bevel knife that was shaped like a fish.

The single-bevel knife is no good if you cut your dovetails tails-first. You need two beveled knives to transfer the shape of your tails to your pinboards. Or you need a different marking approach to this classic joint. So I ended up with a spear-point knife. That was about 10 years ago, and I can't imagine picking up a different shape ever again.

Other woodworkers are fond of using a pocket knife, a utility knife or even a chip-carving tool that they have sharpened in their own peculiar way for layout chores.

Whatever sort of knife you get, I think that a thin blade is better than a thick one – sometimes knives have to sneak into confined spaces. But it shouldn't be so thin that it flexes or breaks under pressure. The blade itself should be somewhat long – I like a knife that has a blade that's at least 1" long. This length allows you to reach into places that stubby ones can't.

And last of all, a marking knife should be comfortable, like wielding a nice pencil instead of a cigar. In many ways, the knife is a writing instrument that transfers your plans to the wood, blazing a path for your other tools to follow.

Tips on Use

Keep it sharp. Duh. When marking out a joint, it's best to use multiple wussy strokes instead of one or two mighty ones. Begin your mark by using the same amount of pressure you would use if you were trying to paint a thin line on your work with a paintbrush. This light pass will faintly score the wood and is unlikely to follow the grain. Then make a few more passes with the knife, and with each pass add a little pressure. Your knife should follow the track made by the first passes.

Winding Sticks

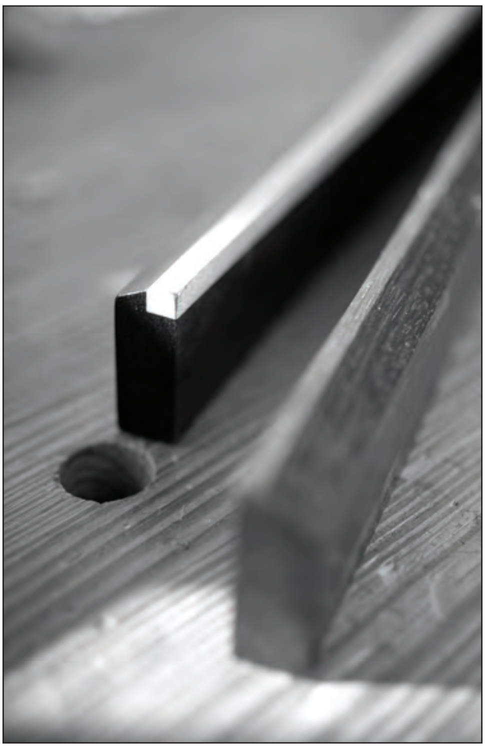
Winding sticks are like the spirit levels of the carpentry world. They tell you whether your work is flat and when it is in twist. They are no more than two long sticks that have parallel long edges. No more. They don't have to be fancy with ivory and ebony inlays. They don't have to be the same width. They don't have to be different colors. Just long and parallel.

I like winding sticks because they trade in hyperbole. Like a Pat Conroy novel, there is great truth in great exaggeration. Winding sticks are always longer than the width of your work, so they exaggerate any twist in your board. The longer the winding sticks, the more they exaggerate. The more they exaggerate, the more accurate they are.

I have a pair of winding sticks made from redheart that I travel with. At

16" long, they are fairly short. Both sticks are nicely beveled on their top edges, and one stick has a 1/4" x 1/4" inlay of hard maple on its top edge. I take these to classes and shows because they fit in my suitcase, plus other woodworkers think they are cool. They take pictures of them and measure them.

When I get back to my shop at home, I stow these sticks away on top of my tool cabinet and take down my favorite winding sticks: two 36"-long sections of aluminum angle that I purchased at the home center. The pair cost me less than $15. During a video shoot I painted the ends of one of them black to help the camera see how my winding sticks work. These winding sticks are super-accurate and butt-ugly.



Truth-tellers. Winding sticks are one of the most powerful measuring tools you own. They are second only to your eyes, which are pretty good at spotting some twist. Winding sticks can find almost any twist.

Here's the other dirty secret about the world of extruded aluminum: it is accurate stuff. In fact, these sticks are so accurate that I use them as straightedges when my wooden one is buried under furniture components. In fact, I think you could eliminate the wooden straightedge from your tool list. I don't recommend that tack because a wooden straightedge is a nice thing to learn how to make. It teaches you how to make the simplest of tools do the finest of jobs.

Still, the aluminum stuff is great. It never twists or warps. It is as lightweight as wood. And the "L" shape of the aluminum allows me to rest the sticks on curved surfaces with ease – that's a huge boon when working on chairs and other wacky surfaces.

How to Make Them

Whenever you make a shop tool, choose a hard-wearing quartersawn wood. I like hard maple or even some exotics when I make winding sticks. Make sure the wood is fully acclimated to your shop environment – that's why it is best to use stock that has been kicking around your shop for a while. A good size is 1/2" x 2" x 36".

True up each piece individually, then tune up the pair so the long edges are perfectly parallel. That's it. Add a decorative bevel if you like. Inlay a strip of a contrasting wood to the top edge of one stick if you like. Apply some finish.

Or go to your hardware store and take the modern aluminum route.

Tips on Use

When I use winding sticks, they are both a bench brush and a truth-teller. After you hog off some waste on the face of a board and are ready to take a reading, use one of the sticks to sweep the shavings off the face of the board. The chips will interfere with the sticks.

Place one stick at one end of the board and the other stick at the other end. Sight across the sticks. Watch the rear stick as you lower your head and see which end of the far stick disappears first behind the near stick. You might have to bob your head a couple times to confirm your suspicion.

Now go to the corner at the far end of the board and mark the corner that disappeared second. Scrawl a mark on that corner, and on the corner that is diagonal to that scrawl mark. Boards twist, which means they corkscrew. That means on the face of a board, two diagonal corners will be high and two will be low.

After you mark the two high corners, you can confirm this by laying a straightedge or one winding stick diagonally across the two high corners then across the low corners. The problem should be obvious. If it's not, take another reading with your winding sticks and shift your sticks to a different place on the face of the board. Wood can be weird.

With the face marked up in pencil, remove the high corners by working diagonally across them. This is important: Check your work after a few strokes. Even if the board looks like it's as twisted as a DNA strand, you should observe your progress after small increments of work. The sticks exaggerate, and you can end up chasing your tail.

When the sticks say you are flat, you are pretty darn close. The only thing standing in your way is the rough texture of the board after all that work.

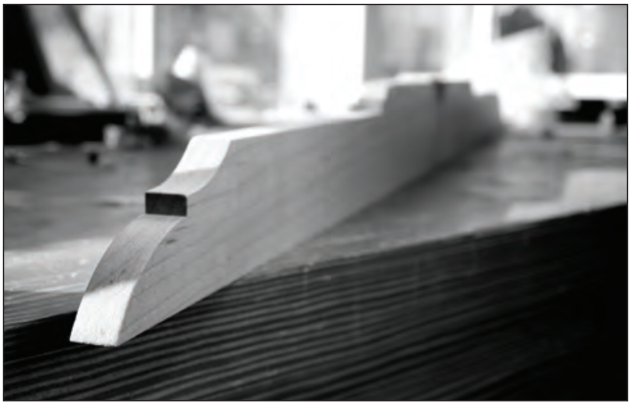
36" Wooden Straightedge

No matter what I wrote about aluminum winding sticks above, ignore it. You should make your own 36"-long wooden straightedge. You should make it completely by hand to prove to yourself that you can true a board to an insane level of accuracy. And you should keep that stick as a reminder of what is possible with hand tools.

When it comes to making a wooden straightedge, there is little agreement on how to do it. And if a bunch of crusty farts can't agree on how to make a simple fricking stick, then I think you know why people keep writing new woodworking books, year after year.

I have my own way of making my stick. And I have my reasons. Here are the details on my 36" rod of perfection. I like my straightedge to be 1/2" thick so that it is easy to balance on edge on my work, yet easy to see light under it. Thinner straightedges tend to topple. Thicker sticks make it harder to see gaps under them.

I like a stick that is 2-1/2" wide. That width is easy to grasp, yet wide



enough that you won't mistake it for a cutoff from a typical rip and throw it away.

I make my straightedges so they have only one true edge. The other edge tapers from the center to the ends. In other words, my straightedge is 2-1/2"-wide in the middle and 1-1/4"-wide at its ends. Why? Well the theory behind this shape is twofold. One: You only have to keep one edge true, and because of the taper you will never confuse the true edge with the other edge. I'll buy that for a dollar.

Second, as wood acclimates to its environment, most of the moisture passes in and out of the end grain of the board. The face grain isn't as involved in moisture exchange. This is important. A wooden smoothing plane is coffin-shaped to expose as much end grain as possible to allow the plane's body to react quickly to changes in humidity. This makes the tool more predictable.

With a wooden straightedge, the two tapers expose a considerable amount of end grain. This allows the middle of the straightedge to expand and contract with changes in environment much faster than if the straightedge resembled a metal machinist's straightedge with two parallel edges. With that shape, the ends would expand and contract faster than the middle.

That's the theory. Does this shape really work in practice? I think so. My straightedge has remained true for insanely long periods of time. In fact, I've trued it only once since I made this version about six years ago. Of course, I wasn't a dolt about making this straightedge. I used some dense exotic redheart that had been kicking around our shop for years. It's heavy stuff.

Stable. And I had observed that other pieces of redheart I had used for shop purposes had remained true.

How to Make a Good Straightedge

Pick the best, most stable and dense wood you can find. Wood selection is everything. Dress the board as accurately as possible. Keep working the stock until it is truly flat and straight. If the board resists your efforts to true it, then put it aside for some other project such as a boomerang or a weenie roast. Pick your wood like you pick a spouse. Good looks are great. But you want something that is agreeable and stable in the long-term.

Once you have a 1/2"-thick stick that is dressed to 2-1/2" wide and 36" long, draw the tapers on one face and saw or plane those tapers to shape. I leave an area of about 5" long that is the full 2-1/2" width. Then I taper each edge to 1-1/4". After you cut those tapers, plane some small chamfers on the tapered edges. These make the straightedge nice to hold and make it less likely that the thing will end up in the scrap bin.

And finally, true the long edge that will be your reference surface. Take your time. Ensure it is 90° to both faces of your stick. Then ensure the long edge is true. There are complex machinist-style ways to determine this using two other straight surfaces, but here is the woodworker's down-and-dirty in-the-field way.

Find a piece of posterboard or plywood, or a big sheet of paper. Place the straightedge flat on this surface and trace along its reference edge with a pencil. Flip the straightedge 180° and compare the reference edge with your pencil line. If there are any gaps between the line and your straightedge, you have work to do to correct things.

Other Stick Shapes

There are other old sources that will tell you to make your straightedge in a different shape. Here is a brief discussion of them.

• Parallel long edges. Consistent thickness. Consistent width.

This sort of straightedge might be fine. Or the ends might swell more quickly than the middle when the wet season comes to your little corner of the world. Likewise, the ends might dry out faster when the humidity drops. Or everything will be fine and your straightedge will be as consistently right as New Hampshire.

• Parallel long edges. Consistent width. The thickness tapers down to 1/4" at the edges.

This is an English variant I found in an early 20th-century text, and it resembles some machinist straightedges I've seen. The theory is that the thin 1/4" profile of the edges will make it easy for you to see errors as you drag the straightedge across your questionable boards.

I don't disagree with that statement. The thin profile will indeed perform as advertised. Where this shape falls down is when you are checking a long edge of a board to see if it is true. Typically you balance a straightedge on a questionable edge to test its truth. If the straightedge spins on its middle, then you have a board with a hump in the middle of the edge that needs to be removed. If the straightedge drags at the ends, then you either have a dead-straight edge or a hollow (called a concavity) along the edge. Hollows are always preferable to humps in my book.

If you have a straightedge with a thin edge, it won't easily balance on your edge. In fact, it is fairly useless for checking edges without an eagle eye to spot gaps between the straightedge and the board in question.

• Consistent thickness. One straight edge. The other edge curves in a broad arc.

This traditional shape works well, too. It just looks butt-ugly to me, like a pastry tool or something used in the oyster industry. You can make this shape and it will work fine, but I think that getting a consistent curve over 36" is harder than making a couple straight tapers.

Bottom line: Make one. No matter which shape appeals to you, making a straightedge by hand will teach you more about truth than a month of Sunday School.

12" (or so) Wooden Try Square

Once again, wood trumps metal here in the rock-paper-scissors-wood-metal competition. I've owned every sort of metal try square with a fixed blade. Here's what I've settled on: I have a combination square (see above), which I use more like an adjustable marking gauge than anything. I use that tool for marking lines parallel to an edge or for transferring measurements.

Its companion is a nice wooden try square with a long, slender blade, which I use for marking lines that are perpendicular to an edge. I also use this square for marking lines to cut rough or prepared stock to final length. And I use it to check my casework to ensure it is square.

This essential tool is easy to make, easy to keep true and easy to use. Once I started using a wooden square, I found the big metal ones ungainly. I am so enamored with this form that a couple years ago I made a whole batch of squares in beech based on a design from André J. Roubo's 18th-century woodworking text "L'Art du Menuisier" and gave them all away to people.

As I was making the squares in my basement shop, Katy, my younger daughter, worked alongside me building her own try square. I made mine with a slip joint – I sawed an open notch in the handle and planed the blade to fit the notch. Simple. Or so I thought.

Katy took a different tack. She salvaged some pine stock from my scrap pile that had a tenon cut on one end for the blade. Then she found a piece of ash that was supposed to be turned into a spindle for the handle. She simply face-glued the pine tenon to the ash – the shoulder of the tenon kept everything square.

After I gave all my fancy squares away, she felt sorry for me and gave me her square. That sucker is square and is still together. I keep it hanging above my office computer as a reminder that there is always room to simplify.

Try me. A wooden try square is more fun to make than it is to buy. Plus, the reasonably priced try squares are butt-ugly. You can make a nice one that is easy to true for a few dollars.

Despite Katy's daily reminder, I do like to dress up the ends of my squares with traditional moulding profiles. Many woodworkers have speculated on why some old squares are decorated with ogees, coves and fillets. Perhaps the craftsmen used these basic shapes to lay out moulding profiles on the end of stock before they went to work on it with hollows and rounds. Perhaps the profile identified its owner in a busy shop (a more elegant solution than painting your tools orange). Both of these ideas might be true. Or they both could be bogus. I tend to think the designs on traditional squares are like the nib on an old handsaw – purely decorative.

How to Make a Good Square

After you make a straightedge and maybe a couple winding sticks, a square is an excellent project because it has only one joint to fuss with. Make your stock from 3/4" x 1-5/8" x 10" material and your blade from 1/4" x 2-1/2" x

15" material that is slightly over-thick at the start. Quartersawn stock is best.

Saw a 1/4"-wide x 2"-deep notch in the handle and true the floor of the notch with a 1/4"-wide chisel. Then plane the blade until it slips into the notch without bending the two forks of your notch. Cut any decorative details you desire on the ends of your stock and blade, then glue the two pieces together. Use a slow-setting glue such as liquid hide glue or white PVA glue so you can carefully manipulate the blade and stock so the inside corner of the square is dead-nuts on 90°. Don't fuss over the angle on the outside of the square. That can easily be trued after the square is complete. But that inside angle is a bear to fix after glue-up, especially if the inside angle is more than 90°.

After the glue dries, pin the blade and stock together with some 1/4"-diameter dowels. True the outside of the square. This is easy to do. Get a scrap piece of wood and true one edge with your jointer plane. Press the stock of the square against the true edge and scribe a line along the outside of the blade. Flip the square 90° and press the stock against the same edge. Compare the blade to the line you scribed. If they are parallel, your square lives up to its name. Otherwise, you have work to do. After you square the outside of the square, repeat this exercise with the inside edge – just in case.

This square is one of my favorite tools. The fact that you can't buy one in a store makes it all the better for a budding anarchist.

Sliding Bevel Square

By this point I'm certain you are expecting me to wax on (perhaps to later wax off) poetic about wooden shop-made sliding bevels. Wrong. I own one. I hate it. My mom collects wooden measuring tools, and all the wooden sliding bevels I've seen at her house suck eggs. In fact, most of the metal ones suck eggs in equal measure. Precious few bevel squares are worth owning.

Why? They don't lock down the blade worth a damn. Or, if they do lock well, then the locking mechanism almost always gets in the way of your using the square in a normal-like fashion.

As a result, whenever I use a sliding bevel, I end up babying the thing and spending way too much effort trying to ensure that nothing bumps it even slightly. And if something does give my sliding bevel a love tap, then I'm going to check the square's accuracy again.

This is a big waste of shop time during a project.

So what makes a good square? It's easier to talk about what makes a bad square. All the squares that lock right at the joint where the blade pivots in the handle are sub-optimal in my experience. If the square locks with a rotating lever, then it's inevitable that the lever will interfere with the square when you try to press the stock or blade against your work. If it locks with a thumbscrew at the pivot point, you'll never be able to get it tight enough. Yes, I tried adding lock washers – everything but J.B. Weld glue. Other sliding bevels lock with a cam lever at the pivot point. These can be almost

Better in metal. Sliding bevels are tricky tools. Even expensive ones are poor. You need one that locks securely and doesn't interfere with layout. In general, the ones that lock at the base of the handle are the best.

acceptable. You will have to tighten up the slack in the mechanism, which is usually controlled with a screw, to the point where the sliding bevel is a real effort to lock. But when it locks, it locks reasonably tight.

So what works? I've had much better results with sliding bevels that lock at the base of the handle, either with a knob or thumbscrew. These sliding bevels – sometimes called butt-locking bevels – have an internal mechanism that wedges the blade in position (instead of merely bending the handle to squeeze the blade at the pivot point).

Butt-locking sliding bevels can be cheap. There is a common aluminum one from Japan that I've owned for many years plus the ubiquitous Stanley No. 18 and a fantastic adaptation by Craftsman. Yes, Craftsman. And no, I was not just struck by lightning. There also are expensive ones out there that cost more than a premium block plane if they are made by an individual modern toolmaker or from some primo vintage maker, such as those from St. Johnsbury Tool Co. These bevels are pricey, but they work well.

Sliding bevels come in a lot of sizes, a 7"- to 10"-long blade being the average and the most useful for furniture work. Smaller bevels, 3" to 4", are usually more for toolmakers and machinist-types. Big ones are for boat builders or individuals with inferiority issues.

Fancy materials, such as stainless steel or brass, are unnecessary unless you are checking boat hulls underwater. Just make sure the square locks. Make sure it stays locked. Make sure the blade is straight and its two long edges are parallel.

Dividers, Two to Four Pair

When I first started in the craft, I could not figure out why I needed dividers. Were they for pirate woodworkers? For woodworkers too cheap to buy a proper compass with a pencil in it? The more stuff I built, however, the more obvious it became that I should take one of two paths:

- Adopt the metric system in my shop and do all my shop calculations with a calculator.
- Get some dividers.

Dividing up space is one of our primary jobs as woodworkers. We divide up boxes into compartments for tools, dishes or underwear. We segment wood to interlock it with other pieces of wood. What is important when we do these things is that the divisions we create are consistent and pleasing. And dividers do this quickly, without math and in a way that confirms your measurements before you make a single cut.

While I am a fan of the Imperial measuring system (for the simple fact that it is tied to our bodies), it can be unwieldy when you need to divide up a 46-3/8"-wide space into seven even cubbyholes separated by 1/2" dividers. Yes, you can probably do the calculations with a CAD program by converting everything to decimal and discover that each cubby should be 6.19642857" wide. But how do you accurately transfer that measurement to the wood? Most people fudge it – hit the measurement close to the mark and take up the slack in one of the cubbies.

But dividers can do this operation quickly and without the digital fudge. Simply step off the entire space in seven steps and bring your dividers to their final point at 1/2" past 46-3/8". Make six marks from one end of your board. Then start from the other end of the board and step back the other way. The result: You will have divided the space into seven cubbyholes with a 1/2" space between each. And the layout will be dead-nuts perfect.

I have a whole coffee mug full of dividers because my mom bought me a handful of vintage ones for my birthday one year. She thought I'd just like to dress up my office with them. Heck no. I cleaned them up, sharpened their tips and put them back to work.

I don't think you need a coffee mug full. Two pair of 6" dividers will probably take care of most chores. I like to use 3" dividers for joinery and the 6" dividers for casework. The good news is that the world is awash in dividers. There are beautiful vintage ones that can be had for a song. And finely made machinist dividers are still available today from many companies. But despite the fact that these tools are so simple, I've bought a few dogs. So here's what to look for.

The Important Points

The most important parts are the points of the dividers. They should be needle sharp and close together so they are touching or almost touching. When I salvage old dividers, most of my effort is on filing the points so they will bite into the wood with very little downward pressure but leave only a pinprick behind. Blunt dividers aren't accurate. They make large depressions in your work, which makes it impossible to fine-tune a measurement. Instead of making a slightly offset hole, a blunt point will just slip into the depression it made during its previous setting. And that is worse than worthless.

A Full Range of Movement

Many dividers use spring action to maintain their setting. The circular spring at the top of the legs of the dividers tries to push the points apart. A machine screw and the tool's adjuster nut restrain the spring and keep the points a consistent distance apart. With some old or cheap dividers, the spring is weak. As a result, you will open the tool up to a certain point and it will become flaccid and useless. When you are trying out a pair of dividers in the store, see how wide you can open them before you buy them. You should be able to open them up to the full width allowed by the machine screw.

More Friction, Please

Old-school dividers didn't use a spring. They used friction to keep the points in position. With these sorts of dividers, the two legs are typically hinged together with a series of leaves, like a finger joint. Then the hinge pin through the leaves is peened to tighten up the action. So the friction is a good thing. I know idiots who have oiled up their old dividers and worked them to the point where the legs move easily – too easily – and the dividers will lose their setting if you just breathe on them wrong.

You want your dividers to be difficult to adjust. In fact, I have several pair that had seen a lot of use and were likely worn loose. Rust actually saved the day, making them difficult to move again. Weird world, huh? If your dividers are too loose, you can peen the hinge pin to tighten things up. Just set the tool flat on a steel plate and strike the hinge pin with a nailset and hammer. Keep tapping and testing until you get some pleasing friction.

Fancy Stuff

Some dividers have a quick-release collar that allows you to open and close them quickly without (literally) a lot of screwing around. If you find these on a pair of used dividers, consider it a bonus. The other features above are far more important.

After you get comfortable using dividers in your shop, you'll find that they'll migrate to your desk where you design furniture. In fact, I sometimes use them to step off stuff on my computer screen as I attempt to create pleasing proportions in my CAD drawings.

Numbers are Like Words

In the end I think what's critical about the marking and measuring tools is that they are rarely called upon to actually measure something numerically. In fact, I think the deeper you dive into the craft, the less significant numbers become. And one day you'll discover "story sticks." Then this chapter will really start to make sense.

Until then, do me a favor. When you are measuring everything with your digital calipers because you are terrified of making a grave error, just remember this: Numbers, like language, are both a crutch and a filter.

They seem to help at first. They seem to describe the world in an accurate way. But in the end all they really do is distort what is right in front of you.

7-ESSENTIAL EDGE TOOLS

To make the leap from "putterer" to woodworker, I believed that I had only to obtain three objects: a table saw, block plane and chisel.

Why I picked those three particular tools I'll never know. But I've always had weird totems associated with my work. The biggest professional thrill I've experienced to this date was when I received my first official press badge as a reporter at *The Greenville News*. I still have it. In a lockbox. No, you can't see it.

So imagine my disappointment when my three magic tools turned out to be total boners. My first table saw? Inherited garbage. My first block plane? Walmart dreck, though it worked OK in pine at times. And my first chisel? Double dreck with a clear plastic handle.

Many people make their first tool purchases with a burning passion but without a scrap of knowledge. They just want to get their feet wet in some way. So they go to a store and buy the thing that kind of looks like the thing they think they need. And it is almost always the wrong thing.

That's because the tool corral at the big box store is festooned with aisle after aisle of "tool-shaped objects." These are poorly made and degraded copies of a real tool that has had every bit of its original intent wrung out of it by aggressive corporate cost-cutting or garden-variety stupidity.

And sometimes the poor object has been festooned with "features" that are at best useless or – at worst – dangerous.

Let's look at the simple chisel. A vintage chisel – something made by Witherby, Swan, Buck Bros. or Butcher – is a simple thing of beauty. It is a well-hardened piece of steel affixed to a stick that's comfortable to hold. Some cabinetmakers preferred chisels with beveled long edges on the steel part, which allow the tool to navigate into the acute angles of dovetails.

When sharp, there is little that a well-made chisel cannot do.

Since the 19th century, chisels have become less and less useful. Those long bevels are still there, but they terminate in chunky flat areas that mar your dovetail joints. The "flat" back of the chisel is rarely flat, making the tool difficult to steer without hours of metalwork on your part. The wooden handle has been "improved" by adding a more durable polypropylene handle. While that new plastic handle might withstand a few more whacks, it is far too corpulent. It makes the tool unbalanced, top-heavy, difficult to hold and tiring to use.

Indeed, the modern chisel looks like a chisel if you squint, but it is almost useless for making furniture.

Then to make things worse, the marketing geniuses got involved. Though these pitch men have yet to add a laser to a chisel-shaped object, they have already done far worse:

They forced the chisel and the rasp to have a baby.

I first saw the abominable spawn at the Hardware Show in Chicago about a decade ago. This object is now sold under such hallowed names as "Nicholson" and sketchy names such as "Cooper." Here's the basic idea: Take a plastic-handled chisel and add rasp teeth on the long metal parts of the blade – and make the front of the blade curved like a half-round rasp.

If you attempt to use this tool, you are going to get gouged in more ways than one. Rasps are two-handed tools. One hand goes on the handle and the other grasps the tip. Which in this case happens to be the chisel's sharp edge. Oops. Oh, and don't try using the thing as a chisel either – the back of the tool also has rasp teeth cut into it.

So why is this piece of dog crap still on the market after almost 10 years? Because people buy them – but don't really use them. Or they use them once and throw them away in disgust.

The bottom line here is there are lots of companies that want you to spend lots of money on things that look just like tools. But they aren't tools. They are things that solve a problem that doesn't really exist (like jigs for sawing straight) or they are things that are designed to be used once on a home-improvement job and forgotten.

So let's buy some chisels that are worthy of the name.

Choice chisels. It seems impossible to muck up the manufacturing of a chisel. But it happens every day. Good chisels are hard to find.

Bevel-edge Chisels: 1/8", 1/4", 3/8", 1/2", 3/4" and 1-1/4"

You have to be careful when buying chisels. Really good ones cost anywhere from $1 to $300 each. Junky crap is available in the exact same price range.

The good news is that there are tons of chisels out there from which to choose. The bad news is that most of them aren't worth buying. So let's try to narrow the field for you.

The Handle or Helve

For woodworking, I like a wooden handle. Plastic handles are heavier than wooden ones, and they tend to make the tool top-heavy when you are trying to chop out waste. If you don't believe me, try working with a couple examples. Holding them by their handle won't tell you squat. You have to hold the blades like you would hold a pencil – that's how you wield a chisel when chopping.

My first good set of chisels were Marples Blue Chips, which had plastic handles. Whenever I would cut dovetails, my right wrist would ache like crazy. Then someone let me try their Japanese chisels, which are never top-heavy. The difference was amazing. Soon after that, I chopped off the top 1" of my Marples. Yeah, they looked like hell after I did that. You could see the ugly blue orifice in the plastic handle for the tang. And even though I shaped the end with a rasp, the tool was forever scarred. Yeah, the tools worked a lot better, but I lost my affection for them and bought some Japanese blue steel chisels.

Wooden Handles are the Best

Wood is lightweight and strong, especially species such as ironwood or hornbeam that are often used in chisel handles. These species can take years of chopping without splitting. But if you make the leap from mallet to framing hammer, you will quickly find that wooden handles have their limits.

And that's why plastic handles are so popular. When they are well made, a plastic-handled chisel will still be around for the cockroaches to use when we're gone. But durability is only one part of the equation.

Hard plastic is slippery, especially when your hands are a little sweaty. The soft plastic – sometimes called an "overmolded grip" on some chisels – grips a bit better. But to me it feels like grasping an overripe banana – it's all squishy and indistinct.

Give me a wooden handle. They are warm in the hand. Lightweight. They can be shaped, sanded and finished to your liking. If it breaks you have the skills to replace it. And it's wood – the raw material that got you into this craft. In my mind, even the ugliest wooden handle is fairer than a plastic one.

The Blade & its Side Bevels

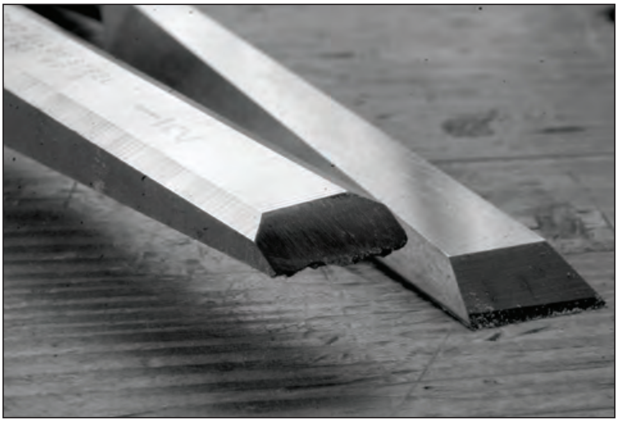
There are bench chisels with bevels on the tool's long edges and chisels without. The so-called bevel-edge chisel is a fairly modern invention, and the bevels allow the tool to sneak into acute corners without bruising the work.

The classic example is cleaning out the waste between the tails of a dovetail.

Chisels without side bevels are sometimes called "firmer" chisels but that's not really the right term. They are simply bench chisels. These tools are great for 90 percent of hand woodworking – unless you don't cut dovetails. Then they are probably good for 99 percent of your work.

Don't misunderstand me here. I know that you can use a straight-edged chisel to clean up dovetails. You just have to use a tool that is slightly narrower than the opening and skew its cutting edge into the acute corner. But bevel-edge chisels are a dang convenient way to perform this operation.

Sadly, most modern chisel makers don't have a clue about how to make a good bevel-edge chisel. You need the flat lands on the side of the tool to be very small (some people grind them away to nothing). Many modern makers have bevel-edge chisels that have flat edges that are larger than those you would find on a traditional straight-edge chisel.



Bad bevels. Here you can see the difference between a poor modern tool with its buck-tooth side bevels – called "lands" – and a proper tool for woodworking.

So you have several choices here. Buy any chisel and modify the tool on the grinder to match the shape you need for dovetailing. This works. I've done it. It sure makes the tool an ugly duck, however. You can buy a vintage bevel-edge chisel, which is more likely to be properly shaped. Or you can spend the extra money to buy a modern tool that has been properly made.

Tang, Socket or Japanese?

There are three basic styles of chisels to choose from: tang, socket or a Japanese variant that combines the two. Each has advantages and disadvantages. While other writers might disagree with my following assessment, I am ignoring them.

Tang chisels are the simplest form and the easiest to repair when something goes wrong. In a tang chisel, the metal is the male part of the way the handle and steel connect, and the wood is the female. The tang is usually a rectangular bit of steel (sometimes rough or barbed) that is driven into a stepped hole that is bored in the handle.

Tang chisels can be simply that: a piece of barbed steel and a wooden handle. But this simple form can be fragile. The tang of the chisel is like a wedge in some forms. Beat the handle hard enough and the tang will split the handle. To prevent (or slow) this splitting action, some tang chisels have a ferrule, which is a circular band of metal that encompasses the point where the steel and wood meet. The ferrule helps to prevent the wood from splitting at the point where the wood is the thinnest and the steel is the thickest.

Other chisels don't have a ferrule, but instead have a flat land where the wood and steel meet. This kind of joint is harder for the manufacturer to fit and in my experience it is also less durable. You'll see this kind of connection on some traditional mortise chisels. It works, up to a point. Then the handle splits. I know this from splitting many of them.

Some tools also have a leather washer between the steel and the wood. This is supposed to cushion the blows and reduce the chance of the wood splitting. Does it work? Can't really say. It seems to help.

The second type of chisel is the socket construction. In this sort of chisel the steel is the female part of the joint – it is formed into a round and tapered socket. This is a more costly way of making a chisel. And the wood is the male part – it is a matching tapered piece of wood that is driven into the steel.

The downside to this arrangement is that it is a more difficult connection to make. You need to get the steel and the wood mating well for the tool to reach its full potential. So there is a lot of fitting.

The other disadvantage is that this form of chisel is more prone to the whims of the environment. In other words, when the air turns dry, the wood shrinks and can fall out of the socket. This happens a lot when you use your chisels only occasionally. And it is a good argument for never ever having a chisel rack that holds only the handles – your steel tips will end up on the floor.

If you use your chisels every few days, you'll never notice this problem. Using the tools keeps them tight.

Three styles. Tang chisels are the easiest to make and repair. Socket chisels are durable. And Japanese chisels combine characteristics of both and are nigh on bulletproof (but harder to make).

The advantage to the socket chisel is that it is, in my opinion, more durable. You are more likely to mushroom the end of the handle with hammer blows than you are to split the handle. In fact, I find it almost impossible to split the handle because the socket is pulling the tip of the wood tighter and tighter.

However, if you choose the wrong wood for the handle (say, maple), then you will still split the handle. But the split will form where your mallet meets the handle – not down by the socket.

The Japanese form of chisel combines the best of both worlds. The steel part is a hermaphrodite – it has both male and female parts. It essentially has a steel (or iron) tang emerging from the center of a socket. This might be the best form of chisel ever made, but boy is it a trick to fit the handle.

The good news here is that you might not ever have to fit a replacement handle because this form of chisel is amazingly durable. In my 15 years of beating Japanese chisels, I have yet to ruin one. I'm sure it can happen, but it hasn't happened to me yet.

Why Western Chisels Might be Better (for Westerners)

Japanese chisels are amazing. Really. While there are some real bright spots among those who make Western-style chisels, overall the Japanese still have everyone else beat. But for Western-style work, I recommend you buy Western chisels. Why? The metric system.

Japanese chisels are handmade, and are almost always made with metric widths. In many cases, the wood doesn't give a hoot that your chisel is metric. You can still pare and chop out a lot of waste without worrying about millimeters or fractional inches.

But things change when you become a hard-core hand-tool user. You need to make a decision as to whether you run a metric shop or an Imperial shop. That's because it is ideal to have your tools agree. If you plow 1/4" grooves with your plow plane, it's handy to have 1/4"-wide mortise chisels, and not some nearby metric equivalent.

I end up using my chisels as measuring instruments. When I need to lay out 1/4"-wide tenon shoulders on a rail, I'll often turn to my 1/4" chisel instead of a rule. The chisel is far more accurate and is also a marking tool as well. But if I have metric chisels, I'm a bit hamstrung and need to rely on the less-accurate rule or combination square.

I'm not saying you can't make metric chisels work in an Imperial shop. You can work around almost any constraint if you really put your mind to it. But if you want to reduce the complexity of the craft, it only makes sense to have all your tools tuned to the same measurement system.

Mortise Chisels

Mortise chisels abide by many of the same rules as their skinnier bench-chisel brethren. Wood handles are probably best (though I might change my mind on this if I split a lot more wooden handles). You have to choose from tang, socket or Japanese construction. The shape of the blade is important. And the width of the tool should match the system of measurement you use in your shop.

But there are lots of small differences with mortise chisels that can make a big difference when you need to beaver through some white oak. Bad mortise chisels will make you want to give up handwork. They cut slowly and shoot about as straight as Festus from "Gunsmoke." So don't tree yourself the wrong 'possum.

Here's the beef. Mortise chisels have to be overbuilt in every way because they take a beating. You need stout blades (I've seen them snap) and handles (I've split many).

Handles for Whaling

It should go without saying that mortise chisels have to take a beating. The handle should be stout and made from a wood that doesn't split easily. However, a stout handle alone can still be vulnerable. If you have seen a lot of old mortising chisels, then you have seen handles that have metal hoops added at the striking end, or handles that have been bound by wire in an effort to keep the wood from toothpicking. Or, saddest of all, you've seen mortising chisels that have lost their handles and are used without them – and the tool's metal socket or tang is mushroomed and split.

Some woodworkers contend that the way to prevent the handle from splitting is to always use a mallet made from a wood that is softer than the chisel. That way the mallet absorbs the damage.

My experience is mixed on this point. I've destroyed a few beech handles with lignum vitae mallets, which would seem to support the theory. But I've cracked just as many beech handles with beech mallets. And softer mallets, such as one I have that's made of soft maple, just won't deliver the punch needed to make the steel penetrate the wood. It feels like hitting a brick of Jell-O with a marshmallow. So there's no point to using it.

I have an opinion on the topic of chisel handles, but I reserve the right to change it. I think that the wood needs to be consistent in its texture. In other words, open-grained woods such as oak and ash are no good. They have areas that are dense and areas that are not. As a result, these woods tend to be fragile when struck repeatedly. Closed-grain woods that are heavy and resist splitting are ideal. Think beech, black locust and hornbeam. I'm sure there are other species like this, especially exotics.

But picking one of these woods isn't enough. The grain has to be dead straight from the striking surface to the bolster or ferrule. If the grain runs through the handle at an angle other than 90°, the handle is compromised. This is not theory. This is experience.

There are other things you can do to help reduce splitting. Covering your mallet with 1/4" shoe leather helps. Adding a leather striking pad to the chisel handle seems to help. Adding an iron ring around the striking end of the chisel definitely helps. And keeping your tools sharp helps, too.

Sizes of Mortise Chisels

At the outset, don't buy a whole set of mortise chisels. Buy a 1/4" or 5/16" chisel. That will handle about 90 percent of your work if you build furniture. Those are the sizes of tools that work with 3/4"-thick and 7/8"-thick stock. Then buy other mortise chisel sizes as you need them. If you build a workbench, you will need a 1/2" chisel. If you build little boxes, you will need an 1/8" or 3/16" tool. It might be a while before you need these bigger and smaller tools. Don't fall for the false economy of owning a set.

Socket or Tang or Japanese

This is a tough question. Traditional heavy English mortising chisels are tang construction, and these are the only forms I've seriously destroyed in my career. Of course, I like this form of tool, so I use it the most. That might be why it has suffered the most.

I've used socket and Japanese mortisers quite a bit, and they take a beating without complaint. Though I have found that they seem to work more slowly, or maybe it's just me. I've not been able to ruin a Japanese mortise chisel, thanks to its hybrid tang/socket construction and the metal hoop that reinforces its oak handle. Wait, didn't I just tell you not to use an oak handle? I think the hoop and socket parts of the tool prevent the oak from splitting.

Handle Shapes

With mortise chisels you can get round or oval in cross section. The oval handles, typically found on English tang-style mortisers, are superior because the long axis of the oval is lined up perfectly with the back and front edge of the tool. You pick it up and you instantly know where the edge is and unconsciously rotate the handle to the right position.

Round handles work fine, but you'll always be eyeballing the steel to ensure you are driving the chisel into the right place.

Don't Forget the Metal Bit

With all my chatter about the wooden part of the tool, you'd think that it did all the work. The metal is important, too. The first question you'll encounter is what sort of steel is best for a mortise chisel. For centuries they were made using plain old high-carbon steel (we call it O1 or W1). Sometimes they were solid steel and sometimes they were iron with a steel bit forge-welded at the pointy part.

In recent years, toolmakers have been using more exotic steels to make mortise chisels, everything from A2 to D2 to the wack-nutty world of powdered metals. I've used all these metals and can tell you that every steel is a trade-off. The more durable the steel, the more difficult it is to sharpen.

For example, D2 holds a good working edge for mortising for an eternity. Of course, when you do have to sharpen it, it seems to take a second eternity. And you might need exotic sharpening equipment when dealing with exotic steels. Diamond stones do a good job with D2. Oilstones, not so much.

So stop looking for some magical steel that sharpens easily and holds an edge forever. That steel is in the same part of the store where they sell unicorn saddles. Pick a steel and learn to sharpen it. Use it and forsake the other steels until you snap your mortise chisel. Yes, this happens. I've seen it, and it's not pretty.

The shape of the steel also is important. Some mortise chisels will have a blade that is square or rectangular in cross-section. This works fine. Other mortise chisels, usually the English ones that look like a dagger, are trapezoidal in cross-section. They look like a pyramid with the top pointy bit sheared off. In chisel language, the sides of the mortise chisel are called the "flanks," and on these chisels the flanks are tapered in a bit.

Why? Well it seems to retard sticking. In other words, when you drive your chisel deep into the wood, tapered flanks help the chisel release. Aggressive mortising can result in your tool getting wedged into the work if you go all Conan the Barbarian on the handle.

Which blade shape should you choose? Either is fine. Sticking mortise chisels aren't the scourge of the craft. They happen, but you can wiggle the thing out. So tapered flanks are a convenience, not a category killer.

Spokeshaves

There are fools who will say that a spokeshave isn't a tool for the furniture builder, that it is an item we snatched from the toolbox of the wheelwright, cooper or chairmaker. That may be true, but I think you should have a spokeshave. Here's why.

Like curves? Spokeshaves are simple plane-like tools that will encourage you to add texture and curves to your work, further separating it from the factory crap.

Many woodworkers get by without this tool their entire lives because their work doesn't require it. They build boxy stuff in the Shaker, Arts & Crafts or Mid-century styles and wouldn't know a fair curve if it wrapped around their necks and strangled them.

A sharp spokeshave in your tool chest can change the way you look at, design and execute furniture. Curves are easy work for the tool, and the shave itself is simple to sharpen, set and master. Curves are visually exciting (why do you think they invented cheerleaders?), and spokeshaves are the gateway drug that will steer you away from building in the styles of Early-Mid- and Late-crate.

Buying a spokeshave is a bit harder than deciding to buy one, however. You have some choices to make.

Bevel-down or Bevel-up?

Oh, you thought we were finished with this topic when you finished the section on handplanes? No such luck. Like planes, spokeshaves come with these two kinds of bodies. Most metal spokeshaves are bevel-down tools and most wooden-bodied tools are bevel-up tools. Yes, Poindexter, I know there are some notable exceptions.

The bevel-down tools are most similar to handplanes. The tool's iron is secured on a bed that is pitched at about 45°. No matter what angle you sharpen on the tip of the iron, it will always cut at 45°, which is a good workaday angle for hardwoods and softwoods.

The bevel-up tools are wilder. The iron of the tool is also its sole. This unusual detail can create some interesting cutting situations. You can end up with a tool with a crazy-low cutting angle – somewhere slightly north of 25°. A low-angle block plane typically has a cutting angle of 37°.

That low angle means the tool can slice through woods with little effort, especially end grain, and leave a beautiful finish. The downside to the low angle is that you are going to suffer more tear-out when you hit a patch of reversing grain.

If your brain is ticking, then it probably just occurred to you to sharpen a higher angle on the bevel-up spokeshave and create a high-angle spokeshave. Well, maybe. I've put some steeper pitches (such as 50°) on my bevel-up spokeshaves with inconsistent results. The steeper pitch seems to increase clogging in my experience.

So what do you do? Well I find that the bevel-up shave is great when working with green lumber, a common task when making chairs. Tear-out is not nearly the same problem with wet wood as it is in dry stuff. So the low angle of the tool allows you to shape green wood quickly and with little effort or tearing. So if you work with green stock, the bevel-up tool is the clear choice.

But if you tend to work with dried hardwoods, a metal bevel-down shave might be the tool for you. Tear-out is less of a problem, and you can reduce the amount of muscle power necessary to drive the tool by skewing it on the work. This effectively lowers the cutting pitch of the tool.

In fact, for chairmaking, I use both kind of tools. I rough out all my green parts to close size with a bevel-up shave. But after the wood has dried in my kiln (OK, a cardboard box with a light bulb in it), then I switch to a bevel-down tool.

Adjusters, Yea or Nay?

Both styles of spokeshaves are available with mechanisms that adjust your depth of cut. Do you need them? Most chairmakers I know don't care for the adjustment mechanisms – they can adjust their shaves with a tap tap here and there. In fact, some do it by merely tapping the handles on the bench or shavehorse. And they can do this operation with great precision. With shaves the traditional set-up is to make one side of the blade cut deeper than the other side. This allows you to take heavy cuts and finishing cuts with one set-up.

Perfect. This is my favorite system for adjusting spokeshave blades, and is common on both old and modern shaves. You can dial in exactly what you want.

Still, I'm a sucker for adjustment mechanisms, both on planes and on spokeshaves. I have no problems adjusting my tools without the mechanisms, but I find that it's easier to learn to use the tool if you have the adjuster to help you dial in your depth of cut. It's one less factor to worry about. Plus, most shaves adjust their blades using two thumbscrews, one on the left side of the blade and the other on the right. Having these two adjusters allows you to easily experiment with different set-ups, including the one I mentioned above.

Now that I've tried to sell you on having a shave with an adjuster, let me tell you how they can stink up a room. For the most part, the adjusters on the metal, bevel-down shaves are bulletproof. They usually consist of a brass nut that is threaded onto a steel machine screw. The brass nut engages a notch in the blade. The only way this mechanism gets fouled is if the machine screw gets bent or its threads get munged. Otherwise, it's a solid mechanism.

The bevel-up shaves are a different story. There are two common kinds of mechanisms. One gets messed up easily; the other is a robust pain in the rear. The fragile version consists of two thumbscrews on the top of the body of the plane. These thread onto posts that stick up from the blade. More times than not, these mechanisms become stripped through abuse. When this happens the blade either won't adjust or it won't hold its setting. So never buy one of these tools unless you've had a chance to disassemble it and use it.

The other common way to adjust bevel-up shaves is quite robust. It looks just like the fragile mechanism from the outside, but it's different on the inside. There are two thumbscrews that grab threaded posts on the blade. But what is different is that you lock the blade against tiny jackscrews that are embedded in the body of the shave. To adjust the tool you take it apart, raise and lower the jackscrews then reassemble the tool and test your set-up. Disassemble and tweak again until you reach the desired result.

On the one hand, once you get the jackscrews in the right place, the tool is pretty well set. The downside is that the set-up process is arduous and making adjustments on the fly ain't gonna happen.

Check the Bed. It Could Suck

So far it sounds like the metal bevel-down tools are the way to go, right? Well they can stink, too. If you buy an inexpensive metal shave, the bed for the cutter can be impossibly awful. Take apart the shave before you buy it and look at the tool's bed. Is it rough and/or painted? That's bad. If the cutter won't bed securely then the only thing you can make with it is chatter.

A quality tool will have a bed that has been machined flat or carefully linished (the fancy word for "sanded") or filed flat. A machined bed is something you're likely to see only on a modern tool. Vintage tools were typically linished. Linishing isn't bad, but you do want to make sure the iron seats firmly on the bed and that the tool doesn't chatter in use.

There are ways to fix a bockety bed. Chairmaker Brian Boggs has fixed his cheapie tools by spreading epoxy on the bed (plus a barrier), then pressing the cutter onto the epoxy. This makes a bedding surface perfectly suited for that cutter. Boggs also recommends replacing the lightweight lever cap with a heavy piece of brass that you shape yourself. But at that point, you might consider just coughing up the money for a well-made tool.

Sole: Curved or Flat?

Conventional wisdom is that flat-soled shaves are the correct tool to have. Shaves with curved soles (the curve is slight and runs from front to back) are too difficult to manage to be useful.

Whew. I am so glad no one told me that until recently. I've been using both styles of shaves for many years without any problems. Are the curved ones more difficult to manage? Heck, I don't think so. Perhaps that's because of the way I use them to scoop out concave edges. I don't grab the handles like bicycle handlebars. Instead, I pinch the body of the tool between my thumbs and forefingers, crowding my fingers as close to the center of the tool as possible.

This allows me to press down with great and directed force, and to feel where the tool's cutter is at all time. Then it's just a matter of feeling for when the cutter meets the wood, and scooping away. It's hard to describe in words, but easy to do if you hold the tool correctly.

The handles do serve a purpose – they rest against your palms, which helps to stabilize the tool.

I like having one flat-soled shave for straight cuts and outside curves. And I like having one convex-soled shave for inside curves. In the end, you will likely end up with both. I'd start out with the flat-soled shave because it is slightly easier to master. It works more like a miniature block plane. The curved-sole shave works more like a drawknife.

Size: S, M, L?

Spokeshaves come in different sizes. Little ones, which have a cutter that is about 1-3/8" wide or a little wider, are useful only for cabinet work. I use a little shave all the time for fairing slow curves and shaping stock.

The standard-sized shave has a blade that is 2" wide or a bit wider. It's well-suited for chairmaking because there is a lot of blade, which allows you to shave legs and tweak the blade so one side is ranker than the other. However, the standard shave is also great for making other forms of furniture. If I had to recommend one size, it would be this medium-sized tool, though I personally prefer the smaller shave when detailing and shaping furniture.

There also are larger shaves with wider blades and longer handles. These are suited for large work (think wheelwright or cooper). If you build big, curvy stuff, give those a test-drive. Otherwise, stick with the small- or medium-sized models.

Cabinet, Modeling & Rattail Rasp

When we cleaned out my grandfather's shop in 1993, years after he died, I was amazed at how many rasps and files the man had accumulated for making period furniture. At the time I was deep into Arts & Crafts furniture, so I wasn't really keen on curves or shaped work. But still, the tools belonged to my grandfather, so I claimed a handful of files for metalwork, with the rest of the rasps going to an uncle.

As my taste in furniture broadened to include all sorts of funny shapes, I began acquiring a few modern Nicholson rasps. It took a lot of oomph to push the teeth into the work, and the surface left behind looked a lot like hamburger (especially when working cherry).

It wasn't until I started using hand-stitched rasps that – sweet baby Moses – I became a true believer.

Friend to the shave. Can you do good work without rasps? Yes. Will your work be more interesting with the shapes rasps can make? Hell, yes.

The difference between a machine-made rasp and a handmade one is startling. With most machine-made rasps, the individual teeth are the same distance from one another. This perfection makes the tool easy to make but difficult to use. At times, the teeth will dig into your wood instead of cut it. And when you push forward, the next row of teeth just jumps into the holes left by the teeth in front. So the tool leapfrogs across the wood instead of cutting it.

Handmade rasps are made by "stitching" the metal surface. Each tooth is generated by a hammer tap made by an artisan. The teeth are irregularly spaced and needle sharp. As a result, the teeth never line up to leapfrog across the wood. So the handmade rasps cut easily, aggressively and leave a smooth surface.

You can buy handmade rasps in all price ranges, from those made in the third-world all the way up to France. While a handmade rasp will always (in my experience) outperform a machine-made one, there are variables in the handmade ones as well. Some are made from stainless steel and have a "gummy" feel when they cut. I prefer those made from old-fashioned high-carbon steel, but other people like the stainless.

Hand-stitched rasps are graded differently than machine-made ones. You'll see machine-made rasps typically graded as "first cut," "second cut" and "smooth" – though there are other grades, too. I've read that some rasps can be labeled up to "eighth cut," which is quite smooth. I've never seen one like that, however.

European hand-stitched rasps are graded in a superior fashion. They have a number – called the "grain" – that ranks the coarseness of the rasp on a scale of one grain (coarse) to 15 (fine). Most jobs fall between nine grain (for stock removal) to 15 grain (for finishing). According to Michél Auriou, a French rasp maker, his company developed this system to avoid confusion and mistakes and provide customers with more precise information.

The source of confusion is the fact that as rasps get larger they get coarser. So a 10" rasp graded as "fine" would be coarser than a 6" rasp graded as fine. Rasps still tend to be coarser as they get larger, but the system of "grain" describes it better.

One more thing to remember about the coarseness and fineness of rasps: Experience brings control. As you learn to manipulate a rasp you'll find you can stretch it to do things outside its grade. A nine-grain rasp can be coaxed into finishing work. A 15-grain rasp can be pressed into removing some stock. It's all in how you handle the tool.

Grades & Shapes You Need

You can't really address the grain of the tool and its shape separately. Well, you can. But not with the way I work. I think you need three rasps to do most furniture-making chores. If you make tools or sculpture you need a much larger set. I'd get one large rasp with a half-round profile – one face is flat, the other is convex. The blade should be about 9" or 10" long and about a nine or 10 grain. This heavy tool will do a lot of your rough shaping.

The second rasp should also have a half-round profile but have a shorter blade – somewhere between 4" to 6" – and have a fine grain in the neighborhood of 15. This tool will finish the work of the big rasp and get you into some tight areas. It is sometimes called a modeler's rasp.

The third rasp should have a cylindrical blade that's 6" long or longer. This is usually called a rattail rasp. It should be fairly fine – 13 grain is common. This helps cope inside miters of mouldings and it works tight curves in fretwork or scrollwork.

Even if you don't think you'll ever make a cabriole leg, I think you should own these three rasps. Everyone eventually encounters curves, and these three tools will encourage you to expand your repertoire.

Card Scrapers

I've always disliked the term "card scraper." Yeah, the tool looks like a card; I'm OK with that part. It's the word "scraper" that bothers me. It gives the impression that the tool is used for coarse work, such as removing paint, finish or soap scum from your bathtub.

The truth is that the card scraper is probably the most delicate and sensitive tool in my chest and is able to remove tear-out on boards that my planes can't tame. But I guess no one would buy the tool if it were called the "little desert flower wispy maker." So "card scraper" it is.

Card scrapers have always been made from steel used to make saws. In fact, many scrapers started out life as saws that were sharpened to death or kinked by a botcher. So they have come in a variety of thicknesses and hardnesses – just like saw steel.

Vintage card scrapers are uncommon. I assume that is because these were used up or thrown away by some anal-retentive relative who thought they were just junk the woodworker had hoarded (imagine that). If you do acquire a vintage scraper, don't go monogamous with it until you've had some quality time sharpening and using it. Vintage scrapers are usually softer steel than modern tools. That means they are easier to sharpen but also that they get dull fairly quickly. Some vintage scrapers I've used lost their edge after just a few minutes of use. That's not right. Of course, a poorly sharpened scraper will also lose its edge quickly, so the problem might actually be you.

Modern scrapers come in a variety of thicknesses, hardnesses and conditions right out of the package.

Secret weapons. These simple bits of steel can fix many problems with tear-out and even finishing. The only trick is to learn to sharpen them.

Thickness or Thinness

You can find scrapers as thin as .01" (similar to the blade on a Japanese saw) all the way up to .042", which is a typical thickness of a full-size Western handsaw before being taper-ground. The difference between the thinnest and thickest scrapers is immense, and it makes a significant difference in how they work.

Thin scrapers are easy to wield. They bend to the correct curvature with little thumb pressure to remove the smallest bit of tear-out in a localized area. The downside is that they cannot make a surface flatter. In fact, the thinnest scrapers will make a surface look more rippled by removing only the soft earlywood in some species. That is how sensitive these suckers are.

So thin scrapers shouldn't be used on a surface that's fresh from a saw (band saw, handsaw, whatever saw). The thin scraper will follow or skip over the low points to create a surface that's just as rippled and twice as ugly.

However, when you use these thin scrapers on a previously flattened surface and are only seeking to remove a little bit of stock here or there, they really shine. Plus, your thumbs will thank you. Thin scrapers can be used for much longer than their thicker cousins.

Thick scrapers are a different animal. Use them for a few minutes, and it will feel like your thumbs are going to catch fire and break off (and perhaps not in that order). It can be really hard to bend them to the correct curvature for the work at hand. Some toolmakers sell scraper holders that do the bending for you. I do not like these devices. Good scraping technique requires you to vary the pitch and curvature of the tool with every stroke. Scraper holders prevent you from varying the curvature, and this makes it hard to find the sweet spot with the tool.

So what does all this mean? Choose a thin scraper when you are dealing with surfaces that are flat and nearly finished. Choose thick scrapers when you are trying to do some smoothing as you clean things up. A good thin scraper is in the .02"-thick neighborhood. Thick scrapers are just north of

.03" thick. The tools at the extreme margins of thick and thin are difficult to wield, so I would avoid them until you get some shavings under your belt.

Hard or Soft?

When it comes to the Rockwell hardness of a scraper, I tend to err a bit on the soft side. Hard scrapers – more than 51 on the Rockwell "C" hardness scale – are a bear to sharpen. Setting one up from the package feels like a finger-breaking experience courtesy of your local mafia. And turning a hook on these tools requires a super-hard and super-polished burnisher. Don't try using a screwdriver or gouge to turn the hook, which is old advice in many books, because the scraper will just mock you. With hard scrapers you need to come loaded for bear. Carbide. Polished.

However, if your scraper is vintage or sharpens up more easily than you expected, you should be wary. Too-soft scrapers are worse than too-hard scrapers. Why? Because they don't get any work done. It's shavings, shavings, then dust, dust. In other words, it's a lot more trouble than it is worth because you'll feel like you are always sharpening.

Initial Preparation

When I started woodworking in earnest in the early 1990s, I bought the scraper that everyone recommended – a Sandvik. I still have it, though it is smaller from sharpening and discolored from use. The scraper is the perfect balance of hardness and thickness. And it took just a few minutes to polish it up after removing it from its orange and white plastic wrapper.

Then the scraper disappeared from the market. Later, the Sandvik company would become Bacho, and the scraper it sold became pedestrian.

As a member of the press, I decided to find out what the heck happened to my favorite scraping tool. So during one of the annual tool shows I attended I cornered the company's representative.

He listened to my plea. Then he offered this explanation. And I am not making it up. The company stopped making its legendary scraper because the machine that prepped the edges of the tool had broken and no one knew how to fix it. So they stopped making the scraper.

I swear this story is true.

Some scrapers are sold with the steel being prepared very little. The manufacturer might only deburr the edges and stamp its logo on it. Other makers will grind the edges and about 1/4" of the faces flat. This shortens your setup time and is worth looking for.

Because this feature isn't always called out properly in catalog copy, you should look for it. When the scraper has been ground, the faces of the tool will be shiny with a stripe of gray on the edges. Look for this. I wish I could provide you with a list of scraper makers that did this, but it seems to change all the time.

Sharpening

There are dozens of different ways to sharpen this tool, from the simplest and stupidest (just file the edge and go to work!) to those techniques that are reserved for woodworkers who think sharpening is the hobby. I think that making tools dull is the hobby – sharpening is a necessary evil.

There are also a host of nutty jigs that claim to shorten your sharpening time. Most of the jigs do a good job in my experience, but they are pretty pricey. The only jig I use is a block of wood that has a groove milled in it to hold a file at 90°. I use the block to file and stone the edges of the scraper. I stone the faces with the assistance of a ruler. Heard of the "ruler trick?" It works for scrapers as well as for plane irons.

ABOUT MACHINES

The first time I ever visited Frank Klausz, it was to shoot some photos for an article on dovetailing, for which he is a well-known savant. The photographer, Al Parrish, and I flew into Newark, N.J., late in the afternoon and Frank graciously insisted we come by his shop for a visit before the photo shoot the next day.

Frank's Cabinet Shop is a large, clean and efficient commercial shop. The walls are covered in hand tools. Many are for display; many are for use. And the machinery is well cared for. After a tour and some chit-chat, the photographer asked Frank a question that took me by surprise, mostly for the fact that I don't ask it myself more often.

"Frank," Al asked, "what's your favorite tool?"

Without hesitation, Frank started striding to the back of his shop. "Come," he said. "I'll show you."

With Frank's reputation as a dovetailing genius and his traditional training, I was expecting his answer to be some sort of traditional tool, perhaps something from his native Hungary, perhaps something handed down to him by his cabinetmaking father.

Nope. Not even close. Instead, we stopped at a stroke sander, a huge piece of industrial machinery. Frank launched into a speech about how much time this machine saved him. How much labor. And how he could use it to sand curved surfaces like no other machine.

I was surprised, but only for a moment. Sometimes the personae of a person gets filtered through the media in a way that's basically right but not quite the whole story. Frank loves his hand tools and is a master at hand-dovetailing because he teaches it everywhere he goes. But when it comes to the day-in-day-out work….

Machinery, when properly used, is like having some noisy apprentices. You have to always be the one in control. You have to know how to direct them. And you never ever let them take charge of the shop.

I use my machines to deal with rough stock. Dimensioning rough lumber by hand is time-consuming. Doing it by machine is child's play. Then I'll use it for roughing out some of the joinery, including mortises, tenons and rabbets. Everything else gets done by hand because it is safer, more accurate, faster or looks better in the end.

As to buying machinery, I don't have a lot to say for this book. I can cite model numbers and brand names by heart, but that won't help you because the powered machinery business changes so fast that the information becomes outdated before you can get it into print. Heck, I've seen Black & Decker replace its line of cordless drills three times in a calendar year. That is just wrong.

But I can give you some helpful principles that never change when buying electric thingys.

1. Buy good brands. It sounds like a no-brainer. But so many woodworkers are such cheap wieners that they end up buying tools from discounters

that have no track record. No-name tools always stink. I can say this because I've tested them. I've had routers flame out on me. Nail guns squirt oil all over my work. Miter saws that couldn't cut straight.

Purchase tools that you have observed on job sites that look like they have some miles on them. These tools cost more than the stuff aimed at the weekend picture-hanger, but they will last you a lifetime.

2. Shoot for the middle. If you spend more than 15 minutes shopping for tools, you'll notice that they are clustered around three different price points. There will be a low-end price point ($200 table saws, for example). These tools are designed to be used a couple times, or not at all, then thrown away. Really. No lie. Stay away from these tools. At the other end of the spectrum are tools that cost an incredible amount of money ($6,000 table saws, for example). These are great machines, but their benefits do not befit their price for a home woodworker.

So shoot for the cluster in the middle ($1,000 table saws, for example). These mid-range tools are going to be sought out by the frugal tradesman – a good place to be.

If you want a quick education in which tools are in the middle range, check out the local or Internet classified listings. The used machines that retain their value – about 60 percent of their new price – are the machines you want.

3. Buy vintage if you dare. In the last 20 years, most machinery manufacturing has gone overseas to Taiwan and China. Some of the toolmakers have done this gracefully, and the quality control is excellent. Other makers have botched it royally and are just selling their faded nameplate on crappy goods and hoping that no one notices.

If you don't want to research this topic to death, one way to get around the problem is to buy used machinery from the disco era or earlier. You can save some serious money and get a better machine. The only real problem is that you need to be able to evaluate the machine before you buy it. Are the bearings shot? (That's always a deal-killer in my book.) Are the critical adjustments still adjustable? Is the motor fried? Do you need to replace the wear parts, such as belts, tires, guides etc.?

In other words, you need to educate yourself before you blindly buy. Go to the Old Wood-working Machines website (owwm.com) and just start reading. In a few days you'll be ready to go vintage.

I will tell you that there are deals to be had. I bought my 14" Delta band saw for about half of what it would have cost new and it is 100-percent solid. Every part but one is solid metal. And the sucker just hums.

4. Metal, not plastic. An easy way to size up a machine is to examine its parts. Are the handles and adjustment knobs plastic or metal? (Aluminum counts as a metal.) Metal is always better than plastic. No exceptions.

First machine? It's an unorthodox choice, I know. But I think a powered planer is a great first tool for a hand-tool shop.

What Machines Should You Buy?

Few people buy all their machines at once. They acquire them over time and build their shop as they build their skills. That's how I did it.

If you can't buy everything at once, there are different paths you can follow when buying machinery. If you are going to be a power-tool woodworker, you should probably start by buying a table saw and purchasing lumber that has already been surfaced. You can go a long way with just that machine. After the table saw, you should buy a powered jointer and planer. Then (in no particular order) a drill press, band saw, powered sanding machinery and mortiser – plus lots of dust-collection equipment.

However, if your shop is going to be based on handwork, then I would recommend a much different route. My recommendations are unusual. In fact, I've never seen anyone else recommend this path in print. But I think it's the right way to go.

Buy a portable 12" or 13" planer first. Why? Because surfacing lumber to thickness is the absolute most time- and energy-consuming job in handwork. So the portable electric planer is a lifesaver. It is cheap, accurate, durable and leaves a surface finish that beats what you get from a big industrial planer. Why? Because their cutterheads are powered by high-speed universal motors.

Why not buy a powered jointer first? Good question. When you use a powered jointer and a planer, you surface one face flat with the jointer, then you thickness the board with the planer. If you have a jack plane, you can quickly surface one face of a board true, then run that board though the planer to get it to finished thickness.

What about jointing edges to make panels? A jack or jointer plane can do that job. In other words, I think you can get away without a powered jointer. But the powered planer is a must-have.

The Second Machine

Get a 14" band saw. A band saw will remove the other biggest drudgery when working wood with hand tools: long rip cuts. In addition, a band saw can do so many other tasks that it is mind-boggling. It can cut curves, it can knock down rough

stock to size, it can make thin boards or even veneer, it can cut perfect circles, it can assist with dovetailing.

Plus, band saws are one of the safest saws ever invented. They don't kick back on you. Their guards are safe and well-integrated into the machine so there is no need to ever remove them.

There are downsides, of course. Compared to a table saw, a band saw is fussy. You will tune it and tweak it more often than a table saw. The blade guides need occasional attention. The tires on the wheels will wear out. The blades will occasionally snap. The dust collection is terrible (but it's terrible on most table saws as well).

Still, I would get rid of my cabinet saw before I got rid of my 14" band saw with a cast iron frame.

The Third Machine

Again, my advice is odd. Get a hollow-chisel mortiser. Cutting accurate mortises by hand is drudgery, especially if you have more than four to do. A mortiser is a miracle machine, and it was one of the first machines developed in the 19th century.

Cutting the matching tenons by hand or with a band saw is much easier than chiseling out a mortise. I have thought many times about getting rid of my mortiser. But I dismiss those thoughts every time I build a piece of traditional furniture.

Other Machines & Tools

I think most hand-tool woodworkers would be happy with the three machines listed above plus some good dust collection. A drill press, a jointer and a table saw are all nice things to have on occasion, but they won't save you as much labor as the three machines above. In fact, before I bought any more machines beyond the three basics, I'd buy a nice battery-powered drill. I find it almost impossible to live without one of those in the shop.

8 - STRIKING AND FASTENING TOOLS

I think I was 13 years old, maybe 14. My father had brought the whole family down to our farm to lay some decking at the "little house," a shed-roof structure that my dad built to practice the principles of building he had learned in classes and books.

My sister Robin was moving stiffly that Saturday thanks to a neck brace she was wearing after a horseback riding accident – I still have photos of her in that brace. But despite the injury, my father insisted that Robin and I drive a gazillion nails to lay the decking material that wrapped around two corners of the little house.

When my dad gave us that job, I was pleased. I don't mind driving nails. I was good at it after years of practicing on the stud walls of our house and just about everything else I'd built in our shop at home. Nails were joinery, plain and simple. And the assignment was a crapload better than digging holes for fence posts.

But just as I can remember Robin's "Square Pegs" neck brace with amazing clarity, I also can remember the wild sounds that day as we laid that decking. There was an enveloping and throbbing growling – like a cicada swarm – that came from over the next hill, out of sight of our house, which was perched on the edge of a high cliff.

After a few seconds of growling, we would hear something that sounded like a hammer hitting an anvil the size of our Suburban. I asked my dad what the sound was.

He answered: strip mining.

We beat the nails all day, and at times my hammering would be in sync with the mining machines, making my Craftsman 16 oz. claw sound like a hammer of the gods.

Many woodworkers I respect think hammers have no place in a proper furniture shop. Hammers are carpenters' tools – crude, brutal and simple. But I couldn't disagree more.

Hammers, and all the other fastening tools related to nails, are essential to traditional woodworking. Nails belong in fine furniture. They add strength when used correctly. They accommodate wood movement better than other fasteners. Nails are beautiful.

I didn't always feel this way. As a kid, we used all kinds of nails on our farm. But in college I was exposed to a heavy dose of Shinto and Buddhist philosophies. Now, I'm sure that I'm going to get this next part wrong about the Shinto way of looking at things, so I hope that Japanese readers will forgive me.

Shinto, which cannot really be called a formal religion these days, embraces the idea that all objects have a spiritual nature (called "kami"). Because trees, rocks and weeds have kami, it influences the way Shinto shrines are built. Bottom line: They aren't going to nail their wooden structures together. A Shinto shrine uses joinery and wooden pegs instead of iron nails.

When I learned about Shinto in a religion class, it was my first exposure to Japanese joinery. And it stuck with me. That shouldn't be too surprising. As a college student in the 1980s, an animistic philosophy seemed a just response to the "rape the land" way of life I saw around our farm.

In fact, avoiding nails seemed like the small-scale antidote to the strip mining that was leveling the hills around my dad's beloved farm.

No matter whether you are nail-happy or not, you are going to need some striking and fastening tools. Many woodworkers make grievous mistakes when picking out these tools. Though they seem simple, almost primitive, they are, in fact, highly refined.

Chisel Mallet

Driving chisels is serious business. The wrong mallet will wear you out, miss the mark or split a chisel handle. In fact, you might end up with more than one chisel mallet, especially if you get into carving.

There are several forms of mallets, and some have specific uses you should understand before buying them.

Wooden mallets with square heads: This is the traditional joiner and carpenter mallet. The head is usually a single piece of wood with a tapered mortise through its thickness. The handle is tapered and fits in the mortise with friction.

A beater for biter. A good chisel mallet is heavy, compact and packs a lot of punch. Even individual mallets that appear identical can be remarkably different because of differences in the wood.

This form works great with all chisels that have wood or plastic handles. They don't stand up against metal very well. So don't buy them if you use Japanese chisels with iron-hooped handles or chisels with steel strike buttons on the end. The metal will just tear up the face of the mallet.

These mallets need to be made of a dense material – beech is the traditional wood. Lightweight woods, or even lightweight examples of heavy woods, are no good. I once owned a maple mallet that was made from a particularly lightweight sample of the species. It was like driving a chisel with a balloon hammer.

The weight of these mallets ranges between 14 oz. and 25 oz. depending on the density of the material and the size of the head. I prefer mallets toward the heavy end of the spectrum, 16 oz. to 20 oz. Lighter mallets just don't have the "punch" necessary to drive mortise chisels deeply into hardwoods.

The heads should be a particular shape. The faces should be angled so that if you drew lines off of each face, they would intersect with the end of the mallet's handle. This allows you to use a very natural arm motion to hit a chisel and make fewer glancing blows.

These forms of mallets are popular because they are easy to make and inexpensive to buy. And their downside? I find they allow for less subtle steering of the tool than some other mallet forms allow. Plus, the head tends to come loose in time. Still, for most work these mallets are hard to beat, or should I say: easy to beat.

Round Mallets

Mallets that are turned typically have heads that taper (the taper follows the same principle used in designing the square-head mallets) plus round handles. They are preferred by woodworkers who also carve – the round-head mallet is fairly standard carving equipment. Some woodworkers report that the round mallet provides more control when driving edge tools, and I tend to agree.

I became a fan of round mallets when I started using one with an indestructible head – it's maple impregnated with resin. There also are round-headed mallets made from brass, urethane and other tough materials. Why? Because many round wooden mallets tend to get chewed up pretty quickly because you are beating both the face grain and edge grain of the turned mallet as you work. The face grain is not as durable as the edge grain.

If you have a lathe and can spin out a new mallet in a few minutes, then the low durability isn't much of a factor. No lathe? You'll get grumpy pretty quickly.

Wooden mallets with round heads tend to be made from woods that can take a beating, such as lignum vitae or black locust. These tend to hold up pretty well.

Brass or Steel Mallets

Other chisel mallets look more like hammers – they have brass or steel heads. These are preferred by woodworkers who drive Japanese chisels, which have a ferrous hoop around the handle.

The handle's hoop allows the handle to take some serious punishment without splitting. I have never split the handle of a Japanese tool thanks to the hoop and the modified tang-and-socket construction. See the section on chisels for more on this.

You can use a metal mallet on a wooden or plastic handle, but you have to take a little care.

The big advantage of the metal mallets is that they pack a lot of punch into a small size. Big beech square-headed mallets can feel a little awkward at times, but not metal mallets. And because they pack a lot of mass into a small package, you can use a lighter metal mallet than if you used an all-wood beater. I prefer metal mallets that are about 10 oz. or so.

The only real downside to these mallets is that some feel top-heavy at times, and the ones that feel top-heavy tend to wear me out faster.

Other Mallet Materials

I'm sure that I haven't encountered all the materials used to make mallets. Some woodworkers use wacky plastics. Others line the faces of their standard mallets with thick leather. Still other mallets have a rawhide striking surface encased in a cast iron frame.

The leather or rawhide striking surface is a nice touch, especially when accompanied by the mass of metal. You end up with a smaller mallet with some serious punch, but it won't split the handles of your chisels.

Cross-peen (Pein) Hammer

Most woodworking requires two hammers. One is for driving the big-boy nails. The other hammer (called the "girl" hammer by one of my co-workers) is for driving sprigs and making sensitive tool adjustments.

In my shop, the small hammer gets more use than the big one. It's always within reach when I'm using my bench planes because it is better at laterally adjusting my planes than the planes' lateral-adjustment levers. A tap on the edges of the iron can almost always center an iron in the mouth of the tool.

When arranging your marriage to a girl hammer, you can choose a claw

A woodworking hammer. While claw hammers are mostly for carpenters, the cross-peen hammer is for us. The peen helps start nails and is ideal for adjusting plane irons, too.

hammer if you like, but I think the better choice is to choose a "cross-peen" hammer. (The spelling of "peen" is forever in debate.) A cross-peen hammer has one round head for driving nails and the other head is a radically tapered rectangle. This rectangular head is used for lots of things, but its most common chore is to sneak between your fingers to start short brads or pins. I also use the cross peen to adjust plane irons side-to-side because the small head can sneak into places a round head cannot.

You don't need a big hammer for these jobs. Usually one with a head weighing 3 oz. to 6 oz. will do the trick. The head can be steel or brass; many shop-made vintage ones are filed from a brass blank. The brass ones get beat up quickly if used to drive steel nails. But if you use them only for adjusting tools, brass is fine. You'll also find small vintage brass hammers used in environments where there is flammable gas because they won't make a spark when striking other metals. If you see these for sale by a vintage tool dealer

For big nails. A well-balanced claw hammer with a comfortable handle is a tool at the top of the evolutionary chain that began with a rock.

consider picking one up for adjusting tools.

The British ironmongers of the 18th and 19th centuries had a lot of different kinds of cross-peen hammers. You'll see names such as London pattern, Warrington pattern, Lancashire pattern and others if you dig deep enough. The different patterns have a different-shaped cross peen or different chamfers filed on the head. I've tried several of these British patterns and can report that they really don't make much of a difference in use. The Warrington pattern is the most common these days, and that one does the job nicely.

13 oz. to 16 oz. Claw Hammer

I have strong opinions about hammers, but I'm not sure my opinions are worth much. Hammers, like saws, have a strong personality – perhaps because they are direct extension of your dominant hand.

I can tell you what I like and why, but I recommend that you test-drive a few nails before you buy one. You should be able to drive a 6*d* nail in a few whacks and get the nail head flush with the work without denting the wood. These dents are called "French marks" – though I bet they have another name for them in France.

The Hammer's Head

Most woodworkers like a claw hammer with a head that weighs between 13 oz. and 16 oz. The overall length of the tool should be about 13". Shorter hammers don't have the punch you need, and longer ones are hard to aim.

If you buy a claw hammer, make sure that the claws have a pronounced curve to them. The tips of the claw should terminate so they are parallel to the handle. If the claws stick straight out – perpendicular to the handle – then you are holding a ripping hammer, which is more suited for dismantling things. The straight claws pull drywall off studs and can pry apart boards that have been nailed together.

The striking face of a hammer can have one of three shapes: flat, slightly bellied or munged. Of the three, munged is the worst. A chewed-up striking face means the hammer head is too soft or that it has been abused. No matter what the cause, the hammer will be tricky to handle and turn your strikes into glancing blows.

You can clean up the face with a file, but you need to keep the geometry the same or restore the correct geometry. The face should be perpendicular to the cheeks of the head. However it should not be parallel to the handle. Instead, the face should pitch forward a few degrees. Why? Well if you envision the striking action of a hammer in your hand you'll see that it is an arc and that your wrist cocks up a bit – this is key. Angling the striking face of the hammer brings the striking face down onto the nail's head straight on once you subtract the arm and wrist geometry. It works.

The flat-faced hammers are generally for people who don't care about leaving French marks. With a flat face, it's hard to set the nail head flush to the surface of the wood. But the flat faces are easier to manufacture.

The shapes to beat. Wooden handles have complex shapes. Some are roundish; some are octagons. Try out several handles before you settle on one.

The slightly bellied faces are the best. The shallow convex curve makes it easy to set the head of a nail without dinging the wood. Sure, you can still French the wood, but it's less likely to happen with a bellied striking face.

The Handle

There is so much variety in hammer handles that it can be hard to make sense of things. They vary in length, girth, shape and material. Let's tackle the easiest one first: material. If you ignore everything else I've written, I hope you will buy a hammer with a wooden handle. I have experience with thousands of nail strikes and can report without any doubt that metal and fiberglass hammers suck turds. They fatigue my forearm faster than a wooden handle. The vibration they transmit to your bones is shocking.

Wooden handles are forgiving. The wood quickly warms to your touch. Wood doesn't get gummy like some modern overmolded piece of junk that

Hold my head. The straps, sometimes called "ears," were designed to keep the head and the handle together. Flying heads were once a common scourge.

looks like a low-rent Naugahyde driving glove. Wood is more comfortable to use for longer periods of time. Wood looks better.

Wooden handles come in two basic shapes: ovalish and octagonalish. I greatly prefer the octagonal profile. Why? Heck if I know. It just feels better. My thumb has a definite place to go and my fingertips settle onto one of a couple flats. It all feels very proper and right. Also, I dang well know where the head of the hammer is at all times, so I find it easier to stay straight while striking.

The oval-ish handles also provide this sort of feedback, but it's not as overt, in my opinion.

The other thing I like about wooden handles is that they have a complex shape that I don't find on the metal handles. The wooden handles have a slight swelling in their length that is useful to the user. In general, a hammer handle is grasped in two ways. You grasp it at the end for power and you choke up on the handle for precision strikes.

The swelling in the middle of the length falls right into your palm when you switch to the precision grip. With my metal-handled hammers, there isn't as much of a swelling on the handles as there is an absence of rubber grip. You run out of rubber and end up holding some rubber and some metal. I don't much like that.

About Vintage Hammers

Most modern hammers have an "adze-eye" head to help keep the head affixed to the handle. The adze-eye head has an hourglass-shaped hole through the steel head and a long neck. So when you affix the handle and wedge it in the top of the head's eye, the head is much more likely to stay in place.

Early hammers might not have an adze-eye head, which was an innovation credited to blacksmith David Maydole, of Norwich, N.Y. He first marketed his adze-eye hammer in 1840. He never patented it and it quickly became the industry standard.

Pre-1840 hammers use a variety of methods to keep the head attached to the handle. The most common method that survives today is to strap the head to the handle. So-called "strapped" hammers have two iron or steel "ears" that extend from the hammer's head down the handle a few inches. The straps are riveted through the handle, which generally does a good job of keeping the head and handle married. However, it does make the hammer a little nose-heavy compared to adze-eye hammers. And it's positively nose-tippy when you compare it to early hammers that have a short neck and a straight hole through the head.

But don't be afraid of vintage hammers. If the tool feels good in your hands – real good – then it's worth keeping. You can wedge the handle tight, and if you are a furniture maker you are unlikely to loosen that connection in your lifetime.

Rehandled Hammers

When you buy vintage, you do have to be wary of hammers that have been rehandled. About 90 percent of the time, the person botched the job. And as a result the hammer's head is cocked left, right or on some sickening compound angle. These are hopeless and will rarely hit a nail square on the head. The only solution is to remove the handle and properly reinstall a new one.

Of course, that recalls the tale of the carpenter who bought a used hammer for a bargain price. He soon found that the hammer had been poorly rehandled so he replaced it with a new handle. After a few months he found the hammer's head was too soft. So he replaced the head and finally had a good tool.

One Last Word on Handles

Don't be afraid to reshape a handle to your liking – another good reason for a wooden handle. Some people drill shallow holes on the handle to improve their grip. Others strip off the ugly, thick lacquer and add a nice coat of boiled linseed oil. Other brave souls take a spokeshave or rasp to the handle. No matter which way you go, remember that the hammer is yours. It is like a neolithic club and should be ready to strike down any nail that defies you. So make it your own.

Dead-blow Mallets

Dead-blow mallets are a luxury. You can get by without one. But they are priced so reasonably that it's puerile parsimony to eschew them. The previous sentence should prove to you that I indeed have a master's degree, which has caused me nothing but trouble at drunk-driving checkpoints (another story entirely).

A good dead-blow mallet is rubber or another similar plastic, such as polypropylene, with a head full of sand or shot. I own the Champagne CH-2 dead-blow. As you know, things named Champagne come from the region

Dead to me. The dead-blow mallet is an inexpensive tool that helps you disassemble joinery. It could be moved to the "not necessary list" if you are down to your last $10.

of Champagne, otherwise it is not Champagne. Mine is made in Taiwan and cost less than a good burger and fries. A good weight for furniture making and unmaking is about 24 oz. The mallet should be heavier than your claw hammer or your chisel mallet so that it will aid in assembly and disassembly.

The shot in the head prevents the mallet from rebounding as much when you strike something, so more force gets transferred into the work and less into the rebound bounce.

There are some expensive dead-blow mallets out there, including some that have interchangeable heads. I've used them. Whatever. The important qualities of a dead-blow are hard to mess up, so even the low-rent guys get it mostly right.

- The head should be filled with shot or sand. Don't buy a solid rubber mallet unless you plan to attend Clown College.

- The handle should be easy to grip, even when your hands are wet. When you are dealing with water-based glue and water to clean off the glue, your hands are going to be wet. And you don't want to throw your dead-blow across the shop.
- The head should not mar the work. Even the best makers of dead-blow mallets will leave the raised plastic seam that is the result of the manufacturing process. This seam will scar your work. And it will chafe your hand down around the handle area. I shaved my seam off with a knife, because I am just that macho. Sandpaper also works.

In all my years of answering questions about tools, no one has ever asked me for a recommendation on a dead-blow mallet, so it's not a tool that elicits a lot of passion. But, like glue, it is inexpensive and dang handy.

Nailsets

Welcome to the tool ghetto where we talk about the tools that no one ever thinks twice about – until they can't find theirs. Nailsets are some of the least glamorous tools out there. The sexiest nailset is a pointed steel rod with some knurling and a colorful plastic coating.

But without nailsets, your furniture would be like a wooden porcupine. And without the right nailset, your furniture would look like it was attacked by a roach with a tiny machine gun. Nailsets set the nail below the surface of the wood. After you set the nail you can leave it be, or you can tint some magic putty to fill the hole, which will look OK on the day you wipe it in. After the wood darkens or lightens, your putty job will show up like liver spots.

Most woodworkers need two nailsets, three at most. A nailset with a 1/32" tip is used for 4*d* nails, a 1/16" nailset handles the 6*d* nails, and (if you are butch) the 3/32" nailset sinks 8*d* nails. Most nailsets have a conical tip, sometimes with an indentation in the tip. These are designed for sinking wire nails, which are round.

If you work with cut nails, like I do, you might want to make your own nailsets. The heads of cut nails are rectangular, and I've found that nailsets that have a rectangular tip tend to work better. Making your own nailset is a breeze. Buy some cheap punches from the hardware store and file or grind the head until it is a perfect fit on your cut headless brads or fine finish nails.

Unsexy but necessary. If you want to set your nails, you need a nailset, which is nothing more than a punch with a tip designed for nails. Don't be afraid to file the tip to suit your nails.

There also is a type of nailset that's made in Japan that some woodworkers like. It looks like a giant old-school cut nail with a head that is 90° to the shaft. The head is actually a second nailset that is designed to get you into close quarters. Unfortunately, its tip is huge, like something designed for an 8*d* nail. So fetch a file and dress it down to something for a 4*d* or 6*d* nail. Then you'll have something that is useful in a pinch.

Nailset Maintenance

Nailsets can get beat up after a lot of use, especially the homemade ones made from soft steel. It's good practice to true them up with a file every now and then. Sometimes a file is the only way to get a nailset working well if it has been covered in grease. Grease makes nailsets slip sideways off the head of your nail and make a nasty hole in the wood next to the nail.

Alternatives to Nailsets

Some woodworkers get by without owning nailsets. How do they set their nails? With nails. You can use one nail to set another, and if you don't have a lot of nails to sink, this works fine. So if you need to save a few dollars (literally) give that a try.

Nail Pincers (Nippers)

Nippers – sometimes called nail pincers – are essential if you use a lot of nails. Nails go astray, sometimes because of your bungling and sometimes because the tip of the nail will follow a soft part of an annular ring in your

The grabber. Nail pincers allow you to pull out fine nails that a claw hammer cannot reach. They are not fun tools, but when disaster strikes, they can save your butt.

wood and poke out rudely. Nippers (and no, they are not named for a racial slur) are the answer.

These special pliers can pull a bad nail from your work with minimum damage to the wood. They also can be used to snip the tips of nails, which is handy if you have lots of *6d* nails and need *4d* nails instead. Or if you have bent the head of a nail, you can snip off the head and set the remainder of the shank below the surface with a nailset.

Nippers come in different sizes. The smallest one is great for headless brads and pins and can sneak into places the larger nippers can't go. However, you don't want to use the little nippers for everything. Because the little guy's head is so small, you will dent your work if you use it to pull a big nail. The larger nippers have bigger heads, which spreads the levering force over a greater area, which means you are less likely to damage the wood. Because of this principle, I always choose the largest nipper I can get away with.

Selecting Your Nippers

Before you buy a pair of nippers, examine the jaws. They should close seamlessly. Any gap between the jaws is bad. The nippers will have a bevel on the inside and the outside of the jaw. This bevel reduces the ability of the tool to grab nails that are flush with the wood, but it strengthens the jaws and prevents them from chipping.

Open the nippers and take a look at the inside of the jaws. The bevel on the jaws should be crisp, but not too sharp. A sharp bevel will cut the nail when you mean to pull it. But the bevel needs to be sharp enough so that you can snip a nail if need be. Run your finger over the bevel with firm finger pressure. If it feels like the bevel could cut you, it's probably too sharp.

And a final note on the jaws: The curved exterior of the jaw should be smooth. Any burrs or roughness will be pressed into the wood, leaving an ugly mark. You can file or sand the burrs on the jaws away if need be.

The right drivers. If you build traditional work, you should use traditional screws. Yes it takes a bit more skill, but they look better than drywall screws.

Straight (Slotted) Screwdrivers

The world of straight screwdrivers can make you nuts. There is little consistency among manufacturers of both the drivers and the screws themselves. Your goal with a straight screwdriver is to have the tip of the driver be ever-so-slightly smaller in width than the diameter of the screw's head. And the thickness of the tip should fit the slot as closely as possible.

At this point, you might be asking why I'm even discussing straight drivers. Why not use an advanced screw design, such as the square-headed Robertson pattern, that is easier to drive?

Simple: Nothing looks as good and as correct on furniture as a straight screw. And nothing looks odder than a Torx or Phillips screw on a highboy. If you are going to fuss over all the moulding details of a piece of furniture, you shouldn't stop when it comes to the fasteners. Save the modern fasteners for the machine-age furniture projects you build.

The shape and size of the tip of your drivers are the most confusing, so let's take a look at those specs first.

Keystone or Cabinet?

The tips of straight screwdrivers come in two profiles: keystone and cabinet. The keystone tips flare out in width then taper again up the shank of the driver. These are the more common pattern. The cabinet drivers are simply straight – no taper. These are harder to find.

The keystone drivers are fine for hardware and installing some screws when building carcases. Their disadvantage is quickly revealed when you try to use a keystone bit to sink a screw in a deep counterbore. The flared edges of the keystone tip chew up the rim of your work.

I don't use many screws in carcase construction, so keystone drivers are perfectly fine. The good news here is that you can always file or grind down the flared-out edges of a keystone driver to make a cabinet driver.

The Tip's Width & Thickness

The most important aspect of a straight driver is the width and thickness of the tip. The width of the tips is fairly standard, and thank goodness. The smallest tip is just under 3/32" wide and is used for No. 0 screws. It isn't a common size. The next size up, which is just under 3/16" wide, will fit in the screws that are sized from a No. 1 screw up to a No. 7 screw, which covers most of the screws for hinges, knobs and other hardware. The next size up, shy of 1/4" wide, covers the No. 8 and No. 9 screws. There are several sizes bigger than 1/4", but I rarely use them for cabinet work.

Note that you might see some variation in the real world depending on the screw. However, usually a 3/16" and a 1/4" driver will handle most screws that are straight and small.

So it sounds like you need only two straight drivers, right? Well, maybe.

The thickness of the tips of these screwdrivers is all over the place. Plus, some of the drivers taper in thickness and some don't. I prefer the tapered tips because you can use that driver for more sizes of screws, even ones with odd-shaped slots. You also have more flexibility with a tapered tip. Most woodworkers grind off 1/32" up to 1/16" off the end of their straight drivers so that the driver won't bottom out in the screw's slot. That guarantees a snug fit at the top of the slot. And a snug fit helps prevent the driver from slipping out and damaging the screw or the work.

Depending on how much your screws vary, you might need a couple of the 3/16" drivers to handle everything – one ground and one un-ground.

Oh, and one more thing about the tapering in the thickness: It needs to be a gradual taper. A pronounced taper will give you trouble. You'll need to apply lots of downward pressure to prevent the driver from slipping out.

The other type of tip isn't tapered in thickness where the driver meets the screw. This is ideal for situations where the tooling matches the screw. For example, some planemakers and gunsmiths offer screwdrivers that are perfectly mated to the hardware on their tools or guns. When these drop into place, it is a beautiful thing. But when you use the driver on a piece of hardware that is oversized, things can get messy.

Bottom line on the tips: Don't be afraid to shape them to your liking. And because screwdrivers are fairly inexpensive, you can afford to have a couple of the same size on hand.

Tip Material

Some tips are too soft and get chewed up easily. Some are plated with chrome or nickel and the plating wears off quickly. I wish I could give you some advice on the best steel and Rockwell hardness for a screwdriver, but most manufacturers don't even publish that information when they sell the tools.

But here are some thoughts if you want to dig deeper into the topic. Screwdrivers can be made from a variety of steels, though plain old high-carbon is fine. Other alloys might be added to make the steel tougher or more resistant to rust. As to hardness, most specs I've seen place a good screwdriver tip at somewhere between 58 to 62 on the Rockwell hardness "C" scale. That makes it harder than a pry bar and a saw and about as hard as some chisels.

While hardness might seem to be the bee's knees here, any tool that is too hard can easily shatter. So you want a balance of toughness and hardness.

In general I think that screwdrivers that are not plated at the tips are going to be higher quality. That can mean that the tip was precision ground after the tool was plated, or that the manufacturer recognizes that the plating flakes off at the tip and is useless. Either way, it shows that the maker knows something.

Handles

As with all my tools, I prefer wooden handles to plastic or metal. As to shape, there are several good choices out there. I prefer oval- and octagonal-shaped handles for two reasons: they won't roll off the bench like a round-handled tool, and the flats or swelling of the handle can – and should – line up with the flat blade at the tip.

This little touch is one more piece of information for your hands. Knowing where the blade is will allow you to "time" your straight screws – lining up all the slots in a hinge so they are perfectly vertical. That might sound anal retentive, and perhaps it is. But that's what I do.

One Final Feature

Another mark of a quality screwdriver is that it will have some way of attaching a tool to the shaft so that you can apply extra torque, especially when pulling rusted screws. On the traditional English turnscrew with an oval handle, the blade has a flat metal area right below the handle that you can grip with pliers. Other screwdrivers have a six-sided ferrule for a box wrench to grip (look out because some of these are metric).

Using pliers or a wrench with your screwdriver isn't an everyday chore, but when you need to do it, it's nice.

Screw Tips for Drill/Drivers

If you are going to drive screws with your cordless drill/driver you are going to need different screws. Driving straight screws with a drill/driver is hard.

As industry blossomed in the 19th and 20th centuries, so did the number of screw options. In fact, there are now so many choices, that it's easy to make mistakes. There is a difference between square-drive and Robertson screws, Phillips and Pozidriv. You are also going to find a lot of combination screws out there that take some combination of a straight and Phillips and Robertson tip. And the screw manufacturer might offer a dedicated driver for the screw they sell.

So much for standardization. My recommendation is to buy the driver

A necessary evil. Even if you build period furniture while wearing a wig, there are going to be times when a Pozidrive screw needs a good tweaking. You need these bits on hand.

from the people who make or sell the screws you use. And keep it simple. Don't bring in a dozen different flavors of screws into your shop. You'll only make it harder on yourself.

Because I'm from the United States, I use Phillips screws when I'm driving screws with a drill. I grew up with Phillips and have lots of those fasteners in my house. Switching to a Robertson screw, for example, would just double the amount of tools I need to maintain my house and furniture. Yes, I've tried Robertson and other systems, and I do recognize that they have advantages. But there's nothing wrong with a well-installed Phillips screw.

Phillips screwdrivers come in three basic sizes for woodworking: No. 1, No. 2 and No. 3 tips. For furniture work, the Nos.1 and 2 will be the most useful. Those will drive screws up to a No. 10 size. And you can sometimes get a No. 2 Phillips driver to work in a No. 10 screw. The No. 3 Phillips driver handles the big No. 10 and No. 12 screws that you sometimes see in woodworking.

Tips vs. Hand Screwdrivers

For your electric drill/driver, you are going to want hex-shanked small tips that pop in and out of a holder in your drill. These bits can be dirt cheap or pricey. But unless you drive screws for a living (building decks, for example), I don't think you need to dive too deeply into the topic. Just make sure the tips fit your screws.

When it comes to screwdrivers with these modern tip shapes, all the same rules apply for these tools as for the straight screwdrivers discussed above. Look for wooden-handled screwdrivers that don't roll off the bench and have un-plated tips.

Sawnut Drivers

If you own saws that have traditional split nuts to secure the tote to the blade, then you are going to have to make or purchase some drivers to keep

Split nuts? If you own split-nut saws, you are going to need some of these drivers. In fact, you might have to make some of your own using old screwdrivers or some other tool.

them tight. Sawnuts tend to come loose with use and seasonal changes, and a floppy handle does not aid precision.

If you have saws with simple slotted screws, you should be able to use your straight screwdrivers to keep things tight. Otherwise, read on.

As far as I know, there are no standards for split nuts, which were common until 1875 and are now common again. I have tested saws by many makers – new and vintage – and have yet to find rhyme or reason when it comes to the size of the slot of the split head. As a result a driver for one brand is unlikely to fit a competitor's saw. So you have a few choices.

- Make or buy a dedicated driver for each brand you own.
- Buy saws from only one maker.
- Buy saws without split nuts.

Don't get me wrong, I like the look of the traditional but tricky split nut. But when you are dealing with a fastener that has fragile threads planted on a thin shank, is made from soft brass and doesn't have a well-fitted driver, you will chew up your nuts in short order. (And this is the moment that earns this book a PG-13 rating.)

I tend to prefer function to form, so I prefer robust sawnuts. Whenever I can, I choose saws that have slotted nuts. When I get one with split nuts, I'll make a dedicated driver for it. It's easy to do. You just grind an old ragged-out screwdriver to the perfect shape. What I don't like about this approach is that I now have four different drivers for four different brands.

Countersink & Counterbore

There are countersinks for wood and countersinks for metal. You might need both, one or none depending on your work.

Countersinks for wood are designed to cut a cone-shaped recess so the

More screw madness. If you do a lot of screw-driving, then you are going to have to invest in the tools to do it correctly, such as a quality countersink and counterbore.

head of a screw is slightly below the surface of your work. If you wish to put a wooden plug over the screw, you are going to have to purchase a counterbore or a tool that makes both a countersink and counterbore. A counterbore is a deep cylinder that is sized to receive a wooden plug.

There are not a lot of choices for countersinks and counterbores. There is a variety that has multiple cutting edges, as many as eight. And there are some that have one cutting surface. The tools with a single cutting surface are more expensive and leave a cleaner hole. They are sharper and work more like a plane. The tools with multiple cutters tend to grind away the wood and leave a jagged hole.

Countersinks for metal are designed for adjusting your hardware. Some hardware comes with countersinks with an 82° included angle; some comes with a 90° countersink. Most screws in North America come with heads that have an 82° included angle. So you might need to touch up your hardware's countersinks to make them fit your screws.

Here's my approach to this category of tools: I use a single-cutter countersink for wood because I occasionally build shop furniture with screw joinery. So I need to countersink my screw heads. However, I don't build furniture for the house or for others with screws, so I don't need a counterbore – I'm never going to use plugged screws as the method of joinery.

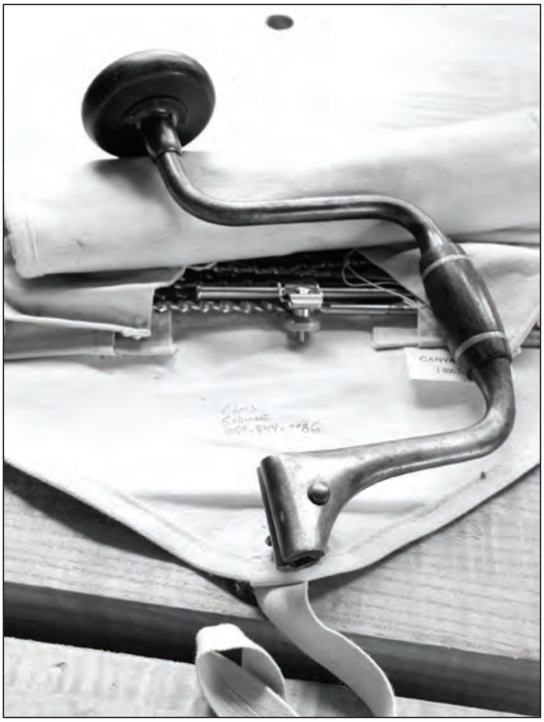
As to the metal countersinks, I've never had the need to buy one. I try to buy my hardware with matched screws. This ensures the finish of the metals will match and the screws will fit properly. I have yet to run into the occasion where I absolutely had to have a metal countersink.

I know lots of woodworkers who don't even own a countersink because they wouldn't dream of using screws. I'm not that kind of crazy.

10" Brace

A good brace has more torque than a cordless drill. It can be used with a precision and sensitivity that power tools simply cannot summon. The brace is one of civilization's amazing achievements, having been almost unchanged since its appearance 500 years ago. And you can buy a world-class specimen for about the price of a ham sandwich.

I cannot imagine life without a brace handy. My father had one when he built his first house on our farm outside Hackett, Ark. We didn't have electricity, so a brace was the only way to bore the large clearance holes for the bolts joining joists and rafters to the rest of the shed-roof structure.



I inherited my grandfather's brace, a pedestrian Craftsman model that still turned like a top.

While I'm sure that someone is making decent braces today, I have yet to find them. So I recommend you turn your attention to the vintage models, which are plentiful. They show up at garage sales, flea markets and auctions every single day. If you are crafty, you can find a perfectly functional brace for little money. For the most part, the best brace and the worst brace cost about the same. Why? Because most people don't know what to look for.

Looks are Deceiving

Don't be blinded by chrome, exotic woods or fancy mechanisms. Those things make a brace pretty, not useful. The best brace has only two important features: jaws that grip the bit securely and straight, and a pad at the top of the brace that spins easily and without any wobble.

Those two features help you drive auger bits true. So when you pick up any brace, check those two features before you check the price tag.

To be sure, there are details that make a brace nicer to use. A comfortable wooden grip that spins freely is nice. A ratcheting mechanism on the chuck allows you to bore in tight corners or to work through difficult jobs by isolating your muscle movements to those that are the easiest. And braces can have all sorts of aesthetic touches, including brass plating, pewter inlay, an ebony stock and turned brass accents. But those don't make holes.

A Close Look at the Chuck

There are a nutty, crazy and insane number of chucks out there. I can't even begin to count them. But I can classify them into three broad categories.

- Chucks that are designed to hold one specific set of bits that are matched to that particular brace or that particular brand of brace.
- Universal chucks of the 19th century and most of the 20th century that are designed to hold a tapered rectangular shank. This shank was the standard for many years and is still made today on some bits. Usually the brace's chuck had two jaws that were held open by a wire spring. The jaws closed on the shank when the chuck's shell was tightened.
- Curious three-jawed modern chucks. Some hold the square tapered shanks and some hold only round-shanked bits. As you can probably guess, I don't have much love to give the three-jawed chucks on braces that hold only the round-shanked bits.

The Sweep

Braces come in a variety of sizes. The larger the size, the more mechanical advantage you gain, but the slower the rotation and the more unwieldy the tool. The size of a brace is measured between the centerline of the tool along the chuck to the centerline of the crank handle. Double this measurement (say, 5") and you have the "sweep" of the tool – in this case the 10" diameter of the circle the handle makes as it goes around.

The smallest typical woodworking sweep is 6" – though I have seen a 4-1/2" sweep in a modern tool. The 8", 10" and 12" sweeps are the most common sizes, and the 14" sweeps and larger are less common, especially among furniture makers.

The standard size most woodworkers prefer is a 10" sweep. This size is a nice balance of speed and torque. If your work is more geared to smaller holes, say as a toolmaker, then you'll opt for a 7" or 8" sweep. If you build workbenches and bore a lot of big or deep holes, a 12" or even a 14" sweep will be ideal for you.

A Word About Ratcheting Mechanisms

Buying a brace with a ratcheting chuck has pluses and minuses. On the downside, a ratcheting mechanism adds considerable weight, which some people don't like. Plus, the ratcheting mechanism is usually complex and is the first thing to gum up or break, rendering the brace useless in some cases.

But there are advantages to consider. The ratcheting mechanism allows you to advance (or retract) the bit by moving the handle in only part of a circle. So you can drill a hole in the floor of a corner of a room with little fuss. And when you are swinging big bits, you can use the ratcheting mechanism so you are advancing the bit only in the area of your stroke that is easiest.

For example: Let's say you are boring a big hole horizontally into a wall or side of a cabinet. With a ratcheting mechanism you set the tool so that it advances only as you move the handle from the top of the tool's arc to the bottom. Then you can return the handle to the top of the arc easily with the ratchet engaged. This allows you to use muscles that are stronger.

The Buck Stops at the Pad

Finally, don't buy a brace with a pad that wobbles a lot. A little wiggle is OK. A pad that doesn't wobble at all is awesome. A tight pad contributes to the smooth and straight usage of the tool. Don't accept a wobbly pad. Move on to the next $5 tool.

Hand Drill or Drill/Driver

For driving bits that are 1/4" diameter or less, you have two good choices: a cordless drill/driver or a hand drill. Battery-powered drill/drivers mutate with the changing seasons. There's nothing that any book, magazine or website can tell you that is valid except for this: The batteries eventually go bad and cannot hold a charge – then it's usually cheaper to buy a new drill/driver. This economic legerdemain ticks me off to no end.

Hand drills, on the other hand, last forever. Sometimes called "eggbeater" drills, these drills spin fast because of the gears that power them. You turn the crank and the chuck spins. There's never anything more to buy.

Vintage hand drills are plentiful – millions were made and only thousands are still in use. Prices start at $5 for excellent user models and go up – way up – from there for fully restored, better-than-new hand drills. There are new modern-made hand drills that are wholly adequate but more expensive than vintage models that work just the same. So it's your decision: Take your time and spend less, or get it done and spend a little more.

Gearing

A good hand drill has a minimum amount of slop between the gear that spins vertically and the gear or gears that spin horizontally. Loose and wobbly gears result in lost effort. The tighter the gears, the less energy is wasted.

High-quality hand drills will have one vertical gear (the one you spin) and two horizontal gears (the ones that spin the chuck. Having two horizontal gears reduces the amount of lost energy in the mechanism. If you latch onto a hand drill with only one horizontal gear, don't fret. As long as everything runs tight you'll be fine.

Advanced Gearing

Some drills have a ridiculous number of options for spinning the chuck, especially those made by the North Bros. of Philadelphia. I have one drill from them, the No. 1530A, which has a gear shift with five positions.

In the position closest to the chuck, the drill operates as you would expect: Spin the wheel clockwise and you drill in. Counterclockwise, drill out.

Position two: Clockwise does nothing. Counterclockwise rotates the chuck to drill out.

Position three: Clockwise rotates the chuck to drill in. Counterclockwise does nothing.

Position four: This is hard to believe until you see it. No matter which way you turn the wheel, the chuck always spins to drill into the work. Crazy.

Position five: The gears are locked, like my brain when I tried to figure it out (downloading the 1908 patent papers didn't help much).

You don't need this sort of alien technology to make holes, but it is fun to show off at parties (Hey baby, wanna try position five?). You'll also pay a premium for the fancy gearboxes because collectors love them. And, as my father used to tell me, it's one more thing that can break, which is why I've owned so many cars with manual crank windows.

Instead, look for closely meshed gears that don't wobble or suffer missing teeth. Look for chucks that open and close properly – many are missing their spring, which makes the jaws a pain to operate. Missing paint, on the other hand, isn't a big deal. It usually means the drill has eaten a lot of wood. And as long as the gears aren't ragged out, it's a fine tool.

The Bits

Hand drills traditionally used a single-flute bit, and you can still find these in the handles of many hand drills. They work OK. I typically just use brad-point bits in my hand drills, which also work just fine. Pretty much anything up to 1/4" will work in the chuck.

One Last Note

These tools are plentiful. Hand drills were in every toolbox in America in the early 20th century. So you don't have to spend a lot of money to get a good one. All it takes is patience and diligence. Sometimes there are temporary shortages of these tools on the used market. Why? Because for some unknown reason – phases of the moon, it's the year of the rat, monkeys aren't good at science – they become temporarily scarce. My guess is that people don't sell them because they don't think they are worth trying to sell. So just wait it out and don't compromise.

Auger Bits

A complete set of auger bits has 13 bits from 1/4" up to 1" in diameter. They are numbered from 4 to 16, which is their diameter in sixteenths. A 4/16ths bit is 1/4". Braces can turn bits larger than the 1", but augers above this size are fairly uncommon in furniture shops. Many woodworkers use an "expansive bit" for large diameters, which is a lot like an adjustable Forstner bit.

When it comes to auger bits for a brace, it's hard to beat those on the

Wood chewers. Auger bits are mechanical marvels. When sharp, they allow you to chew through wood at an astonishing rate.

vintage market. Modern manufacturers have little reason to keep making the square-tanged bits for braces. And while you will find round- or hex-shanked augers designed for powered drills, these are more likely to slip in the chuck of a brace. These modern bits will work in an old brace, but they are not ideal.

Augers come in a dizzying array of designs; there are so many that I cannot even pretend to keep them straight. So I'm instead going to tell you about the characteristics of augers and what they do to the wood. Then, when you see that characteristic (e.g. a really coarse lead screw) you will know what it does (bores like crazy through softwood).

Lead Screws

So let's talk about lead screws first. These are the "Journey to the Center of the Earth" tips you find on augers and they are your best friend. They grab

The important bits. Here you can see the lead screw, the spurs and the cutting lip. Keep these sharp. Keep the spirals polished. Do these two things and you will be a human drill press.

the wood and help you pull the auger into the hole. If your lead screw is stripped or it isn't grabbing, you will have to bring superpower-like strength onto your brace to make it cut. So if the auger won't cut deeply, take a look at the lead screw.

Perhaps it is clogged with debris or caked in sappy wood. Soak the sucker in mineral spirits and it should come out easily. Some people use dental floss to clean their lead screws. Others use valve grinding paste (a technique pioneered by woodworker Tom Price). You start a hole with the lead screw, then put a blob of valve paste in it and drive the lead screw in again. Back and forth. Back and forth. Bring it out and you'll find the lead screw to be clean, shiny and sharp.

If it's not sharp you can touch it up with a fine triangular file. Be careful, but not too careful. After all, once you get good at finding auger bits you will be assaulted by bins of them at flea markets, all priced at 25 cents each. Really.

Once you get the lead screw clean, it's time to figure out what the heck it is intended for. There are, in general, coarse lead screws and fine lead screws. The coarse ones are for softwoods (just like coarse wood screws). And the fine ones are for hardwoods. I find that the coarse ones are more common and – if kept sharp – will do fine in hardwoods. So just keep them sharp and don't worry so much if you have coarse or fine lead screws. The only time the lead screw's design will give you trouble is if you use a fine lead screw in a really soft wood.

The Spurs

After the lead screw buries itself into your work, the spurs travel the circumference of the bit and score the rim of the hole you are trying to bore. If your spurs are dull (or ground away) then your hole will be rough.

The spurs should have a profile like a half of a football. They should be smooth and come to a thin point along the edge that scores the wood. Many auger bits have terrible spurs that have been nicked or blunted by the tool rattling around in a toolbox – hence the reason that augers should be stored in a box or tool roll.

The spurs are easily sharpened with a fine needle file. File the spur on the inside face only. If you file the outside of the spur, the spur will score a hole that is too small for the rest of the bit to enter. And... jam. So gently file the spur in a sweeping motion across its surface. When you raise a small burr or hook you can feel on the outside of the spur, you are done.

A sharp spur will do wonders for an auger. So purchase an auger bit file (they are cheap) or a needle file and get down to work.

The Cutting Lip

Augers will have one or two cutting lips. These lever up the chips between the lead screw and spurs and force them up the spiral of the auger. Having two cutting lips makes the auger cut faster, but you will need to use more downward and turning force to keep the tool chugging along.

No matter how many lips you have, they need to be sharp. Like the spurs, these can be touched up with a needle file or an auger-bit file. For the most part, filing the cutting lip is about removing as little metal as possible. If you change the cutting geometry of the cutting lip significantly, you are in for a world of hurt.

So when I file a cutting lip, I take gentle strokes from the bevel that is part of the ramp heading up the spirals. When I turn a burr over on the edge, I gently file that away on the side that faces the wood. This approach keeps the bit working for a long time, especially if you have two cutting lips.

The Spiral(s)

There are two (kinda sorta) dominant patterns of auger bits: the Irwin bit and the Jennings bit. An Irwin-style bit will have a central shaft and a single spiral that wraps around the shaft. A Jennings bit has no central shaft. It looks more like a piece of taffy that has been twisted to create a spiral.

These bits have different characteristics. Both work fine, but people tend to prefer one type or the other for some reason. I am an Irwin guy. I like the Irwins because they don't clog – there is lots of space between the spirals for making deep deep holes. The Jennings bits tend to clog for me, especially with pitchy woods, but they are more accurate because you have more metal guiding the bit through the hole.

No matter which way you go, here's a tip on the spirals: Keep them clean of rust and as polished as possible. I'll even press my spirals into a buffing wheel charged with rouge on occasion to keep them clean. Anything you can do to keep the spirals clean will help prevent them from jamming with chips.

And one last tip: If you can buy them in a box or tool roll, do it. If you can't, then by all means build them a box (you have the skills, no?) or spring for a tool roll. They will work a lot better if properly maintained.

Brad-point Bits

I wish I could say that brad points are brad points, and that you can just buy an inexpensive set, take care of them and everything will be fine. That is about as likely to happen as pooping a cupcake. Cheap brad points clog constantly, dull easily and snap as quickly as Bob Fosse.

You need good brad points, but you don't need a lot of them. Unless you make toys or mechanical movements that require close tolerances, you can do a lot of work with one fine set of seven bits: 1/8", 3/16", 1/4", 5/16", 3/8", 7/16" and 1/2". What makes a good brad point? Like any tool, it's the material, the machining and the finishing.

Bad brads are made from carbon steel that won't hold an edge for long. Good brads are made from high speed steel (sometimes they are labeled HSS) or some other more modern and exotic steel. You can't tell what kind of steel it is by looking at the bits with your eyeballs, but if the bit uses high speed steel the seller would be a fool not to point it out.

Cheap brads have rough flutes. Typically the manufacturer will try to fool your eye and paint the inside flutes black. Rough flutes encourage clogging. Heck they are dressed like they want some clogging (petticoats, pettipants, pettiskirts). When the bits clog, the chips hold heat,

The pointy bits. Brad points are fairly modern and useful bits. Buy a good set and you are set for life.

which even further reduces the life of the brad. I won't buy a brad with black flutes.

Good brads have shiny, polished flutes that will carry the chips up the bit and out of your hole.

Another aspect of the machining you should pay attention to is if the brad points have lips, sometimes called spurs, that score the outside diameter of the hole. These lips make for a cleaner entry hole – if they are sharp. I've bought some brads that were lip-less, and they made me grumpy.

Good brads will have two lips, sometimes ground with a slight negative rake. The negative rake in this case means they lean back from the cutting direction of the bit. This geometry makes a cleaner entry hole.

Good machining also means the bits are accurate in diameter. This seems a no-brainer, but I've encountered bits of an indeterminate size. No, they weren't metric.

The finishing of a bit also controls how much it clogs and how easily it dives into the work. Highly polished bits are easier to use. Period.

There is another way to separate the bits while shopping: price. Good sets of brad points are two- to three-times as expensive as economy bits. Don't even bother sorting through the cheap stuff. I've never found a dirt-cheap, well-made brad-point bit.

Awl(s)

There are different awls for different jobs. If you buy only one awl, I think it should be a birdcage awl, which is a totally stupid name. The name allegedly comes from its ability to make the holes to create wooden birdcages, á la the carpenter in "Moby Dick."

A lost land bird of strange plumage strays on board, and is made a captive. Out of clean shaved rods of right-whale bone, and cross-beams of sperm whale ivory, the carpenter makes a pagoda-looking cage for it.

OK, so you can make a cage with the tool, but I've never used it for that.

If asked by the International Awl Naming Assoc., I would call it the Screw-hole Awl or the All Awl.

The birdcage awl has a four-sided shank with sharp corners and a pointy pointy end. The sharp corners cut the wood, allowing the awl to beaver through a board (especially softwoods) with hand pressure and hand twisting. I use the birdcage awl for making holes in cabinet backs and for making the screw holes for cabinet hardware. I also use it like a scratch awl; the pointy end makes an excellent scriber in a pinch.

There isn't much to buying one of these. It should be comfortable, easy to grasp and the four corners of the shank should be crisp – sharp even. I have cut myself on my birdcage awl.

The other useful kind of awl is the brad awl. It is narrower, has a round shank and a screwdriver-like tip. This is useful for small, thin-shank nails. Some woodworkers prefer a brad awl because it doesn't really cut the wood fibers. It merely moves them aside. Then you drive the nail in and the fibers may (or may not) tighten up on your brad.

All about awls. A birdcage awl is the most useful awl for making holes.

The last kind of awl you'll see in a shop is a marking awl, which has a long and slender round shank with a tapered point. It is used for laying out lines on your work with the aid of a square. I've never been a fan of marking awls. I just do it all with a knife.

Dowel Plate and/or Steel Plate for Clinching Nails

A piece of steel or plate of iron is helpful to your efforts in the shop. Something – anything – that is at least 1/4" thick and perhaps 3" x 5" is all you will need for a lifetime of nail clinching and dowel skinning. Yes, I know "dowel skinning" sounds like something from the movie "Deliverance."

I'm not apologizing for that or diverting you from that thought. It is a lot like "Deliverance."

Let's first talk about the two things you want to do with this piece of metal. Then we'll discuss how to find one or make one. So what the heck is clinching? It's magic, man. The first time I clinched a nail I did a private little dance.

Clinching (sometimes spelled "clenching") is driving a long nail through two pieces of woodwork. The nail is so long that it goes through both pieces of wood. Its pointy tip is then curled back into the lower piece of wood. It's like a nail that is a big old fish hook. If properly applied, the fish isn't going to get away, and the two pieces of wood won't come apart.

There are a variety of ways to clinch a nail. Here are the two ways that I like.

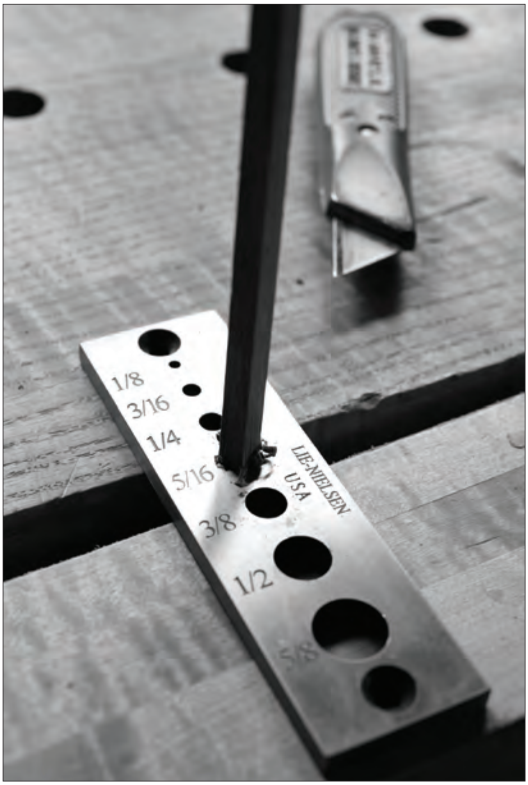
1. You drive the long nail through both pieces of wood. On the "exit wound" side of the joint you have 1/4" to 3/8" of the nail sticking out. So you place the assembly onto a steel or iron plate. Position it so the head of the nail is on the plate. Strike the tip of the nail with your hammer. It will curl into a "J" shape, which you can pound back into the wood.

2. The fast way to clinch a nail is to bore a pilot hole through both pieces then place the work on your metal plate. Put the pilot hole over the plate. Hammer the nail through the holes and into the plate. When the nail hits the plate it will rebound/curl over, and its tip will turn back into the work. Again,

it will look like a fish hook in the end. When the nail is driven all the way in, you can turn the work over and see that the tip of the nail is bent over.

Either way, this is a permanent piece of nail joinery.

The other thing you can do with this steel/iron plate is to turn it into a "dowel skinner" or "dowel plate." This is when you bore different-sized holes through the plate (you will need a friend with a drill press for this). Then you can beat slivers of wood through these holes to make rived pegs. These pegs can be used for pinning or drawboring mortise-and-tenon joints – an essential part of traditional joinery.



The easy way to make a "dowel skinner" is to buy one. A few companies make nice and hard plates that have accurately sized holes bored into them that are the correct and tapered shape.

Wait, the holes are tapered? Yes, in the best of all worlds the hole that you drive the wood through is, at the rim, exactly the size you desire: 1/4", 5/16", whatever. The plate below the rim is slightly wider in diameter so that when you push the entire peg through, it will easily drop out of the dowel plate/skinner.

You don't have to have a tapered hole. In fact, on the plate I used for many years the holes were straight, through and through. That works fine.

You just have to punch the wood a little harder through the last bit of the plate. It's not a big deal. But a dowel plate with tapered holes is a nice thing to have, like indoor plumbing.

You can make your own tapered holes if you find a tapered reamer (sometimes spelled "rimer"). These cone-shaped metal-cutting bits can ream out the underside of your holes in your plate to make them release their woody goodness more easily. But like I said, that's a luxury.

The holes you need in your plate are determined by your work. I like a set of holes sized from 1/4" up to 7/16" in increments of 1/16". This allows you to start with a slightly oversized peg and whittle it down to size with your plate.

In addition to using this plate for clinching nails and skinning pegs, you will use it for straightening cut nails that have been bent, and for swaging butt hinges. Yes, all manner of odd verbs.

"Swaging" is when you pound or press the two leaves of a butt hinge so they are parallel and touching. Usually butt hinges come from the factory so the leaves touch only at the tips when closed. If you installed the hinges with them in this factory condition you would end up with a monstrously huge and ugly reveal (gap) on the hinge side of your door or lid. Swaging the hinge shrinks this gap to an acceptable distance (1/32" or so).

You can swage a hinge by squeezing the two leaves together in a metalworking vise. Or you can beat the gap shut by placing one leaf on your metal plate and tapping the other leaf with a hammer. It doesn't hurt to have a second plate or chunk of metal to do this to help you tap the leaf properly.

A steel or iron plate has a dozen other uses in the shop, especially when you end up modifying hardware or tweaking some of your iron tools. It's like a mini anvil, actually, and will quickly become one of your secret weapons for dealing with all sorts of thorny workshop problems. Get one.

9 - ESSENTIAL SAWS

Handsaws are essential to a woodworker. Attempting to build furniture without at least a couple hand-powered saws will result in some foolish and perhaps dangerous operations with your power equipment.

Hmm. That doesn't sound convincing. How can I say it better?

Using a handsaw to cut along a pencil or knife line is one of the most liberating skills in the entire craft. You'll be able to do operations without a lot of jigs or test cuts. You'll be able to cut small pieces without removing a finger or launching a bullet into your shop. You'll be a faster woodworker because you won't be ginning up any silly setups on your power equipment. With handsaws, every cut is the same, whether it is straight, angled, compound or curved.

That's closer to the truth. The following is my handsaw Kool-Aid: If you can see the line, you can cut the line. Any line.

While this might seem like a skill that takes a lifetime to master, using a handsaw is simplicity itself if you own a good tool and you remove yourself from the cutting equation as much as possible. That sounds silly, I know. Yes, you are doing the work, pushing the saw forward and back. Yet, you are what causes a properly sharpened saw to stray off its line. You are what makes it cut past the baseline. You are the problem. Minimizing you and letting the saw do its flipping job is the name of the game.

So learning to saw is actually about learning not to interfere with your saw. The less you are involved, the better the saw cuts.

Let's first talk about the ideal saw. Then we'll describe the ideal sawyer.

The ideal saw has a comfortable handle, a straight blade and teeth that are sharp and well-set. Each of those characteristics can be described in nauseating detail (get me drunk and try me sometime). You don't need to worry about the subtle differences between 5° of hang or 3° of rake or fleam on the teeth. You can worry about all that stuff when you become a saw geek. Until that day, here is what you really need to know about saws.

This is not for you. The perfect saw tote for my hand might not be the same for your hand. To be sure, there are some totes that work for a wide range of users. And some that work for no one. But there are totes out there that will speak to you.

The Handle, or Tote

Many woodworkers overlook the tote, which is the way that you (Mr. or Ms. Sawyer) interact with the tool. Nothing could be more important. If the saw doesn't fit your hand, then sawing is going to feel like the Bataan Hand March.

A good tote feels like this: You can wrap your three lower fingers around the handle and your fingertips curl over to touch (or almost touch) your palm. Your index finger should extend out along the side of the tote. It shouldn't be curled in there with your other fingers.

A comfortable tote can be all smooth and organic or it can have some hard lines and curves. Either is fine. The problem comes when the curves are too extreme, making the tote hard to hold, or too shallow, making the tote feel as if you are holding a 1x2 in your hand. So you are looking for a magic middle ground that was well-known for hundreds of years, forgotten for about 40 years after World War II, and rediscovered by sawmakers at the end of the 20th century.

A good tote is like pornography. You'll know it when you feel it. So picking out a saw using a photo is difficult. It is always better to hold a saw, make some sample cuts and then get out your credit card. Doing this process in reverse is no fun.

Handles also have a "hang" angle. I could bore you to sleep with discussions of hang angle through the last few centuries (just ask my poor wife about this). Here, however, is what you need to know. "Hang" is essentially how the saw extends from your arm. A low hang angle is where your grip is 90° to the line of saw's teeth. With a low hang angle the cut is slower but easier to control in my opinion.

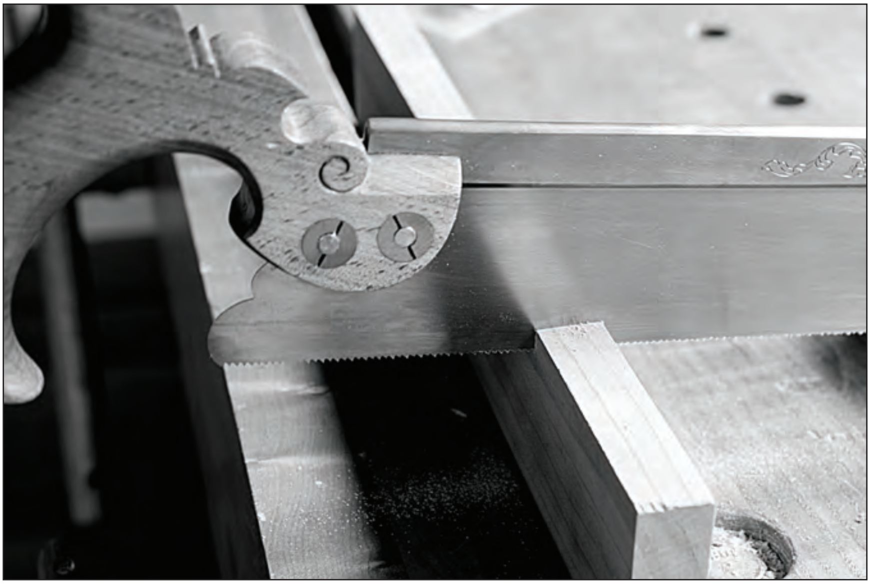
A high hang angle is when your hand is kicked up 25° to 45° off of vertical. This increases the aggressiveness of the tool, and allows you to stand more upright while sawing, but it can make the saw a little trickier to steer.

Hang angles were lower in times past. Nowadays most hang angles are fairly high. You can get used to either. I learned to saw using higher hang angles, and that's what I prefer.

Other things to look for with a tote: You should hold the tote with a relaxed grip, almost like you have a little mouse in your hand that you don't want to harm. When you have the tote in hand like this look at your grip. Are there white (or purple) areas where the tote is digging into your meat mitt? If so, the tote is too small. Even if it feels OK now, it won't feel so good after 122 dovetails.

The Sawblade

Above all, good sawblades are straight, as thin as is possible and shiny. Each of these factors affects how accurate and easy the saw is to use. Let's discuss each attribute.



Straight and narrow. Sawplates need to be dead straight to perform at the highest level. It also helps if they are free of rust and are thin. That will help the sawplate fly through the work.

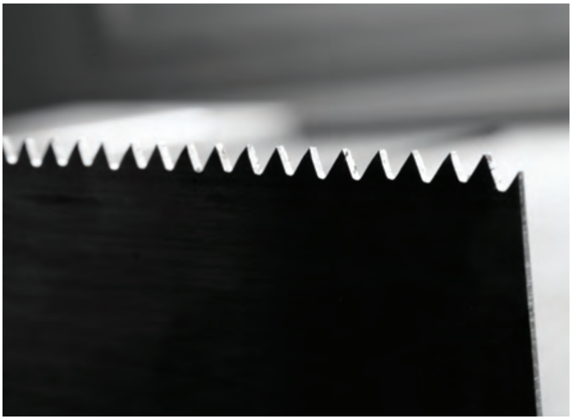
A straight sawblade is a must. If the blade is significantly kinked or overly bowed the saw will jam or refuse to track a line. A slight curve is acceptable and common on saws that have been sharpened on a machine. But it is an ever-so-slight curve – one you cannot detect while working.

To check the straightness of a sawblade, hold the toothline up to your eye and peer down it, much like you would check a long piece of lumber for wind or bow. If there's a problem, you'll see it. If the saw has a wavy blade, you can attempt this simple fix if it is a backsaw: Knock the back sharply against the bench or the floor. Sometimes the blade has come loose from its back, and that is what causes the waviness. Knocking it back into the back will sometimes straighten things out.

If this doesn't work, there are ways to straighten a blade that are outside the scope of this book. I'd consider professional repair as an option only for a special saw.

The thickness of a sawblade is key. The correct thickness makes the saw easy to push through the work and strong enough to stay straight when you use it. Too-thin sawblades kink easily. Too-thick sawblades are heavy and require more effort than necessary to push.

I can't tell you what is right for you. Japanese saw plates are thinner – .012" to .015" thick is common – because they cut on the pull stroke, which tensions and strengthens the blade. Western saws are thicker. A handsaw (a saw without a back) will typically be about .027" to .035" thick or more at the toothline and get thinner as you move up the blade. This taper grinding is intentional and reduces the amount of set required on the teeth.



Backsaw blades can be thinner – .020" thick is typical – because they are stiffened by the back. Saws that are thinner than this are easier for amateurs to kink. Saws that are thicker than .020" require a little more effort.

And a shiny blade is nice. It doesn't have to be polished, but a blade that reflects light is useful for a couple reasons. Corrosion on a sawblade slows your cut, for one. Also, you can use the reflection of your workpiece in your sawblade to ensure you are straight and true. Try it, and you'll immediately see how this works.

The Teeth

Western saws have triangular-shaped teeth. Their shape determines how they cut. If the tooth leans forward, then it will be more aggressive, but it will be harder to start the saw in the cut and keep it moving smoothly. If it leans back, the cut will be slower, but it will be an easier cut to start and maintain. This characteristic is called "rake." With saws, the more the tooth leans back, the more rake it is said to have.

The size of the teeth is important. If the teeth are too small, then the gullets between the teeth will fill up with sawdust and the saw will cut too slow. If the tooth is too big, then the saw will jam and the cut will be rough and splintery. How big should the tooth be?

There are rules of thumb, but there is so much flexibility that I think it's easier to see what the median is then adjust from there.

Dovetail saw specialized for drawers: 18-20 ppi (points per inch)
Dovetail saw ideal for carcases: 15 ppi
Carcase saw: 12-14 ppi
Tenon or sash saw: 10-11 ppi
Handsaw/panel saw for knocking down stock: 7-8 ppi
Handsaw/panel saw for fine cuts: 12 ppi
Ripsaw for furniture work: 4-5 ppi

These saws and these configurations are typical for dealing with stock between 3/4" and 1" thick, a thickness that is typical for furniture. If you deal with small boxes you are going to want saws with teeth that are finer than the above numbers. If you make large-scale furniture, then you are going to want saws with teeth that are coarser than above.

But let me say the following. And it is anti-intellectual. You can make almost any saw do any job at hand – within reason. A 15 ppi dovetail saw can do any dovetail chore. A 10 ppi saw can do any tenon chore. An 8 ppi handsaw can do almost any crosscutting chore. It's only when you do something ridiculous that you will get spanked.

I once taught a class where a student tried to cut tenon cheeks in 3-1/2"-

wide stock with a 24-ppi saw. He worked at it for a good long time. In fact, all the other students were done with four tenons and he was still on his first cheek. So there are limits.

One other characteristic of the teeth is the bevel on the front edge of the tooth. Pure rip teeth have little or no bevel – they are filed straight across. Crosscut teeth are filed with a bevel – called fleam – up to 20° or so. The fleam makes for a cleaner crosscut because it turns each tooth into a knife that slices the grain instead of pulling it up like a rip tooth.

And the final significant tooth characteristic is the "set" of each tooth. Set is how much each tooth is bent left or right. The set makes the kerf – the slot left by the saw – a little wider than the sawplate, which ensures that the saw won't jam in the cut when friction gets involved.

Most saws have too much set, which makes the kerf too large. A large kerf makes the saw harder to push and much harder to keep it sawing on a line. If you have too little set and wood that is a little moist, then the saw will jam about 3/4" into the cut. Game over.

How much set is good? Well if you work in dry hardwoods, then you need minimal set – about .002" on each side of the blade or less. That's about half of what is typical on saws from the factory.

How do you eliminate set? The best way to reduce the set is to learn to sharpen the saw with a saw file. Every sharpening reduces the amount of set in the teeth. After two or three sharpenings, you will have no set on your teeth and you will probably have to introduce some set before your next filing. The tool you need to do this is a saw-set, a pliers-like device that grabs one tooth and bends it away from you.

There is, actually, quite a lot to know about saw sharpening. So my advice would be to buy a good sharp saw at the outset and use it for a year or so until it becomes dull. Then start learning to sharpen. You'll be able to use your experience with your saw to ensure that your filing job gets you back to where you started or where you want to be.

A sawyer who doesn't know what a sharp, well-set saw feels like will have a hard time filing a saw to get to that point that they cannot describe or imagine.

So buy a sharp saw.

The following saws are the ones that belong in the tool kit of the hand-tool woodworker. With this complete "nest" of saws, you can do anything. But you might not want to do all these tasks. You might have a narrower set of chores in mind. So I'm going to describe what each saw does best so you can match it to the joinery you have in mind.

Dovetail Saw

Most woodworkers buy this saw when they decide to become "serious" woodworkers, whatever that is. Dovetails are only as difficult as you decide to make them. To prove this point we once took a fresh-out-of-school computer guy into the workshop on his first day of work at the magazine and showed him how to cut dovetails. He did not know enough to be intimidated. And he made a respectable joint.

What saw did he use? Who cares.

The point is that almost any sharp dovetail saw will work just fine for cutting dovetails. There are a few parameters that I think are important, but you can get away with cutting dovetails with a hacksaw. I've done it.

The teeth of a dovetail saw should be pretty small, somewhere between 15 to 20 ppi is typical. Many dovetail saws are filed for rip cuts, though a little fleam is OK. The blade should be thin (.02" thick or so) and the blade should not be wider than 3". A couple inches under the metal back of the saw is all you need at most. A wide blade is actually harder to control when you are making the angled tail cuts.

Most dovetail saws have a fairly short blade – 9" to 10" is typical. There are shorter dovetail saws, but I've never liked them. They're slow.

The handle of a dovetail saw is important. It should feel like an exten-

The small saw. Dovetail saws are used for dovetailing and for any other small joinery chore. Don't abuse it, however, because these tools are easy to mangle.

sion of your arm. There are a couple types of handles to consider. There is a straight handle. This is the style found on almost all Japanese joinery saws. With Western tools, a straight-handled saw is called a gent's saw. Some woodworkers love a straight handle. Other woodworkers, myself included, prefer a pistol-grip saw because it gives you feedback about how the blade is oriented. A garden-variety round-handled saw doesn't tell you when the blade is vertical or angled.

There are lots of other subtle factors that go into a dovetail saw. How heavy is the back? A heavy back can make the toe of the saw feel heavy and unbalanced. Does the width of the sawblade taper? Some dovetail saws have blades that are slightly narrower at the toe than at the heel. This feature takes weight off the toe, and it ensures you'll hit your baseline first on the side of your work that you can see.

People will get hung up on the "hang" of a dovetail saw, which is the angle of the handle compared to the toothline of the saw. Some prefer a low hang; some prefer a high hang. Either is OK.

There are exotic tooth filings. Progressive pitch is where the teeth start fine and get bigger toward the heel. This makes the saw easy to start but overall pretty aggressive (that's great for cutting thick material). Some saws will be filed with an inch of fine teeth before transitioning suddenly into coarser teeth. The reason is the same as for the progressive-pitch saw. And some custom saws will have crosscut teeth filed at the toe and rip teeth on the rest of the blade. This makes the saw easy to start and it lets you make that quick crosscut when removing the tail waste on the extreme edges of the tail board.

Other people add some rake at the toe to make the saw easier to start. And on and on.

For me, this stuff is distracting when you are trying to get started. Instead ask yourself this when you pick up a dovetail saw: Does it feel right? Are the teeth sharp? Is the blade straight? Those three questions will take you a long way. Later on you can become a saw geek if you like. For now, settle for being a user and not a data nerd.

Carcase Saw

Carcase saws get little love, though it is really hard to do a lot of hand-tool work without one. They cut tenon cheeks with surgical precision. They do all the short crosscutting chores on a bench hook, including cutting stuff to its final length. They cut pegs to length. They slice off the waste at the edges of a tail board, which determines if the most visible seam in your dovetail joint is gappy.

They cut shortish dados and sliding dovetails. They make all manner of notches for fine fitting. They excel at miters.

A razor-sharp carcase saw is a must.

When you pick one out, you should use a lot of the same criteria as when picking out a dovetail saw or any backsaw. The handle has to be comfortable. The blade has to be straight. The teeth must be sharp. But there are other little details about carcase saws that usually escape detection.

For accurate crosscuts. The carcase saw is a tremendous saw for no-compromise cuts when making furniture. It cuts smoothly and cleanly thanks to the fleam on its teeth.

Short or Long?

The length of the blade of a carcase saw can vary from 11" up to about 14". I've found that shorter saws are easier for learning to saw. Perhaps that is because they are close in size to a dovetail saw, which is what most people seem to use to cut their teeth. (Note to self: stop the saw puns.)

I like 11" saws, but I'm amazed at how rapidly the work gets done when I switch to 14". And I can do a lot more chores with a long saw. Here's one example: I prefer cutting dados by hand if I have only one carcase to make. I saw the shoulders of the dado with a long carcase saw and zip the waste out with a chisel and router plane.

With a short carcase saw, this process is slower. The gullets quickly choke with sawdust and slow things down. A longer saw has more gullets, so the work goes faster. There also is some more weight to the longer saws, which speeds you up a tad. And to me, the longer saws just seem easier to keep on line. This might be self-deception, but self-deception is quite useful in woodworking.

The length of the blade also is related to the style of the handle, which is a choice you must make when selecting a carcase saw.

Open or Closed?

Carcase saws are one of the few saws that are sold with both open totes and closed totes. An open tote is like a pistol-grip. The bottom of the handle is unattached to anything else. A closed tote has the bottom of the handle extending forward and connected to the cheeks of the tote. Sometimes this is one of the more decorative and curved parts of the saw and can be carved in the shape of a lamb's tongue.

Open totes and closed totes feel a little different to certain hands. Some people with beefy hands don't like closed totes because they pinch the pinky finger.

But the most important difference between the two totes is their strength. A closed tote is stronger than an open one. And in general, you will find open totes on shorter saws and closed totes on longer saws. This should make sense. You have to push more weight with a longer saw, so a stronger tote will last longer.

Some very early saws of all sizes had open totes, even full-size handsaws. The fact that a lot of these long-term survivors also have repaired totes should be a clue to you.

Carcase Teeth

Most carcase saws have 12-14 ppi. Usually the smaller saws have smaller teeth, and the bigger saws have bigger teeth, just like in the animal kingdom. Don't get too worked up about the ppi of your carcase saw; all the saws between 12-14 ppi can make smooth finish cuts. It just takes more practice with the longer and coarser saws than it does with the shorter and finer ones.

Mystery saw. It's used to cut tenons, but which part of the tenon: the cheek? The shoulder? The answer: You can use it for either depending on how you file it.

There are two things I have noticed with the teeth that bear mentioning. One is the fleam, which is the bevel on the front of each tooth. A typical fleam angle is about 20° for a carcase saw. Adding some more fleam, up to about 5°, can make the saw cut noticeably smoother, but the trade-off is that the teeth will need to be sharpened more often.

The other thing I've noticed is that hand-sharpened carcase saws always perform better than machine-sharpened ones. While this rule is true for all saws, I notice it most with the carcase saw. The small irregularities that arise from hand-filing the teeth seem to make the saw all the sweeter and smoother in the cut.

Tenon Saw

The tenon saw seems so aptly named. You use it for cutting tenons. But which part of the tenon? The cheeks of the joint? That's a rip cut that will require a fairly coarse saw for large work. The shoulders perhaps? Those would best be done with a saw filed for crosscuts with some fleam filed on the front of the teeth.

I don't have ironclad answers here, but I do have some old books and a lot of tenons under my belt.

Early woodworking books don't make a real distinction between saws filed for crosscut and those filed for rip. In fact, there are a fair number of historians, especially those at Colonial Williamsburg, who think that early saws were all filed for rip. So the saws they use in their reproduction shop are filed that way. Other woodworking historians don't buy that.

The truth is that the tenon saw of the past could have been filed for rip, crosscut or something between. Some early books discuss the tenon saw being used for crosscutting the shoulders. A big handsaw or panel saw ripped the cheeks. That works. Other sources have the cheeks being cut with a tenon saw and a carcase saw being used to saw the shoulders. That works, too.

So you don't have to take a stand on this issue. Since the middle of the 19th century, crosscut teeth – sometimes called "fleam" teeth – have become common. You can use fleam or not. I find fleam useful, so I use it.

Here's another historical fact worth pondering: Early tenon saws were larger than the typical modern tenon saw, up to 18" long. And the blades were wider – as wide as 4". Big saws are actually easier to keep vertical than smaller ones. The reason is that the tenon saw has a higher "moment of inertia." When you balance a weight in the air (such as the heavy back of a saw), it's easier to feel when everything is perfectly vertical and maintain it when the weight is higher up.

So a deep blade on the tenon saw allows you to get the sawplate perfectly vertical. And a shallow blade with a lower moment of inertia (such as on a dovetail saw) allows you to angle the tool easily for the tail cuts without the back interfering with your cut, tipping you too far one way or the other.

This little fact could be evidence that tenon saws were used for cheeks because you want vertical cheeks. Or it could be evidence that you wanted dead-vertical shoulders.

More About the Blade

Because the tenon saw is so big, it's easy to make the leap that the blade should be thick. The opposite should be true. Early tenon saws had relatively thin blades, about .026" at times. This makes the saw more fragile and sensitive to heat, but it also makes the saw easier to push in thick stock.

Thick tenon saws are much harder to use for me. I've used some that are .032" and thicker. No matter how sharp they are, it's a lot of steel to push through a big tenon cheek. Thin tenon saws, on the other hand, float through the work, even with the same filing as a thick one. But the thin blades can heat up and temporarily warp.

Tenon Saw Teeth

Tenon saws typically have 10 or 11 ppi. When they are used for sawing tenon cheeks they are filed for rip cuts. Some woodworkers have trouble starting a tenon saw, especially when they are first learning to saw, because the teeth are big. Eventually you learn the trick to starting any saw, which is to take all the weight off the toe of the blade. I tell people that you are trying to make the blade hover over the work as you begin your forward stroke. Some people understand that advice. With others, I tell them that starting a sawcut is like landing an airplane. You want a gentle touchdown.

But until you get that idea burned into your brain and hands, there are some little saw-filing tricks you can use as a crutch. Some tenon saws are filed with progressive pitch, so the teeth begin small at the toe and get bigger toward the heel.

Another option is to give some or all of the teeth a few degrees of rake. Filing the teeth so they lean back as much as 5° from vertical makes the saw easier to start (but slower-cutting). You can also add rake to only the teeth at the toe, which will make the saw a little faster.

If you file your own saws, these modifications are dirt-simple to do. If someone else files your saws, you are going to have to make sure they know what your goals are. A typical saw-sharpening business, which handles everything from lawn mower blades to carbide table saw blades, probably isn't going to do a good job for you. If those shops sharpen handsaws, they probably just clamp them in a saw-filing machine, run the machine, then give them back to you. You need to seek out someone who files by hand.

Or, better yet, learn to file your own saws. It's not that hard, and a tenon saw is the easiest backsaw to sharpen. The only saw easier to sharpen is a full-size ripsaw.

When it comes to tenon-saw teeth, the one question I get all the time is, why aren't they coarser? After all, if you are sawing a 3"-wide cheek, it seems like a 10-point saw would be too fine.

The truth is that even when you are sawing a 3"-wide cheek, you can do it without filling the gullets if you go about it the right way. The right way to saw a tenon is to work diagonally down the cheeks. Start on the corner and make a shallow slit all along the end grain. Then angle the saw so you are advancing along both the end grain and the edge grain.

By working diagonally, you won't fill up the gullets because you very rarely will be cutting through the full width of the material – that will happen only when you hit the baseline of your tenon. So you saw diagonally one way, turn the material around and saw diagonally down the other side. Finally, you remove the waste that remains. The waste is triangle shaped, so once again you won't engage the full width of the material until you hit the baseline. And that's a good time for

Angles are essential. The trick to sawing accurately and not choking the gullets is to saw the tenon at 45°. Three cuts at 45° ensure the teeth will rarely engage the full width of the work.

the sawing action to slow – you don't want to cross your baseline.

I didn't come up with this technique. It's ancient. It's brilliant, and it allows you to use a 10-point for cuts that should – at first glance – require a coarser tool.

Panel Saws

The first saw I learned to use and sharpen was a Craftsman handsaw, a 26"-long piece of junk that my father still owns. The tote is a blister machine, with sharp edges and a hand hole that is entirely too large. But even this terrible example of toolmaking is capable of great deeds. My father built an entire shed-roof house using this saw and just a few other tools.

So even if you cannot find that mint Disston No. 12 that haunts your dreams, almost any brand of saw will do the trick if you learn to sharpen it and conquer your fear of altering the tool to suit your hand and your work.

The primary job of these large, backless saws is to knock stock down to a manageable dimension so you can work on it with other tools. These saws can be used for finish cuts at times, but mostly, the larger saws are the heavy-lifting brutes of the hand-tool world.

These backless saws have blades that range in size from 20" long up to 30". That is quite a range, and it's easy to be bewildered and paralyzed by all the sizes and filings out there. So let's talk about what is common for the furniture maker. That's a good place to start.

The most common-size saw has a 26"-long blade, so if you are looking for a vintage tool, that's the size you're most likely to find. These saws are designed to be used on a sawbench, a knee-high flat-topped horse that allows you to hold the workpiece with your legs and saw comfortably without striking the shop floor with the toe of the tool. While furniture makers would use these long saws, the reason they are so common is because they were favored by house carpenters.

Saws designed for making furniture are naturally smaller than those meant for making houses. And for a furniture maker, the saw of choice is a panel saw. These saws look like a slightly stunted handsaw or ripsaw. They typically have a 20"- to 24"-long blade, which makes them easier to fit in a tool chest and use around a shop. They also are lighter so they can be pressed into use on work that is clamped in a vise on the bench.

The short blade makes them slower than a long saw. But because you aren't cutting all the wood for a house, it's not as big a deal.

So a panel saw is handy, if you can find one on the used market – they are somewhat rare – or you can afford a new one.

Like all saws, panel saws need to have a comfortable handle, a straight blade and proper teeth. Finding a comfortable handle and a straight blade is no different for a panel saw than for a backsaw. However, the teeth are coarser, so we should talk a little about the number of points per inch that are good for making furniture-scale cuts.

One, Two or Three?

If you build furniture, you realistically need no more than three panel saws.

Get one panel saw for rip cuts that is as coarse as you can handle, a 7-point or rip-tooth panel saw is typical. This will rip everything but the thickest stuff. And if you find yourself staring down a 10'-long slab of 8/4 hard maple, you might just consider a band saw instead. I did.

As odd as it sounds, this is the first panel saw I'd purchase. Here's why: You can use this coarse saw for what it was intended: ripping. And, with some care, you can also use it for crosscutting. You have to leave yourself a little extra length when you crosscut with a rip saw. A ripsaw can indeed make an efficient crosscut, but it will chew up the wood, particularly the face and edge where the sawteeth exit.

If you leave a little extra wood, you can remove the tearing by shooting the end with a plane. It's more work than shooting the end of a board after cutting it with a crosscut saw, but all in all I think it's the better way to go. Trying to rip a board with a crosscut saw is a lot more work than shooting the end of a board that was crosscut with a ripsaw.

Give it a little thought, and I think you'll agree. A ripsaw is the correct first panel saw. Besides, when you sharpen it in short order (and sharpen it by hand), the imperfections of your technique will create the randomness that will make it cut more smoothly and cleanly. Hand-filing a saw always introduces some fleam.

So what's the next saw? Well, my inclination would be to buy a 7- or 8-point crosscut saw and call it a day. A saw like this will handle most of your crosscutting chores and, once mastered, will leave an excellent finish that will require little additional dressing.

This saw can be pushed to do both coarse and fine crosscutting chores, whereas a fine saw can do fine work alone. So unless you are itching to start a saw collection, don't even bother with a fine 12-point panel saw. Just skip to the next section on flush-cut saws. You are finished.

Still reading, huh? Well the truth is that a lot of 12-point crosscutting saws are out there. Craftsmen of yore liked them. And on the occasions when I use them, I like them, too. They are not a necessary piece of equipment that pays the rent, feeds the kids and rubs the feet of your spouse. But they are nice to have. And even if you don't seek them out, they will eventually find you.

People who use saws tend to become a magnet for them. One day I got a call from a reader who had obtained about 20 saws at auctions that he didn't want. If you go to auctions and wait until they start selling the box lots, then you know how this happens. The auctioneer throws a bunch of random stuff in a box. You want only one thing in the box, but you have to buy the whole box to get it.

Bottom line: Saws are common filler in box lots.

So this guy had heard I liked saws and asked me to take them off his hands. I did. And that's why I'm the proud owner of a Disston D12 and D100.

Flush-cut Saw

A flush-cut saw is a tool that you could probably squeak by without. You can saw things almost flush with a backsaw then plane or pare things flush later. But flush-cut saws are cheap and handy to have. And they are easy to master once you realize that they all have one fatal flaw that isn't in any manual.

Here it is: Though flush-cut saws are supposed to have zero set to their teeth (which allows them to do their job) the truth is more complex. Flush-cut saws – at least every one that I have encountered – have set, but only on one face of the saw.

Why is this? My guess is that the sawmakers create the flush-cut saw by doing all their filing from one side of the blade. Then they don't set the teeth. The result is that one face is completely free of set and burrs. The other face – which was the face where the file exited – has some burrs and upset teeth. The result? Flush-cut saws are usually set to only one side of the blade.

This can throw some woodworkers. The saw is inconsistent. Sometimes

Useful when understood. Flush-cut saws are supposed to have no set, so they won't scratch the work. Truth is, they have a little set on one side and no set on the other. You need to get this straight in your head before making critical finish cuts.

it works great. Other times it chews up your wood and the saw dives into the work at the wrong moment. If you can figure out which face has set and which does not, you will be ahead of the game.

I do this by observation, with my fingers and with test-cuts. Then I take a fat Sharpie marker and write on the side that is set: "This Side Up." With that mark (and I have been known to engrave it onto the sawblade with one of those cheesy security engravers), you know everything you need. Never place the set teeth against your work and you will never mar it. You will be able to saw pins and dowels and whatnot flush with little effort. You will amaze your friends.

Push or Pull?

As with all modern saws, you can choose between Western-style teeth that are pushed though the work and Eastern-style teeth that are pulled.

While I like Western teeth, this is one case where I prefer the Japanese teeth. Perhaps this preference is rooted in the fact that all (all!) the Western flush-cut saws I've used have been a royal waste of steel and rosewood. Please don't bother buying one of these unless I have totally renounced my writings or there is the Second Coming.

There are many tooth configurations out there for flush-cut saws. Virtually all of them are crosscut-tooth tools, though there are a few rip-tooth saws available. Almost all of your flush-cutting chores are handled with immense aplomb by a crosscutting saw that cuts on the pull stroke.

And because the tools cut on the pull stroke, the work goes remarkably quickly and easily. So much so that some woodworkers get lazy until they get "bit" by one of their own saws.

Teeth from the East

One last thing about the teeth: Don't try to apply the same rules of Western teeth to Eastern teeth when picking a saw. Pull saws have teeth that are shaped more like needles than triangles. As a result, they are more fragile than Western teeth, but they have much deeper gullets. Because of these deep throats, you can use a finer-pitched saw for coarse work. So the ppi of the saw isn't as critical with pull saws as it is with Western saws, except at the margins when dealing with really thick stock.

There is actually a great deal to learn about the teeth on pull saws. But because my name is Schwarz – an Axis-power name to be sure, but a Western Axis power – I'm going to focus this book on Western teeth. Still, here is a short primer on things to look for when buying a pull saw.

The color of the teeth. Really? Yes, really. Consumer-grade Japanese saws have teeth that are discolored. They are kind of black and rainbow-y, like an oil slick. This discoloration, which occurs only at the toothline of the saw, is a result of the induction-hardening process. This is where a high electrical current is passed through the teeth, which makes them extremely hard. Hard is good because they will stay sharp for a long time. But hard is also bad because they will be too hard to resharpen. A file will only skitter over the surface.

Saws with induction-hardened teeth face a grim future. Once they have finally dulled the saws are usually thrown away and replaced. If the owner is particularly industrious (read: cheap or environmentally sensitive) the blade will be cut up and used to make thin scrapers. And if the owner is a full-on cheapskate, he or she will somehow figure out how to shear the induction-hardened teeth off the sawplate and cut new teeth.

This is a lot like taking an ailing hamster to the vet. Or sending a Bic lighter back to the factory for repair.

If the teeth aren't that darkish color, then they will get dull sooner but can be resharpened. Yes, you can resharpen your own Japanese teeth using feather files. Most people, however, send the saw back to Japan for a metate session where the saw sharpener tunes the saw to match the user's work.

Of course, when you are talking about a couple hundred dollars to tune a saw that cost less than $50, you can understand why some woodworkers just pitch their dull Japanese saws. I'm not saying it's the right thing to do. It's not. But the economic equation here is hard to deny.

The Handle

All the flush-cut saws that I've seen have a straight handle. Some are ribbed rubber, some are solid wood, still others are the traditional Japanese rattan-wrapped handle. Honestly, I have yet to find one that is better or worse than another in any meaningful way. Perhaps I'm just not attuned enough to the East, but they all feel like holding a stick. A good stick, but a stick.

Coping Saw

The coping saw is unloved, unheralded and under-appreciated. Yet as far as

I'm concerned, I wouldn't enjoy woodworking as much without one.

When I started woodworking at about age 11, my father forbade me from using machinery. So the only two saws I had were a panel saw with a blue plastic handle (which would not kerf a limp biscuit), and the Craftsman coping saw that I despise.

I've used that tool for everything. Perhaps things that I shouldn't: sawing game that we shot in the backyard, deli meats. As a result, I am attached to the form.

However, I wonder why no one has ever tried to improve upon the modern, barely usable form of the tool. Almost all of the coping saws I've handled have been, to put it mildly, a waste of steel and wood atoms.

Why does this saw stink? Where did it come from? Here are some answers I have dug up from my library.

Some Evidence

The coping saw is a D-shaped metal frame saw that is obviously descended from the early Roman forms, which feature a thin blade that is held in tension by a wooden frame and string.

The frame saw came into use for marquetry, and as this art form reached its zenith in the 17th and 18th centuries, all its tools became specialized and refined. André Roubo dedicated an entire volume to its practice, "Le Menuisier Ébéniste." And in plate 292, Roubo shows what he calls a "marquetry saw," which is a metal frame saw that tensions the blade without a string or toggle arrangement. At first glance the saw looks a lot like what we call a coping saw, though the blade does not rotate in its frame and the throat of the tool is quite deep.

The other tool development that seems related to the coping saw is the development of similar D-shaped frame saws that were used to cut metal or exotic materials, such as jeweler's saws, the hack saw, the piercing saw and the ivory saw. These saws show up in 18th-century plates (such as Roubo's) and become fairly common in the 19th century.

So by the 19th century here's what we have: Marquetry saws with deep throats (sometimes deep enough to warrant an NC-17 rating), and frame saws with shallow throats used for cutting dense materials. The coping saw appears to be a tool that bridges these two forms.

First, what's the deal with its name? "Coping" is a 17th-century term (thank you, "Oxford English Dictionary") that refers to the top course of bricks or blocks on a wall. If the bricks were beveled to help shed rain, they were called "coping blocks." So the term "coping" was clearly related to a beveled edge.

In modern woodworking, coping can refer to removing the bevel from a mitered piece of moulding in order to fit two pieces of moulding in an inside corner. The term coping is also used concerning doors that have their inside edges moulded. The ends of the door's rails are "coped" so they nest against the moulding on the door's stiles. So "coping" is actually the act of cutting the negative shape of the moulding on a piece.

The first references to a "coping saw" appear, as best as I can tell, in the 19th century in books and tool catalogs. The first U.S. patent for a saw that quacks like a modern coping saw is an 1883 application from William Jones – earlier patented frame saws look to me like marquetry saws with deep throats.

That 1883 patent called the tool a "saw frame for a jeweler's saw." The following year, C.A. Fenner patented a mechanism that allowed the blade to rotate in the frame (it's amazing in its gizmosity). He called it (most unhelpfully) a "hand saw."

And in 1887, Christopher Morrow patented a tool called a "coping saw," which uses a blade-tensioning mechanism more like a wooden bowsaw. After that point, the term "coping saw" crops up regularly in catalogs and patent filings. By 1900, the saw is everywhere.

The inexpensive tool became a ubiquitous part of the carpenter's tool kit. It also became a tool that was central to the manual training movement of the late 19th century (what we call shop class). The coping saw was used by students to cut out all manner of toys and decorative objects. And many books, manuals and patterns devoted to coping saw work appear in the late 19th and early 20th centuries.

Used Everywhere, But Not in the Same Way

Though lots of people big and small were using the coping saw, there was (and still is) a major disagreement about it: Should it cut on the push stroke (like most Western saws) or the pull stroke (like most Eastern saws)?

The earliest source I could find that addressed the matter directly was "Trade Foundations," a pre-vocational textbook from 1919 published by the Guy M. Jones Co.

"Most coping saw work is done with the work resting horizontally on the bench and held in place with the left hand. The teeth should point toward the saw handle. When the vise is used to hold the work, the saw teeth should point away from the handle."

When I looked to other writers who were traditionally trained, their opinions seemed to support this early view. Robert Wearing, in "The Essential Woodworker," shows a coping saw cutting on the push to remove waste between dovetails (the work is in a vise). He states that coping saws work on the push, except on a horizontal saw table when working with thin material. Then it should cut on the pull.

Charles Hayward, in "Tools for Woodwork," states that coping saws are generally used on the push, but there are occasions when the blade should be reversed.

Among the modern writers, many (with the exception of Aldren A. Watson) seem to prefer to use the saw on the pull stroke only.

In "Carpentry & Construction" by Rex Miller and Glenn E. Baker, the authors state that the teeth should point toward the handle. "This means it cuts only on the downward stroke."

In the "Band Saw Handbook," Mark Duginske writes that the coping saw is used only on the pull stroke. "Because the blade is cutting on the pull stroke, the blade tensions itself."

So with all this divided opinion, I think it's best to file this debate away with the other unanswerable questions.

The Weak Modern Form

Now we come to the real reason I've been digging through all this old paper. Modern coping saws are – for the most part – flawed. But they weren't always this bad.

What's wrong with them? Mostly it's the mechanism that allows you to rotate the blade. I've never had a coping saw that could hold its setting – no matter how much I tightened the frame or even how many lock washers I added to the saw.

After a certain number of strokes, the blade goes into wind – meaning the blade rotates more (or less) at the toe than at the heel. This warping makes the saw hard to control and is one of the reasons why some dovetail savants use a jeweler's saw and tweak the blades manually with pliers.

Me, I'm done with jeweler's saws, which I suspect are made only to sell the easily snapped blades.

So it sounds like we should get the CAD jockeys to jump on this problem, right? Maybe not. As I was browsing through my old tool catalogs and patent filings, I found all manner of mechanisms for fixing the problem of blades in wind. Some of the solutions were downright silly (see the Fenner patent). Others, including the ones used by Simonds, Jones and Millers Falls, were simple and robust.

In essence, the saws had eight detents to lock the blade at eight different angles. When you see one of these catalog drawings, you'll start looking for an old saw made like this. I did.

The Essential Coping Saw

A coping saw has to be able to do just a few things really well. Most modern ones fail on all three points. Here's my short list. A coping saw should:

1. Hold the blade in tension so you can use it either on the pull stroke or the push stroke.

2. Allow the blade to be rotated 360° and hold that position during a cut, both at the toe and the heel.

3. Have a comfortable handle for pushing or pulling the tool.

Present & Future Tense

The heart of a coping saw is its tensioning mechanism. A low-rent saw makes the blade twang like a wet noodle when you pluck it in the frame. If the blade doesn't ping like the high "E" string on a guitar, it will buckle as you are cutting and wander off line. You can force a saw to tension the blade by bending the frame open. But if the frame is made of low-quality steel then it quickly will forget that tension.

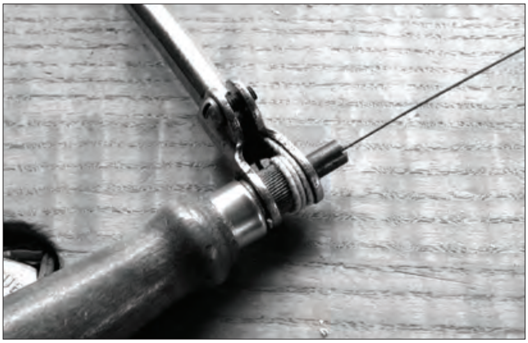
A good coping saw frame should never need to be bent open in order to function. I have 100-year-old coping saws (some that were unused, some that were used heavily) with frames that are still working perfectly. Design and materials are everything.

As far as design goes, look for a saw that will allow you to over-tension the saw. If you can bottom out the tensioning mechanism with ease, you probably should pass on the saw.

As far as materials go, I don't have much advice for you. Some materials don't have as much memory as others. Some will gradually assume a new shape. Others won't. I usually fall back on the reputation of the maker. If the saw can be over-tensioned and is from a quality maker (such as Millers Falls, for example), then I'll take a chance on it.

Rotation

You need to be able to set the blade at positions other than 0°. Most saws will do that. But will they hold that position as you make a cut? That's sadly uncommon. Modern saws especially allow the blade to twist and turn at the toe and heel, so what you end up with is a spirochete-looking blade and a wandering cut.



The string is the thing. The Jones patent coping saw has a string through the frame that links the toe and the heel of the blade. They rotate together as a result. It works, but there is a bit of a delay.

Some quality saws have detents at four, six or eight positions. This is a nice feature, if the detents will actually hold the blade in position and if the tensioning mechanism is up to par.

Other saws don't have detents. This is not a deal-killer, however. If the saw has a robust tensioning mechanism and a sturdy frame, then the tool will work brilliantly.

And finally, there is a small class of saws that has a rotation mechanism that doesn't lock. I know of two old brands, the Jones and the Fenner, that have a mechanism that keeps the blade in line, but it also allows the blade to rotate freely as you are sawing. These saws are complex and rare. You'll immediately spot them because of their extra gizmos: The Jones saw links the toe and heel of the blade using a string that's snaked through the saw's frame. The Fenner uses chain links and sprockets. These are interesting saws, though an evolutionary dead end. But if you find one on the Galapagos Islands, feel free to pick it up.

Handle

The handle of a coping saw is more than just a stick. In fact, if the handle is just a stick then you might not be happy with it over the long term. Why? Because the handles can be optimized for both pulling and pushing with just a small alteration. Or the handles can follow the pattern of modern coping saws and be optimal for neither.

A good coping saw handle will have a small swelling up by the ferrule or the frame (not all saws have a ferule, which is a band of metal around the handle). This swelling is quite useful. When you are pushing the saw, you place your thumb and index finger behind the swelling to help you push the tool without gripping the handle fiercely.

When you are pulling the saw back, the swelling is an excellent place to put your fingers to pull the saw back toward you as you cut. In other words, the swelling is ideal, whether you orient the blade for pull-cut action or pushing.

In addition to the swelling, consider the material. Is the handle made from wood or plastic or worse? Wood is ideal. It is warm and can be easily shaped to fit your hand. Plastic or rubber handles might feel good at first, but they can get slimy or tough as you break them in. Wood, on the other hand, gets better the more you use it.

One last detail on the handle: If you use the saw a lot with it cutting on the pull stroke, don't be surprised if you pull the handle off the saw. This has happened to me a couple times. The best solution is to drill a hole through the ferrule and handle and drive a small steel pin through the hole. File the pin flush.

Good gaps. A skip-tooth blade has smaller teeth and a big gullet. This gives you a smooth cut and allows you to work in thicker material.

Coping Saw Blades

If you have made it this far into this section on coping saws, then you are obviously enthused or incarcerated. So I present to you a discussion on coping saw blades. Yes, it is time to get another beer.

The first thing to say about coping saw blades is that the garden-variety blade is useless. Yes, this is shocking. What can we as regular citizens do about this scourge upon our planet?

There are good blades, but they are not at your home center. In the year 2011, there was only one maker of quality coping saw blades, so I will break from the original intent of this book and recommend a brand: Olson. The company that makes this blade is the only one in the early 21st century that deserves mention. If you are reading this book in the future when coping saws are made well, then I encourage you to investigate your options.

Coping saw blades are inexpensive. The cheap and crappy ones are about the same price as the good ones. What's the difference between the two? Crap blades are stamped. So the teeth are bordered by a big burr. Nice blades are ground. These ground blades don't have a big burr. This keeps them tracking straighter in my experience.

What about the number of teeth per inch? Coping saw blades come in coarse and fine configurations – 18 to 24 ppi is common for a fine blade. The interesting wrinkle with these blades is that you can get some that are skip-tooth blades. So an 18-ppi skip-tooth blade actually has 9 ppi but uses an 18 ppi-sized tooth. The result is a big old gullet between the teeth. So you get a fine and smooth cut, but you can work in thicker materials than you expect with that blade configuration.

An 18-point skip-tooth blade is an ideal configuration for a joiner. You can remove waste between dovetail pins or tails quickly but without ripping out the bone. The saw is also easy to start and cuts smoothly. Why aren't handsaws ever configured this way? I don't know.

Types of Blade Ends

For the most part, modern coping saw blades have pins that bisect the blade stock. The pins hook into the blade-holding mechanism and allow you to tension the frame tight.

There are two other systems you should be aware of. Some blades are pin-less. The end of the blade is just straight and flat. But these aren't coping-saw blades. They are jeweler's saw blades. A jeweler's saw is like a coping saw, but it has a smaller frame and can be adjusted to grip blades of different lengths. It also uses pin-less blades. This is good and bad. The good: You can clamp almost anything in the saw frame. The bad: No matter how hard you try, you will never get a saw that can tension a blade as well as a pin-based coping saw.

There is another, older, blade system with coping saws that you should be aware of. You will encounter this type of blade if you start diving into old models of coping saws. These blades have a small circle made from the blade's body that allows you to tension the saw. I don't know of any modern maker that makes these blades, though vintage, well-made blades are widely available if you are willing to dig.

What do they look like? Like the eye of a big needle. Imagine if you took each end of a blade and bent it around to make a circle on each end of the blade. These small circles of steel drop into the blade-holding mechanism of the saw.

What is important to know is that some saws will accept both these old-school circle-ended blades and the newer pin-style blades. Some will accept only the old blades.

You can modify the pin-ended blades to fit in the old saws. You have to grind down the pins a touch – I use a disc sander because I am a daredevil. If you are a sworn officer of the safety police you might consider snipping the pins with some nippers (see the section on striking and fastening tools). But wear those safety glasses. Snipping the tip of a pin into your eye is no fun.

The Ideal Sawyer

With a good nest of saws in hand, you are ready to saw. Or, as I mentioned before, you are ready to abdicate the task to the saw. Here are the rules I follow as I saw. I remind myself of them as I work because it is always tempting to wrest control of the sawing action away from the tool.

- Use a relaxed grip. Grip the saw only enough to keep the tote under control. When you tense your hand and arm muscles they pull the saw left or right depending on the muscles you use. Imagine the saw handle is a little bird. You don't want to crush it. You don't want to let it get away.

- Extend your index finger out. Always. Even if the tote allows you to cram your entire ham in there, don't do it. You will saw straighter with your index finger pointing down the sawplate.

- Always work so your elbow swings free. Unfortunately, the United States is a land of plenty and we are not the rail-thin sawyers of our country's rural past. This is the nice way of saying that our guts get in the way. If your arm rubs your torso as you saw, put down the French cruller and reposition yourself so your arm swings free.

- Think: tripod. Proper stance encourages straight sawing. Your non-dominant foot should point toward the bench. Your dominant foot should extend back and be about 90° to your other foot. This stance stabilizes you. If you need to lean over to see your knife line, try not to bend your back. Instead, scoot your dominant foot back to lower your entire body. If your bench is at the right height, you should be able to minimize bending over – always a good thing in every situation in life.

- Always work so you can see your line. If you cannot see the line, how can you expect to follow it?

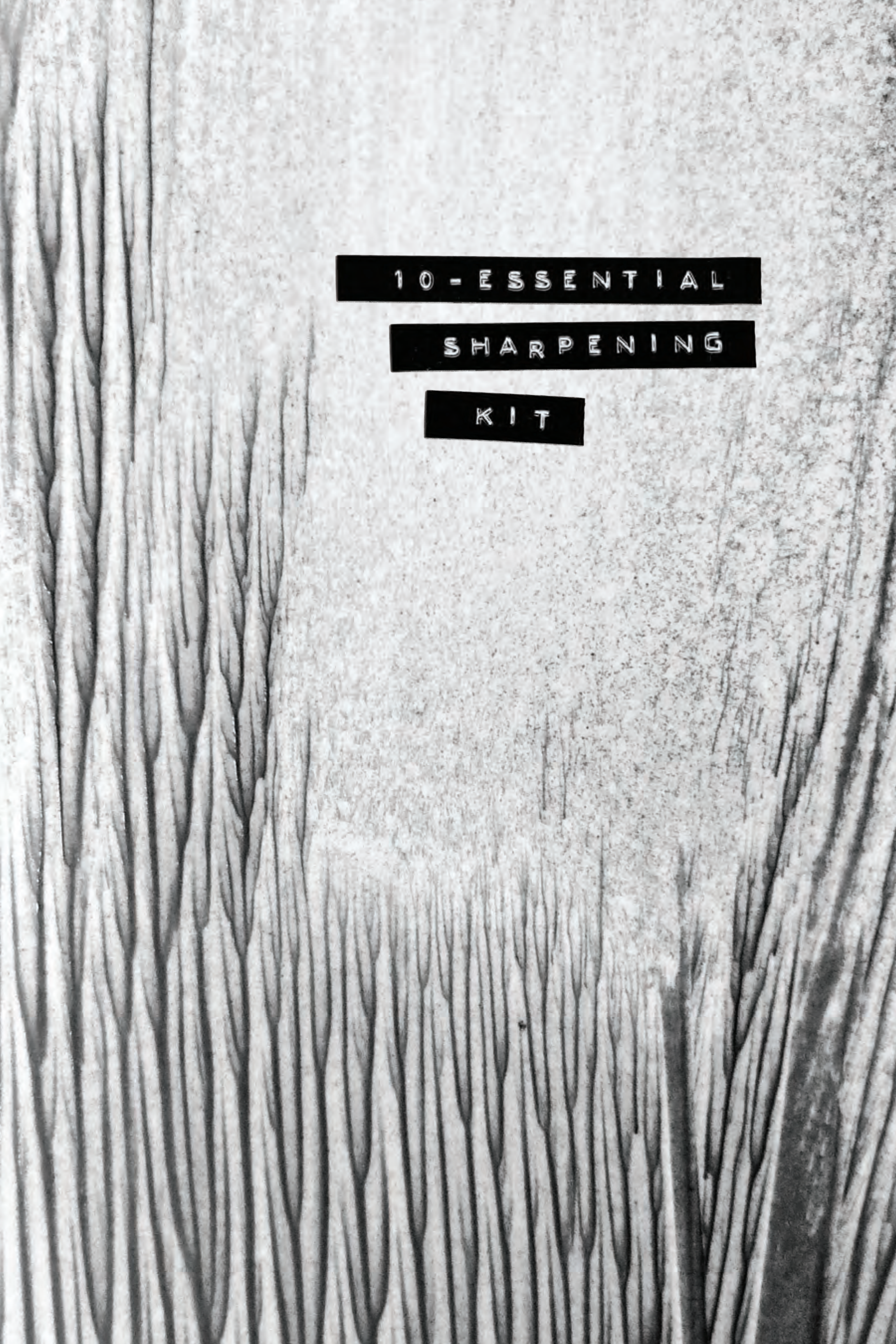
- Use minimal downward pressure. Allow the saw's weight to carry the cut. Downward pressure brings more hand and arm muscles into the equation. And tensing those muscles will steer the saw left or right.

- Imagine the saw as longer than it is. This will fool you into using longer strokes, which will allow you to saw faster and wear your teeth evenly.

- Whenever possible, advance on two lines. For example, when crosscutting a board, saw diagonally through the thickness until you have reached the bottom face of the board. Then focus on sawing the line on the top face. Your diagonal strokes will guide the saw as you move through the board.

- Always work right against a line. Never saw a certain distance away from a line. You will never become a good sawyer if you don't try to snuggle right up against the line. Instead, you will become a good chiseler as you pare your way to your line.

- Lifting the saw a tad on the return stroke helps clear your line of sawdust.


10-ESSENTIAL
SHARPENING
KIT

The simplest thing in woodworking – getting a keen edge – has been made impossibly complex by the crazy number of sharpening stones and guides in catalogs and stores. Anyone can learn to sharpen a passable edge with about 30 minutes of personal instruction. But after that incredible experience, you are then set on a never-ending road of making your next edge better than your last.

Thanks to my job at the magazine, I have set up and sharpened more tools than anyone I know. I personally have taught a few hundred people how to sharpen. I sharpen every single day. Yet, my edges still improve every year.

When you pick a sharpening system, think of it as an old-fashioned wedding. You should devote yourself to one system. Spurn all others. Try to explore the system you picked in immense detail. Take good care of your sharpening medium. Keep it clean. Keep things true. Keep everything ready to go at all times. Do these things, and the rewards will be immense.

Jumping from system to system, jig to jig, is the road to ruin. Every sharpening medium (waterstone, oilstone, ceramic, sandpaper, diamonds) is different, and each reveals its secrets over time.

So here's the big question: Which system should you choose?

Answer: It doesn't matter.

Every system works. I've used them all and each is a trade-off between sharpening speed, maintenance and expense. There is not one system that is fast, easy to maintain and cheap. People will tell you that there is (because they are married to their system), but they are blinded by devotion. And I'm OK with that.

Though the sharpening systems might seem wildly different, they all have three functions in common. They are used to grind, hone and polish your tools. Grinding is when you remove a lot of metal quickly to fix an edge that needs repair or needs to be taken back to a factory state after lots of sharpening jobs. It is infrequent and generally avoided.

Traditional & durable. I started on oilstones, so I am fond of them and their cutting characteristics. They are a little slow, but I can be that way at times, too.

Honing is where you usually begin your sharpening job. Honing removes the old worn edge and starts a new edge. Honing also is the stage where you typically change the shape of an edge. You might add a slight curve to your block plane blade. Or you might straighten out the edge of a chisel that was a little crooked from your last honing.

Polishing is where you refine the honed edge until you get to whatever insane grit level you desire. The more polish you impart, the more durable the edge – but there is a definite point of diminishing returns. For some woodworkers, one polish stone is all they will ever need their entire lives. For others, they will need five or six polish stones to be truly happy.

So let's discuss the trade-offs for the common systems. There are lots of other systems out there, but for the last 100 years or so, these are the ones that most people have used.

Oilstones: Slow, Steady & Durable

For the last century or so, most Western woodworkers have used oilstones. These stones occur naturally, though most oilstones these days are manufactured using a process that bonds the grit together like making a brick.

Oilstones are lubricated with oil. And almost any oil will do, from WD-40 to mineral oil to 3-in-1 light machine oil. The oil is a plus because it won't rust your tools and it (usually) evaporates slowly. So you can squirt and go and not have to constantly re-apply oil.

Oilstones cut slowly compared to most other sharpening systems, so you are going to need to use more strokes to hone and polish your edge. But the upside to the slow cutting action is that the oilstones also wear slowly, so you don't need to flatten the stones very often. In fact, some woodworkers report that they have never flattened their oilstones.

That has not been my experience. Oilstones work better if they are flat. They cut faster because flattening them exposes fresh abrasive and prevents them from glazing. And flat stones are predictable. You'll never have to remember where a low spot is that could ruin an edge. I flatten my oilstones with a diamond plate, which is fast and efficient.

If you adopt an oilstone system you will need to purchase a way to grind your tools (such as a high-speed electric dry grinder), plus one stone for honing and at least one stone for polishing. The coarsest oilstone typically is the "Washita" stone. It's not quite coarse enough for grinding. Most users choose a Washita or the next finer stone, the "soft Arkansas," stone for initial honing. The "hard Arkansas," "hard black" and "translucent" stones are used for polishing.

If you find natural stones, which are nice and made from novaculite, you will find some variation in the stones. I've owned hard black stones and translucent stones that were similar.

Or perhaps I just wasn't prepared to see their differences at the time I had them.

It's just polish. Many woodworkers find stropping mysterious. Like the strop compound is some magic paste. Stropping is simply polishing at the very fine spectrum. The strop compound is just an abrasive.

I love oilstones and used them for many years. They require no setup. You just squirt them and go. The oil helps you fight rust. They don't ask for as much constant maintenance. Price-wise, they are the cheapest of all sharpening systems. You will be hard-pressed to wear out a set of oilstones in a lifetime. Most people can pass them on to their children. So buy the best stones you can find and spread their cost out over your lifetime. A $50 stone is $2.50 a year over 20 years. A $100 stone is $5 a year over the same period. The difference is one cup of fancy coffee a year.

When I used oilstones, I had a soft India stone that was man-made for honing and a hard black Arkansas that was a natural stone for polishing. After polishing on the hard black stone, I would apply one final and traditional touch: I would strop the edge on a piece of hard leather charged with a green polishing compound.

Stropping

Stropping and oilstones go hand in hand. The reason for that is that the finest oilstone (the translucent) is still a little coarse for some tools. So to get the keenest edge, you have to strop. Stropping isn't some weird magical process.

It's just a fine polishing process. The strop itself is like the stone. The polishing compound is a waxy abrasive with very small abrasive particles, as small as 1 micron, that impart a nice polish on the cutting edge.

When you strop, you work the tool in only one direction: pulling the tool toward you. If you push the tool forward, the sharp edge will likely dig into the leather, damaging your strop.

Waterstones

Woodworkers have lubricated some stones with water for centuries – sandstone grinding wheels have always been lubricated with water in every corner of the world. But the Japanese had quarries of stones that could impart an insane polish when lubricated with water. So that country has become the center of the universe for natural and man-made waterstones.

Like the tapped-out veins of oilstones, natural waterstones are fairly rare these days. So most woodworkers buy manufactured waterstones.

The chief advantage of waterstones is that they cut faster than oilstones and practically every other abrasive I've used. How fast? The honing process on a waterstone can be as brief as three or four strokes. On an oilstone, I would expect to make 20 or 30 strokes to cut a fresh edge. For a hobbyist woodworker this difference isn't all that big a deal. But for a person who sharpens as much as I do, the cutting speed is noticeable.

The chief disadvantage of waterstones is they dish out quickly. I flatten my waterstones after every use to ensure they are always flat (I use a coarse diamond plate). If you let your stones get out of flat you are asking to really botch an edge. And because waterstones cut so quickly they will mung your edge with amazing speed.

Waterstones use a cheap and common lubricant – water. And that would seem to be an advantage. But water is the compound that encourages iron and steel to become rust. So you have to keep an eye on the water and wipe down every tool with oil after sharpening. Any slip of vigilance can have nasty brown and crusty consequences.

Waterstones also have a wide range of abrasives, from the very coarse to the insanely fine. If you want only one sharpening system in your shop, waterstones are the way to go.

Soak or No?

In the world of waterstones, there are two broad categories: those that have to be soaked for 10 minutes before use and those that don't. Some brands of waterstones don't ever need to be soaked. You just squirt some water on and go. But with many common brands of honing stones, you need to soak the stones for 10 minutes to saturate them so they won't immediately absorb all the water. And a dry waterstone will quickly become choked by the steel filings.

The honing stones that don't need to be soaked are significantly more expensive, but they are convenient.

Polishing stones of any brand can be soaked if you like, but many do not need it. You can just squirt some water on them and get down to it.

The Waterstones You Need

If you want to grind your tools with waterstones, you'll need a #200-grit stone, which will chew up your steel and go out of flat when you look at it cross-eyed. This stone is usually as thick as a house brick because you'll tear through it when grinding. I'm not fond of grinding on waterstones and am married to a grinding wheel, but some people are frightened by grinders.

For honing, you need one waterstone that is between #800 and #1,200 grit. Most people get a #1,000-grit stone. Some people add a #2,000-grit stone to their sharpening regimen, but I think that's a waste of money and steel. Remember: The more you stroke, the more steel you remove. My goal is always to remove the least amount of material. This also reduces the wear on my stones, which means less flattening chores for me and that means my stones will last longer.

For polishing, you need at least one stone that is #4,000 grit or finer. If you have one polishing stone, you'll pick something between a #4,000 and #8,000 grit.

If you decide you can afford two polishing stones, the typical pick is to get a #4,000 and an #8,000- or #10,000-grit stone. And if you want three polishing stones, you'll go all the way to something like a #30,000-grit stone, which can cost as much as a monthly car payment.

My system has #1,000-, #4,000- and #8,000-grit stones. I think that above #8,000 is a waste of time and money. The fine polishing grits seem to take a lot of time and effort to produce results. I'd rather spend that time banging out a mortise.

The Cost of Waterstones

Waterstones are a mid-range sharpening system. Though each stone costs about the same as an oilstone, the waterstones wear out fairly fast. I've burned through three #1,000-grit stones in the last 15 years, and I'm on my second #4,000-grit stone. The finer polishing stones last a lifetime.

The stones of hobbyist woodworkers could last a lot longer, unless they sharpen every day like I do.

Though I'm not happy about blazing through my waterstones, I do like how fast they cut. I can correct edges, establish cambers and polish an edge to perfection in three minutes flat. Then I am back at the bench.

I bought a nice set of waterstones that didn't need to be soaked – ever. I did this because I travel with my stones and don't want them leaking their water all over my tools. And sometimes I need to pull the stones out and begin sharpening immediately. There's no time to soak.

Hobbyist woodworkers don't have those constraints. So consider this as you choose your system. If you are willing to take a little more time, then waterstones that require soaking are a perfectly good choice.

Flattening Oilstones & Waterstones

To keep your stones flat you can go one of three routes. You can use your stones to flatten your stones. This works, but it does wear your stones more quickly and can be slow. Plus you really have to clean your fine stones so you don't get coarse abrasive embedded in them.

The next option I mention only so you'll know to avoid it. Some woodworkers flatten their stones using wet/dry sandpaper stuck to a flat surface. This is ghastly expensive. You might get only two flattenings on a sheet of paper before it's trashed. Unless you own a sandpaper factory, burn your money on something else.

The third option is to have a dedicated stone for flattening. I prefer a diamond stone (use the coarse or extra-coarse variety). You can get decades of use out of one of these diamond stones if you take care of it.

Note that you'll also see dedicated flattening stones, which usually are made using a brick-like abrasive. I've tested three or four of these during the last 15 years and have yet to find one that was flat or stayed reasonably flat. They seem like a good cheap option. I agree that they are cheap.

Grinding

Grinding is a dirty and necessary business. Most beginners don't want to think about grinding until they need to tackle it. But my advice is to get comfortable with the process. Buy a 25-cent chisel at a garage sale and practice grinding it. You might ruin the tool. But you will learn to grind.

The most common way of grinding tools is to use an electric dry grinder with 6"- or 8"-diameter wheels. The salesman will try to talk you into a more expensive slow-speed grinder ("They won't cook your tools!"). That's crap. Any grinder can cook your tools. I'd rather have a fast grinder (3,450 rpm) and a wheel that breaks down quickly. This creates a fairly low-temperature grinding environment.

Easier than it looks. A hand-cranked grinder takes a little skill to use, but you'll be an expert after a few edges. The vintage grinders accept modern wheels and can go anywhere.

So pass on the slow-speed grinder. In fact, your best bet is to buy a used fast-speed grinder made in the United States before 1980. These old cast iron behemoths are cheap ($20 is a fair price), have lots of iron so they don't vibrate, and they run so smoothly that it can be difficult to tell that they are spinning.

My grinder is a 1970s 6" Craftsman model that probably has another 50 years of life left in it.

So buy an inexpensive old grinder (make sure the shaft runs true before you hand over your money) and take the money you saved and blow it on some primo grinding wheels. I use #80-grit wheels that are highly friable, meaning they break down quickly. Wheels that are friable also run cool.

It works. I'm not overly fond of sandpaper grinding. But if that's what it takes to get you grinding, then do it. Learning to grind is essential.

Too-hard wheels will cook a tool in an instant. And they will glaze over, too.

Don't forget to get a tool to flatten the wheel, which is excellent routine maintenance. This tool can also shape a wheel into a thumbnail profile so you can grind moulding planes with hollow irons.

I also have a hand-cranked grinder that I adore. It takes a little more skill to learn to use. I crank with my dominant hand and grind with my off-hand. But it's not all that hard to learn. And it is dang fast. I can cook a tool with a hand-cranked grinder.

I don't know of any modern hand-cranked grinders being made, but they are plentiful on the vintage market.

Still Not Grinding?

Try as I might, it's hard to convince some people to get an electric or hand-cranked grinder. They live in fear of this spinning demon. It will eat their tools or worse. If you simply are horrified by the thought of a spinning grinder, allow me to offer up this alternative: a flat granite floor tile topped by blue belt-sander paper.

This grinder has a cheap initial cost. I paid $7 for a piece of 12" x 12" granite flooring. Add to that about $15 for the #80-grit alumina zirconia belt-sander paper, which is usually used for shaping nasty stainless steel. I cut up the belts and stuck them to the granite using a spray adhesive.

This gives you a low-cost and safe entry into the world of grinding. But the long-term cost is insane. Even good paper loads with filings (waterstones, on the other hand, break down under pressure, which exposes new abrasive particles). So you might need to replace the paper once or twice a year, which makes the 20-year cost somewhere between $300 and $600. A used grinder and wheels will have a much lower 20-year cost.

When the sandpaper clogs, it creates areas that are sharper than other areas. As a result, it's easy to ruin an edge by not paying attention to where you are sharpening on your plate of sandpaper. When the sandpaper loads, it creates areas that don't cut fast. As a result, you can get some weird and inconsistent results when your paper is loaded.

But sandpaper is a decent way to sharpen tools. In fact, some people swear by it.

Sandpaper Sharpening

Sandpaper sharpening has strong appeal for some woodworkers, so I'm not going to knock it. OK, I lied. Sandpaper sharpening works, but it is crazy expensive over the long run. Good sandpaper costs money. There also are powered sandpaper systems where the motor turns a sanding disc or belt. These are also more expensive in use than a grinder and stones.

The only time I recommend sandpaper sharpening is for people who aren't even sure if they want to learn to sharpen their tools. Or for people who are afraid of an electric dry grinder and won't buy a hand-cranked one.

The chief advantage of sharpening with sandpaper is the low up-front cost. You can get started with just a few sheets of adhesive-backed sandpaper and a flat surface. But you need to change your sandpaper regularly. How often depends on the type of tools you own and how much you sharpen. If you sharpen only a couple chisels, you'll get a lot of use out of a sheet. But if you sharpen plane irons, chisels, knives and carving tools, you are going to be lucky to get through a project without trashing a sheet of abrasive.

Aside from the long-term cost, my chief beef with sandpaper as a sharpening medium is that it clogs easily with filings and the paper wears in spots. When stones wear, you will end up exposing fresh abrasive. With sandpaper, the abrasive gets worn down or away.

So you need to replace your paper often to get consistent results.

If you've read through all my warnings above and the system still appeals to you, then by all means use it. It is your money and your craft. If that's the case, here are my recommendations for the grits that are useful.

For grinding, some #80-grit alumina zirconia sandpaper is the way to go. See the earlier section on grinding for a brief discussion of this. For honing an initial edge, look for paper that is about #600 to #800 grit if you buy paper graded under the CAMI system. If you buy sandpaper graded under the European FEPA system, that's P1,200 to P1,500 grit. If you buy it graded by micron, that's somewhere between 20 and 7 microns.

For polishing, choose a grit or two on up to #2,000 grit (CAMI), P2,500 (FEPA) or .3 to 6 micron. Some woodworkers will choose to use a lot of small steps up in grit with sandpaper, but I don't see the use.

I mention this to caution you when mixing systems. If you mix different brand names of paper or waterstones, you could hone yourself in circles. One brand's #800-grit stone might not be the same as another brand's. I've had #800-grit stones from one brand that were finer than the #1,200-grit stone from another.

Oil Can or Plant Mister

To lubricate your stones, I recommend buying a pressurized plant mister for waterstones or a pump-activated oil can for oilstones.

The plant mister (available for cheap in the garden section) pressurizes with a dozen pumps then you can spray a fine mist for a long time. It's much nicer than using an old Windex bottle.

And old oil cans are just awesome. I pick them up at tool meets and on the Internet for little money. These are vastly superior to the plastic pump bottles that some rust-preventative oils come in.

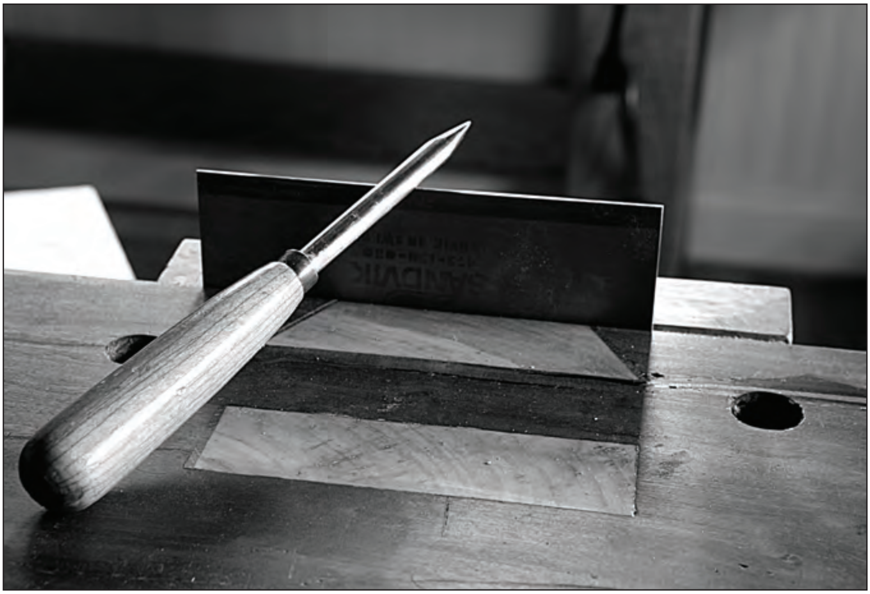
Burnisher

If you are going to sharpen your card scraper you need a burnisher. Some old texts will pooh-pooh this notion and tell you to turn the burr on you scraper with the shank of a screwdriver or the back of a gouge or chisel.

This was great advice back when scrapers were made from softer steel. Nowadays scrapers are harder stuff. So while you might be able to turn a burr using a hard and polished gouge, you will find it vastly easier with a dedicated burnisher.

Burnishers need to be much harder than the scraper, smooth and polished. These three characteristics allow you to morph the metal corner of your card scraper into a perfect little hook that is smooth, not jagged and broken.

When I buy a burnisher I really want just one thing: A money-back guarantee. The quality of these tools is all over the place. Some are soft. Some are



Magic wand. A hard and polished burnisher is essential for sharpening modern scrapers, which are harder than vintage ones.

deeply scratched. But you won't know from a catalog description or photo. So make sure you can return it.

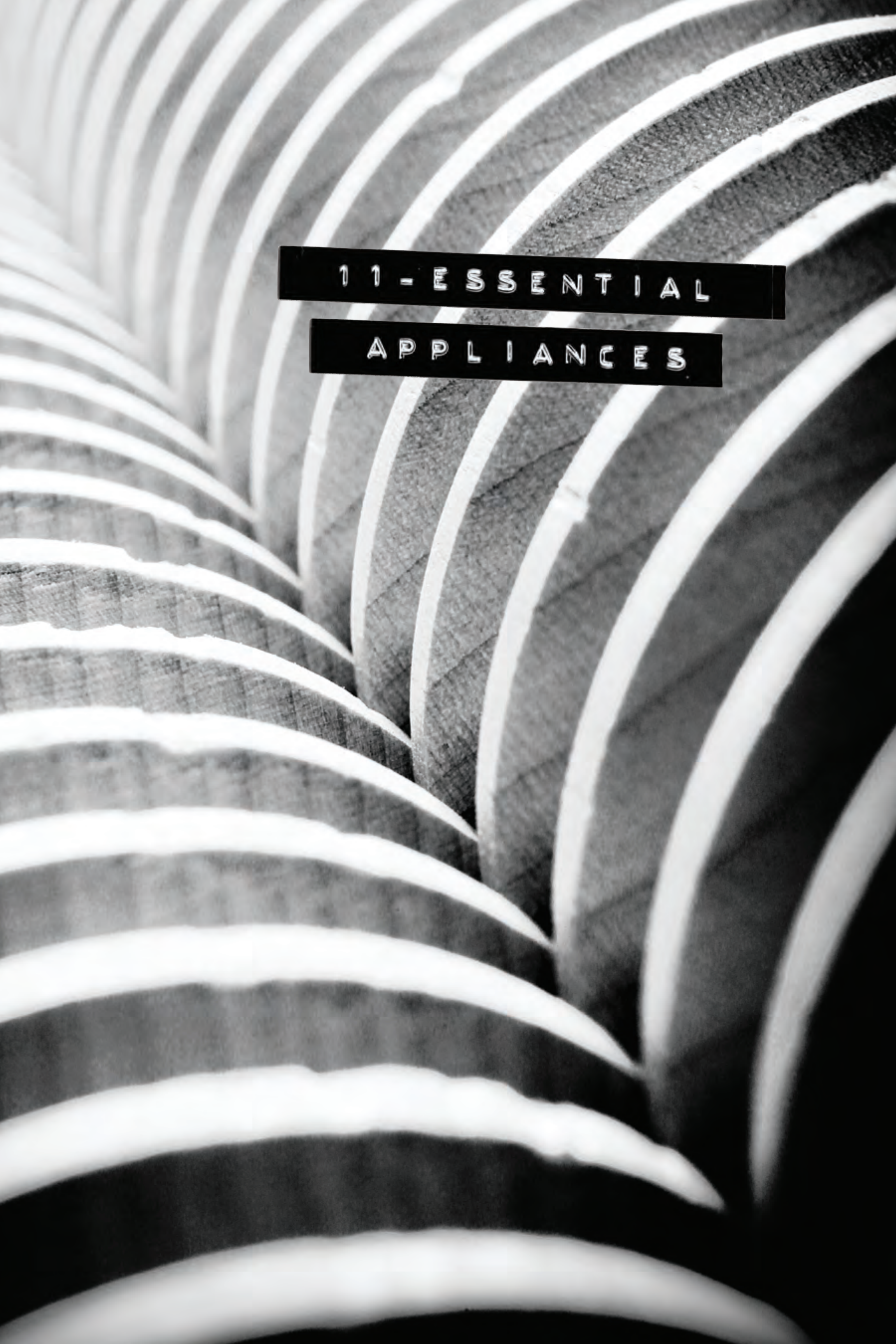
Some people are going to get their panties in twist about the profile of the burnisher. There are round ones and oval ones, football and triangular profiles. Honestly, I couldn't care less about the profile. A tight curve will turn a hook with less pressure. A flat curve will turn a hook with more pressure. You can get the same results by varying the pressure.

'Up-cycled' Burnishers

One final word on burnishers made from discarded carbide rods from industry. These can be awesome – carbide can easily test out at 90 on the Rockwell "C" scale. And they can be crap because they are pitted or scratched.

If you find burnishers for sale that are made from recycled medical equipment or whatnot, don't dismiss them. But do ensure you can get your money back if they aren't smooth or polished enough to do the job.

11-ESSENTIAL APPLIANCES



The first time I heard the expression "workshop appliances," I laughed. I immediately thought of a washing machine for dealing with shop rags or some such. I had always called the little shop-made tool-helpers "jigs" or "fixtures." And perhaps those names are correct in one sense or another.

But the proper name for the things that assist your hand tools are "appliances." Get used to it. Use the word. It's our word.

There are entire books on appliances that you should purchase, such as Robert Wearing's "Making Woodwork Aids & Devices." It's out of print right now, which is a shame. But there are plenty of used copies out there. Do what you have to do to get one for your library.

One single chapter in a book such as this cannot capture everything there is to know about the critical appliances that add accuracy to your hand tools. So I am going to describe what each critical appliance does and give you some tips for using it. How to build the appliances should be obvious, though I've made statements such as that before and regretted it.

Also, this is a list of the appliances I think that every shop should have. You could spend your entire life building little gizmos for the shop – some tinkerers do just that. Start with these appliances and work with them before you start building any more.

But before we get started, let me share with you a little rule about building appliances that was explained to me when I was just getting started. No appliance should have more than 10 pieces nor should it have an integrated dial caliper. If you consider making an appliance that violates these rules, perhaps you should consider becoming a home-shop machinist instead.

The Bench Hook

The bench hook is the first workshop appliance you should build. It can be sawn out of one piece of wood – that is so awesomely Old Testament – or you can make it out of three pieces of wood: the platform, the hook and the fence.

What is beyond essential? The bench hook is so fundamental to accurate sawing that I think it should be one of the first things you build – even before your workbench.

The bench hook is what makes your crosscutting saws work correctly. You cannot hope to do much crosscutting work in your face vise without some serious work-arounds (or learning to saw with your off-hand). Plus a bench hook allows you to work much faster than when you try to clamp things in a vise because the bench hook is designed to exploit both gravity and the way the saw works.

The saw cuts on the push stroke. This pushes the work against the fence and the hook against the bench. Gravity does the rest. You also can use bench hooks for mitering if you kerf in a miter in the fence.

Bench hooks can be almost any size. I like to make mine 5" or 6" wide and have the platform about 8" long. The fence and the hook are about 1" wide, so that gives you a working surface of about 5" x 7".

The trick to using a bench hook is to incorporate your own mass into the equation. Your off-hand should grip both the work and the fence, pinching them together, if possible. If the work is too wide for this, then rest your hand on the edge of the stock nearest you.

Focus all of your weight on the front edge of your work in an effort to immobilize the stock. Your dominant hand – the one holding the saw – needs to swing free and almost float above the work. It's a weird kind of Jungian duality. One hand exerts as much pressure as possible. The other hand exerts as little pressure as possible. Together they create the perfect environment for accurate sawing.

Sawbenches

The second essential sawing appliance is a pair of sawbenches, which are used with handsaws, ripsaws or panel saws. These aren't sawhorses.

A sawbench is a knee-high platform with a flat top that is at least 5" wide and usually about 30" long. The height and surface area of the top allow you to restrain your work with your knees to rip and crosscut it without clamps.

Your little helpers. Sawbenches are another appliance I cannot live without. They are knee-high platforms that hold your work for your handsaws and ripsaws. And you build on top of them.

There are 100 ways to build a sawbench. It can be boxy or semi-pyramidal. It can even be tool-chest shaped. The point isn't the particulars of how the sawbench is built. The point is how it is used.

Say you are right-handed and you want to crosscut a piece of stock on your sawbench. You approach the sawbench. Your right knee should butt up against the work. Then you bend your left knee and place it on top of the work. You can then position the saw to kerf in your line.

Properly positioning your knees is the key to using a sawbench. With your knees boxing in the work, it will remain immobile as you slit it.

This allows you to focus on tracking your knife line rather than thinking about the work jumping around.

Miter Box

The third essential appliance for your saws is a miter box. This can be a simple affair: three pieces of wood nailed into a "U" shape with kerfs cut into the walls to guide your saw in cutting mouldings. I worked with a miter box like this for many years. I wasn't fond of it.

Yes, it did an OK job, but the box quickly ragged out after a few dozen miters, leaving me to tweak each individual miter or build a new miter box.

Then I bought a used metal miter box for $5 or $10 at a flea market. It was a Millers Falls Langdon miter box with a huge miter saw (26" long).

Once I sharpened the saw and lubricated the parts, I cut some miters with it.

I was in love. The Langdon box was more accurate and durable than my shop-made wooden device. And a metal one barely cost me more than making one from wood. It is a robust and un-fussy tool. And unlike the powered sliding compound miter saws I've tested and used in our shop at the magazine, this saw was humane. I know, that's a weird word. But if you have used a powered miter saw much you know why it has earned its nickname: the chop saw. It's hard to do precision work with the tool because it was designed for carpenters.

Using one of these manual miter box saws is exactly like using a bench hook. Your off-hand is what controls the stock and is where you apply all your weight. And your dominant hand is what controls the saw and attempts to make it float through the work.

With miter boxes, you also have to be more aware of what part of the work faces the user and what part of the work faces the fence. The part of the work that faces the fence will get torn up by the teeth exiting the work. You don't want to place the front part of a moulding against the fence because it will look like splintery junk after you cut it. So don't be afraid to swing the saw left or right to be able to saw the work with the moulded edge or show surface facing you.

One last note on use: Sometimes your carcase isn't square, and your miters need to be tweaked to wrap cleanly around the corners. The way to adjust these appliances is by taping a thin shim to the fence of the tool, kicking the work out a bit. The closer the shim is to the kerf, the bigger the adjustment. While I am sure there are formulas to help you, trial and error is faster.

End Grain Shooting Board

Shooting boards are built like an overgrown bench hook. There is a platform that your work rests upon (I like 24" long x 18" deep). There is a hook on the underside to catch the front edge of your bench. And there is a fence, usually 1" thick and up to 2" wide. I use approximate dimensions because shooting boards should be made from scrap, and small differences in dimensions won't make much difference in use.

Shooting boards guide a handplane turned on its side. The simplest shooting board has the plane running on the benchtop. If you have a nice flat bench, this works. Other shooting boards have a little ledge or chute for the plane to ride upon.

These shooting boards are essential bits of kit. After you saw the ends of your parts to length, you should shoot them on this appliance to remove the sawblade marks and straighten them to perfection.

The saw's friend. A shooting board removes the sawblade marks from the end of a board and trues it up. Plus, you can adjust the length of the board in .001" increments.

You also can use this appliance to fit pieces into an assembly. For example: flat mullions that need to be glued inside a door frame. The shooting board allows you to adjust them in .001" increments with ease.

One question that always comes up about shooting boards is why the plane does not eat up the appliance shaving by shaving. The answer to this question is the plane itself. In a bench plane the blade doesn't extend to the edges of the tool (otherwise it would be a rabbeting plane). This small land of metal by the mouth, which is where the sidewall joins the sole, prevents the plane from eating up the shooting board. While the first pass or two on a new shooting board will indeed remove a little material, after that the shooting board will be unmolested by the plane's iron.

Using a shooting board is quite simple once you train your muscles a bit. Just like with a bench hook, your off-hand is the clamp and needs to push the workpiece firmly against the fence. If you waver even a tiny bit, the work will be pushed away from the plane during the cut – spoiling the end. So I recommend putting some sticky-back sandpaper on the fence of the shooting board to help hold the work (#120-grit paper is good). Also, if you can clamp the work in place, all the better. Holdfasts are handy for this, especially when accuracy is critical.

The other thing to learn is what to do with your dominant hand. You need to thrust forward with enough force to keep the tool in the cut. And you need to push the tool toward the work with enough force so that the blade doesn't lift out of the cut.

Here's the trick. The small land on the side of the mouth prevents the plane from chewing up your shooting board.

But you don't want to tilt the tool – a common problem.

One way to help improve the accuracy of a shooting board is to nail a little runner that will capture the plane between the runner and the platform. The downside to this is that you will only be able to use that plane with that shooting board. The upside is that the tool will be easier to control and will not drift out of the cut.

I like to pick a plane with a lot of mass for this job. A metal jack, fore or jointer plane is an excellent choice. This is one of the reasons I prefer planes that are the Bed Rock pattern. The top of the sidewall is flat instead of rounded. This flat area makes it easy to tack a runner to the shooting board to capture the plane.

Two more tips: The iron of the plane must be sharp. If you are getting dust instead of shavings then you need to head back to your stones.

Also, shooting the end grain of boards will splinter the last little corner of the work as the iron exits the wood. To prevent this, you need to do a little prep work before you start shooting. Some woodworkers will plane away a little of the end grain. I prefer to use a chisel because I think it's faster. I chisel away a chamfer on the corner that touches the knife line that I'm going to shoot to. Then I shoot until I hit my knife line.

Long Grain Shooting Board

Another common and useful shooting board is designed for planing the long-grain edges of boards. These shooting boards have a long platform (as long as 48"), are narrower (6" is typical) and many don't have a hook (they are clamped between dogs using your end vise). Of course, they have a fence that secures the work, just like a bench hook or end-grain shooting board.

Most of these have a chute that guides the plane on its side. And some of them are ramped – the platform is a long slow wedge. This complication offers a couple advantages. You spread out the wear on your iron, and if you ramp the platform so the narrow part of the wedge has the fence, then gravity will help you keep the board in place during work.

Long grain shooting boards are great appliances for truing up the long edges of rails and stiles after they have been ripped with a ripsaw. They ensure the edge will be 90° to the true face of the board, which is placed against the platform.

However, if your benchtop is flat and you have an end vise, you can get away without a long grain shooting board. All you need is some thin (1/4" or 3/8") plywood or Masonite scraps. Place these scraps under your work to elevate it a bit. Then clamp the work between dogs. Place your plane on its side and pull it along the long edge of the work. This is a French trick I picked up from an early 20th-century tool catalog, and I quite like it.

If, however, you want to build one, then feel free. As you design yours, be aware of a couple snakebites. It's a real trick to keep the work in place on

For edges. If you are unsteady with your jointer plane, a long grain shooting board is an ideal way to shoot long edges and maintain a square edge. They are built like the end grain shooting board, but with a much longer and narrower bed.

the shooting board as you work. It wants to scooch away from the plane. So if you have a piece that is too long to hold reliably, you are going to have to clamp it down.

Make sure that your shooting board and your benchtop will allow this. In other words, look under your benchtop and see if there is a wide apron there that might interfere with your clamps. And don't make your shooting board wider than your clamp with the deepest throat. If you do this you will sometimes have trouble planing narrow stock on your shooting board.

Miter Shooting Board

The last shooting board you should make is a miter shooting board that is designed for miters on frames, such as picture frames, and small mouldings. This shooting board is much like the shooting board for long-grain edges.

For 45°s. A miter shooting board is an ideal appliance if you don't have a good miter box. It can correct wayward hand-cut miters.

There is a platform, it is usually 24"-30" long, a chute for the plane and a fence.

It's the fence that is different on this shooting board. It is in the shape of a right triangle with the 90° corner tangent to the chute. And it is in the middle of the length of the shooting board.

This position and shape of the fence allows you to shoot miters in both directions. That's quite handy when shooting moulding because you can control where the splintering occurs when you shoot it. You want the splintering to be on the backside of the moulding, which will be applied to the carcase and thus hidden. You don't want the splintering to occur on the moulded front. You can usually turn the moulding over or around to control the splintering (as long as the moulding has enough flats).

The real trick to making these shooting boards is to get the fence correct. When I made mine, I took a perfectly square piece of thick stock and sawed it from corner to corner, making two right triangles. Then I chiseled out a shallow mortise in the platform of the shooting board to hold this fence and adjusted the mortise (this takes some time and fussing) until the block fit perfectly and was planing 45° on both sides of the shooting board.

The time and effort were worth it.

Using this shooting board is fairly simple. Clamp it between dogs on your benchtop. Find a reliable way to secure your work to the board – I'll use clamps or holdfasts if I can. I hate spoiling miters. Relieve the far corner of the work if possible to control splintering. (The proper English word for this is "spelching.") Then shoot away.

Cork-backed Sanding Block

Years ago my boss made cork-backed sanding blocks for everyone in the shop. The "gift" was also an "obligation" to do a better job when hand-sanding. Sanding blocks are an efficient way to remove tool marks and to level the wood in a way that it will appear flat when you cover it with a reflective film finish.

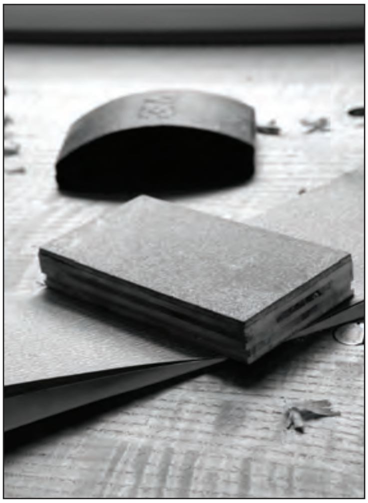
Hand-sanding without a sanding block can encourage sloppiness and a waviness to the wood that will show up when you finish the piece.

The cork gives the block a little "give," which makes it nicer to use, in my opinion. To make the block, my boss cut up sheets of sticky-back cork from the home center and stuck them to pieces of plywood. Then he rounded all the corners (even on the cork side) to make the block easier to use.

The exact size the block is a topic of some debate among sanding-block aficionados. Bob Flexner recommends a block that is 1-1/4" thick, 2-3/4" wide and 3-7/8" long. Others recommend 3/4" by 2-1/4" by 5-1/2". And there are other sizes out there that are designed to use up every scrap of sanding surface on a sheet of 9" x 11" sandpaper. They involve all sorts of different folds. And in the end, the used sandpaper sheet is in the shape of an origami belt sander.

My block fits my hand and, most important, has my name on it so someone doesn't swipe it or throw it away.

Even if you are a hard-core hand-tool only woodworker, I still think



Yup, you need one. If you want to create a flat-looking surface for some film finishes, then a sanding block is essential.

you should use a sanding block and some #220-grit sandpaper. Finishing surfaces with abrasives goes back to the Egyptians. Handplaning with a sharp edge is the newer technology. And even our hand-tool heroes of the 18th century used sandpaper. Reams of the stuff show up in inventories of tool sellers. And it was dang expensive and precious.

Sandpaper shouldn't be a crutch or a substitute for quality work with your edge tools. Rather, it should be the final and brief step that brings all your surfaces to the same condition. Some surfaces will have been planed at a low angle, some at a high angle. Still others will have been chiseled or scraped. The sandpaper prepares all these surfaces for finishing so that the wood will absorb any dye coloring in an even way.

Don't be a masochist. Make yourself a sanding block and buy a box of high-quality #220-grit sandpaper. It will last you a long time.

Workbench

I have written two books on workbenches that agonize over the details of joinery, wood selection, vises and so on. But if you don't want to buy those books, here is the down-and-dirty data you need to pick a bench design.

Note: Before you write me an angry letter about this list – you don't have to have a good bench to be a good woodworker. You can work on the kitchen table and make world-class work. But a good bench will make many operations easier. It's simply a tool: the biggest clamp in the shop.

My daughter's bench. This French-style workbench has yet to fail me. It is sturdy, heavy and easily holds boards when working their faces, edges and ends.

Rule No. 1: Always Add Mass

For workbenches, here's my maxim: If it looks stout, then make it doubly so. Everything about a workbench takes punishment that is akin to a kitchen chair in a house full of 8-year-old boys.

Early Roman workbenches were built like a Windsor chair. Stout legs were tenoned into a massive top and wedged in place. Traditional French workbenches had massive tops (up to 6" thick), with legs that were big enough to be called tree trunks. Later workbenches relied more on engineering than mass. The classic Continental-style workbench uses a trestle design and dovetails in the aprons and vises to create a bench for the ages. The 19th-century English workbench uses an early torsion-box design to create a stable place to work. And good-quality modern workbenches use threaded rods and bolts to tighten up a design that lacks mass.

Many inexpensive commercial benches are ridiculously rickety. They sway and rack under hand pressure. You can push them across your shop by performing simple operations: routing, sawing, planing. If the bench looks delicate or its components are sized like a modern dining table, I would take a closer look before committing.

A big thick top and stout legs add mass that will help your work. Heavy cabinet saws with lots of cast iron tend to run smoother than plastic ones. The same goes with benches. Once your bench hits about 300 pounds, it won't move unless you want it to move.

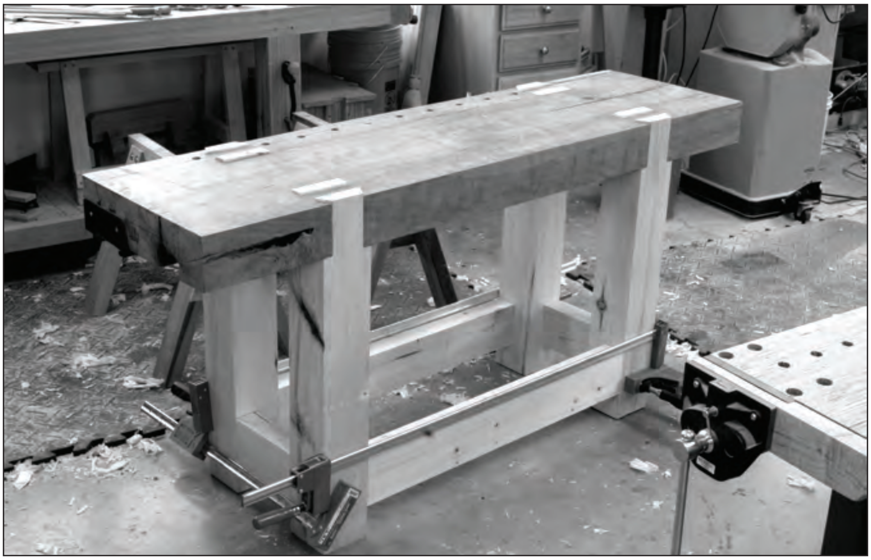
Rule No. 2: Use Stout Joints

Overbuild your workbench by using the best joints. These are times to whip out the through-tenon and dovetail. If you followed rule No. 1, then rule No. 2 should be no problem. Your joints will be sized to fit the massive scale of your components. If you cannot rely on mass, then you should beef things up with superior joinery. While dovetails and through-tenons are overkill for a towel rack, they are *de rigueur* for a bench.

That's because you are applying wracking force to the workbench with typical operations and your vises will do their best to tear apart your bench. All wooden vises need to be overbuilt or they will self-destruct when you cinch them down hard. I've even seen a vise rip a benchtop from its base.

Make your tenons thick and your mortises deep. If you know how to drawbore a mortise-and-tenon joint, this is one good application. Have you ever been in a timber-framed barn? Did you look at the joints? They're massive and pegged. Imitate that.

I think benches are a good place to practice your skills at cutting these classic joints, but some woodworkers still resist. If that's you, you should investigate hardware to strengthen your bench. Threaded rods, bed bolts, special bench bolts or even stove bolts can turn a spindly assembly into something rigid that can be snugged up if it loosens. The hardware won't give you mass, but it will strengthen a rickety assembly.



Permanent. The sliding dovetail and through-tenon on this French bench makes a bench where the base and top act as one.

Rule No. 3: Pick Your Wood Based on Its Stiffness, Not Its Species

Use a stiff, inexpensive and common wood to build your bench. Showcase benches made from exotic materials are nice. But focus on the functions before the flash. I'd rather have a construction-lumber bench that followed all these rules than a beautiful European beech bench that skipped even one of these concepts.

There's a lot of confusion on picking a wood for a bench. Most European benches were built using fine-grained steamed European beech. And many woodworkers go to lengths to purchase precious beech for their workbenches. After all, who wants to argue with hundreds of years of tradition?

I do. European cabinetmakers didn't choose beech because of some magic quality of *Fagus sylvatica*. They chose it because it was dense, stiff, plentiful and inexpensive. In the United States, beech is dense, stiff, hard to find and (sometimes) expensive. You can, of course, use it to build a bench, but you will pay a pretty penny for the privilege. And it will have no demonstrable advantage over a bench built from a cheaper species that is easier to find.

Other woodworkers, tacking toward the sensible, use hard or soft maple for their benches, rationalizing that it is like the beech of the New World. And indeed, the maples have all the qualities of a good species for a workbench.

Maple is stiff, resists denting and can span long distances without much of a support structure below it. But so can other species. In fact, if you went by the numbers from the wood technologists alone, you'd build your bench from shagbark hickory, despite its difficult nature. Once you look at the characteristics that make a good species for a workbench, you'll see that white oak, Southern yellow pine, fir or just about any species (excepting basswood and the soft white pines) will perform fine.

Rule No. 4: Use a Tested Design

After you sketch out your workbench design – but before you cut any wood – compare your design with historical designs of benches. If your bench appears to be a radical design or looks unlike anything built before, chances are your design is flawed.

I've seen workbenches with pneumatic face vises. Why? I've seen a workbench that had two twin-screw vises: One vise for the right end of the workbench that was matched to work with two long rows of dogs along the length of the benchtop; and a second twin-screw vise on the face of the bench that was matched to two more rows of dogs across the width of the bench.

Now I'm certain that there are a few woodworkers who would really need this arrangement – perhaps someone who has to work on a circular tabletop on one end of the bench and a Windsor chair seat at the other. But for most people who build cabinets and furniture, this setup is redundant and neglects some critical bench functions.

Rule No. 5: The Overall Dimensions of Your Bench Are Critical

Your bench design cannot be too heavy or too long. But its top can easily be too wide or too tall. I think your benchtop should be as long as possible. Find the wall where your workbench will go. Hint: Pick the wall that has a window. Measure that space. Subtract 4' from that measurement, and that's a good length for the top. Note: The benchtop must be at least 5' long unless you build only small-scale items. Furniture-sized parts typically range up to 48" long and you want to support these fully with a little room to spare.

I've made tops that are 8' long. It is difficult to imagine a workbench that is too long. The same thing almost goes for thickness. It is the thickness that allows the top to be that long. If you make the top really thick (4" or a tad more), then it will offer unerring support and allow you to build your bench without any support system beneath. The top can perch on the legs and will not sag under its own weight.

The width is a different matter. You can have a bench that is too wide for a one-person shop. I've worked on benches that are 36" wide, and they have downsides. For starters, if you park them against the wall you'll have to stretch to reach the tools hanging on the wall. If you assemble projects on your bench, you will find yourself dancing around it a lot more than you should.

But there's more. Cabinetwork is sized in standard chunks. These sizes come from the human body; they aren't arbitrary. A kitchen's base cabinet is generally 24" deep and 34-1⁄2" high. This is important for a couple reasons. First: It means you don't really need a bench that's much more than 24" deep to build cabinets. With that 24" depth (or even narrower), you actually get some advantages, including the fact that you can clamp the cabinet to your bench from as many as three sides. That's handy. A deep bench allows you to clamp your cabinets to the bench on only two sides (with a couple exceptions). Here's the other thing to keep in mind: Kitchen cabinets are themselves a highly studied work surface. There's a good reason that kitchen cabinets are 24" deep. And it's the same reason you don't want your workbench much deeper either.

Now I'm not going to argue with you if you build really big stuff or have a bench that you share with another woodworker facing you; you might need more depth. But if you are like most of us, a 20"- to 24"-deep bench is a powerful and right-sized tool.

On the issue of workbench height: Many bench builders worry about it, and there are a wide variety of rules and advice. The bottom line is the bench must fit you and your work. And in the end, there are no hard-and-fast rules. I wish there were. Some people like low benches; some like them high.

So consider the following as a good place to start. After taking in my crackpot theories, your next stop should be a friend's house or a woodworking supply store to use their benches and get a feel for what is right (it could be as simple as having a bad back that requires you to have a high bench, or a love for wooden handplanes that dictates a low bench).

Here is my experience with bench height: I started with a bench that was 36" high, which seemed right for someone who is 6' 3-5⁄8" tall. And for machine woodworking I was right. The high bench brought the work close to my eyes. I loved it. Then my passion for handwork emerged.

If you get into hand tools, a high bench becomes less attractive. I started with a jack plane and a few smoothing planes. They worked OK with a high bench, but I became fatigued quickly.

After reading the screeds on bench heights, I lowered the height of my 36" bench. It seemed radical, but one day I got the nerve up and sawed 2" off the legs. Those two inches changed my attitude toward planing.

The 34"-bench height allowed me to use my long leg muscles to propel the plane forward instead of using my arms.

Now, before you build your next bench at 34" high, stop for a minute. That might not be right for you. Do you use wooden-stock planes? If so, you need to consider that the wooden body planes can hold your arms about 3" to 4" higher off the workbench than a metal plane can. As a result, a wooden plane user's workbench should be lower.

This is as good a reason as ever to get to know someone who has a good shop you can visit and discuss your ideas with. It is better not to make this decision on paper alone.

But there are other factors you must consider when settling on the bench's height. How tall are you? If you are more than 6' tall, you should scale your bench a bit higher. Start high and cut it down if it's too high. And prop it up on some blocks of wood if it's too low. Experiment. It's not a highboy; it's a workbench.

Here are other things to consider: Do you work with machinery? If so, a bench that's 34" from the floor – or a bit lower – can be good. The top of a table saw is typically 34" from the floor, so a workbench could be (at most) a great outfeed table or (at least) not in the way of your crosscutting and ripping.

Of course, everyone wants a ballpark idea for where to start. So here it is: Stand up straight and drop your arms against your sides in a relaxed manner. Measure from the floor to the place where your pinky joins your hand. That has been the sweet spot for me.

Rule No. 6: Benches Must Hold the Work in Three Ways

All benches should be able to grip the wood so you can easily work on the faces, the ends and the edges. Many commercial benches fail on this point.

Submit your bench to what I call the Kitchen Cabinet Door Test. Imagine a typical kitchen door that is 3/4" thick, 15" wide and 23" long. How would you affix that door flat on your bench to level its joints then sand (or plane) it flat? How would you clamp the door so you could work on the ends to trim the top rail and tops of the stiles so the door will fit its opening? And how would you secure that door on edge so you can rout its hinge mortise and plane off the sawblade marks without the door flopping around? Does your bench pass this test? OK, now ask the same questions with a door that is 3/4" x 15" x 38". And then try a board that is 3/4" x 12" x 6'.

How you accomplish each of these three functions is up to you and your taste and budget. To work on the faces of boards, you can use a planing stop, a grippy sanding pad, a tail vise with dogs, clamps or hold-downs.

To work on the ends of boards, you can choose a shoulder vise (especially for dovetailing), a metal quick-release vise, a leg vise or a twin-screw vise. And you can use all of these in conjunction with a clamp across your bench. The vise holds one corner of the work; the clamp holds the other corner.

Working the long edges of boards is tricky with most benches. In fact, most benches make it difficult to work the edges of long boards, doors or face frames. There are a couple ways to solve this. Older benches had the front edge of the benchtop flush with the front of the legs and stretchers so you could clamp your frames and long boards to the legs. And the older benches also would have a sliding deadman (sometimes called a board jack). It would slide back and forth and had an adjustable peg to support the work from below. Another old form of bench, an English design, had a wide front apron that was bored with holes for a peg to support long work.

Rule No. 7: Make Your Bench Friendly to Clamps

Your bench is a three-dimensional clamping surface. Anything that interferes with clamping work to your benchtop (aprons, a drawer bank, doors, supports etc.) can make some operations a challenge.

We had a phase at *Popular Woodworking* where we tried to design a cupholder into every project. It started innocently with a deck chair. Who doesn't want a cool beverage at hand out on the deck? Then there was the dartboard. What goes better with darts than beer? We finally came to our senses when designing a series of cupholders into a Gustav Stickley Morris chair reproduction. Do you really need a Big Gulp-sized hole in your Morris chair? I didn't think so.

No skirts. A thin and wide skirt on a workbench will impede your clamping efforts at every turn. A flat underside is a nice feature, no matter what sort of woodworker you are.

The point of this story is to illustrate a trend in workbench design that I personally find troubling. It's a knee-jerk reaction to a common American complaint: We don't think we have enough space in our shops to store our tools and accessories. And how do we solve this problem with our workbenches? By designing them like kitchen cabinets with a countertop work surface.

This design approach gives us lots of drawers below the benchtop, which is great for storing the things you reach for every day. It also can make your bench a pain in the hiney to use for many common operations, such as clamping things to it.

Filling up the space below the benchtop also restricts you from using some kinds of holdfasts or holddowns.

If you build drawers below the top, how will you clamp objects to the benchtop to work with them? Typically, a bank of drawers below the benchtop prohibits a typical F-style clamp from sneaking in there and lending a hand. So you can't use a typical clamp to affix a router template to the bench. There are ways around these problems – a tail vise comes to mind – but the tail vise can be a challenge to install, set and use.

You can try to cheat (as I have) and install the drawer bank so there is a substantial space underneath the benchtop for holdfasts and clamps. Or you can give your bench a large overhang to allow clamping (as some Shaker-style workbenches did) but then you have to start engineering a way to hold long boards and assemblies on edge.

Plane into the screws. Many woodworkers want to reverse the positions of the vises on their bench because they think it will make crosscutting easier. But if you don't plane into the screws of your face vise, you'll tend to pull the board out of the vise's grip.

Rule No. 8: There are Good Rules for Placing the Vises

Place your vises so they work with your tools. Vises confuse many workbench builders. They're bewildering if you've never spent much time working at a bench to develop a feel for the traditional form. There are a lot of tempting and weird configurations in the world, from a table with no vises to the bench with a vise on every corner.

Classic workbenches for right-handers have some sort of vise at the front-left corner of the bench. This is called the face vise. Why is it at the left? When we work with hand tools, especially planes, right-handers work from right to left. So having the vise at the left end of the bench is handy because you will always be planing into the vise that is gripping your work, and the work can be braced against the screws of the vise. So if you are a lefty, placing your vise on the front-right corner makes sense.

So with that left corner occupied by a vise, where are you going to put a second vise that is designed to grip boards so you can work on their faces? (The classic vise for this is a tail vise.) Well, the right side of the bench is free (for right-handers) and there is no disadvantage to placing it there, so that's where it generally goes.

Messing with this arrangement can be trouble. I've seen face vises on the right corners of benches for right-handers. They said they liked it better for crosscutting with a handsaw. But when and if you start handplaning, that vise will be in the way because it won't be ideal for gripping long stock. It will be holding the tail end of the board and the plane will be trying to pull it out of the vise.

Rule No. 9: No Fancy Finishes

When finishing a workbench, less is more. A shiny film finish allows your work to scoot all over the bench. And a film finish will crack when struck by a hammer or dead-blow mallet. Choose a finish that is easy to apply, offers some protection and doesn't build up a thick film. I like an oil/varnish blend (sold at times as Danish Oil), or just boiled linseed oil.

Rule No. 10: Get a Window Seat

Try to place your bench against a wall and under a window, especially if you use hand tools. The wall braces the workbench as you are planing cross-grain and sawing. The light from the window points out the flaws in the work that your hand tools are trying to remove. When I work with hand

Nice light. I like having my bench under a north-facing window, just like this recreation of the Dominy workshop at Winterthur. The light is ideal for handwork all day long.

tools, I turn off the overhead lights. I can see much better with fewer light sources.

For machine work, I find that placing the bench by a window helps with some operations, though not all. When power sanding, for example, the raking window light points out scratches better than overhead fluorescents.

In general, when working with power tools, I tend to pull my workbench away from the wall so I can work on all sides of it. When working with routers, you sometimes have to work with odd clamping setups so that you can rout around a template. So having access to all four sides of the bench is handy. Power tool setups thrive on overhead light – and lots of it. So being by the window is nice but not as necessary.

12-GOOD-TO-HAVE TOOLS

The previous chapters outlined what I think you need to start woodworking in a serious way. You can go a long way with those tools. Yet, the deeper you get into the craft you'll probably want other tools that – while not essential – will make a common task easier or faster.

This chapter is dedicated to an ever-shifting list of things you might want to buy some day. To be sure there are hundreds of tools that didn't make this list, either. And yes, some of them are useful for a specialized operation. And some of them seem quite useful when you read the catalog copy. Buy them if you want to. But you might want to think twice before you start buying non-essential tools until you have filled your chest with the essential ones.

So here are the tools I consider optional, along with short descriptions of what they do best and with my likes and dislikes about them.

Dial Caliper

I end up using this tool quite a bit, especially when thicknessing my stock – either by hand or by power. The dial caliper can point to high or low spots faster than a ruler. It can serve as a handy depth gauge for mortises. It can help you sort out the exact size of some of your drill bits.

It also is useful for fitting joinery. When a shelf is too thick to fit in its dado, I'll measure the dado and the shelf. If the shelf is .006" thicker than the dado is wide and I know that my smoothing plane is taking about a .002"-thick shaving, then I know I have to make at least three passes with the tool to get the shelf even close.

I prefer analog dial calipers that read out in decimal inches. Yes, it takes a little while to learn the decimal equivalents of the common measurements. But that's not why I like them. In hand-tool work, things are rarely at exactly 5/8" or whatever. They are several thousandths of an inch one way or the other off 5/8". So a decimal dial caliper lets me gauge these relationships using simple subtraction and addition of base-10 units. Converting fractions (especially 64ths) is lunacy, so I avoid the fractional calipers.

Pinch in. As much as I have tried to wean myself off this tool, I'm afraid it's hopeless. I use it all the time when dimensioning stock because I find the dial easier to deal with than fractions.

I know that some of you suspect I have some latent love for the metric system as a result of the previous paragraph. While I respect that French system, and occasionally I have to use it when working in Europe, I'm Imperial to the bone for reasons that are too personal and weird to go into in a book such as this.

You can buy a digital caliper if you prefer to toggle between fractions and decimals. But that is one more thing for which to buy replacement batteries. I might buy a digital caliper if I could get one that was treadle-powered.

12" Combination Square

While I get the most use out of my 6" combination square, I really like having a 12" square, plus I have picked up extra blades for it (cheap) that are 18" and 24" long. These long rules can help you mark out things in a hurry. But

more important, you can use the steel blades as unerring reference surfaces in your shop.

When I think a wooden square or straightedge has lost its truth, I can check it against itself and against these rulers or squares. It's just another way to check myself and stay out of trouble.

When you start looking for a quality 12" square or longer blades, be prepared to crap yourself. Good machinist tools – and that's what these are – cost money. However, the good news is that these tools have been made since 1878, so there are a ton of nice ones on the used market. I have bought mint Starrett combination squares and blades at one-fourth the new cost.

You have to be careful if you go this route because the squares can be ragged out and inaccurate – so make sure you can return them. The safest route is always to buy new from the manufacturer, and there are still a surprising number of quality toolmakers who cater to the fussy machinist.

Dovetail Marker

I used to mark out my dovetails with a sliding bevel gauge and a try square. Then I got fancy and made myself a wooden marker that marked both the angled cut and the 90° cut without switching tools.

Then I bought a commercial aluminum one for a trifling. I like the aluminum one because I can use it without worrying about my knife slicing it up. And it has handy little grips. The downside to these little tools is that they lock you into one particular angle. Me? I don't mind this. I like the look of 14°, and that angle works for every dovetail application I've come across.

Jointer & Smoothing Plane

In the chapter on planes I went into detail about the important characteristics of the jointer plane and smoothing plane, so I'm not going to waste more ink and paper here. They are great to have if you start to become a heavy plane user (and I'm not making a joke about your waistline).

Large Shoulder Plane

Again, I discussed this plane quite a bit in the section on rabbet planes, especially because I think a large shoulder plane can do double-duty as a simple rabbet plane. If you followed that advice, then you already have a shoulder plane. If you opted for a dedicated rabbet plane or moving fillister, then I think you should treat yourself to a large shoulder plane.

By "large" I mean one that is 1-1/4" wide, so you have enough mass to plow through the end grain of a shoulder and stay in the cut. And the width makes it ideal for trimming cheeks of tenons, as well as shoulders. Plus, I think the larger tools are easier to hold and steer than the smaller ones.

There are tons of these planes available on the used market. But use caution when buying them. The sidewalls have to be dead-nuts 90° to the sole. That is why these things are so crazy expensive – they are under the milling machine and surface grinder for a long time. And the reject rate can be high compared to other tools.

So if you buy a used one (and I know I'm sounding like a broken record) check it before you buy it or ensure you can return it.

Carpenter's Hatchet

Having a good hatchet in your hand is a safe, effective and medically proven way to raise your testosterone level. It is a great thing to be sharpening when your daughter's date shows up at the house. Oh, and it is useful for woodwork as well.

A good hatchet for woodworking is not the same tool as one for splitting kindling, though they look similar to the unwashed (actually, to the "washed," if we want to get all technical). A hatchet for woodworking has a chisel-like edge. One face of the hatchet's edge is flat. The other is beveled. A hatchet for chopping firewood is more like a knife edge – both faces are beveled.

As with all tools, the handle should be comfortable and the tool should feel like an extension of your forearm. I recommend trying out several when buying one for your shop. The differences in how they hang will be immediately apparent. If you have only one hatchet to choose from, it will be hard to tell if that tool is the most comfortable and balanced one you've ever held.

What can you use it for? Shaping! Splitting! The strongest wooden components are the ones that are split from a log, as opposed to sawn. Splitting a piece of stock will cause it to fail along the grain lines. The resulting piece will have grain that runs the entire length of the piece of stock, from end to end. That is tough stuff that is great for ladder rungs, chair parts and drawbore pegs. Anything, in short, that is going to take a lot of stress.

You also can use a hatchet to remove a lot of stock on the edge of a piece of work. A hatchet is also a good introduction to working with wood when it is green. And that is the road to making chairs, one of my favorite sub-crafts in woodworking.

The problem with buying a hatchet is that there are so few new ones that are suitable. I've found only a couple brands that will do. And the vintage ones tend to have problems. The smallest problem is that the head has become loose from the handle (sometimes called the "helve"). This can be fixed up by wedging the handle at the top of the head.

More common, and difficult to deal with, is that the head is notched like some teen-age nitwit used it to chop rebar. So getting the hatchet back to fighting condition will require a lot of freehand grinding that you might not be ready to do.

And finally, the worst problem is that the hatchet has been re-handled with something that is as ergonomic as a billy club. Shoot, it might actually be a billy club. Making a new handle that suits you is no small affair if you are at the beginning of the craft and might not even know how a good handle feels. Quick example. Build a chifforobe. Don't know what one looks like? Or how it works? Exactly.

And sometimes you will find hatchets with all three problems.

Drawknife

Do you need a drawknife to be a woodworker? No. But once you use one you will not turn back.

A proper drawknife is a revelation. You can rip boards with it faster than you can saw. You can shape spindles with immense finesse. You can make stop-chamfers on edges that will lighten your work and give it impressive visual detail.

The problem with drawknives is that there is an immense amount of contradictory information about them from people who are maestros with the tool.

Should the blade be curved or straight? Should it be used bevel-up or bevel-down? Should the edge have a knife edge or be more like a chisel? Should the underside of the bevel be relieved? Should the handles be straight or canted out? Are folding drawknives worth a damn? Should you use small ones or large ones? Oh, and how should they be sharpened?

Really, no two sources agree on all of these details. It is enough to make you swear off drawknives.

Here's the real deal: I've watched many masters of the tool work with the tool. Mike Dunbar, Brian Boggs, David Wright, Don Weber, Russ Filbeck and on and on. They all have mastered the tool and treat it a little differently. It is, to be sure, no different than a chisel with a couple handles when you boil it all down. And there is very little agreement on how to use a chisel.

So almost any drawknife technique is correct. And almost any drawknife technique is ill-advised. It is, in my opinion, one of the most bitey tools out there. My first trip to the emergency room for a woodworking mishap was while sharpening a drawknife.

So here's what I like. (Feel free to skip this paragraph.) I like a drawknife with a slightly curved blade, which makes every cut a skew cut. I use it both bevel-up and bevel-down. I use it bevel-up when I want to remove a lot of material and I am not worried too much about diving too deep into the work (based on the grain direction and characteristics of the material I am working). I use it bevel-down when I am trying to remove less material and produce a nicer surface.

I like my handles to sweep out a little because that feels more comfortable. I don't like handles that are parallel to one another. I like larger drawknives more than I like smaller ones. The large ones, with a 7"- to 9"-long blade are easier to control than the smaller ones. Mass is good.

I like a chisel edge more than I like a knife edge. But I like the underside of the tool to be relieved behind the cutting edge, a little like a Japanese tool. This makes it easier to sharpen.

But most of all, I like a sharp drawknife. I would rather have a sharp drawknife that was not in the configuration I preferred to a dull one that was otherwise perfect. Sharp fixes everything.

No. 80 Cabinet Scraper

Once you get into preparing your surfaces with planes, you'll encounter a need for a scraper plane. While card scrapers are fantastic, they aren't suited for large surfaces. Try scraping the tear-out on a dining table and two things will happen. One, your thumbs will combust. Two, after you put a film finish on it, the table will resemble England's verdant and rolling hills.

Scraper planes save your thumbs and preserve the appearance of flatness on expansive surfaces. But most scraper planes require an advanced degree in geometry to wield. You have an infinite range of attack angles to choose from, which can be paralyzing. Plus, you generally have to come up with some way to ensure you don't leave any tracks behind if the corners of the scraper's iron dig into the work. Usually you camber the iron.

Enter the Stanley No. 80.

This was my first scraper plane. It was $20. It worked so well that it is a small wonder that I ever tried other scraper planes. You sharpen the iron exactly like you would a card scraper. You drop the iron into the tool so the

hook faces forward. Secure the iron. Turn the tool's thumbscrew slightly to bow the blade. If you take a light cut you will have tremendous results. Too-heavy a cut will result in chatter.

The other types of scraper planes require more tweaking to work well. And they all cost far more than the common and useful Stanley No. 80.

The pattern is so robust that at least one modern maker has copied most of its basic functions in a tool. So now you have the choice of vintage (very cheap) or new (slightly more expensive). You can't go wrong. Just stay away from the more complex scraping planes, and you will wonder why people tear their hair out trying to scrape a tabletop.

Beading Plane

Let's get into the moulding planes. Don't worry, I'll be gentle.

Moulding planes seem like an undiscovered country to many woodworkers. They can have complex profiles, they require some sharpening skill, and vintage ones are common but can be difficult or impossible to restore. But if you can get one common beading plane to work, then I think you will passionately seek out other wooden moulding planes for your chest.

The beading plane creates a simple half-bead – 180° of a circle plus two small flats on either side. You can put beads on many parts in traditional furniture to create a shadow line, which will set off the two areas separated by the bead.

A common place for a bead is between the backboards in a carcase, around a drawer front or along the door stiles. Even along the stiles of a carcase's face frame, which sets the face frame off from the wall behind your project.

Beading planes are dirt cheap because they were used all the time in traditional work. For furniture, you don't want an enormous bead. Look for a bead that is 1/8", 3/16" or 1/4" wide at most. That is a bead designed for furniture work. The larger beads are generally for house mouldings.

Sharpening a beading plane is pretty easy. If the profile of the iron matches the sole, then you can usually just flatten the iron's back on your sharpening stones then polish up the bevel using fine slipstones, which are sharpening stones with a wedge shape and curved points.

The goal is to do most of the work on the flat, unprofiled side of the iron. Then do as little work as you can to the bevel. The bevel is where a small error can make the tool unusable.

Also, pay attention to the wooden body, or stock, of the plane. It should be poker straight. If it is even slightly banana-shaped then it's game over. Once you get the sole and iron tuned up, then you can test the wedge. Yes, there can be serious problems with the wedge. If it doesn't fit the mortise in the plane body perfectly, then as soon as you start using the tool the wedge will come loose and the plane will stop cutting.

If that happens, then you need to find the source of the problem. Usually

there is some wood in the mortise or on the wedge that is getting in the way. You need to remove the wood to get a good fit.

When I run into this problem, I darken the wedge with pencil lead then drive it into the plane. Then I'll remove it and see where the lead has been rubbed away on the wedge. This is a high spot. I'll check the wedge with a straightedge. Does the spot appear high on the wedge? If yes, then I'll try trimming it back with a scraper or a chisel. If it doesn't look high on the wedge then I'll look to the mortise in the plane body. A float or a chisel can help remove the high area.

Then I test the wedge again and repeat this process until it will hold when in use.

A couple beading planes will take care of you for the rest of your life. Because they are common and inexpensive, look for good ones. The good working examples are the same price as the non-working examples. So don't buy on price. The price of a moulding plane is usually a price for collectors and reflects the rarity of the maker, not the usability of the plane.

Small Ovolo or Ogee Moulding Plane

Once you master the beading plane, then you are ready to move up to a small complex moulder, such as a small ovolo or ogee moulding plane. These have all the same challenges and rewards as a beading plane. When you buy vintage examples, the irons can be misshapen, the stocks can be warped, and the wedges might fly out of their mortises in use.

These small complex moulders are useful in producing runs of moulding that need to be identical. As you'll see with the hollow and round planes below, their chief advantage is their flexibility. You can produce almost any moulding you can draw. The chief disadvantage with hollows and rounds is that it is almost impossible to produce the exact same moulding twice. Each is a little unique, owing to the free-form nature of this sort of tool.

The small complex moulders are great for making the work-a-day moulding that is used all the time in cabinet work. Small beads, ogees or ovolos are great for demarcating the areas between a carcase. A square ovolo is great for marking the line between the plinth and the carcase. An astragal is great for dividing the line between a lower case and an upper case. And an ogee or a simple cove can be used to make the transition from the carcase to the top cap of a cabinet.

The great thing about these small complex moulders is that they produce (almost) exactly the same profile every time. When you use one of these planes, they just cut until the profile is formed. As soon as the profile is finished, the plane stops cutting.

This is not the case with hollow and round planes, which typically will cut until you tell them to stop.

Half Set of Hollows & Rounds

Hollow and round planes bewilder many woodworkers. The best cure for this confusion is to buy a half set and start using them. They will reveal their usefulness as you use them.

Like the complex moulders and the beading planes above, the hollow and round planes also have the same problems with their irons, soles and wedges. But the good news is that hollow and round planes are much easier to sharpen and set up because they are simpler tools. A hollow tool has a hollow sole that is 1/6 (60°) of a circle

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They come in different sizes. A half set consists of 18 planes, a full set of planes consists of 36 planes. Each pair is numbered from size No. 1 to No. 18. An even set has the pairs from No. 2 to No. 18. An odd set has pairs numbered from No. 1 to No. 17.

Most people buy a half set of even-numbered planes. But odds – the in-between sizes – are just as useful. Few woodworkers need a full set of hollows and rounds. And some woodworkers get by with a quarter set, which is usually sizes Nos. 2 through 10.

But what do these numbers on the planes mean? Not much. Some makers obeyed standard sizes. So instead of discussing those variants (and the

nutty world of Ohio Tool), let's talk about how to answer the question about your set of planes. Take a hollow plane, a No. 4 plane. Take a ruler and measure the iron's width from tip to tip. That is the radius of the circle it will cut. If it's 1/2" from tip to tip, then the plane will create segments of a 1/2"-radius circle. This allows you to lay out your work on your end grain of both ends of your stock – handy and necessary.

Old Street Tool, formerly named Clark & Williams, uses a modified British system to number its hollow and round planes. I'm reprinting it here so you can get a feel for the scope of circles that are available to you with hollows and rounds.

Number on plane	Width of iron/radius of circle
#1	1/16"
#2	1/8"
#3	3/16"
#4	1/4"
#5	5/16"

#6	3/8"
#7	7/16"
#8	1/2"
#9	9/16"
#10	5/8"
#11	11/16"
#12	3/4"
#13	7/8"
#14	1"
#15	1-1/8"
#16	1-1/4"
#17	1-3/8"
#18	1-1/2"

Using hollows and rounds isn't difficult. The best way to learn to use them is to buy a half-set and start using them to make basic mouldings. Practice on pine then move up to more difficult woods.

Most hollows and rounds will have their iron bedded at 50° or 55°, which helps them plane moulding with a minimal amount of tearing. More expensive moulding planes will have the iron at a skew, which makes them a little more difficult to sharpen and to use.

Once you get some sharpened up and can make some good basic coves and roundovers, get some DVDs or books to complete your education.

1-1/2" Paring Chisel

A paring chisel that is both wide and thin is a great asset when sawing. I use this wide chisel for deepening my scribe lines to make a track for my saw to travel. The long length of the tool makes it easy to control with two hands – one hand on the blade and one on the handle.

Other than that, the rules for this wide chisel are the same as when buy-

ing any chisel. They are available in socket, tang or Japanese constructions. You will never mortise with these chisels, so just about any form of chisel will do. I prefer a socket chisel with this form of tool because it is simple to break the tool down into two pieces to make it easy to pack up for traveling.

Modern chisels in this width are rare. But they are quite common if you start looking for vintage tools. Look for some of the classic makers, such as Buck Bros., Swan, Witherby, old Stanley, Underhill and Peck, Stow & Wilcox. You can't go wrong with those unless they have been abused.

Fishtail Chisel

When you start making dovetailed drawers, you will want one of these tools. The edge is swept out like a fish's tail, which assists you in cleaning out the junk in the corners of the half-blind dovetail sockets in your drawer fronts.

Sure, you can clean out the crap in these acute corners using a variety of picking and paring techniques with your narrow chisels. But it is satisfying to come in and pare out the waste with one sweet motion.

The interesting fact about these chisels is that the fishtail shape of their edge was the common shape for chisels in the 17th century. This presumably was a way to make wider chisels with less iron and steel. And some Asian chisels still exhibit this distinctive shape.

When buying one of these chisels, the first question you should ask is: How cheap am I, really? That's because you don't have to buy one of these specialty chisels, which are fairly expensive. You can make one for your-

self using an inexpensive bench chisel that you can buy from a garage sale.

All you have to do is grind the long edges of the chisel near the edge so that they are angled more than the angle of your typical dovetail sweep. I like my dovetails to be angled at 14°, so my chisel needs to have its long edges ground back at 15° or slightly more. This allows me to get the corner of tool into the corner of my joint.

I've made a couple tools like this from old Marples chisels. They work great. They look like crap.

Drawer Lock Chisel

These ingenious little steel tools are great for making the mortises for half-mortise locks. These tools excel at mortising inside carcases and drawers that are impossible to work with your bench chisels. The chisel has two bevels, one small and one wide. The nice thing about the tools is that you can work almost anywhere with them and strike them with your mallet or even a metal hammer.

Don't bother buying one until you have that first big project where you really need it.

Mortise Floats

If you make a lot of through-mortises for traditional or Arts & Crafts furniture, then a mortise float or two will make life easier. "Floats" are a type of

For your locks. If you install locks on cabinets, then this tool is mighty handy. If you don't believe in locks, skip this.

tool that is basically the love child between a saw and a rasp. The float gets the big teeth from the saw-daddy, and the wide body from the rasp-mommy. Note to self: Stop anthropomorphizing tools. They hate it.

The result is a tool that can square up the difficult ends of a through-mortise better than a chisel or a rasp. A chisel is hard to steer in this situation and almost always will wander too deep or out of the cut, no matter how skilled you are.

A rasp, on the other hand, is easy to steer, but it will want to take a bite out of the long-grain sidewalls when you get into the corners, no matter how skilled you are.

The float is perfectly suited for this operation. Its long length ensures that it won't easily deflect in the end grain like a chisel. And the fact that its teeth are on only one face ensures it won't take a bite out of the long-grain sidewalls of the mortise.

For most woodworkers, a 1/4"- or 5/16"-wide mortise float is all they will ever need. Buy one and tune it up with a saw file. A sharp float is a happy float.

Through with you. Mortise floats are outstanding tools if you make lots of through-mortises. They maintain the crisp corners necessary for a good fit.

Drawbore Pins, One Pair

Drawboring is a traditional joinery technique that has fallen on hard times. It was once fairly common and is mentioned in many early books on woodworking and joinery. Nowadays, it is only in common practice among timber-framers and those who study the old books.

The technique involves boring a hole through a mortise. Then boring a hole through the matching tenon that is slightly offset toward the shoulder, perhaps 1/16" or a little more. Then a wooden peg is driven through the assembled joint and the peg pulls the tenon into the mortise.

The technique is great for cases in which you don't have clamps that are long enough to span the entire length of the joint. Or perhaps you are working with wood that is a little wet and you are concerned about things shrinking a bit. A drawbored joint can help keep things tight. Or maybe you aren't sure about the glue you are using. Perhaps you are working without glue because the wood is too wet.

In these cases, drawboring is a big help.

The risk when drawboring a joint is that, when you drive the peg through the offset holes, it will self-destruct. And that is where the drawbore pin comes into play.

It's an ancient tool that was designed to be pushed into the joint before assembly to test the fit of the components before you drove the peg home, and to deform the rims of some of the bores to make it easier for the wooden peg to snake around the bend. The drawbore pin itself is nothing more than a tapered steel pin. You can buy them for very little money at Sears, but that company calls them drift pins. You can also readily find them on the vintage market, and some toolmakers still produce them today.

Some woodworkers will argue that the steel pin is unnecessary. I think those people are mostly theoretical woodworkers or people who haven't used a healthy offset greater than 1/16". For the record, I have used 1/8" in yellow pine.

The steel pin is insurance. I like insurance when it comes to assembling a frame or door that has all the joinery cut on it. That is not when I want a wooden peg exploding, reducing the potential strength of the assembly.

If you are going to drawbore, get the pins. For the love of corn, we are talking about $3 or so at your local Sears. If you are too cheap to spring for that, what the heck are you doing reading this book?

Oh, and why do you need two pins? Many large joints require two pegs in each tenon, so you need two drawbore pins to check the joint's fit.

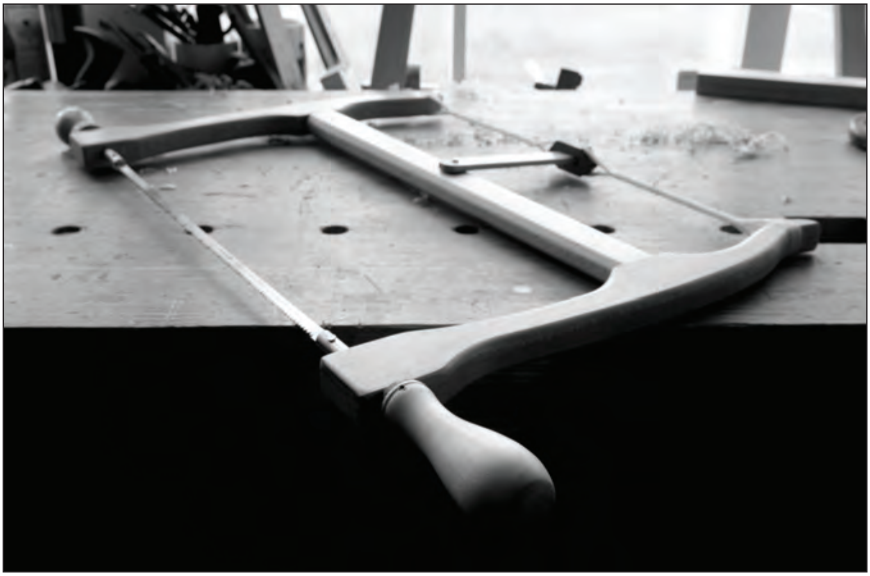
12" Bowsaw

A coping saw can handle a lot of your curve-cutting chores. But if you get heavy into cutting fretwork, then a bowsaw is going to end up on your wish list. This wooden-framed saw is tensioned by a string that is twisted with a wooden toggle. The blade is longer (12" is typical for an English bowsaw) and the throat is deeper than on a 6" coping saw. This allows you to cut curves deeper into boards than a coping saw will.

Like all frame saws, there is a lot of debate swirling about them. Should they cut on the pull or push stroke? Are they used with one or two hands? How much tension do they require?

The answers depend on the user. As with a coping saw, pushing or pulling the blade gives you different results. Orient the blade to get the result you want.

Many woodworkers use the tool with one hand or both hands on the front handle of the tool. I worked with my hand or hands on the front handle for many years until Michael Dunbar showed me how he uses a bowsaw with one hand on the handle at the heel and the other on the handle at the toe. The sawing action is reciprocating, kind of like the action with a scrollsaw.



This two-handed technique made me more accurate, especially on the backside of the work that I couldn't see as I was sawing. Thanks, Mike.

Bowsaws can come with all manner of blades. Thick, thin, coarse, fine. The rules for choosing the proper ppi are the same as when picking a backsaw. Choose more teeth for thin stock. Fewer teeth for thick stock.

As to the width of the blade, that really depends on the curves you plan to cut. Narrow blades (as skinny as 1/8") are more suited for tight turns. Wider blades – 3/16", 1/4" and wider – are better for shallow curves and cuts that might have long, straight areas to cut.

I do own a bowsaw and use it. But in truth, my coping saw gets far more use. That's why I placed a bowsaw on this secondary list and will suffer a fair number of nasty letters as a result.

Saw-files

If you are going to sharpen your own saws then you need to purchase some saw-files and handles to screw onto their tangs. Western saws use saw-files that have a profile that is an equilateral triangle – all three corners are 60°. Japanese saw-files are called feather files and look like a flattened triangle.

Both types of files come in a variety of sizes. Large files for large teeth; small files for small teeth. I'm no expert on sharpening Japanese saws, so I cannot say what the guidelines are for picking a particular Japanese file. But for Western teeth, the rule is that the saw-file should be large enough so that the tooth is less than half the size of the flat area on the file.

In other words, you should be able to file the teeth using all three corners of the file without wearing out the middle area of the file. A file that is too small will wear out much faster and eventually fail to file the all-important tips of the teeth.

Filing saws isn't like filing wood. The steel sawteeth wear out the file quickly. I usually sharpen one or two saws on each corner of the file and call it done. That's why I number the faces of my files so I can quickly figure out which faces of the file are sharp and which are toast.

There are lots of different brands of files, some of which have slightly different characteristics. Some files will have rounded corners; some will have pointy ones. Once you get into the ritual of sharpening your saws you'll start to develop preferences for files, just like you will develop preferences for sharpening stones.

Mill File

A mill file or some other flat, fine fine is essential for sharpening your saws and scrapers. When sharpening a saw, the first step is to confirm that all the teeth are at the same height. If they aren't, then you need to file them that way. The way to do that is with a mill file clamped into a saw jointer, a small metal frame that holds the file at 90° to the sawplate. Or you can press the file into a block of wood to accomplish the same goal. In this case the wood acts as a fence against the sawplate.

Mill files are also the first order of business when sharpening a scraper. The file removes the fatigued steel and exposes a fresh edge to hone and polish. You can file a saw or scraper freehand if you have the hand skills, but I prefer to do both operations guided by a block of wood to keep the file at 90° to the tool I'm sharpening.

Files (and rasps for that matter) cut only on the push stroke. That is, push them in the direction of the tip of the file. If you drag a file or rasp back over the work, you will dull it prematurely.

The other great way to dull a file is to throw it in a drawer with a bunch of other files and let them jiggle around for a while.

When you buy a file, you can probably get away with buying an inexpensive home-center one and getting a feel for the tool. Once you wear out a couple of those, you might be ready to step up to one of the more expensive and smooth-cutting European or Japanese files.

Saw Vise

To sharpen your saws you need a vise to grip the tool securely by the toothline. A good saw vise will prevent the saw from vibrating when you file it and deafening everyone in the tri-state area.

You can easily make your own saw vise from a few blocks of wood. Most woodworkers, however, opt to buy a metal saw vise. A saw vise clamps or screws to your workbench and pinches the saw much like a giant pair of pliers. There are all kinds of saw vises out there, and most of them are inexpensive if you can find one in the wild. Buying them through the mail can get costly because they are usually heavy.

A good saw vise usually has a small gap between the jaws in the middle of its length. When you apply pressure on a saw, the metal bends then clamps the entire sawplate along the length of the vise's jaws. This is very much like a spring joint when joining two boards edge-to-edge.

Most good saw vises are heavy, but they don't have to be. One of the best saw vises I've ever used was made from cast aluminum, and it absorbed vibration quite well.

When buying a saw vise, one of the most important considerations is that you ensure it is convenient for you to use. If it's a pain to set up, you'll be less likely to sharpen your saws. The best setup is to have the vise always ready to go. The second-best setup is to have the vise ready to clamp into one of the vises on your workbench.

Saw Set

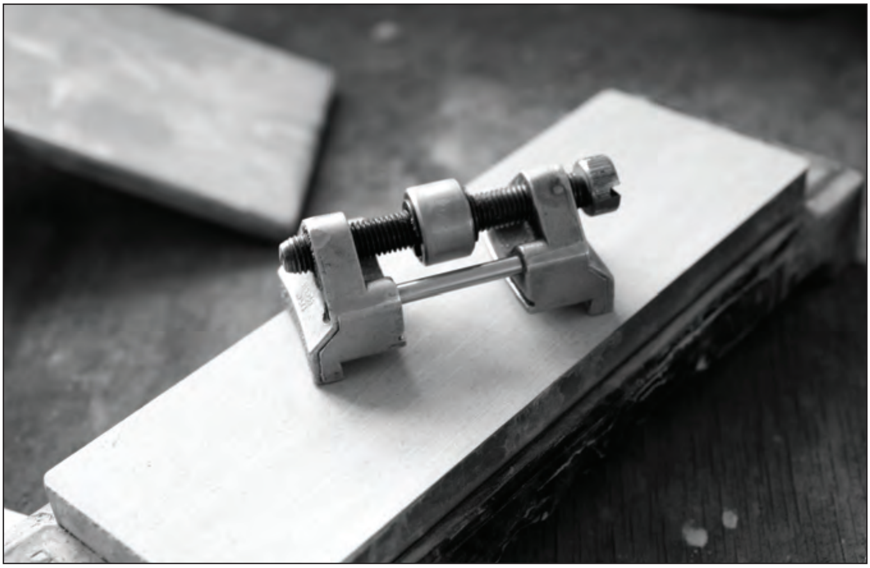
A saw set is a tiny little anvil and plunger that you operate by squeezing its handle like pliers. The only job of a saw set is to bend the teeth of a saw so that they are slightly proud of the sawplate.

If you build furniture, you aren't going to use your saw set much. In fact, I think that most saws are set heavier than necessary. A heavy set is good for cutting wet softwoods but is a detriment when cutting dry hardwoods. A saw with too much set will easily wander off line in hardwoods and be harder to push because you are cutting a wider kerf.

When I buy a new saw, I'll sharpen it a couple times before I fetch the saw set. Every filing removes a little bit of the set and improves the cut, in my opinion. The downside to using as little set as possible is that you will lose the ability to steer the tool in the cut. The set of the teeth gives you a little wiggle room that can make a difference with beginning sawyers.

However, if you have dulled a sharp saw, you are probably a good enough sawyer to run without much set.

As to brands and features, I'm not picky because I don't use a saw set



much. The only tip I have for you is to set the saw near the tip of the teeth, not by the base. You have more leverage at the tip.

Honing Guide for Chisels & Plane Irons

I like to use a cheap side-clamp honing guide for sharpening chisels and plane irons because it gives me consistent results with these tools that I am sharpening all the time.

I can sharpen freehand quite well. I sharpen a lot of tools freehand, especially anything with a curve or a moulding profile. But I still prefer the honing guide for chisels and plane irons. It's fast, and it never fails me.

This statement is not true about all honing guides. In fact, it seems that the more money you spend on them, the fussier they are. I buy an inexpensive side-clamp guide – sometimes called an Eclipse guide – and tune it up a bit.

Many beginners are drawn to honing guides that clamp the tool from above and below. The lure of these guides is that you can use them for more types of tools, including those with skewed edges. However, the trade-off for

that rarely used function is that all your blades will tend to shift left or right, ruining your edges.

I have tried every honing guide that has come on the market. All of the ones that clamp from the top and below are in my experience unreliable. You will spend more time fussing around with tap-tapping the blade and less time woodworking.

So if you are going to get a guide, get a cheap side-clamp guide.

I mentioned earlier that I tune mine up. That's true if the guide was poorly made. I've bought many vintage English-made Eclipse-brand guides that were perfect. However, those can be hard to find in the United States, and most woodworkers tend to buy the generic ones that are made in Taiwan or China.

These work fine if you do three things:

1. Use a triangular file to clean out any globs of paint in the dovetailed-shaped ways that grip a bevel-edge chisel.

2. Clamp the two jaws of the guide together and see if they come together nicely or if there is a hump in the middle. A hump will spoil your accuracy.

File the top surfaces of the jaws. It's easy. The jaws of these guides are made from aluminum.

3. Oil the wheel regularly. If you let it get gummed up, it will stop moving and you will quickly grind a flat on the wheel. Then the guide will be a pain to use and vibrate a lot.

And that's about it. Always use a screwdriver to secure blades in the guide. A slipped blade can result in a trip to the emergency room for stitches (this is experience typing here). And finally, build a little wooden guide that allows you to quickly set your blades to common angles. The guide can be as simple as a block of wood with little stops for the angles.

This setting guide might not be accurate to the nth degree. But it will be unerringly consistent, which is far more important when sharpening.

Trammel Points

Trammel points are the oversized cousins of dividers. If you are never going to build anything with curves, skip them. If you are going to build things with only an occasional curve, skip them – you can MacGyver a trammel using a yardstick, nail and pencil.

I happen to love curves, so I use my grandfather's trammel points all the time. The trammel points were a gift to him from his hosts when he visited Japan on business. They are still in the original and tattered velvet-lined case, which was water damaged sometime before they fell into my hands.

Aesthetically, my trammel points look almost Bauhaus. They appear to be stainless steel and have absolutely no ornamentation besides the functional bits. But I think they are beautiful, and they work quite well.

If you have these tools, they might inspire you to break out of your comfort zone of straight lines and square corners. So I guess I consider them essential to your development as a woodworker and designer.

There are a lot of different varieties of trammel points. All of them are composed of three parts: a fixed head with a point that becomes the centerpoint of your arc or circle, a bar of any length that stretches between the two points, and a sliding head that moves but can be fixed at any point on the bar. This moving head can be equipped with a simple point that scratches a curve, a pencil or even some sort of ink-delivery system.

In many cases, the bar is wood and is something you supply. The bar's thickness and width need to be milled so the trammel points grip it. But the length can be anything – short, long, whatever. The bar I use with my trammel points is 48", though I've made longer temporary bars for special jobs.

13 - A TALE OF THREE TABLES

For two weeks after graduating from college, my girlfriend (soon to be my wife) and I ate our meals on a cardboard box in our rural South Carolina apartment where everything was brown or was slowly turning that color.

With our first paychecks we bought a futon and a Polish-made drop-leaf dining table at Service Merchandise. It was the only nice-looking table in the entire store. The top was quartersawn oak and toned to look like a more expensive piece of Danish modern furniture. And at $60, it also was the only table we could afford on our salaries as cub newspaper reporters.

But the table had a fatal design flaw that we discovered during one of our earliest and most romantic hot dog dinners (nothing says romance like wrapping a meat-filled casing in Pillsbury crescent rolls). One of our cats jumped on the table, and in an effort to nab the naughty feline, I pressed my weight on one of the leaves of the table.

The table, plus the cat and our dinner, somersaulted toward me, flinging bits of mystery meat, silverware and agitated pussycat my direction. Romance canceled.

We stuck with that table for years. But before our first child was born, we knew that we needed something bigger and more stable. We'd just moved to Lexington, Ky., and I was attending woodworking classes. But I wasn't confident enough to build a table that would support a newborn in a bouncy-seat, plus our dinners. So we made the perilous drive to Cincinnati (every trip in my 1972 Chevy pickup truck was perilous) and splurged on a big pine dining table from Pottery Barn.

This was a rectangular apron table with beefy legs at the four corners, so we knew it wouldn't tip over. But when you buy a table from Pottery Barn, your table comes from the warehouse, not the show floor. When we made it (barely) back to Lexington, I assembled the table and became quite grumpy. The wood selection for the top was clearly executed by a blind coma patient. (Apologies to my blind readers in comas.) The top was made

Tabled. After years of suffering with sub-optimal dining tables, I decided to build the last dining table we would need.

from narrow and short finger-jointed strips of pine that were knotty, streaky and ill-matched.

As I became a better woodworker, I hated that table even more. And like any self-respecting woodworker, I wanted to build our family's dining table. So I ripped pages from magazines that showed tables I liked. I photocopied plans from furniture books that I borrowed. I made sketches of tables that I saw at the Pleasant Hill Shaker community in Kentucky. All of these scraps of paper piled up in my office. But all my design efforts grew into nothing more than a bigger pile of paper.

That's because our days were overwhelmed by bottoms that needed to be wiped and mouths that needed to be filled. So I put off the table project until I could afford some nice wood and had some free time to draft and build the dining table of our dreams.

By 2005, I was fed up with the Pottery Barn dining table. I couldn't stand to even look at it. Its top was both too wide and too short. The wood was too soft. And we couldn't get our family around it at Thanksgiving without a certain someone (me) leg-humping an ugly, bulbous leg.

We were by then juggling two young kids, so we still couldn't afford the wood, and we (as always) refused to go into debt. But then I had a stroke of luck.

A friend scored some 18"-wide cherry boards from a farmer in Kentucky, which I bought for $90. I decided that if I built a trestle-style base from Southern yellow pine 2x12s, I could buy all the yellow pine I needed to build the base for $30.

The overall design was the problem. I wanted the width and length just right. We're a close-knit family and eat dinner together every night. So I wanted the table long enough to hold all the food I cooked, yet narrow enough that I could reach over to my wife or one of my daughters. I wanted a table that was narrower than usual but longer than typical.

I wanted a table that I couldn't buy in a store, no matter how much money I made. But this time I had the solution to this problem. I had enough woodworking skills to do the job right. I had scraped together beautiful material (even the yellow pine 2x12s were primo). And, most important, I'd found the time. I figured out how to take off a few days in December 2005 to build the table while the kids were at school and day care.

Switching from Money to Time

Laboring hard without a profit motive is disconcerting to some people. We expect to receive money when we work, so that we can spend it when we are at rest. Woodworking has taught me to reverse that equation. I build things in my free time so I can avoid buying things. And if I don't have to buy as many things, I don't have to take on jobs that I don't like. Then I have more time available in my shop.

Here's another way I look at it: As I get older, I simply have less desire for money and more desire for time. This mental shift might be just the early 40s realization that I'm mortal, but I think it's more profound. I am now an incredible tightwad with my time. I get angry during conference calls at work where people posture, show off or waste my time because they didn't do their homework. Waiting in a long line at a grocery raises my blood pressure. Sitting in traffic makes me nuts.

This might sound like I just need a yoga class or a really cleansing chant. But I'm not an impatient man. My anxiety is merely despair that I am wasting time that could be better spent building, writing or cooking.

I want to make things that are permanent, inspiring or just chewy. And because my head is on backward when it comes to modern capitalism I want time more than I want money.

The idea of time as being the ultimate currency might seem modern or radical, but it's neither. It's not anti-free market or socialist, and it doesn't require women to stop shaving their arm pits or grow cotton in the back yard. Removing money from the equation is an idea that has actually worked in a free-market economy just fine. In fact, one of the most interesting social experiments that turned time into currency occurred just a few minutes from where I'm now sitting.

I live in Northern Kentucky, which is a four-minute drive from the intersection of Fifth and Elm streets in downtown Cincinnati. If you went there today, you would find it the most bland and featureless place in Cincinnati, which is a 19th-century repository of historic architecture.

At this particular intersection there are now two modern high-rise hotels, the city's convention center and a 1980s-era mixed-use development that has a reputation for housing doomed businesses.

Yet this street corner in 1827 is where Josiah Warren, a musician, printer and inventor, opened the Cincinnati Time Store.

The Time Store sold a wide variety of goods, but it didn't accept currency. Instead the legal tender was the customer's time. All of the Time Store's goods were priced at the cost to produce them, plus a small administration fee (4 percent to 7 percent) to keep the store running, plus an additional charge that was based on the time the customer spent haggling for the goods with the shopkeeper.

The motto of the store was: "Cost the limit of price." What that meant can best be explained like this: Say you wanted to buy 12 pounds of corn from the Time Store. The price was one hour of your labor – an astonishingly low price, even now – plus the small administrative fee and any time you spent wasting the clerk's time. You would take the corn and be issued a note and be called upon to do the hour of labor to pay for the corn.

As a result of this unique system, prices at the Cincinnati Time Store were considerably lower than those at other merchants in the city. Soon another competing store opened up using the same principles (after the shop owner consulted with Warren for advice on setting up the competing store). And other merchants began lowering prices or accepting labor as a means of currency. This successful system worked for several years (and in other cities, including Boston) until Warren proved to himself that it worked and closed up shop to put his efforts toward a different social experiment.

Prices were cheaper at Warren's Cincinnati Time Store because all of the middle sellers and distributors had been eliminated. And poor customers had the same currency as richer ones – an hour of labor was an hour of labor.

In other words, your time got you what you wanted or needed. It saved you a step – having to convert your time into money to buy an object.

I look at the dining table I built for our house, and I see 40 hours of time that was spent directly producing a finished product. Well, that's what woodworking is about – making stuff, right? Or is it about something far more radical – practically subversive?

Let's look at those 40 hours another way. Before I became a woodworker, I would've had to use those 40 hours to work for a media corporation and get paid a small percentage of the money I made for the company. So that would be about $650, using the median income for males in Cincinnati. After the state and local taxes, that would give me $515 to spend on a table.

Now $515 will buy only a piece-of-crap table that's new, unless you spent more time looking for an antique (which is probably the route I would take). But if I chose to buy a new table, then the equation would become more complex and the money would become more diluted. That $515 would end up split among the furniture store, the furniture distributor, the owners of the furniture factory and the people who actually made the table. My money wouldn't reward making something as much as it would reward moving something or storing it until it could be sold.

And I should add that a 40-hour table from a furniture store is unlikely to be something that will last forever. That's because mass-manufactured furniture is a terrible compromise, like mass-produced beer, bologna or aerosol cheese. Manufactured furniture never perfectly suits the space or its intended use. It might be close enough for the time being, but it is almost always made using low-quality materials and joints. It is furniture intended to be replaced within a few years – itself a relatively new and awful idea.

And it can be a shocking thing to encounter, as well. My first collision with disposable furniture came at my sister-in-law's house one Thanksgiving. As we all sat down to eat dinner at her Ikea dining set, my chair crumbled under my buttocks. In less than a second I was sitting on the floor, surrounded by splinters and dowels. I was stunned.

What was more stunning was my sister-in-law's reaction. She just shrugged.

"It's Ikea," she said. And she reached for another stylish Swedish chair to support my flummoxed bottom.

This crazy system of disposable furniture is what had my family trapped and tricked into buying dining tables (and other household goods) that were doomed from day one. Our first table, the only one we could afford, was downright dangerous. Even after we became aware it was built to spill, we ended up catapulting a cat and/or dinner at least once a financial quarter. The second table from Pottery Barn was more expensive and stable, but we soon found it the wrong size and ugly.

But the third table, our last table, is perfect. Most nights at dinner I reach under its top and feel the ridges left behind from my fore plane – long and shallow troughs across the width of the tabletop that feel like gentle Atlantic waves. I look at the top and see only two boards, which were cut sequentially from a local cherry tree. My eye follows the grain lines from one end to the other, which is 8' away.

We can get 10 people around it easily. It weighs little, yet its joinery makes it as strong as if it grew into its shape from one piece of wood. I am forever out of the table market as a result, and the cost of this relief was just 40 hours of my labor and an almost insignificant amount of money for wood.

After I built my table, I lost the desire for another one. After I built the chair that I sit in at that table, I eliminated any desire I had for a better one. And so on. The process of building my own furniture extinguished forever my longings for commercial furniture. And I found this attitude seeping into other areas of my life. I now can't stand poorly made clothes, books, food or tools.

If I cannot build or grow something myself, I try to buy stuff from people who also care deeply about the things they make. I buy meat, bread and vegetables from local merchants who cut the sides of beef, bake the bread and grow the vegetables. I haven't eaten in fast-food restaurants since the Clinton administration. And I like to buy tools from the people who actually make them.

I want to reward the people who do the work in the same way that I am directly rewarded when I do the work at my bench in my shop.

Aesthetic Anarchism

As I extinguished my desires one by one, the process began to shape the way I looked at the broader world. What do you call it when you want to make quality things instead of buying crap over and over? Is there a name for supporting people who were also individual makers focused on quality, permanence and actually making something?

I didn't have a name for this. But a cousin did.

My cousin Jessamyn West is the same age as I am, but we grew up in parallel universes. The West side of the family is made up of East Coast eccentrics, geniuses, writers and radicals. I grew up in Arkansas, with high-school fraternities, cheerleader sisters, debutante balls and my unspoken desire to become a West.

When the West and Schwarz families gathered together, I was in heaven, soaking up the ideas, language and even the punk attitudes of Jess and her younger and equally intriguing sister, Kate.

In early 1997, Jessamyn started a blog (jessamyn.com), which she still maintains, and it was a great way to probe her mind and see the occasional photo of a, uh, well, just visit her site. In the early days of her blog she would sometimes mention that she was an anarchist, which didn't make a bit of sense at the time. Jessamyn is likely the most non-violent person I know.

I set that incongruity aside until one day it bugged me so much that I started reading about anarchism and found it to encompass a wider range of thought than I ever suspected. I discovered Josiah Warren – sometimes called America's first anarchist – and his Time Store in Cincinnati. I devoured the book "Native American Anarchists" by Eunice Minette Schuster and learned how early American anarchists were pivotal in the fights for religious freedom, equal rights for women and abolition.

Then one day at a dinner party, fueled by IPA, I said it out loud: I am an anarchist.

This is, of course, about the dumbest thing you can say at a dinner party. I spent the next hour trying to explain myself to my friends, who simply could not grasp what gear had slipped in my head. Most people, especially Europeans, associate "anarchism" with violent radicals.

So I switched my slipped gears and talked about my ideas in terms of the "mutualism" of Pierre-Joseph Proudhon and Clarence Lee Swartz. "Mutualism" seems like a much warmer and fuzzier word. But they didn't buy it then. And they still don't.

I wish that I'd kept my mouth shut. But barring that impossible task, I wish I'd been able to read out loud to them William Bailie's introduction to his 1906 biography of Josiah Warren titled, "Josiah Warren: The First American Anarchist." The passage is worth the ink and paper to quote in full.

"Anarchism is not a cult, nor a party, nor an organization. Neither is it a new idea, nor a reform movement, nor a system of philosophy. It is not even a menace to the social order, nor yet a plotting for the destruction of kings and rulers. Indeed, the social order has often been in danger either from false alarms or from its own weight since the fabric first arose.

"Cults are common enough in these days: – they sprout and fade like the flowers of spring. Parties and organizations rise and fall with almost rhythmic regularity, running their course and becoming transformed with time like all things beneath the sun. Movements arise as occasion demands, and expire when their work is done. New ideas are rare enough, and seldom retain their novel character on close scrutiny. A philosophy is a scheme of life, an explanation of the universe, a concrete intellectual system.

"Anarchism is none of these things. It teaches not violence, nor does it inculcate insurrection. Neither is it an incipient revolution. None the less it has its place in the life of our times. Modern Anarchism, in a word, is primarily a tendency — moral, social, and intellectual. As a tendency it questions the supremacy of the State, the infallibility of Statute laws, and the divine right of all Authority, spiritual or temporal. It is, in truth, a product of Authority, the progeny of the State, a direct consequence of the inadequacy of law and government to fulfill their assumed functions. In short, the Anarchist tendency is a necessity of progress, a protest against usurpation, privilege, and injustice."

If Mr. Bailie were writing this woodworking book instead of me, I think he would state that anarchism is a tendency to question the institutions that make craftsmanship and well-made furniture impossible in this modern age. In short, he would say that anarchism is a tendency to question consumer culture – which is skewed to the advantage of large corporations and is propped up by our governmental institutions.

My aversion to cheap goods, large corporations and meddling governments goes deeper than just building my own furniture and making my own sausage. I don't think you can simply say: I make my own furniture so I'm sticking it to the man.

Building furniture with pocket screws doesn't qualify. Making something trendy isn't a good idea. Using cheap tools doesn't help. I've found there are a few obligations I had to pay in order to fully embrace the life of an individual craftsman.

The anarchist's joint. If you are going to build things that will outlast commercial furniture, you need to use the best joinery available.

Anarchy & Craftsmanship

If you are going to stop buying commercial furniture, then you cannot imitate industrial processes. You must pick your joints with care.

When I built my dining table, each joint had to be robust in order for it to endure daily and hard use. All the joints in the base are drawbored mortise-and-tenon joints that are wedged and pegged for good measure.

If I'd made the base with pocket screws or dowels, I might as well have just bought a table at Value City Furniture and called it future firewood. Those screws are temporary, and will last only a few years in a trestle table.

I'm not saying you should never use a biscuit, screw or dowel. Instead, you need to pick joints that are designed for the rest of your life, if not forever. In a wooden chair or dining table, that means you need to use well-fit mortise-and-tenon joints. Period. No exceptions.

When you build casework, you should use dovetails for the key structural parts when joining panels – mortise-and-tenon for post-and-rail assemblies.

Drawers? Dovetails. Doors? Tables? Stools? Beds? Workbenches? Again, mortise-and-tenon. Classic joinery can't be beat by modern processes, fasteners or adhesives.

Using bomb-proof joints takes a little more shop time, but you will never have to replace your bookcase, hanging cabinet or Morris chair again. So you are actually saving future time and material.

Anarchy & Design

If you want your work to survive time, I think you should embrace simple and classic forms. I'm not saying all ornament should be stripped away, just that it should be applied sparingly so that it doesn't relegate your work to the basement right after your funeral.

I am a believer that there are ideal forms for objects – a table, a chair, a cup. If you look at enough examples of the forms that occupy our homes and our history, then you can sound out the design vocabulary that all good woodworking shares.

When I designed and built my dining table I looked at hundreds of examples before I narrowed it down to a trestle form. I pored over every trestle table design I could put my finger on in books and in real life. I kept a huge clipping file.

Then I did something that woodworker Darrell Peart teaches young designers. First, absorb everything you can find about the object you want to build. Wait a few days. Then sketch it from memory. Most of us cannot draw a reproduction from memory, but our brains will distill everything we've absorbed into a new object, perhaps even an ideal form.

So don't design in isolation, even if you want to make something "new." Look at books. Visit museums and antique stores. Study nature.

In other words, the design cues for the ideal table and cabinet and chair

are waiting for you to discover in Wallace Nutting's "Furniture Treasury" – an inexpensive 20th-century visual dictionary of American furniture. A visit to the Metropolitan Museum of Art in New York City or any major city museum with a decorative arts wing will give you another visual education. The 10-volume set of the books "American Antiques" (Highland House) will help, even if you are living in Sweden.

A dining table is a set of functional characteristics (a top that is about 30" off the ground; room for legs; wide enough for at least two people and their place settings, etc.). It is a set of mechanical characteristics (the table must resist wracking and swift kicks). And it is a set of aesthetic characteristics (good tables combine a delicate appearance with a disproportionate strength).

When you boil down those three characteristics – functional, mechanical and aesthetic – then look at enough tables yourself, you deboss the ideal concept of a table in your heart. You can choose to embellish that form, moving it away from that ideal. Or you can obey it and build something that will always endure the wary eye of future generations.

Anarchy & Tools

I think you should buy tools that are as durable as your furniture. Your first table saw, jointer and planer should be your last (trust me, this is the cheaper

Beyond me. A tool that performs beyond my abilities is my favorite kind of tool. I've grown into this saw and still have some growing to do.

way to go). Your hand tools should never have to be replaced, unless you use up a chisel or sawplate by grinding it into filings.

Buying poorly made tools only encourages manufacturers to make more crappy ones. We are at the point with tools where some manufacturers are making tools with planned obsolescence. Don't believe me? Do the math with cordless drills someday. Most woodworkers end up buying a new cordless drill every two or three years, according to research that manufacturers have shared with me.

A tool that gives you a lifetime of work (or more) is always the less-expensive option. A $150 block plane vs. a $40 block plane is insignificant when factored out over its 100-year lifespan. A $15 brace is demonstrably cheaper than every electric drill ever made.

So buy good tools. Because good tools tend to subvert the greater economy, they should be illegal.

Anarchy & Tool Chests

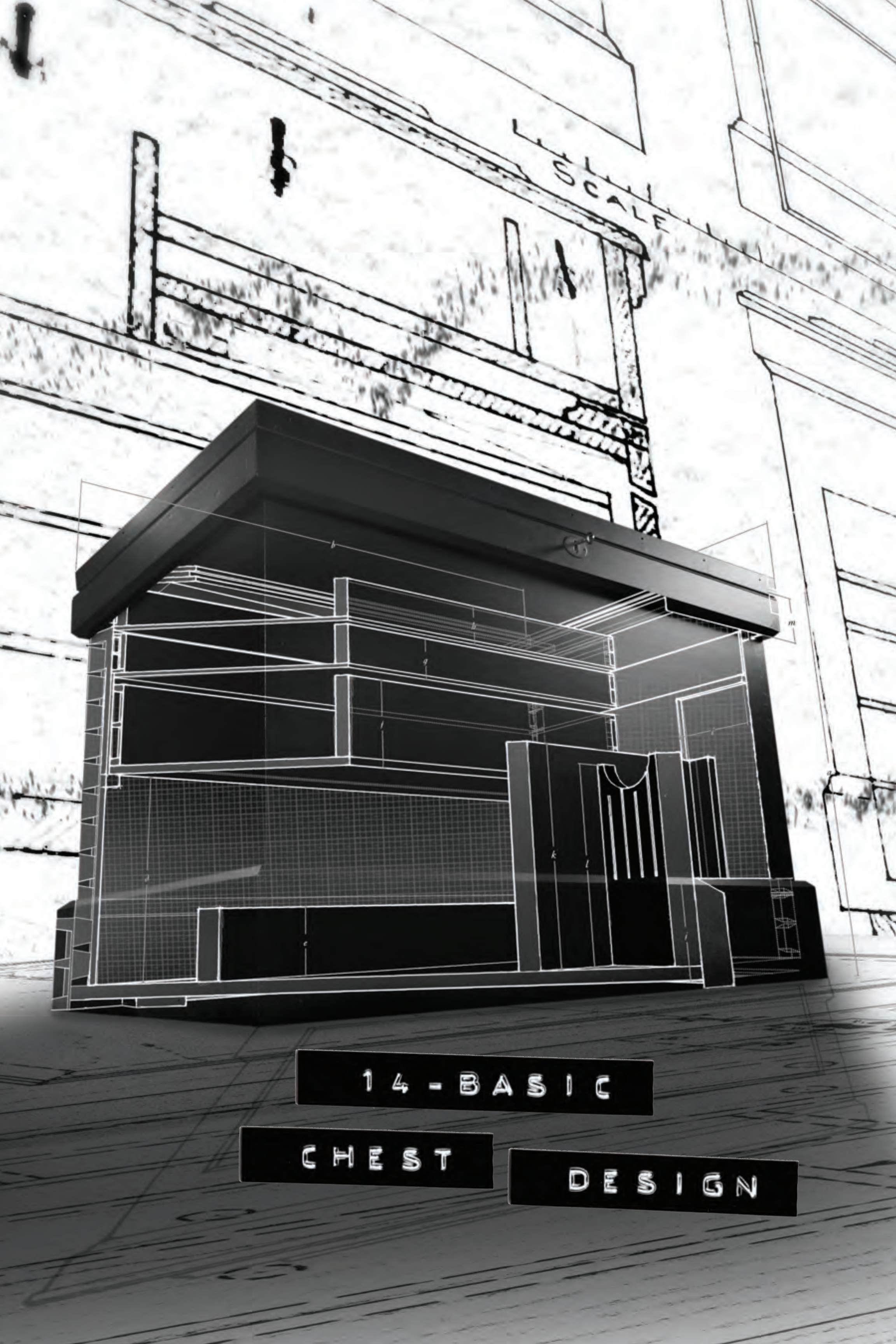
By owning your own tools, you are thumbing your nose at the dehumanizing concept of labor specialization. By rejecting the mass-manufactured style-of-the-moment dining tables, you are questioning the dominant institutions that produce them. By filling your home with furniture that will last for generations, you are knee-capping the system that requires constant consumption.

I call that anarchy. But even if you don't call it that (and I don't recommend that you do) you need a proper tool chest.

Like all important objects and lasagna, you cannot buy a good one. (Unless you get lucky and find a good vintage chest at an auction; I don't recommend vintage lasagna.)

So you need to devote about 40 to 80 hours to make a chest that is suitable for a lifetime. The joinery should be top-shelf. The chest in this book has more than 100 dovetail joints. The chest's design should be tested and traditional – it should look as appealing in 100 years as it does the day you finish it. And it should be the ideal place to store a complete set of tools without taking up too much space and without making the tools difficult to fetch when needed.

If the chest currently in your shop or your dreams meets all these criteria, then you are one of the lucky few. If it fails on any of these points, then you need to redesign your tool chest around some simple rules that I have compiled after looking at dozens of chests, reading lots of books and using a traditional chest I built in the 1990s.



14 - BASIC CHEST DESIGN

So what should an anarchist's tool chest look like? Well that's an easy question if you've read this far. It should be made of the best materials you can find. It should be made with tools that don't waste a moment of precious time because they require excessive fiddling or frustration. And the chest should be a shining example of what a tool chest would look like if you distilled all the examples of tool chests out there into one design.

And that's what I attempted to do in 2010.

I have to begin this section of the book with a confession. The chest in this book is not the chest I set out to build. I started out designing with an inferiority complex about the chest, and dreams of stringing and inlay.

I've always felt a bit like the "slow learner" among my woodworking colleagues and readers. I've been farting around with wood and tools since before I had to shave (age 11). Yet my furniture has always stayed at a certain level of ornamentation.

My tastes in objects – all objects – varies wildly between the simple and the spartan (that is to say, not a lot of variation). I like mid-century modern pieces, Frank Lloyd Wright Usonian pieces, Gustav Stickley stuff, Shaker things, Federal-style furniture, Ohio-valley pieces, Jacobean furniture and so on. I've never much wanted to live among highly ornamented rococo pieces. Veneer and inlay from any time period impress me, but it's not something I want surrounding me.

Steve Latta, one of the finest period woodworkers alive today, stunned me one day during a presentation of his work, which is adorned with inlay, carving, mullioned windows, veneer and so on. Every time Latta advanced his presentation and showed a new piece of furniture, you could hear the entire audience gasp a little at the high level of craftsmanship.

Then Latta dropped the following bomb.

"This is the style of furniture I like to build," he said. "But it's not the style I like to live with."

At that moment, I felt a little better about riding on the short bus when it comes to ornamentation. Yeah, I appreciate the fancy stuff. And sure, I'm interested in learning how to do it. But when it comes to making furniture for myself, it doesn't inspire me.

I'm interested in elemental forms. I like things that are stripped down to the point where if you took anything else away, it would disrupt its function.

But still, I have an inferiority complex when it comes to carving, inlay, veneer and the like. So when I decided to build a tool chest for my shop at home, I resolved to pull out all the stops. I purchased Carlyle Lynch's drawing's of Duncan Phyfe's tool chest. I bought a trunkload of veneer. I drew up fancy plans in SketchUp. And I started reading whatever I could get my hands on on the topic of inlay and banding.

I wanted to build a tool chest that would impress both woodworkers and the unwashed. I wanted the tool chest to make a statement about my skills.

Then I was slapped to my senses by a 108-year-old essay by an anonymous English woodworker. Here's what happened:

While attending a woodworking show, a Canadian woodworker stopped me and gave me a great gift: a bound volume of all the issues of *The Woodworker* magazine from 1902. It was a reprint and signed by my hero, Charles H. Hayward, the editor of the magazine during a large chunk of the 20th century.

I was dazed by the gift and carried it around with me for several weeks. I read it on my lunch hour at work, while waiting for the kids at school, while sitting in the library. One morning while reading the book with my morning coffee, I read an essay that described the characteristics of a good tool chest that was signed by "A Practical Joiner." The end of the essay went like this:

"One thing I strongly object to – this is the use of inlaying and such extravagances on tool chests; they should be made well, strong, and convenient, so as to last a lifetime, being for use, not for show."

The long of it. My 24"-long jointer/try plane is the biggest plane I own. So I made sure that it would fit in the bottom of my chest and could be easily removed.

This sentence and the statement from Latta made me immediately change course.

It was a bit like waking from a dream where you are doing unlikely deeds (walking around without pants, etc.). The chest I was drafting was unlike any chest I had seen in person. I've seen quite a lot of chests at auctions, in tool collections and in shops. But I've never seen one for sale with outlandish inlay, veneer and carving. All the chests I've seen were stout but plain.

All the fancy ones I know of are in books, magazine articles or day-dreams. That day I trashed my plans for the fancy-pants tool chest. And I started again from scratch.

The Rules for a Good Tool Chest

Just like when building a piece of woodwork, there are guidelines when building a chest that you ignore at your own peril. Some of these are more important than others. And many of them are interrelated, especially the guidelines for materials and joinery.

These rules aren't in any book (until now). They are things that I've culled from looking at historic chests in person and on paper. But most of all, they come from my own experience. About 1998, I built a traditional tool chest with a fancy veneered till based on the chest of Benjamin Seaton. I started with that well-established 18th-century form. I've used it just about every day since 1998. And I modified it and observed the things about that chest that I like and hate.

Rule No. 1: As Long as Your Tool Plus Some

First, let's talk about some of the concepts that are cut and dried. The size of tool chests for joiners and cabinetmakers is fairly standard. The length of tool chests is typically somewhere between 35" and 43". This dimension allows the chest to easily hold the handsaws used by a joiner, which have a 26"-long blade plus another 5" of wooden tote. Ripsaws can have an even longer blade, up to 30". Plus the length of the chest should give you some room to get your hand in there to grab the tote of your longest saw.

In addition to long saws, the chest needs to hold the long jointer plane, one of the core tools. While metal planes top out at about 24" long, wooden-bodied planes can go much longer – 30" long isn't uncommon. And a chest longer than 43" will make it harder to transport in a carriage or minivan.

So when you are trying to sketch out the length of your chest, measure your longest saw, add 5" so you can get your hand in there easily, and don't forget to add a couple inches for the thickness of the material. That will easily get you to 37" to 40" if you use full-size saws.

Put your right hand in. Secure your body against the rim of the chest with your off-hand. Root around for the tool you need with your dominant hand. No deep-knee bends necessary.

The shell of my chest ended up at 38" long. I want to be able to hold full-size handsaws (mine are about 31" long), though I am designing this one to hold shorter panel saws for now.

Rule No. 2: High Enough to Make a Human Tripod

In general, modern tool chests are shorter than traditional ones – a trend during the last 60 years or so. The typical explanation for this trend is that the modern woodworker has fewer and more compact tools, hence the shrunken box.

The problem with these stunted boxes is they are harder to use. They are about 14" to 16" high, and when you put them on the floor, it is ridiculously hard to bend over to fetch a tool from them. So you put them on top of your

34"-high workbench or table saw. Then the opening of your toolbox is about 50" from the floor. That's a bit high, and the toolbox is now taking up valuable space on your benchtop.

Traditional tool boxes are usually about 22" to 27" high, with a lot of them at 24" high. That height is ideal for the human form, in my opinion. The rim of the tool chest is slightly below the pivot point of your waist. So you bend over and place your off-hand on the rim of the chest to stabilize yourself as you use your dominant hand to shift trays around to locate the tool you need. Your off-hand becomes the third leg of a human tripod.

After using a chest like this for so many years, the above motion is almost ridiculous to describe, but it needs to be said so you don't build some lilliputian chest in the name of economy or because you are beguiled by some post-World War II plan for a chest. I've had many students with these dwarf chests and watched as they tried to work with them. They end up doing a lot of squatting. I'm no fan of squats.

Naturally, the extra height of an old-school chest gives you more room for tool trays or saw tills or chisel racks. It also makes the chest a nice height for sitting. I have my old chest on low casters and sit on it all the time when I'm working on some piece of detailed work at my bench. It's also a nice height for clamping up panels on top of the closed lid. In a pinch, the chest can be used as a sawbench. I'm not the first woodworker to do this. I've observed several vintage chests that have been scored by sawteeth.

One final note on dwarf chests: There are vintage chests out there that are smaller than the average chest. These typically were for the woodworker on the go. For the joiner who needed to work on-site, or a ship's carpenter, or any other mobile worker, a small chest that could fit in a wagon and hold a smaller set of tools was ideal. Think of these small chests like you would a job-site table saw. You sure as heck wouldn't want to build a highboy with one of those little gizmos in your shop. But by the same token, you wouldn't want to drag a cabinet saw to a construction site.

Rule No. 3: A Depth to Match Your Reach

The depth of the chest is usually about the same dimension as its height, or at least in the same range. This makes sense for a lot of reasons. For one, it looks nice. A square profile is a pleasing form. But it also makes sense for a lot of practical reasons. A shallow tool chest wouldn't be as stable, especially with its lid open. A deeper chest would be a pain to use.

Imagine a 36"-deep chest. Your arms would have a heck of a time trying to reach tools in the back of the chest. Even opening and closing the lid would be inconvenient because you'd have to strain to reach the lid, which is angled back by several degrees when fully open.

Deep chests are less than ideal in the same way that deep workbenches are. Our arms are comfortable reaching across 22" to 26" for a tool. Any longer than that and we have to lean or stretch.

You might not think this is a big deal, but after years of using too-deep benches, I can assure you it is.

So now we have sketched out the shell of a box that's about 38" long, 24" high and 24" deep, maybe a little smaller or a little bigger depending on the material we have. Speaking of material, what wood should we use for the chest? The natural inclination is to use something strong, such as oak or maple. But tool chests in these materials aren't common. Why?

Rules No. 4 & 5: Reduce the Weight; Increase the Joinery

Here is one of those instances where two important characteristics of your tool chest have a symbiotic relationship. And that's because one of the guiding principles of chest construction is to make the chest as lightweight as possible to make it easier to move, and as strong as possible because the chest might take a beating, especially on a voyage.

Lightweight woods aren't typically as strong as heavy woods. So here's what you do: Use a lightweight wood such as pine. But join the corners using the most bombproof joinery available: through-dovetails. Use the light-

Light but strong. If you use pine for your shell (and you should), then you should beef up the thickness a bit. I like 7/8"; some people go for the full inch.

weight (and cheap) wood with dovetails for every component of the chest, except for the parts that have to endure friction. Soft and lightweight woods are easily worn away if they rub constantly against other parts. A good example of this is a drawer or a sliding tray in a tool chest.

If you've studied antique chests of drawers then you know exactly what I'm talking about. In a dresser, pine drawer sides and pine drawer runners make for a piece of furniture that will soon need repairs. The typical fix is to re-line the worn drawer sides with some oak.

So why not make the sliding trays in your chest out of oak? White oak is far heavier than white pine. The specific gravity of white oak is about .77; the specific gravity of white pine is about .42.

So the best strategy is to use oak only where you need it. That means oak drawer runners and oak drawer bottoms – if your drawer bottoms rest on

Fixable. By securing the bottom with nails instead of a fancier joint, you are making the chest easier to repair in the future. Bottom boards can rot.

your runners. If instead your tray's bottoms are captured by the sides, front and back of your tool trays, then make the side pieces out of oak. Use pine for the rest of the parts, and dovetail every corner.

Rule No. 6: Make a Thick Shell

So let's talk about the four walls of the chest. That's where material selection and construction begins. Some old woodworking books are specific about the quality of the material for the shell, that it should be the clearest pine possible, free of knots and even sapwood.

This might seem odd considering that the chest will be painted, but it's good advice. One of the antique chests I owned had several knots on the back. When I bought it, a couple of the knots had fallen out, and after moving the chest to the Midwest, a couple more fell out. Those I glued back in with epoxy. Why be so fussy about knots? They expose your tools to dust, which carries salts, which will corrode your tools.

Most tool chests I encounter have shells made from pine that is between 7/8" and 1" thick. Early furniture was more likely to have thicker structural components, so a 3/4"-thick shell would be unusual. And it makes a difference in the stoutness of the overall shell. I have no compunction about rolling my fully loaded chest onto a truck where it will be slammed and crushed by other heavy objects. But I'd hesitate to do that if the shell were thinner.

So why not make the shell out of 1-1/2" material? You could, but dovetailing those corners would be a major pain in the butt because your material is so thick. You'd probably have to use a tenon saw to cut the dovetails. And I don't think the extra-thick material would add meaningful strength. Chests made from 7/8" material stand up just fine for a couple hundred years.

Rule No. 7: The Bottom Can Be Nailed. But Why?

So after all this talk about dovetails, it might seem odd that I recommend nailing the chest's bottom boards onto the shell. On the surface, that doesn't seem smart. And that's what I thought when I built my first tool chest. I thought I'd do a better job than my ancestors and secure the bottom in a groove I plowed in all four sides of the chest's shell. I made the bottom a 3/4"-thick solid panel and rabbeted its four edges so the underside of the bottom piece was flush with the bottom edges of the shell.

In retrospect, this wasn't a good idea. A solid panel bottom will move a lot compared to five or six individual bottom boards, which will share the seasonal expansion and contraction. So if you use a solid panel bottom you will have to leave some serious space for the panel to swell and shrink in the groove in the shell, which isn't ideal. You want everything to be as tight as possible.

There are some other good reasons to use individual boards secured by nails. If the bottom gets damaged, replacing one cracked board is easier than replacing an entire panel, no matter how the bottom is attached.

And replacing one nailed-on board is easier than replacing a board secured in a groove.

The bottom of the chest is the most susceptible to damage – but not the kind of damage that some extra thickness will fix. The bottom boards are prone to rot, especially in a leaky basement shop.

In fact, if you anticipate that your chest will sit on a floor that sometimes gets damp, you might be better off using white oak, which resists rot, instead of pine, which does not. If the excess weight is a concern, consider a more lightweight rot-resistant species, such as cypress (my first choice), mahogany (an expensive choice) or redwood (which is too lightweight for my tastes).

Most importantly, never try to outfox the dead when it comes to design. It's like a zombie movie; it almost never works out for the living.

Not mitered. Dovetail your skirt and dust seal to the shell to ensure they stick around. Literally.

Rule No. 8: Skirts & Dust Seals & Miters

The chest's skirt and dust seal take almost as much damage as the chest's bottom. They are the first line of defense when the chest is slid onto a truck, or when a piece of machinery is wheeled across the shop and is stopped by your chest.

The skirt and dust seal (the skirt near the top rim of the shell) should be bulletproof. On my first tool chest, I took the easy path with my skirt and dust seal, and I regret it. I glued the skirt and seal to the shell – a good thing. But I mitered the corners instead of dovetailing them – a bad thing.

The miters will almost certainly open up in time, exposing their fragile edges to damage and generally making one look like a woodworker who doesn't understand the craft. Dovetail the corners of your skirt and dust seal. Yes, it's a bit of a pain to fit everything around the shell. And yes, your work will get painted so it won't look any tidier than a quick miter. But a dovetailed skirt and seal will last forever. The corners will never open. So the exterior of your chest will look as sturdy in 100 years as the day you built it.

While I advocate dovetailing the corners, I don't think you have to use a fancy mitered shoulder. A mitered dovetail has its top corner tail and pin mitered so that the joint looks like a plain miter. That's a great joint for a cabinet's carcase. But it's not necessary for a painted skirt or dust seal. Join the corners with a standard through-dovetail. Then cut the moulding shape on the finished parts. Apply some paint and the joint will look seamless.

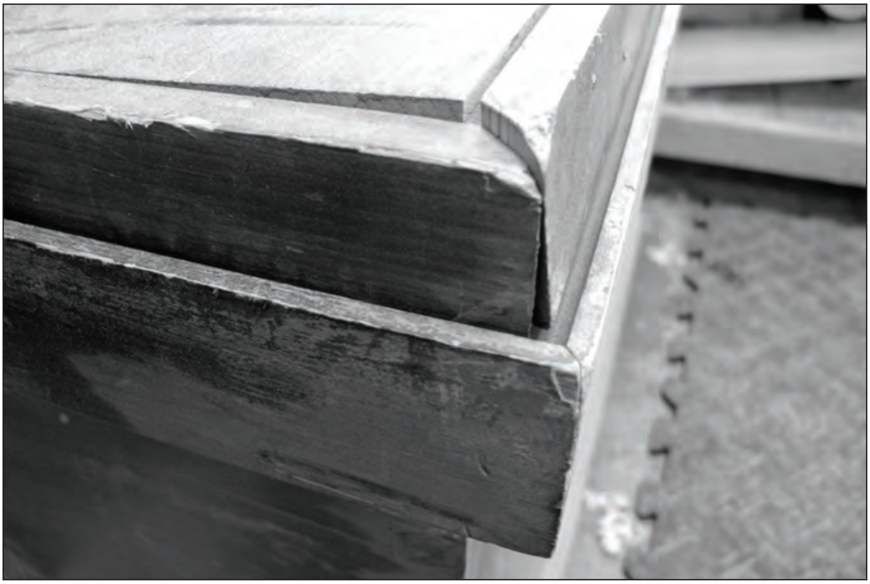
Speaking of the moulding shape, I prefer to use a simple bevel or chamfer. I applied an ogee to the skirt of my first chest. While the ogee held up just as well as a chamfer, it looks out of place to my eye on a piece that is robust and functional.

Rule No. 9: Don't Blow it on the Lid

There are several ways to make the lid. Some work great. Some are quite stupid. Let's start with the stupid ways first. When I built my first tool chest, I copied the construction of the lid from an original. It was a single flat panel of wood trimmed on three of its edges with narrow stock that would interlock with the dust seal attached to the shell.

If I remember correctly, I think the lid worked as intended for about a week, and it has been bockety ever since. The first problem was with the lock strike, the brass plate mortised into the underside of the lid. Because the lid was a simple flat panel, the top shrank a bit, which moved the lock strike.

One day I tried to lock the chest, and the mechanism wouldn't engage. In fact, it just pushed the lid up off the dust seal. So I filed the opening in the



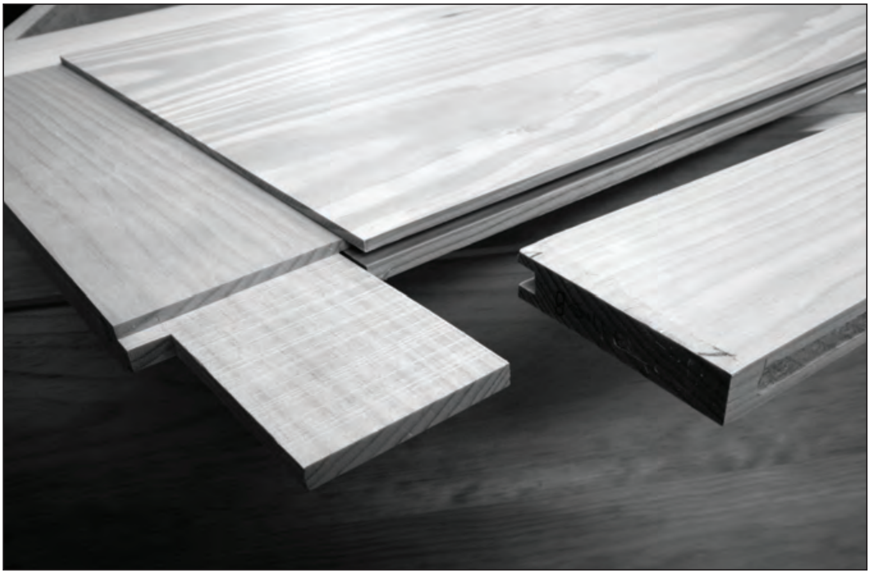
Miters and mayhem. The flat panel lid warped and shrank. The miters lost their hold. This lid is a mess.

strike until the lock worked again. About six months later the top expanded and the lock wouldn't work anymore. This time, filing wasn't going to fix the problem – I would have filed away one wall off the strike. So I resigned myself to having a chest that would lock only during the dry season.

Then the top warped.

Because the top of the lid was the bark side of the tree, the warping made things worse. The front and back edges of the top curled up. And the movement was enough that the strike couldn't be struck by the lock mechanism.

But my troubles didn't end there. When I built the chest, I wasn't a total doofus on the topic of wood movement. I knew the lid was going to move, so I selected a species that didn't move a lot once it was dry. I used white pine. And when I applied the trim around the lid, I did everything I could to minimize the problem of cross-grain construction. The trim pieces on the ends of the lid were the problem. They had to be nailed onto the end grain.



Better lid. A frame-and-panel lid with a raised panel is about as robust as you can get without adding lots of weight.

This is a problem. Nails and screws don't hold as tightly into end grain as they do into face grain. So I wanted to introduce some glue into the joint to help things along. Of course, glue doesn't want to stick to end grain. And when you glue long grain to end grain, the end grain will try to bust apart the joint as it expands and contracts with the seasons.

There are several solutions to this problem. Some involve a sliding dovetail. Others involve screws in elongated slots. The simplest solution is to glue and nail the trim on at the front of the lid and use nails only at the back part of the lid. This was the technique that the original builder had used. The theory here is that the glue and nails will keep the trim secure and tight up at the miters, and the nails at the back of the lid will bend to allow the lid to move.

It's an interesting theory and one that sometimes works. It sure didn't work for me, however.

The trim is barely holding on to the lid. The miters are open and flopping around like a broken finger. And the lid's joints look like crap. I want to remove the lid and rebuild it. I should remove it and rebuild it. But I really like the way the paint has aged on the lid, and the broken joints are a constant reminder about the wily ways of wood.

So when I set out to build a new chest, I looked for other historical examples that would be more durable. The vintage pine chest I bought had the trim glued and pinned to the underside of the lid. This had the advantage of removing the end grain from the equation. All the joints were long-grain-to-long-grain. But this is still a bad way to build a lid. Instead of the trim coming loose, this lid is designed to split. And boy did the lid split. There is a 3/8"-wide canyon right up the middle of the lid, which invites dust inside. It's such a problem that the best solution was to cover the split with tape to keep the dust out.

So don't build your lid like that.

I took a look at other chests. Duncan Phyfe (1768-1854) was a smart guy, one of the most celebrated 19th-century cabinetmakers. And his tool chest, now at the New-York Historical Society, is filled with all manner of amazing tools. But the lid is curious. It's a flat panel with breadboard ends. While the lid worked out for Duncan, it might not work out for you. Breadboard ends definitely can help things and improve the way a dust seal will attach to it. But it still won't help things when you add lock hardware. It's going to move forward and back as the panel expands and contracts.

Really, the best solution is to build the lid as a frame-and-panel assembly (or use a slab of Formica). This confines almost all of the wood movement to the panel that floats harmlessly in the middle of the rails and stiles. And if you choose quartersawn wood for the rails and stiles, they will barely move at all.

So you could build the lid in the same way you would build a raised-panel door. I would recommend using through-tenons on the rails. But what about the panel? You want the panel to be thick and stout because it will

Not for lifting. Installing iron or rope handles on the ends of your chest will help you balance the chest as you move it. Grab the chest at the bottom and keep it balanced by grasping the handles.

take a beating. So the joint between the panel and the lid frame is critical. You don't really want to thin down the edges of the panel as you would when making a door panel. Thin edges will weaken the panel.

The old-school solution here is to plow a groove in the edges of the panel so the panel will interlock with the rails and stiles. This will keep the joint between the panel and frame as stout as possible, and the panel will be raised above the frame of the lid.

There is no downside to this approach. There are no weak spots on the lid. There is no significant wood movement along the edges or ends of the lid. So the trim around it will stay put. It is as permanent as can be.

There are some other details to consider with the lid, especially the hinges. You want stout hinges, and probably the stoutest hinge is a continuous hinge, sometimes called a piano hinge. And I'd use that if I were a blind man. To me they are ugly, akin to an airbrushed barbarian on a custom van.

So the other option is brass or steel butt hinges. Three hinges that are 2-1/2" long should do the trick. Some chests have only two butt hinges, but I'm an overkill guy (as long as the overkill isn't ugly, which would be roadkill).

You also need a way to stop the lid from flopping backward. Some chests ignore this function and just rest the lid against the shop wall. But chests aren't always against a wall. Other chests are so small that you can lift the lid with your off-hand and root around its contents with your other. This, however, is not an ideal way to search around inside a full-size chest.

Another trick is to make the dust seal at the rear of the chest a little taller so it acts as a stop for the lid. I used this method on my first chest, and it works. But I worry about it. Every time I open my lid against the stop, the act pries my butt hinges up from the shell. So far, I've had no problems, but seeing those butt hinges flex a little does not give me long-term confidence.

So I recommend a metal chain. Screw it to the lid and the side of the chest and be done with it. There are other, more complex, lid stays, but they can interfere with your sliding trays. So if you want to use the fancy brass lever mechanisms, be sure you have the room inside your chest first.

Other Exterior Accoutrement

Some people paint eagles on their chests (see my above comment on airbrushing). Others add fancy "beckets" – rope handles on the ends of their chests that are held to the shell by cleats, which can be chipcarved (with unicorns) if you please.

I like beckets. I think they are a gorgeous type of work and saw many on sea chests when visiting Mystic Seaport as a child. But they look out of place on a joiner's chest to my eye. I admit I put cleats and rope handles on my first chest, though it wasn't a fancy braid. The rope was from my grandfather's sailboat. But I don't find the rope handles to be all that useful. Why? Handles on a chest, whether they are rope or metal, aren't really designed to be used to move the chest. Instead, I found that I would use the ropes to pull the chest up, then I would grasp the bottom of the chest to move it. Having the chest swinging near the floor by ropes is murder on your back, and the chest is unbalanced.

After about five years, I put my chest on casters, and the handles became as useful as male mammaries.

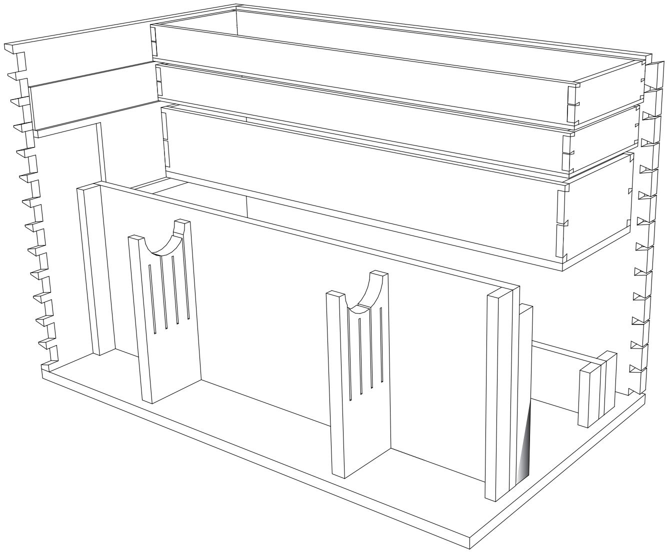
Rule No. 10: Divide the Bottom Layer

With the exterior shell designed, we can now move to divvying up the inside of the chest for your tools. This might seem to be something that is all free-form and open for creativity. However, I have always been struck by how consistently the early chests are laid out. And after trying out several arrangements, I've concluded that the time-tested ways are quite good.

American tool chests tend to put two things on the bottom layer of the tool chest: planes (bench planes, moulding planes and joinery planes) and saws. Some English chests put the saws in a special till affixed to the underside of the chest's lid, some did not. Some American chests would put a saw or two on the lid at times, but mostly the saws went in a rack near the front of the chest.

So the back corner of the chest is a good place for moulding planes and rabbet planes. Set them on their toes with the wedges facing the inside of the chest. A dividing wall under the wedges will hold the planes upright. The good thing is that most moulding planes are the same length and width. (Older planes are inconsistent in length.) Storing the planes upright in your chest is ideal. This allows you to see the profiles on the soles and the sizes, which are usually stamped on the heel. Storing your moulding planes with their soles flat on the bottom of the chest will only invite confusion as you add more moulding planes.

This part of the chest will take up only a small part of the bottom area – about 3-1/2" of space plus the thickness of the wall. So there is lots of space



Classic bottom layout. Most chests have three compartments in the bottom: One for saws, one for moulding planes and one for bench and joinery planes.

left. Note that some chests put the moulding planes in the front of the chest and put the saws on the lid.

If you put the moulding planes at the back, I recommend you put the saw till up at the front of the chest. The size of the saw till really depends on how many large saws you have. A typical kit of saws will have a full-size ripsaw, a crosscut handsaw, a tenon saw, carcase saw and dovetail saw. The big saws (ripsaw, handsaw and tenon saw) can go into a rack, which I'll detail here in a minute. The smaller saws can hang on the inside walls of the chest.

In my kit of tools, I have a ripsaw, a 7-point panel saw and a 12-point panel saw for fine cuts. So I need four slots if I want to hold my longer saws. Some people have even more saws and will need more space. Because I have only four long saws, my rack is only 4-5/8" wide, plus the width of the wall separating the rack from the rest of the chest.

The till itself is pretty simple – a couple boards with kerfs sliced in them to hold the sawblades. Planning the tills is more difficult than making them.

You want to consider the thickness of the handles and the size of the sawblades, both the length and the depth. And you want the till to hold your saws in a place where you can reach them without stooping too far over. The plans for the chest I built show how I balanced these factors to make my tills. Don't copy me. Measure your own saws, and design your own tills.

The rest of the space on the floor of the tool chest is reserved for bench planes and joinery planes, such as plows, moving fillisters, routers and scrapers. In my chest design, I ended up with a space that measured more than 10" x 37". That is a lot of acreage. You should be able to fit all of the standard planes in there, plus have room for a few other things. Some woodworkers would fold their shop apron up and cover the bench planes.

Having the bench planes, saws and moulding planes at the bottom of the chest works well. For one thing, these tools have more mass than the smaller tools stowed above, so this puts more weight at the bottom of the chest, anchoring it to the floor – thanks, gravity!

Also, when I work, the first task of the day is to remove the bench planes and put them under or on the workbench. Then I remove the saws and hang them on the wall in front of me. So now there is a large part of the chest that I don't have to access as I work. The moulding planes can also go on the bench – some woodworkers store them in a rack on their bench that allows them to see the profiles. But for most woodworkers, making mouldings makes up but a small part of the time on a project. So those planes stay safely down at the bottom of the chest and need only be removed when needed.

Rule No. 11: Trays or a Till?

While the bottom sections of tool chests are fairly consistent, what happens at the top of each chest varies a bit more. The simplest solution is to divide the upper section into a number of trays that slide forward and back. Two or three trays are typical, and their number depends on how tall your chest

Sliding till. The fancy-pants solution to divvying up the top of the chest is to make a large sliding till with integrated drawers. This has upsides and downsides.

is. Chests that have trays that slide left and right are out there, though they are more rare.

Why? Hard to say, exactly. I've never worked with a tool chest with this arrangement, so I'm only guessing here. But I think that left-to-right-trays would get in the way of removing the long tools from the bottom of the chest. It would be a bit of wrist gymnastics to get a 30"-long jointer plane or 32"-long handsaw from the bottom of the chest with half of the airspace above being occupied by trays.

Also, and this is a minor point, I want to be able to see all my moulding plane profiles at once. Left-to-right-trays would always keep half of the planes obscured. Maybe that's not a big deal to some woodworkers, but it is important to me.

The trays slide forward and back on runners that are nailed and glued to the sides of the chest. These runners are like shallow steps up the side of the

Three trays. Here you can see my three sliding trays arrayed out so I can see everything in them. I'm only one hand motion away from accessing any of the three bins in the bottom of the chest.

chest so that each tray can be pulled up and out of the chest if you need to repair it or mess around with some serious business below. Trust me on this – you don't want your trays to be a permanent installation.

However, their joinery should be permanent. You want to minimize the trays' weight and maximize their strength and durability. The way I did this was to make my trays out of 1/2"-thick pine and dovetail the corners. This reduces the weight and makes the trays strong. The bottoms are thin slips of white oak that are nailed to the underside of the dovetailed trays. This makes the part that wears, the bottom, quite durable. By nailing the bottoms to the trays, I also save a little space compared to grooving the bottoms in, and I make it easier to repair the bottoms if they are ever wrecked.

I had room for three trays in my chest. One that is about 5" deep and two that are 2-1/2" deep. You need only one deep tray. Shallow trays are better in almost all cases.

What goes in these trays, specifically? Well there are lots of ways to go here, and I hate to get too dogmatic. Here's some advice from "Spons' Mechanics' Own Book," a compendium of advice from 19th-century writers.

In the top tray, the left side should hold your drill and auger bits. Put them in individual trays that you can take to the bench with you. The rest of the top tray holds your brace, level, gauges, squares and "other finer tools," according to the book.

This makes sense to some degree. Squares and gauges should always be right at hand. I'm a bit (no pun intended) wary of the advice to put the bits and brace there. Perhaps I'm not such a boring guy (pun intended). And the spirit level is another curious choice. If I were a house carpenter or house joiner I'd agree. But for making furniture, the level isn't often used.

Me? I want to put my chisels in the top tray or in a rack against the front wall of the chest. Every joinery operation seems to require a chisel. I also would opt to put a block plane in the top tray. As to other finer tools, my gut says to put my combination square, folding rule, dividers and marking knife up there. Those are tools that I want to grab without having to dig.

OK, let's go back to Spons and see what should lurk below.

In the middle tray, Spons puts "gimlets, bradawls, compasses, pliers, and sundry small tools." And in the lower tray are "chisels, gouges, spoke-shaves, mitre-squares." I don't disagree with any of the tools in these trays. But I would move some of them up and some of them down.

You might try different arrangements in your chest before you commit to installing permanent dividers in the trays.

If you don't like trays, you are probably going to want a fancy-pants till. This is a small chest of drawers inside your tool chest that slides forward and back on runners (Duncan Phyfe's rolled on special brass casters). A typical till will have a tray at the top that is covered by a hinged lid. And below that tray will be three or more banks of small drawers.

Most tills are in chests that are fancier than average. Many of the tills I've seen are veneered pine. The drawer fronts are veneered with crossbanded inlay around the edges. You might see some stringing. The till is mighty appealing if you like furniture. It's like having a cubbyhole for everything.

The downsides to building a chest with a till are that it's not as efficient a use of space in many cases. A till is more complex than a tray. It requires more material to build and it can be awkward to use, especially when you want to get to the stuff at the back of a drawer that's inside a chest.

The chief advantage to the till is that it's always a one-stroke operation to get to the bottom of your chest, which is admittedly nice.

With trays, sometimes you have to slide three trays forward to get one moulding plane. However, if you stagger your three trays as you work, you can avoid this and allow yourself to access every corner of your chest with one hand motion.

I have to say I prefer the more open approach and flexibility of the trays. Because they aren't divided up for you, it's much easier to move a few things around so you can hold the long patternmaker's paring chisels that followed you home. With a till, you are stuck with the drawer widths you built. Not so with the simpler and open trays.

Rule No. 12: Sticking Stuff to the Lid & Walls

Don't forget that the front wall and the lid are a good place to store flat stuff. On the lid, some people put a framing square or a few try squares. I've seen a few handsaws and backsaws hanging on the lid, too. On the front wall of the chest you can hang your try squares and some joinery saws – this is the traditional approach. Other chests I've seen have a rack on the front wall of the chest that holds the chisels, augers and other long and narrow tools – gimlets, awls, striking knives, gouges and the like.

In fact, I'd carefully consider what you will put on the front wall of your chest before you start dividing up your trays or designing the drawer sizes of your till. You can get a buttload of stuff on that front wall with some careful planning.

It's clear. A painted finish is the clear choice for a tool chest. The paint protects the chest from the harsh indignities of workshop life.

Rule No. 13: Finish, Inside & Out

This is the easy part. The outside of a tool chest should be painted. The modern choice is to use milk paint, which is quite durable and looks better as it ages. We don't have lead-based paints available, which were the paint of choice in the pre-Industrial world.

Paint will keep your chest looking good for a long time. Any time it gets banged up, you can renew the look with another coat of paint. A stain or clear finish cannot be renewed as easily. Plus, paint is the most weather-, UV- and abuse-resistant finish available. Unless you want to dunk your chest in Plasti Dip.

On the inside of the chest, I recommend skipping a finish. If you have a fancy till you probably will want to finish it, however. For that, I'd recommend shellac, which will cure quickly and not leave a nasty oily smell that can last for years in an enclosed chest like a linseed oil finish will.

Ready for work. After working out of a chest for 14 years and researching traditional chests for another two years, I knew what I needed to build. The result exceeded my expectation.

For Tiny Tim? I've always been flummoxed by small chests. Yes, there were some chests that were designed to be taken to job-sites. But most smaller chests are modern. Some argue that you need a smaller chest for an amateur's smaller tool kit. Here's my theory: The smaller chests are easier to build during woodworking classes and transport home.

Don't believe the old wives tales about having to finish both the inside and out of a piece of woodwork to "balance the moisture exchange." That sounds good on paper. It doesn't hold water in the real world.

The Chest, Complete

After you build your tool chest you should be able to fit every tool you need into it. Set it at your right hand (or left, if you are sinister). And let it serve as a reminder that it holds the tools to build almost anything that you can design. And, more important, it holds the tools that can release you from the bonds of consumption, decay and further consumption.

15 - DOVETAIL

THE SHELL

The first step to building a chest is to gather up the wood. The widths you can find might dictate some slight alterations in your design – a 23"-deep chest won't get you kicked out of the guild. So before you actually draw up your chest, hunt for 4/4 or 5/4 wood that is light but strong.

Then you can start drafting.

When building a tool chest, it is hard to beat Eastern white pine for all the lightweight parts of the carcase. Amongst the pines, the Eastern white is the most hand-tool friendly. It's shockingly friendly – like wearing a tube top friendly.

The wood is lightweight but strong for a pine. It works easily with hand tools, yet it doesn't crumble like some soft pines. The earlywood and latewood are fairly homogeneous in texture – unlike the yellow pines – so it's easy to saw. And it doesn't move much in service. Quartered Eastern white pine is almost as stable as plywood.

To me it smells better than any other wood.

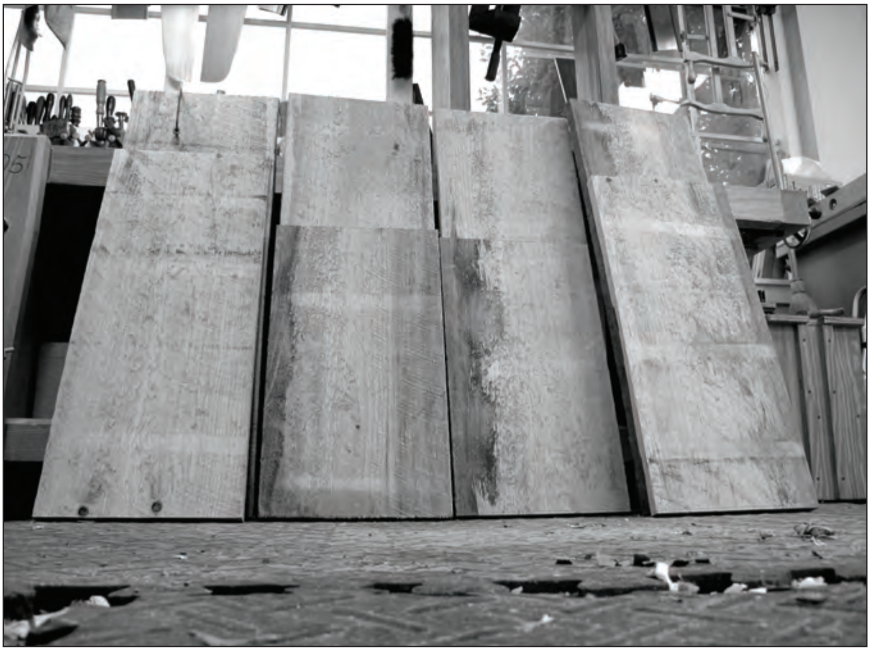
And it can be found in widths that are breathtaking. I can easily get my hands on boards that are 15" wide, and I live outside the tree's natural habitat. Woodworkers who live in the northeast can find boards up to 24" in width if they have a little patience.

While I go the extra mile to get Eastern white pine, almost any other pine will do for a tool chest. I might think twice before I used a yellow pine, such as longleaf pine. While it is incredibly strong and great for workbenches, it also is resinous and quite heavy. Some yellow pine boards feel like they have the specific gravity of hard maple.

And yellow pine is no fun to dovetail.

Picking Individual Boards

Once you find a stash of pine, you need to sort through it because not all boards are ideal for a tool chest. As I mentioned in the previous chapter, knots are bad news. Even tight knots will pop out given enough seasonal



Hanging out to dry. These boards will make the shell of my tool chest. I tend to work the wood in stages and prep only the stock I need for the assembly at hand. It might not be the most efficient way to work, but it sure alleviates boredom.

expansion and contraction. And open knot holes will let in the nasty dust.

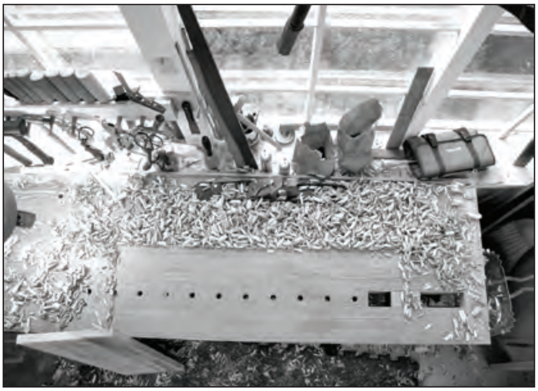
Some early sources even recommend that you rip off any sapwood on the boards, as it was assumed that sapwood was weaker than heartwood. That's not the case, however. Sapwood and heartwood are quite comparable in strength. In fact, in some cases sapwood can be stronger because it tends to be freer of defects because of its young age.

So I don't reject boards with sapwood if I'm going to paint the final result.

I look for boards that are dry, have straight grain and no knots. Other than that, the boards can have a face fit for a radio career as far as I'm concerned. Paint fixes almost everything.

Getting Started

With your wood in hand, the first task is to cut the boards to rough length (usually 1" over-long is enough) and let the wood acclimate to your shop. Remember: Water tends to migrate in and out of the end grain of boards. So cutting them to length will allow them to acclimate quickly. However, sitting them on end on a wet concrete floor will create a cone of wetness. The end on the floor will be wet and the end in the air will be dry. This is bad news.



Narrow is for nitwits. Any woodworking book that tells you to rip your stock into narrow widths should be ignored. Wide wood is always better. Even if you have to handplane one rough face flat before you can run the board through the planer.

If the wood came from an indoor lumberyard, I think you can get by with waiting for just a week or two before you start tearing into the stock on the jointer and planer. But if you aren't sure how wet the wood is, I highly recommend you buy a moisture meter. I know tons of smart woodworkers who have made this foolish omission when buying wet wood. Even if the meter saves your butt only once, it will have paid for itself.

When the wood has reached equilibrium with your shop environment, you can begin jointing and planing the boards to finished thickness.

Notes on Stock Prep

When you deal with wide boards, it is always an excellent strategy to cut them close to their finished width and length before surfacing them with machines or handplanes. By cutting them as small as possible, you are removing twisting, cupping and crooks at the extremities, which will make it much easier to get the board flat with as little effort as possible.

I cut my stock to length using a handsaw and my sawbenches. To rip stuff to width, I turn to my band saw. It makes short work of long rips and is much safer than a table saw when dealing with rough stock. Your band saw can't kick your stock back at you.

Once everything is cut to size and dry, then you can flatten one face of the board. I flatten the concave side of the board (almost always the bark side) first. With a powered jointer, the process is simple. When I do this with a handplane, such as with this chest, I traverse across the board's width with my fore plane, which has its iron ground into a curve.

Traversing allows you to remove an incredibly thick shaving with little effort because you are slicing across the grain – exploiting its weakness.

Be aware that traversing will splinter, or "spelch," the far side of your work as your plane exits the wood. Bevel that far corner before you begin working or begin with your work wider than required (which is a wasteful approach).

The thick and short of it. When you traverse a board, you'll produce these thick curls that have no beam strength along their length. They are as strong as a handful of snow.

Once you get the concave side of each board flat, you can turn to the convex or heart side of the board. A powered planer is the best way to thickness stock. Doing it by hand is the aerobic way, though it's not terrible if you are working with pine.

A good kind of paneling. I made the front, back and sides of the chest from panels made up of two boards each. Arrange the grain so it all runs the same direction on a single panel.

Making Panels; Avoiding Seams

Most old-school resources on building tool chests (and dovetailed chests in general) recommend that you stagger the seam between your glued-up panels so that you don't have one seam running around the girth of the chest.

The reason for this advice is that even if the glue fails on all four panels, the chest will still stay together. If the seam is in the same place all the way around, then the chest could split in two. While I think this sort of catastrophic glue failure is unlikely, the extra five minutes of planning that it requires is no big deal. So you might as well.

After the panels are glued up, square them up to their finished sizes then focus on getting the inside faces of the panels as flat as possible. After all, this is where the joinery will go. The outside surfaces do not have to be dead flat.

The jointer makes way for joinery. Typical machinery cannot make panels as flat as a jointer plane. Period. End of story. I am not listening. Nunga. Nunga. Nunga.

To further mess with your mind, consider this: In this case the inside surfaces should also be the nicest-looking ones. After all, the outside of the chest is going to be painted; the inside of the chest is going to remain unfinished, and with any luck you are going to be looking at those surfaces for a long time.

The best way to make a panel flat is with a jointer plane. Use diagonal strokes at first. Check your work with your winding sticks and straightedge. When the interior surface of the panel is flat, clean off all the tool marks on both surfaces with a smoothing plane and move on to the next panel.

Rabbet Seeks Dove for Long-term Relationship

When I cut dovetails, I always cut a shallow rabbet on the inside of my tail boards. The rabbet is 1/16" deep at most and as wide as the length of the tails. This rabbet makes the hardest part of the entire operation – transferring the tail marks to the pin board – something easier than cake. Brownies?

Thanks to the rabbet you can simply press the fillet of the rabbet against the pin board and the two boards are then perfectly aligned and ready for marking. You can even press the tail board against the pin board to pull out any slight bow in either piece. That way, when you mark, cut and assemble the joint it will pull the bow out and you will have a perfect seam. It also saves chiseling time as you will see below.

Critics of this method say that cutting the rabbet is time-consuming. And

Run rabbet run. This shallow rabbet on the inside of my tail boards makes transferring the tail shape to the pin board a quick and fuss-less process.

most of them have never tried it. To these people, I merely ask them to try it once on a project. If they still think it's slow, I'm going to wonder how long it takes them to cut a rabbet.

If I'm cutting dovetails for one box or drawer, I'll cut the rabbet with a moving fillister plane. If I'm cutting dovetails for a bunch of assemblies, such as on this chest, I'll cut the rabbets using a dado stack in my table saw.

No matter how you cut rabbets, it should be fairly rote and automatic work for you. In fact, it took me longer to take the photos of the process than it took to set up and perform the operation.

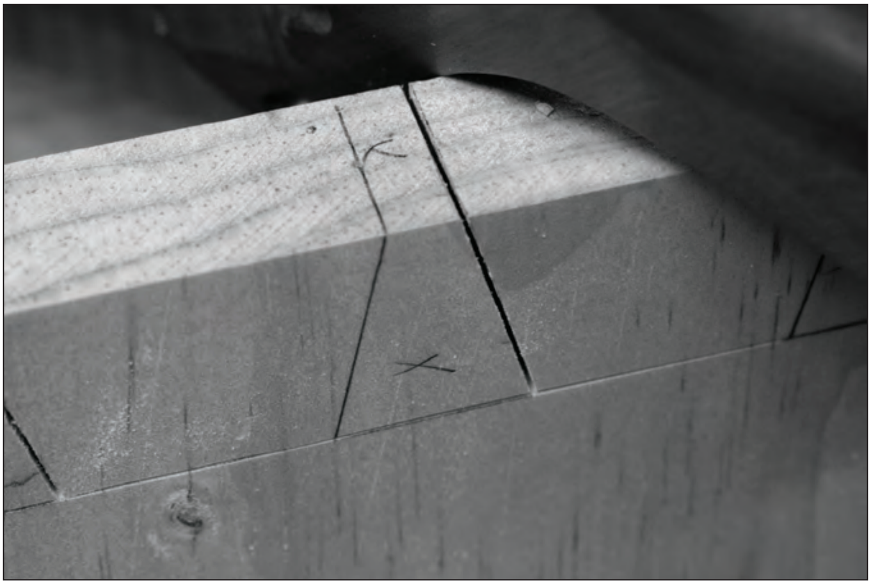
Pencil Please

I cut my tails first when dovetailing. Pins-first is fine, too. I don't have a dog in that fight. But no matter how you cut the joint, what is important is that you understand what is important in the joint.

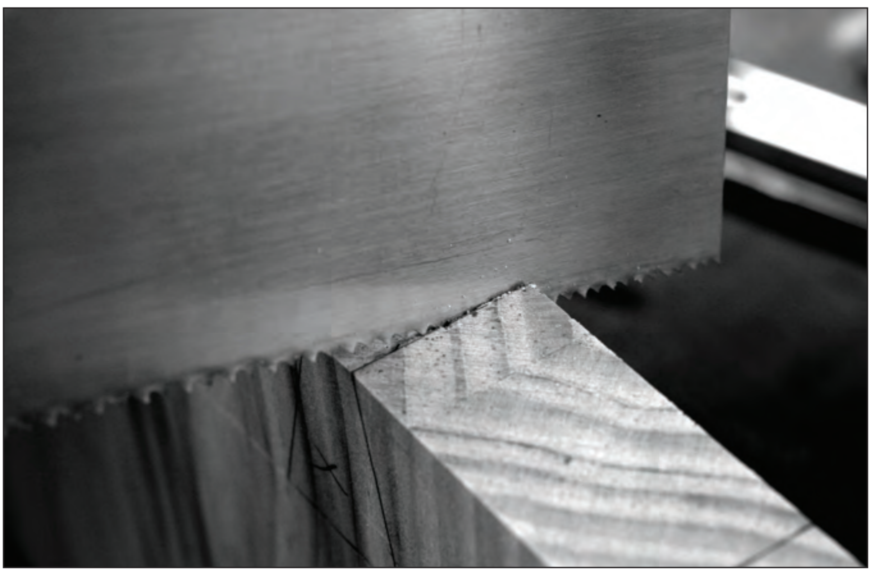
No matter what you cut first, begin by marking the baseline of the joint with a cutting or marking gauge.

The first half of the joint is the pattern for the second part of the joint. If the first part is the tail board, then the slope of the tail isn't important. What's important is that your cut is square across the thickness of the board. The slope can be anywhere from 7° to 20°; that is an aesthetic choice in my book.

Some writers advise you to use different slopes for softwoods and hardwoods, but the furniture record unclogs its nose in their general direction.



Pencil you in. I mark the slope on the show face of the board and across the end grain. Then I cut my tail slopes.



How I remain square. I begin my tail cuts at the edge of the board that faces the bench. Then I creep toward myself, tracking my line.

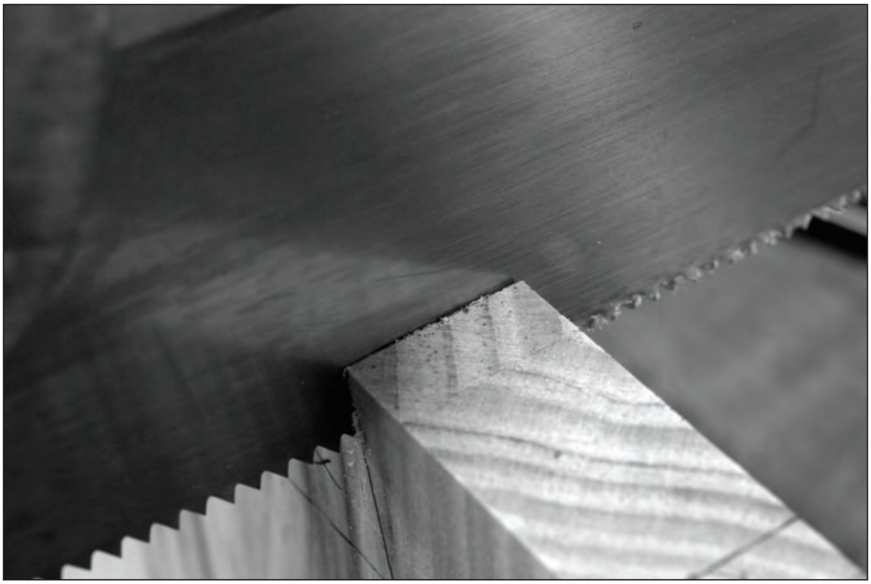
Time to accelerate. After I have sawn square across the thickness I can speed up my sawing because I'm not committed to a particular slope.

Real furniture (not furniture built from words) features slopes that are slight and slightly radical. I like bold 14° dovetails. But I think my choice is dictated a bit by fashion. Earlier writers talk about how dovetails that are visible in a piece should have less slope because they look better.

This long-running debate is just something to think about as you choose a slope. A radical slope in either direction might look dated soon enough.

Because the first half of the joint is the pattern for the second, I use just a pencil to lay out the slopes of the joint – knifing the joint is a waste of time. And because these tail cuts have to be square across the board's thickness, marking the backside of the joint is also a waste.

Some woodworkers don't even mark out the joint at all. They merely start cutting and lay out everything by eye. This is the fastest way to do it, but I prefer to mark it out so that I can preview the look of the joint before I take up my saw in hand and commit to that spacing of tails and pins.



And now level. As I dive to the baseline, I hold my saw parallel to the floor so I can hit my baselines simultaneously.

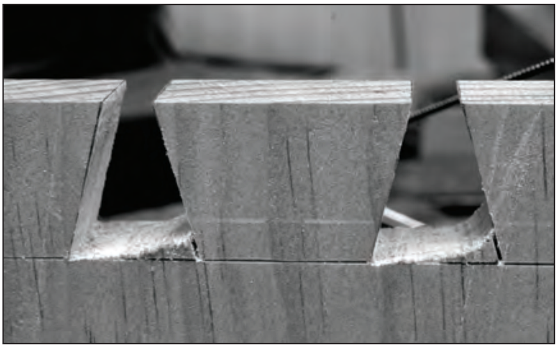
Excavating Waste

I've always sawn out my dovetail waste with a coping saw. I'm fast with a coping saw and can get quite close to my baseline without going over.

You can chisel out your waste without sawing it. But here's why I do what I do: I use a coping saw because it's easier to replace a dull coping saw blade than it is to sharpen my chisel several times during a project.

By sawing out the waste, my chisel stays sharp much longer because I'm using it less. And a coping saw blade lasts me for at least three projects. So because of these kinds of numbers, I find it efficient (for me) to saw out the waste. Your equation might be different.

Why do I use a coping saw and not a fretsaw? While fretsaws have much finer blades that can make a turn a lot faster than a coping saw, fretsaw blades are slower and more fragile. I'll snap two fretsaw blades (at least) in a typical project. Or, put another way, I've never replaced a fretsaw blade because it was dull. They snap before they dull. In contrast, I've probably snapped only one coping saw blade.



Almost completely wasted. Here's how close I can get to my baseline. While it looks like I crossed the baseline on the left side of these joints, you're actually seeing the ragged edge of the sawcut covering the baseline. It's there.

Chisel the Rest

If I'm on my game, then I should be able to remove the rest of the waste with just a few knocks of a chisel. I usually can even begin my chisel cut with the tip of the tool right in my baseline without worrying about the tool creeping back past it.

If I'm not able to cope well, then here's my chiseling strategy.

- I position myself so that I can see if the chisel is truly vertical. That means standing to the side of the tool. Not in front of it. Not behind it.
- Place the tip of the chisel so that you are removing half of the waste. If there is 1/8" of waste to remove, then place the chisel 1/16" away from the baseline. Drive it in so it goes halfway into the thickness of the board.
- Continue to remove half the remaining waste until your chisel cannot bisect the waste. This is usually when you have 1/16" left or so. Drop your chisel in the baseline and tap the tool halfway through the thickness.
- Flip the board over to deal with the rabbeted face. Thanks to the rabbet, you can begin right in your baseline, even if you have a lot of waste. The wall of the rabbet will prevent your tool from crossing the baseline – another good reason to use the shallow rabbet on tail boards.

Stand aside. You can see vertical. And after a few years of dovetailing, you'll know vertical like you know your spouse.

Halfway home. Here I have about 1/8" of waste left, so I place the chisel 1/16" away from the baseline and drive the tool halfway through the thickness.

On the line. When I have 1/16" of waste left (or less), I drop the tip of the chisel in the baseline and drive down.

The Easy Transfer

With all the tails cut, it's time to transfer the shape of the tails to the pin board. I place the pin board in my vise then position my tail board so its rabbet drops right on top of the pin board. You'll have to support the tail board with something, such as a block of wood.

After the tail board is on the pin board, align the edges of the two boards by placing the back of a chisel against the corner of the intersection. Shift the tail board left or right until the two edges are aligned. Then peer into the gaps between the tails in the middle of your panels. Look for any bowing, which will reveal itself as a gap between the two components.

If you have a bowed panel, press out the bow by pressing the tail board down and toward you. This is where the rabbet on your tail board will save your butt.

Align the edges. Don't align your edges by eye. Use a chisel so it will be dead-on. This will reduce your edge-planing chores after assembly.

From a Caress to a Stabbing

Knifing the shape of the tail board onto the pin board gives some woodworkers fits. But that's because their knife skills stink. Most woodworkers begin with entirely too much downward pressure. This makes the knife follow the softest part of the grain in the pin board, taking you way off line.

The right way to knife in a joint is to begin with the lightest caress you can manage. Focus your pressure so that the flat of the knife is riding the tail and the tip is riding lightly across the pin board. Take another caressing stroke. Then take two more with slightly more pressure. Then, because we are all going blind, make one final stroke with lots of downward pressure but almost no lateral pressure, which can push your tail board left or right and reduce a nun to a cursing fit.

Trace around all your tails this way. Remove the tail board. Mark your baseline on your pin board. Because of the rabbet on the tail board, your baseline isn't in the same place on the pin board as it is on the tail board. Set your gauge so it matches the finished thickness of the tails. Mark that baseline on your pin board.

Pointy bit by bit. Use light downward pressure on your first two strokes. Then you can increase the downward pressure during subsequent strokes to create a nice crisp line.

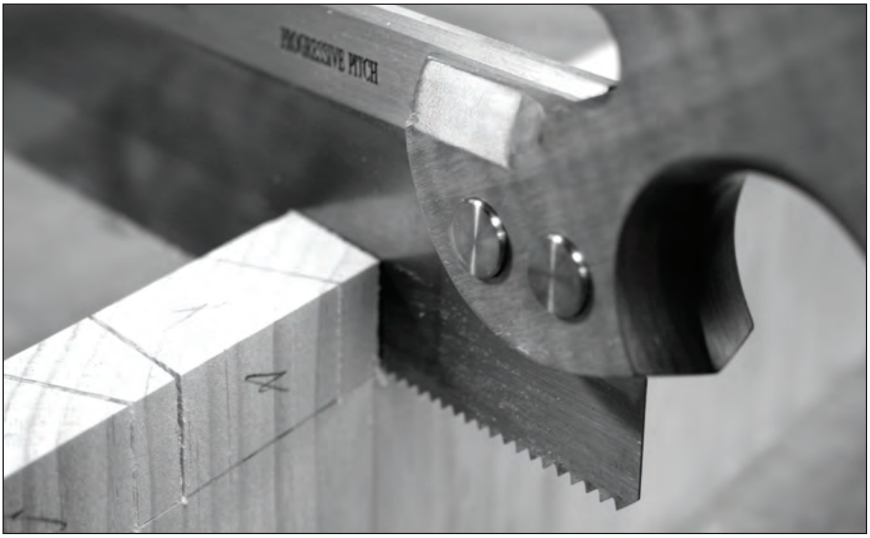
The Critical Pins

When you cut the pins, you have to watch a lot of things at the same time. Here are the three important things:

- Follow the slope you traced on the end grain of the pin board.
- Keep your saw dead vertical as you cut.
- Don't cross the baseline on either side of the board.

Because there is so much going on, I take two extra measures to ensure I don't botch this part of the cut. These slow me down a bit, but I think the end result is worth the effort.

- I knife in the vertical cuts I'm going to make. I drop my knife into the mark on the pin board and use a square to guide the knife. Remember to use light pressure.
- I drag a pencil through my knife lines to make them more visible. A .3mm drafting pencil is thin enough to get inside a knife line and mark the bottom. In the end, the line looks like it was made with a laser.



Saw straight down. If you can't saw vertical, you need practice. Not a new saw. Not a jig. Just more sawing. Mark 100 lines on a board and saw straight down. That should do it.

Then remove the waste between the pins using a coping saw and chisel. Use the same method you used on the tail board.

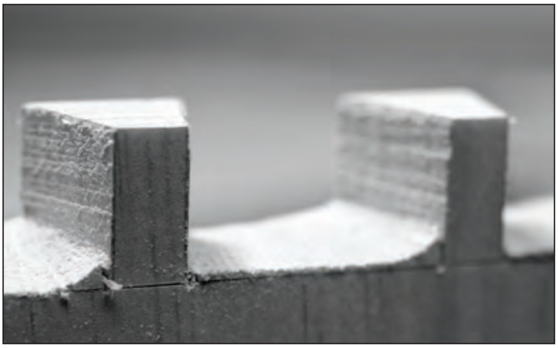
Assembly (or a Beat-down)

When you make your dovetail joints correctly, you don't need clamps or cauls. To assemble the carcase, all you need is glue, a mallet and a scrap of wood. You might need one clamp, which you will apply diagonally to bring the carcase into square after all the gluing.

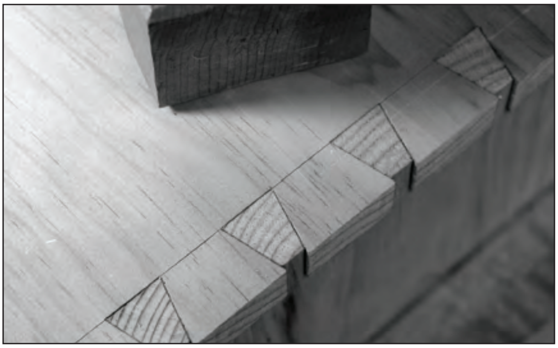
Here's how to go about this: Take your glue and squirt dime-sized squirts onto the end grain between each pin. Then take a palette knife – an artist's tool – and push the glue into the end grain and then up the walls of the pins.

By starting on the end grain, you will use the glue to clog up the pores of the end grain before you spread the glue up the face grain of the pins.

This will add a good deal of strength to the joint. The reason end grain doesn't hold well in a glue joint is that it is too absorbent – it sucks the glue away from the seam, starving the joint of adhesive. By letting the glue pool on the end grain before you spread it, you allow the glue to clog the absorbent pores and actually form a bond between the face grain of the tails and the end grain of the pin board.



More waste. Here's how close I can get to my baseline with a coping saw on the pin board. That's less than 1/16" so I can just drop the chisel tip right into the baseline and whale away.



And assembled. After some practice, this is what a dovetail joint will look like every time. Even if your joints have some gaps, don't despair. Paint hides many ills.

All this sounds like it is far-fetched. But we have done many glue-failure experiments in our shop and have consulted the pointy heads at Franklin Industries, a company that spends a lot of resources researching glue and wood failure.

This approach works. Believe it. End of story. So apply glue to the end-grain surfaces of the pin board. You won't be sorry.

But you do have to be quick about it. Yellow glue (PVA) sets up fast, as does hot hide glue. If you want to slow down the assembly process, look for PVAs that have an extended open time (or extend the open time of your standard PVA by adding a little bit of water – about 10 percent additional

Assemble slowly. You can assemble this case one panel at at time if you like. Begin by making one corner by assembling the back and one end. Add the other end piece. Then add the front piece.

water will do it). You also can use a liquid hide glue, which is quite nice because it is reversible. Or you can use a polyurethane glue, which can have an open time of almost an hour.

My first choice is liquid hide glue, because it is reversible. My second choice is a PVA.

Whatever glue you choose, let it pool on the end grain. Wipe it onto the edges of the pins. Drive the tail board on with a mallet. Then strike each tail. Here's how: Place a block of wood on the tail and hit it with the mallet to seat the tail into the socket. When all the tails have been struck, they should touch the baseline of the pin boards,

If this is so, check the assembled carcase for square. If you can't get the tails to seat, you should fetch some clamps and try to squeeze the tails into position.

Nail that Bottom

The bottom of the tool chest should be nailed to the shell, then wrapped by the skirt moulding. This arrangement accomplishes many goals. One, it makes the bottom boards easy to replace if they become rotted from sitting in water. Second, you can nail them in place in two directions: Up through the bottom and through the base moulding. This two-way nailing scheme

Nailed to stay. Cut nails wedge the bottom boards in place better than wire nails ever will. Here you can see that I used the heads of my brads to space the bottom boards. I was out of dimes.

makes the bottom stay in place if the bottom boards are sound. But they can be easily pulled out if they are rotten.

Early workshop writers recommend that the grain of the bottom boards should run from the back of the chest to the front. This arrangement makes the bottom stronger – it will be less likely to bend under the weight of the tools than if you used bottom boards where the grain was parallel to the front and rear panels.

All this might be overkill, but it is the pleasant brand of overkill.

You should make all your bottom boards interlock in some way – butt joints are a Bozo No-No. You can use a simple ship-lap joint, sort of like a back on a mid-range cabinet project. Or you can do things the proper way and use a tongue-and-groove joint on your bottom boards.

This superior joint will add a little strength with only a nominal addition of working time. And if you own match planes that do this sort of joint auto-

Three disposable strips. These battens will rot first if your chest is exposed to water, and they are easy to replace because they aren't nailed to the base moulding.

Tried and true. With the carcase assembled, you can true up all the proud bits, such as the bottom boards, the battens and the ends of the tail boards. A try plane has the mass and momentum to do this job with ease.

matically, it will be a crazy quick process.

Nail the bottom pieces to the shell using 6*d* cut brads. (Don't forget the pilot holes, Ed.)

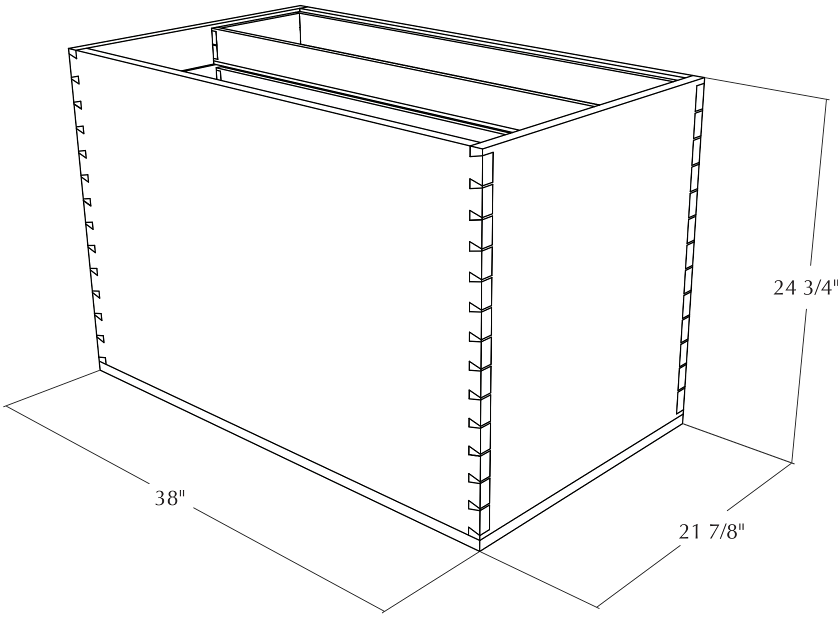
Whenever you nail on bottom boards, the goal is to make them hang over the carcase by about 1/16" or so, so you can plane them flush to the carcase after the nailing is complete. Oh, and you also want to put a small gap between the shoulders of each bottom board. The gap will allow the bottom boards to shrink, expand and contract with the seasons. No matter what season it is, I tend to use a dime spacing between the boards. This spacing ensures I'll never see daylight between my bottom boards and it will also ensure the bottom will never buckle and splinter.

Battens: Flood Insurance

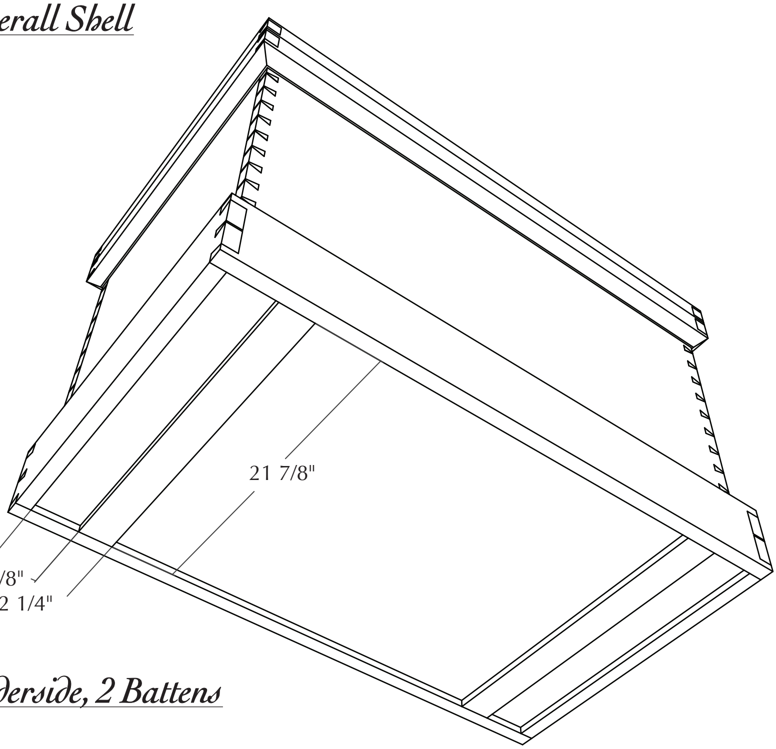
If you really want to go all out (and you should), then I recommend you add three battens to the bottom of your bottom boards, instead of the two battens I show on the illustrations. These three lengths of pine will be the first defense against rot. And anything that protects your tools from moisture is worth doing, especially if it costs about $2 to do.

These three battens are nailed (and glued if you like) to the bottom boards. The base moulding is wrapped around the bottom boards and the battens. But the base moulding is not – repeat not – nailed to these battens. This means you can simply pry these out if they become rotted.

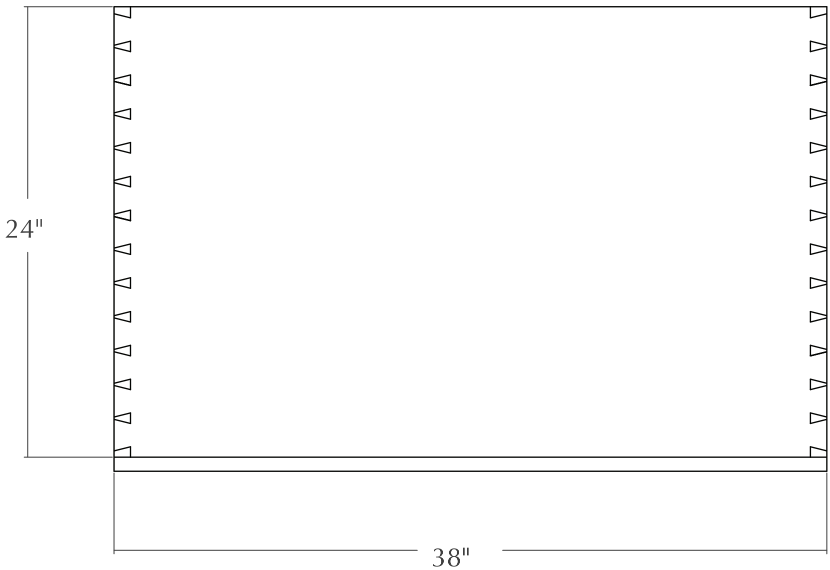
And the hard bits. You might be wondering how to true up the end grain of the bottom boards. The answer: mass and sharpness. A sharp metal try plane can plow through the end grain and bring the proud bottom bits flush with the carcase.



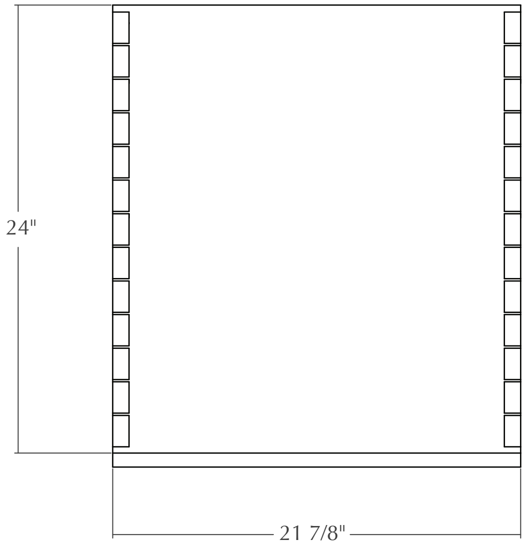
Overall Shell



Underside, 2 Battens



Elevation, Shell



Profile, Shell

16 - SKIRTS

I am not a slavish follower of the so-called "column orders" of design. The "column orders" are where you apply the proportions from classical columns to architecture and furniture. There are different "orders" – Ionic, Corinthian etc. – that have slightly different proportioning systems. But they all come down to one basic idea:

Every structure has a base (sometimes called the plinth), a middle section (the column, proper) and a capital (the top bit).

When you reduce the idea to this level of simplicity, I can get behind it.

Our 1928 Tudor-revival house, for example, doesn't have a real base. Because of the way it was designed, you cannot see the foundation stones from the front of the house. As a result, it looks unbalanced to my eye. I want to raise the sucker up about 2' at the front so it looks rooted to the ground.

This lack of balance bugged me so much that I did something about it. No, I didn't raise up the house. Instead, I planted boxwoods along the front of the house, which concealed the lack of a base and in time actually created a foliage base (I call it the "faux-lidge" base), which greatly improves the look of the structure.

As much as the classical orders seem distant and academic ideas at times, they offer real guidelines that we can adopt or adapt. And you cannot or should not ignore them when building a tool chest.

The Plinth Design

There is some common advice in building chests and tool chests that needs to be examined. Here's the (fully clothed) maxim: The tails on the skirt should not be on the same face as the tails on the carcase. Or, put another way: If you put the tails of your dovetails on the front and back pieces of your chest (as I did), then you should put the tails of your skirt boards on the end pieces.

To me, this seems much like the advice offered on designing the panels for a chest and avoiding a seam that circumnavigates the shell. If you stag-

A fitting end. Place one of the skirt's end board on the end of the chest. Clamp it to the chest and then lay out your baselines for your dovetail joints by marking the seam between the carcase and the inside of the skirt board.

ger the position of the tails on your chest and on your skirt, then you avoid catastrophe if the glue decides to up and fail on you.

This seems excessive to me. But being a big fan of excess, I decided to comply with this ancient advice. Besides, the entire outside of the chest is painted, so the mismatched skirt and carcase won't be as noticeable.

Fitting the Skirt

Getting the skirt boards to wrap around the carcase without splitting, bending or leaving an ugly gap might seem like a big challenge. In fact, it looks like you need to do some careful measurements to get everything lined up so the assembled skirt just slides onto the carcase.

Truth is, you shouldn't measure jack crap when you make the skirt.

Here are the facts: Your carcase is not entirely square. Each face might even taper in or out a bit. Who knows? Measuring the carcase and then making the skirts fit those measurements is the road to failure.

Instead, you need to focus on fitting the skirt boards one by one. This is simple to do, doesn't require any real measuring and produces good results.

Begin at the End

Set the chest on end and clamp a skirt board to the end of the carcase that's propped up in the air. Center the skirt board as best you can. If it's a little too long, then that's OK. If it's too short, fetch another couple boards.

Once the skirt board is centered, you can set a marking gauge to scribe your baselines. If you centered the skirt board correctly, the baselines should line up with the corners of the carcase.

If the carcase isn't square, you might need to change your strategy. If you cannot mark a consistent baseline because of the shape of the carcase, I recommend you trace the shape of the carcase on the skirt board. Then wrap the baseline around the skirt board.

Either way, you should end up with baselines that follow the contours of the carcase.

More Dovetails

Unclamp the skirt board and lay out some tails on each end of the board. These are simple through-dovetails, nothing fancy. You could use through-dovetails with mitered shoulders to make the moulding on the skirt look mitered. But because the exterior of the chest is painted, I didn't see the point in the extra layout work.

After the tails are cut on this one end piece, cut the mating pins on the long skirt boards that are attached to the front and back of the carcase. When this is complete, you should have a large "U"-shaped assembly that slips over your carcase. Don't glue this up yet.

Mark to Fit

The finished lengths of the skirt boards has to be bang-on. In fact, they have to be so perfect that measuring them would only mess things up. You need to just mark and cut everything to fit. It's easier and faster, to boot.

Sleeve the dry-assembled, semi-completed skirt over the carcase and set things so the fourth end of the skirt that you need to fit faces the ceiling. Place a clamp across the skirt to pull it tight against the carcase. Check out the photo at right for a glimpse of what this should look like.

Tails on the ends. The tail board of the skirt should have about three tails. You can keep this simple and just use through-dovetails. Save your mitered dovetails for an instance where they will show.

This set-up will allow you to determine the final length of your long skirt boards so you can trim them to the right size. And this is your chance to also mark the length of the fourth skirt board. Your carcase might be slightly narrower or wider at this end. This is your chance to find out.

Once you determine how long all the pieces should really be and trim them to those sizes, it's a simple matter of dovetailing them together without making any mistakes. Don't cross any baselines or the skirt won't go together.

Chamfer & Fudge

The top edge of your skirt needs a moulding. I've seen some chests that have skirts without a moulding. They look like crap. Or, more precisely, they look like the builder didn't know what he or she was doing.

Skirt in the air. With the partially finished skirt clamped to the carcase, show the fourth skirt piece to the assembly. Mark where they intersect so you can trim the long skirt boards to their finished length.

You don't need to apply a fancy moulding. In fact, some old texts are quite fond of a simple chamfer, which is what I used on this chest. On my last chest I used an ogee, which got the living heck beat out of it by normal workshop life.

We'll see how the chamfer fares.

I laid out and cut the chamfer on the skirt boards with the skirt disassembled. This makes it easier to make the profile. When you do it this way, you'll see that the corners need some attention to make the chamfer consistent all the way around the skirt.

Tweaking these corners is easiest to do before you get out the glue. Assemble the skirt (without the carcase) and clamp up the corners. Then trim the corners so that the chamfer wraps around the chest all nice and proper-like. You can make this cut with a block plane or even a chisel. No matter what tool you use, work so that the tool doesn't spelch off the end grain.

Almost right. By chamfering the skirt before assembly, I made it easy to lay out and cut the profile – it was all with-the-grain work. But when the corners are assembled you can see how the half pin needs to be cut back.

Assembling the skirt and attaching it to the carcase is a tricky affair. I glued and clamped the long boards of the skirt to the front and back of the carcase. Then I glued and drove on the ends of the skirt. Yeah, I know I made it sound easy. It's a bit of a sticky and sliding mess.

The Dust Seal

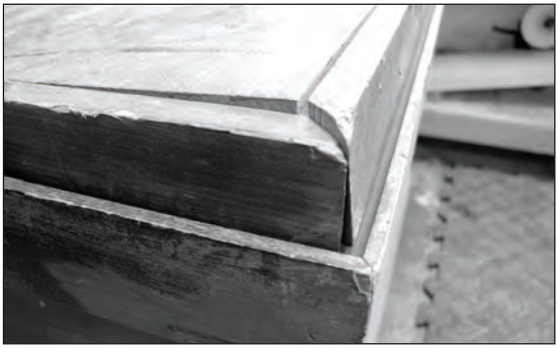
The so-called dust seal on a tool chest has an aesthetic and practical purpose. The seal is actually a mini-skirt that wraps around the carcase near the top. Then the lid, which also has a mini-skirt around it, sleeves over the top of the carcase and meets the skirt below.

It sounds more complex than it really is. The result of all this tricky fitting is that you have a lid that will not allow the casual dust mote to enter your chest. Without the dust seal, even a slight warping of the top would allow dust inside the chest, bringing in harmful salts that will absorb water from the air and pit your tools with iron oxide (rust).

The seal ensures that only the most determined specks of dust will find their way into your chest.

Now, there are other more advanced forms of dust seals out there. My first chest had a dust seal that was an engineering marvel. The top mini-skirt also had a rabbet on it. So the lid and its skirt nested into the rabbet of the skirt on the carcase. The seal works brilliantly, but the rabbet is a mite fragile and has split off in a couple places from the hard knocks of shop life.

Before the great slide. This is the dry-assembly, right before I broke out the glue and all mayhem broke loose. Just keep lots of clamps handy for this process. This is the trickiest glue-up of the project.



Fragile seal. The thin rabbet below the lid makes for a fragile dust seal, which has split off in several places.

The simple seal on this chest has just one dovetail at each corner (the tails are on the end pieces, by the way). Some chests have a seal that is wider (and has more dovetails), but these chests look top-heavy to my eye, especially considering that you are going to have a second small skirt around the lid that will beef up the top visually.

Fitting the seal to the carcase uses the same procedure that you followed to fit the skirt around the base of the chest. Fit one end to the carcase. Then

One tail. Because the mini-skirt is so narrow you really can't put more than a single dovetail at each corner unless you decrease the slope of the joint. One tail will do the trick – especially when compared to a plain old miter on some chests.

dovetail the front and back pieces to that end piece to create a "U"-shaped assembly. Sleeve that over the carcase and use that to fit the fourth piece on the end of the chest.

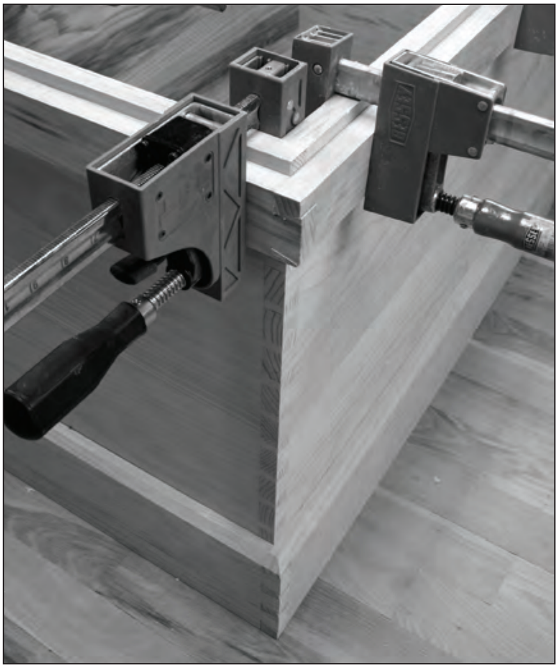
Like the bottom skirt, this top skirt has a chamfer. But this time the chamfer is on the bottom edge of the skirt. The top edge has a 3/16"-wide bead. The bead is both decorative and functional. It's decorative because it separates the lid from the carcase. And it's functional because you will find your fingertips on the bead to lift the lid – unless you put a handle or some hardware on the lid (I didn't).

And the bead has another purpose: forgiveness for the maker. Fitting all these pieces so they all align in multiple planes is a challenge. The bead conceals the minute differences between the lid and carcase that even a careful woodworker will experience.

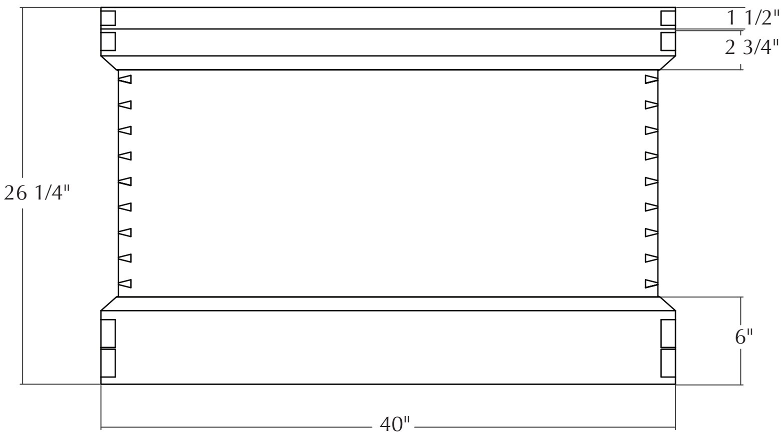
After you cut the chamfer, glue all the pieces together and to the carcase. I cut the bead after assembly because I was going to have to use my beading plane to shape some end grain at the corners. This is easier to do with the dust seal assembled and on the chest.

Before building the lid, true up the top rim of the chest to clean up the tool marks and level the joints. You'll probably do some more fitting when you add the lid and its three-piece skirt, but starting with a carcase that has a clean and coplanar rim is better than a sharp stick in the eye.

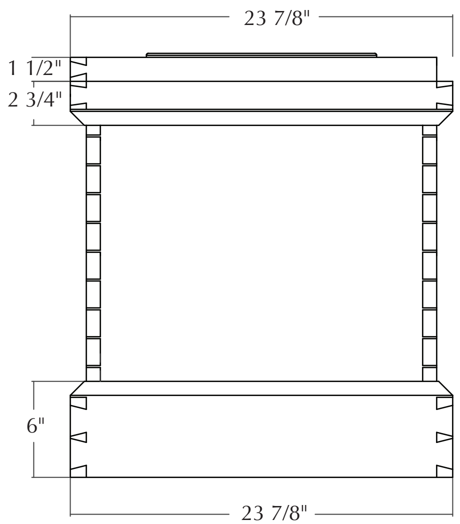
Coping with a chisel. Cut the chamfer with your block plane before assembling the dust seal. Dry-fit the seal then chamfer the corners with a chisel to make the profile follow all around the carcase.



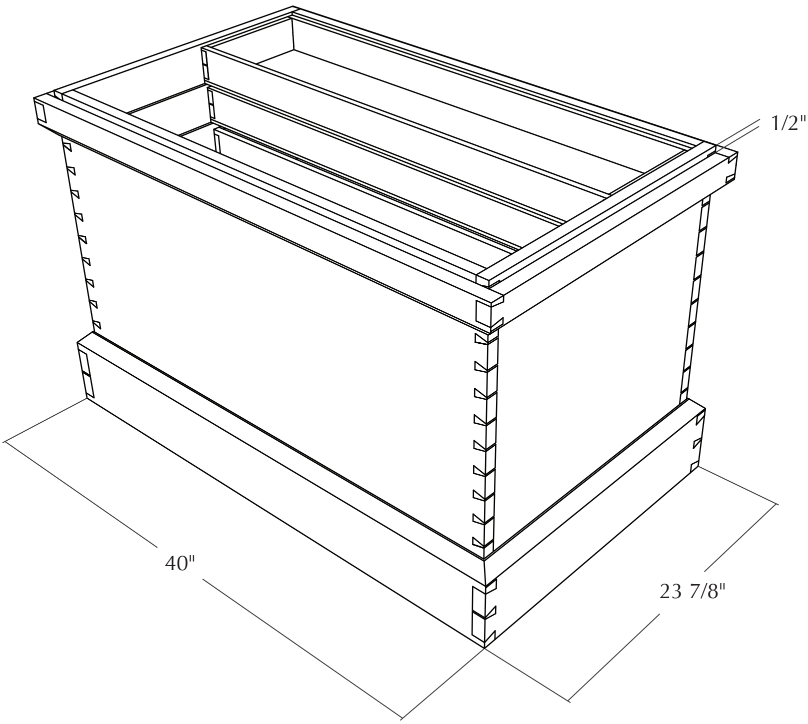
Clamp the corners. A couple clamps at each corner should be enough to pull the dust seal tight against the carcase.



Skirt, Elevation



Skirt, Profile



Lid Removed


17-LID
AND
HINGES

It is difficult to over-build the lid of a tool chest. Many examples of lids I've seen – including the lid on my first chest – are weak. You might as well cover your chest with a blanket.

The lids are too thin or move too much with the seasons. They are not flat or will not stay flat. They destroy your miter joints at the corners. They rip out their own hinges with normal use. They won't work with a lock over the long term.

And they crack beneath your bony or ample buttocks.

When I set out to make the lid for this chest, my intention was to engineer it like a piece of Soviet swimwear. It might not be the sexiest, simplest or sparest thing around. But because of its engineering, cockroaches will find it intact and useful in their post-apocalyptic world.

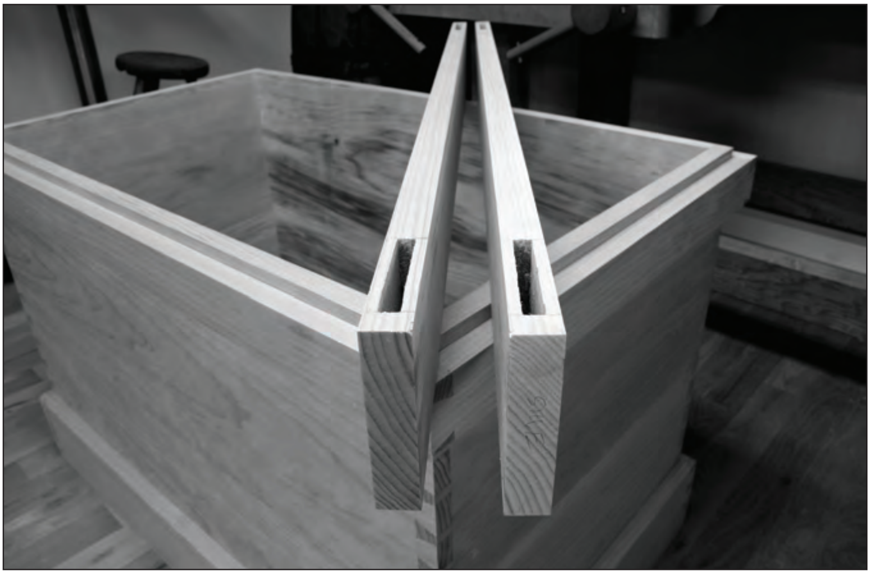
The trick is to use lightweight wood (natch) but to exploit its strengths and use joinery that is bulletproof. So the lid should be 7/8"-thick pine – perhaps even a bit thicker if you can manage. When you get into structural thickets like this one, it's best to go for the thickest stock you can manage and still end up with it flat.

For joinery, I used through-tenons at the corners of the framework. You cannot do any better. The center panel is unlike your typical raised panel, but it is raised.

Many people are confused by this construction when they first see it. Here's how it works. The rails and stiles of the lid have a groove on their inside edges, just like you would find on a typical frame-and-panel door.

The difference is with the panel. In a typical door, the edges of the panel would be thinned to nest in the groove in the rails and stiles. Not so with this construction. To make the panel interlock with the rails and stiles, you plow a groove in the panel. Instead of tongue-in-grove, this is groove-in-groove.

When the lid is assembled, the lower tongue of the panel goes into the groove in the framework. The top tongue of the framework slips into the groove of the panel.



Mortises that don't mess around. Yeah, using a through-mortise here at the corners of the lid's framework is definitely excessive. But after dealing with a wimpy lid for more than a decade....

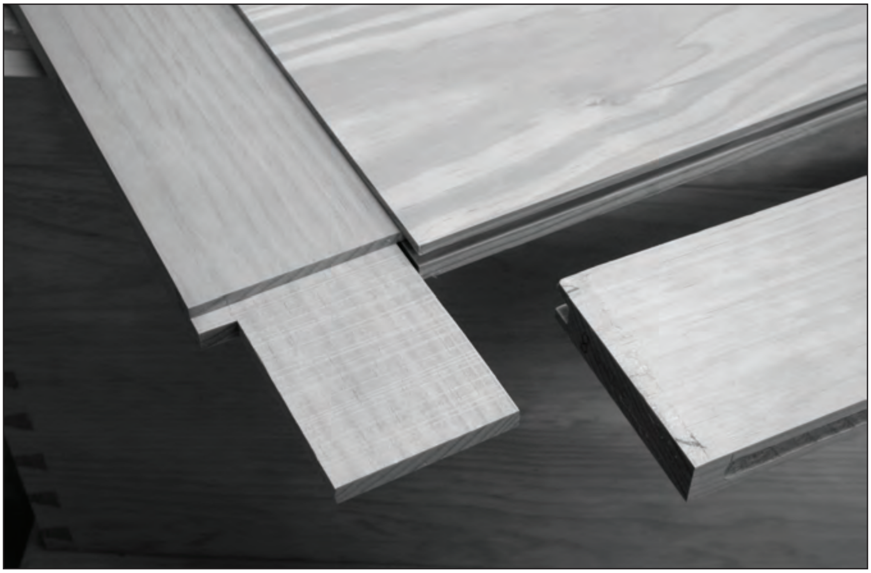
The net result is that the panel is raised, but none of the individual components is thinner, which helps the lid maintain its strength.

Lid Design

As with all frame constructions, you should select the straightest quartersawn or rift-sawn stock possible to make the rails and stiles. Not only does this look good, but the stock will move less and is unlikely to warp.

When selecting my material for rails and stiles, I am perfectly content to selectively cut up really wide or choice boards to pick out just the piece I need for a good rail or stile. When you mill up your rails and stiles, try to maintain as much thickness as possible. While most of the stock for this tool chest ended up at 7/8" thick, I managed to get 15/16" out of my stock for the lid pieces. Every little extra bit of strength on the lid counts.

The panel in the center can be regular flatsawn stock. But be sure to



Raise your expectations. Here's how the panel fits into the grooves in the rails and stiles. The only way to make this more robust would be to make the panel even thicker and mill two grooves in it so it is raised on both faces of the lid.

choose the most attractive face as the inside of the lid. That's the surface you are going to look at every time you open your chest.

Begin construction by cutting the 3/8"-wide through-mortises in the stiles. The mortises should be almost the full-width of the 4"-wide rails. Leave about 3/8" at the ends for the edge shoulders and 3/8" on the inside for the other edge shoulder. So the mortises should be about 3-1/4" long.

Next up is plowing the groove on the inside edges of the rails and stiles that will interlock with your panel. The groove should be 3/8" x 3/8" and run the entire length of the rails and stiles.

Because this groove runs the entire length of the rails and stiles, you'll need to leave a haunch on your tenons to fill the void at the end of the stiles. This is more of an aesthetic choice than a structural one, but the haunch does add some strength and it prevents your rail stock from corkscrewing.

For long tenons – these are 4" long – I'll usually rely on my table saw and

Long and strong. These tenons have an enormous gluing area thanks to the length and width of the tenons. Take care when assembling things; the mortises are a bit weak until the rails and stiles are glued up.

a dado stack to make them. By using a dado stack to cut the cheeks and shoulders, you can make the tenons as long as necessary with safety and ease. Other methods can be awkward.

And don't forget to leave the haunch, which is 3/8" x 3/8" x 3/8" and fills the groove in the stile. Assemble the frame without glue and lay it on top of the assembled chest. This allows you to discover and remedy any problems when they are easier to fix. If the frame is twisted or the components are too wide you can dress them one by one until the whole thing lies flat on the rim of the chest and hangs over the front and ends of the shell by 1/16".

The dry assembly also allows you to measure up the exact size of the panel. You want the panel to bottom out in the groove in the rails, but you want to leave some room for expansion and contraction in the groove in the stiles. How much room is a tricky question that depends on your species of wood and the amount of changes you see each year in the humidity in your shop.

As I was using white pine, I knew it wasn't going to move much. It's pretty stable stuff. I built the chest in December, when the humidity is low. So I knew the panel was going to expand a bit during the warm and humid months. So I made my panel with about 3/16" expansion room. That might be a wee bit more than I need, but I like to err on the side of wee bit more than necessary.

Panel Construction

The panel is easy work, once you understand how to tweak it to get it fitting just right. Once you cut the panel to its finished width and length, get out your marking gauge and set it so that it is exactly the width of your groove in your rails and stiles.

Scribe this measurement on all four edges of the panel by running the fence of your gauge against the underside of the panel's face.

The next step is to measure the thickness of the upper tongue on the rails and stiles and find some tooling that matches that dimension. It could be a 3/8"-wide plow plane iron. It could be three dado-stack blades and some shims.

Take this tooling and use it to plow a groove on all four edges of the panel that begins on your scribe line and is 3/8" deep.

If the panel is too tight, you can adjust the fit by planing the underside of the panel or planing the top of the rails and stiles. I prefer to plane the panel whenever possible. When everything fits, there is one last task before gluing things up: Plane a small roundover on the top edge of the panel. This softens the look and strengthens it against damage. And it's easier to do when the lid is disassembled.

A trial fit. You want to discover if your lid frame needs fixing before you get out the glue. A little twist or some undersized rails are a rude surprise that you can avoid. I'd rather re-make one component than glue up an entire lid that needs to go on the bonfire.

Glue up the lid (don't use glue in the panel grooves), clamp it and wait for the glue to cure.

The Lid's Skirt

The lid is banded on three edges by a dovetailed skirt that is much like the skirt and dust seal on the shell of the chest. Like the dust seal, this skirt on the lid has only a single dovetail at each corner. But unlike the other skirts, this one is easy to fit because it surrounds the lid only on the front edge and ends.

Slightly off. Don't clamp right on the dovetail joints. Clamp on the baseline instead. This will close up the joint and press the skirt to the lid.

After all the dovetails for the shell and skirt, this one should be child's play for you. The easy way to do it is not to worry about the exact measurements of everything. Make the three parts about 1/2" longer than necessary. Dovetail one end piece to the front piece (the tails are on the end pieces; the pins are on the front piece). Then clamp that "L"-shaped assembly to the lid. Use the lid itself to determine where the baseline should go on the other end of the front piece. Mark the baseline all around the front board of the skirt.

Now it should be easy to cut the dovetail joint for that corner. Glue up the dovetails then – while the glue is still wet – glue that assembly to the lid. When the glue is dry you can trim up the edges but do not – repeat, do not – trim the excess length at the back of the lid. This excess 1/2" of length can be used to make a stop for the lid. More on that process as we fit the hinges.

After the glue sets up, remove the clamps and drop the lid onto the top of the shell. If you have done everything flawlessly (highly unlikely) then the skirt and the seal should mate up perfectly all around the front and ends of the chest. At the rear of the chest, the inside face of the lid and the rim should just touch or be a hair's width apart.

If you didn't achieve perfection (I didn't) then you need to plane the skirt around the lid and the dust seal around the shell until you achieve a perfect fit. Don't settle for anything less. This is a place where sloppy work will be obvious.

When everything fits and sits correctly, drive cut nails through the skirt and into the rails and stiles. These nails are there in case the glue ever fails. It might seem a bit much, but lots of old chests have nails as a fail-safe.

Nails clinch it. Driving cut nails through the skirt and into the lid is a way to ensure that the skirt will remain attached to the lid through heat, moisture and shock.

Hinge the Lid

I attached the lid to the shell with three brass butt hinges. While two hinges would probably be sufficient, I've seen a lot of surviving chests with three hinges. It's your call.

Installing hinges on a lid is fairly easy work even for a beginner, if you take it one step at a time. The first step is to place the lid on the shell and shift it around until it is exactly where you want it to be when the hinges are installed. There should be a small and consistent gap between the rear of the lid and the shell of the chest.

When you achieve this cosmic balance, fetch your marking knife. The goal here is to make one perfect stab in that gap between the lid and shell that will mark one wall of the mortise for the hinge leaves.

Where should the hinges go on the lid? The middle hinge should be centered. The two other hinges should be aligned so their leaves are aligned with the joint line between the rail and stile of the lid. This is standard practice in joinery.

When you make this "perfect stab," you only need to make one stab for each hinge. The other wall of the hinge mortise will be determined by the hinge itself.

I approach this single mark like I would perform surgery on a butterfly. There is no room for error.

When Japanese carpenters build a temple, they have a ritual where the senior craftsman walks onto the job site and makes a single mark that sets in motion all the other marking, cutting and assembly that follows.

When it comes to marking hinges, I stand on this ceremony. Make your stab for each hinge. Then remove the lid from the shell and fetch your hinges.

Set a cutting gauge so it is the exact width of one leaf of the hinge. The width of a leaf is the distance from the edge of the leaf to the edge where the knuckles of the hinge begin. Lock this measurement on your gauge and don't change it until all the hinges are installed and working correctly.

Place the hinge on the interior face of the lid and line up the end of a leaf with your perfect knife mark. Mark the lid at the other end of the leaf with your knife. Now use those two knife marks and your cutting gauge to mark out the mortise for the hinge.

But you are missing one critical measurement: the depth of the mortise. For this, you need a second gauge. Set this gauge so it marks the thickness of the hinge leaf. Use this gauge to scribe the thickness on the lid.

Now waste away the mortise for the hinge leaf. I define the walls of the mortise with a chisel. Then I waste away most of the wood with a saw and a chisel. Then I clean up the bottom of the mortise using a small router plane. Keep the router plane set for the final depth of the hinge mortise as you install all the hinges.

It's all about timing. Lining up the slots on the screw heads is called "timing" the screws so they all stop in the same place. Yes, it is totally anal retentive.

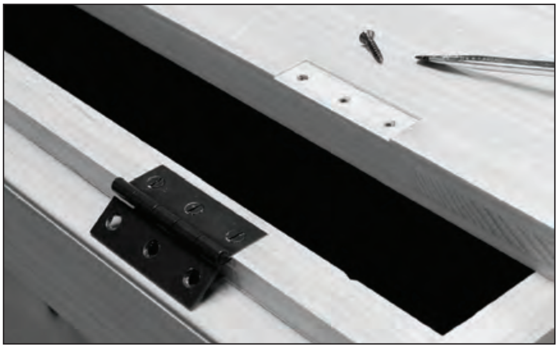
After you cut a mortise, install the leaf into it so you don't get the hinges mixed up while installing them. Sometimes the hinges vary from piece to piece.

Installing hinge screws takes time to do right. You need to drill a pilot hole that is the right size for the screw and it needs to be centered. Some people sight the hole by eye. Some mark it with an awl then drill the hole. Others use a special self-centering drill bit.

I've used all these techniques and they are varying degrees of unreliable and expensive (the special self-centering bits tend to break).

I use a self-centering punch to locate the pilot holes. This is an inexpensive tool available at any hardware store. You do need to learn to use it properly. Some people tap them with a hammer to drive the centered pin into the wood. Other use finger pressure. I recommend finger pressure because the pin is less likely to shift off-center.

Then drill your pilot holes and drive the screws. For traditional woodwork, I use slot-head screws. Phillips and square-drive screws look ugly to my eye. These slot-head screws are easy to install if you have the right screwdrivers. The driver's tip should fit snugly into the slot and fill the width of the screw's slot as well. A well-fitted screwdriver tip is less likely to slip. Another trick is to rub the screw threads with some paraffin before driving them. Paraffin is simply mineral spirits and won't do anything bad to the wood, metal or cosmos.



Install, remove, repeat. After installing one hinge leaf, remove the hinge and cut the mortise for the other leaf. Having the hinge unattached makes a good fit easier to accomplish.

With one hinge leaf installed, remove the screws and repeat the entire mortising and installation process on the hinge's other leaf. After you have the two outside hinges fit, you can attempt a test run to see if the lid will lift without binding or twisting. But first you'll have to trim those bits of excess skirt length sticking out the rear of the lid.

You can saw a bevel on the waste to produce a way to stop the lid from opening all the way and hitting the floor. The photo shows this better than words can explain. If your dust seal is in the proper place, then leaving the tip of the waste about 7/16" to 1/2" long should make a good stop.

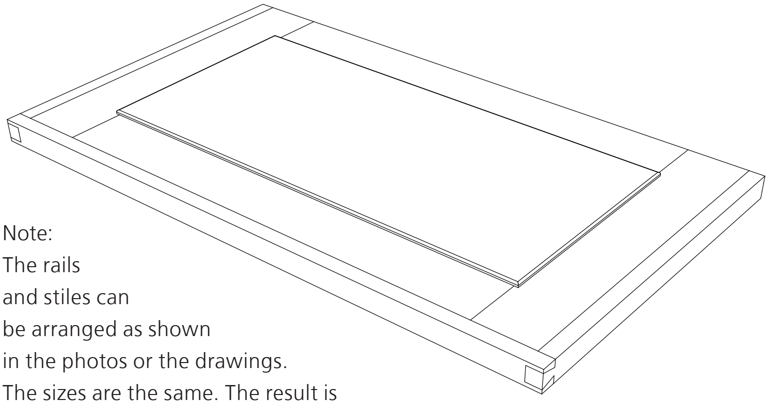
I don't recommend this as a permanent or everyday stop. This style of stop will try to pull up the hinge screws that are driven into the shell. A chain that is attached to the lid and the shell is a more secure long-term solution.

While I plan to add the chain to my lid, I'm also going to keep the angled stops on the lid as well. These will serve as a back-up if the chain fails or is pulled out accidentally. Once you have installed the two outer hinges and sawn your stops for the lid, remove all the hardware and install the third hinge. Then you can re-install everything.

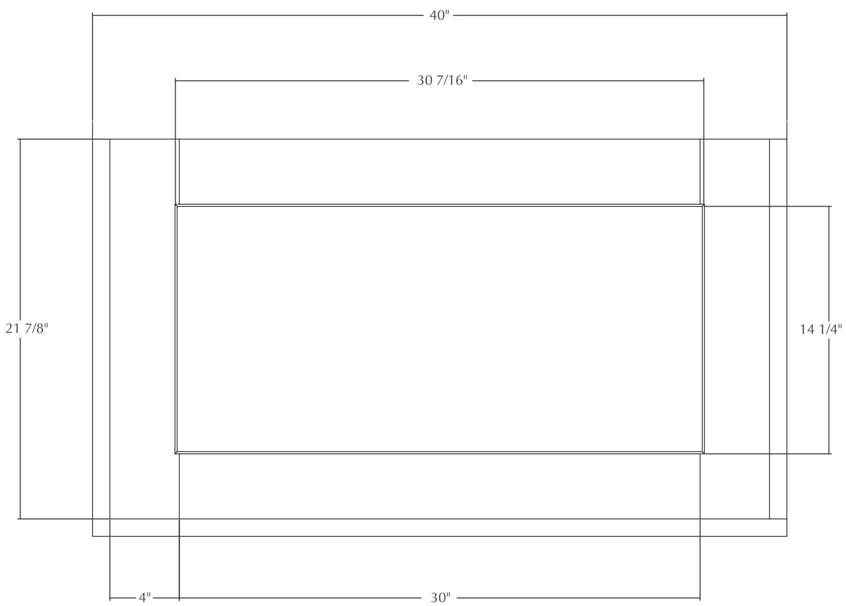
With the hinges installed, you have completed a traditional shell of a tool chest. As you arrange and install the guts of the chest, you have far more choices about the best way to partition your box for your tools. These partitions can be as simple as a few nailed-together trays. Or they can be as complex as a second tool chest inside the big chest that has a dozen small drawers and a lift lid.

My solution shoots for the middle. And naturally, I have my reasons for picking that path.

A temporary stop. By beveling the excess of the lid's skirt, you can create a temporary stop for the lid. You can use this as a permanent stop if you are careful, but using a chain is gentler on the hinges and the screws.

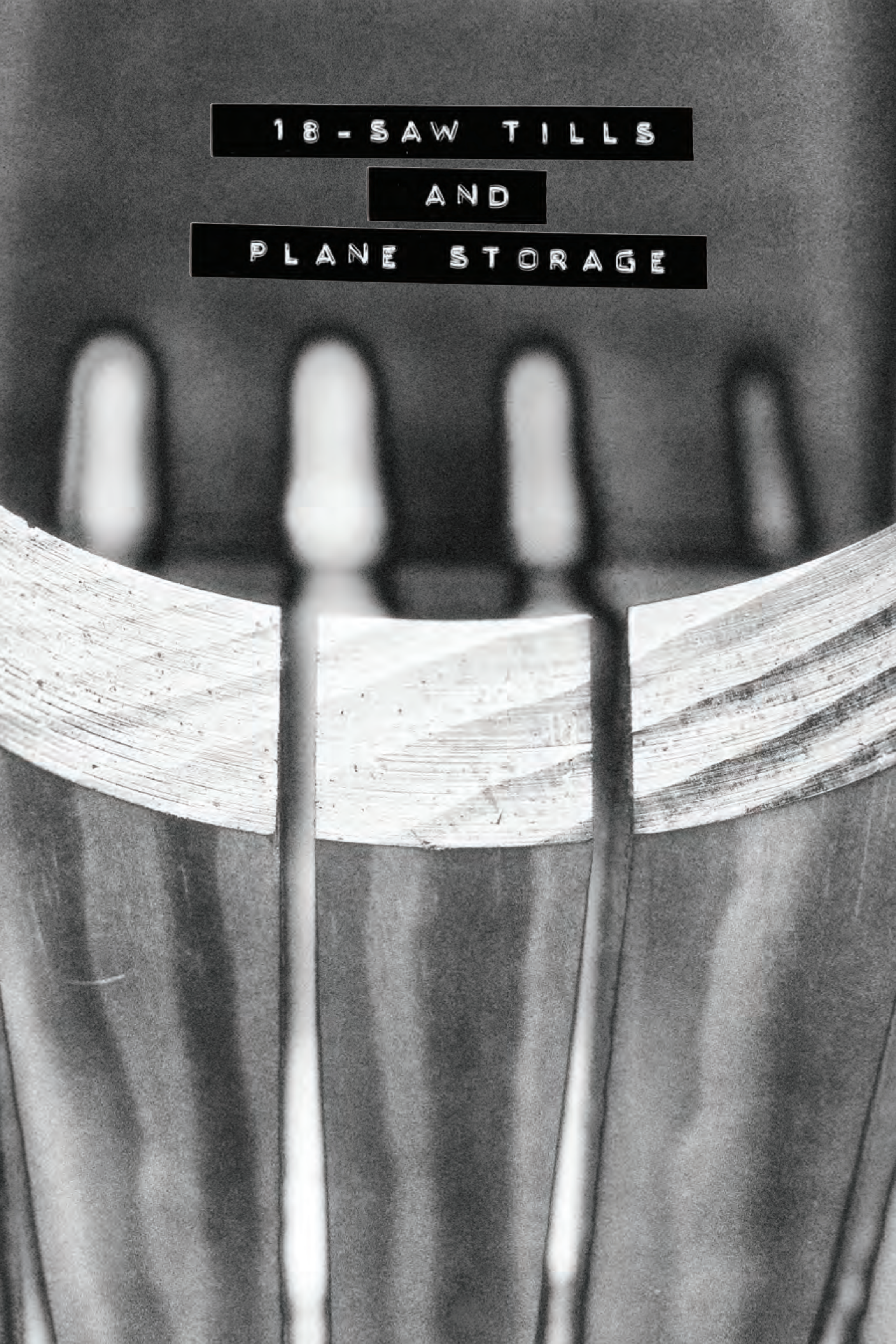


Lid, Overall



Lid, Plan

18 - SAW TILLS AND PLANE STORAGE



When you start dividing up your space in your tool chest, one of the first questions you need to answer is where you are going to store the big iron. The longest tools – particularly your handsaws and your jointer plane – have to be dealt with first. Don't try to sneak them in after the fact.

The question of where to put the jointer plane is pretty straightforward to answer: Put it in the bottom of the chest. Most tool chests have a well in the bottom for the bench planes and joinery planes. The thornier question, really, is where to put your big saws.

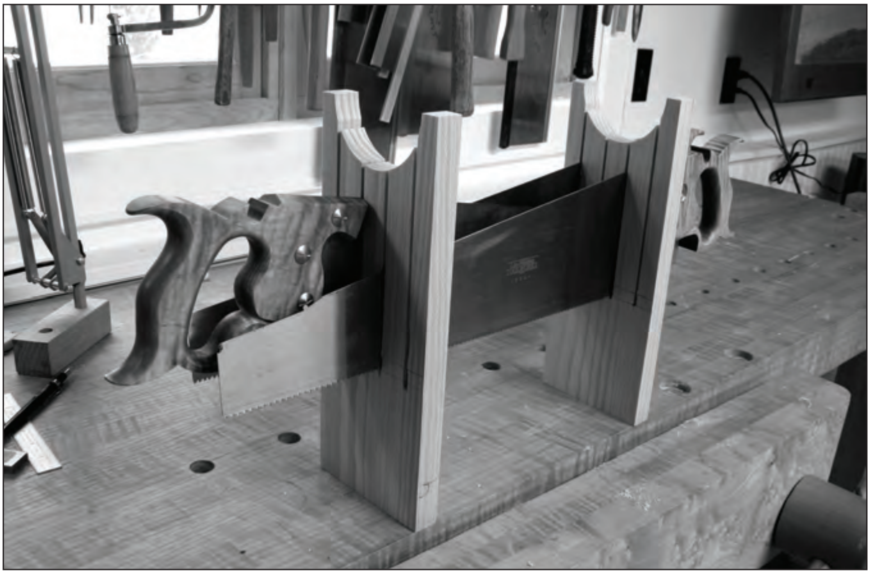
Some English joiners would build a till on the underside of the chest's lid for the saws. This works (I have a till like this on my first chest). The only downside to this approach is that you have to have a lot of clearance to the sides of your chest to pull these saws out without hitting something. Depending on my shop set-up, I've run into walls, benches, cabinets and other tool racks. Or you can secure a few saws to the underside of the lid with toggles that hold the handles. These eat up "airspace" at the top of the chest.

The third option is to store the saws in a "saw till" in the bottom of the tool chest – a rack that is usually up against the front wall of the chest. This location is convenient and it doesn't require you to have any extra clearance to the sides of your chest to whip things out.

The downside to storing them on the floor of the chest is that you eat up some valuable floor space, plus some valuable airspace above the saws.

You can reduce your guilt about gobbling up so much space by shoehorning in some other tools in the same area as your saws. Typically, joiners would try to incorporate a chisel rack in or around the saw till for bench chisels, mortise chisels and gouges. Another typical approach was to add a rack at the front that would hold try squares. Still another approach was to hang the joinery backsaws vertically amongst the handsaws and ripsaws.

So there are a lot of valid paths to take with your sawtill. Here's what I decided to do: After living with an English sawtill on the lid of my last chest,



This is a test. To ensure my saws were easy to grab and remove, I mocked up the two upright pieces I was going to use for my sawtill and gave them a test drive. After a week of futzing with them, I was happy.

I was eager to build one on the floor of the chest and squeeze in some other tools (backsaws, squares and perhaps chisels or gouges) around the till.

The till I chose to build is traditional, and it works well. The till is simply two upright pieces of wood with slots cut in them. The sawplates drop into the slots. The other interesting feature of the sawtill is that you cut a semi-circle into the top edge of each till piece. This lightens the look of the till pieces, and it makes it a little easier to grab the saw you want.

Before you install anything in your chest, mock up some sample pieces on your bench to see how the till will work and will feel in use. You won't know all the answers until the till is installed and you have used it for a few years. But if you hate it immediately, you'll hate it more in three years.

This sawtill has four slots. Three are for panel saws and one is for a large tenon saw. One panel saw is a fairly coarse rip saw. The other two panel saws are a coarse (about 7 ppi) crosscut saw and a fine 12-point crosscut saw for finish cuts. When those four saws have a home, then I just have to squeeze in a dovetail saw and a carcase saw and I'm set for life.

Build the Sawtill

The thickness of the pieces for your sawtill is immaterial. Or "nominal," as people with fancy vocabularies will say. Their widths and their lengths, however, are critical.

On width: These till pieces are 4-5/8" wide and are designed to hold four saws. Each of the four kerfs is 1/8"-wide, and the kerfs are evenly spaced across the till. Use your dividers to lay these out. A ruler will waste a day and untold numbers of brain cells.

The width of the sawtill pieces and the spacing of the kerfs makes it ideal – for me, anyway – to grab a saw without engaging in finger yoga.

The till pieces are 12" long, and the four kerfs (before cutting the semi-circle) are 7" long. That holds the saws about 5" above the floor of the tool chest. I use this space for holding saw-files, my sawset and my saw jointer. If you don't sharpen your own saws, you can keep your weed down there.

After cutting the till pieces to size and plowing the kerfs, you can lay out and cut the semi-circle in the top of the sawtill pieces. The semi-circle has a diameter of 3-5/8". Lay it out on the top of each sawtill part. Cut it out and sand or rasp it to shape.

Stand these pieces up on your bench and load them up with your saws. It should be fairly easy to remove the saws, even from the middle of the nest of saws.

The last layout chore is to figure out where to place these till parts. If you are storing full-size saws, then you should position the till parts so they are about 8" away from the centerline of the chest. If the saws are smaller, then you can offset the till parts and shift them over a bit to one end of the chest. After fussing around with the position of the tills, you can make the wall that will separate the till from the well used to store bench planes.

Screw then slide. Attach the sawtill parts to the wall using #8 wood screws. Drill your pilot and clearance holes before wedging the wall inside the chest. Note: I countersunk these screws after thinking about the screw heads scraping the sidewalls of my planes.

Install the Wall

The wall piece should be about 13" wide (a little wider than the sawtill pieces are long) and just long enough to slide between the end pieces of the chest. Screw the sawtill parts to the wall. The holes through the wall should be slightly oval-shaped to allow the wood to move with the seasons without splitting with the seasons.

Installing the wall between the sawtill and the well for the bench planes might seem like another choice opportunity for overkill joinery. Sliding dovetail, perhaps? Instead, I'd use some lowly nailed-in cleats to fence in the wall.

There are no particular obscene forces pressing on the wall. So it just needs to resist gravity. The other reason I chose cleats is that I might want to alter the wall in the future. Maybe higher. Maybe lower. Maybe gone.

So slide the assembled till in place in the chest. Clamp cleats to either face

Cleats for now. There are more permanent ways to install the wall between the sawtill and well for the bench planes. But the problem is that those methods are more permanent. Four nailed cleats will do the job admirably and allow changes down the road.

of the wall and nail the cleats to the insides of the chest using *4d* cut nails (I used fine finish standard nails). The nails will allow the ends to move without splitting any of the components.

For good measure (I like that expression) drive a screw through the top of each till piece and into the front wall of the chest. These two screws will prevent the till assembly from sliding up when your chest is on an Atlantic steamer that encounters heavy seas and all (here endeth the romantic J. Peterman section of this book).

The Moulding Plane Corral

Lucky thing: Almost all moulding planes have bodies that are the same height (some earlier planes are inconsistent in length). This homogeneity allows us to build a rack that secures all the moulding planes using one low wall and four cleats.

More cleats. Secure the low wall that holds the wooden-stock moulding planes and rabbet planes using the same system you used for the wall at the front of the chest. What's left in the middle of the floor of the chest is for the bench planes and joinery planes.

The ideal setup for moulding planes is to store them toe-down. This arrangement allows you to see instantly the profile of each plane without playing guess and grab. I like storing them toe-down instead of toe-up because this keeps the irons and wedges from falling out and dropping to the chest's floor.

With some of your less-used planes, the wedges will loosen up with the seasons. If you store the plane toe-down then the wedge and iron will stay in place until you try to lift the plane. For my collection of planes, my wall was 4" wide and the well for my moulding planes was 3-9/16". Your planes might be a little different, so measure them before you trust my cutting list.

Nail the cleats in place and walk away.

What's left between the sawtill and the holding pen for the moulding planes is the well for the bench planes and the joinery planes. You could parse this space with dividers to hold each plane (I've done this in other chests). Maybe you could knit a cozy for each tool (I haven't crossed this forbidding frontier). Or you could do what I did: Leave the space open. Put your big jointer plane down there and fit the other tools around it.

Are You Moulding Plane Deprived?

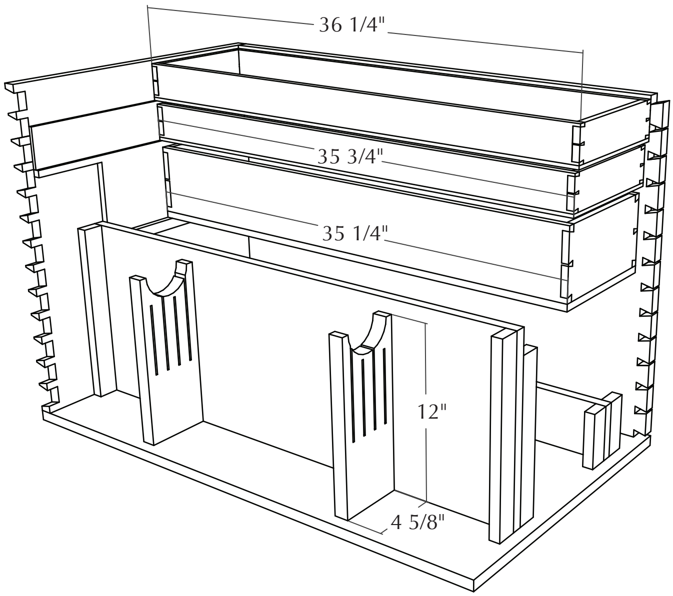
These days, it's rare to find woodworkers with a decent working set of moulding planes. It's even more rare to find a woodworker who knows how to use them. If this is you, don't despair. You are in the majority. But I'd like to make the pitch that you should join the ranks of modern-day craftsmen who have sold their router tables and router bit collections and embraced moulding planes and the freedom they bring.

If you use planes, then you know what a brilliant surface they leave. It's ready to finish. If you use routers then you know what a horrible surface they can leave. It requires lots of sanding to get the tool marks out. And that sanding makes the moulding look more like a Grecian Shmoo instead of an ogee. Your furniture deserves better.

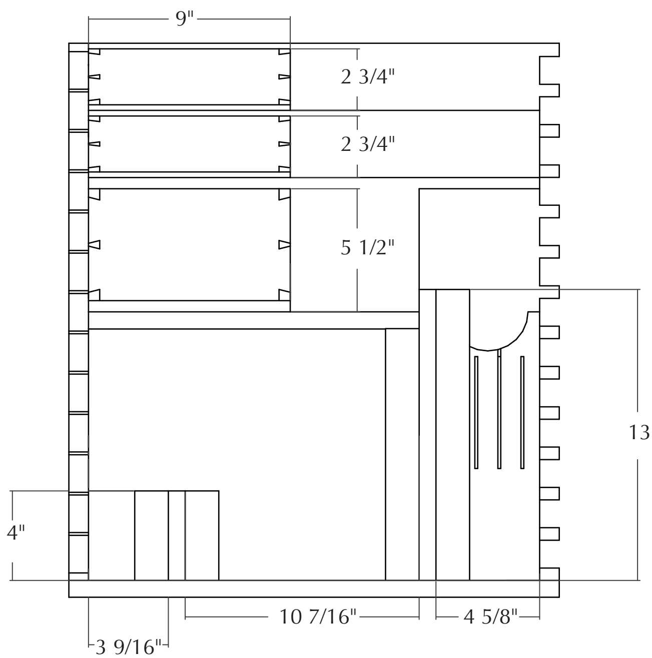
A half-set of hollows and rounds is an investment. But it will free you from the tyranny of the router bit makers, who lock you in to using one bit for one profile. Even if you are poor (or are cheap) you can do a lot better by purchasing a pair of No. 4 and No. 6 hollow and round sizes and a couple vintage beaders and complex moulders. That will set you back less than the price of a single electric router.

I'll be honest with you, there isn't enough information out there on choosing, setting up and using moulding planes. You'll find 100 articles on block planes and bench planes for every article on moulding planes. That is actually a gross exaggeration – it's really more like 1,000 to one.

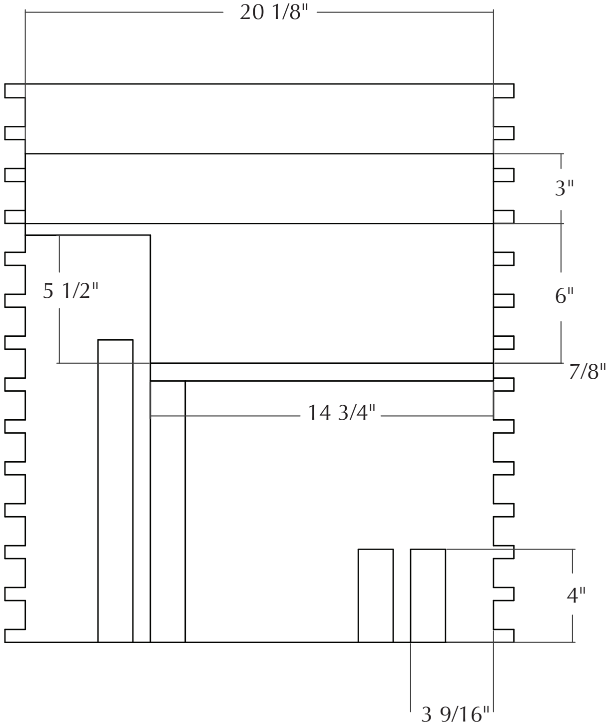
But don't despair. The information is out there, and it is once again becoming easier to find thanks to the efforts of woodworkers who refuse to let this technology die an early and undeserved death. This isn't just some effort by the breeches-and-jodhpurs set. When making short runs of mouldings, moulding planes are superior in every way to the electric router. If I were trimming out a house, I'd break out the electric router. But for furniture? No contest.



Interior, Overall



Interior Section, Profile



Interior Wall, Profile


19-TILLS
HARDWARE
PAINT

The last significant bit of construction on the chest is to build the sliding trays that hover above your plane-storage area. Historically, these trays move forward and back to allow you access to the different levels of the chest.

As you design your own chest, you might be inclined to be contrary, like a typical modern, and make your trays slide left and right. Is this good? Bad? Just different? I've seen the rare tool chest that has trays that move left and right and I think they are flawed.

If you have tools that are longer than 15", you are going to find them difficult to fish out of the bottom of the chest. So if you have a 26"-long handsaw or a jointer plane, you should think twice before bucking the historical model.

So what is this historical model? Typically you will have two or three trays, depending on how tall your chest is. Small chests have two trays. Tall chests, three. The bottom tray is deep. The top tray (or trays) are shallow.

When I divided up the airspace above my planes I could fit two small trays that are 2-3/4" high and 9" wide, including the bottoms. The large tray has a 5-1/2" height and a 9" width.

Those are outside dimensions of the trays. The interior dimensions depend on how thin you can manage to make your components. Oh, and you want the trays to be lightweight, strong and hard-wearing.

To balance these competing interests, you need to be able to tweak the joinery and the types of materials you are using to make your tills.

To make the trays lightweight and strong, make the walls from thin pine that is dovetailed at the corners. Pine that's 1/2" thick should be strong enough. To make the trays hard-wearing, make the bottoms using thin slips of white oak nailed to the bottoms of the trays. I used 1/4"-thick oak for the small trays and 1/2"-thick oak for the big tray.

By nailing the bottoms to the trays, you accomplish several goals: You create more storage space than if you put the bottom pieces in a groove in

Stacked. Here you can see how the runners work. The lower runner rests on the cleats below. Above that are the 1/2"-thick runners (note the extension near the front of the chest). The top 1/4"-thick runner runs the full inside depth of the chest.

the tray. And you make the bottom pieces easy to replace if they get damaged down the road. Oh, and this arrangement makes the trays easier to build.

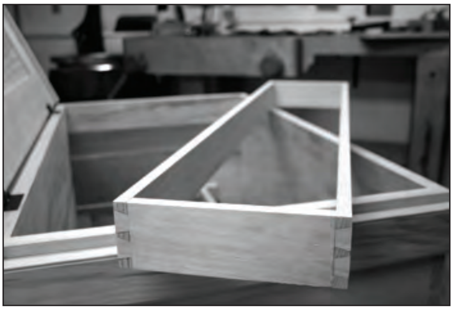
Runners for the Trays

The other design consideration with your trays is how best to allow them to slide back and forth in the chest. The runners should be hard-wearing, add as little weight as possible and not gobble up storage space.

I used thin slips of white oak as the runners. Because oak is so strong and hard-wearing, I could get away with using thin pieces. And that's a good thing because white oak is heavy and almost every other wood option available here in the middle west will wear out a lot faster.

The trays' runners are three different thicknesses – they are stacked and look like steps against the ends of the chest. The bottom runners stick out 1" from the walls of the chest. The middle runners stick out 1/2" and the top runners protrude 1/4". (The bottom runners have some extra meat because they have to support a heavier tray.)

Cut and fit all the runners and begin installing them from the bottom up. Press the lower runners against the cleats that help divide the bottom of the chest. Glue and nail them to the walls of your chest. Next glue and nail the 1/2"-thick runners on top of the 1" lower runners. Note that these 1/2"-thick runners have a short extension at the front that allows the middle tray to slide fully forward. Then add the top runners with glue and nails. You are set to begin building your trays.



Two for the top. I used two through-dovetails at each corner of the small trays. There is no groove for the bottom, so these are as simple as it gets.

Tray Construction

After building the heavy-duty shell, skirts and dust seals, these lightweight trays made using thin materials should be cake to build. Start with the top two trays and cut two tails on the end of each end piece. Then cut the sockets in the fronts and backs of the trays.

By putting the tails on the ends, the tray will resist the endless pushing and pulling, back and forth. It's like a simplified drawer.

The other thing that makes these trays like a drawer is the tolerances you should fit them to. It might seem like a good idea to make them fit a little sloppy so the trays slide easily, but that would be folly. Drawers actually move a lot smoother when they are tightly fitted.

The close fit prevents the drawer from racking between the drawer guides or runners. If the drawer can't rack, it also can't wedge itself in there. Trust me. Having a close fit sounds counter-intuitive, but it works.

A little smaller. The middle tray is the same height, but it is a wee bit shorter in length – about 1/2". Make this tray square and close to the finished dimensions and trim it ever-so-slightly to fit.

The bottom tray is a little larger and uses four dovetails at each corner instead of two. Other than that, it's not much different than its friends above.

Nailed-on Bottoms

The thin oak bottoms are nailed on with *4d* cut nails. Be sure to countersink the heads so they don't drag on your drawer runners. In addition to nails, you can use glue to make the drawer bottoms stronger, though it will make the bottoms more difficult to replace if they get busted up.

Here's the plan: I used narrow boards of quartersawn white oak to make my bottom boards. To allow them to move with the seasons, I made each bottom from two pieces of white oak that were shiplapped together. The shiplap joint itself is unglued, which allows the ends of the bottom to stay put, flush to the front and back edge of the till trays.

That way you can glue the bottom boards to the front and back of the tray. This forces the wood movement into the center of the tray. A narrow gap between these bottom boards ensures your bottom will not buckle over time.

Few chests that I have encountered have their tills divided up for individual tools. They might have a few dividers, but only a few have the French-fitted compartments that make a tool chest look like it's ready to repair the Hubble telescope.

More nailing. the bottoms are nailed in place. And you can use glue in certain places, too – if you are smart.

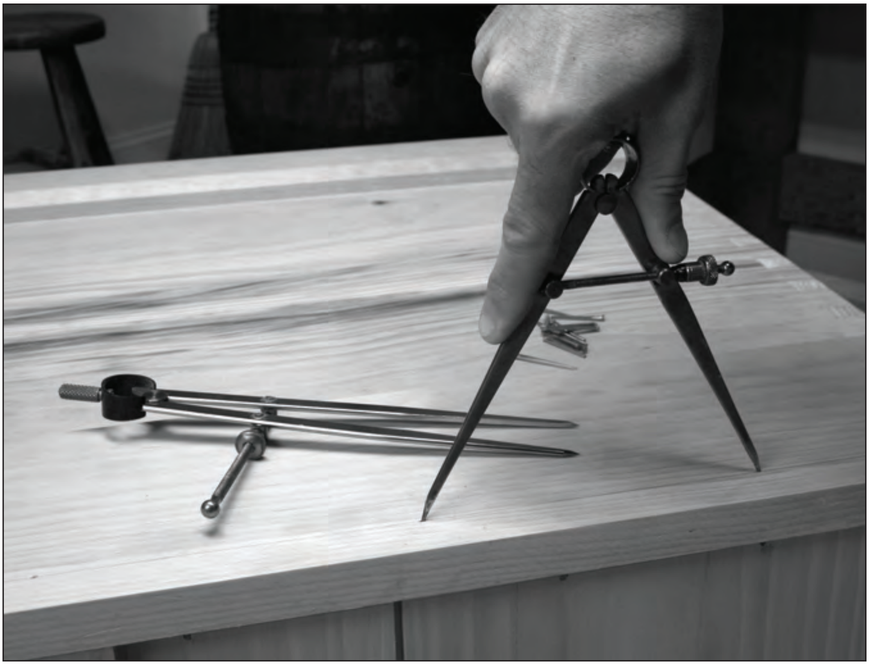
I built individual compartments in the top till of my first chest, and within a year the thing was a mess. I'm an orderly person, but the way I work changes constantly as my skills and interests change. Sometimes I need my grandfather's carving tools close at hand. Sometimes I don't need them for two years.

In addition to my tool chest at work, I also have a wall-hanging tool cabinet. The way I divided up that cabinet has been much more successful. I have a few dividers in each drawer. This gives me some flexibility, but it's not like the junk drawer in my house growing up (bits of string, dead batteries and tampons).

Really, this is not me just trying to finish this book. I don't like micromanaged tool storage. It looks impressive, but it wastes precious space.

Metal Bits

With the trays built, you can call it a tool chest and get on with your craft. But a few extra metal thingys will make the chest stronger, more mobile and secure. First order of business: Nail in the bottom of the chest's shell through the skirt. Use long nails, *4d* or *6d* if you can manage it.



More nails in your bottom. After everything is together, I recommend a few extra steps to make the chest nicer. Nail the bottom boards of the shell through the skirt. I spaced the pilot holes with dividers.

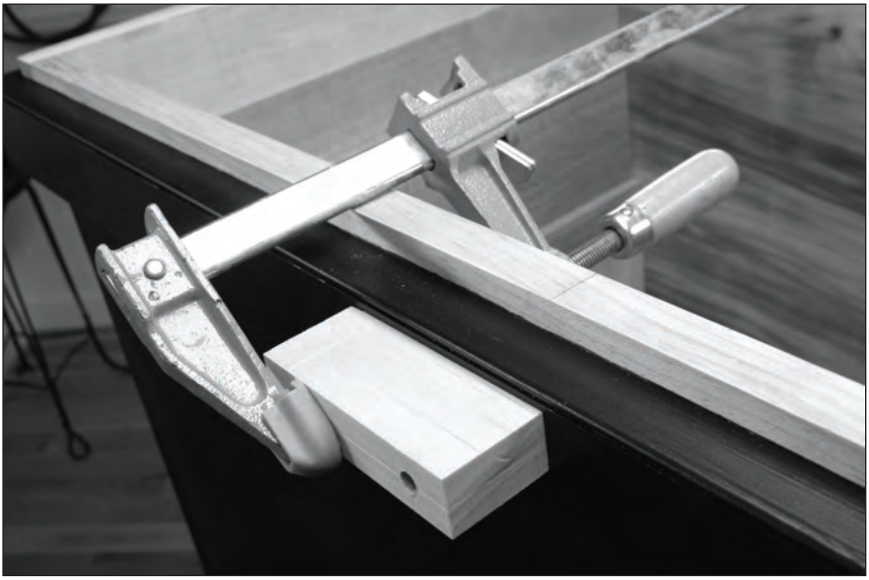
While you have the chest off its bottom, I recommend adding some low casters to the four corners. This protects the base from rot and makes it easier to move around the shop. Plus, in more than a decade of use with my first chest, I've never once thought: If only this chest would stay put.

I also added some ring pulls to the front of my trays. I admit that few chests have this detail, but I wanted an easy way to get that middle tray pulled out.

I also added a chest lock and an escutcheon at the front of the chest. I'm not really worried about theft – this chest will be locked in my shop at home. But it is a traditional touch and there is something satisfying about a well-fitted lock and feeling its barrels slide in place.

Cheap and durable. These cast metal wheels are inexpensive and work well on my flat wooden shop floor. They squeak (even when greased), but oh well.

I hate locks. Really. I dislike locking anything and grew up in a house where we only really locked the house when on vacation. But a traditional chest has a lock.



One hole to guide them. The hole that lines up with the center pin of the lock is critical. I made this little guide to ensure the sucker was straight.

Finishing the Chest

Applying a finish to my projects is either super-simple (clear finish on the bare wood) or agonizing.

Because tool chests are supposed to be painted, I knew I was in for a dose of self-induced agony. The first question with a painted piece is: what color? Tool chests run the gamut, from dark brown to dark green, pea (pee?) green to baby-poo green. And there's blue.

I already own a blue tool chest at work, and I don't need another. So my first instinct was to paint it red, which would make it look good in pictures. But when it comes to painted furniture, my favorite finish is black milk paint over red milk paint, which is what I use on many chairs. To do this you paint the chair red, then you paint it black. Then you let nature run its course. The black paint gets rubbed through, and the red emerges in the areas that see the most wear. This looks great.

So I decided to paint the tool chest red and see how it looked. If worst came to worst, I could always, in the words of the Rolling Stones, paint it black.

So I applied three coats of red milk paint. I love milk paint. It's like a mix between a paint and a stain. It doesn't have a lot of body, so it allows the wood's texture to show through. That's a good thing. Unless you left too much texture behind during the construction process.

As this chest was completed by hand, I left a number of tool marks behind. In truth, I didn't think I'd left a lot of tool marks, but the first coat of milk paint revealed some plane tracks and saw marks on the edges of the lid's dust seal.

Tape me. Mask off the areas you don't want painted, such as the rim. And wipe yourself, too. I know this is bleeding obvious, but I like this photo.

A couple coats of oil and varnish over the red didn't improve things, so I prodded my wife, Lucy, to offer her opinion. If you have been married for at least a spell (18 years in this case) then you know how this conversation works.

"It looks great," she said of the chest.

"It sucks," I replied, wondering how many times I had put this poor woman through this. "I can see these tool marks and it makes me nuts."

Lucy looked at the chest for an appropriate amount of time so that one could term it a "thoughtful" gaze. Then she looked me square in the eyes.

"I guess you should figure out how perfect an anarchist would want it," she said.

Inhale. Exhale. I have my answer. Of course, if I'm asking the question then I already have the answer. Lucy turned her back on me and headed upstairs. I pried open the quart of black paint I bought on my lunch hour that day. Black on red it is.

When you paint furniture, it's not like slopping a hog. Really. Painting furniture is much harder than a few coats of sprayed-on lacquer or shellac. When I apply milk paint I use a nice artificial-bristle brush, because milk paint is a lot like a water-base finish. If you use natural bristles with a water-base finish the bristles end up flopping around like wet noodles.

After a couple coats of milk paint, let the results dry and take a hard look. Milk paint leaves a chalky result. Perhaps you can live with that, but I cannot. Plain old milk paint will result in a fairly pastel color.

From this point you can add a topcoat finish to darken the milk paint. Boiled linseed oil, wax or a film finish (such as varnish or lacquer) will do the trick. If you choose oil or wax, know that those don't offer much protection against stains, so your chest will look worn in a hurry. This is not always bad.

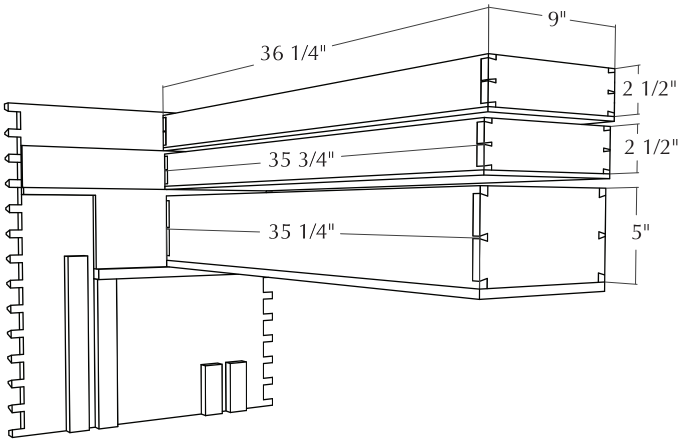
If you apply a film finish, the flat areas will get a fair amount of protection, but nothing can protect the edges and corners. These take a serious beating in a shop.

After you apply the oil, varnish or wax, you can go a step further, like I did. Apply another coat of paint over everything.

After leveling out all the milk paint, then applying two coats of oil then two more coats of thin wiping varnish, I added two coats of black latex satin paint. If you go this route, don't ask the paint store people to tint you a base color until it is black; get a paint that was factory-made to be black. Professional paint stores carry it. It's wonderful stuff, and it covers the red quite well.

Two coats of black and you are ready to sing with Johnny Cash.

While the black will cover everything, the normal wear and tear in a shop will slowly reveal the red below, and eventually the raw pine. After 15 years or so, the chest will look magnificent.



Overall Section, Trays


20-AFTER
THE WAR

"The industrial system has brought with it tremendous advantages. It means we are living at a far higher standard of comfort than our forefathers, and with far more leisure. But it is always working toward uniformity, the dead level only minimizes costs and increases output.

"If we are going not only to acquiesce but to follow blindly where it leads, then we shall get standardization – and deserve it.

"If we, as craftsmen, still keep our judgments keen and our tastes discriminating; if, that is to say, we persist in being individuals still, we can do something to stem the tide. But those children, who have gone out into the very heart of their own land and seen for themselves, and weighed things in the balance as children do, I think they will do even more."

— Charles H. Hayward, The Woodworker*, April 1940*

When a tree is cut down by chainsaws or a storm, there's a strange period of time when its leaves are still vibrant, green and supple, like the tree hasn't quite figured out that it's already dead.

It can take days for the news of the death to make it to the far reaches of the plant, and then the leaves droop, crinkle and fall off one by one until all that is left is the rotting skeleton of branches.

I think it's a bold but fair statement to say that the craft of woodworking was cut down by the aftermath of World War II. The global reconstruction in Europe and the mass mechanization required to do it quickly girdled the bole of the woodworking craft. Chisels were put away. Moulding planes were burned. Saws were allowed to rust.

To be sure, hand woodworking had been in decline (especially in the Americas) since the advent of the Industrial Revolution in the 19th century. But while Americans embraced industry, the English and the Europeans kept handcraft alive with the help of the medieval guild system. Before World War II, there were still lots of quality hand tools being made and used in shops. Even the infill plane maker Norris was hanging on until the war.

Up until 1945, hand tools were still the norm in the home. Power tools were too expensive and were reserved for industry. Heck, just look at Stanley's production history to see this whole thing play out. Up until the war, Stanley was still making a full range of high-quality planes and chisels. After the war, things took a nosedive in New Britain, Conn. Today tool collectors draw a bright line between tools made before World War II and those made after.

After the war, the world turned upside down. Rebuilding the decimated cities and towns across Europe required new ways of building (enter the 32mm system of making cabinets). New materials (PVA glue). And mechanization to allow it to be done quickly and cheaply.

And it was the same mechanization that helped factories crank out electric tools, making them inexpensive enough for the home hobbyist.

Stuff like this doesn't change the world overnight. Some people – like my hero Charles H. Hayward – saw it coming early on and remarked upon it many times in his editorials in *The Woodworker* magazine.

But, like the death of a tree, it took more than 60 years for the news to reach every corner of the globe, including one remarkable shop in Sunbury, Ohio.

When I started at *Popular Woodworking*, one of my first assignments took me to the shop of Troy Sexton, a professional cabinetmaker who builds furniture in a spacious shop he constructed on his farm outside Columbus, Ohio.

I spent many years working on stories for our magazine with Troy, who built furniture alone in his shop, but somehow managed the output of three people. Troy is impossibly fast. When I drove up to work with him on an article for the magazine, he would start a project when I arrived at about 8:30 a.m. By lunchtime, the project was all but finished, except for some sanding and detail work.

His secret? Well, it isn't really a secret. Troy is just one of the smartest and fastest woodworkers I've ever met. He purchases good tools and keeps many of them set for specific operations. Here's a small sample of his genius: He has a small power planer with sharp blades that is set for exactly 3/4". He roughs out all his stock on his big machines and passes everything through this small planer, which leaves a great finish and ensures everything is perfectly sized.

He has a small table saw set up for cutting only face cheeks of tenons. He has a second saw bolted to that one for cutting edge cheeks. And a small jig that drops onto the fence to make the haunches.

He has small router tables set up to make matching cope-and-stick profiles that are always bang-on (he reinforces these joints with loose tenons).

And his dovetail system still boggles my mind.

I know what you must be thinking: What the hell is going on here? I thought this book was about promoting hand work. Well, I am all about hand work. I use only a few machines (fewer every year). But this particular story involves machines deeply because every choice we make in the craft involves mechanization.

Troy does not mess around. He can do anything with any tool, whether powered by man or electron. He souped up several old handplanes to an extreme degree to try to produce period surface finishes. He could make any tool obey his whim because he had a complete mastery of the way that wood and steel interact.

But Troy decided to compete with the machines on their own turf. He tried to become a one-man factory. He succeeded in that. But the most efficient one-man factory cannot compete with a factory driven by a hundred men.

So no matter what Troy did, the prices for work (good or otherwise) declined. Ikea's well-designed kitchens and Value City's cheap junk made it impossible to survive and live well.

So Troy struggled with his business. And that's nuts. He should have had more business than he could handle. But like many professional cabinetmakers I know, it became harder and harder for him to make ends meet every year. His cabinetmaking business is now a shadow of its former self, and Troy spends more of his time working for his wife's successful tax business.

Who is to blame for this? We are.

We have become a culture that is obsessed with price more than any other attribute of the things we buy. It doesn't matter if the item is ugly, poorly made or constructed of materials that cannot be recycled. All that matters is if the price is low enough.

Because the price of our household objects has hit rock bottom, if an item breaks or starts to look dated, we can throw it away and buy something else. For the first time in human history, manufactured furniture is shockingly inexpensive.

So it's no wonder that artisans are exiting the craft. It's difficult to compete against furniture that costs less than what you pay for your raw materials.

Lesson: People cannot imitate machines and defeat them.

Don't believe me? There is little doubt that the professional class of artisans is shrinking. There were 140,000 cabinetmakers and bench carpenters in the United States in 1999. In 2003, there were 126,350. As of 2009, that number had shrunk to 99,870, according to the Bureau of Labor Statistics.

And those declining numbers are the overarching reason I wrote "The Anarchist's Tool Chest." Yeah, I know it is arguable that this book is a belly-button-gazing text about how handcraft is in decline and ... cue the whining and hand-wringing.

But the truth is, I don't give a crap about personal self-actualization. I don't care if you find peace in your smoothing plane. I don't care if you find your power animal.

What I care about is the craft of woodworking, which is closer to extinction now than at any other time in the history of the human race. How do we save it?

I'm so glad you asked.

It is our duty as amateurs to pick up the mantle of the craft of woodworking from the professionals, who have been carrying this heavy burden for us for generation after generation. It is our turn to preserve the design, joinery and finishing skills that are now being transferred to CNC machinery.

How can we do this? Part of this is done by sustaining the toolmakers who make tools that actually function. Part of this is done by preserving the written woodworking knowledge about how to build stuff without computers or automation.

But those two tasks above are the easy things to do. The hard part is the important part. We have to acquire, store and redistribute the actual hand skills. But you can't deposit those into a book, a video or a computer.

There is only one place that hard-won hand skills can be stored then accessed by future generations: that is in your hands and your heart.

By absorbing and practicing these skills we can ensure they will not be lost – as long as we are willing to teach them freely to younger woodworkers. For most of human history, the important stuff about working wood was never written down or shared outside a tight-knit group of professionals. Most of their knowledge is gone. Read George Sturt's "The Wheelwright's Shop" for a first-hand example of this. I ask you to share what you know with anyone who will listen. Write a book. Start a blog.

But those tasks – difficult as they are – are not all I am asking of you.

If you honestly want to preserve the craft as more than an academic curiosity – perhaps to lay the groundwork for a craft revival, then try this: Consider living more like an 18th-century artisan and less like a 21st-century mega-consumer. This path isn't chock-full of fun. I know because I'm on it. During the last decade, my priorities have shifted to the point where now I:

- Buy things that are well-made by skilled people who sell them for a fair price.
- Decline to purchase cheap goods that are designed to be discarded.

- Whenever possible, make exactly what I need, instead of buying something that will suffice for now.

For me, this behavior has resulted in my questioning the institutions that encourage wasteful consumption, particularly large corporations and the governments in service to them. These institutions are the opposite of individual enterprise, and I worry about the way they work because I think they endanger our craft.

I call this practical skepticism, but its more proper name is "anarchism." So be it.

By living like an artisan and encouraging others to do likewise, it's my sincerest hope that it will some day encourage a renaissance in the craft that is similar to what has occurred in other nearly lost pre-industrial professions, such as small-scale brewing, micro-farming and even cheese-making.

If a woodworking renaissance ever occurs, then you and I will have laid the groundwork for a future generation of craftsmen. With our help, they will have the hand skills we have taught them. They will have access to the books to help them continue to learn the craft. They will have a stout chest filled with quality tools that are sharp. They will be ready to build furniture that lasts forever and is better than anything a computer could construct.

Or, to end this book on a more "writerly" note and bring the story full circle so my college newswriting professor will approve: We will have gathered the acorns from around the fallen tree and spread them throughout the land in the hope that some of them will take root to replace what was lost after the war.

APPENDICES

Appendix A: Tools: 1678-1973

	Charles Hayward	Joseph Moxon	Randle Holme	Benjamin Seaton	Joiner & Etc.
Handsaw	Y	Y	Y	Y	Y
Backsaw 10"	Y			Y	
Ripsaw				Y	
Tenon/Sash saw	Y	Y	Y	Y/Y	Y
Dovetail saw	Y			Y	Y
Saw pad				Y	
Jack plane	Y			Y	Y
Fore plane	Y	Y	Y	Y	
Smoothing plane	Y	Y	Y	Y	Y
Jointer/Try plane		Y	Y	Y	Y
Strike block plane		Y			
Firmer chisels	Y	Y	Y	Y	Y
Hammer	Y	Y	Y	Y	Y
Mallet	Y	Y	Y		Y
Punches, nail	Y			Y	Y
Pincers	Y			Y	Y
Screwdrivers	Y			Y	Y
Cutting gauge	Y			Y	
Brace	Y	Y	Y	Y	Y
Auger bit	Y				
Twist or brad-point	Y				
Countersink bit	Y				Y
Center bit	Y				Y
Brad awl	Y		Y	Y	Y
Marking awl				Y	
Trammel				Y	

	Charles Hayward	*Joseph Moxon*	*Randle Holme*	*Benjamin Seaton*	*Joiner & Etc.*
Try square, 6"	Y	Y	Y	Y	Y
Card scraper	Y			Y	Y
Oilstone(s)	Y	Y		Y	Y
Folding rule	Y				Y
Bow saw, 12"	Y	Y	Y	Y	Y
Keyhole saw	Y	Y	Y	Y	Y
Coping saw	Y				
Bullnose plane	Y				
Shoulder plane	Y				
Compass plane	Y		Y	Y	
Rabbet plane	Y	Y	Y	Y	Y
Toothing plane	Y			Y	Y
Plow plane	Y	Y	Y	Y	Y
Moulding planes		Y		Y	Y
Snipes bills				Y	
Side rabbet				Y	
Cock bead planes				Y	
Paring chisel, 1-1⁄2"	Y	Y	Y	Y	Y
Skew firmer chisel		Y	Y		
Mortise chisels	Y	Y	Y	Y	Y
Patternmaker's hammer	Y				
Marking gauge	Y	Y	Y	Y	Y
Mortise gauge	Y			Y	
Spokeshave	Y			Y	
Center bits	Y			Y	
Shell bits				Y	
Tapered reamer			Y	Y	

	Charles Hayward	Joseph Moxon	Randle Holme	Benjamin Seaton	Joiner & Etc.
Sash clamps, 36"	Y				Y
C-clamps	Y				
Handscrews	Y				
Try square, large	Y			Y	
Miter square	Y	Y	Y		
Sliding bevel	Y	Y	Y	Y	
Gouges	Y	Y	Y	Y	Y
Rasps/Surform tool	Y			Y	
Router plane	Y			Y	
Dividers	Y	Y	Y	Y	Y
Miter block	Y			Y	
Miter box	Y	Y	Y		
Shooting board	Y				Y
Sticking board				Y	
Straightedge	Y				
Square, 24"	Y		Y		
Winding sticks	Y				
Oilstone case	Y	Y			Y
Veneering hammer	Y			Y	Y
Bench hook	Y	Y	Y		Y
Scratch stock	Y			Y	
Miter template	Y				
Workbench		Y	Y		Y
Bench screw		Y	Y		
Holdfast		Y	Y		
Double screw		Y	Y		
Hatchet		Y	Y		

	Charles Hayward	Joseph Moxon	Randle Holme	Benjamin Seaton	Joiner & Etc.
Gimlet		Y	Y	Y	Y
Auger(s)	Y	Y	Y	Y	
Saw vise		Y	Y		
Saw wrest/Set		Y	Y	Y	
Pitsaw		Y	Y		
Whip saw		Y	Y		
Trestles		Y			
24" rule		Y	Y	Y	
Glue pot		Y	Y		Y
Waving engine		Y	Y		
Bench hook (metal)		Y	Y		
Joiners saddle			Y		
Ginnet (Adze)			Y		
Calipers			Y		
Dado planes				Y	
Butt gauge				Y	
Scrivener's wheel				Y	
Hand vise				Y	
Pliers				Y	
Saw files				Y	

Sources:

Charles H. Hayward "Tools for Woodwork" Evans Bros., 1973
Joseph Moxon "Mechanick Exercises" Lost Art Press, first published 1678
Randle Holme III "The Academie of Armorie, or, A Storehouse of Armory and Blazon" The Scolar Press Limited, first pub. 1688
Anon. "The Joiner & Cabinet Maker" Lost Art Press, first pub. circa 1839

Appendix B: Vintage Tool Dealers

I could never compile a comprehensive list of tool dealers. There are too many honorable people out there selling tools for both collectors and users. My first and best recommendation is to join the tool-collecting clubs and attend their meetings. There is no better way to see thousands of tools in one place and become educated in their differences.

Plus, if you really are a user and not a collector, you'll find many items priced for you.

Mid-West Tool Collectors Association (M-WTCA)

mwtca.org

This is the world's largest tool-collecting organization. It's inexpensive to become a member. And the benefits are tremendous. The organization has about 40 meeting across the country each year. And these meetings are great places to learn about, sell and buy old tools. Another good reason to join: You get reprints of awesome vintage tool catalogs.

Early American Industries Association (EAIA)

eaiainfo.org

The EAIA is like the Mid-West group, but its meetings and publications are more highbrow. (Note: I belong to – and avidly support – both). The organization's quarterly magazine, *The Chronicle,* alone is worth the price of admission. EAIA also has annual and smaller meetings that have both selling and educational components. Honestly, I think you should join both.

Other Ways to Buy Tools

I'm not a joiner. In fact, the above organizations are the only two "clubs" I belong to. I don't even belong to any societies of journalists (functional alcoholics) or writers (self-absorbed blowhards). So I mean it when I say this: Join these two groups. The people are nice. And you won't end up selling cleaning products.

But I know that there are some numbskulls who want to buy tools and not have to join an organization for a few bucks a year. You can troll eBay – hell you can have it. eBay is for suckers.

If you want to buy good vintage tools, then you need to buy from people who know their stuff. People who stand behind their products. People who will take a tool back if it doesn't meet your expectations.

The jokers on eBay are usually none of these things.

So it pays to buy your tools from tool people. I have several people I buy from all the time and recommend. Here's a short list.

Jim Bode

Jim Bode Tools
jimbodetools.com
518-537-8665
Jim Bode gets some crazy minty stuff, like Patrick Leach at The Superior Works. While Patrick Leach's descriptions of tools are snarky (see my description, below), Bode's tend toward hyperbole. However, I've always gotten good tools and good service from Jim. And if you like minty and rare stuff (with an occasional user), he's a good source.

Josh Clark

Hyperkitten
hyperkitten.com
jclark@hyperkitten.com
Josh specializes in finding great user-grade stuff and selling it at incredibly friendly prices. His stuff generally is cleaner, straighter and cheaper that what you'll find on eBay. His selection isn't all that deep at any given time,

but he's happy to take requests to help you find things, and he's a great guy to deal with.

Patrick Leach

The Superior Works
supertool.com
leach@supertool.com
Patrick Leach has a nose for the primo stuff. The stuff that is in mint condition. Tools that you've never seen before because only a few were made. And tools that are just drop-dead gorgeous. While a lot of his stuff is aimed at collectors, he carries a wide range of better-quality user stuff. Expect to pay more than eBay for a tool, but expect to be impressed. Patrick's monthly e-mail newsletter – written in his hilarious, snarky tone – is the best way to buy stuff from him – or at tool shows, where he sells off a wide range of stuff.

Sanford Moss

Sydnas Sloot
sydnassloot.com
sushandel@msn.com
Sanford Moss specializes in braces and boring tools, and his site is a deep well of knowledge on braces. But he sells lots of other tools, too. His selection of tools for sale isn't deep. But his prices are fair, and he's one of the most honorable men you'll meet in the business.

Tony Murland

Tony Murland Antique Tools
antiquetools.co.uk
tony@antiquetools.co.uk
While Tony Murland is based in the United Kingdom, he spends some time each year in the United States and is a great source for woodworkers who

are looking for English tools. He always has stuff that can be hard to find, such as sets of hollow and round planes, lots of infills and Record and Preston tools. His auction carries some pretty pricey tools, but he also has some down-to-earth things as well.

Lee Richmond

The Best Things
thebestthings.com
800-884-1373
Lee Richmond sells both new and vintage tools, and he turns up some fine examples of moulding planes and infills, especially. He does an outstanding job of describing the tools so it's clear if they are for a user or a collector. His prices are fair.

AFTERWORD

The idea for this book came to me in February 2010 as I was running along an empty Maine road before sunrise and freezing my butt off (or the small bony part of my anatomy that I call a "butt").

The kernel of that early morning brainstorm was to create the definitive list of the core tools you need to build furniture – no more, no less. I wanted to help beginning woodworkers focus only on those 40-odd tools, instead of being distracted by the dozens and dozens of tools that look deceivingly useful, but are really just nice reproductions of wildly unsuccessful tools that collectors desired for their trophy rooms.

In short, I wanted to write the book that I wish I'd owned at age 11.

After my run that February morning, I flopped on my bed and started writing this book's chapter on handplanes. When I finished it three days later, I kinda liked it. I thought my employer would like it, too. So I wrote up a full proposal for this book and submitted it to my superiors at F+W Media.

About a week later my boss, Steve, sat down with me to discuss it.

While he liked my proposal, Steve thought it would be a better book if I switched gears and focused on blending hand and power tools instead of my idea, which was to distill a list of the hard-core handtools, discuss how to pick them then build a chest to protect them.

Steve argued that a book on blending hand and power tools would cast a wider net and appeal to lots more woodworkers.

He's totally and completely correct. But someone else can write that book.

I told Steve that I wouldn't write the "blended woodworking" book he wanted. While other bosses would have fired me for refusing, Steve has always given me a healthy length of rope.

So I dove into this book on my own time, and I latched onto the idea of tying together the radical act of building furniture that lasts forever with American anarchism, about which I knew just enough to be annoying at dinner parties.

To augment my knowledge of American anarchism, I read a lot of books with titles that alarmed both my liberal and conservative friends. I gathered first-hand accounts of pre-capitalistic artisans in Estonia and England. And I became thoroughly convinced of three things:

- We cannot look to our government to preserve woodworking. During the last 20 years, our public school systems have only eliminated classes in the manual arts. Our schools are designed to turn out machine-minders and computer nerds. There are no classes on how to be an "artisan."
- We cannot look to free enterprise to preserve woodworking. The last 100 years of mechanization have made most furniture and tools both cheap and flimsy. Corporations' efforts to make things cheaper and cheaper only undermine good woodwork.
- The only people who will preserve our craft are the passionate amateurs, who can pursue all manner of crazy historical methods without worrying about starving.

Like it or not, these three points describe a typical buttoned-down, mild-mannered American anarchist. That's me. And perhaps it's you, too. You can choose to call it "populism," "pragmatism" or "mutualism." But those are all highbrow names for the fierce individualists who forged our young nation's pre-capitalistic society, which was based on the efforts of millions of artisans in wood, metal and cloth.

The deeper I delved into writing this book and the history of anarchism, the more those long-dead artisans whispered the following ideas into my ear: Quit your corporate job. Get yourself fired.

But something keeps me on the payroll at *Popular Woodworking Magazine*. Perhaps I'm just chicken. Or perhaps I still have work to do, and a corporation that turns out woodworking content for the masses is a great bullhorn for my ideas on how to sustain our craft.

Someday my superiors will find out that I'm hiding straight razors in the bright red apples I hand out to readers of the magazine and my blogs. And then I'll be back in business for myself again. (I failed miserably with a little newspaper I helped launch in the mid-1990s.)

But until that day comes, let's just keep this little anarchism thing between you and me.

Date: Nov. 18, 2011

Shortly after I wrote the final paragraph (above) of my original text, I sent the first printing of this book to the presses. Then I had time to think – a dangerous thing.

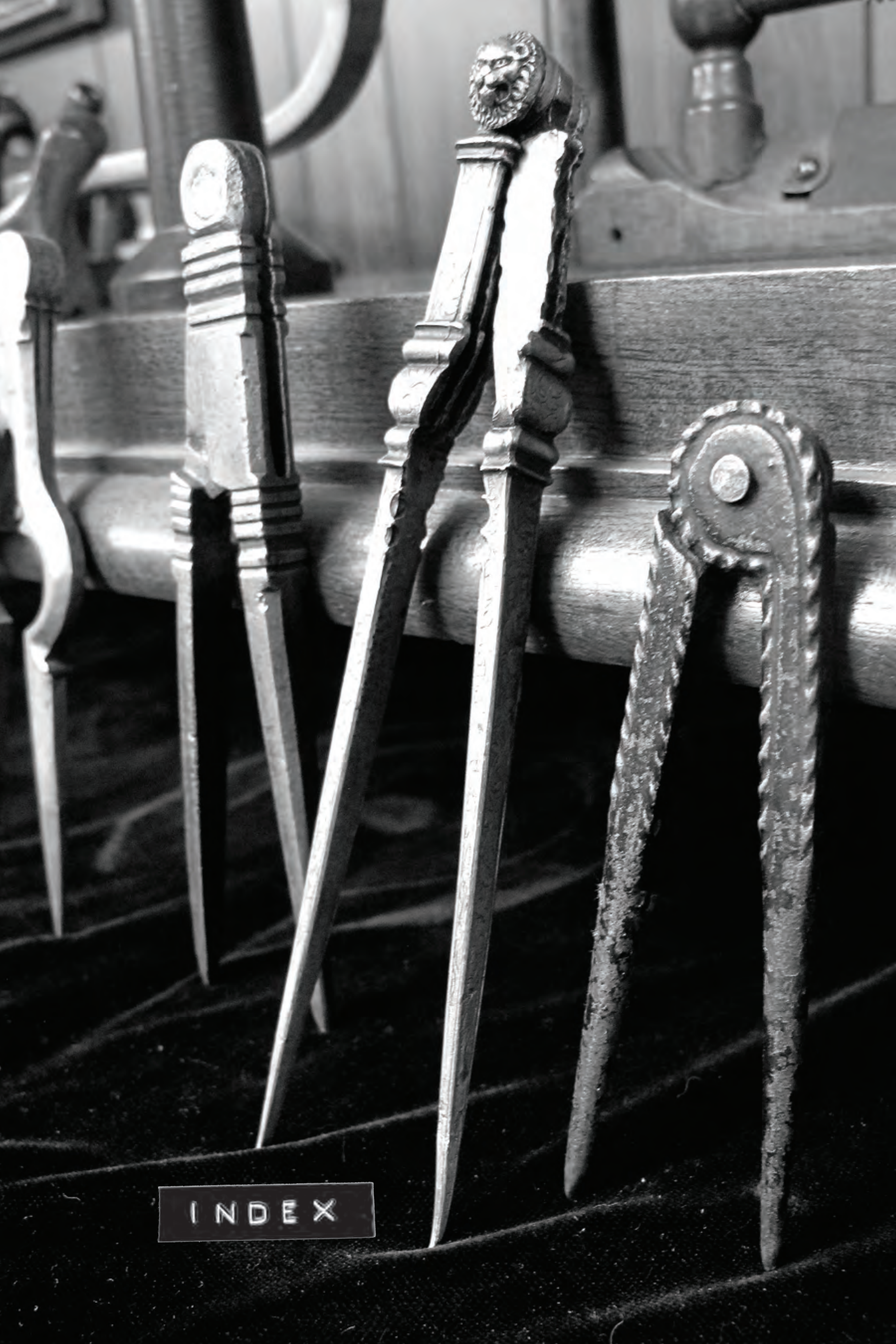
Some people (not me!) write books in hopes of changing the world. As a lifelong writer I can tell you that what usually happens is that a book really changes only one person – the author. After forcing myself to face the stupid things that institutions do to individuals, it became impossible for me to go to work every day for one of these large institutions.

Lucky for me, my wife and I had paid off our mortgage in 2008. We had no debts or obligations, other than our utilities and the cat food bill. So I quit my job. It was the happiest day of my life – right behind the birth of my two children and my wedding day. (Right honey? Did I say that right?)

Since the day I walked out of my fantastic dream job in June 2011 I have focused all my energy on publishing books and blog entries that promote the cause of handwork – my true love.

By the time you read this, I might be handing you a carton of fries via some Midwestern drive-through window. But when I'm not cleaning out the grease trap for the deep-fryer or adjusting my hairnet to conceal my receeding hairline, I'll be writing outlines during my breaks for my next book.

Next up: Furniture design.



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A List of Personages Mentioned in 'ATC'

Some Notable Quotes

Charles H. Hayward from *The Woodworker*:

"(Tools and skills), in the dawn of the world were a man's first, best friends. They remain his best friends still in a world grown old and infinitely complex. By means of them he can unlock the doors to a life of creative activity that is full of interest. Without them he is mere shadow of the man he might be."
— May 1954 (p.12)

"If we as craftsmen still keep our judgements keen and our tastes discriminating; if, that is to say, we persist in being individuals still, we can do something to stem the tide. But those children, who have gone out into the very heart of their own land and seen for themselves, and weighed things in the balance as children do, I think they will do even more."
— April 1940 (p.455)

Herbert Cescinsky:

"A dog kennel carved and inlaid may be rare but it is not valuable, and the man who carved and inlaid it was not a genius but a lunatic."
— 1924 (p.48)

Christopher Schwarz:

"When I am too exhausted, ill or busy to work in my shop, I will shuffle down the stairs to my 15' x 25' workshop and simply stand there for a few minutes with my hands on my tools." (p.9)

"…my relationship with my tools is like a tumultuous combination of an Italian family drama, a bigamist's decision about whom to sleep with and a careful gardener." (p.9)

"Build stuff until I croak." (p.26)

"I wasn't destined to have the same dream as my father. I am a different person with different DNA. But between us the urge to build is undeniable. In the driver's seat in 1981, he knew that. I didn't. But I do now." (p.46)

"One of the other advantages of infill planes is hard to quantify. Most woodworkers (me included) find them fetching." (p.71)

"The jack plane usually has a curved iron so it can hog off wood with extreme prejudice. But the plane, like me, has a more sensitive side, too." (p.72)

"So Viva La Rabbet !" (p.91)

“Gauges are the tools that guide other tools. They lay out the lines that you work to: the baseline of where your dovetails take wing from your board. The width and depth of a rabbet. The cheek of a tenon. The wall of a mortise.” (p.117)

“Most woodworking requires two hammers. One is for driving the big-boy nails. The other hammer (called the “girl” hammer….) is for driving sprigs and making sensitive tool adjustments.” (p.191)

“The following is my handsaw Kool-Aid: If you can see the line, you can cut the line. Any line.” (p.231)

“Sharp fixes everything.” (p.316)

“But the third table, our last table, is perfect. Most nights at dinner I reach under its top and feel the ridges left behind from my fore plane — long and shallow troughs across the width of the tabletop that feel like gentle Atlantic waves.” (p.345)

“If a woodworking renaissance ever occurs, then you and I will have laid the groundwork for future generations of craftsman…..We will have gathered the acorns from around the fallen tree and spread them throughout the land in the hope that some of them will take root to replace what was lost after the war.” (p.460)

“But until that day comes, let’s just keep this little anarchism thing between you and me.” (p.475)