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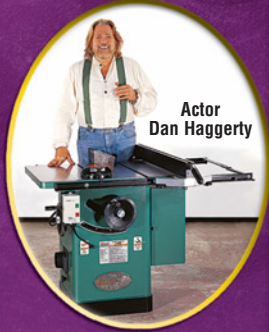
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- APPROX. SHIPPING WEIGHT: 220 LBS. • PRECISION GROUND CAST IRON TABLE

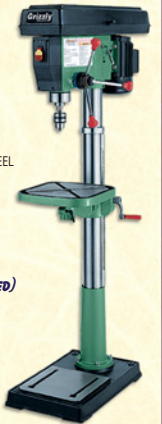
TOOL BUYING GUIDE Editors' Choice



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- STROKE LENGTH: 1"
- FLOOR-TO-TABLE HEIGHT: 39 1/2"
- BUILT-IN 2" DUST COLLECTION PORT
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content



TOOLS AND TECHNIQUES

16 Sturdy Fold-Away Sawhorses

TRICKS OF THE TRADE

We like plastic folding sawhorses, but they get expensive. You can build your own using this clever idea sent in by a reader. Also, learn to set up your dovetail jig to become a precision dado machine.

18 HTC Rip Fence Improves the Venerable Biesemeyer

TOOL TEST

By adding a micro-adjustability feature and easy-to-remove fence faces, HTC has refined the classic Biesemeyer fence system found in most commercial woodshops. We tell you if it's worth upgrading. We also test Milwaukee's BodyGrip router and Bosch's 1619EVS plunge router.

22 Multipurpose Sled and Tenon Jig

INGENIOUS JIGS

Instead of purchasing an expensive aftermarket miter gauge, try this shop-made cutoff sled with a smart tenoning attachment. The whole rig is simple, inexpensive and highly accurate.

By Nick Engler

25 Grizzly 1023S Cabinet Saw

ENDURANCE TEST

This cabinet saw — with the price tag of a contractor saw — has turned the table saw market for home woodworkers upside down. After two years of hard use in our shop, we tell you how the 1023S fared.

38 Air Compressors in the Shop

The right compressor can transform your woodworking by giving you access to spray finishing and nail guns. With prices dropping every year, here's what you need to know to buy the right machine.

By Rick Peters

48 Metal-bodied Jack Planes

Many woodworkers do everything in their power to avoid using hand planes. And no wonder: Bench planes are tricky to set up and use. Here's a complete lesson on how to buy, set up and use a metal-bodied jack plane — one of the most useful all-around planes.

70 Mortising Jig for a Router

You can make highly accurate mortises using your plunge router and a simple jig made from shop scraps with some simple hardware. Here's how to build and use one of our favorite jigs.

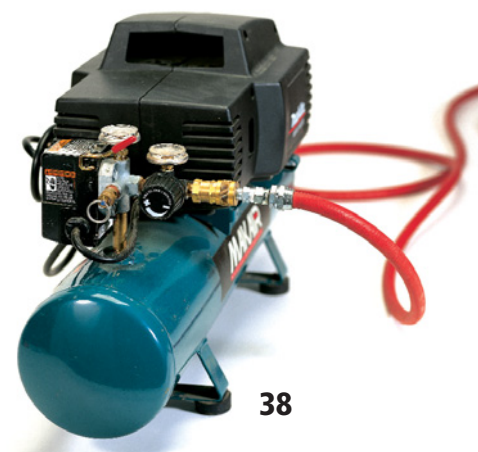
74 Using a Cutting List

A properly organized cutting list can help you avoid costly and frustrating mistakes, and make your work on a project feel much more under your control. Here are the tips from a lifelong pro.

By Lonnie Bird

76 \$30 Lumber Rack

Most people buy expensive brackets or build bulky shelves to store lumber. Here's a third way. It's inexpensive, flexible, cheap and takes up little space in your shop.



PROJECTS

30 Ultimate Tool Cabinet

If you've got the tools, the time, the wood and the skills, then we've got the project. This father-and-son tool cabinet is your final exam in case construction. If you're not ready to take the test, you still can learn a lot about designing tool storage for whatever type of tool cabinet is on your drawing board.

By Glen and Malcolm Huey

42 All-Weather Morris Chair

Armed with \$40 in pine, a saw and a drill, you can build this fall-asleep-in-it outdoor Morris chair. Start in the morning, and it'll be ready by nap time. Our personal best time for construction: four hours.

57 A Child's Double Dulcimer

This Appalachian folk instrument is easy to play and build (no curves here). Our version is designed so two people can play at the same time.

By Claude Crowley

62 Shaker Storage Cabinet

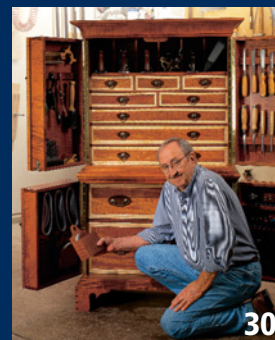
Whatever you've got to store, this face-frame cabinet can probably take it.

Two different shelving systems help you pack away stuff that's either heavy or light.

By Troy Sexton



62



30

ON THE COVER

Built in a garage using machines found in most home shops, this tool cabinet is one ultimate woodworking project. Father-and-son team Glen and Malcolm Huey joined forces to show you how to build enough storage space for almost any set of tools.

Cover photo by Al Parrish

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66 Knockdown Bookcase

This unusual and useful Arts & Crafts bookcase can be taken completely apart with four raps of a hammer.

80 Seedling Shelter

This simple "cold frame" helps nurture your spring plantings during winter.

By Jim Stuard

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Feeling Set Up

Out of the box, many hand planes set you up to fail.

If you harbor a dark little secret about the disgraceful results you get with a hand plane, let me shine the warm light of redemption on your self-doubt as a woodworker. It's not your fault.

How were you to know that the hand planes most often bought by woodworkers haven't completed the manufacturing process and require hours of set-up time? My experience with other new tools is they're ready to go, out of the box.

I had no idea what a hand plane required, and no one told me for years. That's why the first planes I bought were more useful as paperweights than woodworking tools. Every time I used them they'd tear out the wood and sometimes ruin the work. No amount

of sharpening would improve the result, so back on the shelf it went, my feelings of failure eclipsing my sense of frustration. Hey, I'm a good woodworker, and I'm supposed to be able to pull off wispy curls!

Well, not quite. You see, what came out of the box, I learned, was akin to a new piano that was all shiny and new but never tuned. So I learned a lot of work was required to set up my plane. So much so, I abandoned my original paperweight and bought a vintage "fixer" on the internet. My original plane, a name brand, was of such poor quality that no amount of work would make it right.

I also figured that the work I'd invest in a fixer plane would produce a top-notch tool, save me money, and I'd really learn the fundamentals of what makes a good plane and how to set it up properly.

When it arrived, I anxiously inspected my \$22.50 investment. I was pleased to find it was in pretty good shape. Even the original rosewood handles were intact.

In all, I spent about six hours rehabbing my "new" old plane. The hardest part was the two hours it took to flatten the sole. I also flattened the machined surfaces of the

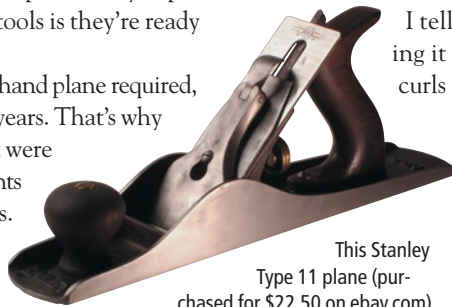
frog and made sure the chipbreaker seated fully on the iron. The rest of the work was cleaning and polishing. When done, it didn't look new; it looked better than new.

The iron that came with it had seen better days so I replaced it with a nice aftermarket Hock blade, which added another \$25 to the cost. After sharpening I installed the blade and set it up. Can

I tell you how nice a feeling it was producing wispy curls a few minutes later?

I strongly encourage you to read the complete article on rehabbing an old plane like I did. If you aren't already producing nice shavings, you can, and it won't cost

you an arm and a leg. Best of all, you'll be a better woodworker for it. And you can send in your first wispy shaving and we'll send you an official hand plane merit badge for free. You can read more about that on page 48.



This Stanley Type 11 plane (purchased for \$22.50 on ebay.com) outperforms many modern planes.

SawStop Table Saw Safety Poll Results

In the December issue, I wrote about the SawStop table saw safety device, a passive safety mechanism that might save many a woodworker's finger.

I asked you to cast a vote on our web site about your willingness to pay \$150 to \$200 more for a table saw to gain the type of protection SawStop potentially offers. Now let me make good on my promise to publish the results: In favor 1,127; opposed 396.

I'm also sharing these results with manufacturers and the inventor with the hope that the data may help all involved make the right decision in a timely fashion. **PW**

Steve Shanesy

Steve Shanesy, editor and publisher

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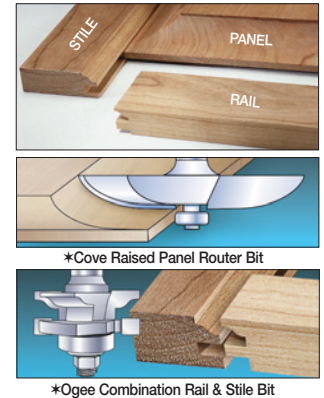
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- 1 45° Chamfer,
- 1 Flush Trim (1/2"),
- 1 Hinge Mortising (1/2"),
- 1 Round Nose (1/4")
- 1 V-Groove (3/8")
- 1 allen wrench and
- 1 bearing to convert Round Over into Beading bit.



\$39⁹⁵
1/4" Shank • #1442
1/2" Shank • #1443

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- 5 Straight (1/4", 5/16", 3/8", 1/2", 3/4")
- 1 Chamfer (45°),
- 1 Slot Cutter (1/4"),
- 1 Rabbeting (3/8")
- 1 V-Groove (1/2"),
- 1 Bevel (25°)
- 1 Panel Pilot (3/8")
- 3 Round Nose (1/4", 3/8", 1/2"),
- 3 Dovetail (14°-1/2", 5/8" & 9°-3/8")
- 2 Roman Ogee (5/32", 1/4")
- 1 Allen Wrench and 1 bearing to convert Round Over into Beading bit.



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- Hinge Mortising (1/2", 5/8", 3/4"), Classical Bit (3/16" r),
- 3 Core Box (1/4", 3/8", 1/2"), 1 Dish Cutter (1"),
- V-Groove (3/8", 5/8"), Cove (1/8", 3/16", 5/16"),
- 1 Flat Bottom Sign Lettering (5/8" 60°),
- 1 Double Cove & Bead, 1 Ogee Filet (1-3/8"), 1 Cove and Bead (5/16" r), 2 Edge Beading (1/4", 3/8"),
- Dovetail (7.5°-1/4", 14°-3/4), Slot Cutter (3/8")
- 1 Point Cutting Round Over (1/2"),
- 1 Flat Bottom Round Over (1/4" r),
- 1 Multi Bead/Reed Bit (1/8" r),
- 1 Double Round Over (5/32" r),
- 1 Cove Sign Lettering (5/8" 60°),
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\$224⁹⁵
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- Ogee Raised Panel (2-3/4")
- Round Over & Ogee Door Lip (1-1/4")



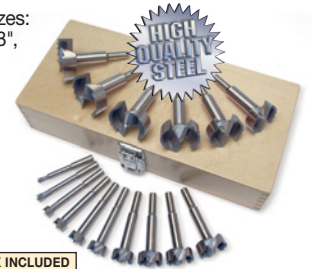
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SET #1452

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- 1-3/8", 1-1/2",
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- 1-7/8", 2", 2-1/8".



\$43⁹⁵
SET #1418

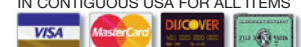
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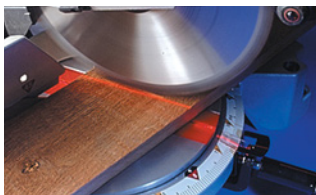
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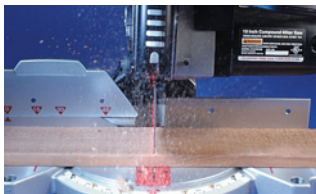
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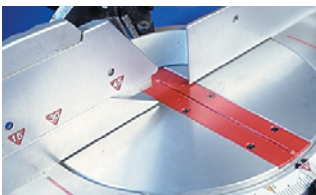
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Readers Weigh in on SawStop Device

SawStop May Save Fingers, But it Shouldn't be Forced on Us

I recently answered "no!" to the SawStop poll on your magazine's web site. I wish I had read Steve Shanesy's "Out On a Limb" column about the issue first. I would have added where Stephen Gass could stick his SawStop device. The SawStop is a great idea, and it may very well save a few fingers, but just as I don't believe in helmet laws, I don't want the SawStop forced on me either. And, now that I see Gass is not only trying to get rich on the idea, but is trying to use the government to help him, I don't want it.

On the practical side, I'm a maintenance electrician, and I've seen many pieces of electrical/electronics equipment fail, for virtually no reason. Some of the equipment has not been in as harsh an environment as my table saw. I would hate to be cutting a \$65 cherry board (or worse) when the thing failed. I could re-cut the board and actually waste very little, but why would I want that at all?

There is one more reason why I don't want it. As electrical/electronics components age, their electrical characteristics change. This is why there are adjustments, such as nulls and offsets on various electronic components. Heat, humidity, vibration and many other things have an adverse effect on these electrical properties as well. Will the SawStop have an offset or a null adjustment? It may work great on a hot dog right now, but a year from now will my saw stop when it hits a small knot or a change in moisture content in the wood?

Steve Snodgrass
via the internet

SawStop Inventor Explains the Risks Ahead for His Company

We were gratified with the strong positive response to SawStop from woodworkers reflected in the results of the *Popular Woodworking* survey. We appreciate *Popular*

Woodworking's interest in promoting the adoption of new technology that promises to make woodworking safer. We hope the survey will help tool manufacturers understand the value of safety to woodworkers.

Manufacturers say they have not embraced SawStop because of the possible loss of sales when costs of retooling and our royalty are added to the price of a saw. However, the results of *Popular Woodworking's* survey confirmed our belief that a large majority of woodworkers are willing to pay a reasonable premium for SawStop. We believe the \$150 premium used in the survey is more than sufficient to cover the costs to implement SawStop. Nonetheless, we have tried to minimize the introduction cost by offering manufacturers a royalty rate that starts very low (approximately \$12 on a contractor-type saw). The rate increases (to about \$30 on a contractor saw) only if most consumers buy saws with SawStop instead of other saws in the marketplace. As to the cost of retooling, manufacturers face that issue whenever they introduce a new product, and it is not unique to SawStop.

Manufacturers also say they are concerned with product liability issues. We have provided prototype saws for testing to almost every major saw manufacturer in the world, and to the U.S. Consumer Product Safety

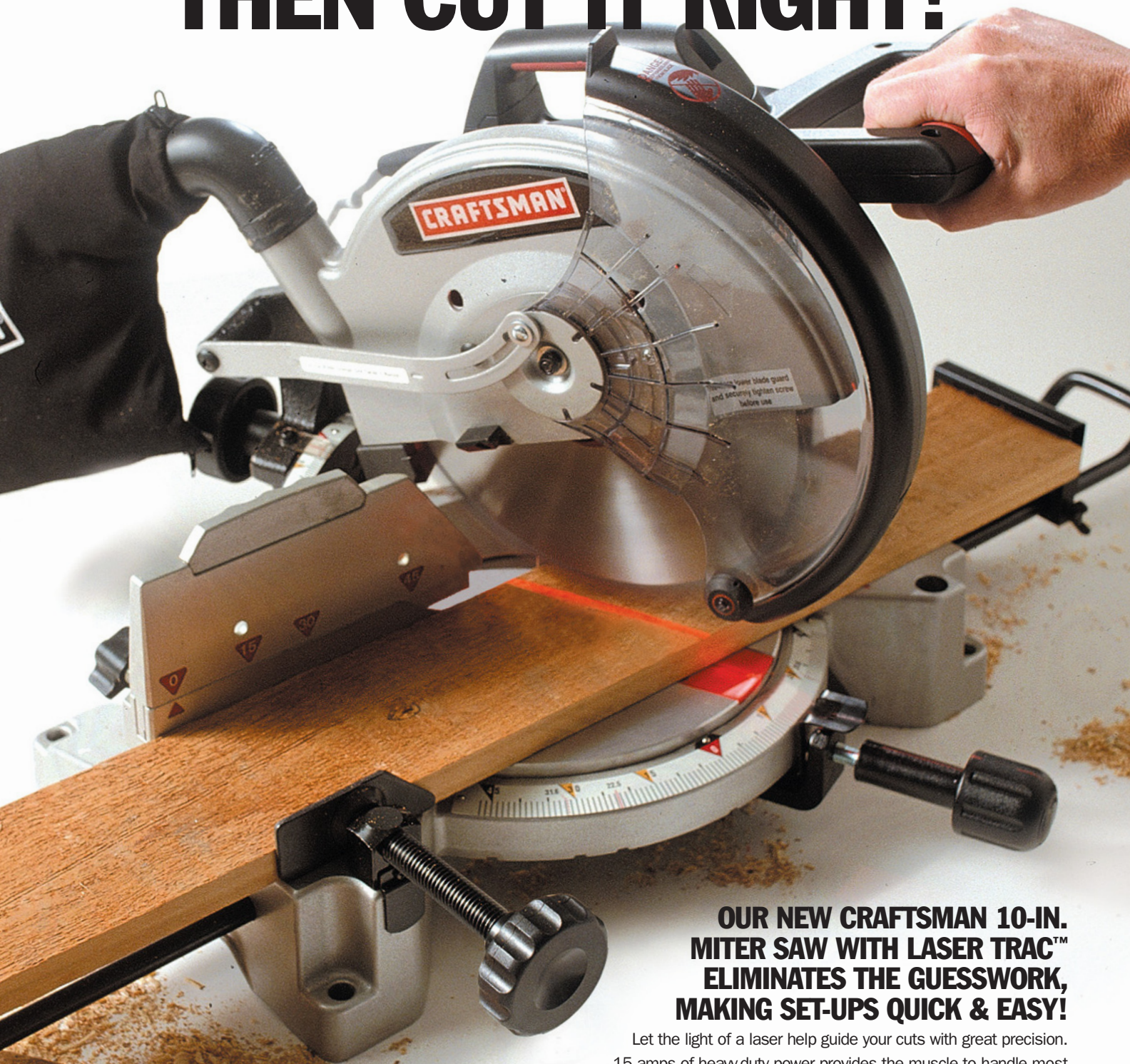
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Includes:
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Door Lip
Glue Joint
Drawer Locker

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2 3/4" D Panel Raiser (Ogee)
Door Lip
Glue Joint
Drawer Locker

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Includes:
2 Classical - 5/32"R & 1/4"R, 1 Wavy
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(1/2" Shank Router Bits)

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LETTERS

Commission, the German safety agency BIA, and the French safety agency INRS.

Not one of those manufacturers or safety agencies has identified any issue that questions the viability of the SawStop technology. To the contrary, as far as we are aware, all of those entities have concluded that the SawStop technology will make saws safer.

Unfortunately, most manufacturers have not yet decided to move forward with SawStop. In the meantime, because we do not know when or whether manufacturers will move forward, we have decided to build and market our own table saw.

We hope to have it at IWF in Atlanta this August, and to take orders at that show. At present, that seems like the only sure way to get SawStop out there. In any case, even if we never make a penny at the end of the day, if SawStop or something like it is adopted on saws and people are no longer being maimed on a regular basis, we will be proud to have started the ball rolling that leads to such a good result for woodworkers.

Stephen F. Gass, president
SawStop LLC
Wilsonville, Oregon

Why SawStop is a Bargain at \$150

Sure, \$150 is a lot to add to the price of a contractor saw, and I like to think I'll never actually need this device — but I'm sure anyone who has lost a finger or hand to a table saw would gladly pay \$150 to have it back. To me, it's like an air bag or a fire extinguisher — something that I'll probably never need, but that might be extremely important one day. PW

Andy Stephens
via the internet

CORRECTIONS & CLARIFICATIONS

In our article on rehandling a chisel in the February 2002 issue, we stated that some chisels have been formed by casting. Actually, no chisels (to our knowledge) are cast; those shown as cast in the photographs are likely drop-forged.

In our article on the Pennsylvania Spice Box (December 2001 issue) the diagram of the base scroll pattern on page 55 should read: "One square= 1/2" "

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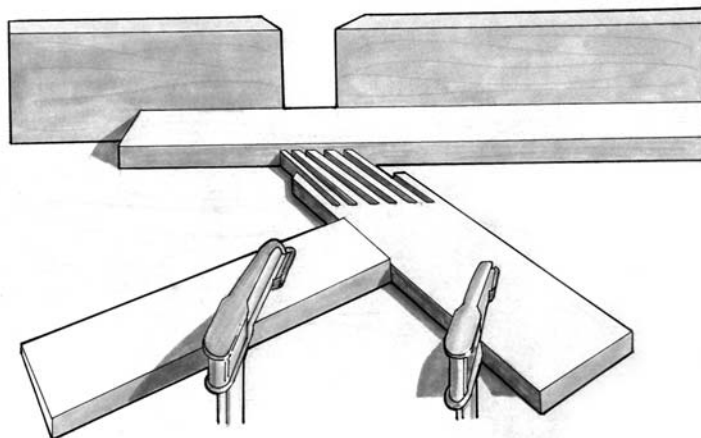
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Q & A

Featherboards for Safety and Accuracy



Are Featherboards Really Necessary? And How Do You Make Them?

I'm somewhat new to woodworking and want to know more about featherboards. I've seen them in photos and mentioned in articles as safety devices. Should I use them in my shop?

Fred Tipplewait
Dallas, Texas

I consider featherboards both a safety device and an excellent aid when making special cuts on a table saw or shaping stock in a router table or on a shaper.

You probably realize that the "spring" from the "fingers" on the end of the featherboard are a great way to hold stock firmly in place, especially near the blade or bit. That's the safety advantage. They also supply continuous pressure on the stock, holding it to a fence. This will produce a more consistent cut or profile on the wood, even compensating for some amount of warp in narrow stock. Sometimes two featherboards are used: one to hold stock to the fence and one from above to hold it down on the table.

A word of caution when using one on a table saw. Set it up so that the pressure is just in front of where the blade is cutting the stock. Don't allow the featherboard to apply pressure behind the cut where the kerf will close up, binding on the blade and leading to a dangerous kickback.

There are many ways to make them and they can be of various shapes and sizes depending on their application.

— Steve Shanesy, editor and publisher

Why are Radial Arm Saws so Scarce These Days?

I have used a radial arm saw in the past and liked it. I now want to buy a saw of my own and wonder why there are no radial arm saws advertised in your magazine. Is there something about a radial arm saw that is inferior to a table saw or other type of saw? I like the fact that I don't have to move the wood with a radial arm saw; I just move the saw itself. With a table saw or any other saw, you have to move the wood.

Joe Casey
via the internet

In many of today's woodshops, the sliding compound miter saw is replacing the radial arm. The sliding compound miter saw is often more accurate and less expensive. In fact, there are only a few manufacturers making radial arm saws these days, and their sales in that category are nothing to brag about.

As for comparing the radial arm saw to a table saw, it's our opinion that there is no real comparison. The capacity, accuracy and versatility

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provided by a table saw far outshines those in a radial arm saw. Your comments on having to move the material rather than the saw apply only to crosscutting with the radial arm saw. To rip on a radial arm saw (a process we do not recommend due to a number of safety concerns) you still need to move the material. A table saw provides a larger area of support and an adjustable fence to guide the work. If you haven't used a table saw, then you may be missing an opportunity to learn first hand the benefits of the machine.

— David Thiel, senior editor

How Long Should I Let My Lumber Sit Before Starting a Project?

How long do you need to store lumber purchased rough-cut from a lumber yard before starting to work? I purchased some 6/4 poplar to make raised-panel closet doors, and I don't want the wood warping after it's worked.

Tom Wehmeier
Cincinnati, Ohio

The answer depends on how damp the wood was when you bought it. If it's been kiln-dried and stored inside, wait two or three weeks before jumping into the project. If it's air-dried or been stored outside, wait a little longer or — better yet — get a moisture meter and check the moisture content.

A lot of people ask us about their meters, too. They wonder what moisture content is right before they start cutting up their wood pile. There are charts and maps that can guide you, but here's what we recommend. If you're going to build something out of maple, use your meter to check the moisture content of a piece of furniture that is maple and has been in your house for a while. If the numbers are close, you're ready to go.

— Christopher Schwarz, senior editor

WRITE TO US

Every day we get questions from readers on all subjects about their woodworking. Some are letters; many are e-mail messages. We are more than happy to share our woodworking experience with you by answering your questions or adding some clarity to whatever aspect of your craft you are unsure about. In addition to the hundreds we answer privately every month, we want to share the best questions here with readers.

Send your questions via e-mail to popwood@fwpubs.com. Or send us a note by mail to: *Popular Woodworking*, Q&A, 1507 Dana Ave., Cincinnati, OH 45207.

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Q & A

Solid Wood or Plywood for Fireplace Surround?

I'm building an oak fireplace surround with a mantel. The mantel will have a mirror, mantel and columns mounted on a 42" x 78" oak backing. The oak backing will be wrapped with a 3" oak board on three sides. My question is, should I make the oak backing out of one piece of 3/4" oak plywood, or should I use biscuits to join multiple pieces of solid oak together into one big panel?

Michael Gallo
Ringoos, New Jersey

Don't use solid lumber. A piece the size you need is prone to wide swings of expansion and contraction, especially in a hot/cold, wet/dry climate like yours. Use plywood. It's easier and the veneers will be of a consistent color, making the overall appearance better. You can even use 1/2" ply if you like.

—Steve Shanesy, editor and publisher

I Need a Kid-Proof, Light-Proof Finish

I am going to stain the oak trim and seat for a new bay window. I would like to use a finish that provides protection from kids and pets. I originally thought about using polyurethane (this is what I typically use for most projects) but I think it may be too shiny and difficult to apply around the window. If I use polyurethane on just the seat it may not match the finish on the rest of the window.

Do you think leaving the wood stained and nothing else would be OK? Or would the sun break down the finish? Would tung oil be a good alternative?

Mark
Cincinnati, Ohio

*Stick with polyurethane for the seat and trim, and don't worry about the gloss. Like most finishes, polyurethane is sold in gloss, semi-gloss and satin sheens. Look at a sample in the store and choose between the semi-gloss and satin. Also, remember that oil-based polyurethane will yellow from sunlight. Water-based polyurethane does not yellow. By the way, you must always use a top coat over a stain, or else the stain will eventually wear off. Stains provide no protection for the wood. So-called tung oil finishes won't offer the protection you are looking for when kids and pets are concerned. **PW***

—Steve Shanesy, editor and publisher

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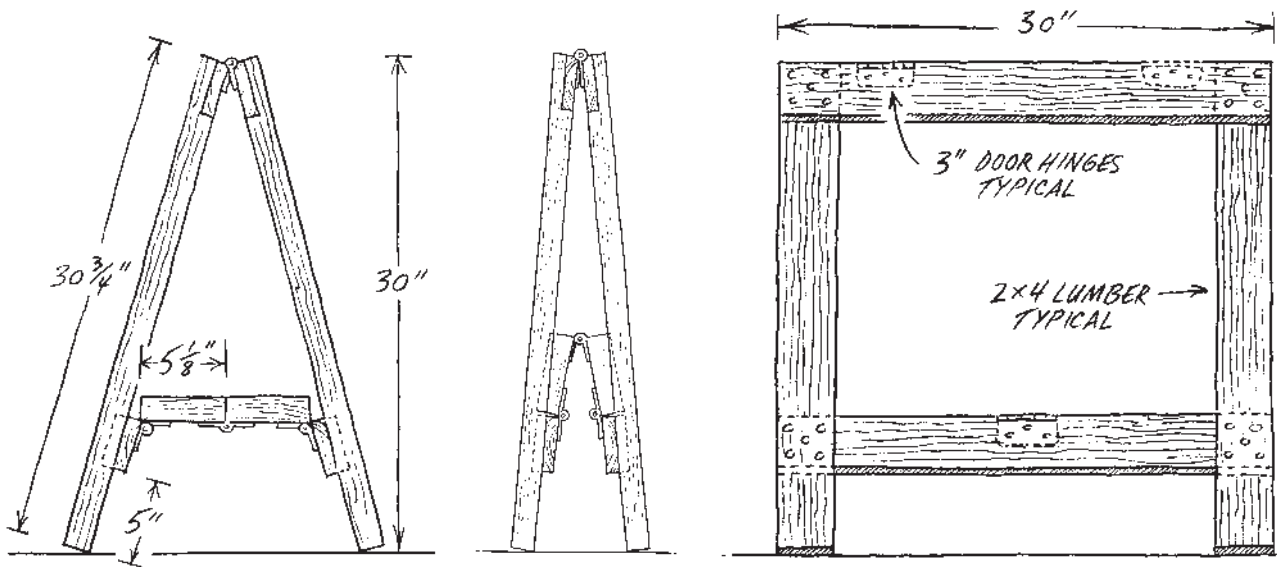
Sturdy, Fold-Away Work Horses

THE WINNER:

Below you'll see drawings of some useful sawhorses for woodworkers like me, who have limited room to work, and even less room dedicated to storage. I cannot claim design rights for these because I got the general configuration from a workman who came to my house several years ago to install a water purifier. His were made using 1x4 material, over which he placed a piece of plywood to make a temporary work table. They seemed strong even in that thin material, so I decided to build mine using 2x4s,

which suited my needs more adequately. Certainly they can be configured to suit other, more particular, requirements. I don't know what the weight capacity of these sawhorses is, but I have used them for several years now for all sorts of purposes. In fact, two adults have stood atop the horses without incident with 2 x 8s laid over them to make a platform.

Ralph Scheeler
New Orleans, Louisiana



Make Your Own Outdoor Wood Putty

Granted, most of the time when you're doing woodworking for use out of doors you aren't too worried about putting nail holes. There are, however, situations where you're building something that you want to look nice, and you end up with an unsightly gap. Standard wood putties aren't designed for outdoor exposure, so

we started using Durhams Rock Hard Putty, but rather than mixing it with just water, we also added Titebond II glue. The glue's weather-resistant formula mixes into a non-shrinking, water-resistant putty that really works.

The Popular Woodworking staff



CASH AND PRIZES FOR YOUR TRICKS AND TIPS!

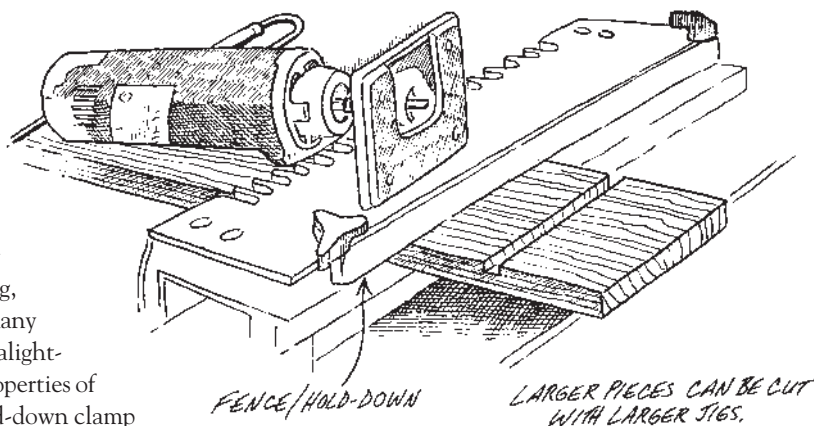
Each issue we publish woodworking tips and tricks from our readers that we think are useful. We want to encourage you to share with your fellow woodworkers, as well as reward the most useful and original concepts. Delta has agreed to lend us a hand with that, and the author of this issue's winning trick receives the new 22-580 two-speed portable thickness finisher (shown at left). The other trick's authors receive \$75.



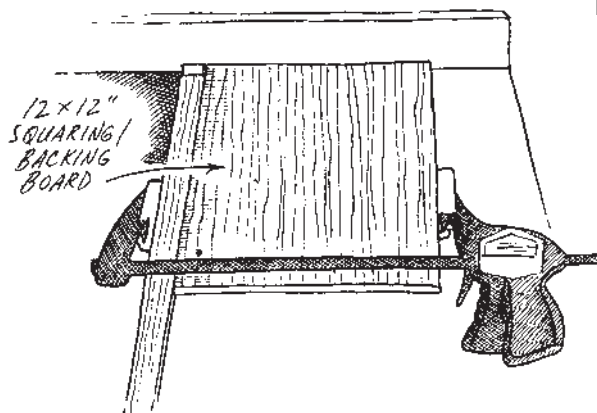
To submit your tip or trick, e-mail it along with a daytime phone number to david.thiel@fwpubs.com or mail it to: Tricks of the Trade • Popular Woodworking
1507 Dana Ave. Cincinnati, OH 45207.

Double-duty Dovetail Jig

I was intrigued with Nick Engler's *Ingenious Jigs* article from December 2001 that showed you how to make a jig for cutting perfect dados in the sides of case pieces. After my last project, where the routing was the most repetitious and boring part of the piece, I thought there should be an easier way. I wasn't happy with the dados made using my router table, radial arm saw or table saw. I don't like to take the time to make a jig, even though some have been proven helpful and many times reusable. In looking around my shop, my eye alighted on my commercial dovetail jig. It had all the properties of the jig from the article: a good straight sturdy hold-down clamp with a wide throat to accommodate wide boards or even multiple boards needing the same dado. The clamp that holds boards in the jig makes a perfect fence for my router. When running multiple boards, I did take the precaution of clamping the pieces together with another clamp to prevent them from slipping in the jig, as many times slight variances of wood thickness will allow this to happen.



Roberta Keefe
Lexington, Kentucky



Make a Tenon Square From Scrap

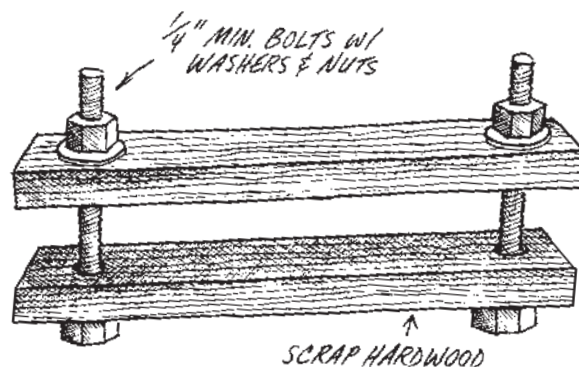
A router mounted in a table with a straight bit can be used to cut nice tenons. But usually these tenons are on the end of a narrow board and require a miter gauge to hold the board. Unfortunately my router table lacks a miter slot. However, a square block of wood serves just as well. Cut a square block of wood approximately 12" x 12". Butt it against the router fence and clamp the board to be tenoned to the square board, keeping the tenon end also flush against the router fence as shown in the drawing. This has the added advantage of providing a backer board, which also reduces tearout.

Bill Law
Cincinnati, Ohio

Custom Scrap Wood Clamps

Recently, I had to glue up many slender pieces of wood to make tapers for a pencil post bed that had revealed layers. Because the posts were almost 8' long, I needed a wealth of clamps that I didn't have. I came up with this design in order to save money, and I have since used these clamps on many other projects with great success and only a little cost. **PW**

Yoko Sorensen
Raleigh, North Carolina



HTC Improves the Venerable Biesemeyer

We're not saying you should replace your Biesemeyer rip fence with HTC's new fence; but you could, and it would be an improvement.

The HTC Multi-Fence System has everything you expect from a quality T-square style fence: repeatable accuracy, stability and ease of use and adjustment. In addition, this fence offers features not found on the Biesemeyer: micro-adjustability, easily removed/replaced fence faces and a simple way to square the fence to the saw's table.

The fence micro-adjusts by first engaging a quick-lock lever, which clamps the fence's support bar against the rail. Then you turn the micro-adjust knob to fine-tune the fence setting left or right. One revolution of the micro-adjust knob moves the fence $\frac{1}{16}$ " , but the adjustment knob is sensitive enough that one-eighth of a rotation of that knob yields a $\frac{1}{128}$ " adjustment.

The fence faces are solid UHMW (ultra high molecular weight) material, commonly called "slick stuff," which provides a stable and smooth surface. Biesemeyer owners who have ever replaced their fence faces will appreciate how easy this is to do on the HTC. Rap the far end of the face and it pops off the studs attached to the fence beam. Not only does this make removing or replacing the faces a snap, it allows you to easily attach special jigs to your fence beam by adding the separately available clips to your shop jigs.

A third improvement is the addition of easily accessible screws that allow you to set the fence face at 90° to your saw's table. On the Biesemeyer, this operation is performed by shimming with masking tape.

The HTC fences fit most contractor and cabinet saws. If you already have a T-square style fence, such a Biesemeyer, you can purchase the fence alone and use the existing

front rail on your saw. The fence also is available with the rails for a bit more. Prices range from \$239.95 for the HTC-800 contractor style fence (\$349.95 with 30" rails included) to \$269.95 for the HTC-900 commercial fence (\$379.95 with 30" rails).

Without a doubt, the HTC fence improves on Biesemeyer's highly successful design. While the upgrades are great, we don't recommend that you trash an existing T-square style system to get them. But if you're shopping for a new fence system, this is a great option.

The model we tested included a magnifying lens indicator that we had problems reading. HTC officials say the product in stores would not include the magnifying lens shown in the photo above. Check before you buy; it's quite difficult to read.

The extra precision and versatility of this fence system does cost a little more. About

\$50 more than a Biesemeyer, and \$150 more than the Shop Fox Classic fence.

You also will have an opportunity to buy this fence system included on a new saw. HTC has contracted with JET Equipment to provide the upgraded fences on their saws.

For more information, circle #141 on Reader Service Card.



SPECIFICATIONS

HTC 800 & 900 Multi-Fence Systems

Street price: \$240 and \$270

Faces: 800: $\frac{3}{8}$ " x $1\frac{1}{8}$ " x $37\frac{1}{4}$ "
900: $\frac{3}{4}$ " x $2\frac{3}{8}$ " x $41\frac{1}{4}$ "

Fence tube: 800: $1\frac{1}{2}$ " x 3" x 36"
900: 2" x 3" x $39\frac{1}{4}$ "

T-Clamp bar: 800: 14"
900: 16"

Performance: ●●●●●

Value: ●●●●○

HTC Products: 800-624-2027 or
www.amazon.com

HOW WE RATE TOOLS

At *Popular Woodworking* we test new tools and products with an honest, real-world workout. We check for ease of assembly and determine how clear and complete the manuals are. Then we use the tool in our shop to build projects that appear in the magazine. Each issue, our editorial staff shares its results and experiences with the tools.

We use a one-to-five scale, with "five" in performance indicating that we consider it to be the leader in its category. For value, "five" means the tool is a great deal for the money, while "one" means we consider it pricey. Though, a unique low-value tool may be worth the price.

If our tool reviews don't answer all your questions, e-mail me at david.thiel@fwpubs.com or call me at 513-531-2690, ext. 255. You can also visit our website www.popwood.com to check out previous tool reviews and sign up for our free e-mail newsletter (focusing on tools) that's sent out every other week.

—David Thiel, senior editor

Bosch's Plunge Router Designed for Router Table Use

For years, router tables — combined with plunge routers — have offered woodworkers many of the features of a shaper at a fraction of the cost. One nagging problem, however, has been the plunging spring that always pushes the router to the “up” position.

The Bosch 1619EVS router was designed to solve this nuisance by making it possible to disengage the spring and the plunge lock, allowing the motor to hang free for easier adjustment. Combined with a depth adjustment rod that locks into the turret depth stop (linking the base to the depth rod) the cutting height can be adjusted precisely and almost effortlessly in a router table.

But this router isn't a one-trick pony. The 1619EVS also offers soft start, Bosch's Constant Response circuitry to maintain speed and power under load, a spindle lock for one-wrench bit changes, variable speed and plenty of raw routing power.

We put this router through its paces and found that it definitely has the power to tackle any job. The feedback circuitry maintains a constant rpm to allow larger cutters to keep working, even at low speeds.

We found that disengaging the spring was a complicated task at first, but with practice it becomes second nature. Even with the spring disengaged, the height adjustment wasn't effortless, however. There's a big motor on this router, so gravity is working against you. But the effort is nothing like fighting against the spring. Once locked in place under the table, the fine adjustment knob works easily to adjust the cutter height with a tight precision with a quarter-turn equating to $\frac{1}{64}$ " change.

While not a problem when being used out of the router table, we found the lock-on button on the right handle awkward when inverted under a table. A secondary switch mounted on the motor (as with some other larger routers) would be beneficial. Conveniently, the Bosch router table we were using (model RA1200) has an independent switch mounted on the table to plug the router into, solving this awkwardness.

Many woodworkers have been modifying their own plunge routers by removing the return spring. We're glad to see a manufacturer recognize an idea that's overdue and improve on it. While the 1619EVS is priced at the high end of the large plunge router category, we feel the features and the performance of this tool justify the price, and make this a valuable tool for woodworkers who spend a lot of time at their router table.

For more information, circle #142 on Reader Service Card.

SPECIFICATIONS

Bosch 1619EVS

Street price: \$320
 HP/amps: $\frac{3}{4}$ hp/15 amp
 RPM: 8,000 - 21,000
 Plunge depth: $2\frac{9}{16}$ "
 Collets: $\frac{1}{4}$ " and $\frac{1}{2}$ "
 Weight: 13.2 pounds
 Performance: ●●●●●
 Value: ●●●●○
 Bosch: 877-267-2499
 or www.boschtools.com



TOOL SCOOP

Veritas $5\frac{1}{4}$ W Plane Shows Refinements

When I reviewed the Veritas $4\frac{1}{2}$ smoothing plane in the August 2001 issue, I complained that it is a bit fussy to set

up. Veritas has just released its second bench plane, a $5\frac{1}{4}$ W (sometimes called a junior jack plane) and it seems the bugs have been worked out of this new



line of bench planes. The cap iron doesn't bend the blade when fully screwed down, and the throat is much less likely to clog with shavings because the plane body has been altered to allow more room for chips. However, I still find that the frog locking screw, which secures the frog to the plane body, requires a delicate touch to get just right. This $5\frac{1}{4}$ W required less fettle than the $4\frac{1}{2}$ and is an excellent size for trimming inset doors and drawers and for smoothing edges of shorter pieces. It's a good value at \$175. Buy it from Lee Valley Tools, 800-871-8158. Also, for the record, a couple readers have pointed out that the blade adjuster that Lee Valley uses is actually not a Norris-style adjuster. It was patented by Leonard Bailey in 1878 and appeared on his #12 Victor pocket block plane.

—Christopher Schwarz

Update On Rockler's Miter Gauge

Rockler's accurate and well-priced miter gauge has been redesigned. Previously, the gauge used “poker chip”-like ridges to align the head every $2\frac{1}{2}$ °. Rockler has redesigned the head to now offer $1\frac{1}{2}$ ° accuracy — a measurable improvement. Rockler also redesigned the fence to include a tall milled-flat aluminum face with an adjustable (and replaceable) MDF front piece. The adjustable-width miter bar is now 2" longer to increase stability when cutting larger pieces. The miter gauge and fence (with adjustable stop) is priced at \$129, which is \$30 to \$40 less than much of the competition. Inca offers a more affordable gauge, but it doesn't offer the wide range of repeatable settings, the high fence or quality stop. Take a look at the changes by contacting Rockler at 800-279-4441 or www.rockler.com.



Milwaukee's BodyGrip Router Improves Handling and Under-Table Adjustment

While a number of tool companies have been designing router accessories to make router adjustment while in a router table more simple, Milwaukee decided simply to build an adjusting mechanism into its newest tool.

The model 5615-21 fixed-base router is "sleeved," meaning the motor slides straight into the base, rather than screwing in. This has several advantages. First, it keeps the switch oriented in one location so you don't end up fumbling under the router table. Second, it makes the router more accurate. Routers that twist in their bases don't all have their collets in the exact center of the tool. So when the motor is twisted to adjust the bit height when in a router table, the bit can move in or out in relation to the router table's fence. It also makes adjusting the cutter height faster. Once at the proper depth, the motor is locked in place by simply snapping a convenient lever into place.

The height adjustment is accomplished out of a table by turning the micro-adjustment dial, calibrated to within 1/64". When mounted in a table, you adjust the bit height from above the table by turning a 3/8" socket wrench. The wrench attaches to the router's adjustment rod through a hole

drilled in your router table's insert and a hole in the base of the router. It's quite simple and ingenious. Our only gripe is the wrench (shown in the photo) isn't included.

Milwaukee didn't forget about the rest of the tool either. An over-molded grip and strap (the "body grip") lets you safely use the router one-handed for simple cuts without fear of dropping. The router is available alone, or with a clamshell case that has a pull-out base that allows the router (with a bit in the collet) to sit upright on your bench. The 11-amp motor operates at 24,000 rpm, and the tool includes both 1/4" and 1/2" collets. Priced about \$155 for the router alone, or \$170 with the case, this is a nicely appointed, well-crafted router that is comfortable to use out of a router table, and easy to adjust when in a table. In the next year or so, we hope Milwaukee also will manufacture a variable-speed model, too.

For more information, circle #143 on Reader Service Card.



SPECIFICATIONS

Milwaukee 5615-21 BodyGrip Router

Street price: \$155 or \$170

HP/amps: 1.75 hp/11 amps

RPM: 24,000

Collets included: 1/4" and 1/2"

Weight: 8.2 lbs.

Performance: ●●●●●

Value: ●●●●●

Milwaukee: 877-729-3878

or www.mil-electric-tool.com

Stanley's Folding Workbench is Three Tools In One

I've never been a person easily swayed by gimmicky tools — OK, that's an exaggeration — but this one seemed pretty clever from the start. Folding sawhorses have been on the market for a number of years, but the ZAG Folding Workbench from Stanley has taken it a step further by adding a serviceable vise (that stores in the unit) and a work surface that will hold up to 500 pounds.

With the work surface unattached, you have a sawhorse with good weight capacity and good stability for use in any number of applications. Simply snap the 20" x 27" work surface to the horse and you have a working platform for any number of benchtop tools.

There's even a reasonable-sized shelf mounted underneath to help keep the work surface clear. If you're using a router table and want to clamp it in place, open the storage compartment in the work surface and take out the two surface-mounted vises and lock it in place. The work surface also includes a drill holder and recessed storage areas to keep those small items from being knocked onto the floor.

Weighing in at 14 pounds, the workbench folds to a 4 1/2"-thick unit for storage. Priced at just \$40, this handy accessory makes a versatile and useful addition to any home workshop. **PW**

For more information, circle #144 on Reader Service Card.



SPECIFICATIONS

Stanley ZAG Folding Workbench

Street price: \$40

Top size: 20" x 27"

Weight cap.: 500 pounds

Weight: 14 pounds

Performance: ●●●●○

Value: ●●●●○

Stanley: 800-STANLEY

or www.stanleyworks.com

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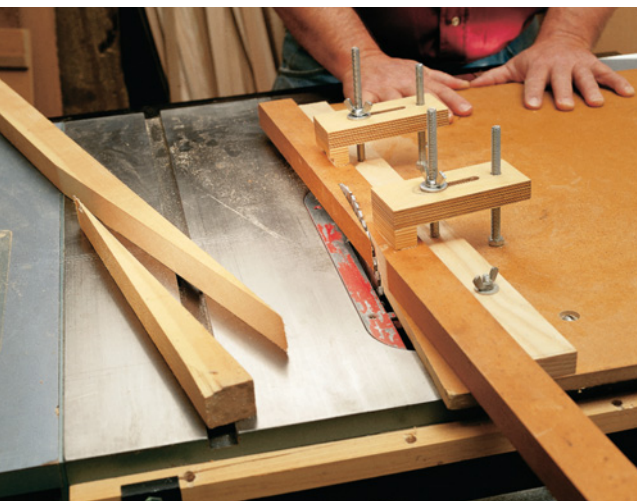
Multipurpose Saw Sled

It takes just nine pieces of wood to turn your table saw into a precision crosscutting and tenoning machine.

For many years I had the pleasure of working with Jim McCann, a craftsman I admired as much for his ingenuity as his considerable skill. Jim and I designed projects of all sorts, but we had a special fondness for jigs. It was a challenge for us to create a shop-made tool as simple and as functional as possible. This sliding table or saw sled was one of our best efforts. There are really four jigs here — the sliding table itself, a micro-adjustable fence stop for duplication and accuracy, an auxiliary table to prevent binding and kickbacks, and a tenoning jig to hold stock vertically — just nine wooden parts to do dozens of sawing chores.

Sliding Table

The table is a large base with a long fence that slides across the saw table, past the saw blade. A miter bar attached to the underside of the base guides the jig. This is the one spe-



In addition to everything else it does, the sliding table also makes an excellent base for other sawing jigs that you might need. Here I've attached a special fence and clamp-downs to make scarf joint in the spars for a reproduction of a Wright Brothers' flyer.

cial piece of hardware you need to make this jig — a miter bar to fit the slot in your particular table saw. (Most are $\frac{3}{8}$ " deep and $\frac{3}{4}$ " wide.) Attach the bar to the base with machine screws, countersinking the heads so they're slightly below the surface of the base. Position the bar so that when you saw with the jig for the first time, the blade shaves about $\frac{1}{16}$ " from the edge of the sled's base.

Make the fence from a single piece of straight-grained hardwood. Tip: To make a long, slender part such as the fence as stable as possible, rip it in half parallel to the annual rings. Rotate one part 180° and glue the parts back together so the annual rings cup in the opposite directions. This will help the fence stay straight and true.

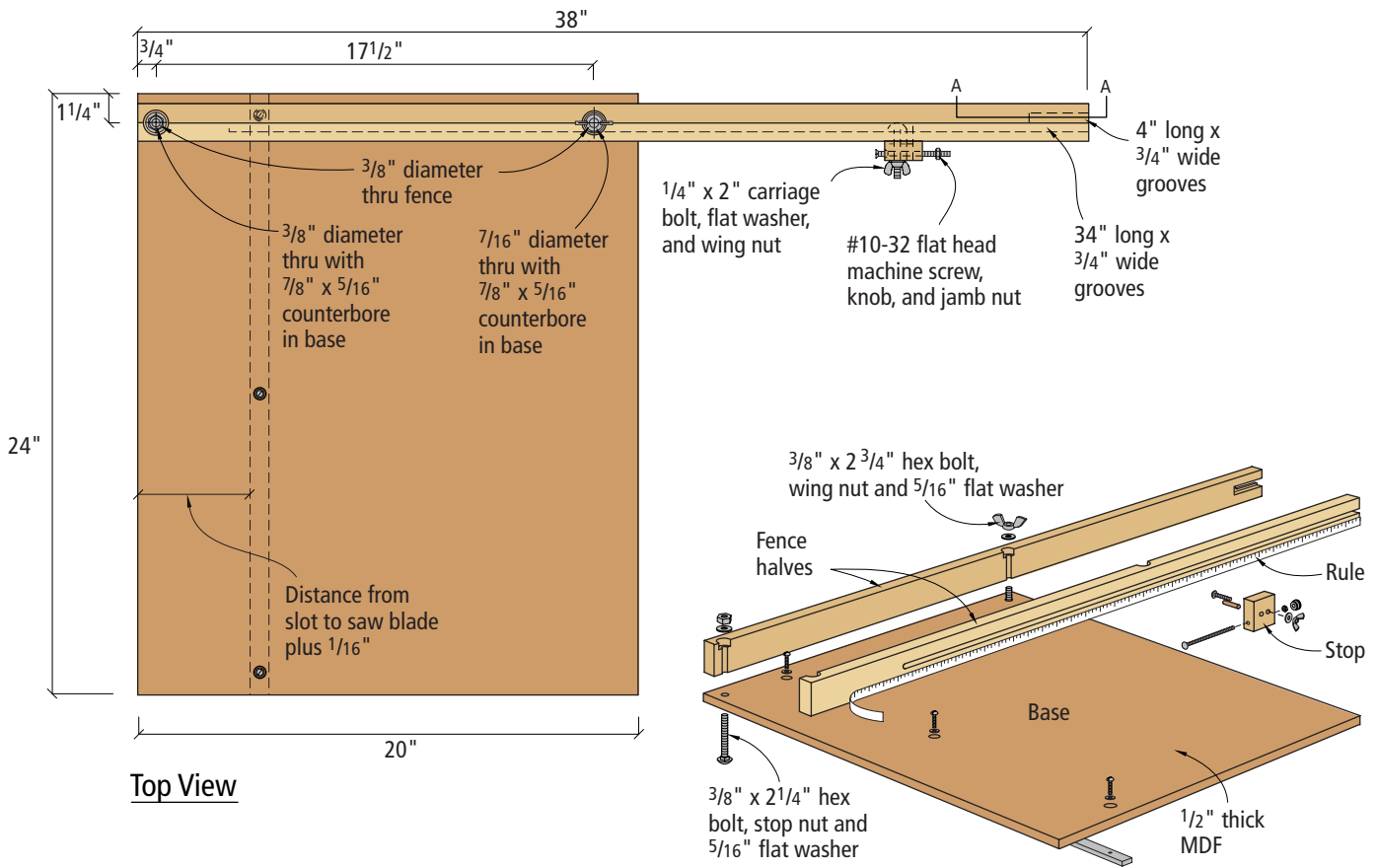
Rip the board for your fence down the middle, joint both halves straight, and cut two grooves in each half — a $\frac{3}{4}$ "-wide, $\frac{3}{8}$ "-deep groove followed by a $\frac{1}{4}$ "-wide groove all the way through the stock, as shown in the Elevation Section A drawing and the shaded area of the Fence Detail drawing on a following page. The grooves in the front half should run almost the complete length of the fence, while the grooves in the back half need to be only a few inches long. When you glue the fence halves

back together, the grooves will form T-slots. Use the long T-slot on the front of the fence to mount the fence stop and the tenoning jig. The shorter slot on the back stores the stop and keeps it handy.

Mount the fence to the base with $\frac{3}{8}$ " hex bolts. Drill counterbores for the heads of the bolts so they don't protrude from the underside of the base. The bolt nearest the saw blade serves as a pivot, should you need to angle the fence to cut miters. The other bolt secures the fence and provides a small amount of angle adjustment. The shank hole for this bolt is $\frac{7}{16}$ " in diameter. That extra clearance lets you move the fence back and forth a few degrees to adjust it square to the blade. Once the fence is adjusted, draw a pencil line to mark the position of the fence on the base. If you ever need to change the angle of the fence, the pencil line will make it easy to square it up again.

Since 95 percent of your saw cuts are made at 90° , and another $4\frac{1}{2}$ percent are made at





45°, I suggest you drill holes and counterbores so you can secure the fence at 90° and 45°, and leave it at that. For those odd angles, you can either drill holes as you need them or resort to your miter gauge.

To help measure as I cut, I added a scale to the front of the fence, inset in a 1/32"-deep rabbet. Note that the scale is upside down. It's easier to read when I lean over the fence.

Auxiliary Table

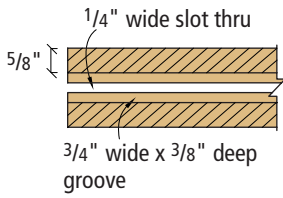
One of the few drawbacks to a sliding table is that the base raises the work off the saw table, leaving it unsupported on the far side of the saw blade. Because of this, the wood will drop down as you finish the cut, binding the blade. This in turn may cause the cut-off part to kick back.

The auxiliary table (shown in the opening photo on the facing page) prevents this. It's a second base the same size as the first, but without a fence or a miter bar. Instead, there is a cleat at the front edge that hooks

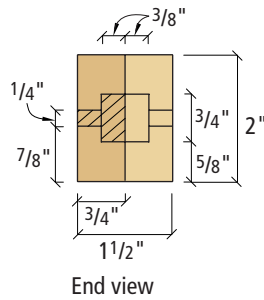


Tip: To adjust the fence so it holds the wood precisely square to the saw blade, take a scrap piece and rip it so the edges are parallel. Mark one face, saw through the mark (left), and flip one part over. Bring the cut ends together, holding the edges against the fence (right). If the seam between the parts gaps at the top or bottom, the fence is not square to the blade.

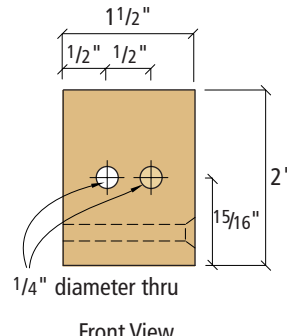




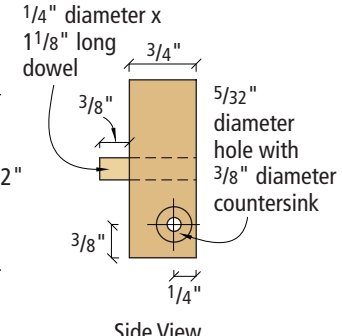
Elevation Section A



Fence Detail



Stop Detail



over your saw table and prevents the auxiliary table from sliding forward as you work. Depending on the design of your saw, cut the cleat so that you can secure it with a clamp either to the fence rail or the front of the saw.

Fence Stop

The stop is a block of wood you can mount anywhere along the length of the fence and can make duplicate cuts without having to measure for each cut. A 1/4" carriage bolt secures the stop in the T-slot, and a 1/4"-diameter dowel prevents it from pivoting. To get the stop to slide smoothly you'll need to do

a little file work. The head of a carriage bolt is stamped so there is a curved transition or fillet between the head and the square section at the beginning of the shaft. This fillet wedges itself in the slot and makes it difficult to move the stop. To fix this, file the carriage bolt to remove the fillet, creating a square shoulder between the head and the shank of the carriage bolt.

I also added a micro-adjustment to my stop. Drill a 5/32"-diameter hole through the stop that's parallel to the bottom edge and thread this hole with a 10-32 tap. (A dense hardwood such as hard maple will take these

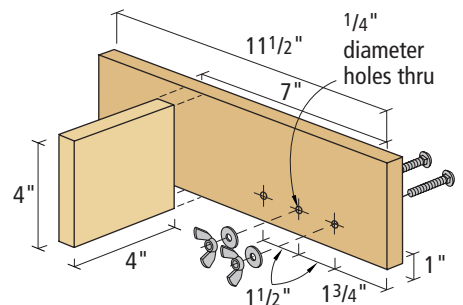
small threads no problem.) Countersink the end of the hole nearest the blade (when the stop is mounted to the fence). Turn a 10-32 flathead machine screw into the threaded hole and tighten a jamb nut and a knurled nut on the other end so you can turn the screw easily. One turn of the screw will advance the head precisely 1/32", allowing you to make extremely accurate adjustments.

Tenoning Jig

The tenoning jig is two pieces of wood joined at 90°. This makes a cradle to hold boards vertically to the saw blade — just place the board in the corner formed by the two parts and secure it with a clamp. Don't waste good wood on this jig; make it from scraps. The tenoning jig is a "disposable" fixture — it eventually gets eaten up by the saw blade, and you'll have to make a new one. Mount the jig to the fence with two 1/4" carriage bolts, much the same way you mounted the fence stop. **PW**



Use the tenoning jig and the fence stop in combination. Slide the tenoning jig into the T-slot, then slide the fence stop right behind it. Turn the micro-adjustment screw until it's snug against the end of the jig. Clamp a piece of wood in the cradle, make a test cut, and check the results. If you need to adjust the position of the jig, loosen the carriage bolts and rotate the adjustment screw. In this manner you can make very fine adjustments, getting the cut just right.



Tenoning Jig

Grizzly G1023S Cabinet Saw

Cabinet saw performance at a contractor saw price.

When we first heard about the G1023S in late 1999, we figured it was just another cabinet saw. But when we saw that the price was about \$800, we couldn't get to the phone fast enough to request one for testing. The saw showed up in March 2000, and we were skeptical and prepared to be disappointed. After all, how much saw can you buy for \$800? A contractor saw, sure. But a decent cabinet saw? Boy, were we wrong.

After setting up the saw (which was remarkably easy), we checked the adjustments. The blade was a couple thousandths out of parallel with the miter slot, but that was easily remedied by loosening four bolts and tapping the top until everything lined up. Also, the fence wasn't 90° to the table. We removed the plastic faces on the fence and found someone had shimmed the plastic with tape. We removed the tape, and the fence was perfectly square to the table.

We thought the magnetic switch got in the way every time we reached for the beveling handle, and we would have preferred the accessory motor cover (\$30) to be a standard item. But overall we were amazed at the value and performance of this saw.

Now, two years later, we're pleased to report this saw is still one of the best values available for woodworkers. The G1023S has seen constant use in our shop and remains accurate and tight. The beefy and comfortable handles still turn easily, and we've gotten used to the switch location, though it's still in the way. We added the motor cover and dust collection hood, which made the saw more pleasant to use. However, we still wish these were standard items.

The Shop Fox Classic fence system continues to provide accurate repeatable cuts with no fuss. The fit and finish of the saw has remained nice, with no loosening of parts or wearing of paint or surface areas.

As mentioned in our original October 2000 review, though the saw comes equipped with two throat plate inserts we quickly replaced both with homemade zero-clearance

inserts. This isn't an indictment of this machine; most saws come equipped with less-than-perfect inserts. The same goes for the saw's guard. Though meeting safety requirements, the guard doesn't make it easy to work safely. Again, almost every saw on the market has this issue, not just Grizzly's machine.

We did notice one thing after continued use that's worth mentioning. When cutting tenons or dados, the arbor would creep down slightly if the height adjustment wasn't locked in place. It's a minor inconvenience, and locking in your blade height is a good habit to acquire regardless.

When you think of a top-of-the-line cabinet saw, the venerable Powermatic 66 and Delta Unisaw still hold top marks. But if you're looking for a good quality contractor saw, or a great value in a cabinet saw, we're still happy to recommend the G1023.

We're not the only ones thrilled with this machine. We've talked to dozens of professional and amateur woodworkers who have bought this saw and have nothing but praise for its performance.

To make things more interesting, Grizzly now offers a left-tilt version, the G1023SL, for \$895. That price includes a motor cover and dust hood. (Sorry, Grizzly says there are no plans to add the extras to the G1023S.) There also is a 110-volt version of the saw, the G1023S110, with a 2-horsepower motor, which we haven't tested. **PW**

— David Thiel



SPECIFICATIONS

Grizzly G1023S Cabinet Saw

Street price: \$795

Motor: 3 hp, 18 amp, single phase, 220V TEFC

Max cut depth: 3 1/8"

Cut capacity to left of blade: 8"

Cut capacity to right of blade: 25"

Table size: 36 1/4" x 27 1/8"

Table material: cast iron, with two solid cast wings

Fence: Shop Fox Classic T-Style

Weight: 360 lbs.

Nice features: An amazing price for a quality cabinet saw with a very good precision fence system. Why spend money on a high-end contractor saw when you can own a cabinet saw?

Recommended modifications: Though Grizzly lists the motor cover and dust hood as accessories, they are must-have items with a cabinet saw. The motor cover, G4223, is \$29.95.

Available at: Grizzly Industrial: 800-523-4777 or www.grizzly.com

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

A Mountain Stradivarius

Scott Phillips, host of TV's 'American Woodshop,' visits dulcimer virtuoso Warren May in his Kentucky workshop.

For years I've wanted to make my own Appalachian-inspired, mountain lap dulcimer. These wooden wonders have been part of American culture since before the American Revolution. Dulcimers are easy enough to make, yet tricky to perfect. Woodworker Warren May of Berea, Ky., just might have figured out the best way to make these four-string instruments. I recently visited this dulcimer maker and learned a few things about designing a workshop to make his projects — and yours — easier.

May's workshop is located on about 40 acres of gently rolling hills, about five miles from Berea. It's forested with mixed hardwoods. Many of the huge black walnut and cherry trees will be harvested in coming years to be turned into mountain dulcimers and fine furniture. Yep — even though May's shop (he has three employees) has completed more than 12,000 dulcimers, he still has time to produce dozens of pieces of fine furniture to sell every year.

After looking around his shop, I decided that May and Thomas Edison might be distant relatives. May uses machines that you would find in a well-equipped home shop. But every machine is decked out with shop-made jigs and fixtures. In some cases he's built or modified power tools (including an incredible "gang fret saw," more on that later).



May's motorized "gang fret saw" allows the fret board to be held against the fence on the sliding table, as the table carriage is pushed over the blades. It's a tool that's hard to imagine, let alone make. But May's invention has helped him make instruments with exacting precision—and save time.

And sometimes he's taken an unlikely object, such as Rollerblade wheels, and built a safety device, such as a resawing featherboard for his band saw. May works with both hand and power tools. And perhaps his continued success is a result of the hand-worked details he adds to every piece before it leaves his workshop.

In May's shop there are huge windows on every available wall. The abundance of natural light makes the shop much easier to work in. The electric heat pump is nice, too. It keeps the 2,500-square-foot shop conditioned and comfortable year round.

For dust collection, May has a big impeller that exhausts chips directly out the back of his shop into a recycling pile. Dust collection is more than a convenience in this shop. May's finishing room is adjacent to the main shop and must be kept virtually dust-free.

The finishing area is outfitted with a sizable exhaust fan. When applying his usual sanding sealer followed by multiple light coats of lacquer, the fan really reduces overspray, smell and fumes.

I asked May what the toughest part of making a dulcimer is and he pointed to the fret board. All frets (metal strips perpendicular to the strings) must be perfectly spaced and fitted to produce perfect tonality. So he designed a saw that will cut all the slots for the frets in the neck of a dulcimer at once.



This "gang fret saw" looks like a miniature direct-drive table saw (with more than a dozen blades) and a sliding table. All the 2"-diameter circular saw blades have thin kerfs that fit the metal fret strips perfectly.

Almost any musical instrument maker will tell you that gluing up the body takes lots of time and clamps. So May invented a spring-loaded jig to glue up the bodies that uses only one clamp. I'm not lying. The photo on the next page explains it better than words can.

Many dulcimer parts require very thin, resawn wood. Here, May uses a generic brand 1 horsepower band saw with a $\frac{3}{4}$ " Lenox resaw blade. May frequently uses a Teflon-like spray called DriCote to coat the blade. This reduces blade friction and



The Rollerblade wheel featherboard makes frequent resawing activities on May's band saw safe, precise and pretty easy.

minimizes pitch and resin buildup. Ultimately, this extends blade life.

And, of course, there's the Rollerblade wheels. He uses the urethane-coated bearings to make a spring-tensioned featherboard that pushes material firmly against his band saw's fence. The wheel material won't mar the wood or let it slip.

In a dulcimer, the sound holes, along with the shape and thickness of the sound board (the wide top board), impart the tonal qualities to the finished instrument. Often, May will take advantage of nature's own book-matched limb holes, knots or natural openings to form the sound holes. Or, he'll use the scroll saw to cut humming birds, floral or heart-shaped openings. His love of hand work is evident in the beveled edges carved on each sound hole design and the carved details on the tuning head.

Often, delicate-edged details require extra support. A unique blend of thick viscosity cyanoacrylate (super glue) mixed with rosewood dust makes a solid backing in seconds. A catalyst isn't required because a chemical in the dust accelerates the curing. Remember to wear a mask when working with rosewood — this specie can cause allergic reactions.

I've been in hundreds of woodshops in the last 20 years. No two are alike. May's shop is a long, rectangular building that he built on a budget and has added to as needed. His shop has grown and evolved over the years. My day with May gave me new ideas that will help make my work better and easier. **PW**

—Scott Phillips, contributing editor



May's clamping jig is a set of 5/16" bolts that are held in a special pattern frame. There are multiple dulcimer profiles and each requires a matching "spring clamping jig." All bolts are spaced properly to place just the right amount of pressure at exactly the right spot. While one jig costs about \$30 to make, it replaces about 40 spring clamps and makes a better product.



AMERICAN WOODSHOPS

Woodworkers love to see the shops of other woodworkers. And few people see as many notable shops as Scott Phillips, host of PBS' "The American Woodshop." Every issue, Phillips takes us inside the shops of some of the finest craftsmen (and women) in America. You can see more about Warren May's shop by tuning in to "The American Woodshop" on your local PBS station. Look for episode #1010, or visit Woodcraft Supply to purchase a videotape of the show.

WORKSHOP AND RETAIL STORE

To see outstanding dulcimers surrounded with elegant furniture, I went to the Warren A. May Woodworker store in Berea. Warren and his wife, Frankye, work closely together to offer a wide selection of wooden objects for every budget. It is fair to say they have something for everyone. I bought a \$400 dulcimer (my wife really needed it for her birthday) that not only looks perfect but the notes that escape it just sing. Their store is on the same block as Berea's famous Boone Tavern and is where he and Frankye both made and sold dulcimers and furniture in their early years. Today, they have the store set up for sales and the country wood shop perfected for woodworking.

The store always has a selection of Kentucky-style furniture. Warren May describes it as honest, well-made, solid hardwood furniture with folk-inspired hand work in the finishing touches. Hand tool work is part of the tradition of fine Kentucky-made furniture. Over the last 200 years, Kentucky has developed a unique style of honest furniture design—simple, solid walnut, cherry and maple designs accented with hand beading, diamond keyhole

accents, line inlay of contrasting woods and shaped aprons. Some folks might misjudge this style as Shaker simplicity with decorative highlights. I believe the Kentucky style started before Shaker times and in turn, may have influenced the "western" Shakers' furniture.

His popular Kentucky sideboard uses inlaid maple diamond keyhole escutcheons. Beaded drawer fronts hide the perfect hand-made dovetails inside. Frankye May made a sign nearby that says: "Please do not remove the drawers, trust me they are made correctly." Many drawers have been dropped over the years when folks got a little too

excited about the perfect details. All of the pieces are finished to a beautiful sheen.

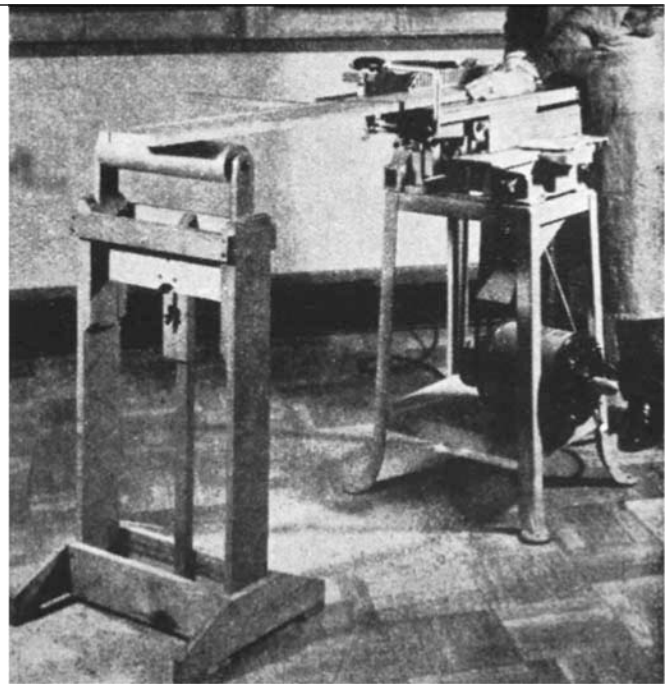
The Mays have been in their store for 27 years and at the country woodshop for 15 years. Earlier, Warren May taught industrial arts to high school students. Today, he continues to teach, but now it's how to play the dulcimer. His energy and skills are contagious. He believes anyone can play a well-made instrument, and I have to agree. Dulcimers are easy to learn to play and he can teach anyone the basics in just one sitting. They're almost as easy to play as humming into a kazoo—and that is part of their magic.

Roller Supports

For long work on the table saw.

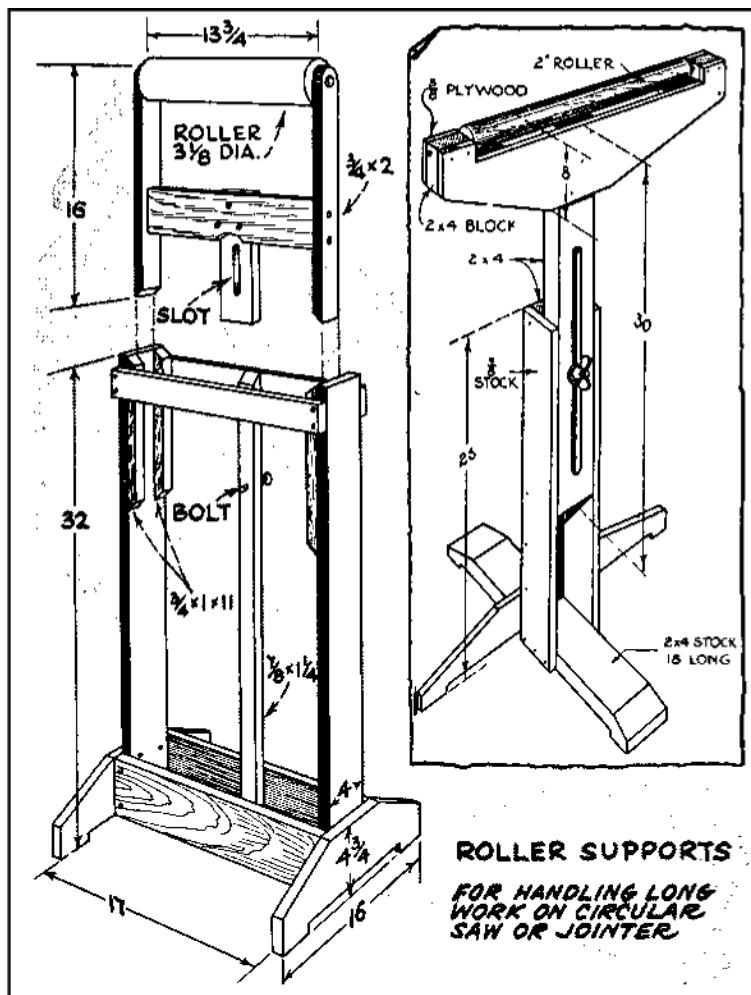
Long work, which is ordinarily difficult and dangerous to handle on either the table saw or jointer, can be sawn or jointed as easily as a shorter board if a roller support is used. The two designs shown here are typical of the numerous units, which have been built by craftsmen. While both are intended as end supports, they can be used successfully when set parallel with the table as a side slide when crosscutting or rabbeting.

Unit No. 1, as shown below left, is made up from various widths of $\frac{3}{4}$ " stock. The roller is turned to the specified size, the $\frac{3}{4}$ " tenons at either end being made a part of the turning or doweled in place later as desired. The dimensions as given are standard for the table saw only and if desired to handle jointer work also, should be varied to suit.



Unit No. 2 embodies the same general ideas as to usage, but varies somewhat in construction. The dimensions as given apply to work on either the table saw or a jointer. A $\frac{3}{8}$ " bolt is driven into either end of the roller to fit corresponding holes drilled in the 2" by 4" end pieces.

Dimensions as given for either unit can be varied to suit such scrap lumber as may be on hand. Also, the length of the slide can be increased so that the support also can be used in connection with the band saw, shaper or any other tool where a support is frequently necessary. Instead of the slotted adjusting hole, a set position for each machine can be made by drilling holes through the slide to take a wood or metal pin. This has some advantages over the single long slide in that the correct height for any machine can be located instantly without the need of checking the roller against the machine table. Its disadvantage, of course, is that on a rough floor or where the machine is used out-of-doors, the exact setting might not always be correct. Great care should be used in setting the support for jointer or shaper work to prevent any lifting or sagging. PW



The Deltagram

From Vol. 4

January 1935

A nostalgic look back at plans published by Delta Machinery during the mid-20th century.



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BW-210

Spindle Shaper

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BW-510TS
Shown with optional mobile base

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Specifications:	BW-110	BW-210	BW-310SL	BW-510TS
Motor	1-1/2hp 1ph	2hp 1ph	3hp 1 ph	3hp 1ph
Table size (overall)	18" x 20"	21-5/8" x 25"	29" x 23"	24" x 27.5"
Sliding table size	N/A	N/A	10" x 21.5"	7.75" x 24"
Insert opening (max. dia.)	4-3/4"	5-7/8"	5.5"	7.25"
Spindles	.50" and .75"	.50", .75" and 1"	.50, .75 and 1"	.50, .75 and 1"
Spindle speeds (RPM)	2 (5k to 9.5k)	2 (8k to 10k)	2 (7.5/10.0k)	3 (5.5/7.5/10.0k)



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21st century TOOL CABINET

After making a living building fine furniture in a too-small shop for the past 10 years, my dad and I finally have decided to move the business into a larger shop. I got a little giddy once I saw all the extra space and promptly decided to build something to fill it. Malcolm, my dad, and I talked about it, and as potential clients would be visiting the location, we decided to build a piece to show off our work as well.

That's how this tool cabinet came about. We decided the cabinet should be for a 21st century woodworker. Sure there's storage for a few hand planes, but there's also storage for cordless drills and pneumatic air nailers. I also decided this would be a great opportunity to share some quality shop time with my dad.

Let me stop a minute here and mention that while dad and I have worked for the same customers for years, and continue to work under the same family name, we don't often work on the

same piece of furniture. Part of this is because of certain skills and preferences, but as the project continued, I was reminded that one other reason was that we think and work quite differently. Much like the process when the Transcontinental Railroad was built, dad and I eventually decided to work on our individual pieces, knowing that they were supposed to meet in the middle. Happily, it worked.

After a number of discussions we determined that the case should be two pieces, an upper and a lower cabinet, with four deep-set doors for storing tools as well. When opened, the cabinet would array our most-used tools with easy access, while less attractive and less-used tools would be

With space for modern and antique tools, this tool cabinet will keep things in order for another 100 years.

by Glen Huey & Malcolm Huey

Glen and Malcolm own Malcolm Huey & Sons in Middletown, Ohio. They both build custom furniture for a demanding clientele; Glen is a contributing editor for Popular Woodworking.

Photo by Al Parrish. Step photos by Glen Huey.





Shaker-Style Storage

Dragging this 18th-century concept into the 21st century is shown most easily in the doors. To the left, Shaker pegs and a variation on a Shaker candle box take care of most of my electric sanding needs. The belts hang neatly out of the way, and the random orbit disc sheets can be arranged in a "coarse" box and a "fine" box and taken to the work as necessary. To the right, all my router bits and many of my most often-used router accessories are within easy reach. Purchased router bit holders drop into specially fit niches in the door for easy access.



stored in drawers. We decided I would build the upper section and dad would build the lower case.

While I'm going to give you the basics on how to build this cabinet in this article, I'm not going to go into extensive detail. This is a project that should be adapted to your tool needs. While you can follow the construction and concepts, the sizes are likely to be different for your shop. Also, this isn't a project for beginners. Even with our years of experience, we found ourselves scratching our heads once or twice figuring out how to make some-

thing work. If you need a great deal more information than presented here, you should put this project on the back burner.

Everything In Its Place

After building hundreds of antique reproduction pieces, this cabinet naturally followed the construction techniques we've grown used to. The case pieces were dovetailed together, with the solid shiplapped backs set into rabbets. Many of the drawers are divided by, and glide on, individual mortise-and-tenoned web frames that are dadoed into the

sides. To give the piece a sophisticated feel, we included a prominent crown moulding, a dramatic waist moulding and traditional bracket feet to support the entire piece. The case is made from curly maple, while the drawer fronts are mahogany with natural curly maple banding and an inset walnut oval.

After looking at the tools that we wanted to store, we determined that the best use of the case storage area was mostly drawers. While shelves are easier to make, tools tend to wander toward the back of the cabinet, and

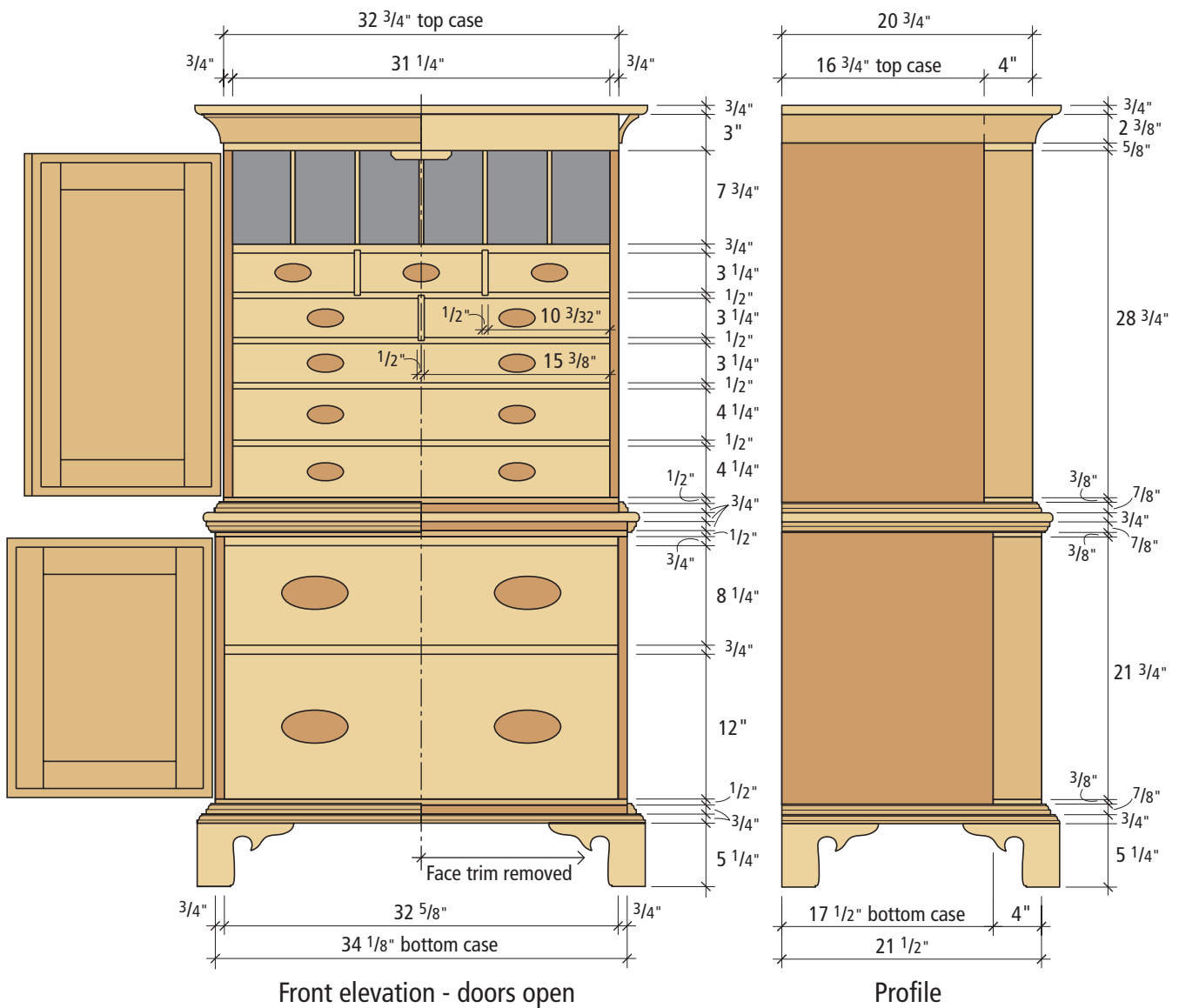
in the lower section you end up having to almost lie on the ground to tell if the tool you want is in its place. Drawers allow you to look down into the storage area and quickly find the tool you're looking for. Drawers also give the cabinet a cleaner look. While I'm happy to tell you that I enjoy my random orbit sander, I don't think it's a very attractive tool.

There are certainly tools that should be seen, and these include hand planes, specialty saws, chisels and marking tools. Rather than risk hanging the planes on the doors (where they could fall



A Place for Everything

With all my chisels in a row, everything is stored away nicely. Rare earth magnets (buried in the strips attached to the right-hand door) play an important role here. They hold the chisels and gouges to the door tightly, but allow easy removal. The drill bit holder, lower left, also is held in place with magnets. The cubbyholes for planes keep everything tidy, but accessible, and also do double duty for a brad nailer.

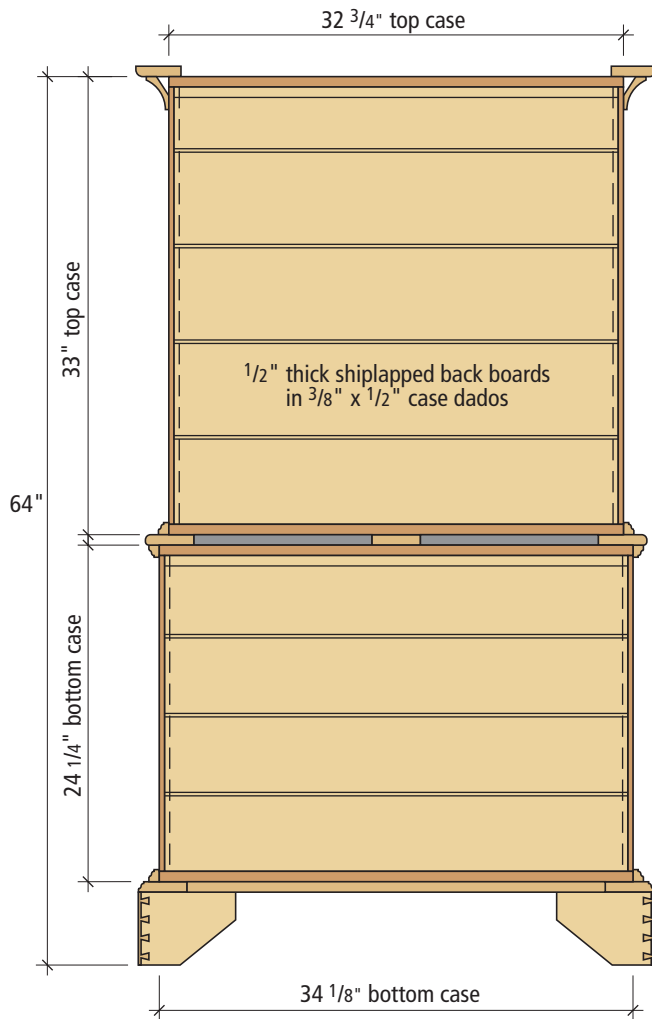


off if the door were jostled) we designed spaces for the four larger bench planes we use often (and room to add two more) above the drawers at the top of the cabinet. All the smaller tools went into the doors, with a variety of ways to hang or store them. You'll note in the photos that router bits are stored in a bit holder that fits onto a ledge in the doors. I used simple cup hooks to hang some drawknives and scrapers, and the drill bits are stored in a box temporarily attached to the door.

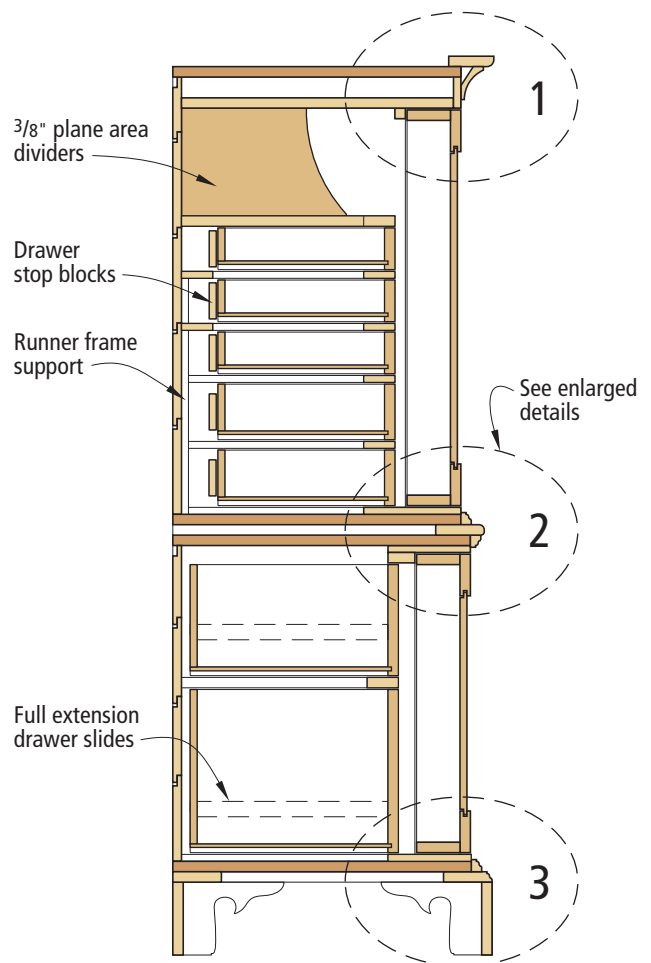
If you haven't discovered the joy of rare earth magnets, it's time. I used these little wonders throughout the tool cabinet. They provide amazing support (holding chisels and gouges suspended firmly) but still allow you to easily pry them loose to use. They're reasonably priced, and can be countersunk into a wood strip (as with the chisels) so they're out of the way. I mentioned the drill box earlier, it's held to the cabinet door bottom with rare earth magnets. When the door is opened

or closed the box stays in place. But when I want to use the bits, I pull the whole set free and take it to the work. While most fine woodworkers are embarrassed to admit they own a belt sander, there is a time and a place for it. Keeping the belts handy is what is difficult. The Shaker pegs attached to the lower left door offer a great storage answer for the belts and many other "hanging" tools. In that same door you'll notice another adaptation of mine

from the Shakers. The candle box is a Shaker staple, but by adapting the size some I made two convenient storage bins for my most common random orbit sanding discs. Once again, the Shaker pegs make it easy to take a selection of grits to the work. The plane storage is also worthy of comment. There are purists out there screaming foul about storing planes on their soles. Yes, if the blade is not retracted inside the body of the plane, it could be damaged when putting the



Back elevation



Section

HARDWARE

Rockler: 800-279-4441, or www.rockler.com

2 - Accuride 14" full extension slides, #32805

1 - 48" piano hinge (lower section), #19291

1 - 72" piano hinge (upper section), #19316

2 - Barrel bolts, #30923

Horton Brasses: 800-754-9127

4 - Rosette pulls w/1" backplate, 3" bore, #H-10

11 - Stirrup pulls w/1" backplate, #H-83

2 - Latches, SL-3

Misc. Hardware:

2 - 1/4" washers

Rare earth magnets available from Lee Valley Tools, 800-871-8158 or www.leevalley.com



plane down.

That's why I added a 1/4"-tall riser block to the back of each plane cubby. The block lifts the front end of the plane far enough to keep the blade from touching the bottom of the cubby. With shorter length planes, you can make the riser block an "L"-shaped affair that will keep the plane's handle within easy reach of the front of the cabinet, rather than sliding too far into the cubby.

Storing tools in the drawers is a science in its own right. You

Ready for glue, the upper case shows the extended top and bottom, the dovetailed sides and the dado grooves for the drawer dividers.

can go with the minimalist approach: Leave the drawer interior open and toss in the tools, or you can add dividers of a variety of shapes to keep the tools more orderly. Rockler (800-279-4441) offers a ready-made plastic insert that allows you to easily adjust 1/4"-thick drawer dividers to accommodate any tool, without having to nail or screw the dividers in place.

Every woodworker has different tools. While my chisels and gouges will fit in the spaces allotted in this cabinet nicely, you may have a complete set of turning tools requiring different storage. I hope the ideas presented

21ST CENTURY TOOL CABINET

NO.	ITEM	DIM. (INCHES)			MAT.	NOTES
		T	W	L		
Lower Cabinet						
□ 2	Sides	3/4	17 1/2	24 1/4	Maple	
□ 2	Top & bottom	3/4	21 1/2	34 1/8	Poplar	
□ 1	Bottom filler	1/2	7 1/4	34 1/8	Maple	
□ 1	Top filler	1/2	7 1/4	34 1/8	Maple	
□ 1	Front drawer divider	3/4	3	33 1/8	Maple	
□ 1	Rear drawer divider	3/4	3	33 1/8	Poplar	
□ 1	Base frame front	3/4	3	37 1/8	Maple	45° both ends
□ 2	Base frame sides	3/4	3	23	Maple	45° both ends
□ 1	Base frame back	3/4	2 1/2	34 1/8	Poplar	1 1/2" TBE
□ 6	Front & side feet	3/4	8	5 1/4	Maple	
□ 2	Rear feet	3/4	7	5 1/4	Poplar	
□ 4	Door extension sides	3/4	3 1/4	21 1/2	Maple	
□ 4	Door ext, top & bott	3/4	3 1/4	16 1/2	Maple	
□ 4	Door front stiles	3/4	3	21 1/2	Maple	
□ 2	Door front rails	3/4	3 7/8	14 1/8	Maple	1 1/4" TBE
□ 2	Door front rails	3/4	2 7/8	14 1/8	Maple	1 1/4" TBE
□ 2	Door panels	1/2	12	15 3/8	Maple	1/4" x 3/8" rabbets
□ 1	Waist moulding, front	3/4	3 3/4	36	Maple	45° both ends
□ 2	Waist moulding, sides	3/4	3 3/4	22 1/2	Maple	45° one end
□ 1	Moulding under waist	3/4	7/8	84	Maple	cut to fit
□ 1	Moulding above feet	3/4	7/8	84	Maple	cut to fit
□ 2	Upper drwr sides	1/2	8	14 1/4	Poplar	
□ 2	Upper drwr F&B	1/2	8	31 3/4	Poplar	
□ 1	Upper drwr face	3/4	8 1/4	32 1/2	Mahogany	
□ 2	Lower drwr sides	1/2	11 5/8	14 1/4	Poplar	
□ 2	Lower drwr F&B	1/2	11 5/8	31 3/4	Poplar	
□ 1	Lower drwr face	3/4	12	32 1/2	Mahogany	
□ 2	Drawer bottoms	1/2	14	31 1/4	Plywood	
□ 1	Back	1/2	22 3/4	33 3/8	Poplar	4 boards
Upper Cabinet						
□ 1	Moulding above waist	3/4	7/8	84	Maple	cut to fit
□ 2	Sides	3/4	16 3/4	33	Maple	
□ 2	Top & bottom	3/4	20 3/4	32 3/4	Poplar	
□ 1	Sub top	3/4	20	31 5/8	Maple	
□ 1	Bottom front filler	1/2	8	31 1/4	4" Maple/2 1/8" Mahogany	
□ 1	Cubby bottom	3/4	14 3/4	32	Ply w/2 1/8" Mahogany	
□ 5	Cubby dividers	3/8	12	8 1/8	Maple	
□ 4	Drawer dividers	1/2	2 1/4	31 5/8	Mahogany	

here will allow you to lay out the most useful interior for you.

Construction

Looking at the front of the cabinet (and the materials list), the number and placement of all the pieces can be overwhelming. To get a simple look at the construction, you just need to walk around back. The rear view in the diagrams quickly shows many of the details of the construction

and simplifies the built-up mouldings, making them approachable.

Start construction by gluing up and trimming to size the panels for the sides, tops and bottoms for both sections.

After the panels are sized, cut dados in the sides to accommodate the drawer runners. If you're building the cabinet as pictured, use the diagrams to locate the divider locations and cut the dados in the sides.

NO.	ITEM	DIM. (INCHES)			MAT.	NOTES
		T	W	L		
Upper Cabinet (cont.)						
□ 3	Vert. drwr dividers	1/2	1	3 3/4	Mahogany	
□ 3	Center drwr runners	1/2	2	13	Poplar	half-lap w/divider
□ 3	Center drwr guides	1/2	5/8	11 1/2	Poplar	
□ 6	Side runners	1/2	3/4	12 3/8	Poplar	
□ 4	Housed side runners	1/2	3/4	10	Poplar	
□ 2	Rear drwr dividers	1/2	2 1/4	31 5/8	Poplar	
□ 1	Vertical back support	3/4	3	13 3/8	Poplar	
□ 1	Filler @ crown	1/2	2 1/4	48	Maple	
□ 1	Crown	3/4	3	90	Maple	
□ 1	Cornice top moulding	3/4	3 1/4	90	Maple	
□ 4	Door extension sides	3/4	3 1/4	28 5/8	Maple	
□ 2	Right door ext T&B	3/4	3 1/4	16 3/8	Maple	
□ 2	Left door ext T&B	3/4	3 1/4	15 1/8	Maple	
□ 4	Door front stiles	3/4	3	28 5/8	Maple	
□ 4	Door front rails	3/4	3	13	Maple	1 1/4" TBE
□ 2	Door panels	1/2	11	23 1/4	Maple	1/4" x 3/8" rabbets
□ 12	Top/2nd/3rd drwr sides	1/2	3 1/8	12	Poplar	
□ 3	Top drawer backs	1/2	2 1/2	10	Poplar	
□ 3	Top drawer fronts	3/4	3 1/4	10	Mahogany	
□ 3	Top drawer bottoms	1/4	12	9 1/2	Plywood	
□ 2	2nd row drwr backs	1/2	2 1/2	15 5/16	Poplar	
□ 2	2nd row drwr fronts	3/4	3 1/4	15 5/16	Mahogany	
□ 2	2nd row drwr botts	1/4	12	14 3/4	Plywood	
□ 1	3rd row drwr back	1/2	2 1/2	31 1/2	Poplar	
□ 1	3rd row drwr front	3/4	3 1/4	31 1/8	Mahogany	
□ 1	3rd row drwr bottom	1/4	12	30 1/2	Plywood	
□ 4	4th/5th drwr sides	1/2	4 1/8	12	Poplar	
□ 2	4th/5th drwr backs	1/2	3 1/2	31 1/8	Poplar	
□ 2	4th/5th drwr fronts	3/4	4 1/4	31 1/8	Mahogany	
□ 2	4th/5th drwr botts	1/4	12	30 1/2	Plywood	
□ 1	Back	1/2	32	31 3/8	Poplar	5 boards
Drawer edge inlay						
□	Top three rows	1/8	1/2	240	Maple	
□	4th & 5th rows	1/8	3/4	144	Maple	
□	Lower section	1/8	1	180	Maple	
□ 11	Upper section ovals	1/8	1 1/2		Walnut	
□ 4	Lower section ovals	1/8	2 3/4		Walnut	

KEY: TBE= tenon on both ends

Both cabinets have 1/2"-thick shiplapped backs made from multiple boards. To accommodate the back thickness, cut a 1/2" x 5/8" rabbet on all four sides.

Next, cut through-dovetails to join each cabinets' sides, tops and bottoms. Glue up both carcasses; be sure to check them for squareness as you go.

Now let's look at the upper and lower sections separately, starting with the simpler lower

cabinet, which is nearly complete. All that's left is to glue the front and rear drawer dividers in place. Unlike the upper cabinet, the drawers in the lower unit use heavy-duty full extension drawer slides. So there's no need for drawer runners, but dad's a perfectionist, so he went ahead and used mortise-and-tenon joinery to attach the two runners to the front and rear dividers.

When you attach the dividers,



As the dividers are assembled, the interior takes on a pleasing complexity. Note the sub-top panel at the top of the photo taken from the back. The space formed by the sub-top allows room to mount the impressive crown moulding, without affecting the interior function of the cabinet. You can also see the front drawer dividers, side runners and rear drawer dividers in place.

glue the front divider in place, but leave the runners and rear divider joint loose. This will allow for seasonal wood movement in the sides of the case.

The upper cabinet has many more drawer dividers, as well as drawer runners, supports and a sub-top and horizontal partition to form the hand plane cubby spaces.

The cubby bottom also serves as the top divider of the drawer section, so the leading edge should be mahogany to match the other dividers. Because I didn't feel like wasting that much mahogany, I added a 2 1/8" solid mahogany edge to a poplar panel to make the full panel. While doing this glue-up, I also made the bottom front filler, which is made up of a maple and

a mahogany piece.

Next, mark and cut the dados for the cubby dividers in the sub-top and the cubby bottom.

While you're cutting dados, take care of some other notches. The top and second rows of drawers require three drawer runners that are half-lapped onto the dividers. Two for the top tier of drawers, and one for the second tier. The front dividers are half-lapped only to the rear of the rail, and then dadoed to accept the vertical drawer dividers, visible from the front of the cabinet. You also can cut the mating half-laps on the drawer runners at this time.

After cutting all the runners, guides and supports, it's time to try the giant jigsaw puzzle be-



After assembly and finishing, but before the back is in place, you have a chance to see all the pieces come together from their less attractive angle. The smaller drawer dividers and supports are plainly visible here.

fore putting glue and nail to wood. Start with the plane cubby hole section, then work down to the two upper tiers of drawer dividers. Finally place the lower drawers, front dividers and the runners in place. If everything fits well, take it apart and do it all again with glue.

As with the lower cabinet, seasonal wood movement is a concern, so glue the front dividers and guides in place, but leave the rear dividers loose. On the lower

runners, I used screws in slotted holes to let things move.

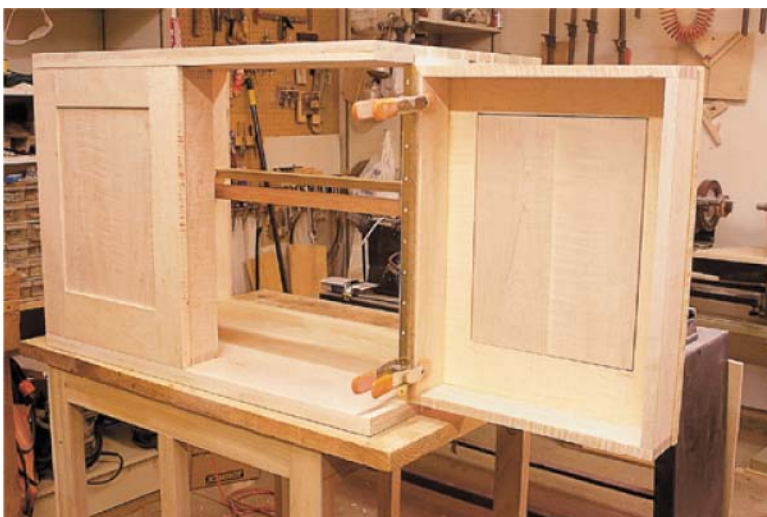
Doors

The doors are essentially frame-and-panel doors with a dovetailed box glued to the back. About as basic as this type of door gets, the doors use a flat panel, grooved stiles and rails, and haunched mortise-and-tenon joinery for the frame itself.

With the cabinets assembled (minus the mouldings) you can check the door dimensions in the cutting list against your cabinet size. The doors' faces extend beyond the dovetailed extension at the center of each pair. This leaves room for the barrel slide catches holding one of each pair of doors.

Drawers

There are many drawers, but they're built essentially the same way. The drawers in the upper section are built with the fronts attached to the sides using half-blind dovetails. The drawer backs attach to the sides with through-



The lower cabinet is shown with the left door held in place while the hinge is attached. The doors themselves are small cabinets, with a frame-and-panel door front attached to a dovetailed frame. Because the door is captured by the cabinet (top and bottom), and flush to the sides, you want to make sure you've got the door the right size before you glue it up. Adjusting afterward is tricky. To give myself a little room, you'll notice that the door front overhangs the frame a little to allow some fitting.



With the upper case flipped over, you can see the top and sub top extending beyond the cabinet, with the filler, top cornice moulding and crown moulding ready to be put in place.

dovetails. The bottoms of the drawers are inserted into grooves cut in the sides and fronts, $\frac{1}{2}$ " up from the bottom edge. The bottoms slide below the lower edge of the drawer back, and then are nailed in place to the drawer backs.

While the upper drawers ride on, and are supported by, drawer runners attached to the cabinet sides, the lower drawers ride on full-extension drawer slides. Because of this, the drawer fronts, or faces in this case, extend $\frac{1}{2}$ " beyond the drawer sides on either side to hide the drawer slides. The easiest way to do this was to simply make a drawer box, with dovetailed $\frac{1}{2}$ "-thick sides, front and back and the same bottom arrangements as on the upper drawers. The $\frac{3}{4}$ "-thick mahogany, maple and walnut drawer fronts are then screwed to the drawer box front once the proper spacing is determined.

Details and Finish

The photos in the beginning of the story discuss the many different details you can add to the cabinet to trick it out to best suit your tools. If you need a visual image to help you lay out your door storage, start with a blank



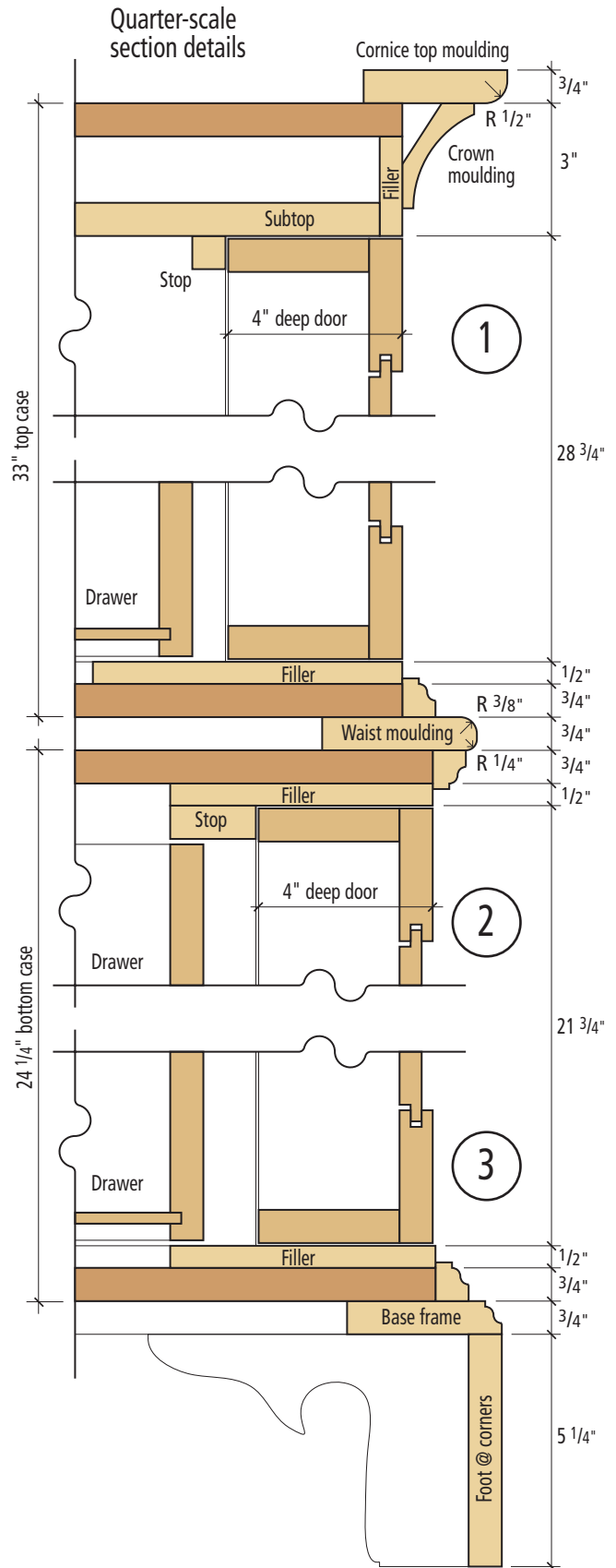
The left-hand doors are held in place with a sliding catch.

piece of paper that is the size of the door interiors and lay your tools on it until you're happy with the arrangement and spacing.

The color for the piece is a water-based aniline dye (Moser's Golden Amber Maple from Woodworker's Supply, 800-645-9292 or www.woodworker.com). I then top-coated the piece with multiple coats of

sprayed-on satin-finish clear lacquer. One note: To achieve the natural tiger maple detail on the drawer fronts, all those were finished with a simple Danish oil.

With all the work done, and the tools in place, dad and I spent about 40 minutes just leaning back with a cup of coffee looking at the piece. I won't try and tell you that there weren't a few awkward discussions between us. For example, the backs for the two sections were different thicknesses (we fixed that for you in the cutting list) and we ended up with the catches on the doors on opposite sides from one another (that we left alone). All in all, working with dad was a rewarding experience. But I think we're both OK with getting back to our individual projects. **PW**



Air Compresso

IN THE WOODSHOP

How to choose the right machine for the work you do.

AIR SUPERIORITY

Air tools are lightweight.

Since air tools are powered by a compressor, they don't need motors. This means they typically weigh less than their electric cousins.

Air tools are compact. No internal motor also means air tools can be smaller and more compact. The average air-powered drill is half the size of an electric drill. It fits better in your hand and is more comfortable to use.

Air tools are powerful.

Although compact and small, air tools are just as powerful as the electric equivalent. As an added bonus, the air that flows through the tool to power it also cools it down. Unlike an electric tool that heats up the harder you work it, an air tool stays cool and won't bog down.

Air tools are simple. Although air tools can break like any other tool, most of them are easy to repair or rebuild yourself. For example, most manufacturers of nailers and sanders sell parts kits that will make your worn-out air tools as good as new.

Air tools are convenient.

Wouldn't it be convenient if all your electric tools used a single power cord that was detachable? This way all you'd have to do is plug in one cord and then hook it up to the tool you wanted to use. No more jumble of cords. That's exactly how it is with air tools. They're all powered by and accept the same single air hose.

Like many woodworkers, I never gave much thought to buying an air compressor. The guys I knew that owned one were mainly garage mechanics. They used their compressor to power impact wrenches or to fill up a low tire or the kid's pool toys. But when Norm started using compressors on many of his projects, I started to give it some thought. As I watched him effortlessly attach delicate mouldings with a brad nailer or apply an even coat of finish to a large project, it dawned on me that maybe he had something.

So when a neighbor asked for help installing wainscoting in his kitchen, I jumped at the chance because I knew he was planning on using his finish nail-

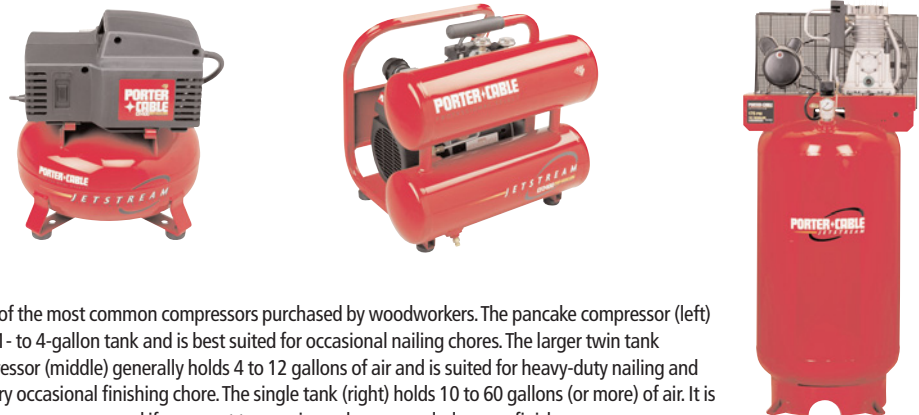
er. And that's all it took – one afternoon, and I was hooked. One reason why is I've always been hammer-challenged. That's right, I can't drive in a nail for beans – I inevitably bend the nail, or ding the wood. But with the pull of a trigger, an air nailer will drive and set a fastener in the blink of an eye. I knew it was the start of yet another love affair with a tool. Since then, I've used dozens of different air-powered tools and compressors and can't imagine working in the shop without them (see "Air Superiority" at left).

The catch, of course, to air-powered tools is that you need a compressor to power them. But plummeting compressor prices have brought air power within

reach of the average woodworker. The challenge is wading through the myriad choices out there. Terms like "cfm," "psi," "horsepower" and "cycle time" more often confuse the shopper than help. But armed with the right knowledge, choosing a compressor is easy.

For starters, let's eliminate one entire class of compressors – those powered by gasoline. Gas compressors require such constant attention (like changing the oil and adding gas), it's like owning another vehicle. The only reason to buy one is if you don't have access to electricity – highly unlikely in a wood-working shop.

So far so good. Let's continue to pare down your choices by tak-



Three of the most common compressors purchased by woodworkers. The pancake compressor (left) has a 1- to 4-gallon tank and is best suited for occasional nailing chores. The larger twin tank compressor (middle) generally holds 4 to 12 gallons of air and is suited for heavy-duty nailing and the very occasional finishing chore. The single tank (right) holds 10 to 60 gallons (or more) of air. It is the compressor you need if you want to use air sanders or regularly spray finishes.

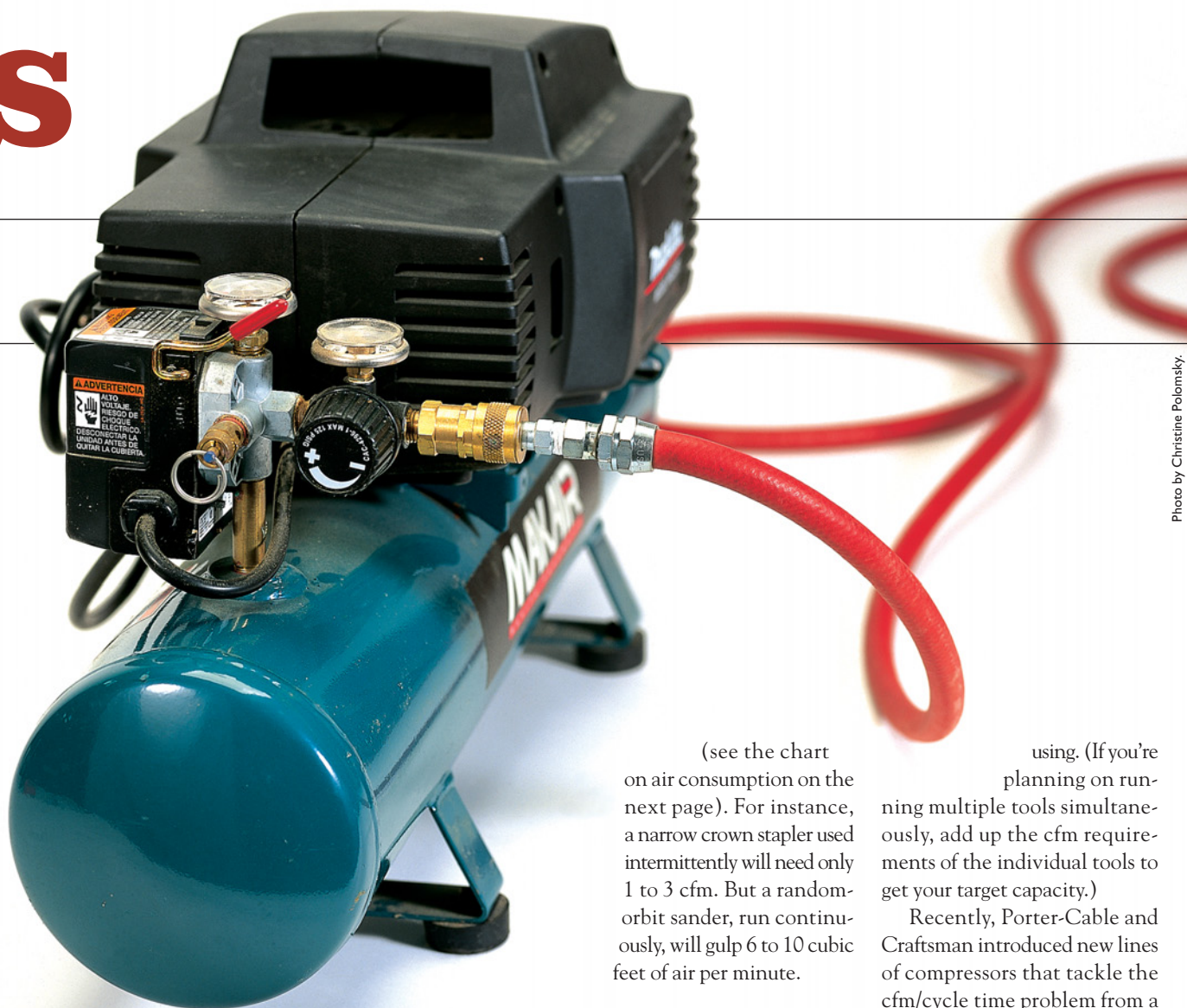


Photo by Christine Polomsky.

ing a look at some important compressor characteristics: horsepower, cycle time, compressor design, tank configuration and the machine's required routine maintenance.

Horsepower Rating

While compressors are typically rated by horsepower – between $\frac{3}{4}$ hp to 10 hp and up – what's really important is the volume of air they produce at a sustained pressure. The secret to selecting a compressor? Define what air

tools you'll be using now and in the future. As long as you find a compressor that can produce the volume of air you need, the horsepower is insignificant. Most air tools run at 90 psi (pounds per square inch) – a pressure every compressor is capable of producing. But what volume of air (measured in cubic feet per minute or cfm) does the tool need to operate properly? All air tools have varying cfm needs

(see the chart on air consumption on the next page). For instance, a narrow crown stapler used intermittently will need only 1 to 3 cfm. But a random-orbit sander, run continuously, will gulp 6 to 10 cubic feet of air per minute.

Cycle Time

Since most compressors are rated for a 50 percent “duty cycle” (which means the motor is supposed to be running no more than half the time the compressor is in use), running a tool like a sander non-stop will make the compressor run more often – maybe continuously, which will ruin the machine. To get around this, you'll need a compressor that produces a cfm higher than the highest rated tool you're planning on

using. (If you're planning on running multiple tools simultaneously, add up the cfm requirements of the individual tools to get your target capacity.)

Recently, Porter-Cable and Craftsman introduced new lines of compressors that tackle the cfm/cycle time problem from a different angle. These new compressors use “high pressure technology” to provide longer, more continuous air to tools. To achieve this, they've tinkered with the cut-out and cut-in pressure points of the compressor. The cut-out pressure is the point where the compressor stops filling the tank; cut-in pressure is where it starts filling the tank. By raising both of these points, a larger “reserve” of air is available, which lets you work longer without risking reduced performance – a common problem with compressors that cut-in at 95 psi – only 5 psi above the minimum requirement for most air tools.

by Rick Peters

Rick Peters is the author of “Air Tools: How to Choose, Use and Maintain Them” (Sterling Publications).

Compressor Design

Here's another factor: When comparing compressors, you may find two with the same horsepower rating that yield widely different airflows. The reason is design: a single-stage or two-stage, with one piston or two. A single-stage compressor squeezes air in a single piston stroke to 25 to 125 psi. In a two-stage compressor, intermediate pressurized air is further compressed in a second cylinder to 100 to 250 psi. Since most air tools only require 90 to 100 psi to operate, a single-stage compressor will handle just about any job you can throw at it. Also, two-stage compressors tend to be more expensive and heavier than single-stage units and usually require 220-volt power.

Tank Configuration

There are four basic tank configurations to consider: single (10 to 60 gallons), twin (4 to 12 gallons), pancake (1 to 4 gallons)

and no tank at all. The larger the tank, the longer you can work at a desired pressure and flow rate – but at the cost of portability. I prefer twin tanks for small compressors because I can carry them with the tanks against my leg; this prevents accidental burns as the compressor heats up from use. I'd advise going with a conventional single tank for a larger compressor because they're well balanced and easy to move. Small, oil-free compressors are available sans tank, but they run continuously and have trouble delivering the air volume you'll need.

Recommendations

If you're planning on using high-cfm tools like framing nailers and random-orbit sanders, I recommend a large compressor (around 3 hp) with a 20- to 30-gallon tank and an output between 8-10 cfm. If you want to try your hand at spraying finishes, go with a midsize com-

AIR CONSUMPTION CHART

TOOL	CFM	PSI
Air chisel	4-6	70-90
3/8" drill	4-6	70-90
3/8" impact wrench	3-4	70-90
Stapler	1-3	70-90
Brad nailer	2-4	70-90
Finish nailer	4-7	70-90
Framing nailer	4-10	70-90
Caulk gun	1-2	5-70
Finish sander	5-9	70-90
Random-orbit sander	6-10	70-90
Sandblast gun	2-3	30-90
Pressure washer	2-5	40-60
Paint sprayer	1-5	10-70

pressor that can produce 5 to 6 cfm. If you won't be working with air-gobbling tools, a small portable compressor (around 1 1/2 hp) capable of producing 3 to 4 cfm with a 4- to 6-gallon tank will do the job. **PW**

MAINTAINING COMPRESSORS

Just like a car engine, oil-lubricated compressors need regular maintenance: Oil must be checked and topped off, and the filter and oil need to be periodically replaced. Despite this, oil-lubricated compressors have a reputation for performance. They often will run twice as long as an oil-free compressor between rebuilds. A typical, well-designed, oil-lubricated compressor will need a rebuild after 2,000 hours of use – that's three to four years if you use your compressor 10 hours a week.

Oil-free compressors, on the other hand, use non-metal piston rings, Teflon-coated parts and sealed bearings. Yes, they're maintenance-free – but only for a while. Since they don't use a lubricant, the internal parts of an oil-free compressor are constantly rubbing against each other. These compressors need rebuilds roughly twice as often as oil-lubricated compressors.

There's little to go wrong with a compressor as long as you service it regularly – in particular, you need to religiously empty the compressor tank after every use (top). When air is pressurized, the moisture in the air collects inside the tank. If you don't empty it out, it'll rot your tank. It's also important to change the compressor oil and clean the filter per the manufacturer instructions. Finally, make sure to test the pressure relief valve on a regular basis. This important safety device will eventually wear out under pressure. And when it does, you won't know until the tank explodes (no fun at all). Just pull the pin periodically to make sure it's functioning well.

Water tends to collect in your air compressor's tank. Unscrew the valve at the bottom of the tank to release the water.



The pressure release valve is a fast way to empty your compressor of air. This valve also prevents the machine from exploding if over-pressurized.



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A photograph of a wooden Morris chair on a deck. The chair has a white cushion with three dark stripes. The deck is made of reddish-brown wood. In the background, there are green trees and a glimpse of a body of water.

all-weather MORRIS CHAIR

A Morris chair is a great place to settle in and do lots of things, including reading a book, enjoying a drink, chatting with friends and watching a good rain storm. During at least half of the year in the Midwest these things are nice to do outside, as well as inside, but dragging a white oak mortise-and-tenoned Morris chair onto your deck isn't the easiest thing. Not one to be put out of a comfortable position, I decided painted pine could work for a Morris chair as well, and so I headed for the home center store.

The chair is made entirely from 1 x 4 and 1 x 6 pine, about \$40 worth. The hardest joint on this chair is a butt joint, and if you've got a jigsaw, drill and a hammer you can knock one out in a day. With the help of a couple extra tools, my personal best time is under four hours. Your hardest work will be picking through the lumber racks to find the straightest and most knot-free lumber from the store.

The chair is designed to have a cushion, but you don't have to add one. If you don't use a cushion, the chair may feel a little deep when you sit in it. Because of this, I'd suggest taking 2" off the lengths for the side rails, arms, seat slats and side cleats. Readjust the spacing of the side slats to fit the shorter seat. My cushions came from a home center store and were modified with a little sewing. You also can check out www.summerlivingdirect.com and buy their "Winston cushions" (items # W1917 and W1907).

Start your building by cutting out the pieces to form the front and rear legs. Traditional Morris chairs typically have very stout legs, and I didn't want to lose that look or stability, so I edge-glued and nailed two pieces together to form a "T." Face-on or from the side, the sturdy leg is still visible. With the legs formed, the rear (shorter) legs need to have the top

Morris chairs are pretty darn comfortable, but they aren't the type of furniture you drag out onto the porch — until now.

by David Thiel

Questions or comments? You can contact David at 513-531-2690 ext.255 or at david.thiel@fwpubs.com.



With the legs assembled, attach both lower side stretchers. Then place an upper stretcher in position and draw a line from the top of the angle on the back leg to the front leg. Cut the stretcher on the mark, then attach the upper stretchers, completing the two side frames.

end cut at a 5° angle from front to back. Remember that the back on these legs is the top of the “T.” A miter box made quick work of this step.

The next step is to get your box of 1¼" deck screws out and attach the lower stretchers to the inside of the legs with the top edge 8" off the floor. With those attached, slip the top stretchers into place, flush with the front leg, and mark and cut the bevel on the rail to allow the arms of the chair to slope back. Then screw these stretchers in place, also on the inside of the legs and then screw the front and rear stretchers in place, above the lower side stretchers. With the side frames complete, cut the pieces for the side slats using the sides themselves to determine the angle to cut on the top of the slats. I spaced them evenly and used a pneumatic brad nailer to attach the slats as they're more decorative than structural.

The two arms are cut from 37"-long pieces. Measure 4½" in from the front edge of each, then cross-cut the pieces at this point at a 2½° angle. By flipping over the

shorter piece, a 5° angle is formed, and the arms can be attached to the legs and top rails. Cut the taper shown in the diagrams on the back of the arms to add a little more grace to the piece, then center the arms on the front legs and attach. I used screws here, because I knew in my heart that I'd be dragging the chairs around by the arms. I was right. The extra strength is a good move.

The seat of the chair is formed by simply adding nailing cleats to the inside of the chair frame. Screw the rear cleat in place with

The side slats are mounted flush to the bottom of the lower side rail and cut to match the angle of the top rail. Simply hold the piece in place, make a mark, and choose your toothed tool of choice to make the cut.

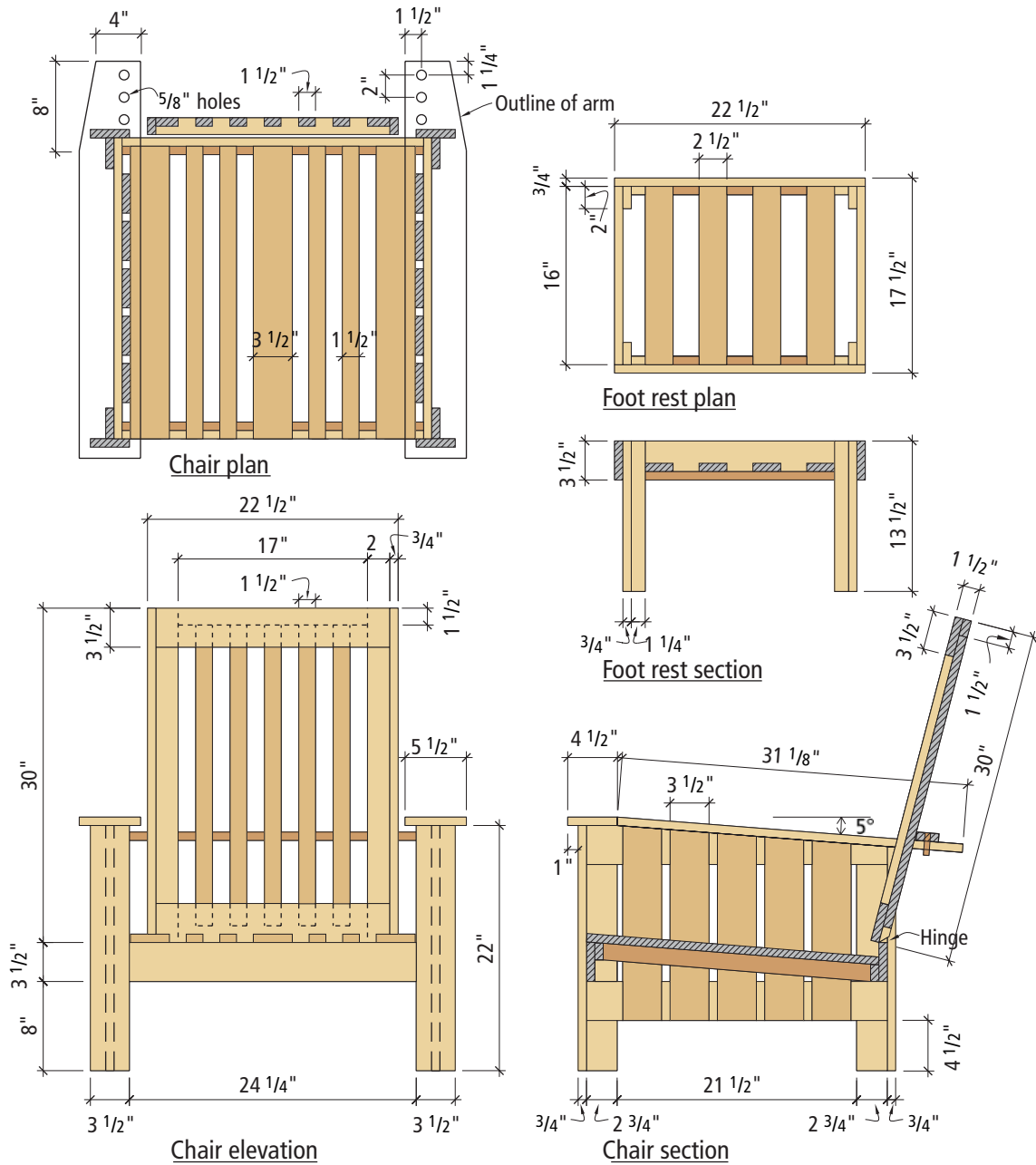


Simply screw the front and rear stretcher between the side frames and it starts to look like a chair.

the bottom edge flush to the bottom of the rear seat stretcher. Then lay a straightedge on the rear cleat, stretching across the front stretcher of the chair. This is the angle the seat will take. Mount the front cleat to the front stretcher so that it fits under the straightedge. The two side cleats are mounted following the angle of the straightedge. Mounting the seat slats is simple from here. Cut the slats and use a router to round over at least the front edges of the boards. If you like, go ahead and round over the long edges as

well. Then simply lay the two outside slats tight against the sides and back and nail them in place. Put the center slat in place next, then fill in with the four thinner slats, spacing them evenly.

The back is constructed by forming L-shaped sides, screwing a top and bottom rail between them, then nailing the slats evenly spaced across the back. To allow the back to fold both forward and back, the continuous hinge needs to be mounted to the inside of the back chair rail and to the outside of the lower back rail.



ALL-WEATHER MORRIS CHAIR

NO.	ITEM	DIMENSIONS (INCHES)			NOTES
		T	W	L	
□ 2	Legs (front)	3/4	3 1/2	22"	
□ 2	Legs (front)	3/4	2 3/4	22"	
□ 2	Legs (rear)	3/4	3 1/2	20 1/8"	bevel to fit
□ 2	Legs (rear)	3/4	2 3/4	20 1/8"	bevel to fit
□ 6	Stretchers	3/4	3 1/2	27"	bevel 2 to fit
□ 2	Arms	3/4	5 1/2	37"	trim to length
□ 10	Side slats	3/4	3 1/2	17 1/2"	bevel to fit
□ 2	Back stiles	3/4	1 1/2	30"	
□ 2	Back stiles	3/4	2	30"	
□ 2	Back rails	3/4	3 1/2	21"	
□ 1	Back rail	3/4	1 1/2	17"	
□ 5	Back slats	3/4	1 1/2	27"	
□ 1	Back support	3/4	2	28"	bevel to fit

NO.	ITEM	DIMENSIONS (INCHES)			NOTES
		T	W	L	
□ 4	Seat cleats	3/4	1 1/2	27"	bevel 2 to fit
□ 3	Seat slats	3/4	3 1/2	26 1/2"	trim to fit
□ 4	Seat slats	3/4	1 1/2	26 1/2"	trim to fit
□ 2	Dowels	1/2 dia.		2"	
□ 1	Hinge	1 1/2		20"	

Foot rest

□ 4	Legs	3/4	1 1/4	13 1/2"
□ 4	Legs	3/4	2	13 1/2"
□ 2	Sides	3/4	3 1/2	22 1/2"
□ 2	Sides	3/4	3 1/2	16"
□ 4	Slats	3/4	2 1/2	16"
□ 2	Cleats	3/4	3/4	17"

Outdoor screws are available at McFeely's 800-443-7937 or www.mcfeelys.com



The arms are cut to the front and rear lengths at a $2\frac{1}{2}^\circ$ angle and then the front piece is flipped upside down. This gives you a 5° angle at the joint. While the inner part of the arm is well supported by the legs and stretchers, the outer part of the arm needs some extra support. With a little variation on the Arts & Crafts exposed joinery theme, I used an exposed biscuit, cutting the biscuit slot at the mating point of the arm, then inserting the biscuit and later cutting and sanding it flush.



As you can see on the end, the back stiles are glued together to form "L"-shaped sides, then the back rails are screwed in place between the two sides. The $1\frac{1}{2}''$ rail is attached to the upper rail to make a more solid looking and feeling back.

Mounted this way, the two back stiles will keep the back from reclining. To solve this I cut a bevel on the back stiles using a hand saw. Mount the back and fold it forward for now.

Next, mark the $\frac{5}{8}''$ hole locations on the arms and drill the holes using a spade bit. To avoid tear-out, drill through the top of the arm until the tip of the bit pokes through the bottom of the

arm, then drill the rest of the hole from the underside of the arm.

To make the chair an adjustable recliner, cut a back support bar as shown in the cutting list and cut a chamfer along one edge. Then mark the bar to match the holes in the arms and drill two $\frac{1}{2}''$ holes through the piece. Put a little glue on the two 2"-long sections of dowel and insert them into the holes until they are flush

with the top edge of the piece. The glue should hold, but to add a little extra strength I shot a brad nail through the back of the piece into each dowel.

It's not a decent Morris chair unless it has a foot rest. This one is fairly simple, with the four legs again using the strength formed by an L-shaped glue-up. Four stretchers screwed between give the footstool its shape, and cleats and some evenly spaced slats finish the job. Again, this is designed for the footstool its shape, and cleats and some evenly spaced slats finish the job. Again, this is designed for a cushion, adjust your dimensions and mount the slats to the top of the stretchers.

You're ready to finish. Do a lit-

tle sanding to knock off the sharp edges and make a nice surface on the arms. The best outdoor finish is one that blocks light and seals the wood. Around my neighborhood that's paint. I picked a nice kelly green and used about seven cans of spray paint.

You may have noticed the reference to my "best time" at the beginning of this story. Since building the first of these chairs I've built a second for myself, and there have been orders pouring in from family and neighbors. So why don't some of you take these plans and start up a side business. Please, take some pressure off me! **PW**



With the back slats in place, the ends of the back stiles need to be beveled to allow the back to recline to a comfortable position. I'm beveling the pieces here with a pull saw at more of an angle than necessary, but it won't hurt anything.



The completed back is screwed in place against the back seat rail with a continuous hinge. You can also see the three holes in each arm that the back support (shown on the right-hand arm) drops into.

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Metal-bodied Jack Planes

A well-tuned jack plane can quickly trim doors, fit drawers and eliminate edge sanding forever. If you've never successfully used a plane before, here's how to buy one, set it up and use it.

Let's be honest here: Teaching yourself to use a hand plane properly is difficult. It's like trying to teach yourself to drive an 18-wheeler. Don't let anyone tell you any different.

Back in the day — before the apprentice system was disbanded — journeymen cabinetmakers showed their apprentices how to properly sharpen the iron, how to adjust the tool and how to cut paper-thin shavings. Perhaps most importantly, the master was there to tell the apprentice what he was doing wrong when the plane stopped working well. “Your iron is dull; your frog is too far forward; your chipbreaker is set too far back. Here, this should fix things.”

These days, unless you take a good class, you're on your own. So it should come as no surprise to you if you've had terrible luck using a hand plane. Unlike many

power tools, there are myriad adjustments that must be made to adapt the tool to different planing situations. A plane set up to cut perfect shavings on sugar pine might not do so well on ash, white oak or hard maple.

Now before you give yourself up to a life of power sanding, let me tell you this: Learning to use a plane is worth every minute of agony and puzzlement. In fact, I personally couldn't imagine woodworking without hand planes — or without my table saw and jointer, for that matter.

Of all my planes, three see the most use. I have a shoulder plane for trimming tenons, a smoothing plane for preparing wood for finishing and a jack plane for just

about everything else.

Equipped with a fence from Lee Valley Tools, my jack plane cleans saw blade marks off the edge of every board in a project. I never have to worry about rounding over any edges with a random-orbit sander again. This isn't about some “hand-tool heritage” stuff. It's simply a better and faster way to do things.

The same goes for trimming doors and drawers. The inset doors I fit with my jack plane fit better than those I've fit with a power jointer or table saw. Why? I have more control over where the cut stops and starts, so things are less likely to spiral out of control.

Finally, my jack plane excels at cleaning up bandsawn edges.

by Christopher Schwarz

Comments or questions? Contact Chris at 513-531-2690 ext. 407 or chris.schwarz@fwpubs.com.



Photos by Al Parrish.

I'll taper table legs on my band saw and clean up the tapers with a jack plane. Again, I have more control, and the tapers need almost no sanding when I'm done.

First, Learn to Sharpen

Before you'll have any luck with a jack plane, you need to get familiar with sharpening. The iron's edge must be keen, or the plane won't work. All the sharpening systems out there work; you need to find one that's right for your budget and your level of dedication. There are lots of decent books on sharpening; I recommend “The Complete Guide to Sharpening” (The Taunton Press) by Leonard Lee.



Once you learn to sharpen, you need to purchase a decent plane. We've reviewed all of the new jack planes available on the market today and one of Stanley's classic 100-year-old planes, which you'll see at flea markets almost anywhere. Find a plane that fits your budget, sharpen the iron and get ready to tune it up for work.

Set-up: Same for Antique and New Jack Planes

All planes (old and new) require "fettling," also called tuning. In general, the more money you pay up front for your plane, the less fettling you're in for. On average, expect to spend anywhere from one to six hours to fettle a plane.

Begin by working on the sole. To be fair, there are people out there who insist the sole must be lapped 100 percent dead flat and be as shiny as a mirror when done. Others say that sole flatness is highly overrated, and the only thing you need to be worried about are major warps and bows.

It's been my experience that the truth is somewhere between. I lap my soles so that the area in front of the mouth is flat. And I make sure that most of the sole (especially the edges) is flat behind the mouth. I don't worry much about the extreme front and rear of the sole. These are more likely to be out of kilter, especially if the plane has ever been

GIVE US YOUR BEST SHAVING AND WE'LL SEND YOU A FREE 'MERIT BADGE'

Learning to set up a bench plane for woodworking is a major accomplishment. I can remember pulling my first perfect shaving from a maple board after hours of practice. Excited, I held up the shaving like a fresh kill and showed it to my wife.

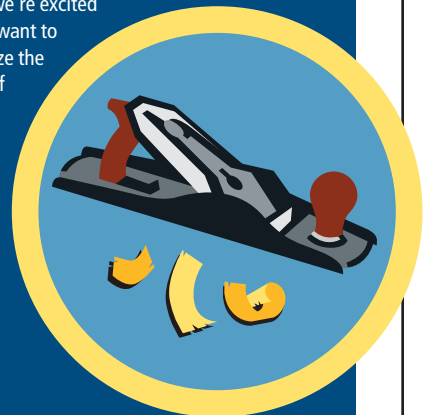
"Um, that's nice, dear," she said.

If this article helps you tune up a plane, we want you to know that — unlike your spouse — we're excited about your accomplishment. And we want to give you a little something to recognize the moment. We've ordered a big batch of embroidered badges that are in the spirit of the merit badges that Boy Scouts earn on their path to becoming Eagle Scouts. We think they look quite nice on a shop apron.

Once you get your plane in tune, put your best shaving in an envelope along with a self-addressed stamped envelope and send them to:

Popular Woodworking
Hand Plane Merit Badge
1507 Dana Ave.
Cincinnati, OH 45207

We'll send you the free badge, and then you can show that to your spouse. To which he or she will probably reply, "That's nice." And remember: Don't forget to include the self-addressed stamped envelope. That will ensure you get your free badge.





Flatten, or lap, the sole with the plane fully assembled (but with the iron retracted into the body). I start with 90-grit silicon carbide powder and kerosene. Rub the sole on your flat surface in a figure-8 pattern, being sure not to concentrate your efforts in one certain place. It's like a big sharpening stone, and you don't want to dish the center.

Turn the plane over after a few minutes and check your progress. You can see the red marks at the toe and heel of the sole. This is the point where I'm ready to move up to a finer-grit powder.



THE JACK OF ALL PLANES?

Many hand planes have nicknames that describe what they're used for: smoothing planes for smoothing, jointer planes for jointing, shoulder planes for trimming shoulders etc. But what does "jack" have to do with a "jack plane?"

Ever since I got into woodworking, people have told me that the "jack" refers to the expression "jack of all trades." The jack plane, it was explained, was a good all-around plane, so that's the nickname it received.

So I asked Graham Blackburn, the author of "Traditional Woodworking Handtools" (The Lyons Press) and a longtime hero of mine, about jack planes. According to Blackburn, "jack" is an expression used since the Middle Ages to describe something that is common, such as jack boots or a jack knife. The jack plane is indeed one of the most common sizes you'll find on the shelves of hardware stores. However, it could be argued that the "jack" refers instead to the most common sort of carpentry and construction work performed with this plane.

Indeed, Blackburn explained how carpenters called the plane a "jack plane" while cabinetmakers called the same instrument a "fore plane." And to make things even more complex, the premier English plane manufacturers of the day tried to separate their products from the common ones by calling the same-size plane a "panel plane."

But in the end, the people spoke, and in this country we call it a jack plane — no matter if the tool is used for fine furniture work or trimming an interior door to fit its jamb.

dropped. And as to the required final sheen on the sole, I'm not much of a purist here, either. I've made a few soles look like a mirror, but it didn't seem to boost performance much. Lap until you're tired, then give the plane a try. If you're satisfied, stop. If not, carry on.

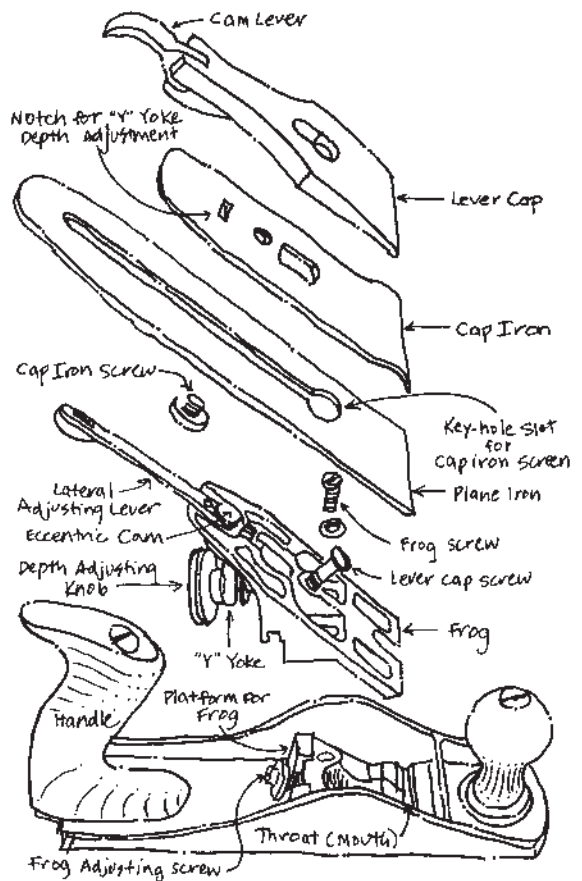
There are several ways to lap the sole, but the most important thing to remember is that the surface you use for lapping must be flat. Your choices include thick glass, a marble pastry slab or a metal casting — usually the wing on your table saw.

Sandpaper or Silicon Carbide?

Next you have to choose an abrasive. Most people use either sandpaper or silicon carbide grit. In sandpaper, the choice product these days is called Alumina-Zirconia (and sometimes it's called,

oddly enough, Zirconia Alumina). No matter what you call it, this light blue-colored sanding belt is used for thickening wood in wide-belt sanders and abrading stainless steel and titanium; so it's fine for a plane's sole. You can purchase it in belts from a home center (\$6 for two belts; get some medium- and fine-grit belts to start), or order it from Klingspor (800-645-5555). Attach the belts to a flat surface using a spray adhesive or rubber cement.

The other option is silicon carbide powder. You sprinkle a few pinches of powder along with a light-bodied oil or kerosene on your flat surface and rub the sole until it's flat (see photo at left). You can buy a 4-ounce jar of 90-grit powder for \$3.95 from Lee Valley Tools (800-871-8158). Or you can buy a kit of five grits (90 grit up to 600 grit) for \$12.95. One thing worth mentioning is



that if you use the powder on your table saw wing it will lower the sheen of the cast iron to a dull grey. It's only cosmetic, but it bothers some people.

Personally, I prefer the sandpaper over the powder. It makes much less mess and leaves a shinier surface on the sole of your plane.

No matter which abrasive you choose, the method is essentially the same. Affix the sandpaper to or mix up a slurry on your flat surface using a few pinches of powder. Put your plane together as if you were going to plane wood, but retract the blade into the body. This is critical because the lever cap exerts pressure on the base casting and it can affect the shape of the sole slightly.

Now take a permanent magic marker and color the sole of the plane. I like red. Rub the plane for about 30 seconds on your abrasive surface and turn the plane over. The red spots are your low-lying areas. Continue rubbing the plane on the abrasive until you get as much red off as you can.

With the sandpaper, you will periodically have to use a brush to clean off the metal filings. With

the silicon carbide, you will have to occasionally refresh the slurry with another pinch or two of the abrasive powder.

When your sole looks good, move up a grit and continue your work. Keep doing this until you run out of finer grits or patience.

Fixing Your Frog

The frog is the soul of your hand plane. It holds the iron steady so it won't chatter and hop across your work like, well, a frog. Essentially, you want your iron to seat firmly against the frog and the frog to screw firmly to the base.

First, fix up the face of the frog. On a medium-grit sharpening stone, rub the face of the frog to remove milling marks and high spots. As with your plane's sole, you can check your progress with a magic marker. Move up in grits as you did with the sole. Unlike the sole, this is quick work.

Now screw the frog to the base casting as shown in the photo on the next page. Notice the black rib between the two legs of the frog. Keep an eye on that rib. First position the frog about where you will keep it for general-purpose



I use a diamond stone to flatten the face of the frog, but any medium-grit stone will do. You'll have to work around the lateral adjustment lever, but you'll get most of the frog flattened this way.



Here you can see the difference a little stoning makes to your frog. Your iron is going to seat much more firmly against the frog once it's flattened to this point.

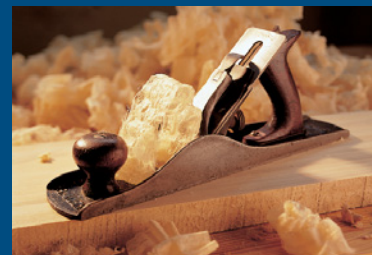
THE VENERABLE AND AFFORDABLE STANLEY TYPE 11 JACK PLANE

I'm sorry to say it, but Stanley just doesn't make hand planes like it used to. Though the new English-made Stanleys can be tuned up to perform adequately, you can easily purchase a plane from the Stanley Works' glory days for less money. The only catch is that you might have to do a lot more tuning and cleaning than you would on a new plane. But believe me, the results are worth it.

Without a doubt, the best bench planes that Stanley ever produced were the Bed Rock line of professional planes, which began production in 1902 and were discontinued after World War II. These planes are different than other Stanley planes in the way the frog mates with the base casting. Simply put, there's a lot more contact between the frog and base, so there's less opportunity for blade chatter. It's such a good idea that Lie-Nielsen Toolworks and Clifton use that same 100-year-old technology on their premium planes. But trust me, it's tough to afford a Bed Rock plane (unless you're prone to dumb luck at yard sales). They're as expensive as a new Clifton or Lie-Nielsen.

In my opinion, the next best thing is a Stanley Type 11 plane. These planes, produced between 1910 and 1918, are common sights at flea markets and on eBay, the internet auction site. I've fixed up four of these planes and find them excellent performers. Here's why: The face of the frog of the Type 11s (and earlier planes) is a flat casting. Properly prepared, this frog will give rock-solid support to your iron and chipbreaker. Modern-day frogs have small ribs on the face of the frog that support the iron, so blade chatter is more likely. As an added bonus, the body castings of the Type 11s have had almost 100 years to settle — unlike some manufacturers' new castings that have not been completely stress-relieved during manufacturing. So after you flatten the sole, it's likely to stay that way.

So how do you know if you have a Type 11? It's pretty easy. Type 11 planes have three patent dates cast into the base behind the frog: March 25, 1902; Aug. 19, 1902; and April 19, 1910. As far as I know, it's the only Stanley bench plane with three patent dates. Additionally, the front knob is a low, squat, mushroom-shaped thing. All later planes have the same "high" knob on planes today. There are some other trademarks of planes of that era, including the fact that the lever cap does not have "Stanley" cast into it, a feature found on planes made from 1925 until today.



Sometimes you'll find a plane that has some of the Type 11 characteristics, but the plane might have a high knob or a lever cap with Stanley's logo cast into it. Likely you have a "frankenplane" that has been assembled from parts from different eras. If the frog still has the solid cast face, it's worth considering. However, be sure to ask the seller for a discount.

The low knob is an immediate clue that the plane you're looking at may be a Type 11, a desirable and inexpensive option to many modern-day planes.

So how much should you pay for a Type 11? That depends on how pretty you like your tools and how long you're willing to troll around. Nice examples of Type 11s fetch \$30 to \$40 on eBay. Planes with defects, such as a split in the handle or rust pitting on the iron, can be had for as little as \$7.50. I've bought all mine for between \$12 and \$15, but they all needed a little work.

Many of these Type 11 planes have corrugated soles. The thought was that the corrugations would reduce friction while planing, which has been dismissed by many physicists-turned-woodworkers. However, the corrugations do make it easier to flatten the sole of the plane. You have to remove only about half the metal as you would on a sole without the corrugations.

Finally, I recommend you purchase a new iron for your Type 11. Hock Tools (888-282-5233), Lee Valley Tools (800-871-8158) and Woodcraft (800-225-1153) all manufacture or sell aftermarket irons that are thicker and better made than stock irons. You'll be glad you did.

—Christopher Schwarz, senior editor



Take a few minutes to polish the top hump of the chipbreaker. Anytime you can reduce friction you'll improve planing performance.

work. You want your mouth to be about $\frac{1}{16}$ " wide, perhaps smaller if you're going to use this occasionally as a smoothing plane.

Put the iron and chipbreaker in place and lock the lever cap. Check the mouth. If it's about the right size, remove the lever cap, chipbreaker and iron. Rub your finger over that rib. If it protrudes past the frog, you've got trouble. A protruding rib can easily prevent your iron from seating against the frog and make all sorts of trouble. Take a file to the rib.

You also want to make sure that the base casting isn't interfering with the mating of the iron and frog. If your frog is set too far back, the blade will rest against the base casting and some point at the back of your frog. The result will be chatter. So move the frog forward a bit.

Quick Chipbreaker Fix

Another oft-neglected part of the plane is the chipbreaker. There are two common problems with this part. First, it doesn't mate tightly with the cutting face of the iron. And second, it doesn't have any "spring" to it. Luckily, both are simple to fix.

If you screw the chipbreaker to the iron and the chipbreaker doesn't have to bend even a little, that's a problem. If the chipbreaker bends so much that the



You can stone the edge of your chipbreaker freehand, but a scrap piece of wood will make the operation foolproof and quick. Stone this edge until it seats tightly against the iron. A well-seated chipbreaker will save you from disassembling your plane every few strokes to clean out the shavings choking the mouth.

iron bends, too, that's also a problem. Put the chipbreaker in a vise and bend it using your hands to increase or decrease the amount of spring in it. It's not hard to do.

Now, screw the chipbreaker to the iron and hold the assembly up to a light. If you can see light between the chipbreaker and iron, you need to stone the edge of the chipbreaker.



This is what your shavings should look like when your plane is properly set up for smoothing. This is the perfect setting for removing saw marks from the edge of a board or smoothing a board before finishing. If you want to hog off more wood in a hurry, advance the blade just a little more.

Hold the plane upside down and look at it head on as you tweak the lateral adjustment lever. When the cutting edge and sole are parallel, back the iron out and go to work.



Here you can see the rib between the two legs of the frog. This is a good, all-purpose setting. For rough work, set the chipbreaker back a little more. For fine work, move the chipbreaker up slightly.

This is a quick fix. Put a scrap piece of wood next to your sharpening stone and stone the edge of the chipbreaker. It shouldn't take a lot of time; chipbreakers are made from soft metal. The scrap of wood keeps your chipbreaker at a consistent angle.

Reassemble the iron and chipbreaker and check your work. When there's no more light, you're done.

Finally, while you're working on the chipbreaker, it's a good idea to stone the top of the curved

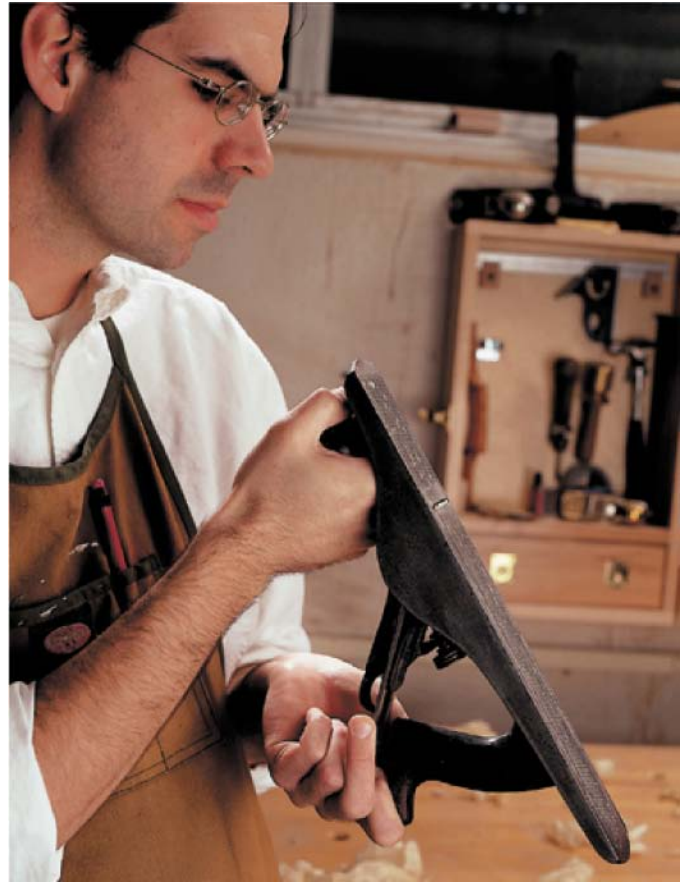
edge a bit. Anything you can do to reduce friction between the plane and the shavings will make your tool work better.

Tricks for a Perfect Setup

The hard part is over; now it's time for a test run. Attach the chipbreaker to the iron. Set the chipbreaker so it's a little less than $\frac{1}{16}$ " back from the edge of the iron. This is a good, all-purpose setting. For rough work, set the chipbreaker back a little more. For fine work, move the chipbreaker up slightly.

Put the iron assembly in place on the frog and put the lever cap in place. Now is a good time to check the setting of that screw in the middle that holds everything together. The screw should be tight against the lever cap but you should still be able to smoothly adjust the iron's cutting depth by turning the wheel behind the frog.

Turn that wheel until the iron protrudes from the mouth just a bit. Now hold the plane as shown in the photo below and move the





With your jack plane set up for smoothing, you can easily trim fitted drawers to a perfect flush fit. If you have to plane the end grain of the drawer front and the grain direction of the sides dictates that the drawer front is at the end of your cut, be sure to clamp a back-up block to the drawer front. This will help prevent you from blowing chunks out of your drawer front.

lateral adjustment lever until you can see that the cutting edge and sole are parallel. Now, without touching the lateral adjustment lever, retract the iron so it's almost protruding from the sole.

Get a piece of scrap wood. Try something easy at first, like poplar. Just like with your woodworking machines, you need to read the grain direction on a board when deciding which direction to plane. You want to plane with the grain. The wood fibers will likely tear out if you plane against the grain.

Turn the iron adjustment knob just a bit to advance the iron. It's important to note that you should always adjust the iron by increasing the depth of cut. This avoids what is called "backlash." If you retract the blade and then start cutting, the blade can back up during use because there is slack in the adjustment mechanism.

Push the plane over the board and see what happens. How you hold and push the plane is important. Skew the body of the plane about 5° left or right as you push it forward; this will almost always improve your cut. When you begin the cut, keep most of the downward pressure on the front knob. In the middle of the cut, keep the downward pressure

even on both the front knob and rear handle. As you finish the cut, most of the downward pressure should be on the rear handle. This takes a bit of practice to master, but it's worth it because your boards will remain true as a result.

After your first stroke, advance the iron in tiny increments until the plane starts to cut. If the plane seems to be cutting on one side only, you need to tweak the lateral adjustment lever left or right. Just like with a ham radio, it's all about small adjustments. In a perfect world, the shavings should be the width of the blade (2"), about .001" to .002" thick and fluffy.

You'll also know if you're in the ballpark by the sound the plane makes while it's cutting. When things are going well, it sounds like "swish." When your cut is too heavy, the sound will be lower and have a grinding quality.

Troubleshooting

Lots of things can go wrong for the beginner, so here are some things to think about. If the plane chatters or skips across the work, look for something loose. Is the frog screwed tightly to the base? How about the iron? Is it seated correctly on the frog? Is the screw that comes up through the iron



Using machinery to trim inset doors so you have a perfect 1/16" gap all around is a real skill because it's easy to go too far. With a jack plane and the Veritas jointer fence, you can sneak up on the perfect fit. This method also removes any milling marks from your doors' edges, so you don't have to sand the edges once the door fits.

assembly tight enough to keep everything in place? Have you checked for backlash?

Another common problem is shavings choking the mouth. Check the location of the frog. If it's too far forward for the cut you're making, the shavings will bunch up in the mouth. Next, check the

fit between the chipbreaker and the iron. If it's not airtight, chips will bunch up there.

If the plane seems to cut inconsistently — that is, it cuts in some places on a board but not in others, you need to check two things. First, the board might be twisted, so you're only able to plane the high spots. Second, your lateral adjustment might be out of wack. Try adjusting the lever this way and that a bit.

Finally, just keep at it. Start working with some pine 2 x 4s, which is a forgiving wood that begs to be planed. Then try some poplar, which gives up wispy shavings easily. Then move on to oak, maple and cherry. With practice, all your common cabinet woods will do as you please.

And when you're ready to be humbled again, move on to the exotic woods. That's a bit like teaching yourself to steer the QE II, and that's another story. **PW**



SUPPLIES

Lee Valley Tools
800-871-8158
Veritas Jointer Fence,
item # 05P30.01, \$28.95

Silicon carbide grit, 90x,
item # 05M24.01, \$3.95

Silicon carbide grit, set of five grits,
item # 05M01.01, \$12.95

Glass lapping plate, item #
05M20.12, \$8.95

The Veritas jointer fence is a must-have accessory for me. In fact, it's on my jack plane more than it's off. This accessory really shines when it comes to removing machinery marks from the edges of your boards. With the fence attached to a well-tuned plane, you'll produce shimmering straight edges that are ready for finishing. No more edges rounded by your sander, and no more toiling over the edges with a sanding block.

Buying a Jack

Though all the jack planes in this review look basically the same — they're all based on Leonard Bailey's 19th-century designs — there are fundamental differences that separate a \$40 plane from a \$300 one.

Like all tools, it comes down to three things:

- The design of the tool
- The materials used
- The quality of the manufacturing process

Design: Thanks Leonard

Two of Bailey's patented ideas show up on most of these planes. The way you adjust the depth of the cut on all these planes has remained basically unchanged since Bailey patented his idea in 1867. All the planes but the Record also use Bailey's idea for securing the lever cap.

However, there are significant differences in design among these tools. Two of these planes — the Clifton and the Lie-Nielsen — have a superior way of securing the frog to the base. Commonly called "Bed Rock"-style frogs, these were patented in 1895 and were used on Stanley's premium bench planes. Unlike other Bailey-style planes, Bed Rock planes have a large machined area where the frog mates with the base. Depending on the brand, Bed Rock frogs have three to five times as much contact between the frog and base compared to standard Bailey planes. Without a doubt, this reduces chatter. The Bed Rock frogs also allow you to move the frog forward and back easily without disassembling the plane.

Materials: Not Just a Pretty Knob

More expensive planes are generally made using better materials. For example, the cutting iron will be thicker and properly heat-treated. Parts that are plastic on one plane will be brass or even bronze on another.

Except for the Lie-Nielsen, all of the plane bodies in this re-

view are cast using grey iron. There's nothing wrong with grey iron, but it is brittle and will crack or break when dropped from, oh, about bench height. Ductile iron, which is used by Lie-Nielsen only, is about as strong as cast steel. A Lie-Nielsen plane should be safe from even sledgehammers. That strength comes at a cost, however; Lie-Nielsen's jack plane is

the most expensive in our test.

Another important difference between Lie-Nielsen's planes and the others is the cutting iron. Lie-Nielsen's A-2 steel iron has been cryogenically treated, which means you will have to sharpen it less.

Manufacturing

What really separates the inexpensive tools from the expensive



ANANT

This India-manufactured tool has its followers, and it's no wonder. You can purchase a complete set of seven Anant planes for \$4 more than a single Lie-Nielsen jack plane. Of course, the real question is: Should you? The sole was remarkably flat on the Anant, second only to the Lie-Nielsen. But the iron needed a lot of work to be serviceable. Fine-tuning the plane to take a nice smoothing cut proved tricky. The adjustment knob had to be spun more than three times before the iron would advance or retract — more than any other plane in our test. Also, the adjustment knob had sharp edges that needed to be sanded down before it would be comfortable. We give the Anant points for wooden handles, but they were lumpy and poorly finished. You can easily refinish the handles for a custom fit. In all, the Anant did better than expected, though we found the vintage and premium-priced planes outmatched it. Available from Woodworker's Supply at 800-645-9292.

CLIFTON

The toughest skirmish in our test was when we pitted the Clifton against the Lie-Nielsen. Both are based on Stanley's long-discontinued Bed Rock model, and both excel on nearly every front. The biggest disappointment with the Clifton came with the sole. It needed a lot more work than the Lie-Nielsen's — in fact, the largest gap we could find between the sole and a straightedge was more than three times bigger than the gap we found on the Lie-Nielsen. That said, we've set up three other Clifton bench planes that had soles that were much flatter than this one. Once fettled, the Clifton is a real champ at the bench. It has excellent heft and feel, and the adjustment knob is responsive to your slightest whim. The Bubinga handles are comfortable in use and attractive when at rest. If you cannot quite swing the cash for a Lie-Nielsen, then you should definitely purchase a Clifton. For a list of dealers, contact Robert Larson at 800-356-2195 or www.rlarson.com.

LIE-NIELSEN

At \$300, you're probably wondering if this tool is intended for collectors or users. While I know of a few people who collect these tools, the Lie-Nielsen was designed for hard use and will earn its keep in your shop. Of all the planes in our test, the Lie-Nielsen required the least fettling. The sole was in exceptional shape out of the box (it took a lot of searching to find any gap between the sole and straightedge). The blade was in perfect shape and ready for a light honing. And all of the parts mated perfectly. In use, the Lie-Nielsen is at the top of the heap. Everything moved smoothly and the plane was taking long, wide and wispy shavings from a board with only slight adjustments. The cherry handles are beautiful and comfortable. The Lie-Nielsen is a combination of excellent manufacturing and premium materials (including indestructible ductile iron and rustproof bronze). For these reasons, it is a lifetime tool. Available from Lie-Nielsen at 800-327-2520 or www.lie-nielsen.com.

Plane

by Christopher Schwarz

Comments or questions? Contact Chris at 513-531-2690 ext. 407 or chris.schwarz@fupubs.com.

ones is the care taken to fit the parts into a tool that is easily set up and adjusted. This truly is the “fit” in fit and finish.

If a frog doesn't mate well with the body casting, you're in for a world of hurt. The only thing you're going to make is chatter marks. If the sides of the plane aren't ground at 90° to the sole, you'll never be able to shoot an

edge that's 90°. And if the sole isn't ground reasonably flat, or if it warps because it wasn't properly stress-relieved, you don't have an inexpensive plane in your hands, you have an expensive anchor for a bass boat.

As a result, one of our primary concerns was how all the parts worked together. We checked each sole for flatness by placing

a straightedge across the sole and measuring the low spots using a feeler gauge. We checked the flatness of each frog face by flattening them on a diamond-impregnated sharpening stone and checking our progress. We also checked the cutting irons in a similar way by flattening the irons' cutting faces on the diamond stone.

At last it was time to cut some

wood. After lapping the soles, frogs and irons flat, we set up these planes for use. All of the editors tried the planes on a variety of hardwoods, softwoods and exotics. To test the durability of the iron's edge, we used each plane on an exceedingly nasty piece of purpleheart and then observed the cutting edge to see how dull it had become.



RECORD

We were dismayed by the poor fit and finish on the test model we purchased. One side wing was poorly ground and the back of the iron was completely and weirdly discolored. The sole was in average shape. However, this plane has got it where it counts. I like the cap that uses a screw instead of a lever to secure the iron assembly, which is the mechanism on all the other planes in our test. The shape of the handles is nice, though the plastic gets slippery after a few minutes of hard use. All the adjustments were smooth, and the Record was easy to get set up and cutting. The fact that there was no frog adjustment screw at the rear makes adjusting the frog a tricky matter, but this function isn't as important as it is on a smoothing plane. If this plane is on your shopping list, we recommend you examine it before you buy, or be ready to send it back to the cataloger if the plane doesn't meet your personal expectations. Available from Garrett Wade at 800-221-2942 or www.garrettwade.com.

SHOP FOX

The latest entry to the world of jack planes comes from China with an attractive price tag. While this tool has some things going for it (such as an oversized adjustment knob and half-decent blade) it struggled on some other fronts. Most notably, the chipbreaker was entirely too springy and bent the iron when engaged. Once we hammered out a good deal of the spring in the chipbreaker, things started to work better. Like the Stanley 12-205L, the Shop Fox was difficult to tune initially. If the cap iron screw was even slightly overtightened, the blade would refuse to advance or retract. If you loosened the screw, you would quickly run into chatter problems. The handles are painted wood, which is better than plastic, but the front knob was a bit too small for average-sized hands. All in all, we think you might want to wait a bit for the manufacturers to work the bugs out of this one before you buy it. Available from Grizzly at 800-523-4777 or www.grizzly.com.

STANLEY TYPE 11

This flea-market special really held its own against its shiny new cousins. We restored four of these vintage planes and found that they all needed as much work as a mid-priced new tool. They also needed a new iron. Spend the extra \$30 to buy an aftermarket Hock iron (888-282-5233) or one from another manufacturer. You will be amazed at the difference it makes. Once your plane is set up (expect a long afternoon of work), we think you'll be pleased. The rosewood handles are a pleasure to hold. Iron adjustment is smooth (though we've all found the blade adjustment knob to be a little on the small side). Our only caution in buying one is you have to keep a sharp eye for cracked or rewelded castings, and soles that are warped or bent because they were dropped while in service. If you're a scrounger and are willing to do a little work on your plane, we recommend the Stanley Type 11 as a best buy. Available at flea markets and www.ebay.com.

STANLEY 12-205L

Stanley makes a “contractor grade” version of this tool with a few more niceties (a frog adjustment screw, brass fittings and more machined areas between the frog and body casting). We've tested that version, too, and if you buy a new Stanley jack plane, it's the one to buy. The 12-205L has a plastic knob for adjusting the iron that's difficult to use; and getting the chipbreaker, lever cap and cap iron screw all working together takes some intense fiddling. If the screw is too loose, the plane will chatter on your work. If the screw is too tight, the iron won't move when you turn the blade adjustment knob. Speaking of that knob, you need to turn it two complete revolutions before it will advance or retract the blade. The contractor version is more on par with the Record in performance and ease of use. If you buy a new English-made Stanley for fine woodworking, spend a few extra dollars to get the upgraded version. Available from Amazon at www.amazon.com.

	ANANT	CLIFTON	LIE-NIELSEN	RECORD	SHOP FOX	STANLEY TYPE 11	STANLEY 12-205L
Street price	40	200	300	70	44	8 to 40	47

MATERIALS

Base	grey iron	grey iron	ductile iron	grey iron	grey iron	grey iron	grey iron
Frog	grey iron	grey iron	bronze	grey iron	grey iron	grey iron	grey iron
Handles	wood	bubinga	cherry	plastic	wood	rosewood	plastic
Adjustment knob	steel	brass	bronze	brass	brass	brass	plastic

BLADE/FROG ASSEMBLY

Thickness of blade (in.)	.079	.118	.115	.091	.076	.078	.079
Thickness of chipbreaker (in.)	.078	.123	.068	.072	.075	.069	.074
Fine frog adjustment?	yes	yes/Bed Rock	yes/Bed Rock	no	yes	yes	no
Machined area* (sq. in.)	3.07	10.02	9.15	1.59	1.78	2.76	0
Initial blade face flatness (1-5)	2	5	5	3	4	2	5
Initial chipbreaker alignment (1-5)	2	5	5	3	2	3	3

OVERALL STATS

Weight (lbs.)	4 lbs. 6 oz.	5 lbs. 13 oz.	5 lbs. 5 oz.	5 lbs. 7 oz.	5 lbs. 4 oz.	4 lbs. 6 oz.	4 lbs. 7 oz.
Fit & finish (1-5)	2	5	5	3.3	2.6	varies	2
Initial sole flatness (1-5)	4	3	5	3	2	3	3
Largest gap in sole (in.)	.002	.005	.0015	.004	.014	.005†	.005
Sides square to sole?***	.006/.007	square	square	.007/.010	.007/.008	.007†	.005/.006
Comfort of handles (1-5)	2	5	5	3.7	3	4	2.3

KEY

Ratings are based on a 1-5 scale with "1" being "poor" and "5" being "excellent." *The "machined area" is the amount of cast iron that was machined between the frog and the base casting. This number does not take into account holes bored into the machined areas. ** This measurement is the gap on each wing beneath an engineer's square. For those planes that were not ground square to the sides, these gaps translated to between 1/4° to 1/2° off of 90°. † This measurement is an average of four Type 11 planes tested.

I think it's generally fair to say you get what you pay for when it comes to jack planes. But it's not fair to say that the inexpensive planes were universally bad. It's more accurate to say that the manufacturing was inconsistent with the lower-priced tools. For example, the sole of the Anant was outstanding, but the iron required an unacceptable amount of work (that is, I was looking longingly at my belt sander when flattening the frustrating cutting face). On the Shop Fox plane, the situation was reversed. The sole was quite warped (I tried the belt sander on this one), but the iron was in nice shape. Of all the planes, the one that required the least setup was the Lie-Nielsen. From the sole to the frog to the iron, everything mated perfectly and was as flat as you could want.

The Clifton was in the next best shape. Its only flaw lay in the sole, which required a lot more work than I expected. This could be an anomaly with the tool in our test, however. The other three Clifton planes I've set up (a #3, #4 and #7) had soles that were in better shape.

The rest of the planes required several long hours of work before they'd ever touch a board.

On the inexpensive planes, the area that requires most of your attention is, of course, the frog — particularly where all those parts sandwich together. This is the area where most of the inexpensive planes ran into trouble. The cap iron screw is what holds everything down. If it's too loose, your plane will chatter like a pair of wind-up teeth. If it's too tight, the iron will refuse to budge when

you turn the adjustment knob. You've got to find the sweet spot.

If nothing works, look to the chipbreaker as the culprit. If it's too springy, it will bend the iron, which forces you to really torque down that cap iron screw. Don't be afraid to bend the chipbreaker until you get a tight fit between the chipbreaker and iron. However, after you bend the chipbreaker, make sure the iron isn't bending under the pressure.

Conclusion: Real Cheap or Real Expensive

In the end, we came to the conclusion that there are two paths to follow. For those on a budget, we recommend you buy a vintage Stanley Type 11 plane, purchase an aftermarket Hock iron and spend a day in the shop tuning everything. You'll spend about

\$50 all told and end up with an outstanding tool.

The second path is with the premium planes. If you've never used a Lie-Nielsen or a Clifton, you're in for a real shock. There is an astonishing difference between these planes and the less-expensive tools. Once you've used one of these planes, you'll never want to go back.

It's our opinion that the Lie-Nielsen edges out the Clifton thanks to its superior materials (ductile iron, bronze and the cryogenically treated A2 iron) and the unerring consistency of its manufacture. However, if \$300 is just too much to spend, you'll be well served by the less expensive but impressive Clifton plane. **PW**

BUILDING A CHILD'S Double Dulcimer



This project is simple enough to build with your kids, and nice enough that you'll want to make one for yourself, too.



The Appalachian dulcimer fascinates me, first, because its plaintive music is a link to earlier times, and second, because it is so easy to build and play. Ten-year-old twins of a friend gave me the excuse I needed to build my fourth dulcimer — this time an unusual double, or “courting” dulcimer, to be played by two people at once.

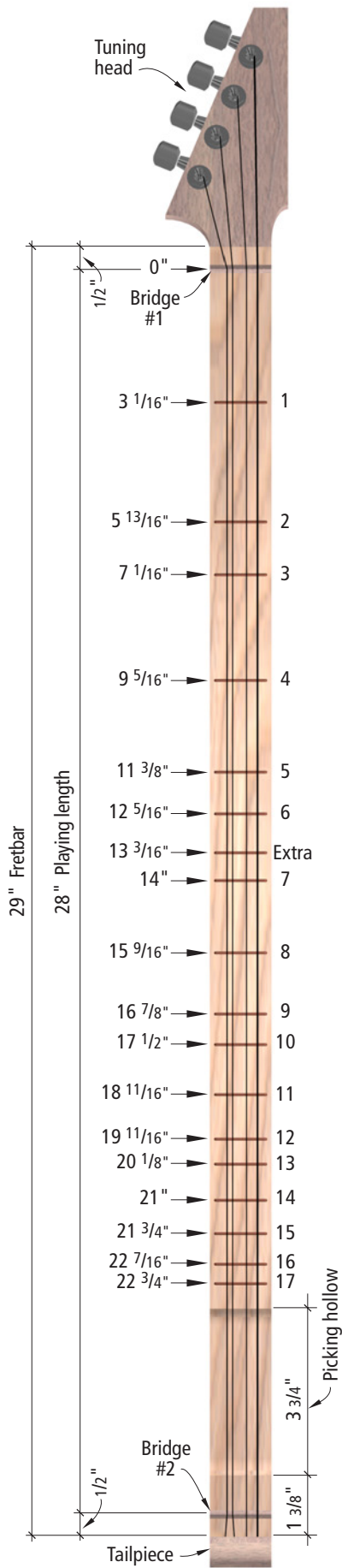
Designed for fun and rugged service, Debi and John's instrument turned out to be one of my easiest and most satisfying projects.

Construct the Sound Box

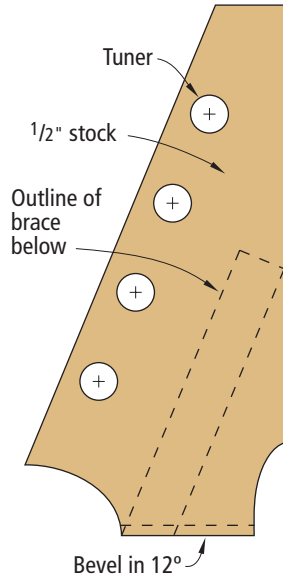
The straight sides of this design make this part easy. Glue the side and end pieces to the bottom to form a shallow, open-topped box. From $\frac{1}{4}$ "

by Claude Crowley

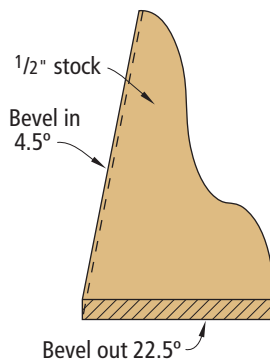
Claude Crowley builds dulcimers and the occasional Kentucky long rifle in Ft. Worth, Texas



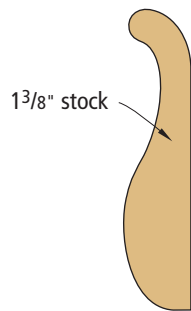
All patterns shown half-scale



Tuning head plan



Tuning head brace plan



Tailpiece profile



Heart cutout plan

square stock, make two light, open braces, like the ribs in an airplane's wing, $\frac{1}{4}$ " x $1\frac{3}{4}$ " x 15". Glue them across the bottom, one-third of the way from each end. Leave the top open for now.

Dueling Fretbars

Cut two fretbar blanks 29" long. Before you build your fretbars, however, decide if your instrument will be for left- or right-handed players. (More on that later.) Using a square, pencil a line across the fretbar about $\frac{1}{2}$ " from one end. Bridge No. 1 (called a "nut" by professional instrument builders) will go here. This is the tuning head end.

Physics dictate that the playing length of the strings must be 28" — so exactly 28" from bridge No. 1, make a mark for bridge No. 2, at the tailpiece end.

Lightly pencil each fret's position following the fretbar layout diagram at left.

A quick word about the fret at $13\frac{3}{16}$ ". Some people consider this fret unnecessary. I can't remember where I learned about adding this extra fret. Many old dulcimers don't have it — but I know from experience that many tunes can't be played without it.

Before installing the frets, cut out the picking hollow using a band saw or coping saw. Make it about $3\frac{3}{4}$ " long, starting $1\frac{3}{8}$ " from the tailpiece end.

Use $\frac{3}{64}$ " brass rods for making the frets. Starting with pieces slightly more than 2" long, bend $\frac{1}{2}$ " legs down from each end with square-nosed pliers. After making each bend, use the pliers as a mini anvil and lightly hammer the staple corners square. With a little practice, you'll soon be hammering out perfect little croquet wickets, 1" wide, with $\frac{1}{2}$ "-long vertical legs. Make 18 for each fretbar. Now draw two parallel lines lengthwise on the fret-



This is what your frets will look like after the ends are bent down for insertion into the fretboard.

bars to align the frets, $\frac{3}{16}$ " from each edge. Drill pilot holes where the fret lines and alignment lines cross and tap in the staples. Use a straightedge to get them level with each other.

Traditionally, the dulcimer is a three-stringed instrument. When a fourth string is added, as I have done, the extra string is placed about $\frac{1}{8}$ " from the third string.

The "twin" string reinforces the volume of the melody and is fretted and strummed with its sibling as a single string.

For the bridges, use a bit of hardwood about double the size of a kitchen match, or a little more. Cut four string notches in the bridges at $\frac{3}{8}$ ", $\frac{1}{2}$ ", $\frac{13}{16}$ " and $1\frac{1}{16}$ " from the end that will be closest to the player, just deep

DOUBLE DULCIMER

NO.	ITEM	DIMENSIONS (INCHES)			MATERIAL
		T	W	L	
□ 2	Soundbox sides	$\frac{1}{4}$	$1\frac{3}{4}$	29	Birch ply
□ 2	Soundbox ends	$\frac{1}{4}$	$1\frac{3}{4}$	15	Birch ply
□ 2	Soundbox top, bot.	$\frac{1}{8}$	16	$29\frac{1}{2}$	Birch ply
□ 4	Long rib brace	$\frac{1}{4}$	$\frac{1}{4}$	15	Hardwood
□ 8	Short rib brace	$\frac{1}{4}$	$\frac{1}{4}$	$1\frac{1}{4}$	Hardwood
□ 2	Fretboards	$\frac{5}{8}$	$1\frac{3}{8}$	29	Hardwood
□ 2	Tuning heads	$\frac{1}{2}$	$2\frac{3}{4}$	$5\frac{3}{4}$	Hardwood
□ 2	Tuning head braces	$\frac{1}{2}$	2	$3\frac{1}{4}$	Hardwood
□ 2	Tailpieces	$\frac{3}{4}$	$1\frac{3}{8}$	$3\frac{1}{8}$	Hardwood
□ 4	Bridges	$\frac{1}{8}$	$\frac{3}{8}$	$1\frac{3}{8}$	Dense wood

enough to hold the strings slightly above the frets. Seat and glue bridge No. 1 at your mark on the tuning head end. Don't glue bridge No. 2. It is held in place by string tension, and it can be adjusted slightly by sliding if needed.

$\frac{1}{8}$ " thick for this critical part. I used $\frac{1}{8}$ "-thick birch plywood.

The soundboard must have holes to let the music out. No one hole shape works better than another, so take your choice of hearts, scrolls, diamonds, stars or just plain circles.

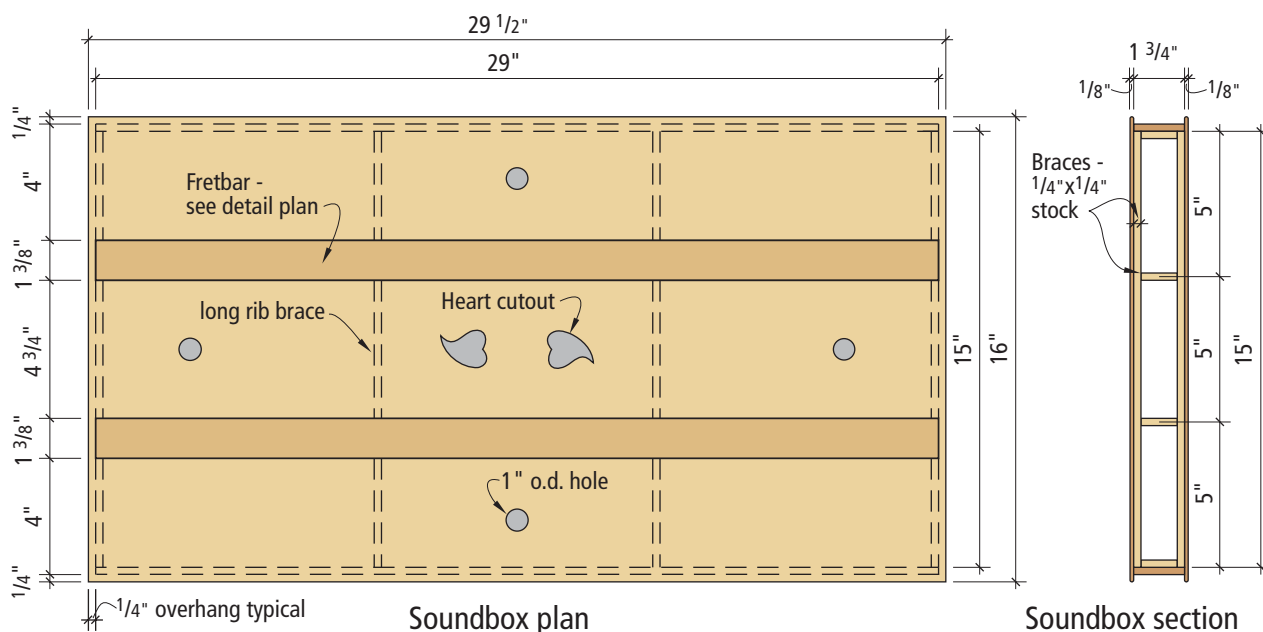
A Sound Soundboard

A soundboard that's too thick will give the instrument a "dead" sound. One that's too thin can be punched or damaged during normal use. Heavy woods, such as oak or hickory, will penalize sound quality. Select a springy, responsive piece of wood about

Heads and Tailpieces

The tailpieces anchor the strings on the end opposite the tuning head. The shape is arbitrary. Create a design that suits you or use mine on the previous page.

The tuning heads slope down slightly in relation to the fret-





In this photo, you can see how the ribs look before you add the soundboard. This particular dulcimer was built to be played by a right-handed person on one side and a left-handed person on the other.

bar. Drill them as shown to accommodate the four mechanical tuners. Because tuner shafts vary in diameter from manufacturer to manufacturer, size the holes to accommodate your tuners (see the supplies box for a good source). Shape and glue braces to the tuning heads. Because of the angles involved, the tuning heads are a bit tricky. Take your time. Don't install the mechanical tuners yet.

Final Touches

I assumed that my young friends were both right-handed, and made the two fretbars alike, to point in opposite directions on the finished box so the children could play the instrument while facing each other. Fortunately, I learned that John is left-handed, and Debi is right-handed, so I made a new left-handed fretbar, which a southpaw can play comfortably. That's why the fretbars face the same way on the instrument shown in

the story at right that shows you how to play the dulcimer.

For you, this is decision time. Most people are right-handed, so if you want to please most people, make your fretbars exactly alike, but face them in opposite directions on the soundboard. As the performers play the instrument, facing each other, the dulcimer's picking hollows will be to each person's right.

Glue the fretbars directly on the soundboard, 4" from the sides.

Attach the tuning heads and tailpieces to the open-top soundbox with glue and screws at the precise location where the ends of the fretbars will butt against them on the completed piece. Reinforce these points inside with triangular blocks.

Now temporarily place the soundboard on the soundbox. Draw a line across each tailpiece where the top of the fretbar strikes it. Along this line, drill four downward-angling string holes $\frac{1}{4}$ " apart with an $\frac{1}{8}$ " bit. Make this hole about $\frac{1}{8}$ " deep. Then, with your smallest drill bit, drill into the countersink and through the dulcimer's tailpiece.

Create a small label with your name and the date. Glue it on

the inside of the bottom where it can be read through the soundboard holes.

For final assembly, apply glue on the edges of the soundbox and internal braces, and stick on the soundboard. If you have plenty of clamps, that's great. I didn't, and placed the dulcimer on the garage floor and used weights to get a good bond. I finished the instrument with a light stain and a couple of coats of low-gloss polyurethane varnish. Be careful while staining and varnishing around the sound holes to keep drips off your inside label. After the varnish is dry, screw the mechanical tuning keys onto the tuning heads.

Stringing, Tuning and Playing

Follow these instructions for each side of the dulcimer:

Stringing: Thread the three thinner strings (these are all .01" thick, the high "E" string on a guitar) through the tailpiece, beginning with the holes closest to the player. String the large string (.02" thick, or the "B" string on a guitar) through the last hole (farthest from the player). Fasten the strings to the appropriate posts



Here you can see the graceful curve of the tailpiece and the countersunk holes for the strings. I screwed the tailpiece and the tuning head braces through the sound box and into a triangular brace block, which you can see above.

on the tuning heads, and seat them in the bridge notches.

Now it's time to tune the instrument. Tighten or loosen the large string until the plucked sound matches "middle C" on a piano. Now hold the large string down at the fourth fret from the tuning head and tune the other three strings to this note. The result will be a harmonious bing-bing-bing-bong. Check with your library for other tuning styles.

If your frets are correctly placed, the sound will be pleasing. If it sounds discordant with the strings in tune, don't hesitate to fiddle with the tuning of the two strings furthest from you.

John and Debi were picking out "The Bear Went Over the Mountain," after only a few minutes of instruction — it's that easy. Press down the pair of strings closest to you (the melody strings) with a length of dowel about the size of a pencil. Slide the dowel back and forth on the fretbar over the two strings closest to you to select the notes desired as you strum with a soft pick down in the picking hollow. The dulcimer comes to life with a quaint, romantic buzz — almost a purr — straight from the hills and coves of Appalachia. When you and a friend or family member perform together on this unusual dulcimer, you'll be the hit of any gathering. **PW**

SUPPLIES

You can order a hardware kit for this project that includes the eight tuners and strings you need for \$25 plus UPS shipping charges. Be sure to mention if the dulcimer will be for right- or left-handed players. Contact: Bill Foley, German Village Music Haus, 350 S. Grant Ave., Columbus, OH 43215, 614-228-8467 12-9 PM EST, Monday-Saturday.



TIPS ON PLAYING THE DULCIMER AND A SONG TO TRY

Anyone who has had musical training can play a dulcimer at once. Press down the two strings closest to you (the melody strings) with a stick about the size of a pencil, and slide it back and forth over those strings to select the notes. You strum all four strings, but two are drones, and just hum along with the melody strings. The resulting mix is a quaint, romantic buzz (almost a purr).

Musically illiterate people, like me, can play, too, using the tablature system. This simply means playing by number. Here's how to do it:

Stick a strip of Scotch Removable Magic Tape on the soundboard alongside the fretbar. This will not damage the finish. If you don't have any Scotch Removable Magic Tape, get some. It has many practical uses around the shop.

Pencil a number for each fret on the tape, 1 through 18, starting at the end with the widest fret spacing. Now you're ready to play. You don't have to understand notes, clefs, octaves or any of that pesky stuff. Just press down on the melody string just to the left of the numbered fret to get the correct note.

Here is a numbered tune for you to start with:

The Bear Went Over the Mountain

5 5 5 5 4 5 6 5

The bear went ov-er the moun-tain,

5 4 4 4 3 4 5 3

The bear went ov-er the moun-tain,

5 5 5 5 4 5 6 9

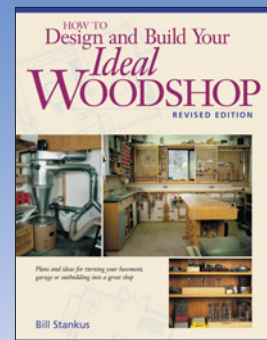
The bear went ov-er the moun-tain,

9 8 8 6 5 4 3

To see what he could see.

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Shaker Storage Cabinet

Maximize storage space in any cabinet with a couple of simple tricks.



The Shakers always had a knack for packing a lot of storage into a small space and making it look good. The three-sided built-in in the Center family residence at Pleasant Hill, Ky., is a prime example. You've probably seen a photo of it. It's the impressive cherry unit that's in an attic with a skylight that illuminates all 45 drawers.

It is in that spirit that I designed this two-door cabinet for a client in Ohio. The family needed to store an enormous number of board games and toys in a small space. The doors had to hide everything.

How to Pack Lots of Stuff Into Small Spaces

Organizing clutter is an interesting problem that you also might face as you design storage in your home or case pieces. Here's what I did: Behind the left door I put a series of five $\frac{3}{4}$ "-thick adjustable solid-wood shelves. These would handle the heavier games and books. Behind the right door is a series of $\frac{1}{4}$ "-thick tempered Masonite shelves. These 10 shelves slide in and out of $\frac{1}{4}$ " x $\frac{1}{4}$ " dados.

The Masonite won't hold a lot of weight, but it's just right for storing lightweight objects. Think home office, and you'll know what I mean. Masonite (sometimes called "hardboard") shelves are perfect for storing letterhead, envelopes, CDs and any other paper goods in an office. The other challenge in this piece was getting the shelves, doors and face frame positioned so they didn't interfere with one another. As you'll see in the drawings, it took a few pieces of "blocking" to get everything to work in this cabinet.

Face Frame First

This seems backwards, I know, but begin construction by building the face frame. The size of the case and doors are determined by your face frame, so it's clearly the place to begin.

When ripping out the material for the face frame stiles, cut them each about $\frac{1}{16}$ " wider than the dimension called for in the cutting list. This will make your face frame hang over the edge of the case sides. Once the face frame is attached, you can trim it flush for a perfect fit.

I use mortise-and-tenon joinery to build both the face frames and doors. The tenons are $\frac{3}{8}$ " thick and 1" long, and I usually cut a $\frac{3}{8}$ " to $\frac{1}{2}$ " shoulder on the edges. Be sure to cut your mortises $\frac{1}{16}$ " deep so your tenons don't bottom out. When everything fits, put glue in the mortises, clamp the frame and allow the glue to cure.

Doors are Second

Next, build the doors. It's much easier to fit the doors into your face frame before it's attached to the case. Build the doors much like you did your face frame by using mortise-and-tenon joints. The only difference is that you need to cut a $\frac{3}{8}$ " x $\frac{3}{8}$ " groove in the rails and stiles to hold the door panels.

I cut my grooves along the entire length of the stiles; as a result, I cut my tenons with a "haunch" to fill in that extra space on the ends of the stiles. The panels are flat on the front, and beveled on the backside so they fit in the grooves in the rails and stiles. I cut that bevel by setting my table saw blade to 7° and slicing off a little of the backside of each door until the panels fit snug and without rattling.

Sand the panels up to your final grit (120 will be fine for a painted piece) and assemble the doors. Sand the assembled doors and face frame and then

by Troy Sexton

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





I'm not perfect, and neither are you. If your face frame is exactly the width of your case, it's going to be difficult to fasten it square. Make life easier by ripping your stiles $\frac{1}{16}$ " oversize in width. After you nail and glue the face frame to the case, use a flush-trimming bit in your router to trim the face frame flush with the side of the cabinet's case.

peg the tenons if you like. I used square pegs that I pounded into round holes.

Finally, the Case

The case goes together quickly thanks to my nail gun. Begin construction by cutting a $\frac{3}{4}$ "-wide by $\frac{1}{4}$ "-deep dado in the side pieces for the bottom of the cabinet. I like to use a dado stack in my table saw for this operation. Now cut a $\frac{1}{2}$ " x $\frac{1}{2}$ " rabbet on the back edges of the sides to hold the plywood back in place. Sand the inside of the case and get ready for the first bit of assembly.

Put the case together on its back. First put glue in the dados in the sides and fit the bottom in



You could use a router and a straight bit to make this cut as long as you had a reliable way of guiding the router (such as an edge guide). I find a table saw is much faster for this operation.



You can see the haunch on the tenons on the rail closest to the camera. When it comes to fitting your panels, remember to work tight in summer and loose in winter. Panels of this size will shrink and contract noticeably.

there. Nail the bottom in place from the outside of the case. I use a finish nailer for this task.

Now put the nailing strip in place at the top of the case. The diagrams show you where this needs to be, but essentially it's flush with both the rabbets in the sides and top of the case. Nail it home. Glue and nail the face frame to the case using brads. Trim the face frame flush to the case.

All the Insides

There's nothing complicated



SHAKER STORAGE CABINET

NO.	LET.	ITEM	DIMENSIONS (INCHES)			MATERIAL
			T	W	L	
Face Frame						
□ 2	A	Stiles	$\frac{3}{4}$	$2\frac{1}{2}$	$51\frac{1}{4}$	Poplar
□ 1	B	Top rail*	$\frac{3}{4}$	2	45	Poplar
□ 1	C	Bottom rail*	$\frac{3}{4}$	$5\frac{1}{2}$	45	Poplar
Doors						
□ 4	D	Stiles	$\frac{3}{4}$	$2\frac{1}{2}$	$43\frac{3}{4}$	Poplar
□ 6	E	Rails*	$\frac{3}{4}$	$2\frac{1}{2}$	$18\frac{1}{2}$	Poplar
□ 4	F	Panels	$\frac{5}{8}$	17	$18\frac{5}{8}$	Poplar
Carcase						
□ 1	G	Top	$\frac{3}{4}$	19	50	Maple
□ 2	H	Sides	$\frac{3}{4}$	$17\frac{1}{4}$	$51\frac{1}{4}$	Poplar
□ 1	I	Bottom	$\frac{3}{4}$	$16\frac{3}{4}$	47	Poplar
□ 2	J	Dividers	$\frac{3}{4}$	$16\frac{1}{4}$	$45\frac{1}{2}$	Poplar
□ 1	K	Nailing strip	$\frac{3}{4}$	$1\frac{1}{2}$	$46\frac{1}{2}$	Poplar
□ 1	L	Blocking 1	$\frac{3}{4}$	$2\frac{1}{4}$	$45\frac{1}{2}$	Poplar
□ 1	M	Blocking 2	$\frac{1}{2}$	$1\frac{3}{4}$	$45\frac{1}{2}$	Poplar
□ 5	N	Adj. shelves	$\frac{3}{4}$	$16\frac{1}{4}$	$22\frac{5}{8}$	Poplar
□ 10	O	Masonite shelves	$\frac{1}{4}$	$16\frac{1}{4}$	$20\frac{1}{4}$	Masonite
□ 1	P	Back	$\frac{1}{2}$	47	$51\frac{1}{4}$	Ply

* = 1" tenon on both ends

about the insides once you have a plan. Begin by cutting the $\frac{1}{4}$ " x $\frac{1}{4}$ " dados in the dividers. These are spaced 2" apart, and there are 21 of them. I used a dado stack in my table saw and simply moved the fence $1\frac{3}{4}$ " after each pass.

Now it's time to add the dividers to the case. Turn the case on its head. Cut a notch in each divider so it will fit around the nailing strip. Get the divider right where it needs to be and nail it in place through the bottom and the nailing strip. Now nail the

two blocking pieces shown on the diagram in place. The blocking does a couple things. First, it allows the Masonite shelves to be slid in and out without having to swing the doors wide open. Second, the thinner piece of blocking fills in the gap between the divider and face frame and leaves room for the hinges.

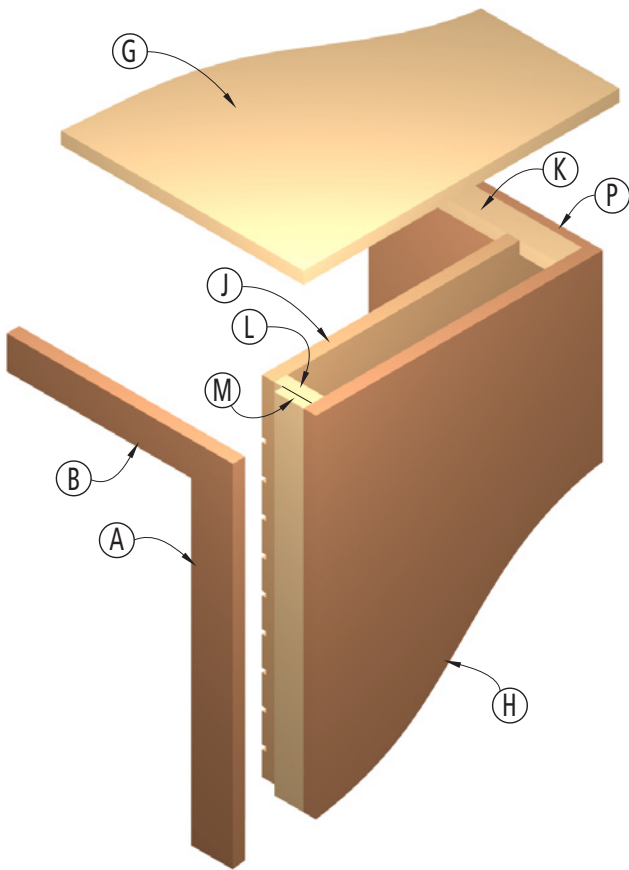
Now drill the holes in the left side of the case and the center divider for the adjustable solid-wood shelves. I'm partial to 5 mm holes spaced $1\frac{3}{8}$ " on center.



In addition to cutting this detail on the sides and front (above), I also cut it on the bottom of the plywood back, which gives it a finished look when the cabinet is viewed from down low or from a distance.

Once you nail the dividers in place through the bottom piece, turn the case over on its feet and nail through the nailing strip into the dividers (left).

Top right corner - exploded



Mark the base cutouts on the sides, front and plywood back of the case using the diagrams as a guide. Use a jigsaw to make these cuts and clean up your work with sandpaper.

Cut your top to size. I used a piece of bird's-eye maple. You have a couple options for attaching the top. You could use pocket holes, figure-8 fasteners or wooden cleats. No matter which way you go, prepare the case for the top but don't attach it. I like to glue the top to the front edge of the case after finishing.

Finishing

On the knobs, top and all the inside pieces (except the Masonite), I wiped on a light honey-colored stain. Then I painted the case a dark red and added a topcoat of lacquer to protect the paint. Hang

the doors, nail in the back and add the knobs.

I have no idea how the Shakers would feel about seeing one of their cabinets filled with "Parcheesi," "Connect Four" and "Uncle Wiggly" games. But I'm sure at least they would approve of the efficient use of space. **PW**

SUPPLIES

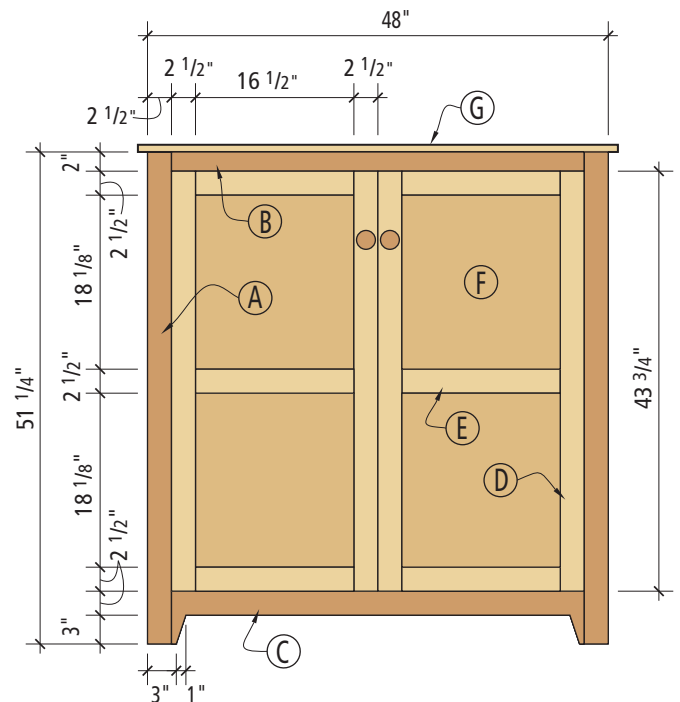
Woodworker's Supply
800-645-9292

Amerock non-mortising hinges,
#891-749, \$2.95 each

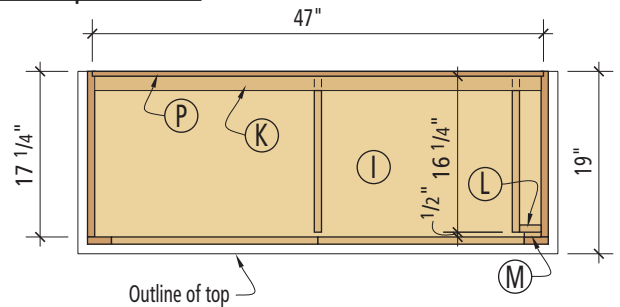
Horton Brasses
800-754-9127

Maple knobs, #WK-3, 1½" diameter, call for pricing

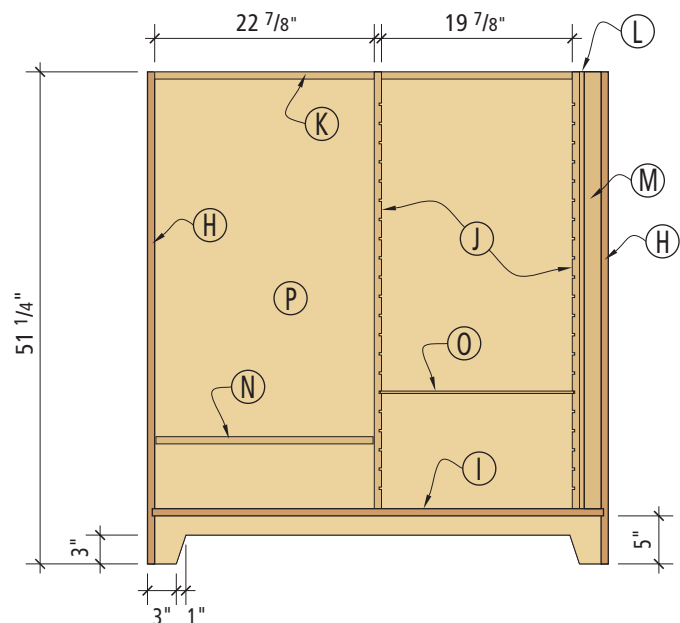
Elevation



Plan - top removed



Elevation - face frame & doors removed





Knockdown BOOKCASE

Designed to travel, this slant-sided bookcase was the perfect early-1900s answer to buying furniture through the mail.

The Arts & Crafts movement was part of an interesting social change in America — the advent of mail-order purchases. Catalogs from Sears, Roebuck and Co. and Montgomery Ward were all the rage, and many companies took their cue and offered their wares for sale through catalogs rather than set up expensive retail establishments throughout the country. While it was a great idea, it raised a difficult problem with furniture. The majority of space in any piece of furniture is air. While air is very light, it's also bulky and expensive to ship. So furniture makers perfected a style of furniture that continues today — knockdown furniture. Finished disassembled, the furniture could be shipped flat, then assembled by the owner. Through-tenons with tusks were the turn-of-the-20th-century answer, while hidden cam-locking hardware is the answer today.

Slanted Construction

This project is actually a very simple bookcase made challenging by slanting the sides. Many of the knockdown bookcases had straight sides, but why do things the easy way?

Start construction by preparing the panels for the sides and four shelves. If you aren't fortunate enough to have oak that's wide enough to make your sides using a single board, glue up the shelves or sides using two boards, but make sure the joint falls in the center of the finished panel. This is less important on the shelves; but since the sides come to a peak at the center, the joint becomes obvious if you're off the mark. Also, you can cut the top and bottom shelves to length, but leave the two center shelves long at this time. When the through-tenons are cut and fit, you can measure for the exact length of the center shelves.

Critical Pencil Lines

With the sides prepared, lay out the shelf locations, mortise locations and the overall shape in pencil on one of them. To allow you to do a minimum of angled or beveled cutting on the pieces, the shelves all fit into $\frac{3}{4}$ "-wide by $\frac{3}{8}$ "-deep dados cut at a 5° angle in the sides using the table saw. Because of this, the location of the shelves actually falls at an angle on the sides. A $\frac{1}{16}$ " difference in shelf height

By David Thiel

Questions or comments? You can contact David at 513-531-2690 ext.255 or at david.thiel@fwpubs.com.



After carefully laying out the shelf locations, use a dado stack (set at a 5° angle) and the saw's miter gauge to cut the angled dados.

one way or the other won't dramatically affect the use of the bookcase, but you must make sure that the dados are cut at the same locations on each side.

If you happen to have a sliding table on your table saw, you're in great shape. Most people don't, so the next best option to cut the angled dados is to use your miter gauge. If you don't have a substantial wooden fence attached to your gauge, now is a good time. A fence that is 18" to 24" long and about 3" high will work fine. You'll need to determine which way to orient the sides on your saw depending on the way the arbor of your saw tilts. With some of the cuts, the majority of the side will be supported by the miter gauge, and you can use your rip fence to guide your cut. When the larger section of the side will be between the blade and rip fence, this is an unsafe cut. The board

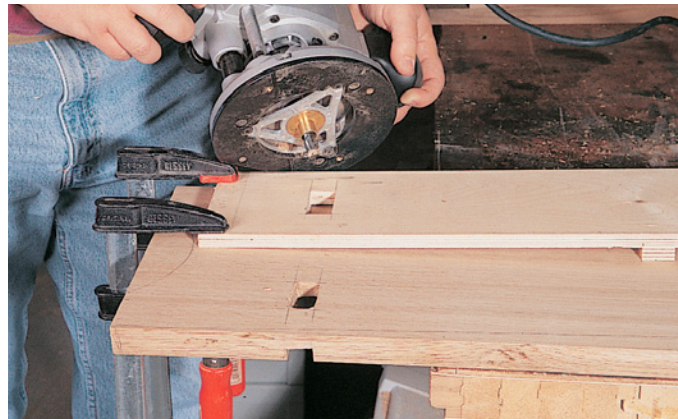
can twist and bind against the blade and cause a kickback. Move the rip fence out of the way, mark the sides and make the next cuts with only the miter gauge fence. With the dados complete, swap the dado with a crosscut blade, and bevel the bottom edge of each side at that angle.

Angled Mortising

The next step is the through-mortises. For these to work correctly, they also need to be cut at a 5° angle, and they must fall directly in the dados you just cut on the saw. You could cut them by hand, but the 5° angle is tricky to maintain. You could also set up a mortiser to do the job, but I got a little smarter and came up with a router template.

By using a piece of 1/2" Baltic birch with a strip added beneath one end, I made a router template that would make cuts at a 5° angle. It takes some rearranging of the guide for the different cuts, but the results work rather well.

Careful layout lines are critical here. To make the 5° ramp, I used a scrap piece of 1/2" material for the back strip, nailed to the template 14" from the end. Check this dimension carefully



This simple scrap-wood jig made angled mortises a fairly simple task.

on your materials to get as close to 5° as possible.

The rest is fairly simple. Check the offset on your router template guide from the bit, and add this to the 3/4" x 2" dimension for the mortise. Mark that size on the template and use a drill and jigsaw to make a square hole.

Clamp the template in place over the mortise locations and cut your through-mortises using two or three depth settings. Depending on the router bit you're using, you may want to use a backing board behind the side to reduce tear-out. I used a jigsaw and chisel to square up the corners.

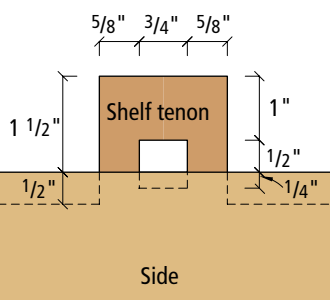
Shaping up the Sides

The next step is to cut the sides to their "spade" shape. I used my band saw for most of this work, but used a jigsaw to cut the radii under the top shelf and the arch at the bottom. Cut a little wide of your layout lines, then clamp the sides together, aligning the sides by the shelf grooves on the inside surface. Plane and sand the sides to matching shapes.

Fitting the Through-Tenons

Now it's time to fit things together. Start by checking the fit of your shelves in the dados in the sides. Mine were a hair thick, so I was

Detail of shelf joinery



With the sides clamped together and mounted in my vise, shaping the sides simply took some sanding and planing.



KNOCKDOWN BOOKCASE

NO.	ITEM	DIMENSIONS (INCHES)			NOTES
		T	W	L	
2	Sides	3/4	12	48*	
1	Bottom shelf	3/4	11 1/8	24 1/2	2" TBE
1	Top shelf	3/4	10	19 3/8*	2" TBE
1	Third shelf	3/4	9 7/8	19*	
1	Second shelf	3/4	8 11/16	17*	
8	Tusks	3/4	3/4	3 1/2	

* Oversized for fitting; TBE = tenon, both ends



A close look at the wedged through-tenons shows the recess behind the side that allows the wedge to pull the sides tight.

able to run them down on the planer to make an almost-perfect fit. Check the width of the bottom shelf against the width of the sides at the shelf location, now that the sides are shaped. Rip the shelf to size. Next, fit the shelf into the dado and, from the outside, mark the tenon location through the mortise on the end of the shelf. Remove the shelf and mark off the 2" length of each mortise, then head for the band saw again. The width of the tenons is the critical cut. The shoulder of the tenons should be neat, but that edge is buried in the side's dados, so it doesn't have to be perfect.

With the tenons cut for the bottom shelf, fit the shelf and sides together. You want a snug fit, but not too loose and not too tight. A chisel, file or rasp and some sanding should do the job. Take your time and get it right.

With the bottom shelf fit, check the dimensions on the top shelf, mark the tenons and repeat the fitting process. When that task is complete, fit the two center shelves and slide them into position. These shelves are designed to be left loose, but if they slide a little more than you like, a nail through the side into the center of the shelf will make a permanent solution, or you can drive a short wedge into the joint under the shelf for a temporary fix.

case together — disassemble the case and mark the 3/4" x 3/4" through-mortises on the shelf tenons as shown in the diagrams. I used my mortising machine to cut these holes. Another option is to use a drill press to cut the mortises and then square up the corners using a chisel.

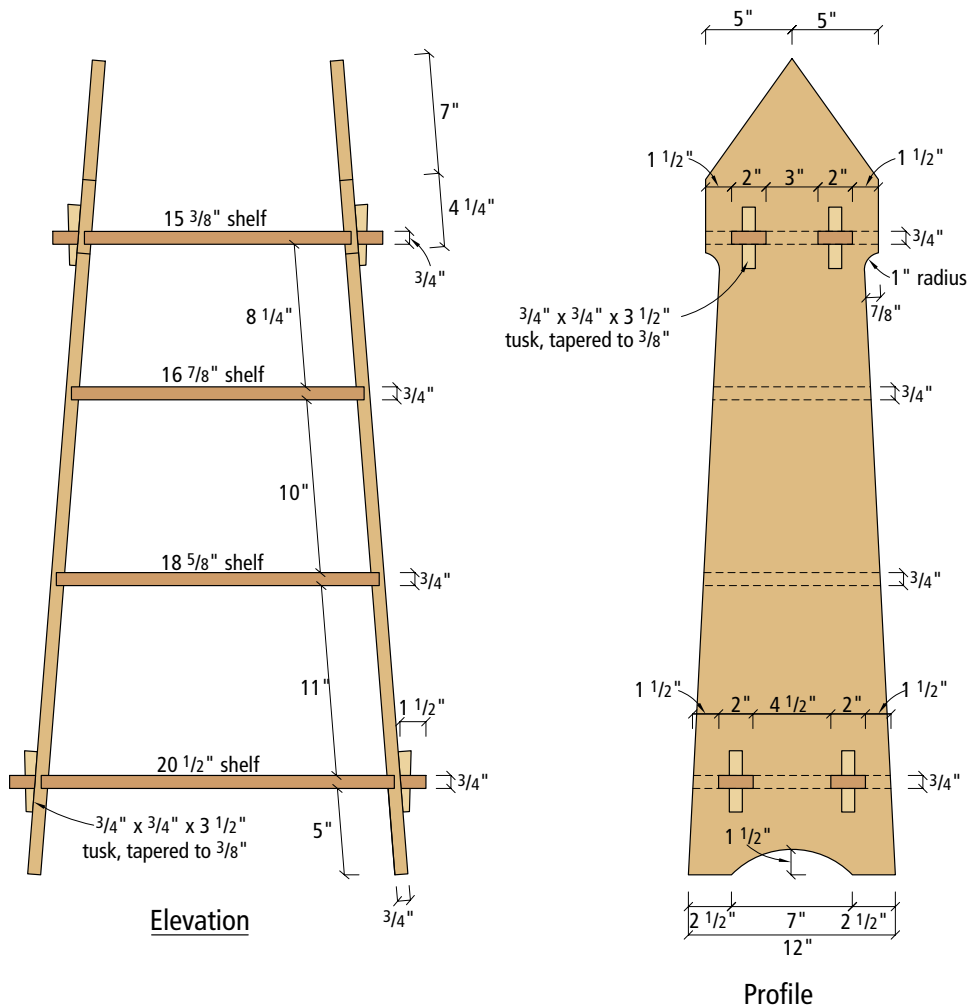
Reassemble the case, then cut the eight tusks. Appropriately,

the tusks should seat with their center at the shelf tenon. Fit the tusks as necessary, and tap them into place to make the whole case rigid. Now take it all apart one last time and sand everything to 150 grit.

For a finish, I used a simple dark-colored gel stain, wiping off

the excess until I was happy with the depth of the color. I then top-coated the case with a couple of coats of lacquer.

The nicest thing about moving this bookcase is that after you knock out the eight tusks, everything fits in the trunk of a compact car. **PW**



Tusks and the Home Stretch

To hold the top and bottom shelves in place — and the whole

Illustration by Jim Seward.

Mortising Jig



Make quick, easy and accurate mortises with this jig and your plunge router.

Most woodworking jigs fall into two categories: Those you use once and then pitch, and those you use over and over again. This mortising jig falls into the latter group. And if longevity and amount of use a jig gets is any indicator of value, consider this jig worth its weight in gold.

More than 20 years ago I made a version of this jig as a companion to my then-new plunge router (shown in the photo). The concept was shown in an early woodworking book by The Taunton Press by venerable woodworker Tage Frid. Both the jig and the router continue to see service in my shop, although I made a new jig for this article and added a couple new features.

Over the years, I've cut mortises by hand, with this jig and using a variety of benchtop mortising machines. I find one big advantage of router-cut mortises is the smooth wall of the mortise itself, which is certain to produce a stronger glue joint than those made with a chisel or mortising machine. The smooth surface is especially advantageous given the cross-grain condition of typical mortise-and-tenon joints. The jig also sets up quickly and provides a high degree of repeatable accuracy. Combine

the unit with an aftermarket router fence such as the Micro Fence (www.microfence.com) and set-up time is even faster. One downside to all router-cut mortises is the round, rather than square, ends produced. The problem is overcome most easily by rounding over the square corners of the tenons using a file.

Once the mortise location is drawn on a part, you secure your work in the jig using the built-in clamps. Lower the router bit to the height of the part and adjust the router fence to align with the mortise location. The forward and backward travel of the router is quickly limited by the jig's adjustable stops on the top of the jig's side. Set the depth of plunge on the router and you're ready to cut your mortise. Remember to pull the router toward you when making cuts; this uses the rotation of the bit to hold the router fence to the jig's side.

Jig Construction

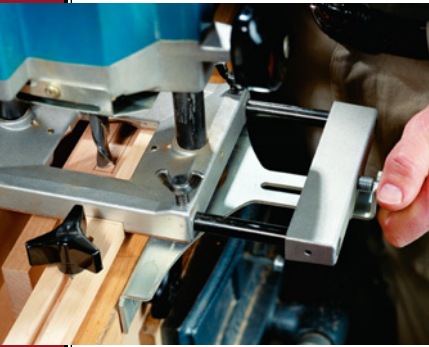
Building the jig is simple and should take an afternoon. When done, you'll be able to rout mortises for a set of table legs, for example, in less than 15 minutes, including set-up time.

Buy your hardware before building the jig. It is easier to drill the holes and install the barbed inserts in the side of the jig before assembly. These are placed in a $\frac{3}{8}$ " hole that's 2" deep on the top edge of the side. Take care to drill in the center of the plywood. Next, drill out a $\frac{1}{4}$ " hole in a length of $\frac{1}{2}$ " dowel that will both plug the hole and further secure the insert — yet allow the bolt to access the buried insert. Now drive in the threaded insert.

by Steve Shanesy

Comments or questions? Contact David at 513-531-2690 ext. 238 or steve.shanesy@fwpubs.com.





Set-up can be a snap. With the bit set to just clear the work piece, set the stops for the router, then adjust the router's edge guide to the mortise layout lines.

It's a good idea to place the side in a vise to prevent the plywood from splitting during this operation. When done, chase the hole with a 1/2" drill bit to the depth of the insert so the dowel will fit the hole. Next, glue the dowel in place. Go easy on the glue so you don't fill the inserts threads with glue. Apply the hardwood edgbanding on the tops of the jig's sides.

When making the bottom, first glue up an oversized double-thickness plywood blank. Cut it to final dimension, making sure your table saw blade is dead square to the saw table. This will ensure your side parts will be square to the part you are mortising. When the bottom is ready, glue and clamp the two sides in place. Keep the bottom edge of the sides in line with the bottom surface of the bottom part.

Clamping Mechanism

While this assembly is drying, make the parts for the clamp mechanism and the adjustable stops. Use hardwood and make them to the shape and dimensions given in the diagrams and cutting list. Make longer lengths that can later be cut to final size. It's both safer and faster.

Use a router in a router table to make the adjustable stops. First



Rout mortises making stepped cuts for safety. Each pass should be 1/4" to 3/8" deep. Pull the router toward you so the bit rotation forces the router's edge guide to the side of the jig.

cut them to width, then rout the groove below so that it is centered on the stock. Check the fit on the jig side. You want it to move freely but without side-to-side play. When done, rout the 1/4" slot. If you didn't move

MORTISING JIG

NO.	ITEM	DIMENSIONS (INCHES)			MATERIAL
		T	W	L	
□ 2	Sides	3/4	5	26	Plywood
□ 2	Bottoms	3/4	3 1/2	26	Plywood
□ 2	Edge bands	1/4	3/4	26	Maple
□ 2	Stops	1/2	1 1/4	7	Maple
□ 2	Clamp blocks	2	2	4	Maple
□ 1	Dowel	1/2			Dowel stock

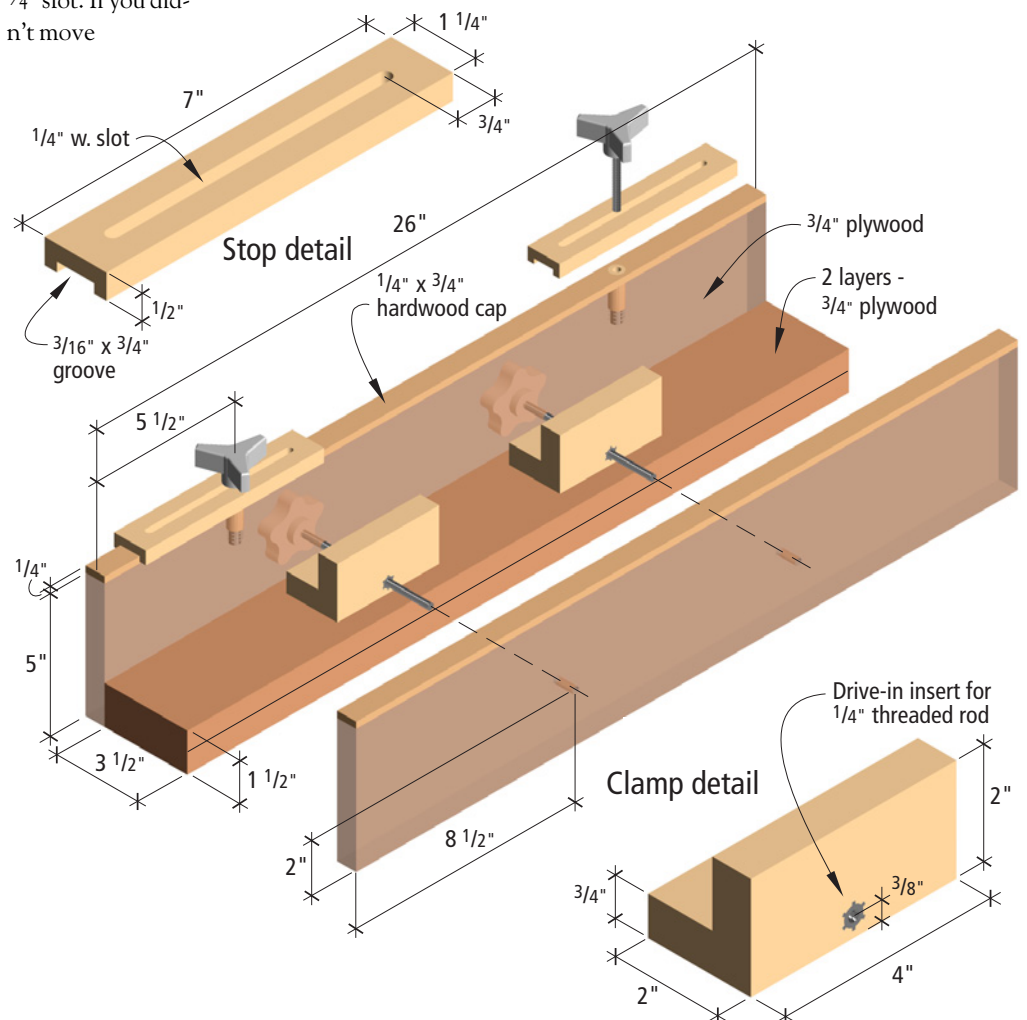
the router table's fence after routing the groove, it should be centered on the part. Take the jig out of the clamps, install the stops, bolts and knobs. Bore the holes for the clamp mechanism in the clamping blocks and jig sides. Also, install the threaded inserts in the clamp blocks. Complete the jig by installing the clamp assembly in the jig.

Tips on Use

When using the jig, be sure it is securely fastened to a bench or

held in a vise. You will also need to clamp a stop block on the inside of the jig's side to use as a gauge for placing successive parts in the exact same location.

Remember to make multiple passes when routing your mortises. I'd recommend no more than a 3/8"-deep cut at a time when using a router bit in the 3/8"- to 1/2"-diameter range. And as for bit selection, an up-spiral straight bit is best because the spiral design evacuates the waste up through the flutes in the bit. **PW**

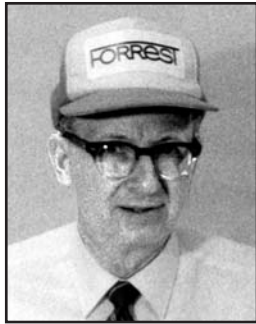




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Jim Forrest

Woodworker II

ALL PURPOSE – table saws and portable circular saws.

	Sale Price	10% Off First Blade	15% Off Second Blade
12" x 40T x 1"	\$129	\$116	\$110
10" x 40T (1/8" or 3/32" K)	\$119	\$107	\$101
10" x 30T (1/8" or 3/32" K)	\$99	\$ 89	\$ 84
8 1/4" x 40T (3/32" K)*	\$99	\$ 89	\$ 84
8" x 40T (3/32" K)	\$99	\$ 89	\$ 84
7 1/4" x 30T (3/32" K)	\$89	\$ 62	\$ 59
5 3/8" x 40T x 10mm (5/64" K)**	\$89	\$ 80	\$ 76

Also available: 14" x 40T x 1" • 14" x 30T x 1" • 12" x 30T x 1" • 9" x 40T • 9" x 30T • 8" x 30T (3/32" K) • 6" x 40T (3/32" K). Call for prices.

The 10" x 40T earned the Editor's Choice for the best performance regardless of price. American Woodworker April 1998, pp 68-69.

*For Sears & Makita **For DeWalt Cordless Portables

New! Customized Woodworker II

For the advanced table saw operator. Ideal for joinery and special uses!

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10" x 40T (1/8" K) #1 grind for square cut box joints.	\$130	\$117	\$111
10" x 40T (1/8" K) #6 grind for near flat bottom, easy feed.	\$130	\$117	\$111
10" x 40T (1/8" K) Dovetail joint grind. Specify angle & left or right points. See Fine WW12/01.	\$130	\$117	\$111
10" x 40T (5/64" K) Ultra thin kerf for precision work. Use stiffener plate.	\$130	\$125	\$118
10" x 20T (1/8" K) Fast feed rip for thick hardwood without burning, but finish is not smooth like WWII.	\$94	\$ 85	\$ 80

Dado-King

You get flat-bottomed grooves and no splintering—even when crosscutting oak plys and melamine. This award-winning set comes with six 4-tooth chippers (including 3/32" chipper), two 24-tooth outside blades plus shims. Cuts 1/8" to 29/32" grooves.

	Sale Price	10% Off First Set	15% Off Second Set
6" set	\$269	\$242	\$229
8" set	\$289	\$260	\$245
10" set	\$349	\$314	\$297
12" set	\$449	\$404	\$382

FREE \$21 value! 10" Blade Runner carrying case. Protects and holds up to 10 blades. Ships with 6", 8", or 10" Dado sets. Included free with your order!

Chop Master

Specially designed for sliding compound miter, miter-chop, and radial saws.

	Sale Price	10% Off First Blade	15% Off Second Blade
7 1/2" x 60T x 5/8" Makita Cordless Slide	\$105	\$ 95	\$ 89
8 1/2" x 60T x 5/8" Hitachi, DeWalt, Ryobi, Freud TR125	\$119	\$107	\$101
10" x 80T x 5/8" Delta, Bosch, Hitachi, Makita, Ryobi, AEG & all	\$139	\$125	\$118
12" x 80T x 1" Delta, Hitachi, Makita, B&D, Sears & all	\$149	\$134	\$127
15" x 100T x 1" Makita, Ryobi	\$199	\$179	\$169

Also available: 8 1/4" x 60T • 6 1/2" x 40T • 9" x 80T • 14" x 100T. Call for prices.

Duraline HI A/T

Cuts melamine perfectly. 220mm & 300mm available. Our best plywood blade.

	Sale Price	10% Off First Blade	15% Off Second Blade
10" x 80T (1/8" or 3/32" K)	\$159	\$143	\$135
12" x 80T x 1" (1/8" K)	\$184	\$163	\$154

14" x 100T x 1" • 14" x 80T x 1" • 16" x 100T x 1" • 8" • 7 1/4" and others. Call for prices.

Woodworker I

Designed for radial arm or tablesaws—fine crosscut.

	Sale Price	10% Off First Blade	15% Off Second Blade
7 1/4", 8", 8 1/4" x 60T	\$109	\$ 98	\$ 93
10" x 60T	\$129	\$116	\$110
12" x 60T	\$139	\$125	\$118

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Using a CUTTING LIST

A properly organized cutting list can prevent major errors (have you ever made a door too small?). Here are the basics for getting your plans on paper.

By now, every woodworker has heard the joke about the proverbial lumber stretcher. Cutting a board too short is a common mistake that most of us have made at one time or another. If it's just run-of-the-mill lumber, the stock can be used in another part of the project. But if the board is figured or part of a matched set from the same log, miscutting a board can be quite disappointing. One way to prevent this common mistake is to use a cutting list. What's a cutting list? Simply a chart that details sizes and quantities for each part in a project. By referring to a cutting list I'm able to avoid guesswork or mathematical errors. Organizing the parts on the cutting list into sub-assemblies also helps keep my projects organized and my work flowing smoothly. Obviously, a cutting

list is ideal for large, complex projects. But it also works well for small projects by providing me with a shopping list when I purchase lumber.

Getting Started

Organizing a cutting list is much easier if you begin with a drawing or a story pole. A story pole is simply a stick with all the linear dimensions for a project recorded along its length. Although a story pole can work well for simple cabinets and casework, I find that a drawing works best for more complex projects—especially those with compound curves such as chairs. As I study a drawing, I'll jot down the finished sizes for each

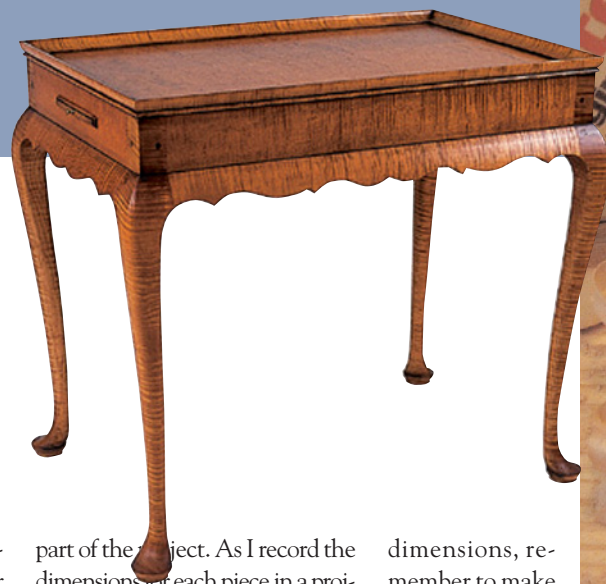
part of the project. As I record the dimensions for each piece in a project, I'll add extra length for a tenon or other joinery. When recording parts that will require careful fitting, I'll use rough dimensions instead. For example, when making drawers and doors for a case, I'll wait and mill all those parts to final size after the case is constructed to ensure I get a precise fit.

It's also a good idea to list the dimensions in the order that they are milled. The most common order is thickness, width then length. I typically work each dimension to final size in that order, so I use the same sequence on my cutting list.

As you're writing down the

dimensions, remember to make separate columns for quantities and materials. Obviously, symmetrical assemblies will require pairs. You often can save money on material by nesting mating parts, such as chair legs, together on the same plank. Unusually thin parts, such as dividers and partitions in a desk gallery, can be resawn from 4/4 stock. This, too, should be noted on the cutting list.

I also group sub-assemblies such as doors, drawers and case parts. This way I'll remember to mill mating parts and those that share common dimensions at the same time, using the same settings on the planer and table saw. This method is not only more productive, but it also helps ensure



by Lonnie Bird

Lonnie Bird (lonniebird@earthlink.net) builds period furniture and conducts woodworking seminars in Dandridge, Tennessee.

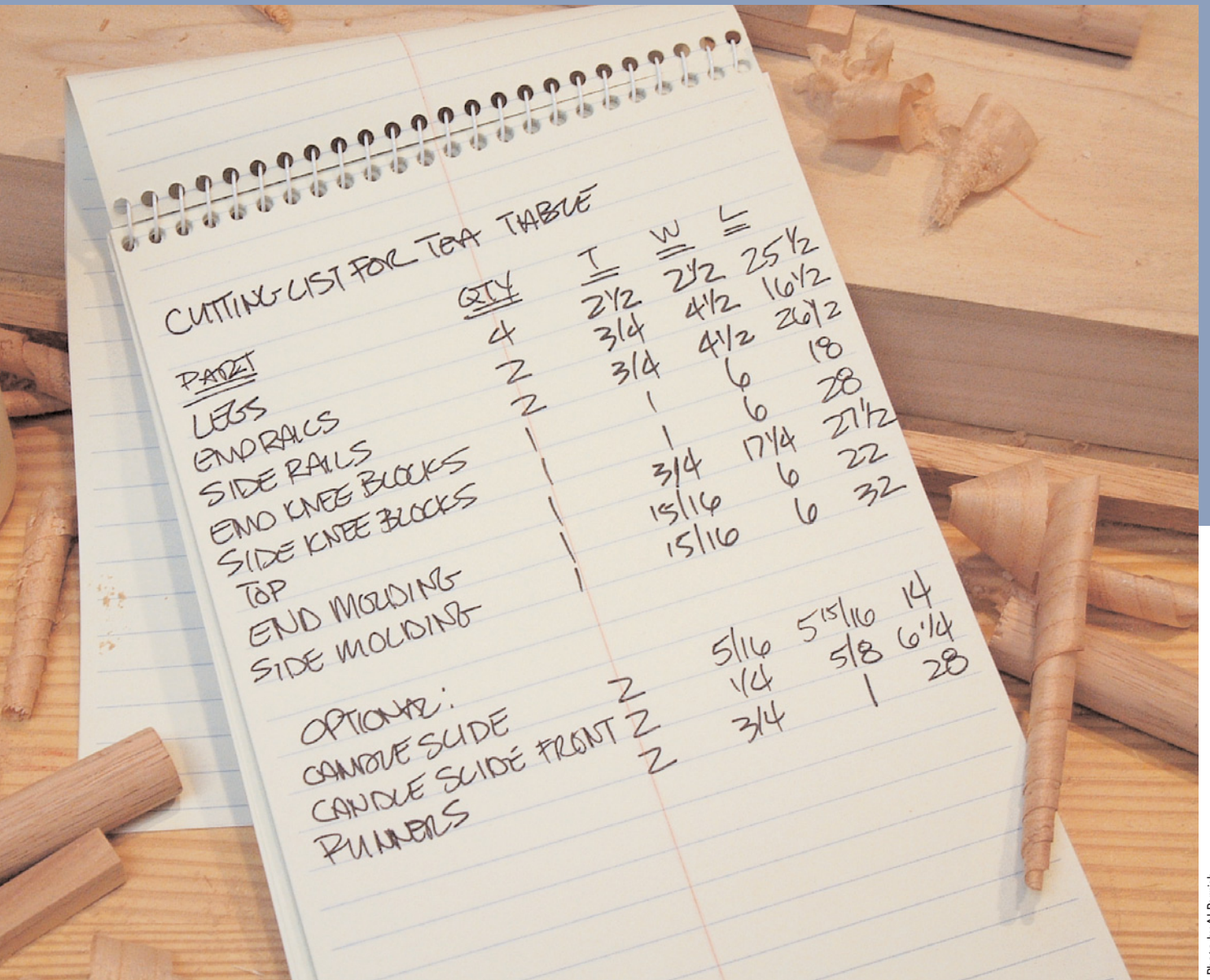


Photo by Al Parrish.

CUTTING LIST FOR TEA TABLE

PART	QTY	T	W	L
LEGS	4	2 1/2	2 1/2	25 1/2
END RAILS	2	3 1/4	4 1/2	16 1/2
SIDE RAILS	2	3 1/4	4 1/2	26 1/2
END KNEE BLOCKS	1	1	6	18
SIDE KNEE BLOCKS	1	3 1/4	17 1/4	28
TOP	1	15 1/16	6	21 1/2
END MOLDING	1	15 1/16	6	22
SIDE MOLDING	1	15 1/16	6	32
OPTIONAL:				
CANDLE SIDE FRONT	2	5 1/16	5 15/16	14
CANDLE SIDE REAR	2	1/4	5/8	6 1/4
PINNERS	2	3/4	1	28

a precise fit between parts that will be joined together later.

Using a secondary wood such as pine or poplar on drawers, case backs, and other surfaces that are normally hidden from view is another way to save money on materials. I also note this in a separate column on the list.

A cutting list isn't complete without columns to check off rough and final dimensions. To help prevent problems associated with wood movement, I always cut stock to rough size and allow it to acclimate in my shop for a few weeks (see "Wood Movement" *Popular Woodworking*

February 2002, issue #126). My cutting list tells me which material has been cut to size.

Putting the List to Use

Once the cutting list is complete, I'm ready to put it to use. As I search through my lumber storage shed, I keep the list close at hand for reference. I always begin by first scanning the list for the wide and long stock. Rough cutting the largest parts first allows them plenty of time to acclimate; and often the offcuts are suitable for smaller parts on the list. When rough cutting parts to size, always add to the finished dimensions on the list. For

thickness I add at least 1/4" for flattening the board and planing it to final thickness. For example, 3/4"-thick stock will require 4/4 material. Because wide boards will sometimes warp more severely as they dry, I sometimes find it necessary to use thicker stock.

As a rule of thumb, I add 1/2" to the final width and length. This is usually enough to joint the stock straight, rip it to its final width, and cut it to its final length.

Keeping It Handy

I keep all my cutting lists stored in a filing cabinet in my shop. I also like to keep a copy stored on

disk. This makes it easy to update the list or generate a new copy later on. And, when I'm designing a new piece of furniture that is similar to a piece I've already built, I can simply modify the existing cutting list. As you can imagine, this saves considerable time because I don't have to generate a totally new list from scratch.

When a project is complete, I store the cut list and construction notes along with a hardware list in my shop's file cabinet. The next time I receive a commission for a piece, I'm organized and ready to jump into the project. **PW**



\$30 Lumber Rack

It doesn't take a lot of time or money to build a flexible and sturdy rack for your rough lumber and offcuts.

In my family, we still remember the day my old lumber rack collapsed. I was upstairs with the kids when there was a sudden and horrible crash. The two cats ran in four directions; the baby started to wail. It was that loud.

When I went down the steps to the shop it looked like a giant box

of toothpicks had spilled everywhere. It seems the metal brackets I had bolted to the walls had reached their limit. One of the brackets gave way and everything came tumbling down.

So when I went to rebuild, I wanted something stout, simple and cheap. I pored over books and magazines for ideas, borrowed a few and made some changes. Here's what I came up with:

Pipe and 2 x 4s

Essentially, the backbones of this rack are 2 x 4s bolted on edge to the double top plate and the bottom plate of my shop wall. The bottom edges of your 2 x 4s should rest on something solid. In most shops,



Clamp all your pieces together when laying out the holes. This is faster and more accurate.

that means running them to the floor. In my shop, the lower half of my wall is cinder block, so I set the 2 x 4s on those. To hold the lumber, I drilled $\frac{7}{8}$ "-diameter holes through the 2 x 4s at 4" intervals and at a 5° angle. Then I inserted 12" lengths of $\frac{1}{2}$ " galvanized pipe in the holes. The $\frac{1}{2}$ " pipe, avail-

able in the plumbing section, actually has an exterior diameter of just under $\frac{7}{8}$ ", so it fits nicely.

Before you get started, there are a couple things to consider when building this rack for your shop. First, I used 12" lengths of pipe because I rarely have anything in my rack wider than 8". Wider lumber needs longer pipes. Plus, this rack is right over my jointer, so I didn't want the pipes to stick out any more than necessary.

Prep Your Lumber

I bought a single Southern yellow pine 2 x 8 that was 8' long for this project. By ripping it down the middle and crosscutting it into 4' lengths, I got four 4'-

by Christopher Schwarz

Comments or questions? Contact Chris at 513-531-2690 ext. 407 or chris.schwarz@fwpubs.com.



Because the table is at a 5° angle, it's easier to align your holes using the rim of the Forstner bit instead of the center spur.

tom plate of your stud wall. The location of the hole in the diagram is for a stud wall with a double top plate. Your wall may be different.

Now drill a 1³/₈"-diameter recess for the washer — it only needs to be deep enough to seat the washer. Then drill a 1/2"-diameter hole in the middle of the recess. Repeat this process on the other end of the board and

on the other boards. long 2 x 4s. If you don't have Southern yellow pine in your area, try vertical-grade fir or any other tough construction timber.

I ran the parts over my jointer and through my thickness planer to get them straight and true. They finished out at 1³/₈" thick and 3" wide.

Clearance Holes

The first thing to do is taper the ends of the boards and drill the clearance holes to bolt them to your wall. I used 4¹/₂"-long lag screws and 1³/₈"-diameter washers. You want the holes in your boards to be clearance holes — that is, you want the threads on the lag bolt biting only into the wood in the wall.

Examine the diagrams and you'll see that the easiest way to accomplish this is to taper the ends as shown. I used a band saw to cut the taper and cleaned up the cut with a hand plane.

The holes for the lag screws should be located so the screws enter into the top plate and bot-

Even More Drill Press Work

Now, drill the holes for the galvanized pipe. Chuck a 7/8" Forstner bit in your drill press and set the table at a 5° angle. This slight angle will use gravity to keep your lumber in the rack.

Clamp all the pieces of wood together with the ends aligned and make a mark every 4" across all four boards.

Now drill the holes through the boards. Because the table is at 5°, it's difficult to get the center of the bit to hit your line. So don't. Instead, align your holes so the edge of the Forstner bit touches the line instead of the center. It's much easier.

Pipes and Installation

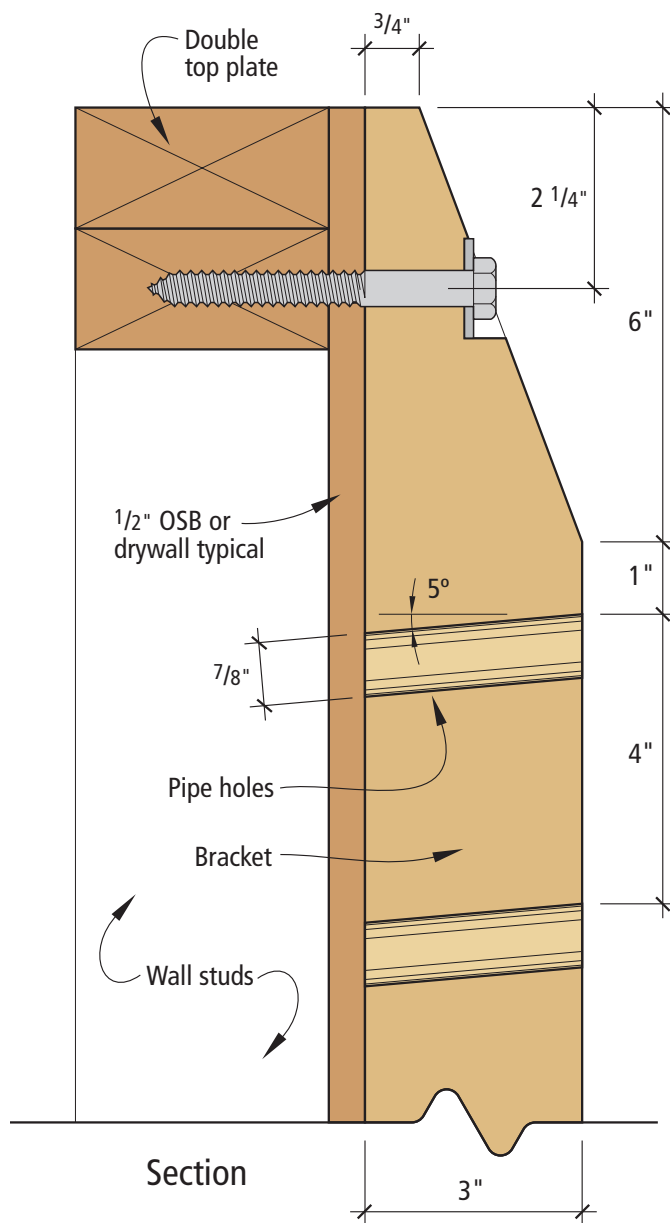
I bought galvanized pipe and cut it to length using a hack saw. Dress the ends using a grinder or file to remove the rough spots. Now get ready to install your rack.

Use a level to ensure your layout lines are plumb and parallel.

\$30 LUMBER RACK

NO.	ITEM	DIMENSIONS (INCHES)			NOTES
		T	W	L	
4	Vertical braces	1 ³ / ₈	3	48	Yellow pine
16	Pipes	1/2 ID		12	Galvanized pipe
8	Lag screws			4 ¹ / ₂	
8	Washers	1 ³ / ₈ dia.			

ID=interior diameter; the exterior diameter of this pipe is just under 7/8".

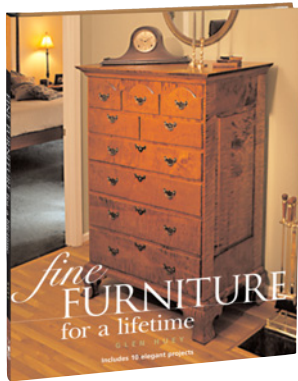


Mark where the bolts will go and drill pilot holes for the lag screws. Fasten the lag screws to the wall using a ratchet.

I think you'll see quickly how

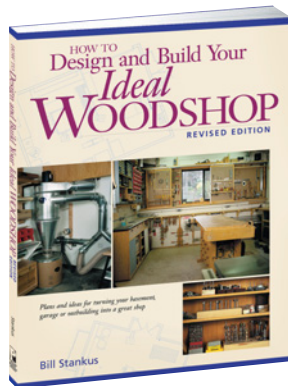
nice it is to have a flexible rack like this. You can reserve a couple pipes for short scraps, and add more pipes or braces as your lumber pile expands. **PW**

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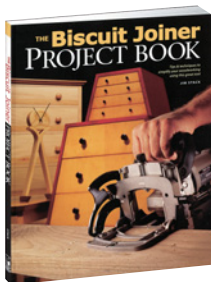


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seedling shelter



When it's freezing out and you want to get a jump on spring, nothing beats this cold frame.

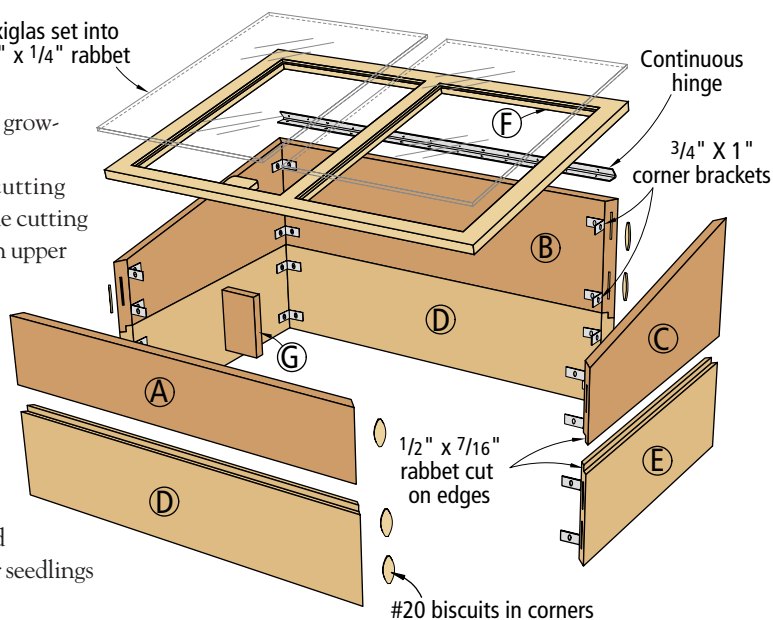
Not being much of a gardener myself, when my wife decided to get into gardening I had a learning curve to overcome. I wasn't aware that the growing season starts late in the winter months rather than the spring. Around here (Ohio) it's too cold to get the vegetables started without the aid of a cold frame. What's a cold frame? Simply a mini-greenhouse. The interiors should be painted with light colors to reflect as much light and heat as possible. The top is mostly glass (or Plexiglas) to generate solar heat, and the lid needs to be adjusted at least twice daily to prevent mold from growing because of the condensation that forms in this cozy little plant-friendly environment.

As designed, this cold frame will keep three flats of seedlings safe from the elements. I didn't feel like adjusting a lid all the time, and Lee Valley Tools came to the rescue with a heat-activated window opener that opens and closes as the ambient temperature changes, eliminating the daily lid adjustment. This project takes only a couple afternoons to complete, so you'll have your seedlings growing in no time.

Begin construction by cutting out the parts according to the cutting list. The box is made up of an upper and lower box that nest together in rabbets. Cut the box parts to size and mill the $\frac{1}{2}$ " x $\frac{7}{16}$ " rabbets in what will be the top edge of the lower box and the bottom edge of the top box. This rabbet allows the two boxes to nest together and make a taller unit when your seedlings mature and need the room.

After cutting the box parts to length, cut 45° angles on the ends and cut two biscuit joints in each corner. Clamp two halves of a joint together to form a square corner, making it easier to use a biscuit joiner. Dry-clamp the top box together and lay out the angle for cutting the pitch of the box to better catch the sun's rays. Use a jigsaw to cut the angle on the sides, then use a table saw with the blade angled

Plexiglas set into $\frac{1}{4}$ " x $\frac{1}{4}$ " rabbet



by Jim Stuard

Jim is a former associate editor and now divides his time on the projects he is most proud of: his children, his writing and teaching woodworking.

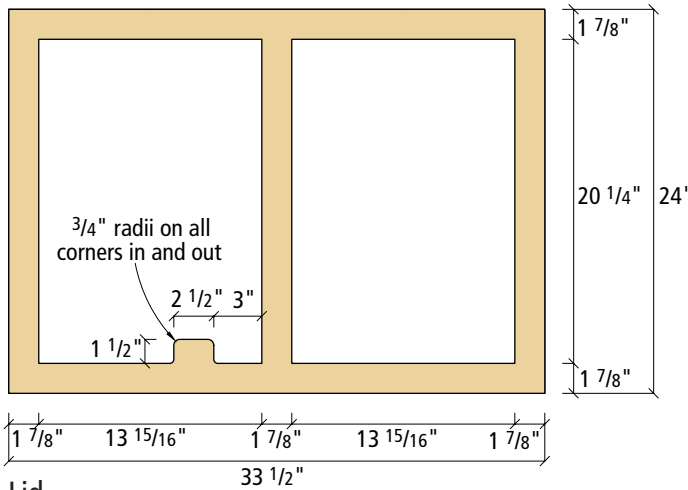
Photo by Al Parrish.

SEEDLING SHELTER

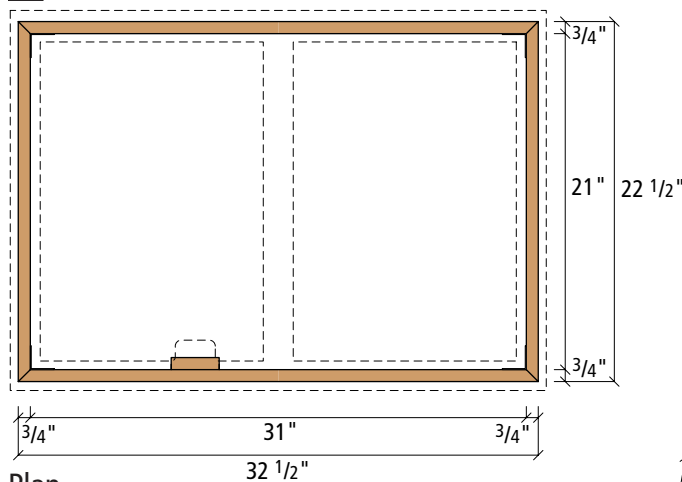
NO.	LET.	ITEM	DIMENSIONS (INCHES)			MATERIAL
			T	W	L	
1	A	Top box front	$\frac{3}{4}$	6	$32\frac{1}{2}$	CDX Ply
1	B	Top box back	$\frac{3}{4}$	10	$32\frac{1}{2}$	CDX Ply
2	C	Top box sides	$\frac{3}{4}$	10	$22\frac{1}{2}$	CDX Ply
2	D	Bot box frnt and bk.	$\frac{3}{4}$	$8\frac{1}{2}$	$32\frac{1}{2}$	CDX Ply
2	E	Bot box sides	$\frac{3}{4}$	$8\frac{1}{2}$	$22\frac{1}{2}$	CDX Ply
1	F	Lid	$\frac{3}{4}$	24	$33\frac{1}{2}$	CDX Ply
1	G	Hinge mounting tab	$\frac{3}{4}$	3	5	CDX Ply



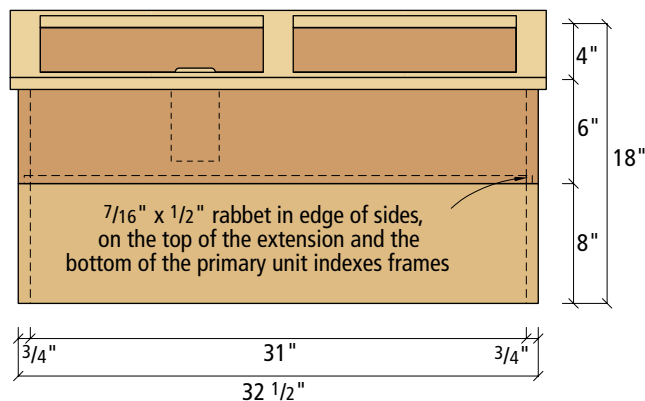
When your seedlings start to kick into high gear, you can add the second box to the seedling shelter to give them more room to grow.



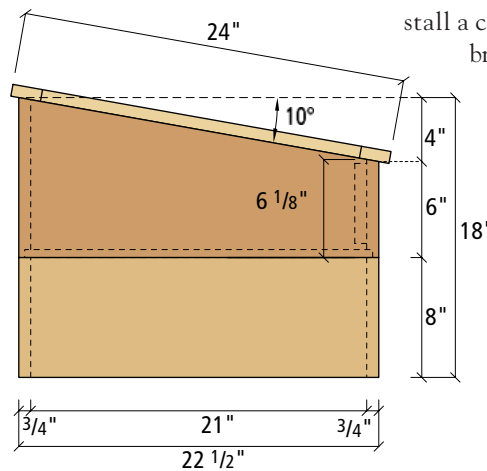
Lid



Plan



Elevation



Profile

to bevel-cut the top edges on the front and back pieces. You'll be cutting away one of your biscuit joints, but you'll be adding corner braces later to reinforce the frames. Use polyurethane glue in each joint to make the boxes water-resistant. When the glue is dry, plane all the edges flush and then check the fit between the top and bottom boxes.

Now make and attach the lid. Cut it out of one piece of plywood, then make the cutouts according to the diagram. Take a router with a rabbeting bit and cut a $\frac{1}{4}$ " x $\frac{1}{4}$ "-wide rabbet on the top edge of the cutouts to accommodate the thickness of the Plexiglas. The adhesive used to hold the Plexiglas in place later will leave it a little proud of the lid surface and will help the lid

shed water. The mounting tab for the window opener (Lee Valley Tools, 800-871-8158, item #AM401, \$36.50) is located between two seedling flats when they're in place. You'll have to plane the top of the tab so it's flush with the rest of the rabbet. Attach the lid with a piece of continuous hinge. Attach the window opener so it doesn't go beneath the bottom edge of the top box when it's on the ground. This takes a little finagling but it can be done. The openings for the Plexiglas pieces are the same size. Cut two "panes" to size and set them aside for later.

Go ahead and paint the entire cold frame with a durable outdoor paint. Use white or at least a light color for good reflectivity. Apply two coats to every surface. When the paint is dry, install a couple of metal corner brackets to each corner for extra support. Attach the lid; glue in the Plexiglas with epoxy and seal the rabbets in the lid with white caulk. Attach the window opener and apply weatherstripping to the joint between the lid and the frame.

Now get to the potting shed for some serious seedling duty. **PW**

CAPTION THE CARTOON

Illustrated by Bob Rech
bobrech@juno.com



#53

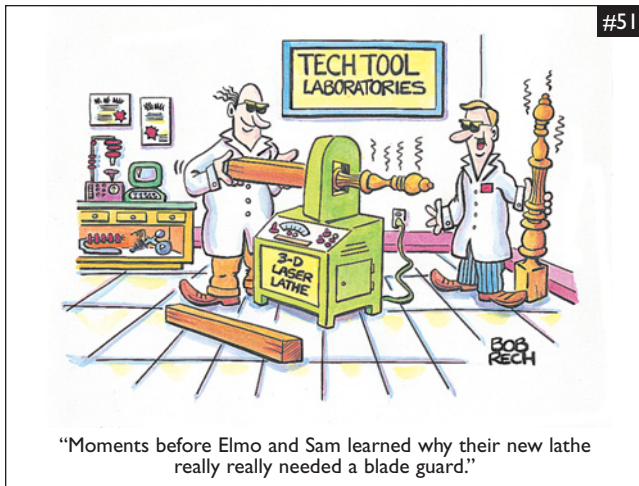
We Now Take E-mail Entries!

Submit your captions for this cartoon by e-mailing them to cartoon@fwpubs.com (be sure to put "Cartoon Caption #53" as the subject of your e-mail). Or send it to us on a postcard: *Popular Woodworking*, Cartoon Caption #53, 1507 Dana Ave., Cincinnati, OH 45207 by **May 1**. Winners will be chosen by the editorial staff.

The winner will receive the new Freud FJ85 Jigsaw with Electronic Cruise Control. This variable speed, 6-amp, orbital jigsaw offers toolless blade change and the cruise control keeps the blade speed constant under different loads to provide a finer, faster cut. The runners-up each win a one-year subscription to *Popular Woodworking*.



freud[®]



#51

"Moments before Elmo and Sam learned why their new lathe really really needed a blade guard."

Bruce Wilson, of Framingham, Massachusetts, is the winner of our Cartoon Contest from the December issue and recipient of a fine set of Freud router bits. The following runners-up each receive a one-year subscription to *Popular Woodworking*:

"We give the glasses free with each tool, get the price down to under \$1 million and think we have a winner!"
Tay Buono, Bound Brook, New Jersey

"A computer programmer, Star Trek fan and now woodworker. I just can't figure out why neither of us is married yet!"
John Moeykens, Stanton, North Dakota

"What do ya say we get a couple of pounds of bratwurst and see what it will do?"
Dan Landis, Goshen, Indiana

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Understanding Solvents and Thinners

You can change the properties of your finishes (such as making them dry more slowly) when you understand a few things about solvents and thinners.

Finishing can't exist without solvents and thinners – even water-based stains and finishes contain them. If you understand a little about them and how they relate to each other, you'll have more control of your work. You'll be able to speed up or slow down the drying time of your finish to compensate for the humidity or the type of project you're finishing. You'll also be able to manipulate the viscosity of your finish to make it flow better.

Though the terms “solvent” and “thinner” often are used interchangeably (and I will sometimes use the more general term “solvent” here to refer to both), they are actually quite different. A solvent is a liquid that dissolves a solid, such as a cured finish, while a thinner thins a liquid stain or finish. Sometimes a liquid just thins a finish, and other times it both dissolves and thins a finish. (See the table on the next page.)

Solvents are grouped in families. There are five, not including the special ones used in paint-and-varnish removers: petroleum distillates, alcohols, ketones, esters and glycol ethers. Each family reacts with a finish in a different way.

Within each family, solvents differ primarily in evaporation rate, with some evaporating rapidly at room temperature and others evaporating very slowly or not at all. The most well-known family with which to illustrate this relationship is the petroleum-distillate family.

Petroleum Distillates

Petroleum distillates are composed entirely of hydrogen and carbon and are distilled from petroleum and sometimes from coal tar. They are used in finishing primarily to thin and clean up oils and varnishes.

The smallest petroleum-distillate is methane, which is a gas at room temperature. Heptane



Photo by Al Parrish.

and octane are fast-evaporating liquids at room temperature and are used in gasoline. Naphtha evaporates slower than gasoline and mineral spirits (paint thinner) slower still. These are the petroleum distillates commonly found on paint store shelves and used most often in finishing.

Kerosene also is widely available, but it evaporates too slowly to be much use in finishing. Mineral oil (also called paraffin oil) and paraffin wax don't evaporate at all at room temperature. Paraffin wax, in fact, is a solid at room temperature.

You may have noticed in using these solvents that the slower the evaporation, the oilier the liquid substance. Mineral spirits is oilier than naphtha, and kerosene is oilier than mineral spirits. Mineral oil is oil. Because none of these distillations damage finishes, and because oily substances are effective at picking up dust and adding shine to dull sur-

faces, petroleum distillates are widely used as the main ingredient in furniture polishes.

Toluene (toluol) and xylene (xylol) make up part of naphtha and mineral spirits, and when removed leave these solvents “odorless” and also a little weaker in solvent strength. Toluene and xylene are used primarily as cleaners to remove oily substances from metals and wood, and to soften water-based finish, latex paint and white and yellow glue. You can remove any of these from wood by wetting and scrubbing with toluene or xylene.

Turpentine is a distillation of pine-tree sap and is equivalent to petroleum distillates in its chemical structure and uses. It is oilier and evaporates a little slower than mineral spirits, but it has a solvent strength similar to naphtha.

Other Families

Other solvents used in finishing also are mem-

bers of families, having the same relationships within those families as the individual petroleum distillates have within their family – evaporating more or less fast and being more or less oily.

Alcohols are used primarily to thin and remove shellac, and as an ingredient in lacquer thinner and many paint-and-varnish removers. Three alcohols used in finishing are common: methanol, denatured alcohol and glycol (usually propylene glycol).

Methanol evaporates the fastest and is used for thinning non-grain-raising (NGR) stains because the fast-evaporation helps control the depth of stain penetration when spraying. But methanol is very toxic, so it should be used only with adequate ventilation, since respirator masks aren't effective.

Denatured alcohol is ethanol (common in liquors) made poisonous so it can be sold without a tax. This is the best alcohol to use with shellac.

Glycol is an extremely slow evaporating alcohol used in water-based stains and finishes to slow their drying and help them level out. It is often sold as a "flow additive." (Rubbing alcohol, sold in pharmacies, contains too much water to be useful in finishing.)

Ketones, esters and glycol ethers dissolve lacquer, so they're used as the active solvents in lacquer thinner. Acetone and methyl ethyl ketone (MEK) evaporate rapidly and are often used to remove oil from metal and wood, and for stripping paints and finishes. They are usually available in paint stores and home centers, unlike esters and glycol ethers, which aren't commonly available.

To make lacquer thinner, manufacturers

choose between these solvents primarily for evaporation rate (to control the drying of the finish), with the slower-evaporating solvents being used in lacquer retarders and faster ones being used in "fast" lacquer thinners.

Glycol ethers are the primary solvents used in water-based stains and finishes because these solvents evaporate slower than water, which is necessary or these finishes won't cure properly.

Using this Information

Solvents and thinners help you control the finishing products you work with.

- You can control the working time of paste-wood filler and glaze by choosing between mineral spirits and naphtha for the thinner.

- You can control the working properties of homemade paste wax by choosing mineral spirits or turpentine for slow drying, and naphtha, toluene or xylene for fast drying.

- You can slow the drying of lacquer so it doesn't blush in high humidity or feel sandy from overspray (especially common when spraying the insides of cabinets and drawers) by adding lacquer retarder to the lacquer.

- You can add glycol to water-based stains and finishes to increase your working time and get them to flow out better.

- You can add a little lacquer retarder to shellac to slow the drying (useful in hot weather). Lacquer thinners and retarders contain alcohol and will thin shellac. **PW**

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

TABLE: WHAT DISSOLVES AND THINS WHAT		
SUBSTANCE	DISSOLVES	THINS
Mineral Spirits (paint thinner) Naphtha Turpentine	Wax	Wax, Oil, Varnish, Polyurethane
Toluene Xylene	Wax, Water-Based Finish, White and Yellow Glue	Wax, Oil, Varnish, Polyurethane, Conversion Varnish
Alcohol	Shellac	Shellac, Lacquer
Lacquer Thinner	Shellac, Lacquer, Water-based Finish	Lacquer, Shellac, Catalyzed Lacquer
Glycol Ether	Shellac, Lacquer, Water-based Finish	Lacquer, Water-based Finish
Water	—	Water-based Finish

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Woodworker Meets Wordworker

What do gambling, medieval wagons and missile warheads have to do with today's woodworkers?

As a professor of English I love words, and, like you, I also love woodworking. Non-woodworking friends consider strange the words we use regularly in our craft, among them “carcass,” “cockbead,” “dado,” “ogee,” “rabbet” and others. Where did we get these unusual words? Their origins might surprise you.

Suppose you wanted to make a highboy, a tall chest of drawers usually divided into two sections. First, you should know that highboy has nothing to do with gender. Boy is an English pronunciation of the French *bois*, meaning “wood”; *boiserie* is French for “woodwork” or “casing.”

To make a strong highboy, begin by making a carcass. You can spell this word *carcass* or *carcase*. Both spellings are common today and are pronounced the same, “CAR-cuss.” As far back as the 13th century, carcass has meant “a dead body.” Nowadays the word is a term of derision: “Get your lazy carcass out of that recliner!” Because carcass means a corpse or skeleton, woodworkers appropriated the term to describe the framework, or skeleton, of a piece of furniture.

One way of making a carcass is using a “dado,” an efficient groove method of joinery. *Dado* is an Italian word related to “die,” the cube used in gambling (the plural is *dice*). Woodworkers took a gambling term to describe the basic cube shape.

By the way, don't use “dado” and “rabbet” interchangeably. And above all, don't misspell “rabbet” as “rabbit.” Furry animals have nothing to do with this word's origin. When you ask a salesperson for a *rebate* on a purchase, you are asking for a reduction in the price. The Old French word *rabbat* — to reduce or diminish — came almost directly into English to describe the act of reducing the surface of wood or stone. Therefore, “rabbet” and “rebate” are modern English cousins with a common French ancestor.

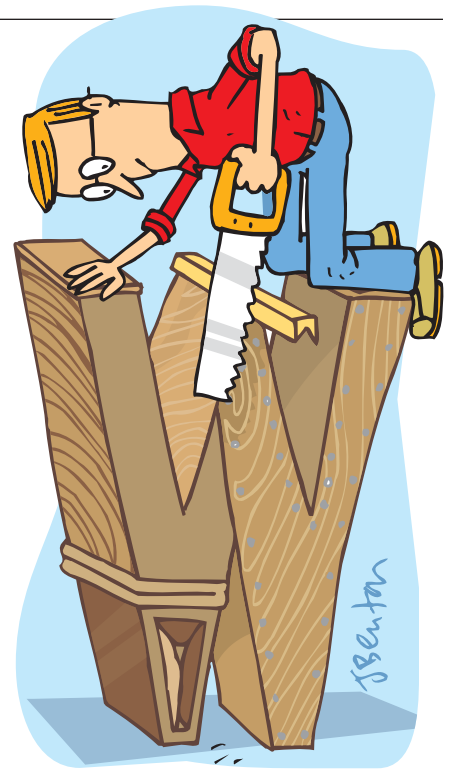
You might want to embellish your highboy's drawers with a strip of raised, narrow moulding or a band attached to the edges of the drawer front. The proper name for this strip is *cockbeading*. “Cock” means something that sticks up as, for instance, the cocking-piece of a weapon. Beads, such as on a rosary, usually are found on a strip or in a line. Think of a marksman who “draws a bead” from himself to a target. These two words combine to form cockbeading, a “strip that sticks up.”

The raised panels in doors fit between vertical pieces called *stiles*. This word came into English through the Dutch *stijl*, meaning pillar or post. Think of a turnstile that you pass through to an athletic event; the turning mechanism rests atop a pillar.

Woodworkers also like to decorate the edge of some surfaces using an “ogee” router bit. An ogee is not an object but a shape. “Ogee” describes an S-shaped curve that you can see if you view your routed edge in profile. “Ogee” derives from the French *ogive*, a word still in use today to mean an arch. Ogive mouldings join the upper legs of a highboy with the rail at the front of the case. Oddly, the word *ogive* has been applied to the shape of disparate objects. In the 19th century, the word described a Gothic arch in a sanctuary and, in the 20th century, it described the profile of the head of a projectile, such as the warhead or topmost point of a missile.

Beginning woodworkers sometimes confuse “muntin” and “mullion” because they look and sound alike and both are related to windows. “Muntin” comes from the French *montant*, meaning any object that protrudes or rises above the surface, such as a mountain. Hence, a “muntin” is the raised material separating panes of glass in a window or door.

“Mullion” is a variant of *muniall*, an Old French word derived from Latin meaning “in the middle of” or between. You could



probably use either word without fear of the Word Police coming after you, but I recommend using “muntin” to refer only to strips between glass and “mullion” to strips between any sort of panel such as wainscoting.

Speaking of wainscot, do you pronounce it “WAINS-kaht” or “WAINS-coat?” Dictionaries recognize both pronunciations, but the first seems to be more widespread. “Wain” is an Old English form of the German *wagen*, meaning “wagon” or “cart,” and “scot” comes from the German *schot*, originally a type of fine oak panel. But what does a wagon have to do with this word? Imagine a medieval wagon partially enclosed with panels separated by stiles, and you should see something resembling the lower portion of a wainscoted room.

Woodworkers pride ourselves in shunning “manufactured” items. But “manufacture” used to mean “made by hand” (“manu-” hand; “fact-” make). Similarly, “artificial” used to mean “made with great skill or art” (“art-” art; “fic-” make). Today it means the opposite.

Definitions and pronunciations change over time. When we understand the origins of woodworking terms, we connect with the artisans of the past, our collective forebears whose ingenuity developed the craft that we enjoy today. **PW**

Philip Leon is a professor of English at The Citadel in Charleston, South Carolina; he is the author of four books on literary subjects.