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December 2001 #125

Popular Woodworking

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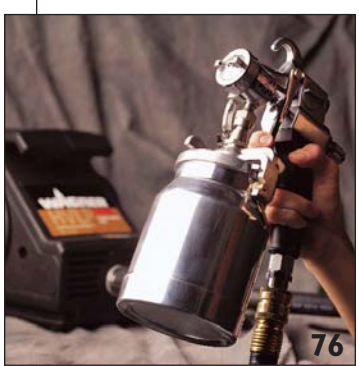
Part One: Traditional Casework

contents

Popular Woodworking



TOOLS & TECHNIQUES

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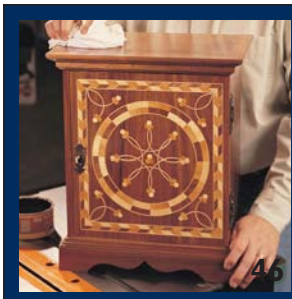

On the Cover

Master marquetry without mastering hand tools. Table saw and router master Glen Huey shows you how it's done in this two-part article that walks you through construction of this classic spice box.

Cover photo by Al Parrish

In Every Issue

Projects

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What's Your Finger Worth?

New technology could save thousands of fingers a year.

How much more would you pay for a table saw equipped with a passive safety device that would send you looking for a bandage after a saw accident instead of to the emergency room carrying your finger in a baggie?

Woodworkers were first shown the SawStop (sawstop.com) system 18 months ago. It halts a table saw blade in less than a quarter turn, or within milliseconds, when the blade senses contact with human flesh. I saw it operate, and it performed as advertised. Of course, this doesn't mean it's foolproof. Field testing is necessary to learn how reliably it operates in the real world.

And while testing is underway, what should be of concern to woodworkers is why the evaluation process hasn't progressed more. Understandably, manufacturers are now figuring out how this safety feature would change their business. Key issues include:

- Product liability (some say it would actually rise for tool manufacturers).
- How many millions of dollars it will cost to retool the manufacturing plants to accommodate the device.
- And the impact on sales when the cost of the device itself — plus fees to the inventor, a patent attorney named Stephen Gass — are all added to the price tag.

There's disagreement between the inventor and tool manufacturers about how much this device will cost you on a new table saw. Our best guess, and it's only a guess based on their disparate claims, is about $150 to the price of a contractor saw and $200 or more for a cabinet saw.

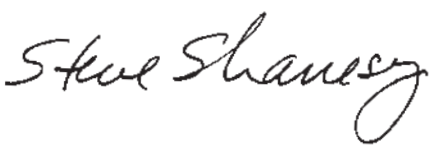
But it's not just the price of a table saw that is slowing this process down. Manufacturers I spoke with made the case that they can't simply rush forward. And while some manufacturers seem more interested than others, none has set the goal of finding a way to make it work. While nobody wants to be first to market with the device, most admit that once one manufacturer takes the plunge, the rest will follow.

Then there's Mr. Gass. His frustration with not seeing his invention enthusiastically embraced by manufacturers may also be an obstacle. When interest among woodworkers upon its announcement didn't translate into licensing agreements with tool manufacturers, Gass took his case to governmental safety regulatory agencies, which may force its use by fiat. This tactic raised the hackles of most tool makers. Gass also appears to want greater fees for SawStop as time goes on because, he says, his investment continues to rise. From my understanding of Mr. Gass's royalty structure, he will make millions every year on table saws alone. If installed on other equipment, millions more will flow to him.

We don't take issue that Mr. Gass should enjoy a comfortable life if his clever device prevents thousands of serious finger and hand injuries every year. We also recognize that manufacturers have to make money to stay in business and can be held responsible to shareholders when they don't.

All parties involved need to focus on the fact that it's their current and future customers whose hands and fingers are at risk here. And to their customers they also have a responsibility. It's time manufacturers and Mr. Gass get together and map out a plan that takes everyone's best interests into account then move forward with all deliberate speed.

You can help this process. Please go to our web site (popwood.com) now through December and weigh in on your willingness to pay more for equipment that offers real protection without interfering with your use of the machine. Or send us a postcard stating "yes" or "no" to spending an extra $150 on a contractor saw equipped with SawStop. We'll share the results with you, the manufacturers and Mr. Gass. The results just might be the nudge that will get the decision makers off square one. **PW**



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Why Slow-Speed Mortisers Stall in Tough Woods

Don't Forget Chip Removal When Evaluating Machines

I just read your article "Mortiser Slug-Fest" in the August 2001 issue (#123). It was a good article, but there is one thing I'd like to comment on. The reason slow speed mortisers tend to stall easier has little to do with horsepower or torque. If it did, then a slow-speed machine would actually be better — because all other things being equal, a 1,700 rpm motor will have twice the torque as a 3,400 rpm motor, and would therefore be more resistant to stalling.

The real reason has to do with chip removal. On a mortise chisel and bit, the cutting diameter of the bit is larger than the shaft of the bit. The head of the bit tends to cut off larger chunks of wood than can easily fit between the bit and the chisel at the point where the hole in the chisel is necked down. So these chunks must be chewed up first before they can get up into the chip-removal flutes of the bit.

A 1,700 rpm mortiser will only chew up and remove material half as fast as an equivalent 3,400 rpm mortiser. This is fine if the operator plunges half as fast, but as you indicate by doing time measurements in your article, we're all in a hurry and don't like to go slow. You indicated that a smaller gap between bit and chisel works better for the slow mortisers. This is for exactly the same reason. Just as when you close the gap on a hand plane to take a thinner shaving, closing the bit/chisel gap forces the bit to take a smaller bite and the slow mortiser can keep up with the reduced amount and size of the chips more easily.

There is also a second, but less significant, reason for a faster motor to work better. Even if the horsepower is equal, the mechanical energy stored in the rotating motor is four times greater on a 3,400 rpm motor than on a 1,700 rpm motor. This won't help you if you constantly plunge too fast, but it does help when once in a while the bit breaks off a large piece of wood that has to be forced up the flutes. It can offer a lot more energy momentarily to force that one piece through before the motor slows too much and stalls. This is the same reason why an engine with a larger flywheel is harder to stall than one with a small flywheel.

I still like the slower machines because they're quieter and run cooler when running idle. Once you start cutting, there isn't much difference in noise or heat, but I don't like to run them long without wood going through them because the metal-to-metal contact noise is irritating, and can really heat up the bits (I have turned some blue idling, but never while actually cutting through wood).

Jim Neeb
Chandler, Arizona

Thinned Down Polyurethane Finish Really Works Well

I was getting ready to finish some cabinets for a customer when I read your Trick of the Trade on finishing in the June 2001 (issue #122). I figured, "What have I got to lose, I can always go over it with a brush later." I diluted Minwax satin polyurethane by 25 percent with mineral spirits as you suggested, and went to work with a cotton rag. As you said, it went on smooth and fast, with no drips or runs. Why have I been cleaning brushes all these years?

I was working with shop-grade birch

We Want to Hear From You

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

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plywood with a poplar trim. After the first coat, I sanded with an orbital sander and 400-grit paper to knock off the rough surface. After the third coat, I used an idea picked up from another source and sanded by hand with 400 wet/dry paper and a detergent solution. The result was a beautiful, smooth satin finish.

Now here is the good part. On the next set of cabinets, I decided to experiment. For the first coat, I used a brush with factory-mixed polyurethane. After sanding as above with the orbital sander, I applied two coats of diluted varnish with the rag. The first coat used a pint of varnish, and took over an hour to apply. The second and third coats combined used about ½ a pint and less than an hour! That didn't include the final sanding.

A friend of mine who is a professional painter was so impressed with the finished product that he asked to read your article. Thanks for making my work not only better but easier and cheaper.

David Herman
Glendale, California

Porter-Cable 557 Biscuit Joiner a Good Machine With One Flaw

Being a subscriber and professional woodworker I found your comparison of biscuit joiners (June 2001, issue #122) interesting, however I would like to advise you of an issue you did not find. I own and use both the DeWalt and Porter-Cable 557. There is a design fault with the 557 worth noting: when the face-frame cutter is installed, you cannot "T" joints because the bar across the fence prevents the machine from sliding forward. Fold the fence up as you do to plunge cut into the center of a piece, and you will find that the motor housing hits that darn crossbar and prevents you from making the cut.

I find that part very annoying since it really limits an otherwise very nice machine. Also, to keep removing and reinstalling the complete fence system is too much of a pain to be worth it. Just thought I would pass that along. **PW**

Jack Mazzuchelli
Netcong, New Jersey

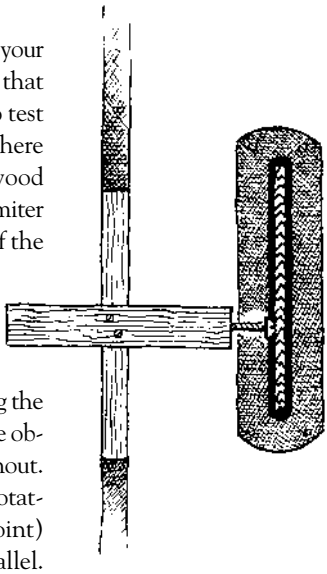
Illustrations: John McCormick

Set up Your Table Saw With Scraps and a Screw

THE WINNER:

Homemade Table Saw Tester

The secret to smooth rips and clean cross cuts is having your table saw's miter slot parallel to the blade and a blade that runs true. Commercial products use dial indicators to test this and cost anywhere from $20 to $200. As always, there is a cheaper way. Simply use a 1½" x 1½" piece of wood screwed to a piece of hardwood that fits snugly into the miter slot of your table saw. Drill a pilot hole into the end of the 1½" square stock, then screw a brass screw (round-head works best) into the block so it protrudes about ¾" to the side of the blade. By moving the screw in or out in the block (using pliars), the screw can be positioned exactly against the flat of the blade. By rotating the blade (with the saw turned off and unplugged) it will be obvious whether the blade is running true or with any runout. By moving the jig forward and back in the slot (and rotating the blade so the screw always contacts the same point) you can determine if your miter slot and blade are parallel.



Dan Locaputo
Cincinnati, Ohio

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TRICKS OF THE TRADE FROM THE AMERICAN WOODSHOP

GREETINGS FROM 'THE AMERICAN WOODSHOP'

Each issue we publish tricks that come in from readers, and some I've learned over the years in the American Woodshop. But we've had so many good ones from readers recently, I've decided to give them all the attention. The tricks in this month's issue are all from *Popular Woodworking* readers. Thanks to Delta Woodworking Machinery, 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. Thanks to everyone who entered their shop tips and tricks.

DELTA MACHINERY

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

- Scott Phillips

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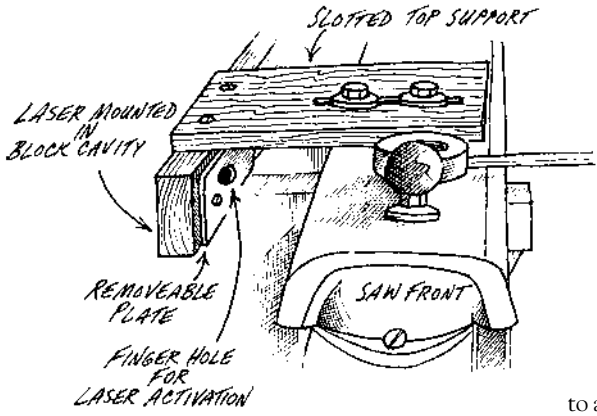


See the Light on Your Radial Arm Saw

About three years ago I added a laser to my radial arm saw that allows me to align the saw blade with the pencil line on my work. The laser itself is an inexpensive ($10) item I picked up at Harbor Freight (www.harborfreight.com, #382460VGA). It projects a thin, straight line when you press a button. The laser is mounted to the top front of the radial arm using a bracket, and is suspended in a solid block of wood with a cover plate to hold it in place. The plate has a hole in it to reach the on/off button, and the block has a saw kerf cut in the bottom to let the laser light shine out. Slotted holes in the bracket allow you to adjust the laser left to right, and the laser disc can be rotated in the block to shine directly on the board. To use it you just put your index finger into the hole and press to align your board.

Robert Rich
Sherborn, Massachusetts

Note to Self: Where Did I Put that Pencil Mark?

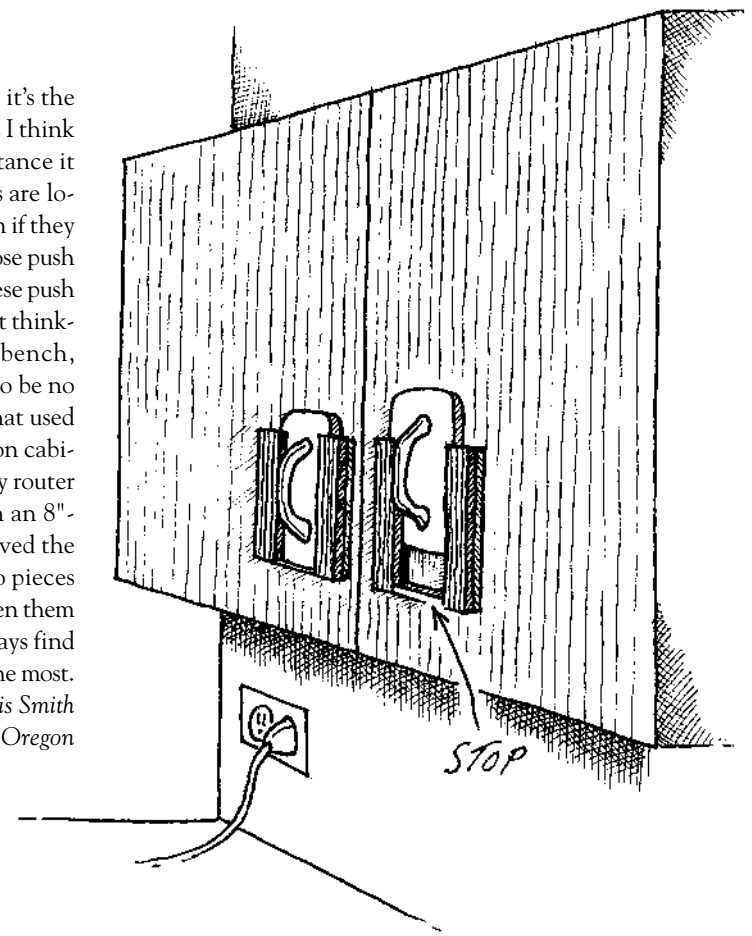
One trick that I have recently started using is sticking up Post-It notes when marking rough surfaces, as well as dark or grainy surfaces. By putting Post-It notes on a painted wall, for example, I'm able to accurately measure screw holes for hanging a shelf with two key hole hangers. The smooth surface lets me mark the wall and then adjust the marks when I'm off a little. After I've made the mark and installed the screws, I simply remove the Post-It note and there are no marks to erase on the wall, or paint to touch up. I also recently used this same idea to install handles on kitchen drawers. I placed the Post-It notes, marked for the handles, drilled the holes, then pulled the Post-Its off. No marks, just holes.

Bob Bean
Hayward, California

You'll Never Look in a Cabinet for Your Push Pads Again

Safety is of the utmost importance to woodworkers, and it's the first thing we should all focus on as we enter our shops. As I think about safety I also consider convenience and the importance it plays in creating a safe work environment. If push sticks are located near the table saw, they are more apt to be used than if they are more than an arm's length away. The same goes for those push pads for router tables and jointers. I got a couple sets of these push pads with several of the machines I purchased and, without thinking, haphazardly threw them to the back of the workbench, soon to be covered with dust and debris. There seemed to be no easy, convenient place to store the pads near the tools that used them the most until I thought of using them as handles on cabinets above those tools. This worked especially well for my router cabinet. To form a holder for the pads I cut a rabbet in an 8"-long strip of wood and then cut this in half. After I removed the small original handles on the router bit cabinet, the two pieces were then screwed to the cabinet with enough space between them for the push pads to slide into the rabbet. Now I can always find them conveniently located near the tools that need them the most.

Chris Smith
Clackamas, Oregon



Finally, the First Cordless Router is a Functional Reality

We've watched cordless technology revolutionize woodworking, and often we've joked about when the first cordless router would be available. It's no laughing matter now. Porter-Cable has introduced the first cordless router, and the smiles on our faces are from pleasure, not humor.

The Porter-Cable 9290, is built on the popular 690 platform (in fact, it uses the same bases). By taking advantage of improved motor designs and improved battery technology, Porter-Cable has answered the tricky question of torque versus runtime. Porter-Cable Product Manager Mark Woodlief credits the battery design with making the tool possible. The slip-on battery allows for a low profile and evenly centered design that keeps the router well balanced and only slightly top-heavy.

But enough of that, we wanted to know if it could make the cut. The pre-release information boasted that it would cut ½" roundovers in 100 lineal feet of oak, or 200 lineal feet in pine, on one charge. It's true. More importantly the router didn't feel like very much torque was sacrificed by switching to battery power. It plowed through roman ogee edge cuts in ash and ½" groove cuts in plywood.

One of our concerns was how the motor responded when the battery charge ran down. As the battery starts to lose charge you can feel the motor slow and anticipate ending your cut. With a spare battery (the 9290 is sold with only one, and a spare's about $100) it would be no problem to pick up right where you left off.

Initially I was a little skeptical at the appropriate home-shop application of this tool. It's about $100 more than the corded original. Is it worth it? I can't begin to tell you how pleasant it is not to worry about a cord dragging across your cut or getting stepped on.

The 9290 will accept ¼", ⅜" and ½" collets, but is shipped with only the ¼" collet. This is to encourage the user to get the best performance out of the tool. Smaller bits put less draw on the battery. But if you must use a ½", the router will do it.

Other things we noticed: the 9290 is four decibels quieter than a corded 690. The switch is a little harder to turn on and off than you might expect, but this is actually by design. Since you can't unplug the router to change a bit, (and you know we won't always remove the battery), P-C made it harder to accidentally turn the router on. Also, the router employs a spindle lock for one-wrench bit changes, but still has two nuts for extra tightening as well.

Being built on the 690 platform adds nice options, but it also includes a less attractive holdover. The 9290 will retain the awkward thumb screw lock for the base release. The corded 690 is getting an upgrade to its lever lock soon, and we hope the upgrade will show up on the 9290, too.

Overall, the tool is a little pricey, but we like it. It performs well and is amazingly convenient. We're interested in seeing what the future of cordless tools has in store after this major breakthrough.

For more information, circle #163 on the Resource Directory Coupon.

SPECIFICATIONS:

Porter-Cable Model 9290

Street price: $250
Motor: 19.2 volt, 600 watt
RPM: 23,000
Collet sizes: ¼", ⅜", ½"
Weight: 7¾ lbs.
Battery: one 2 amp-hour
Bases: Will accept any base designed for use with the 690 router system.

Performance: ●●●●●
Value: ●●●●○

Porter-Cable 800-487-8665, or www.porter-cable.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, the magazine's editorial staff shares its results and experiences with the tools, rating each for performance and value.

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. However, a tool with a low value rating may be worth the high price.

If our tool reviews don't answer all your questions, e-mail me at DavidT@FWPubs.com or call me at 513-531-2690, ext. 255. If we haven't reviewed the tool you're considering, there's a good chance I've used the tool, but simply haven't had a chance to write a review. Give me a call and see if I can help. You can also visit our website www.popwood.com to check out our past published 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*

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Clamp Competition Gets Tighter With New Parallel-Jaw Clamp from Gross Stabil

We've been in love with Bessey's K-Body parallel-jaw clamps from the first day we tried them. But now our eye is wandering a little and our affections are being toyed with. Gross Stabil has introduced a new parallel-jaw bar clamp that offers many of the same features as the Bessey clamps, and a couple of new ones as well.

The Gross Stabil PC^2 adds removable soft pads for easier cleaning and "gentle" work, removable clamp heads in case of damage (rather than replace the whole clamp) and increased clamping area on the jaws (1¾" x 3⅝" with the removable pads in place, and 1 9/16" x 3½" without. Bessey's offers 1⅜" x 3⅜"). Gross Stabil has also added ¾" to the clamp screw's length. If you're saying, "so what?" you may never have run out of screw during a glue-up, forcing you to back off the clamp, unscrew the spindle and readjust. If you've had to do that more than once, you'll recognize the benefit.

For those of you who've been paying attention to clamps over the years, you may recall that Gross Stabil already offered a parallel-jaw clamp. Quite true, but the design wasn't without some problems, including imperfect parallelism over the entire depth of the jaw and a higher retail price than the Bessey model. Both of these issues have been addressed in the PC^2. This clamp maintains its parallelism nicely, and Gross Stabil informs us the pricing will be directly in line with Bessey's.

This clamp feels good, operates well, has improved versatility and is priced to compete. We're looking forward to adding some to our shop. But we won't fill up all the space on our clamp rack as we're waiting to test a new parallel-jaw clamp from Jorgensen as well. We love competition, and you can never own too many clamps!

SPECIFICATIONS:

Gross Stabil PC^2

Street price: 12" - $32, 48" - $43
Jaw depth: 3½"
Stated clamping pressure: 1,100 lbs.
Rail material: Galvanized steel
Jaw material: Polyamide nylon
Performance: ●●●●●
Value: ●●●○○
Contact Gross Stabil at 800-671-0838, or www.grossstabil.com

For more information, circle #164 on the Resource Directory Coupon.

Tool Dock Brings Machinist-Quality Storage to the Woodshop

Many of us woodworkers have looked at machinists' steel storage cabinets with envy, and even bought a few, but they haven't been designed for woodworkers. Now Waterloo Industries (the folks who have been making those cabinets for machinists and grease monkeys for 65 years) have turned their sights on us. Rolling out a new line of eight storage units and five inserts, the Tool Dock system allows you to mix and match the units to fit your needs, space and style of woodworking. With sturdy, well-constructed steel bases (which go together easier than the average contractor saw), 1¼" replaceable MDF (medium density fiberboard) tops and slide-out tool stations inserts, it's simple to design your own workshop space. In fact, Waterloo's website gives you a program to help do just that. One of the things that makes the system unique is the ability to mount benchtop tools to one of the inserts. The insert boards fit into cutouts in some of the tops and lock down to hold the tool in place during use. Afterward, unlock the insert, lift out the tool and slide it into one of the tool storage units. The insert becomes the shelf. Doing some sanding? One insert is designed as a sanding station, and three of the units offer integral dust collection hook-up. There's a router table and a workbench as well. This is a nice system that offers lots of good ideas for anyone looking to set up shop with little fuss and mess. But organization does come at a price, and there could be a few more drawers built in. Waterloo, thanks for the attention, and keep up the good work. **PW**

SPECIFICATIONS:

Tool Dock Modular Workshop

Street price: $149 - $309
Tables: 1¼" MDF
Bases: 18-gauge molded steel
Performance: ●●●◐○
Value: ●●●○○
Waterloo Industries: 866-866-5365, or www.tooldock.com

For more information, circle #165 on the Resource Directory Coupon.

Two Accuset Nailers That Have Endured

In February 1998, Senco asked us to look at its new line of light-duty brad nailers and staplers and make any recommendations. Later that year we received some of the first tools in the Accuset fastener line. Three years later, two of those tools still see daily use in our shop. And that's saying something when you consider the number of tools at our disposal.

The A200BN brad nailer is the workhorse, driving brad nails from 5/8" to 2" lengths (sinking the heads even in oak) without a hitch. The A100MP micro pinner is a specialty tool that fires very thin headless pins ranging from 1/2" to 1" lengths. It fills a need that's not an everyday occurrence, but when you need a quick fastener that leaves a nearly invisible hole, it's just right.

It's not supposed to matter to a woodworker, but the look of the Accuset line is attractive, and the tools have a very smooth and dramatic form. They seem to invite you to grip them. When you do, the feel is comfortable and balanced.

Features shared by these two Taiwanese tools are rear-exhaust ports to direct any potentially oily air away from the work surface and a visible reload indicator on the magazine. Both require routine oiling of the chamber, but that isn't unusual in this price category. The A200BN also offers a mechanical depth-of-drive adjustment for setting the nail head to suit your needs.

While we know these tools were designed for the home woodworker, we haven't seen anything that wouldn't recommend these tools to even the most die-hard woodworker or small commercial shop. Reportedly tested through more than 400,000 firings, these tools would be able to fire 100 brads a day for the next 10 years. That is, by most measures, a lot of woodworking.

Photo by Al Parrish

SPECIFICATIONS:

Accuset Model A200BN Brad Nailer
Street price: $115 - $140
Brad sizes: 18 gauge, 5/8" - 2"
Safety device: restrictive nose guard
Depth-of-drive adjustment? Yes
PSI operating range: 70 - 100
Weight: 3.4 lbs

Accuset Model A100MP Micro pinner
Street price: $120
Brad sizes: 23 gauge, 1/2", 5/8", 3/4", 1"
Safety device: lock-out switch
Depth-of-drive adjustment? No
PSI operating range: 70 - 100
Weight: 2.4 lbs

NICE FEATURES:
• Reliable, comfortable to use and well-priced

RECOMMENDED MODIFICATIONS:
• A more positive safety on the Micro pinner

Senco: 888-222-8144 or www.accuset.com

There are very few recommendations for changes we can make on these tools. The safety device on the micro pinner is a simple lock-out button, which is effective if you're just picking the gun up, but we'd prefer to see some type of more restrictive safety, though it's not required by law for this size fastener.

While some reviewers have noted the lack of a jam-clearing nose door, we have yet to run into a jam that couldn't be easily cleared through the rear of the mechanism. In fact, we've encountered very few jams at all in three years.

The A200BN is a versatile and reliable tool for any woodworker ready to go pneumatic. The micro pinner fills a unique niche that grows larger every time we take it out of the tool cabinet. **PW**

— David Thiel

ABOUT OUR ENDURANCE TESTS

It's nice to know how a new tool performs, but most woodworkers also want to know how long the tool will last. Each issue we tell you about tools that have stood up to regular use in our shop for at least a year. We tell you how the tools have fared, any recommendations we have and if the tools have passed the *Popular Woodworking* Endurance Test. *— David Thiel, senior editor*

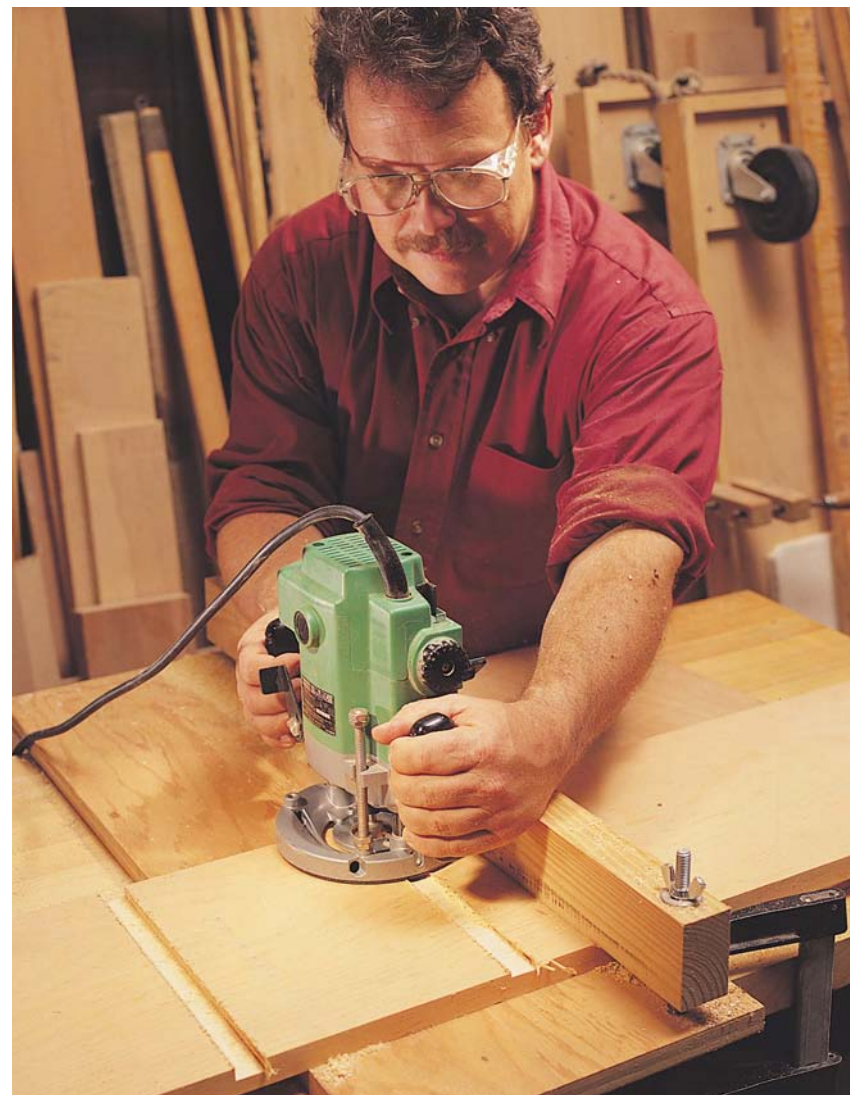
Super-Simple Dado and Rabbet Jig

Two pieces of wood and some hardware will speed you through making bookshelves, tenons and even breadboard ends.

When building a bookcase, you often must make a series of repetitive dadoes in the long uprights to support the shelves. You could do this on a table saw with a dado blade, but you'll find it's difficult to control the long stock as you feed it over the blade. If you have a router, you could clamp a straightedge to the stock and use it to guide the router, but it's time-consuming to measure and set up for each individual cut.

The dado-and-rabbet jig simplifies both the set-up and the operation. Lock the board between the base and clamping bar, then guide the router along the bar. The stock doesn't move, so you don't have to worry about controlling a large piece of wood. The straightedge is also the clamp, so the set-up is very simple.

And that's not all it does. The jig helps create any long dado, rabbet or slot. You can make repetitive cuts in multiple parts. And you can use it to guide other handheld tools to make straight cuts, such as a sabre saw or a circular saw.



Photos by Al Parrish.

Cutting dadoes in long pieces of material is fast and easy with this simple jig.

Making the Dado-and-Rabbet Jig

The jig is just two pieces of wood (a base and a clamping bar). The sizes of both parts is determined by your own needs. My jig is about as long as my workbench is wide. This allows me to clamp the ends of the base to the bench. Not only does this keep the jig from moving around while I'm using it, it also keeps the base flat when I tighten the clamping bar against the stock to be routed.

Make the base from ¾" plywood and the clamping bar from a hard, dense wood such as oak or maple. The bar should be fairly thick from top to bottom so it doesn't bow when tightened down. If it bows, the clamping pressure won't be even all across the stock. In fact, the bar will only press against the stock at the edges and the stock will be more likely to slip. This becomes more and more of a problem the longer you make the clamping bar. To solve it, I crowned the top and bottom surfaces of the clamping bar, making it 1/32" to 1/16" thicker in the center than at the ends. Even though the bar flexes, the clamping pressure remains even. However, remember that the sides of the clamping bar (the surfaces that will guide your router) must be perfectly straight.

Tip: To keep the stock from shifting in

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To make a positioning gauge, clamp a scrap under the clamping bar so you won't cut into the base. Rest a scrap of 1/4" plywood or hardboard against the bar and secure it to the scrap with a separate clamp. Then rout through the material, saving the strip between the router bit and the clamping bar.

Use the positioning gauge to align the stock underneath the clamping bar. The edge of the gauge indicates the inside edge of the cut.

the jig, apply self-adhesive sandpaper to the underside of the clamping bar. In some cases, you may also want to apply a strip of sandpaper to the base, directly under the bar.

Drill counterbored holes for the carriage bolts in both the base and the clamping bar. The counterbores in the base recess the heads of the bolts so the base will rest flat on the workbench. The counterbores in the clamping bar provide recesses for the compressed spring, allowing you to clamp thin stock.

The purpose of these springs, of course, is to automatically raise the bar every time you need to move or remove the stock. What do you do if you're routing thick stock and the springs don't reach far enough into the counterbores to raise the clamping bar? Simply turn the bar over so the springs are no longer recessed in the counterbores. (This, by the way, is why I crowned both the top and bottom of the bar.)

Making Dadoes and Rabbets

To use the jig, first you must position the stock on the base under the clamping bar. To do this quickly and accurately, it helps to make a positioning gauge from a scrap of thin plywood or hardboard. Lock the bar down on the base and place the scrap so one straight edge rests against the side of the bar. (The scrap mustn't be under the clamping bar.) Mount the bit you will use to make the cuts in your router, then rout all the way through the scrap, creating a strip about as long as the bar. This width of this strip is precisely the distance from the edge of the router to the cutting edge of the bit, and it becomes the positioning gauge for that specific router and that bit.

Lay out the cut you want to make, slide the stock beneath the bar, and turn the wing nuts so the bar is snug against the stock, but not tight. Place the positioning gauge against the clamping bar and line up your layout marks with the edge of the gauge. Then tighten the bar down and remove the gauge.

Rout the dado or the rabbet, keeping the router against the side of the clamping bar. This is like any other router operation (feed the router left to right as you face the bar so the rotation of the bit helps hold the router against the guiding edge). Make deep cuts in several passes, routing about 1/8" deeper with each pass.

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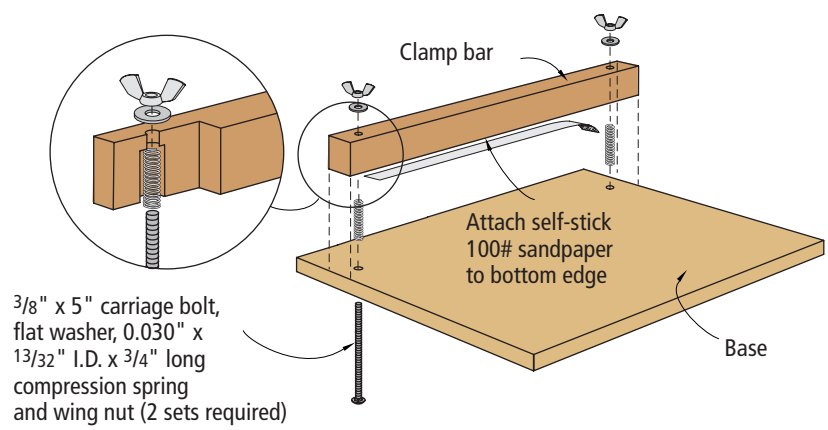

Illustration by Mary Jane Favorite

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You can rout multiple parts by stacking them edge to edge or face to face. However, you must be very careful that all the parts are secure under the clamping bar. If there is a slight discrepancy in the thickness of the pieces, one or more parts may shift during the cut. To prevent this, you may have to use additional clamps to secure individual pieces to the base.

To make multiple identical cuts, such as cutting the cheeks and shoulder of tenons in several rails, clamp a short fence to the base to automatically position the parts. Always check with the positioning gauge, however, before you make each cut.

If your router has a flat side to its base, keep that pressed against the fence. If the base is round, you may want to mount the router to a square sole for this operation. Router bits aren't always perfectly concentric to the sole, and the bit may move in and out slightly from the clamping bar if the router turns as you make the cut. This will make the cut curved or wavy.

The jig is not only useful for cutting dados and rabbets in wide stock, it's a time-saver for making identical cuts in multiple parts. You can line up the parts under that clamping bar and cut several at once. For example, you can makes tenons in the ends of multiple door rails by cutting four identical rabbets in the end of each piece. To do this, first position two parts under the clamping bar, one near each end. Then clamp a short fence, no taller than the stock is thick, against the ends of the parts. This will automatically position the rails for each cut you make.

Line up several rails edge to edge with the ends against the fence and lock the bar down on top of them. Check to see that each part is secure. If it shifts, you may have to add another clamp behind the clamping bar. Rout the faces of the rails, then turn them over and repeat. After routing the faces, make identical cuts in the edges. If the router seems unstable when routing the edges, either wait until you have enough parts to stack face to face to make a larger platform for the router or put spacers between the parts to spread them out.

PW

Nick Engler is the author of over 50 books on woodworking. Currently, he is heading up an effort to help kids across the United States build the ribs for a replica of the Wright Brothers 1903 Flyer in time for the centennial of the first flight in 2003. If you'd like to help, you can learn more about the project from the Wright Brothers Aeroplane Co. on the internet at www.wright-brothers.org.

Centennial Flyer Update

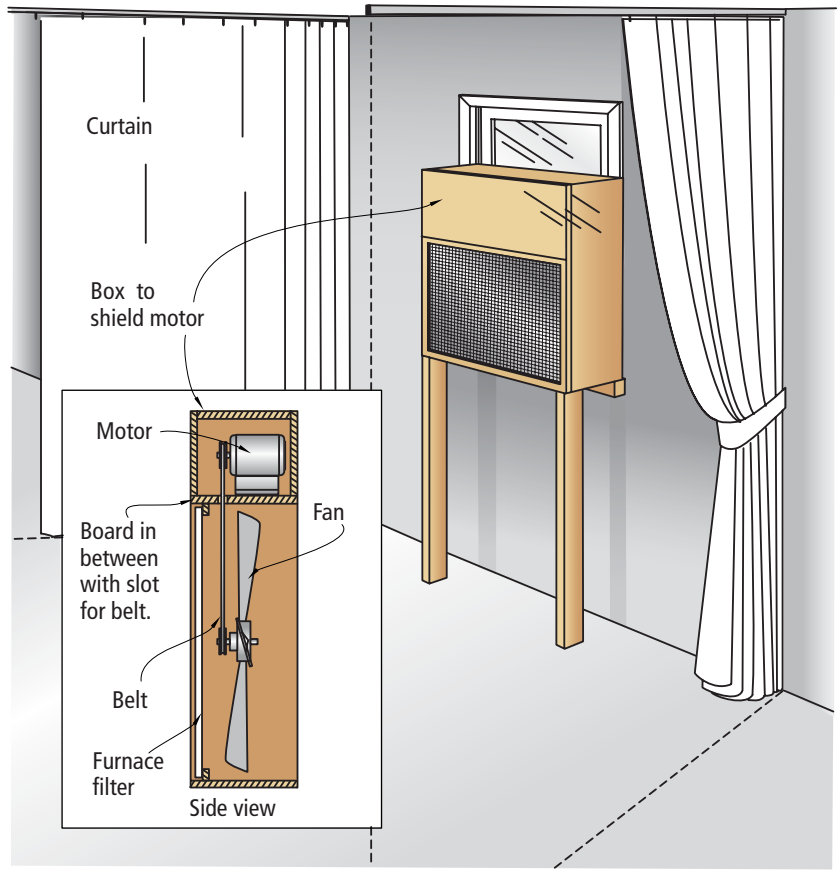
Children across America continue to build ribs for the 1903 Wright Flyer that will be assembled into a completed replica of that historic aircraft. Nick, his wife, Mary Jane, and their dogs have been traveling across the country running workshops and showing off the two Wright airplanes that have already been built for the project.

In late July, Nick rolled into a Long Island Home Depot where more than 50 kids showed up to build two full-size ribs for the 1903 flyer (which they all signed for posterity) and a quarter-sized rib for each of them to take home. In addition to learning a little woodworking, the enthusiastic crowd also got a lesson in aviation history and physics.

If you'd like more information about the Centennial Flyer Project and how you can help, visit the website at www.wright-brothers.org.

Exhausting Overspray in the Home Shop

If you want to spray finishes indoors, you need an exhaust system. This affordable homemade set-up makes it possible and affordable.



Illustrations by Mary Jane Favorite

Spray guns, especially the high-volume, low-pressure (HVLP) type with turbine-supplied air, have become fairly popular with amateur woodworkers. Like all spray systems, turbine HVLP guns transfer the finish from the can to the wood faster than brushing and produce a more level surface (no brush marks).

Also, like all spray systems, turbine HVLP guns create overspray, though considerably less than high-pressure guns. This overspray should be exhausted to remove explosive vapors, for health reasons and to keep the dried particles of finish from settling back on the finished work and other objects in your shop. Rarely is this need for exhaust, or ways of accomplishing it, mentioned in ads for spray equipment or in articles about HVLP spray guns or spraying.

Commercial Spray Booths

Professionally equipped shops and factories use commercially made spray booths to exhaust overspray. Essentially, a spray booth is a box that's open at one end with an exhaust fan at the other and filters in between to catch overspray (see the drawing on the next page). Commercial spray booths have the following features:

- Steel construction for fire safety.
- Filters to catch and hold overspray before it gets to the fan.
- A chamber for collecting the air to be exhausted. This exhaust chamber makes it possible for air to be drawn uniformly through a much larger square footage of filters than the simple diameter of the fan.
- A large enough fan to create an air flow of 100 feet-or-more per minute, which is enough to pull "bounce-back" overspray away from the object being sprayed. The fan and motor are also "explosion proof" to eliminate sparks that might cause a fire or explosion from contact with solvent vapors. (Beware that a buildup of vapors can be ignited by a pilot light in your furnace, your water heater or from another source at home, too.)
- Side walls and a ceiling to create a work chamber or "tunnel" for directing the flow of air through the filters.
- Ceiling and sometimes side lighting so the operator can see a reflection off the surface he or she is spraying. (Working with a reflected light source is the only way an operator can know if the finish is being applied wet and without orange peel, runs, sags or other problems.)

Commercial spray booths are an essential tool for production shops, but these booths are too large, too expensive ($3,000 to $5,000 minimum) and require too much make-up air (heated air to replace the air being exhausted) for almost all home shops. If you are using a spray gun on an infrequent basis at home and have to work inside to avoid cold, wind, bugs, falling leaves and so on, you should consider building your own modified spray booth.

Making Your Own

With a note of caution that doing any type of spraying in your house, with or without

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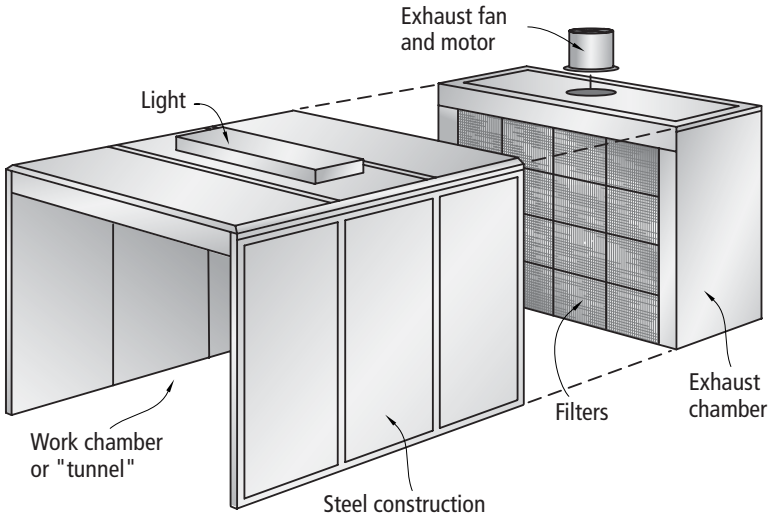
a spray booth, could affect your homeowner's insurance, here's how to build a safe, inexpensive spray booth that will be adequate in the volume of air and overspray exhausted and take up very little space.

The spray booth consists of a fan with a separate motor connected by a fan belt, one or more furnace filters and plastic curtains.

Your choice of fan is determined by the amount of air, measured in cubic feet per minute (cfm), you want to move and is a trade off between better exhaust of overspray and reducing the need to supply heated make-up air on cold days. In other words, the more air your fan moves, the better the exhaust but the more windows you'll need to open at the opposite end of your shop and the faster the heat in your shop will be lost. Generally, the larger the fan and the more sharply angled its blades the more air it is capable of moving.

To mount the fan, construct a box from plywood or particleboard approximately one-foot deep with both ends open. The dimensions of the four sides should be adequate to hold the fan at one end and furnace filters, which should be efficient enough to trap all overspray particles before they reach the fan, at the other.



Commercial spray booth

Cut a slot on the top of the box large enough for the fan belt to pass through and mount a motor adequate in horsepower to drive the fan on the outside of the box. A ¼- to ½-horsepower motor (1,725 rpm) would be typical. If you are going to spray solvent-based finishes, an explosion-proof motor is best. A standard TEFC (totally enclosed, fan-cooled) motor will do if you are going to spray only water-base finishes. Either way, the motor needs to be en-

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closed in a box to keep overspray from building up on it.

Place the box with the enclosed fan in a window, possibly resting on a stand just in front of the window and seal the spaces between the box and window opening. Then hang plastic curtains from the ceiling on either side of the fan running out about 8 feet from the window wall. If the window is near a side wall, you could use it as one side of your booth instead of a curtain. You want the curtains to be wide enough apart so you can stand inside, or just outside, the tunnel when spraying.

The best curtains to use are heavy, fire-resistant, "Industrial Curtain Partitions" with supplied ceiling tracking that are available from auto-body supply stores, Grainger's or Goff's Curtain Walls (800-234-0337). But you can use any type of plastic sheeting with the downside being that if the plastic is very light, it might be sucked in a little by the exhaust fan.

Mount the curtains to tracking on the ceiling so they can be pushed back when you aren't spraying and pulled open when you are. This way, you lose almost no space in your workshop.

Don't forget that you still need to wear a respirator while spraying with this exhaust system. I recommend a respirator with organic-vapor cartridges. (Lee Valley Tools sells one for $37.50. Phone: 800-871-8158).

For lighting, recess a four-tube, four-foot fluorescent fixture between the joists in the ceiling as close as possible to the window and shield the lights from contact with overspray by inserting glass plates between the light and the ceiling. For the best color balance, use full-spectrum fluorescent bulbs.

To avoid a fire hazard with your spray booth, it's essential that you keep it clean. Sweep the floor after each job and clean or replace the filter. If finish starts to cake on the curtains or fan box, clean or replace them. **PW**

Bob Flexner is a nationally known finishing expert in Norman, Oklahoma, and the author of "Understanding Wood Finishing."

Sources

Probably the biggest decision you have to make when building this system for your home is in selecting a fan. You have a few choices here.

All-in-one Units: By spending a little money, you can make things simple. Grainger (www.grainger.com; 888-361-8649) sells exhaust fans for areas with flammable or explosive vapors. Some examples include:

- **Dayton 16" Panel Fan; cast aluminum blades; max cfm: 1,215; stock # 3XK37, price $435.25.**
- **Dayton 16" Exhaust Fan; cast aluminum blades; max cfm: 1,980; stock #4C369; price $457.25.**
- **Other sizes are available.**

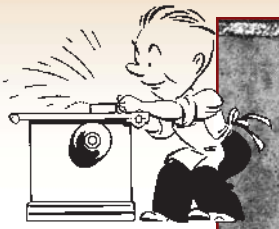
Motor-Separate Units: You also might be able to find a belt-driven fan without a motor from an industrial supply company. With these, you can mount a TEFC or explosion-proof motor outside of the path of the airflow as described in the article.

FILTERS: Use the standard blue woven furnace filters you can find at any home center store. Make sure that they are not too dense; some filters can greatly reduce your airflow. Be sure to clean the filter after each project.

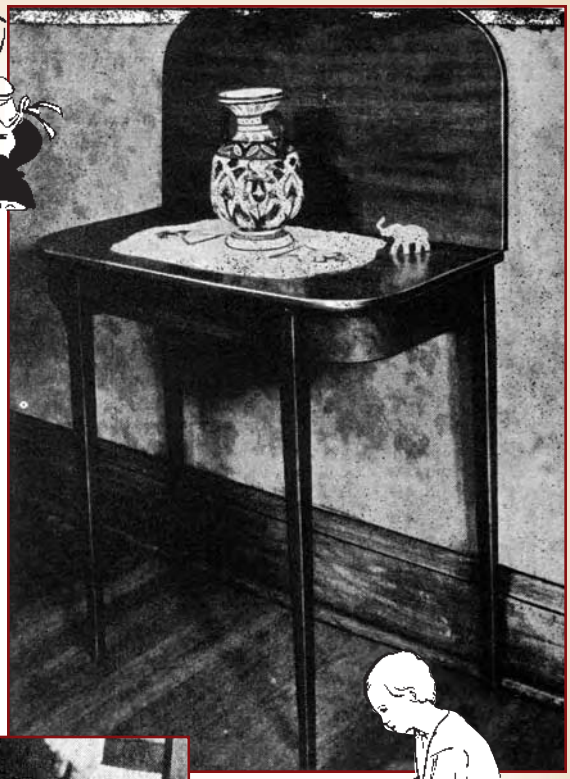
The Deltagram

A nostalgic look back at plans published by Delta Machinery during the World War II era.

From Vol. 5, Issue No. 5, 1936



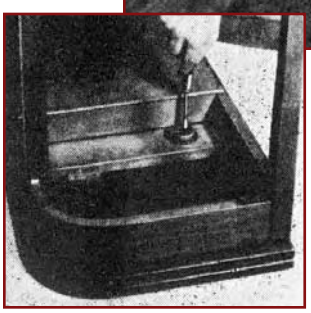
Console Table

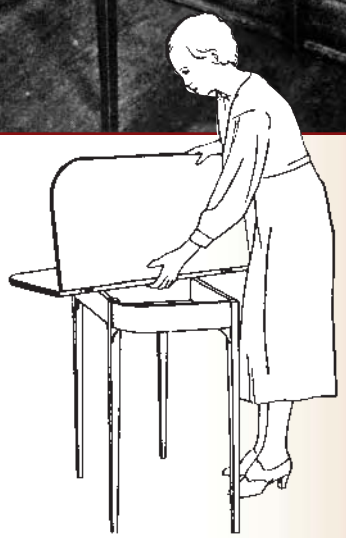


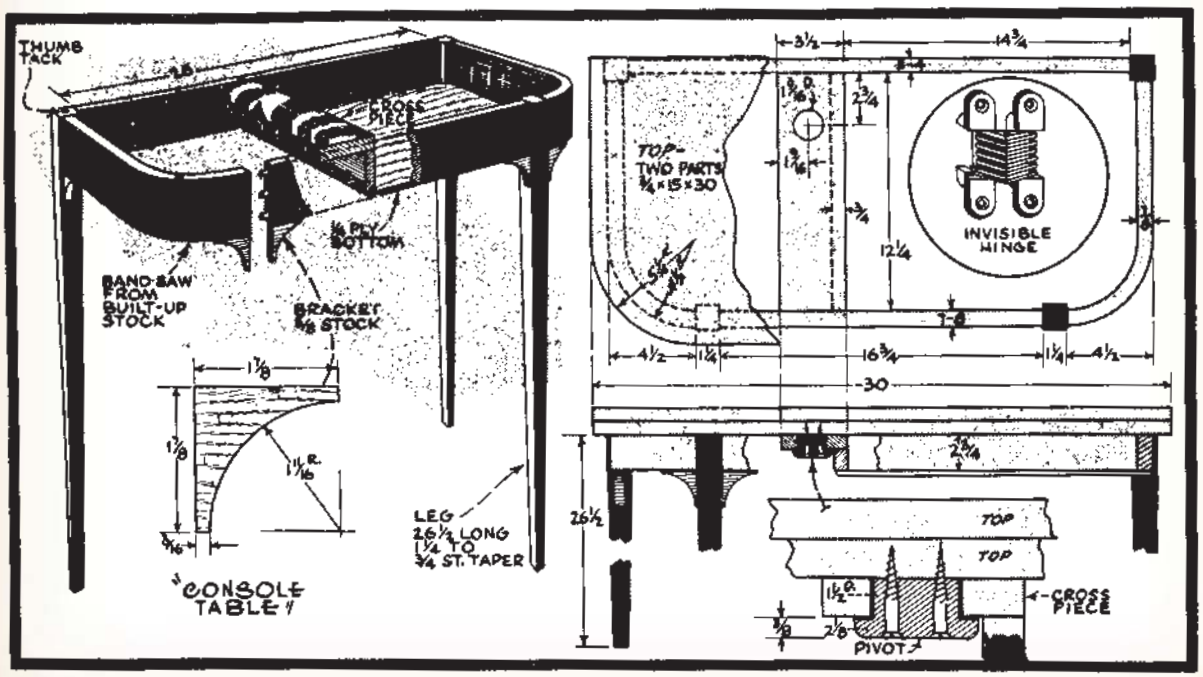
Working on a simple pivot, the top of this attractive console table can be instantly revolved to convert it into a practical card table. It can also be used as an occasional table with both top leaves folded to a single surface.

The construction is not difficult, and perhaps the only real piece of work consists of band sawing the curved end pieces. These should be carefully sanded to a smooth, even surface. Both pieces should be cut from one piece of wood in order to cut down the waste. The stock can be either solid or built-up from three or four thinner pieces. Taper the legs on the jointer, and make the frame assembly with dowel joints as shown in the sketch. The corner brackets are bradded and glued into place slightly inside the edge of the frame.

The top is made in two pieces, each to the dimensions given in the drawing. The upper leaf of the top must be finished on both sides. The two parts are fitted together with invisible hinges of the type shown in the insert. These can be procured from any hardware dealer and cost about 30 cents per pair in brass ($17 these days). Complete the project by making the pivot turning shown. This should be a snug revolving fit in the hole in the cross piece. The photo shows the pivot being screwed in place, the top being carefully placed, flush with the back of the frame. **PW**







They're not always practical, they're not always affordable, but they are the

Best New Tools of 2001

Economists say 2001 has been a real stinker. But we figure those guys have yet to get their bean-counting digits on a 23,000-rpm 19.2-volt cordless router. In our ledger, 2001 has been a very good year for new tools.

Not only has Porter-Cable ended years of speculation and whispering with this ground-breaking new router, there are a host of other amazing tools out there that are making their mark on woodworking. Milwaukee has re-invented the fixed-base router. Bridgewood has chopped more than $200 off the price of a premium contractor saw. And quality hand tools are making a big comeback.

Unlike the reviews you read in our regular "Tool Test" column, these are a little different. For one issue we stow away our practical side and look at the tools that have blown through some barrier. These tools are here because they represent new heights in technology, craftsmanship, performance or even value for the money.

To find these tools, we scour tool shows, visit manufacturing plants and burn up the phone lines all year round. The winning tools are the ones that survived our "gut checks" whenever a visitor stops by our shop and asks us what's new.

All of our comments in this article are brief; some of these tools have been reviewed in past issues this year and others will get full-blown reviews in the coming months.

We hope you enjoy looking at the best the tool manufacturers have to offer. They've certainly done their job this year. Now it's your turn. Get out that credit card and start stimulating the economy. **PW**

by David Thiel & Christopher Schwarz

Questions or comments? You can contact Chris at 513-531-2690 ext. 407 or at ChrisS@FWPubs.com; or David at 513-531-2690 ext.255 or at DavidT@FWPubs.com.

THE WINNERS

Bosch
Makita
Bridgewood
Clifton
Craftsman
Porter-Cable
Bench Dog
Delta
Grizzly
Powermatic
Milwaukee
Veritas
Lie-Nielsen
Shop Fox
Triton

Two-Base Router Kits

We love getting a deal on tools, and when you can buy a good-quality router that accepts both a plunge and fixed base, you've got a great deal. Porter-Cable did it about two years ago, and it took awhile for the competition to respond. But respond they did, and both Bosch and Makita have come out with both collets blazing.

Both the new 1617PK and 1617EVSPK (shown) from Bosch and the Makita RF1101KIT have improved on the PC 690 kit. Two kits offer variable speed, and the Bosch models offer a base-release mechanism that is a toolless snap. The details on the Makita aren't finalized, but we're told a toolless option is under consideration (we tested a preproduction model). Both new routers are strong performers, with excellent height adjustment, good ergonomics, and plenty of power (12 amps on the Bosch and 11 amps on the Makita).

They are, however, priced higher than the Porter-Cable kit ($200), with the single-speed Bosch at $220 and the variable speed at $240. The Makita should price out just under $300, but they've thrown in a number of accessories not provided by Bosch or Porter-Cable. If it's your first router, or your next router, one of these kits will make an excellent choice.

Contact Bosch at 877-267-2499 or www.boschtools.com, and Makita at 800-462-5482 or www.makita.com.

Bridgewood TSC-10CL Contractor Saw

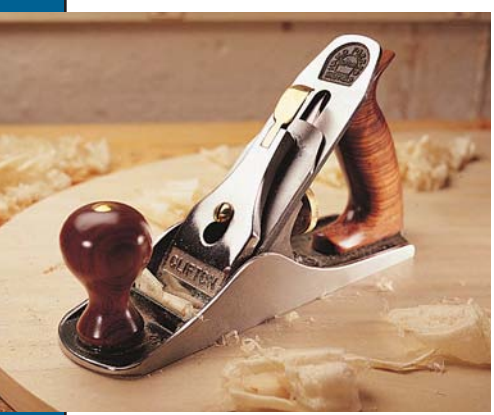
For the average home woodworker, the 10" contractor saw satisfies most needs. Yes, a beefier cabinet saw might be more desirable, but the cost just doesn't always make it practical. That's why we were delighted to test the Bridgewood TSC-10CL.

This contractor saw has many of the features we look for: a solid cast wing (only one, though); a quality, accurate rip fence; sturdy construction; and it's a left-tilt saw, offering improved safety and convenience. Best of all, it's now sale priced at $499! That's nearly $200 less than most comparable saws. But you're not giving up quality for price. This is a nice saw. The cast metal handles function smoothly, the motor provides plenty of power for routine use and the switch is conveniently located. The fence is a copy of the Biesemeyer rip fence (one of our favorites) but with the addition of aluminum faces on both sides that offer T-slots for attaching stops or accessories.

Bottom line, it's got all the features a home woodworker needs in a table saw at an unbelievable price. Build a table insert for the right side of the saw, and you're in great shape.

Contact Wilke Machinery at 800-235-2100 or www.wilkemach.com

Clifton Bench Planes



If you need proof that high-quality hand planes are making a comeback, look no further than the new English-made planes from Clifton. These Bailey-style planes have all the desirable features as the coveted (and long discontinued) Bed Rock planes from Stanley. The Cliftons are heavy, well-made and easily beat the pants off any new Stanley or Record plane.

Of course, the real question is how the Cliftons compare to Lie-Nielsen's line of high-quality bench planes. The Cliftons, if you haven't noticed, can be bought for less than the same-size Lie-Nielsen ($55 to $130 less). Here's the dirt: The Lie-Nielsen plane bodies are made from nearly indestructible ductile iron, so they're more likely to survive a fall than the grey iron Cliftons. Lie-Nielsen's frogs are cast bronze, which isn't susceptible to rust like the grey iron frogs on the Cliftons. The Cliftons come with a different cap iron, which is more easily removed for sharpening. But in performance and ease of setup, we see very little difference between the two. The Cliftons are simply great planes. Our only real question is how Clifton makes a tool this good for so little money.

Contact Robert Larson Co. at 415-821-1021 or www.rlarson.com

Craftsman #27994 Corded Drill

The Craftsman 27994 drill is one of those rare tools that makes you shake your head and wonder why no one has done this before. If you've ever tried to sink screws with a corded drill, you know what I'm saying. Either you go blazing in there at full power and ruin the screw, or you try to slowly sink the screw in just the right place with 100 short bursts on the trigger. Why don't corded drills have clutches like their battery-powered brethren?

Craftsman's answer to this cry of anguish is the 27994. It's got high and low gear settings (just like a cordless drill) and it's got 24 clutch settings (just like a cordless drill). But surprise, there's a cord! This $100 tool also comes with a bunch of screw tips, drill bits and drivers. You can sink screws all day long at your bench and never run out of juice. The only change we would wish upon this nice tool is that it had a ½" chuck. It seems to have the power and weight necessary to handle big bits.

Contact Craftsman at 800-377-7414 or www.craftsman.com

Craftsman Laser Miter Saw

Every since Norm Abram used his laser miter saw on the New Yankee Workshop, home woodworkers have been drooling to get one in their shop. Norm's version (a since-discontinued Porter-Cable model) was expensive and the laser mount wasn't perfect. Well, Craftsman revisited the laser design, added the technology to an already decent miter saw and have answered the prayers of the radiant-challenged woodworker for under $200.

The well-appointed #24315 10" compound miter saw offers a 15-amp universal motor (capable of 5,000 rpm) with an electronic brake. As for capacities, the saw will cut a 2x6 or 4x4 at the 90° setting and offers extension rails to both sides of the blade for longer cuts. A hold-down clamp and stop blocks provide for accurate repeat cuts. A tall sliding fence offers increased support (even when beveling) for crown moulding. The horizontal D-handle is comfortable and well-designed.

For what is essentially the same price as most standard 10" compound miter saws, you get the benefit of laser guidance. Though it takes a little getting used to (the laser actually aligns directly to the left of your cut line), once you have the hang of it, this is a handy and useful tool for crosscutting.

Contact Craftsman at 800-377-7414 or www.craftsman.com

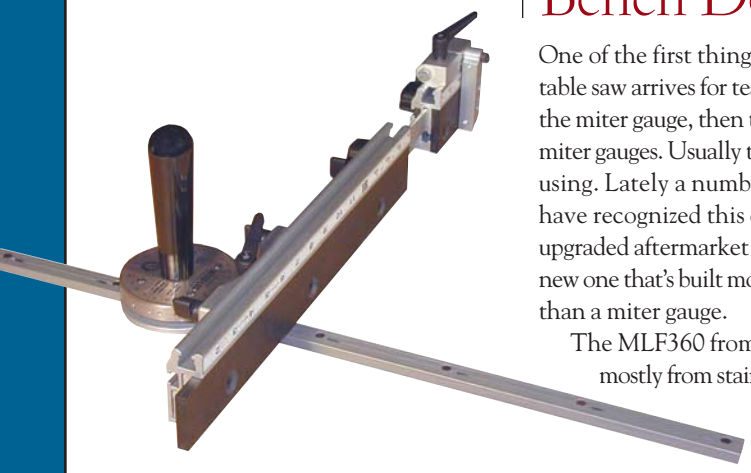
Porter-Cable Cordless Router

The Porter-Cable model 9290 router is essentially a modified model 690 router with a 19.2-volt battery on top. It features a 23,000-rpm, 600-watt motor and the 19.2-volt pack is interchangeable with the company's other 19.2 cordless tools. The router uses all the bases and accessories available for the venerable 690 router, and is reported to be capable of cutting a ½" roundover in over 100 lineal feet of oak, or in 200 feet of pine, on a single charge. The router takes both ½" and ¼" collets and employs a spindle lock for single-wrench bit changes (though you can use two wrenches if you prefer). Weighing 7¾ pounds, the router comes with one battery for about $250.

No question here, this is a cool tool. Its application in a home shop is honestly limited, but we expect a lot of us tool junkies will be buying them anyway. Our in-shop testing showed the router has ample power and torque to handle most routing tasks. Plus it's nice not to have to hassle with the cord as you work. With the option of using existing 690 bases (including the plunge base) this is a great idea. More importantly, the potential for offering sustained torque in a cordless tool offers lots of opportunities for the future.

Contact Porter-Cable at 800-487-8665 or www.porter-cable.com

Bench Dog MLF360 Miter Gauge



One of the first things we do when a new table saw arrives for testing is take a look at the miter gauge, then toss it into our pile of miter gauges. Usually they just aren't worth using. Lately a number of manufacturers have recognized this deficiency and offer upgraded aftermarket models. We've got a new one that's built more like a surgical tool than a miter gauge.

The MLF360 from Bench Dog is built mostly from stainless steel, machined to perfection, and offers a full 360° head rotation for use in any number of situations. The head has 24 preset detents at 0°, 15°, 22.5°, 30°, 45° and 60° in each quadrant, and the detents can be overridden and locked down to within 1/10 of a degree using the easily read etched stainless steel dials. The miter bar fits all standard 3/8" x 3/4" slots, is 24" long and adjusts to fit the slot along the length of the bar. The fence is 2 1/2" tall and extends from 20" to 36" long, with a scale that can be used anywhere along the full length. A two-position flip stop allows positive, repeatable crosscuts, and lifts easily out of the way when not in use. All this comes at a price, though. At around $250 it's one of the more expensive miter gauges available. But if your shop demands the best, this is a Land Rover.

Contact Bench Dog at 800-786-8902 or www.benchdog.com.

Delta 22-580 13", 2-Speed Planer

To compete in the portable planer market, adding bells and whistles isn't enough anymore. Delta has added to its already competitive line by offering a completely new and valuable feature in the portable market. The new 22-580 portable 13" planer offers two feed speeds, something previously found only in larger stationary planers. Featuring either 22.4- or 14.8-feet per minute, the planer offers the slower speed to give 90 cuts per inch for a finished surface, which requires less sanding. The planer also offers a new full-range depth stop for repeatable thicknesses, a 15-amp universal motor, two double-sided disposable knives, a head lock for snipe control and a top-read depth-of-cut scale. One little feature that you can appreciate only if you've changed planer blades is the external head-adjustment tool. Rather than grabbing the head to rotate it into position, you turn the head with a tool through an access hole in the side. There's less chance of getting cut. Available this year, the planer will sell for about $500. While pricey, it's likely to top a lot of Christmas lists. We think Delta has a winner with this one.

Contact Delta at 800-438-2486 or www.deltawoodworking.com

Grizzly G9900 Dial Protractor

If you want to make perfect miters, and I mean really perfect, then the Grizzly G9900 dial protractor is a must. This simple tool will measure any angle and give it to you in 10ths of a degree (you can easily extrapolate hundredths) on a dial that looks a lot like a dial on a caliper. With this tool, it's simple work to set up your miter saw or table saw miter gauge to cut a perfect 45°, or 22 1/2° or whatever angle your work needs.

The 11 3/4"-long beveled blade can be locked in at any place along its length, which allows you to get into tight areas. The other knob locks in the current angle setting, so you can easily transfer an exact angle measurement to your work.

We started using this protractor mostly for setting up machines, but it was quickly pressed into service as a layout tool and a "truthsayer" when it came to checking miters and 90° angles. Without exception, this $40 tool has been dead-on accurate. We have the picture frames to prove it.

Contact Grizzly at 800-523-4777 or www.grizzly.com

Powermatic 719A Mortiser

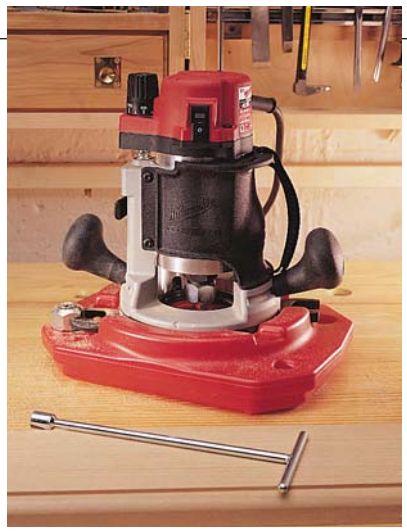
Benchtop mortisers can be fussy machines to set up, adjust and keep in alignment. And then using them involves a long series of motions to move your work and keep it in position as you plunge. If you're seriously into mortises, you need to check out the Powermatic 719A floor-model mortiser. This $790 monster sports a sliding table that looks like it's off a metalworking milling machine. To make a mortise, you clamp your work on the table and use two hand wheels to move the work. Nothing could be easier.

The 1 hp motor spins at 1,720 rpm, but refuses to stall in even the toughest cut. Because this thing is so big, you can mortise work up to 7¼" high, something that's tricky to do with nearly any benchtop machine. The machine is also equipped with stops that allow you to control where each mortise begins and ends; however, we rarely use them and have found it just as easy to eyeball our layout lines.

After almost a year of use in our shop, the Powermatic has become a shop favorite. Save your pennies, and you'll find out why, too.

Contact Powermatic at 800-248-0144 or www.powermatic.com

Milwaukee BodyGrip Router



The hottest router accessory over the past year or two has been some mechanism to easily adjust the router height while in a router table. Milwaukee shocked a lot of people this summer with the announcement of two new routers that offer that feature built-in and easy to use. The 5615-20 or the D-handled 5619-20 fixed-base routers are sleeved routers that slide directly into the base. A micro-adjustment threaded rod is permanently attached to the motor and adjusts the motor height directly up and down, locking in place with a user-friendly lever. Simple.

A hole is drilled in the base and sub-base to access the threaded rod from the underside of the router using the provided ⅜" hex-drive tool. In addition, the two-handle 5615 model offers a new over-molded grip and strap, which lets you use the router one-handed for simple cuts. It's very comfortable. The routers will also be available with a handy clamshell case that holds the router (with a bit in the chuck) upright on your bench. Both routers have 11-amp motors operating at 24,000 rpm, and both ¼" and ½" collets. Priced about $150, these are nicely appointed, well-crafted routers that answer a need in a simple way. Keep up the good work, guys.

Contact Milwaukee at 877-279-7819 or www.mil-electric-tool.com

Veritas Low-Angle Spokeshave

Nothing beats a traditional wooden spokeshave for shaping end grain. But wooden shaves wear out and are difficult to sharpen. Modern metal-bodied spokeshaves are hardy tools and easy to sharpen, but they don't perform as well. This year, Veritas started manufacturing a traditional-looking shave in cast aluminum and added some more features that make this the best spokeshave on the market today.

The ⅛"-thick A2 steel blade is easy to remove for sharpening and can be slid forward and back to open and close the mouth of the shave — much like a plane. That's nice, but the big difference between this tool and every other one on the market is the toe piece screwed on the front of the tool. With one side of the toe down, you can fair outside curves. Turn it over, and you can shape inside hollows with surprising ease.

In addition to its traditional role in shaping chair parts, this spokeshave will easily fill in for an oscillating spindle sander in a powered shop. And at less than $40, there's no reason not to add this one-of-a-kind tool to your collection.

Contact Lee Valley Tools at 800-871-8158 or www.leevalley.com

Lie-Nielsen 60½R Rabbet Block Plane

Hand plane collectors have known for years about the merits of the Sargent 507 rabbeting block plane. This excellent little tool is great for cleaning up rabbets, trimming tenons and general edge smoothing. Too bad it's discontinued, hard to find and expensive ($200 to $600 on eBay). Lie-Nielsen Toolworks has revived this useful tool with the 60½R rabbet block plane. There are some changes from the original Sargent, but they are all for the better. Lie-Nielsen lowered the angle of the blade to 12° from 20°, making this a low-angle plane. The plane is a little narrower, which makes it fit nicely in your hand. The bronze cap holds the blade in place with a screw instead of a lever. And the Lie-Nielsen body is cast from ductile iron, which is considerably stronger than the original gray iron body.

As with all Lie-Nielsen tools, the fit and finish are excellent, and the plane is ready to go to work after flattening the face of the blade and honing the cutting edge. This $150 plane excels at the workaday trimming jobs that block planes are used for, and it does double-duty as a shoulder or rabbet plane, too.

Contact Lie-Nielsen at 800-327-2520 or www.lie-nielsen.com.

Shop Fox W1671 Mortiser

This mortiser stands apart from the crowd, but it didn't start out that way. We tested a pre-production model in July and liked the machine, except it would stall in tough cuts (like all the other slow-speed machines on the market). The Shop Fox 1671 now offers a bigger ¾ hp, high-speed (3,450 rpm) motor — the biggest motor in a benchtop machine. We prefer the high-speed motors because they are less likely to stall, and with the extra power of a ¾ hp motor, it's fair to say this thing sails through wood. In addition, the base of the mortiser is large and heavy, which adds stability, plus the table and fence are longer than in other machines. And unlike any other mortiser, the Shop Fox comes with three different hold-down posts you can swap out when dealing with really thick stock. You can easily reconfigure this machine to mortise a board as thick as 7¾". Shop Fox also changed the handle to a horizontal bar design (not shown in the photo at right), which greatly improves the comfort during use. Still priced at $235, this is a great benchtop mortiser.

Contact Shop Fox at 800- 840-8420 or www.woodstockint.com.

Triton Multi-Stand

When someone pulls us aside at a tool show and says, "Hey, take a look at this really cool stand!" we're a little skeptical. But from the land down under (that's Australia) comes a stand that had us thinking of more and more applications as we got acquainted with the thing. The Multi-Stand from Triton starts out folded into a compact 6" x 36" cylinder and unfolds into an outboard support, tool support, clamp and has many other uses. It opens into a height-adjustable (25" to 37") wide tripod stand (for better stability on uneven floors) and sports a swivelling, tilting, clamping head that has low-friction, rounded pads on the top for smooth sliding. This is better than a single roller (which can be tricky to align) or transfer balls (which can miss narrow stock). The versatility offers lots of potential uses, and the stand is rated to handle more than 220 lbs. Pretty cool. And even better, it's priced under $60. Triton is working on gaining a foothold in the U.S. market, and if they keep coming up with ideas like this we think that's bloody easy. Available at all Sears Hardware stores. **PW**

Contact Triton at 888-874-8661 or www.multi-stand.com.

PENNSYLVANIA

Spice Box

THE FIRST OF TWO PARTS.

Build this heirloom 18th century project, then choose a raised-panel door or a marquetry door like the original.

The idea of trying marquetry came to me after seeing a picture of a particularly fine specimen in a book called *Pennsylvania Spice Boxes* by Lee Ellen Griffith. Feeling much more comfortable with tools that plug in, I looked at the picture of a highly inlaid spice box a number of times trying to figure out how to adapt modern power tools to a very hand-tool driven skill. It took me a while, but I was finally ready to give it a try (and I was fully expecting to fall on my face). So that my time wouldn't be a total loss if I messed up, I built the spice box first with a raised-panel door. After that, I tried the marquetry door. I figured if all went well, great. If not, I'd still have a nice spice box. Turns out, I got both.

Somewhat Complex Casework

The construction for this box itself is actually more complicated than you'd expect from such a little thing. The sides are dovetailed to the case top, while the bottom is fit into dadoes cut in the sides. The back rests in a rabbet, and the center dividers for the drawers are joined with dadoes to one another and to the case.

Start construction by gluing up panels (unless you have some nice wide boards) and cutting the sides, bottom, top and dividers to the sizes given. Most of the joinery is done with stopped dadoes. Though you can make through-dadoes with a table saw, stopped dadoes are easier with a router. I used a trim router to form the ¼"-wide dadoes in the sides for the drawer partitions. Cut each dado 7/16" deep and 7⅛" long, starting from the back edge of each side. Locate the dadoes by using the diagrams. And remember: you are making right- and left-handed pieces.

While you have a ¼" bit set up in a router, run the ⅛"-deep dadoes in the drawer dividers to form the interlocking divider assembly. You might be tempted to nail the interior assembly together now, but wait until you can dry-fit it with the rest of the case assembled.

Next, change to a ¾"-diameter pattern-cutting bit (a smaller diameter bit will do, just make a couple of passes to achieve the final width) and cut the dadoes in the sides for the bottom using a straight edge as a guide. Then use the same setup to form the rabbets on the sides for the back boards. The bottom dado is ⅜" deep and it starts 2" up from the bottom.

by Glen Huey

Glen Huey builds custom furniture in his shop in Middletown, Ohio, for Malcolm Huey & Sons and is a contributing editor for Popular Woodworking.

Photo by Al Parrish. Special thanks to Sharon Woods for use of location.

Pennsylvania Spice Box

	NO.	ITEM	DIMENSIONS (INCHES) T	W	L	MATERIAL	NOTES
Case							
❑	2	Sides	3/4	9 1/8	18	Walnut	
❑	1	Bottom	3/4	8 1/2	12 1/4	Walnut	
❑	1	Top	3/4	9 1/8	13	Walnut	
❑	1	Sub-top	3/4	8 1/2	11 1/2	Walnut	
❑	3	Horiz. dividers	1/4	6 1/2	12 3/8	Walnut	
❑	2	Horiz. dividers	1/4	6 1/2	4	Walnut	
❑	2	Vert. dividers	1/4	6 1/2	4 3/8	Walnut	
❑	1	Vert. divider	1/4	6 1/2	3 1/8	Walnut	
❑	1	Back	5/8	12 3/8	17 1/4	Poplar	Shiplapped
❑	-	Top moulding	1 1/16	1 7/16	44	Walnut	
❑	-	Bottom moulding	5/8	2 5/8	36	Walnut	
Drawers							
❑	1	Bottom front †	5/8	3	11 1/2	Walnut	
❑	1	Center front †	5/8	4 1/8	4 1/8	Walnut	
❑	4	Small fronts †	5/8	1 15/16	3 7/16	Walnut	
❑	2	Split fronts †	5/8	2 7/8	5 5/8	Walnut	
❑	1	Top front †	5/8	3	11 1/2	Walnut	
❑	18	Sides 1/4" thick x (front width-1/4") wide x 5 3/4" long					
❑	9	Bottoms 1/4" thick x 6" wide x (length of front) long					
❑	9	Backs 1/4" thick x (front width-1/4") wide x (length of front) long					
Door*							
❑	1	Top rail	3/4	1 3/4	11	Walnut	1 1/4" TBE
❑	1	Bottom rail	3/4	2 1/4	11	Walnut	1 1/4" TBE
❑	2	Stiles	3/4	2	13 3/4	Walnut	
❑	1	Panel	5/8	9 1/8	10 3/8	Walnut	5/16" TAS

TBE = TENON ON BOTH ENDS; TAS = TENONS ALL SIDES
*DOOR WIDTH NOMINAL, TRIMMED TO FIT AFTER ASSEMBLY
† DRAWER FRONT SIZES FIT OPENINGS EXACTLY. TRIM TO FIT ONCE YOUR CASE IS ASSEMBLED.

The back rabbet is 5/8" x 7/16" and runs the full length of the side.

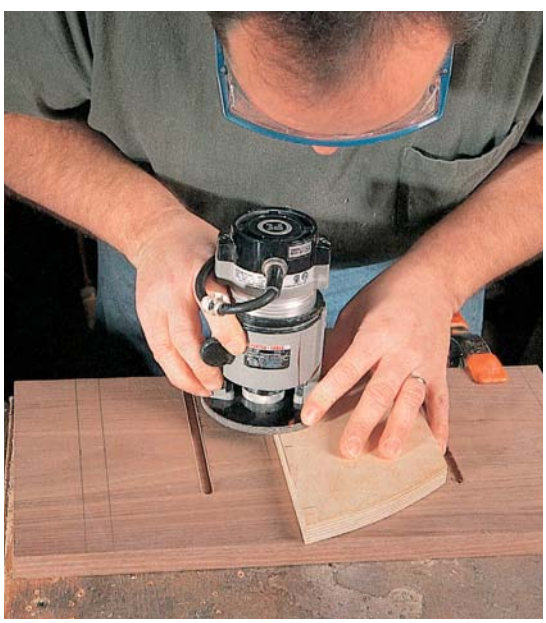
The door fits onto the case by cutting a stopped rabbet on the left side piece, and notching out the right side. Make the 1/4" x 3/4" stopped rabbet using a router, starting at the top edge of the lower dado and stopping 1 1/2" down from the top edge of the side. Square out the rabbet using a sharp chisel and mallet. To notch the right side, I used my table saw, again starting at the top edge of the lower dado and stopping 1 1/2" down from the top edge of the side.

The next step is to cut the through-dovetails to mate the top to the sides. Use whatever dovetailing method you prefer. I cut mind by hand to give the piece an authentic period appearance.

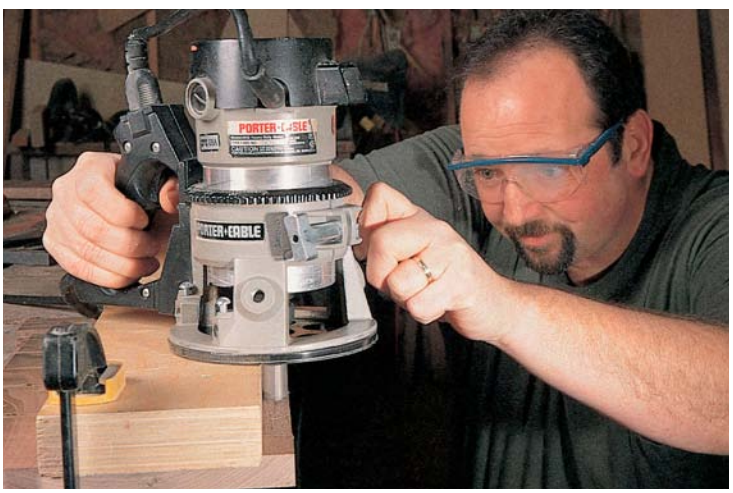
The last step before assembly is to cut away the lower part of each side up to the previously cut dado, but leaving "feet" on either side. This cutaway allows you to attach the bottom (resting in the exposed dado which now becomes essentially a rabbet) to the sides using cut nails, and allows the lower moulding to appear open below the cabinet, but makes attaching the moulding simple and makes it stronger. Use the moulding patterns to locate the cutaways, holding the top edge at the bottom of the lower dadoes.

After some interior sanding, round over the leading edges of the drawer partitions a fair amount to give the interior a more finished appearance. You're now ready to assemble the case. Start with the dovetails, then slip the bottom in place and nail it in place up through the bottom. Next, add the sub-top that is slipped into place inside the case (under the top) and attach it to the top using screws. This sub-top builds up the front edge of the case to support the top moulding.

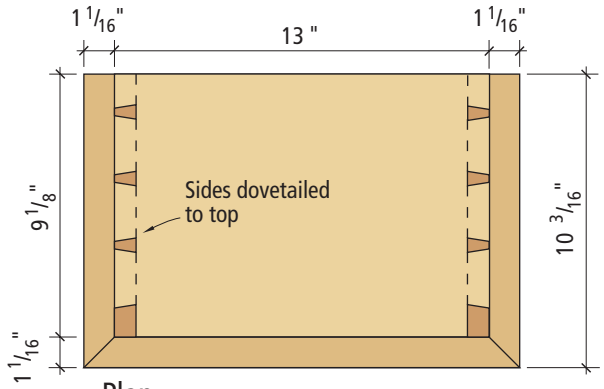
After a dry test-fit, assemble the drawer dividers using glue and one or two strate-



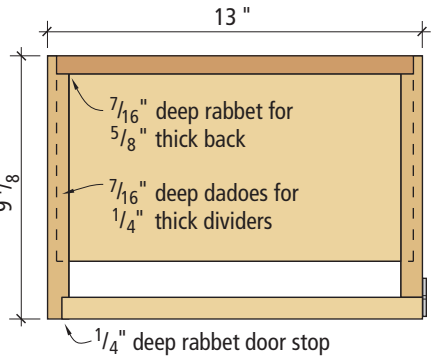
Four 1/4" dadoes are cut in each side to hold the drawer dividers. I like using a trim router for this step and also use a template guide with a straight bit and a piece of scrap wood as a straight edge.



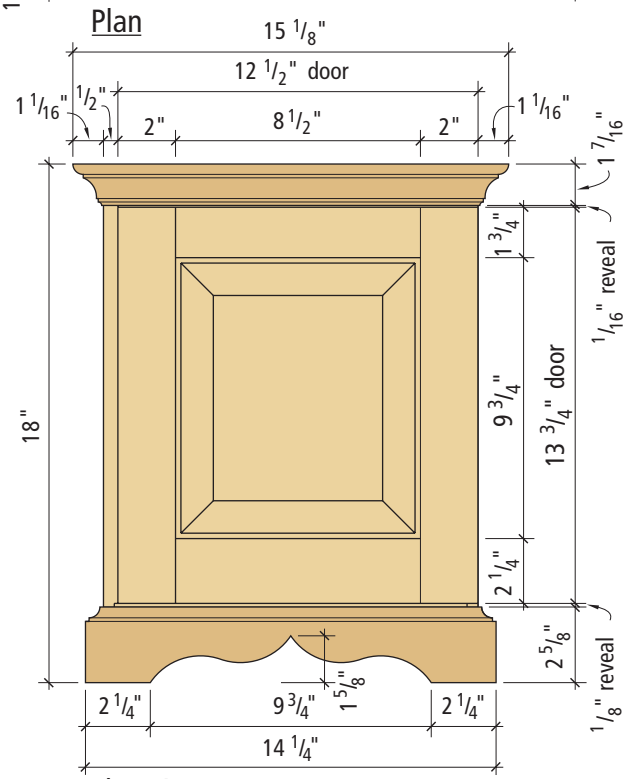
I switched bits and routers then cut a dado for the bottom in each side and a stopped rabbet on the back edge of each side to hold the 5/8" back boards in place.



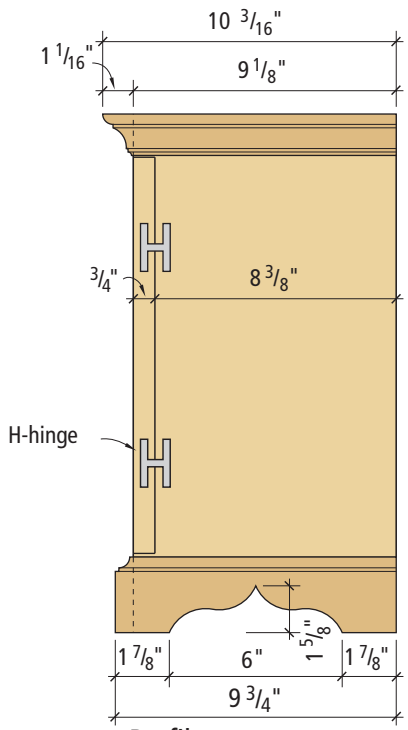
Plan



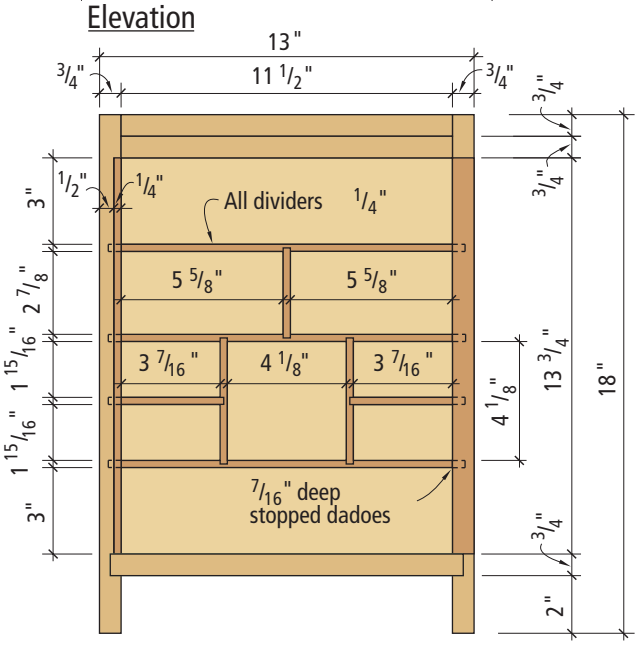
Horizontal box section



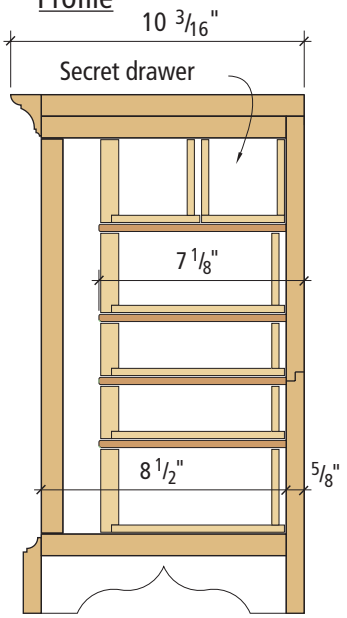
Elevation



Profile



Elevation - door & trim removed



Vertical section

The door is fit into a recess on the right side. I made this recess by first running the side on edge over the table saw to define the top and bottom of the recess. I then reset the saw, ran the blade height down below the surface of the table, and slowly raised the blade into the piece while running. The piece is then pushed through the saw to the end of the cut and the saw turned off. The waste is connected by small pieces of wood and can be cut free simply with a hand saw.

gically placed brads. Then slide the drawer assembly into place in the case, using only glue.

While letting the case sit clamped-up for about an hour, mill the material for the top and bottom mouldings. Using the provided patterns, mark and then cut out the bracket feet patterns on the lower mouldings. The lower mouldings also have a decorative detail routed onto the top edge. Cut this next. The upper moulding uses a double-ogee design to form a miniature crown. See the diagrams to help match these patterns on your case. With the moulding shaped, miter the corners and attach them to the case using small brads. Nail directly through the moulding into the case. Cut the front mouldings to fit first, then work back from the corners to get the side mouldings the proper length. Set the brad nails below the wood surface, then use a matching putty to fill the holes.

The back for the case is made from two interlocking shiplapped poplar boards. The grain is run horizontally and the shiplapped joint is horizontal and falls somewhere near the center of the back. Cut the pieces and mill the rabbets to form the shiplapping, but leave the back loose till after finishing the piece. It's hard enough to finish the small drawer divider spaces without a back.

The drawers use straightforward, traditional half-blind dovetails. Use poplar for all the parts except the fronts, which are walnut. See the "Traditional Drawers" article at right for details.

The door is last. My fall-back door was a frame-and-panel design built with haunched mortise-and-tenon joinery. While I don't want to set you up for failure with next issue's marquetry article, I'd definitely make sure I had enough walnut for the frame-and-panel door if things didn't work out as planned.

To make the door, cut your rails, stiles and panel to rough size. Select stock for the panel with some nice figure to make the door really special. Start by running a $\frac{3}{16}$" beading profile on the inside front edge of each piece. The inside edge of the bead should roll into the panel once it's in place. Next cut a $\frac{1}{4}$"-wide x $\frac{3}{8}$"-deep groove

Tips On Wood Putty

One of the tricky parts about using wood putty to hide nail holes is matching the wood's color. Store-bought putty comes in an array of colors, but it may not dry to the same color as it appears when wet. In addition, if you match the putty to the color of the wood prior to finishing the piece you may find that the putty doesn't change in color when the finish is applied.

To avoid this problem, either apply some finish to a scrap piece, then match your purchased putty to the sample. This make take a couple of tries, but it's well worth the effort. Some manufactured putties will indicate that they will take a stain. This may be true, but I'd still recommend a test piece.

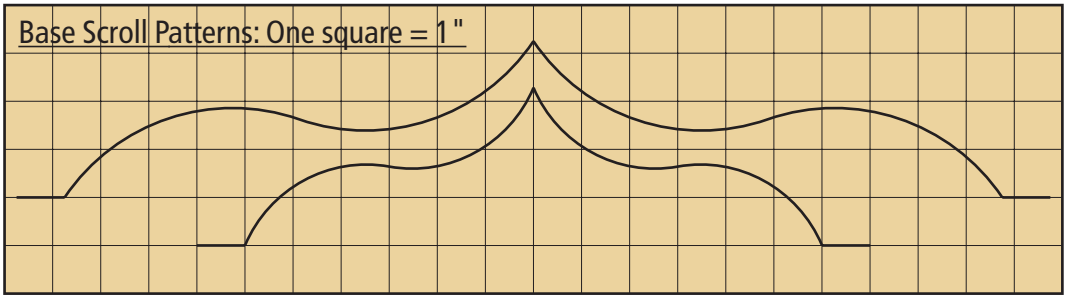
Another method would be to make your own putty using sanding dust from the wood you are using and white or yellow wood glue. Proportionally use the least amount of glue possible in the mix as it will serve as a sealer, keeping any stain or finish from penetrating into the sawdust or surrounding wood.

Using either type of putty, allow the putty to mound slightly higher than the surface of the wood, as shrinkage will occur as the putty dries. When dry, simply sand the putty flush and apply your finish.

With the case dovetails cut and the bottom bracket for the feet cut out, you're ready to assemble. The dovetails are simple, and the cleverness of the design shows as you're able to nail the bottom in place in the rabbets through the access made by cutting out the feet brackets.

With the drawer dividers assembled and installed, the moulding is ready to go on. The top moulding was made using a roman ogee bit in two steps, then nailed in place. The lower moulding is cut to provide the bracket base design using the scaled patterns provided, then an attractive profile is run on the top edge. The rest is simply mitering and nailing in place.

The drawers are built to match the traditional style of the original piece, with the backs captured in through-dovetails to the sides, and the fronts attached to the sides with half-blind dovetails. The bottoms are simply nailed onto the sides, which would be a poor idea in anything larger than these drawers. Though the materials list doesn't call out the pieces for it, I added a very typical secret drawer behind one of the drawers.



Traditional Dovetailed Drawers

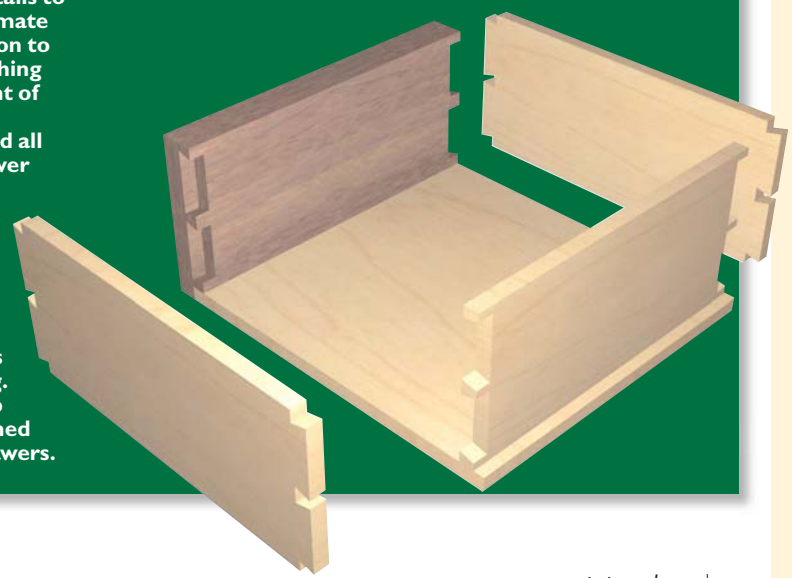
Not only is the construction of the drawers traditional, the secret hiding spaces are as well. The spices kept in these boxes were already considered valuable, but the original builders wanted to make it possible to store even more valuable items undetected. Behind both second-tier, shortened drawers are secret drawers. It's a nice touch, but it's your choice. The sizes given in the materials list are for full-depth drawers in those spaces. You can change the dimensions as you like to add your own secret.

Construction of the drawers uses half-blind dovetails to mate the fronts and sides, and through-dovetails to mate the backs and sides. The bottoms are simply tacked on to the sides and back using brads. This method of attaching the bottoms will prove sufficient to carry the amount of weight in these small drawers.

Each drawer uses three dovetail pins per joint, and all that I made were hand-cut. Start by cutting the drawer fronts to fit in each of the spaces with about 1/16" clearance on all sides. With all the fronts cut, set up a router to cut a 1/4" high x 3/8" rabbet on the inside bottom edge of each front. The sides should align with the top of the rabbet, so go ahead and lay out your dovetails on the fronts, sides and backs and get comfortable.

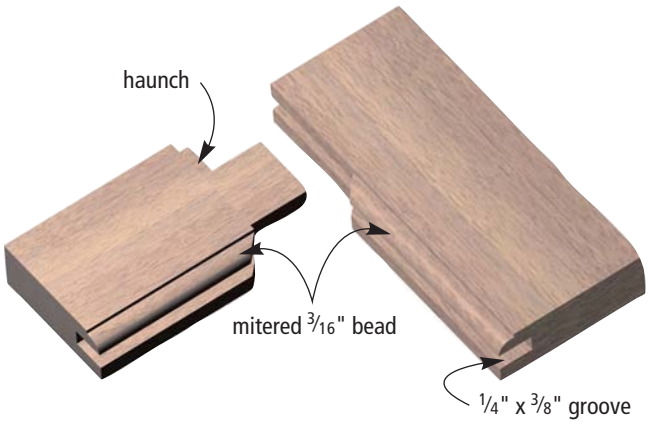
With all the dovetails cut and fit, cut the bottoms to width for each drawer, but leave them a little long. The length of the drawer bottom will serve as a stop against the case back to keep the drawer fronts aligned properly. The exception to this is with any secret drawers. Leave only a longer bottom on the secret drawer and make the front drawer bottom flush to the back. Assemble the drawers with glue, then tack the bottoms in place using a few small brads.

Trim the drawer bottoms so that everything aligns in front nicely, then add the simple screw-on knobs to the drawers. Follow the same finishing technique for the drawers as for the main case and you're ready to start filling up your spice box.



Take your time fitting and attaching the door to the case. Because it's inset on three sides, and the traditional hinges don't allow for much slop, you need to get it right the first time.

Detail of Door Construction



down the center of the inside edge of each door stile and rail. Then make a 1/4" x 1" mortise, 1 1/4" deep at the top and bottom of each stile, 1/4" in from each end. The 1/4" width should center on the previously made groove, and the depth of the mortise should include the depth of the groove itself.

Next, set up your table saw to make the 1/4"-thick x 1 1/4"-long tenons on both ends of the door rails. The tenon is again centered on the piece. Now miter the beaded profile. Tip your table saw's blade to 45°, and with the rail resting on the inside edge, use your miter gauge to notch the inside corners, 1 1/4" in from each end, and at a height of 3/16". While the blade is set to 45°, make a similar cut on the two stiles, set at 3/16" high, and starting 1 3/4" in from the top end of each stile, and 2 1/4" in from the bottom end.

Reset the blade to 90°, and by running each stile on end with the outside edge against the rip fence, trim 3/16" from the inside edge of each stile, up to the height of the previously cut 45° miter.

With the tenon formed, it's time to make it a haunched tenon. Using your miter gauge, notch the outside edge of each door rail tenon 1" in (including the blade thickness) and 1/4" high. Then use your rip fence again to cut away the tenon waste on either side of the rail tenons, leaving the appropriate width tenon to fit in the mortises in the stiles. You should be able to dry-fit the door together now to check your joints.

I used a panel-raising bit in my router table to shape the door panel. Allow the appropriate thickness at the edge of the panel for it to fit into the grooves in the stiles and rails. The flat of the panel will extend 1/8" beyond the front surface of the door, while the back surface of the panel will fit exactly into the groove and form a 1/4" recess. Assemble the door using glue in the mortise-and-tenon joints, but allow the panel to float loose in the grooves. I added squared pegs to the joints, drilling all the way through the door at the center of each tenon, sanding the pegs flush to the surface of the door.

The door is hung on the case using an "H"-shaped hinge that's screwed into the right-hand edge of the door and the right side of the case. The lock set requires a recess routed into the back of the door. Since each of the locks are fairly individual, use the actual lock to determine the appropriate sized recess. The same goes for the recess required in the left-side piece to accept the bolt from the lock.

To finish the piece, I filled the grain with a paste filler then applied a couple of coats of blond shellac to bring out the beauty of the walnut. Though there are lots of little pieces, this is a very pleasing piece when finished. All the basics of a larger piece, but it fits on your table. Next issue: the fancy door. **PW**

In The Next Issue:

In the February issue of *Popular Woodworking,* Glen will walk us through his first try at marquetry, with stunning results. If you've ever thought this would be an interesting skill to acquire but were scared off, check out this article. Glen shows you how to do it with tools you already own, and skills you've already mastered. Who knew marquetry could be this manageable?

Sources

Horton Brasses, Inc. 800-754-9127
(1) Lock, LK-11
(1) Escutcheon, H-121
(11) Knobs, H-42
(2) Hinges, HH2, the 2 1/2" versions

WHY YOU SHOULD Freeze YOUR TOOLS

Cooling your tooling to -320° can double or triple the time between sharpenings.

And here's the real kick: it's inexpensive and companies that offer this deep cryogenic freezing are becoming more common. However, here's what you absolutely need to know before you try it.

About 150 years ago, Swiss watchmakers noticed that extreme cold changed the properties of their metal clock parts for the better. So after manufacturing their gears or what have you, some watchmakers would then store the parts in caves during the cold Swiss winters and let them freeze.

Unwittingly, they had given birth to what is now commonly known as cryogenics.

During the last century, toolmakers and metal heat treaters have explored what extremely cold temperatures do to tooling, metals and other materials. And they have come to some remarkable conclusions. For certain types of metals, cooling them to -320° Fahrenheit can make them at least twice as resistant to wear as untreated metal.

The wear resistance is permanent. You have to treat your tooling only once, and it will remain that durable forever, experts say. And the price of cryogenically treating your tooling is becoming quite reasonable. We found that treating about four pounds of metal will cost you about $30 to $50. (If you treat a lot of items, the cost can be as little as $1 a pound — and prices continue to drop). Cryo labs themselves are also becoming more common because commercial heat treaters are investing in the technology so they can offer the service to their customers. If you live in an industrial area, you'll probably be able to find a cryo lab locally. But even if you live in the sticks, there are cryo labs you can ship your tooling to for treatment.

So what's the catch? If cryo is so amazing why doesn't anyone sell cryogenically treated planer knives or router bits? Many of the manufacturers we talked to, including Freud, had experimented with the process in its early days and found it had little or no effect.

That's not surprising, says Bill Bryson, author of the book "Cryogenics" (Hanser Gardner Publications) and the president of the company Advisor in Metals in Milton, New Hampshire.

"Back in the 1970s it was a free-for-all, and it hurt the industry," Bryson says. "People were dumping tools in liquid nitrogen and they were cracking, or they weren't tempering the tools after the (cryogenic) process."

As a result, cryogenics got a bad rap in the steel and tooling industry, Bryson says. Not only for the early mistakes that were made but because some people thought that cryogenics would hurt sales. If tooling lasted twice as long, they might sell only half as many tools.

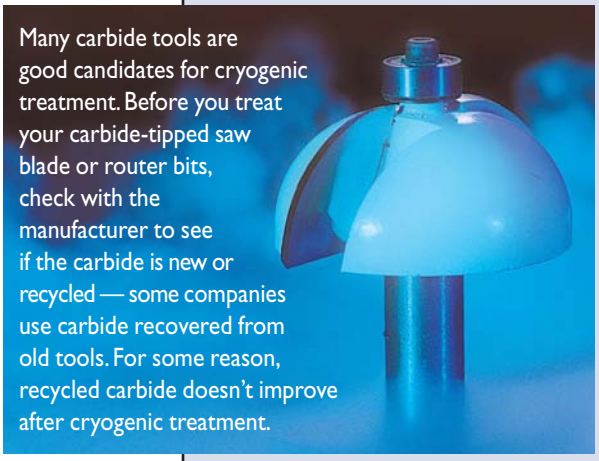
But during the last 30 years, heat treaters and cryogenic advocates began figuring out more about how, why and when cryogenics works. And today, most people in the industry acknowledge that it works well for certain types of metals, Bryson says, particularly the more complex alloys (more on that later).

In the home woodworking market, we've seen only a few cryogenically treated tools on the market. A few years ago, Vermont American announced it would sell "Ice Bits," cryogenically hardened screwdriver bits. Hock Tools recently began offering a line of cryogenically treated A2 plane blades. The cryo blades cost between $5.50 and $12.50 more than the same-size high-carbon steel blades. And toolmakers Bridge City Toolworks and Steve Knight, owner of Knight Toolworks, also offer cryogenically treated blades.

But cryogenic treatment can help woodworkers with a lot more than plane blades or screwdriver bits, Bryson says. Just ask James Larry Poole of P & K Custom Cabinets in Lula, Ga.

A couple years ago Poole sent out his carbide-tipped sawblades, router bits and shaper cutters to a lab for treatment.

"It really makes them last longer," he says. "I had one sawblade in par-



Many carbide tools are good candidates for cryogenic treatment. Before you treat your carbide-tipped saw blade or router bits, check with the manufacturer to see if the carbide is new or recycled — some companies use carbide recovered from old tools. For some reason, recycled carbide doesn't improve after cryogenic treatment.

by Christopher Schwarz

Comments or questions? Contact Chris at 513-531-2690 ext. 407 or ChrisS@FWPubs.com.

CRYO: IT'S NOT JUST FOR TOOLS ANYMORE

Sure, cryogenics can make your tools last longer, but it also has a lot of other benefits, some practical and some wild. Here's a short list of claims we've gathered from books, magazine articles and the internet:

- **PANTIHOSE: Nylon stockings that have been cryogenically treated are less likely to develop runs.**
- **GOLFING: Cryogenically treated golf clubs hit balls 3 percent to 5 percent farther. Cryogenically treated balls can be hit farther.**
- **RACING: Hickson Engines has treated small-block Chevy engines and found significantly less cylinder wear during a racing season. Many other racing professionals have also used cryo.**
- **FIREARMS: Treated rifles are more accurate.**
- **MUSICAL INSTRUMENTS: Cryogenically treated instruments have a better tonal quality and the valves slide more easily.**
- **GUITAR STRINGS: It doesn't even have to be the entire instrument. Some people treat guitar strings and say it improves their tone.**
- **SPORTS: Baseball bats that have been frozen hit balls 2 percent to 4 percent farther.**

Where to go for Cryo

If you can't find a cryogenics lab or a heat treater locally, here are a few labs across the country that provide the service. Please contact them for pricing and shipping information.

Advisor in Metals
Bill Bryson
336 Governors Road
Milton, NH 03851
603-755-9232

Applied Cryogenics
Bruce Medlyn
Fort Smith, AR
800-734-7042

Down River Cryogenics
Mike Pate
606 West St.
Whitehall, AR 71602
501-397-7189

ADS Cryogenics
Aaron Bennett
P.O. Box 3401
Crestline, CA 92325
909-338-6756

Advanced Cryo Techniques
Jim Sabinas
110 E. Center St.
North Fort Wayne, IN 46554

Cryogenic Services
Jim Younger
18308 West 79th St.
Viola, KA 67149
316-545-7555

York Cryogenics
Leon Patterson
3945 Farm Road
York, PA 17402
717-309-0639

Cryotron, LTD
Gordon McKay
75 E. Shep St.
Spruce Grove, Alberta Canada
780-960-0960

Tools that are difficult or expensive to resharpen, such as this Forstner bit, are prime candidates for cryogenic treatment.

ticular that just would not wear out."

Poole used to be involved in car racing, and he had heard about the benefits of cryogenically treating some car parts, including crankshafts and pistons. So when a friend of his from the racing business started a cryo lab, Poole decided to see if it would help his tools.

"You really can tell the difference," he says. "I get twice the life at least... so it's worth the money."

But before you start gathering all the cutting tools in your shop to take to a lab, there are some things you need to know.

In a Nutshell: What Cryo Does

There's a little science here, but it's easy to digest. When tooling is made, the manufacturer heats it to make it hold an edge. During heat treatment, the structure of the steel changes. As it is heated, the steel has a structure that is called "austenite," which is softer and has a coarse, irregular grain. When the blade is quenched (reduced quickly in temperature), the austenite changes into "martensite," which has a finer grain and is more resistant to wear.

The problem is that the transformation from austenite to martensite is never 100 percent. If a tool is carefully heat treated, it might end up with 90 percent martensite and 10 percent austenite. Commercial heat treating typically results in 75 percent martensite, Bryson says. In low-quality tooling, it can be as low as 50 percent martensite.

By carefully cooling the tooling to -320° and then thoroughly retempering the metal, nearly all of the austenite is transformed into martensite. Bryson says it's proven to be a 99.9-percent transformation or more.

All tooling will benefit from cryogenics, Bryson says. But if the steel is an alloy containing cobalt or tungsten, the cryogenic process will create very fine micro-carbides, which add even more durability to the edge.

The alloy A2 steel, which is now found on some hand plane blades, contains carbon and chrome, so it reacts well to cryogenic treatment. High speed steel (HSS) contains molybdenum (which makes the tool resistant to heat), chromium and sometimes tungsten, which makes it ideal for cryo treatment. You'll find HSS in your planer knives, your jointer knives and in other cutting tools. As a rule with metals, the higher the alloy content, the better the cryogenics will work.

But what about carbide tools? Will saw blades and router bits benefit from cryogenic freezing? According to Bryson, that depends.

If the carbide is newly manufactured and not recycled from old carbide tooling, cryogenic treatment works, Bryson says. Carbide that has been reclaimed or recycled is not improved.

"And we don't know why," he says.

In new carbide, cryogenic treatment strengthens the binder between the individual carbides, he says. Cryogenically treated bits should last twice as long between sharpenings, Bryson says, though some people report even longer times between sharpenings.

Beware of the Thin Film

Perhaps one of the strangest aspects of cryogenic treatment is something that experts have yet to fully explain. It seems that after a tool has been frozen and then retempered, some report you won't get the added wear-resistance until the tool is resharpened.

Bryson says there's a layer of metal that's between .00007" and .0001" thick on the outside that remains untreated. After you remove this layer by sharpening, the tool works great. Bryson calls this the "Thin Film Phenomenon," and he says it's one of the reasons some people thought cryogenics was a crock in the early days. People would treat their sharp new tools, put them to use and see almost no difference in the tool's life. But if you sharpen the tools after treatment, Bryson says, that's when you see the the full benefits of cryogenic treatment.

How to Shop for Cryo

There are several ways to cryogenically treat tools, and experts say some are better than others.

• Warmer Cryo: Some labs use dry ice to cool the tools. Dry ice will take the temperature down to -109° Fahrenheit. This process works, but you won't get a full transformation of austenite to martensite.

• Quick Dip: Some labs dip the tools into liquid nitrogen (-320°), leave it there for a short period of time, remove the tools and let them return to room temperature. This process can cause the tools to shatter from thermal shock. It also can transform only the outer layer and leave the core untreated. Many of the experts we talked to do not recommend this procedure.

• Long Bath: Other cryo labs use gaseous nitrogen to reduce the temperature slowly; they keep it there for 20 hours or more (using either gas or liquid nitrogen), and then slowly return the tools to room temperature. Bryson says he's tried a variety of methods, and the equipment he prefers (and sells to other cryo labs) takes the temperature down using gas and then soaks the tools in liquid nitrogen. Either process works, however.

One of the keys to getting the best results is to choose a lab that has some knowledge of heat-treating and metallurgy and is willing to soak the tools for a long time, says Randall Barron, professor emeritus at Louisiana Tech University's Department of Mechanical Engineering. Barron's pioneering research in the 1970s, 1980s and 1990s helped convince many industries to use the process in manufacturing.

Barron's studies showed that bringing the temperature down to -320° created a more durable tool. Plus, his research showed that soaking the tools for hours was what led to the creation of the micro-carbides, which lend additional wear resistance.

No matter which process is used, after the tools return to room temperature, the tools need to be retempered because the new martensite is fragile and can shatter, experts say. This retempering process is almost always included in the price for the cryo treatment.

Bryson recommends that the tools be tempered at 300° to 350° for two hours for every inch of thickness of the tool. He also says you should make sure that the items are not stacked on top of one another during tempering.

How Well Does it Work?

This, of course, is the big question. Some of the claims seem outright outrageous. A dowel maker claimed his A2 knives lasted 800 percent longer. A titanium aircraft bit that once lasted for 15 holes was replaced by a common bit that had been cryogenically treated that would last for 200 holes.

Most cryogenic labs will tell you it's reasonable to expect your tooling to last two or three times longer between sharpenings. Considering how inexpensive cryogenic treatment can be, you'll make your money back after one sharpening.

In August, we sent a batch of tooling from our shop here at *Popular Woodworking* to a cryo lab for treatment — everything from a chisel to 12" jointer knives. We're going to compare the durability of these tools with the identical untreated tooling we recently installed in our machinery.

Next year, we'll let you know what we found. But even if we find out that cryogenic processing really works, don't be surprised if you don't see cryogenic planer blades for sale in woodworking catalogs.

Professor Barron says that one of the studies he did in the early days was for a manufacturer of razor blades. The company wanted to see if the cryogenic process could improve the dies they used in making the blades.

"I asked if they wanted to treat the razor blades to make them last longer," he says with a chuckle. "They said no, because then they might not make as much money." **PW**

Ron Hock's A2 blades and Thomas Lie-Nielsen's planes are both available from Woodcraft (800-225-1153), Japan Woodworker (800-537-7820) and Garrett Wade (800-221-2942). The products are also available directly from the manufacturers:

- **Hock Tools**
  888-282-5233
  www.hocktools.com
- **Lie-Nielsen**
  800-327-2520
  www.lie-nielsen.com

Hock Tools newest plane blade is made from A2 tool steel that has been cryogenically treated. Cryogenics can more than double the time between sharpenings on plane blades.

In Search of Proof Cryo Really Works

To many people, cryogenics sounds too good to be true. So we went looking for some stories to back up the claims we'd read so much about. Ron Hock, the founder of Hock Tools, began offering A2 plane blades this year that have been cryogenically treated — in addition to his line of high-carbon steel blades that he's offered for years.

He says he began offering the A2 tools after other plane blade manufacturers, such as Veritas of Canada, began selling A2 blades. Hock says he isn't entirely convinced that A2 can be made as sharp as his high-carbon blades, but it does appear to wear longer and be slightly more corrosion-resistant.

"It was adding the cryo that tipped it for me," Hock says. "Without the cryo improvement, I wouldn't use the A2."

Hock says he's getting good reports back from customers who are seeing longer edge life.

Thomas Lie-Nielsen, the founder of Lie-Nielsen Toolworks in Warren, Maine, was also looking for answers. During the summer, he was considering switching to a different type of blade for his line of high-quality planes. For years he's used a high-carbon steel that he carefully heat treated. Lie-Nielsen was considering switching to A2 that was cryogenically treated.

So he took three A2 blades (some of which had been cryogenically treated) and three high-carbon blades and made 300 identical cuts with each. He then sent them to an independent lab to examine the blades. Lie-Nielsen says it was obvious that the A2 blades retained their edge longer than the high-carbon blades. And he hopes the lab will be able to tell him how the cryogenically treated blades fared. We promise to share the results with you in a future issue.

Photo by Al Parrish

Craftsman
WALL SHELF

Learn to make through-mortises using a template and a router as you construct this simple and sturdy shelf.

Like most woodworkers, I try not to reinvent the wheel every time I build a project. Instead, I search through my library and back issues of woodworking magazines to see if I can find what I'm looking for. I usually don't find exactly what I want – but if it's close, it's easy to modify a dimension or decorative feature. So I was quite surprised when I started looking around for a Craftsman-style wall shelf, and came up empty. Further digging revealed that the Craftsman folks of yesteryear didn't use them. Not because they didn't have knickknacks, but because they relied on built-in shelving units and large sideboards or buffets to store and display their cherished collectibles.

Undaunted, I dusted off my drafting table and put pencil to paper. Designing a wall shelf like this was fairly straightforward as I had a rough idea of the dimensions I needed and I knew I wanted three shelves approximately 30" long. As I worked, I incorporated three classic Craftsman-style details into the wall shelf: shallow, graceful curves, the corbel (the distinctive curved shape at the bottom of the sides), and the honesty of through-mortise-and-tenon joints. Although quartersawn oak is a trademark of Craftsman-style furniture, I chose cherry instead for two reasons. First, quartersawn oak is highly figured and I wanted the items displayed to catch the eye rather than the shelf itself. Second, since I was looking for a formal, dignified look, I chose cherry – a wood I've always felt adds a touch of elegance to any piece.

Once I was comfortable with the design and had worked out the majority of the details, I made a quick mock-up to get a better feel of how the curves would work together and to better visualize the finished piece. See the story "Crude but Effective Mock-up" on the following pages.

Construction

To build the Craftsman-style wall shelf,

by Rick Peters

Rick Peters is a woodworker and publishing professional and resides in Emmaus, Pennsylvania.

Cleats screwed around the perimeter of the mortising jig capture a side piece for routing the mortises.

start by cutting the parts to size. See the cutting list and illustrations. There are only seven parts to the shelf: two identical sides, three identical shelves and a top and bottom bracket. The sides and shelves are 7/8"-thick and the brackets are 3/4". As you cut the parts to size, set some of the thicknessed scraps aside for test cuts later.

A plunge router plus a mortising jig equals precision mortises – something that's paramount when the mortises are through and the tenons are exposed.

Mortises

The biggest challenge to building the wall shelf is cutting the mortises in the sides for the shelf tenons. Because these are through-tenons and will be highly visible, I decided it would be best to build a simple router jig for added accuracy (see the drawing on the next page). The jig is just a piece of 1/4"-thick hardboard with cleats screwed around the edges to hold a side piece in perfect position. Pairs of slots for the mortises in the hardboard are sized to accept a 5/8" OD, 17/32" ID template guide bushing for the router. This bushing can be used with a 1/2"-diameter straight bit or spiral-end mill bit. I drilled the holes in the hardboard with a 5/8" brad-point bit and removed the waste between the holes with a sharp chisel.

To use the router jig, fit it over a side and slide a scrap of plywood underneath since you'll be routing all the way through the side. Using a plunge router, take a series of light cuts, blowing out the chips from the mortise after every pass. Continue until you've cut all the way through. Then move onto the next mortise.

All that's left is to square up the round corners of each through-mortise with a chisel. Although you can do this with a conventional beveled-edge chisel, a corner chisel will make quick work of the job. Since I lean heavily towards the Craftsman style, it was easy to justify the modest cost of this fine tool. To ensure the corner cuts are perfectly vertical, clamp a guide block flush with the edge of the mortise and press the corner chisel firmly against it as you strike the chisel with a hammer.

There are a couple more mortises to cut on each side piece – these accept the tenons on the ends of the top and bottom brackets. Since these aren't through-mortises, you needn't use a jig. Instead, lay them out directly on the sides making sure to bookmatch them as shown. To cut these mortises, I used a 1/4" mortising bit in the drill press and clamped a fence on the back edge for accuracy.

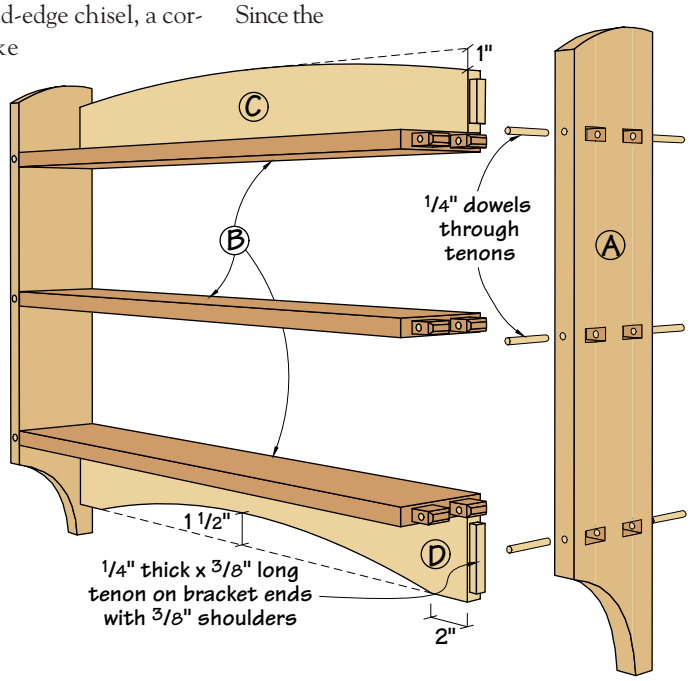
Side Shapes

With the mortises complete, use the drawing on the last page to make a pattern of the sides out of 1/4" hardboard. Carefully cut this out with a jigsaw or band saw and sand the edges smooth. Then place the pattern on each side piece and trace around it with a pencil. Now you can cut the sides to shape and sand the edges smooth.

Shelf Tenons

Now that the sides are complete, you can turn your attention to the shelves. Basically all there is to do here is to cut the tenons on the ends to fit the mortises in the sides. Since the

To guarantee the mortise corners end up perfectly vertical, clamp a scrap of wood flush with the edge of the mortise to guide the chisel.



A drum sander fitted in the drill press will make quick work of smoothing the corbel on the bottom and the gentle curve on top of each side piece.

Book match the two sides and lay out the mortises for the brackets directly on each side piece.

sides are 7/8" thick, I made the tenons 1" long so they'd protrude through the 7/8"-thick sides by 1/8". I cut the twin tenons in two steps. First, with a dado blade in the table saw set for a shallow cut, cut an equal amount off each face to create the shoulders leaving a 1/2"-thick tenon (here's where those scrap pieces come in handy). Then with each shelf on end and a tall support piece attached to the miter gauge, make the end and middle shoulder cuts to form the twin tenons. Here again, use the scrap pieces and sneak up on the perfect fit. Take your time and test the fit often – what you're looking for is a friction-fit – if you even think about reaching for a hammer to persuade the joint to go together, it's too tight. Stop and take a little more off. (A finely tuned shoulder plane is excellent for this.) Finally, to soften the ends of the tenons and help them slide more easily into the mortises, I chamfered the ends with a block plane.

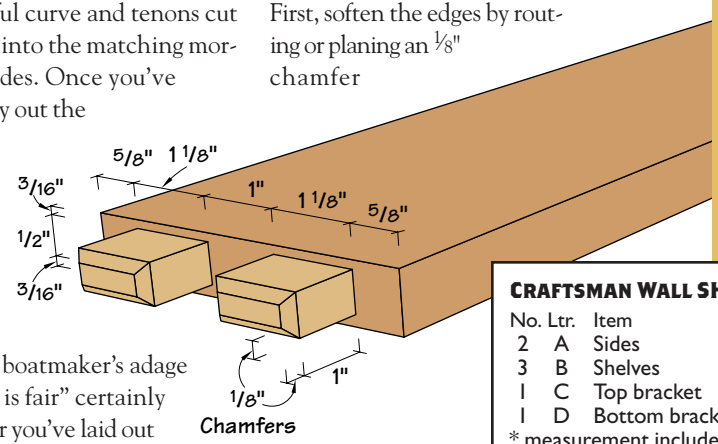
The shoulders for tenons on the shelves are easily cut on the table saw fitted with a dado blade.

Brackets

The last two pieces of the wall shelf to make are the top and bottom brackets. Each has a graceful curve and tenons cut on the ends to fit into the matching mortises cut in the sides. Once you've cut the tenons, lay out the curves by bending a thin strip of wood into a graceful curve and having a helper trace the outline on each bracket. The old boatmaker's adage "if it looks fair, it is fair" certainly applies here. After you've laid out the curves, cut out the shapes and sand the edges smooth.

Assembly

Before assembling the Craftsman-style wall shelf, there are a couple things to do. First, soften the edges by routing or planing an 1/8" chamfer



Crude But Effective Mock-Up

If you've ever built a project that you designed only to be disappointed with the final proportions or the decorative details, consider making a crude, but effective mock-up before cutting into your precious stack of hardwood. I unintentionally started using foam board years ago when I was rummaging around the shop one day looking for inexpensive scrap to mock up a project. I stumbled across a battered piece of 3/4"-thick foam insulation board and thought "why not?" It cuts easily by hand or with power tools, you can screw it together temporarily with drywall screws, and it's really cheap. (The only problem working with it is getting past the color – the rather hideous pink shown here or the other common color, pale blue.) On the mock-up I built for the wall shelf, I was playing around with the back curves on the top piece trying to figure out what looked best. I cut a couple different foam pieces and tried each in turn. It only took a few minutes, and it's a great way to lock in a troublesome detail. Ever since that first foam board mock-up, I try to keep at least one sheet of 1/2" and one sheet of 3/4" foam board stocked in the shop.

Foam insulation board is an inexpensive mock-up material that allows you to quickly visualize what a project will look like before cutting any wood.

Craftsman Wall Shelf

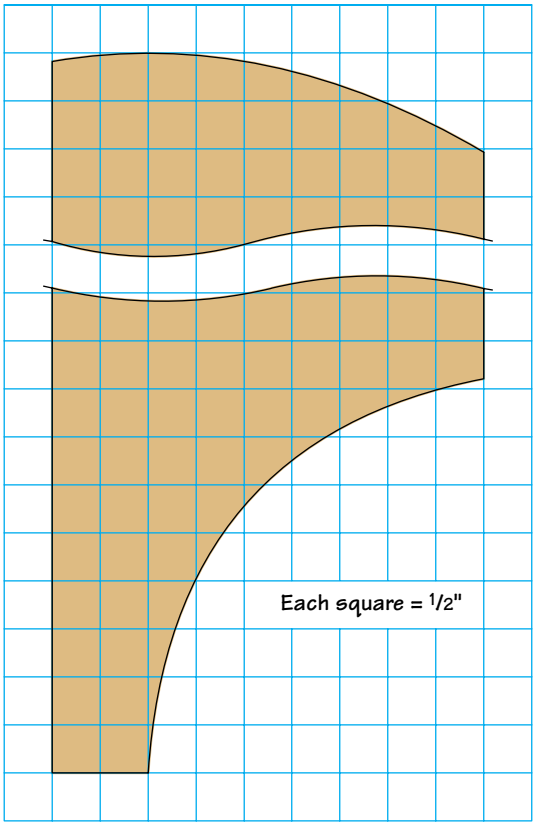
No.	Ltr.	Item	Dimensions T W L	Material
2	A	Sides	7/8" x 4 1/2" x 24"	Cherry
3	B	Shelves	7/8" x 4 1/2" x 30"*	Cherry
1	C	Top bracket	3/4" x 3 1/2" x 28 3/4"*	Cherry
1	D	Bottom bracket	3/4" x 3 1/2" x 28 3/4"*	Cherry

* measurement includes tenon length on both ends

Clamping a tall support fence to your miter gauge will make cutting the twin tenons a safe and easy operation.

A friction fit of the tenons in the mortises is what you're looking for.You should feel just a slight resistance as you slide the pieces together.

The graceful curves on the top and bottom brackets can be laid out with the aid of a helper by tracing along a bent strip of thin wood.

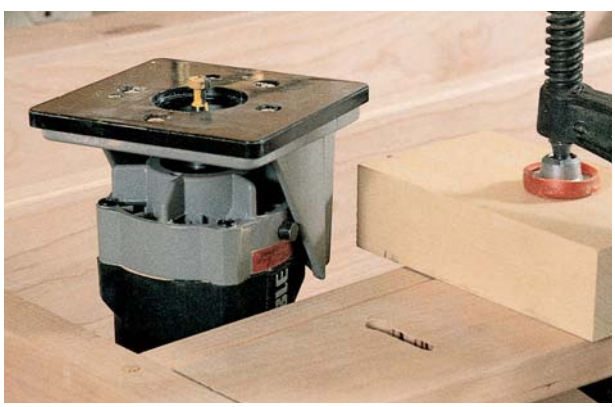


Pattern for the Sides

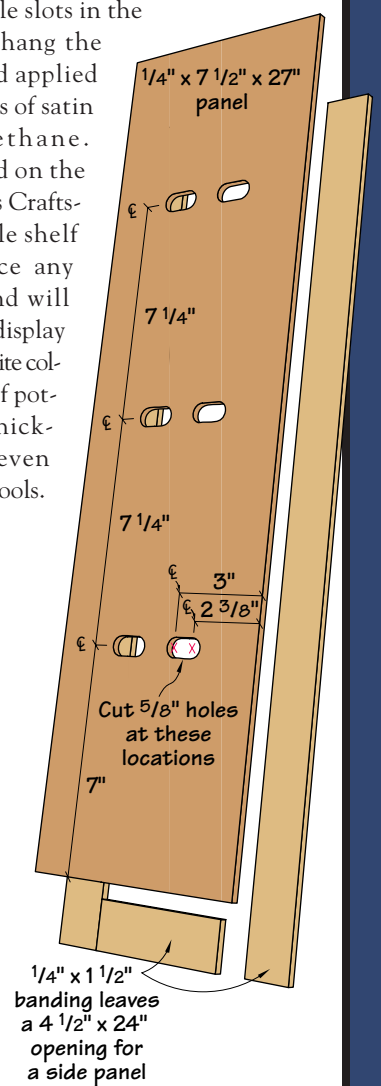
on all edges except for the top edges of the bottom bracket, the bottom edges of the top bracket, and the back edges of the shelves. Next, sand all the pieces now – this is a habit that's worth developing – you'll save yourself a lot of frustration in the long run trying to sand inaccessible spots.

To assemble the wall shelf, first make a dry run. Assemble all the pieces and clamp the shelf together without glue to make sure there won't be any unwanted surprises. Then carefully disassemble the shelf and apply a small amount of white glue (don't use yellow glue here, it sets up too quickly) to the tenons on the shelves and the tenons on the top and bottom bracket. Also, apply a thin bead of glue to the bottom edge of the top bracket and the top edge of the bottom bracket. Working quickly, slide the shelves and top and bottom brackets into one side piece. Then position the remaining side piece and apply clamps from side to side. You'll also want to clamp the top and bottom brackets along their lengths to their respective shelves. After the glue dries, remove the clamps and pin the shelves to the sides with short lengths of dowel for added strength. I drilled 2"-deep holes from both the front and back of each side piece to allow the dowel to pass completely through each tenon to lock it securely in place. A dollop of glue on each end and a few raps of a hammer is all it takes. (Pare off any protruding dowel with a sharp chisel.) Finally, I routed a pair of keyhole slots in the back to hang the shelf and applied two coats of satin polyurethane. Mounted on the wall, this Craftsman-style shelf will grace any home and will proudly display your favorite collection of pottery, knick-knacks – even antique tools.

PW



A keyhole bit fitted in a hand-held router and run along a guide block is an easy way to attach the shelf to a wall



TRACTOR-TRAILER toy

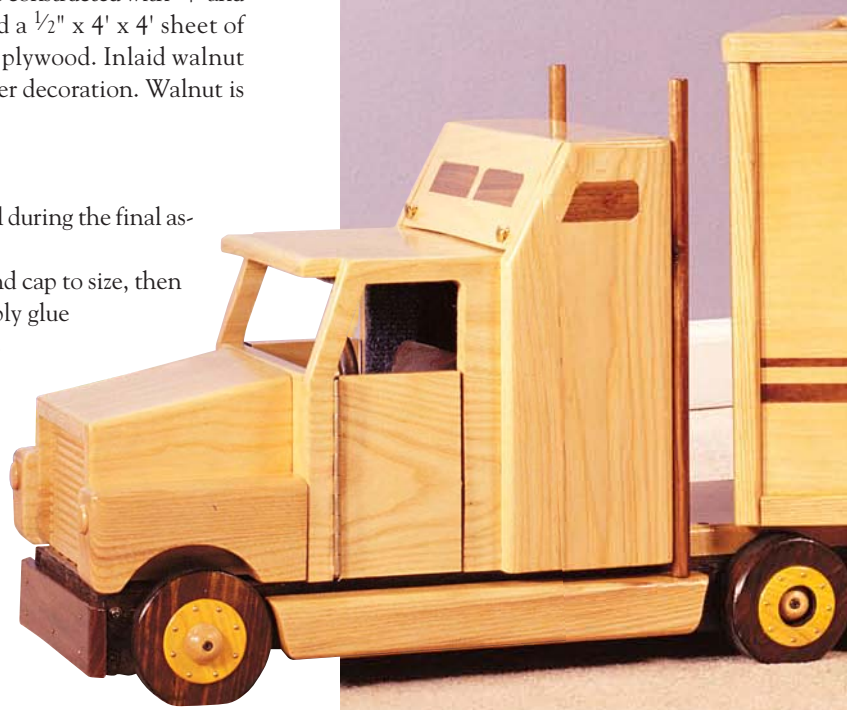
Lift up the top and fill this rig with toys. This 18-wheeler is fit for a kid.

After designing and building toy boxes and doll furniture for four granddaughters, I wanted to come up with something suitable for a grand*son* should we ever be blessed with one. This is a multi-functional project — a lot of fun to build and play with (with or without a grandchild) as well as a perfect storage box for miscellaneous cargo.

This mobile toy storage tractor-trailer truck features a hood that opens up for tune-up work on the V8 engine. Driver- and passenger-side doors have latches to keep them shut during transport time. The cab seat is upholstered, as well as the interior of the cab. By lifting up on the brass air horns, the roof of the sleeper opens up for additional storage.

The trailer can be detached and left standing full of toys or other cargo by flipping down the parking dolly. The lid is attached with a piano hinge and features a toy box lid support.

The rig is constructed with ¾" and ½" ash and a ½" x 4' x 4' sheet of birch-face plywood. Inlaid walnut veneer is used for the sleeper windows and trailer decoration. Walnut is also used for the front and back bumpers.



Working From the Ground Up

Completing the chassis and wheels first is helpful during the final assembly of the cab and hood portions of the rig.

Cut the tractor chassis sides, spreaders and end cap to size, then use a ¾" Forstner bit to drill the axle holes. Apply glue to the mating surfaces and assemble the chassis with two screws per joint.

by Al Krogh

After working for 36 years in a large company, Al Krogh took early retirement from the corporate world in order to spend more time on his hobbies. Besides designing and building children's furniture, he is currently working on a total restoration of a 1951 Ford pickup truck. You are never too old to play with trucks.

box

Tractor-Trailer Toy Box

	NO.	ITEM	DIMENSIONS (INCHES) T	W	L	MATERIAL	NOTES
Tractor Chassis Frame							
❑	2	Sides (A)	3/4	2	22 1/4	Ply	
❑	2	Spreaders (B)	3/4	2	6 1/2	Ply	
❑	1	End cap (C)	3/4	2	8	Ply	
❑	1	Front axle	3/4 dia		9 3/4	Dowel	
❑	2	Rear axles	3/4 dia		10 3/8	Dowel	
Trailer Chassis Frame							
❑	2	Sides (D)	3/4	3	27	Ply	
❑	3	Spreaders (E)	3/4	3	6 1/2	Ply	
❑	1	End cap (F)	3/4	3	8	Ply	
❑	2	Rear axles	3/4 dia		10 3/8	Dowel	
Tires and Wheels							
❑	2	Front tires	3/4	3 1/2 dia.		Pine	
❑	8	Dual tires	1 1/2	3 1/2 dia.		Pine	
❑	10	Tire rims	1/8	2 1/8 dia.		Ash	
❑	10	Hubcaps	1 dia. wooden balls				cut in half
Tractor Cab							
❑	1	Cab floor (G)	1/2	9	8 1/2	Birch ply	
❑	1	Firewall (H)	1/2	8	5	Birch ply	
❑	1	Sleeper back (I)	1/2	9	10 1/4	Birch ply	
❑	2	Cab sides (J)	1/2	5 1/2	8	Ash	
❑	1	Cab top (K)	1/2	5 1/2	8	Ash	
❑	2	Sleeper sides (L)	1/2	4 1/2	11	Ash	
❑	1	Sleeper frt (M)	1/2	2 3/4	9	Ash	cut to fit
❑	1	Sleeper top (N)	1/2	3 1/4	9	Ash	cut to fit
❑	2	Fuel tanks (O)	1	1 1/2	11 1/2	Ash	
❑	4	Window inlay veneer		1	various	Walnut	
❑	1	Hitch pltfrm (P)	3/4	8	8 1/2	Ash	
❑	1	Hitch (Q)	1 1/8 dia.		1 1/2	Dowel	
❑	2	Exhaust stacks	1/2 dia.		13	Walnut dowel	
❑	1	Seat bench (R)	3/4	7 1/2	2 1/2	Ply	
❑	1	Upholstery		9	8 3/4	Vinyl	
❑	1	Seat back (S)	3/8	7 1/2	4	Ply	
❑	1	Upholstery		9 1/2	5 1/2	Vinyl	
❑	1	Seat riser (T)	3/4	1 3/4	6	Ply	cut to fit
❑	1	Steering whl	2 1/2 dia.			Hardwood	
❑	1	Dashboard (U)	3/4	3/4	8	Ash	
❑	1	Front bmpr (V)	3/8	2 3/4	9	Walnut	
Engine Compartment & Front Fenders							
❑	2	Frt fenders (W)	1 3/8	2 1/2	5 1/2	Ash	
❑	1	Grill (X)	1/2	3 1/2	5 1/4	Ash	
❑	1	Hood top (Y)	1/2	5 1/4	5 1/4	Ash	cut long to fit later
❑	2	Hood sides (Z)	1/2	5	5 1/4	Ash	
❑	2	Headlights (AA)	3/4 dia.		3/16	Dowel	
Trailer							
❑	2	Sides (BB)	1/2	12	36	Ply	
❑	2	Ends (CC)	1/2	12	12	Ply	
❑	1	Bot (DD)	1/2	11 1/2	35	Ply	
❑	4	Corner trim (EE)	3/4	3/4	12 1/8	Ash	
❑	2	Side decoration	1/8	3/4	36	Ash	cut to fit
❑	2	End decoration	1/8	3/4	12	Ash	cut to fit
❑	2	Stripes		1/2	36	Walnut veneer	
❑	2	Stripes		1/4	36	Walnut veneer	
❑	2	Top banding	1/8	1/2	12	Ash	
❑	1	Top banding	1/8	1/2	36	Ash	
Trailer Lid							
❑	1	Center (FF)	1/2	8 3/4	32 1/4	Ply	
❑	2	Edges (GG)	3/4	2	36 1/4	Ash	
❑	2	Ends (HH)	3/4	2	8 3/4	Ash	

Trailer Chassis

Assemble the trailer's chassis using the same simple butt joints, glue and screws.

Use two self-closing overlay hinges for the parking dolly. Mount the hinges to the back of the front spreader, orienting them so they snap to attention when down. I used a scrap of ash for the cross piece. Two lengths of bead chain limit the swing of the dolly to 90°.

Tires and Wheels

All of the tires are 3 1/2" in diameter. The two front tires are made from 1x pine; 2x stock provides the necessary traction for the eight dual tires. Rounding out the bill of material, I used 1/8" ash for the 2 1/8"-diameter hub/rims.

Before cutting the dual tires, drill a 1 1/8"-diameter hole at the center point to a depth of 1/2". The stopped hole creates the illusion of a dual tire and makes room for the hubcap.

Change to a 3/4" bit and drill through the rest of the way. Drill the axle holes in the 1x pieces using the 3/4" bit.

The wheel rims are made the same way with a few added steps. Begin by drawing a 1 3/4"-diameter circle on the 1/8" stock. Divide it into eight equal parts. These points are where the wheel lugs (escutcheon pins) will be installed.

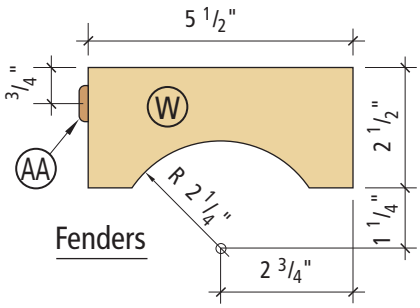
Drill out the axle opening using the 3/4" bit for the two front rims and 1 1/8" for the eight dual tires.

Although I used a circle-cutting jig to make the wheel and rim cutouts, a good eye, steady hands and a band saw can make for smooth-riding wheels. Breaking the edge between the sidewalls and tread area gives the tires a more realistic appearance.

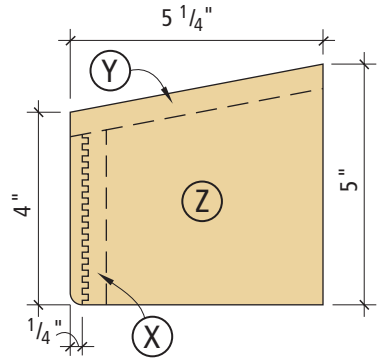
The frames and tires are the only parts that are stained. It is easier to do so prior to assembly. I used a brown dye for coloring the frames, tires and steering wheel. Stain the rims yellow.

Hubcaps

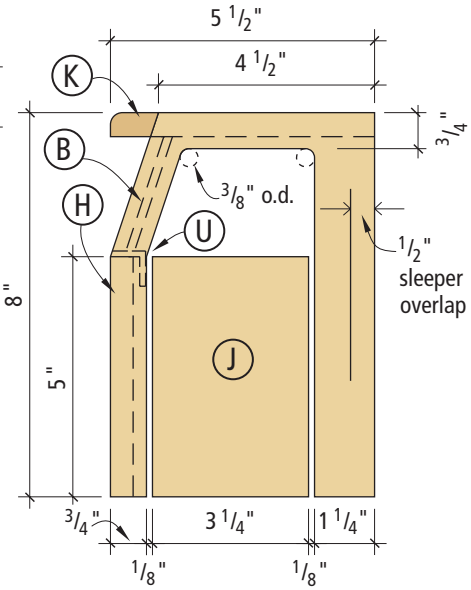
While the economy associated with splitting five, 1" wooden balls in half to make 10 hubcaps appealed to my woodworker frugality, I decided to spring for 10 balls (about $3) and keep all my fingers. Using a large countersink chucked into your drill



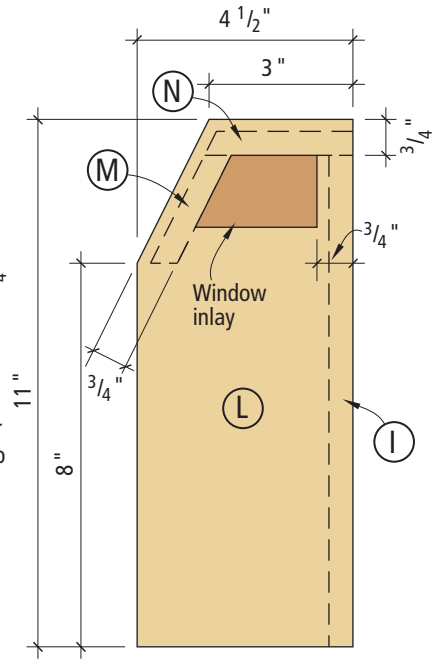
Fenders



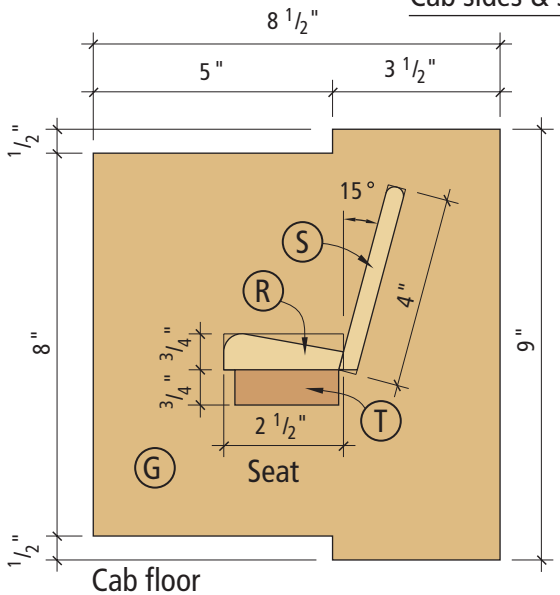
Hood sides & spreaders



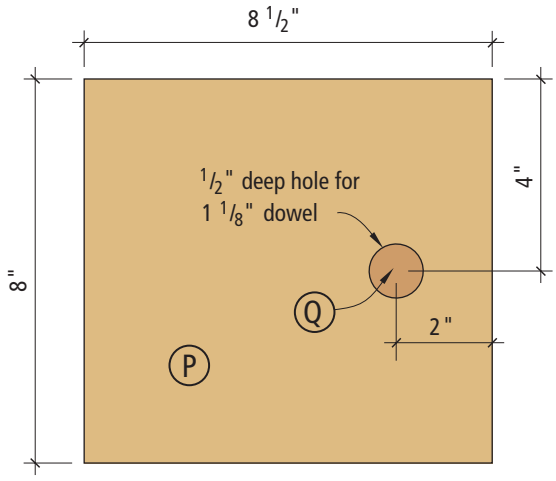
Cab sides & spreaders



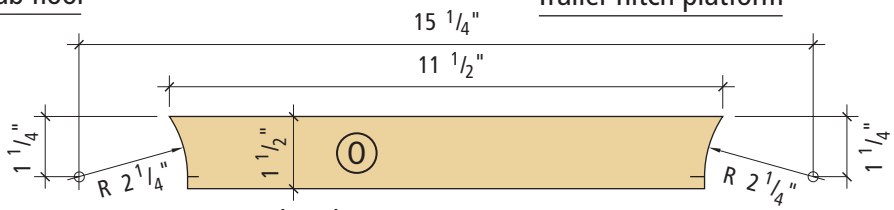
Sleeper sides & spreaders



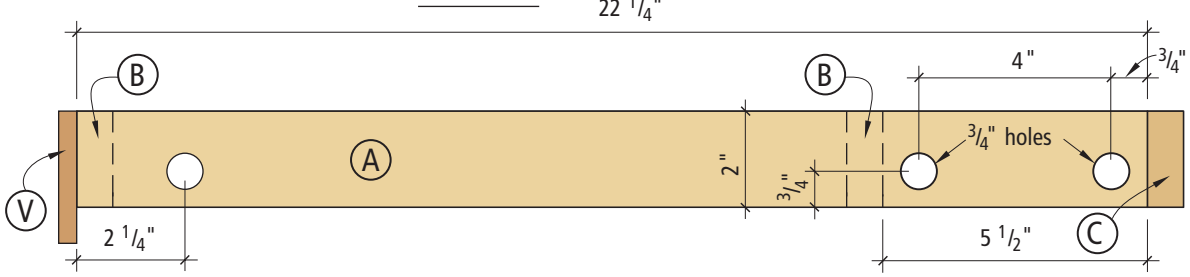
Cab floor



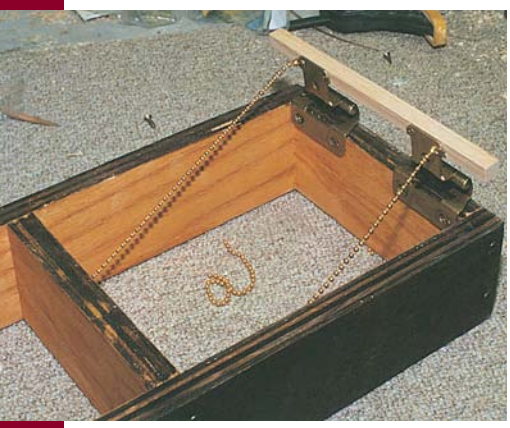
Trailer hitch platform



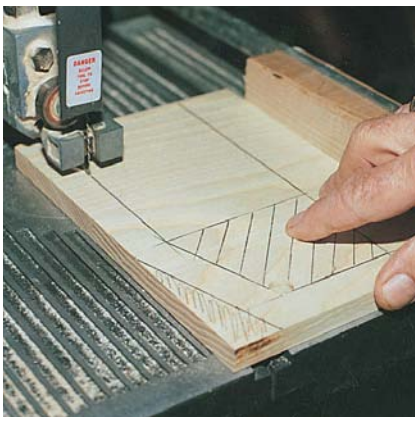
Fuel tanks



Tractor chassis sides, spreaders & end cap



Mount the two hinges to the front frame, orienting so the hinge snaps shut in the closed, or upright position. I used a scrap of ash, 3/8" x 3/8" left over from making the trailer corner mouldings, for the cross piece.



Cut the doors out on the band saw or scroll saw. A fence will help make your cuts more accurate. Keep the inside piece because you'll use it again when making the doors that open and close.

On the seat edges, fold the vinyl under itself. Affix it to the edges of the back using three or four escutcheon pins as shown below. Mount the seat riser block to the bottom of the seat bench.

press, make 10 equal-depth divots along a length of 1x pine. After gluing the balls in the depressions, grain horizontal, switch to a #6 countersink bit and predrill the screw holes at the top centers of the balls for mounting the hubcaps to the axles. Finally, guided by a fence on your band saw, turn the mounting board on edge and lop off half spheres like bologna through a slicer.

Tractor Cab

Refer to the drawings on the previous page and the cutting list for the cab parts.

Note that the driver's seat, steering wheel and interior upholstering must be installed prior to attaching the roof.

Each cab side and door is made from one piece of 8" x 5½" wood. I used a band saw to make the cuts, drilling ⅜" holes in the upper corners of the doors to aid in negotiating the corners. Set the doors aside after marking their original orientation.

Here you can see how the cab goes together. The sleeper roof will be constructed after the cab roof is installed. And the cab doors will be made and installed after the cab, seat and upholstery installation is complete.

Sleeper Sides

Cut out the sides, ease all edges except the bottom, and inlay the walnut veneer "windows." I used 13/16"-wide edging veneer for this. After cutting the windows from the banding, trace the shapes onto the sides of the sleeper and remove enough stock to accomplish a flush inlay.

Trailer Hitch Platform

Cut the trailer hitch platform to the 8" x 8½" dimensions. Again, use your roundover bit on the top back and sides of the plate, leaving the front edge straight to mount flush with the cab back. Using a 1⅛" Forstner bit, drill ½" into the plate, 2" in from the back. Make sure not to drill completely through the plate. Leave ¼" for hitch mounting purposes.

Round over the top edge of a 1⅛" hardwood dowel. Cut a 1½" length and mount it in the plate using glue and a screw driven through the bottom of the platform.

Cab Seat

See the drawings for a cross-section through the seat, seat back and riser. First round the ends of the seat and back. I can staple far better than I can sew, so I used a staple gun to attach the upholstery. After laying a bit of padding on the seat bench, wrap the vinyl around and staple to the bottom of the seat, leaving room in the center of the bottom for the riser block.

Now lay a bit of padding on the front of the seat back, staple one edge to the bottom, and wrap the vinyl over the top and back to the bottom and staple. On the edges, fold the vinyl under itself. Use three or four escutcheon pins to tack the edges.

Cab Assembly

The firewall, cab sides, sleeper sides and sleeper back mount to the edges of the cab floor. After dry-fitting to ensure tight joints, glue and nail the joints using 1" brads. Note that the front edges of the sleeper overlap the back of the cab sides by ½". The sleeper roof is constructed after the cab roof is installed. The cab doors are hung after the seat and steering wheel are installed.

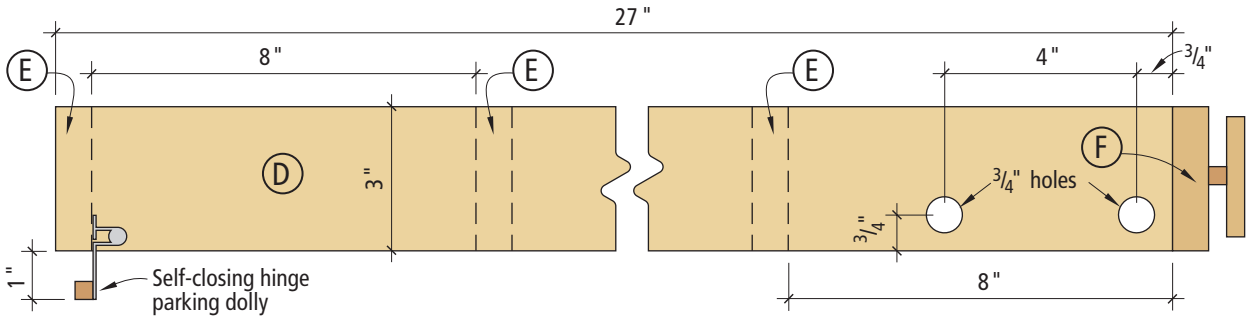
Engine Compartment & Fenders

Cut the hood top, sides and grill to size. I used the table saw to make the grill bars. Lower the blade to ⅛" and install a zero-clearance insert. Set the fence ¼" from the blade. Using a push stick and featherboard, slide the grill stock through the saw. Move the fence another ¼" from the blade and make another pass. This will result in a ⅛" groove and ⅛" raised portion. Keep moving the fence in ¼" increments until you have completed the grill.

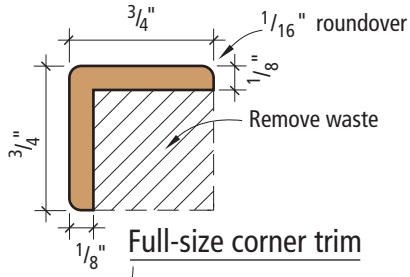
Assemble the top, sides and grill per

Hardware List

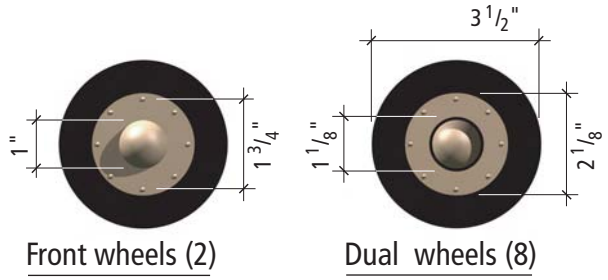
- 1 1/16" x 60" piano hinge
- 1 toy box lid support
- 1 pkg solid brass knobs for air horns
- 1 pkg 3/8" overlay hinges
- 1 - 2" bead chain for trailer dolly
- 10 - 1" hardwood balls
- 1 - 2½" wheel for steering wheel
- 2 - 5/16" bullet catches



Trailer chassis sides, spreaders & end cap

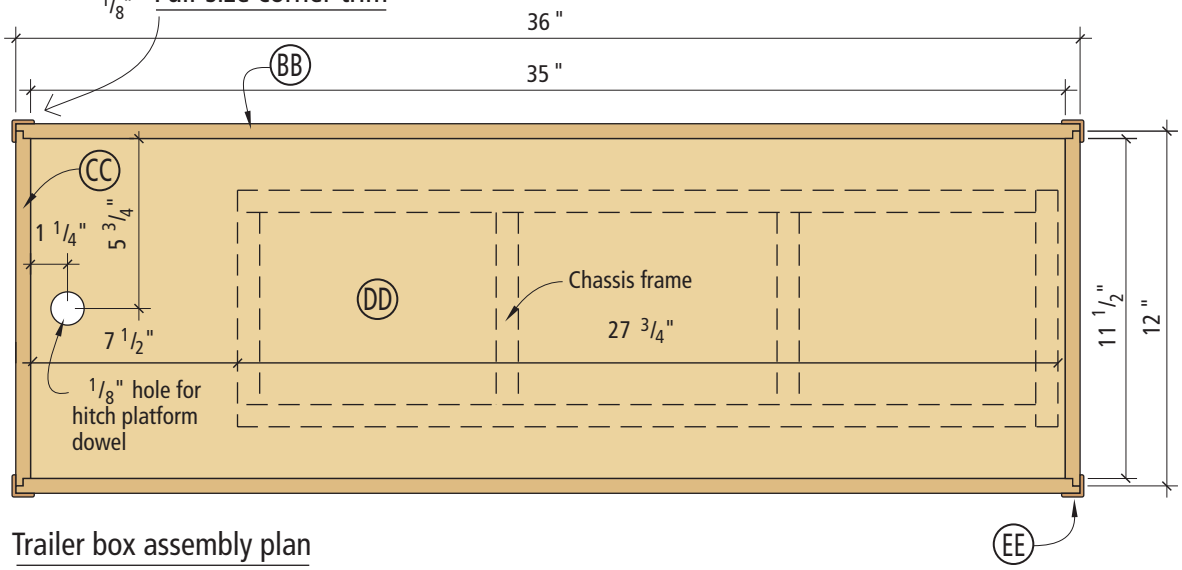


Full-size corner trim

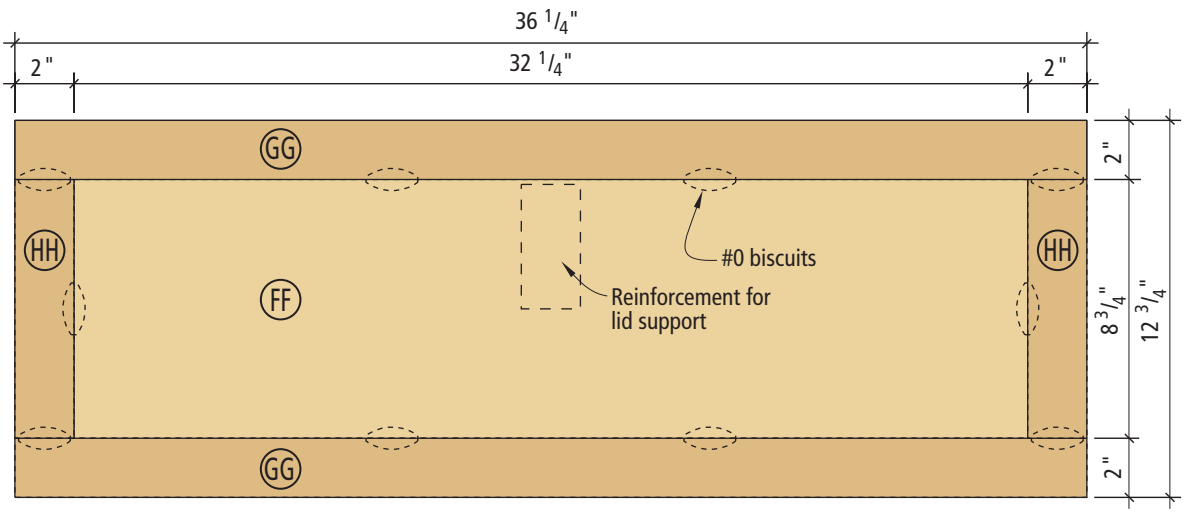


Front wheels (2)

Dual wheels (8)

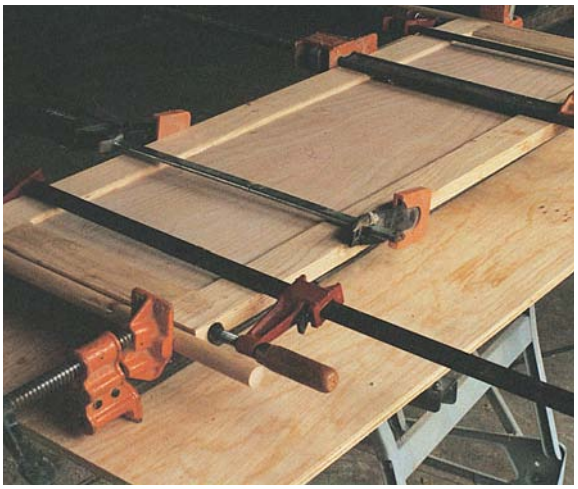


Trailer box assembly plan



Trailer lid assembly plan

Prior to final installation, carpet the interior of the roof. I started the carpet where the top of the windshield meets the roof, about ¾" back from the leading edge.



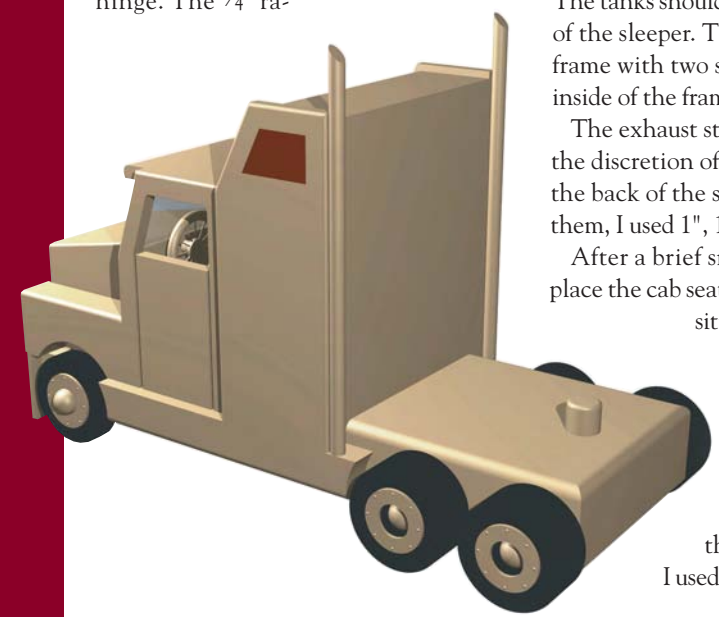
The lid is a simple frame-and-panel assembled with biscuits and glue. But because the panel is a piece of plywood, you don't need to worry about seasonal expansion or contraction.

the drawings. The hood top edges should extend beyond the front and rear of the hood sides to allow for final trimming.

After you've cut the fenders to size, install short slices of rounded ¾" dowel for the headlights.

To keep things rolling along, install a length of ¾" dowel, about 18", through the front axle hole on the cab frame. Set the assembled cab and hood portions in position on the frame and mount the fenders to the hood sides, using glue and screws driven from the engine compartment.

After aligning the face of the grill with the front of the cab chassis, mount the hood to the frame with a piano hinge. The ¼" radius at the bottom of the hood sides allow full opening of the hood assembly when the front bumper is installed.



Install the front bumper to the front of the frame using glue and escutcheon pins.

Engine Installation

The engine is made from a 2½" x 3¾" piece of pine with a bevel, at about 30°, for the valve covers on each side. I made the valve covers from two pieces of ¾" walnut, 1⅛" wide. The motor is installed by fastening a short piece of walnut to an "oil pan" and then to the bottom of the cab.

Fuel Tanks & Details

The tanks should fit flush with the sides of the sleeper. They're mounted to the frame with two screws driven from the inside of the frame.

The exhaust stacks (to be installed at the discretion of the builder) mount to the back of the sleeper sides. To secure them, I used 1", 18-gauge brads.

After a brief snooze at the rest stop, place the cab seat in the appropriate position on the cab floor and draw a line around the seat base. Remove the seat and drill two clearance holes, within the seat base rectangle, through the floor.

I used a short length of carpet runner for the cab upholstery. Cut a length (about 24") 8" wide for the firewall/cab portion and 9" for the sleeper area. I used a stapler to mount the carpet and turned to my hot glue gun for the difficult-to-reach areas.

Be sure to leave a ½" area uncarpeted on the top and front edge of the sleeper sides for the sleeper lid installation. Install the seat by placing it into position and driving two screws up through the base.

The steering wheel is a spoked wheel sold for making toy cars. Using the axle of the wheel as the steering column will allow your youngster to negotiate tight turns.

The dashboard is an extra length of corner molding from the trailer. Mount it on the inside of the cab over the firewall carpeting. Some trimming may be needed if it intrudes into the engine compartment. Drill an angled hole into the dashboard for the steering wheel column; press and glue into place.

Now carpet the interior of the roof and install it. The sleeper cab lid is made from a 6" x 9" piece of ½" ash. Tilt the saw to 26.5°, 3" from the fence, and rip it to form the sleeper top and front. Install the front-facing windows following the same technique used for the side windows. Mount the assembled lid to the top of the sleeper back using a 9" length of piano hinge.

The use of jewelry box pulls for the "air horns" gives a bit of flair to the rig. Because of the angle of the front piece, I drilled an

angled cavity to enable the air horns to be mounted perpendicular to the cab roof.

Doors and Wheels

The doors need 1/8" clearance on each of the edges for hinge and door latch installations. They are mounted to the sides with 5" lengths of 1/2"-wide piano hinge. After hanging the doors, install bullet catches to keep the doors closed.

After drilling pilot holes in the ends of the axles, slide the axles into the mounting locations, place the tires in position and install the hubcaps using one screw through the hubcap into the axle ends.

Trailer

The box is constructed from plywood joined at the corners with rabbet joints. After cutting the plywood for the box carcase, make a 1/4" rabbet on the joining edges of the sides and ends.

To dress up the trailer, I inlaid a little walnut on the sides. The top strip is 4 1/4" from the bottom of the box, and the lower is 3 1/4". Cut the recess using a dado stack or router. I used an 8' length of 13/16" walnut edge banding. Glue the strips into the slots and sand the sides.

Drill a 1 1/8" hole through the box bottom to accept the tractor-trailer hitch. Use a backer board on the backside of the hole to reduce tear-out.

Assemble the sides, ends and bottom with glue and brads (the bottom slips inside the sides). The seams will be covered by the corner and bottom pieces.

The box corners are made from 3/4" x 3/4" ash. Round the edges using a roundover bit on the router table. Set the fence on the table saw 1/8" from the blade and 5/8" high. Run the strip through, reorient the strip and make another pass, removing the center portion of the strip. Since you cannot use the blade guard during this, great care must be taken. Fingerboards and push sticks are a must.

This will leave an outside 1/8" corner piece, rounded on three sides. Cut into four 12 1/8" strips. The extra 1/8" of length is needed for the edge banding space on three of the top edges as well as a dado for the piano hinge, making the lid fit flush on the box.

Rip 3/4" stock into 1/8" thickness — two 36" and two 12" lengths. Rip the 1/2" ash stock into 1/8" thickness — one at 36" and two 12" lengths.

With glue and brads, mount the 1/2" stock on the top edges of the box, leaving one long side without the edge banding. This side is where the piano hinge goes.

Install the bottom 3/4" decoration pieces around the bottom of the box.

Turn the box upside down and lay the chassis in place. The rear of the chassis should be 1" from the rear of the box. Trace its outline and set it aside. Drill pilot holes within the outline through the bottom, glue and clamp the chassis in place and turn the unit over and fasten the frame and box together with countersunk screws driven from the inside of the box.

The lid of the box is made from plywood with a 3/4"-thick frame biscuited to the plywood center panel. and is mounted with a piano hinge. Round over the frame pieces, then attach them to the center panel using biscuits and glue.

After the glue has cured, sand the top and bottom of the lid. Round the outside corners and use a roundover bit in the router to relieve the outside edges.

Mount the lid to the box with a piano hinge and toy box support. Because of the 1/2" thickness of the plywood, I reinforced the mounting locations on the top and side with 1/4" hardwood scraps.

Install the axles, wheels and hubcaps. Mount the back bumper (a 3/8" x 2 1/2" x 11 3/8" piece) using screws. I used the inside cutouts of the corner mouldings as spacers between the frame and back bumper.

Finishing

Two coats of 50/50 cut white shellac brings out the grain of the ash. I like the protection and ease of application of General Finishes Arm-R-Seal for these types of projects. Two top coats of this oil and urethane top coat gives the rig some protection and a "just waxed" appearance.

Take the rig out for a test drive — diesel motor and air brake noises are optional. Happy motoring! Keep on truckin' and woodworkin'! **PW**

Tire Making 101

Use a scrap of wood large enough to cover the band saw table slot and saw blade kerf path, about 5" x 7". On the bottom, attach a wood strip about 8" long to serve as a slot insert guide. Draw a line, at a right angle to the saw blade kerf, on the top of the jig. Start the saw and slide the jig slowly into the blade. When the saw blade meets the perpendicular line, turn off the saw. Carefully place a "stop block" in the slot behind the slot insert and clamp in place. This will serve as the starting point for cutting out the tires. Back the jig out and measure 1 3/4" from the saw blade kerf, along the line drawn on the jig. This will be the axis point for the 3 1/2"-diameter tires. Cut a short piece of 3/4" dowel and mount it vertically on that center point, making sure that the dowel is square with the jig face. The tire block should rotate easily on this dowel. If it doesn't, apply some wax or lightly sand the dowel

To actually make the tires, place one of the tire blocks on the dowel and hold the block firmly while sliding the jig toward the saw blade. When the jig meets the stop block, hold the jig securely in place and rotate the tire block clockwise until the circle is complete. Turn the saw off and back the jig out through the entrance kerf.

Some sanding of the tread area may be needed. I used a dowel to act as an axle and a belt sander, mounted upside down, to smooth down the cut marks. Breaking the edge between the sidewalls and tread area also give the tire a more realistic appearance. After final sanding, stain the tires.

The tire-making jig in place on the band saw.

Then it's a simple matter of slowly rotating the stock to create a tire that needs just a little sanding.

A BEGINNER'S GUIDE TO HVLP Finishing

Nothing compares to a spray finish for your project. But you need to learn to do it correctly, and choose the right tool. We'll do both, right here.

By adjusting the fan on the air cap (or air nozzle), you can spray a wide fan either vertically or horizontally, adjust the width of the fan, spray a thin line, or even do a morse code or a little graffiti. I'd recommend you set yourself up with a large piece of paper as soon as you get your gun and spend some time practicing. Try not only the different ways of adjusting the fan, but also overlapping the spray patterns and to get a feel for how fast or slow you need to move the gun to get an even coat without causing runs.

Over the years I've used almost every variety of finishing technique from brushes and rags to high-pressure spraying systems. Whatever the style of furniture, I still get the best results from a sprayed-on finish. It's fast, quick-drying, provides a durable surface and looks great. I've used high-pressure finishing systems, but I now prefer a high-volume, low-pressure (HVLP) system. It wastes less finishing material, it's safer, more environmentally friendly, creates less overspray and generally is less expensive.

by Troy Sexton

Contributing editor Troy Sexton designs and builds custom furniture in Sunbury, Ohio.

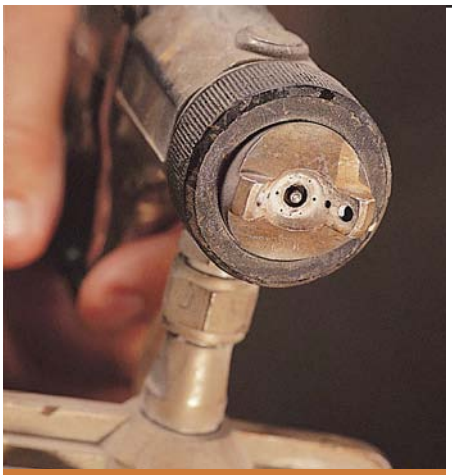
High Pressure vs. HVLP

What's the difference between a conventional high-pressure system and a low-pressure system? In a nutshell, it's the speed of the air and the amount of finishing material you waste. HVLP systems produce no more than 10 pounds of air pressure per square inch (psi), and the amount of finishing material that lands on the work piece (also called the "transfer efficiency") is 65 percent or higher. Conventional high-pressure systems generally operate at around 35 psi and have a transfer efficiency of about 35 percent.

There are two types of HVLP systems: conversion and turbine. Conversion guns are similar to a conventional high-pressure system, working with a compressor but using a regulator to step down the pressure of the air at the gun. Though this is a good system and it produces less waste and overspray, it requires a fairly large compressor, which is expensive. One advantage of a conversion system is it applies finishing material faster than a turbine system, making it a favorite choice for production shops.

Turbine units operate by producing air through a series of turbines (spinning fan blades, or a squirrel cage). The air produced is fed continuously to the gun at a lower pressure, but is capable of producing a high volume of air. This produces a gentle (but slower) application of finishing material to the project. Air flows from the turbine through the gun and into a plastic tube running to the cup to pressurize it enough to push the fluid into the fluid passageway of the gun. Unlike a conventional or conversion system, the air is not stored in a compressor's tank, but is a continuous stream. In bleeder-style guns, the air passes continuously through the nozzle, causing a constant hiss. Non-bleeder guns evacuate the unused air near the turbine, giving the gun a more conventional feel and reducing the chance of blowing dust around with the air stream.

When speaking of HVLP, most people are referring to a turbine system (as we will be here). For most readers a turbine sys-



De-'Mistifying' Spraying

I started to try and explain how a liquid finish is turned into a mist by a spray gun, but then I read Bob Flexner's description from his *Understanding Wood Finishing* book and I thought I'd let him do the talking:

"Spray guns shoot a stream of fluid that is broken up into a mist of tiny droplets by jets of air coming out of the air nozzle. The droplets hit the wood and flow together to make a smooth film. The breaking up of the finish into droplets is called *atomization*. It's important that the atomization be thorough, or the droplets won't flow together well.

"The trick to achieving proper atomization is getting the right amount of air striking the fluid as it comes out of the tip of the gun. If you have too little air, the atomization won't be great enough, and the finish won't flow together. It will cure looking like the surface of an orange; the effect is called *orange peel*. If you have too much air, the finish will dry before it hits the wood, producing a dusty look. This is called *dry spray*.

"The two air jets that direct the atomizing air have an additional function. Because they are placed 180° apart, in the horns of the air nozzle, they force the atomized air into an oval-shaped pattern called a *fan*. The fan is perpendicular to the line of the horns. By increasing the air flow through these jets, you widen the fan, so you can coat a wider area with each pass. By decreasing the airflow, you shrink the fan to a very small circular pattern, which you can use to fill in small defects. By rotating the air nozzle, you can change the angle of the fan relative to the gun."

The nozzle on either an HVLP or conventional spray gun works the same. It's just that the way the air is delivered to the jet nozzles is different. The photo above shows the nose of an HVLP gun. You can clearly see the jets described by Bob, as well as the fact that I've been using the gun and it's due for a cleaning...

tem is the better choice because it's less expensive, more mobile and safer to use.

What Affects the Finish Quality?

No matter what spray system you're using, many of the same concerns exist to produce a good-quality finish: humidity, air temperature during spraying and keeping the system clean.

Spraying during periods of high humidity (over 40 percent) and high temperatures (over 70 degrees) can result in a poor-quality finish by causing the material to dry either too fast or too slow. By adjusting the material-to-carrier (lacquer-to-thinner) ratio you can adapt to atmospheric conditions.

Many HVLP systems provide a viscosity cup to determine how much to thin the finishing material for optimal spraying conditions. First-time users should try the viscosity cup to get an idea of what "thin" is. Play with the mixture a little to get a feel of your gun's capabilities. Honestly, most furniture finishes (not paint, mind you) spray adequately through the standard nozzle provided with most guns without thinning. Eventually you'll put the cup away. I haven't used mine in years.

No matter how experienced you are at spraying a finish, if the fluid passageways in the cup and the gun (especially around the fluid nozzle) aren't clean, you're headed for trouble. The jet nozzles control the amount of air atomizing the fluid, as well as adjusting the shape of the fan (the spray shape). If those nozzles are clogged or partially blocked, the finish will not apply correctly. Another critical area to keep clean is the little hose leading from the cup to the gun itself. If it becomes clogged, air will blow through a bleeder gun but no material will be added. The best advice is to clean the gun and cup after each use.

You can probably leave the material in the cup overnight, but make sure you back the material out of the gun by lifting the gun out of the cup and pulling the trigger (with the turbine off) to allow the fluid to drain out of the gun. This isn't perfect, but will help overnight.

Even with the reduced amount of overspray from an HVLP system, it's best to work in a place that is either well ventilated, or equipped with a spray booth of some type (see Flexner On Finishing for a simple home exhaust unit). Unlike high-pressure systems, you can use an HVLP system in your driveway without concerns of overspray (though a respirator is still a good idea). Of course, if you're spraying outside, there are trade-offs. A slight breeze will pull the slight overspray away from you and the work, but it may blow bugs and falling leaves onto your project.

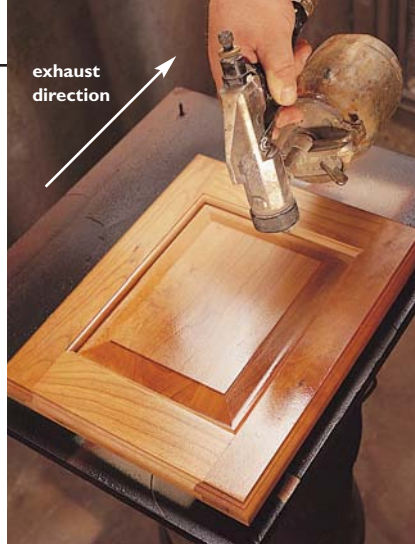
There are several critical adjustments on an HVLP gun. The fluid control knob regulates how much liquid is allowed into the airstream at the nozzle. The ring around the nozzle controls the width of the fan. The fan pattern in most guns is controlled by rotating the horns. The airflow is regulated either at the hose or on the gun.

What Materials Can I Spray?

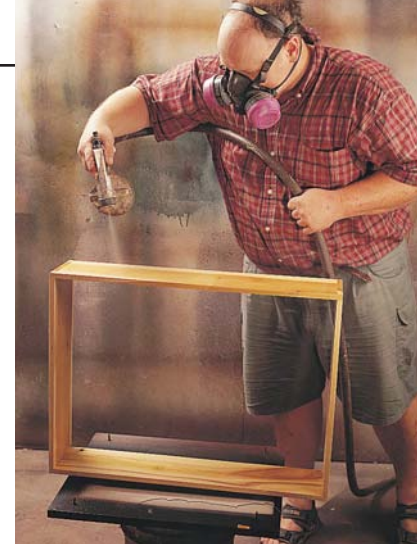
You can spray all types of top-coat finishes with an HVLP system, including paint, shellac, lacquer and polyurethane. However, most home woodworkers don't have a shop that is adequately ventilated or exhausted for some of these materials. Unless you are using a tested and approved spray booth with explosion-proof accommodations, I recommend only spraying water-based finishes in an HVLP system.

HVLP systems are capable of spraying stains as well, but spraying stains is a little more complicated than spraying a clear finish, and the clean-up usually isn't worth the mess (unless you're doing production work, like an entire kitchen). I'd recommend ragging or brushing on the stain and saving the HVLP for the top coat.

As with most finishing products, I recommend you choose one type of finish and learn to work well with it. Lacquer is my preference and, again, unless you're properly outfitted, use a water-based lacquer.



As with a shelf, there's a good side and a less good side to a door. Start with the good side down and spray the back, working the pattern toward your exhaust fan. Hold the gun above the piece and spray overlapping stripes across the good side. Keep the gun pointing straight down and move your wrist back and forth as if it were on tracks, maintaining the distance to the piece. When that side has dried, flip the piece over and spray the edges. If you rig up a Lazy Susan-type stand it's easy to keep the piece oriented between you and your exhaust fan. If not, you end up dancing around the piece or misdirecting some overspray. With the edges sprayed, go ahead and spray the good face of the door. Because of the recesses formed by the frame-and-panel design, you may need to rotate your wrist slightly, moving the gun in an arc, to allow the spray to hit the inner edges.



Drawers add an interesting problem in spraying (as do all pieces that are essentially a box, such as cabinets). The inside and outside of the piece must be finished, and there's usually one surface that you need to stand on your head to spray. First off, leave any bottoms or backs out of the piece until after you've sprayed the drawer or cabinet. Spray the bottom edges of the drawer, then flip the drawer over, spray the top edges, then spray alternate interior and exterior surfaces. For example, with the drawer front facing away from you, spray the outside back, then the inside front. Turn the table (or move) one-quarter turn, then spray the outside side and the opposite inside side. Rotate, spray. Rotate, spray. And you're done. If you're not using a Lazy Susan, set the drawer on its front (as in the photo), spray the edges, then the inside front, both inside sides and then the outside back surface. Flip the drawer over and spray the inside back, both outside sides and finally the front.

Getting Started

After assembling the gun, use your viscosity cup to get a feel for the proper thickness of the material. It should flow about like canned pear juice. Heavier than water, but not quite a syrup.

Start with the fan adjusted to its largest size, and the fluid turned almost all the way off. The air should be adjusted to fully open. Start spraying into the air, and slowly turn the fluid knob until a steam-like spray is produced and you can see the size of the fan. Now reduce the size of the fan by adjusting the nozzle until the fan is about 8" to 10" wide about 10" from the nozzle. This a good place to start. You can refine the adjustments as you go. Now you need to learn how to move the spray pattern to get the best coverage.

Applying a Finish

With an HVLP system you need to keep the nozzle of the gun closer to the material than with a conventional system. I recommend 6" to 8" distance. On surfaces wider than 6" you'll need to make more than one pass, often many passes. You need to overlap your spray pattern to get an even coat. I recommend overlapping each pass by one-half the width.

Don't rock your wrist during spraying. Keep the gun perpendicular to the work and always strive to get an even coat on your work. The amount of finish on the piece should look wet, but shouldn't hide the grain pattern. It should be a film covering. It's easier to spray three or four thin coats (which will dry quicker) than to spray two heavy coats and end up with runs or a "plastic" look to your finish.

Start and stop your spray passes off of the piece. Start spraying with the gun pointed off the piece, then move across the piece, continuing beyond the edge. Don't hesitate to adjust the fan orientation as you're spraying. It's a simple adjustment that lets you feel more comfortable with the movement and keeps you from having to tilt the gun, which may cause finish to build in places. You can also adjust the width of the fan for spraying edges.

When you start spraying, you need to plan the best spraying pattern to evenly cover all the surfaces of the piece you're spraying. A shelf is fairly simple, spray the back side, let it dry, then flip it over and spray the edges and front side. But doors and drawers require a little more thought.

In general you should always spray a piece starting with the edge closest to you (assuming that you have air being drawn away from you) and work away from your body. This keeps any overspray on the area you'll spray next, so it will be covered by your next pass. Another mantra to remember is to always spray the most visible piece last — the top of a table, a drawer front, the front side of a drawer, the back and seat of a chair.

Finally, you have got to be diligent about cleaning your gun. Read the directions and follow them religiously. If you don't occasionally strip your gun to clean it, you will be in for a rude surprise one day. Either your gun will stop spraying, or it will refuse to stop spraying, or chunks of garbage will end up on your project. So clean the gun.

That's the basics about HVLP and some tips on getting started. The rest is practice and getting to know your system and the finish you choose to apply. On the next few pages you'll see our test of five HVLP turbine systems to help you decide which system will fit your finishing needs. **PW**

Bookshelf

There are more things to know about finishing and spray finishing than covered here. To learn more, we recommend the following books:

Understanding Wood Finishing
by Bob Flexner, 1994, Rodale Press

The New Wood Finishing Book
by Michael Dresdner, 1999, Taunton Press

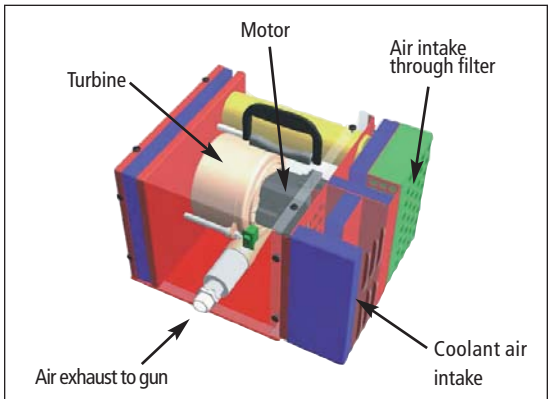
Spray Finishing
by Andy Charron, 1996, Taunton Press

Classic Finishing Techniques
by Sam Allen, 1995, Sterling Publications

Good Wood Finishes
by Albert Jackson and David Day, 1997, Popular Woodworking Books

CHOOSING AN HVLP
Turbine System

For less than $500 you can spray a professional-quality finish in your shop or driveway.



A view of a three-stage turbine unit. Air is taken in through two filtered areas. One leads to the turbine to provide air for spraying, and the other provides air to cool the motor.

By this point you should be convinced that your woodworking will benefit from a turbine HVLP system. Now the question is what to buy. There are a variety of turbine systems available, ranging from $200 to $2,000. Recognizing that the higher-priced units are not what a home woodworker needs, we looked to the lower end of the scale. But we also realized that the least expensive systems were designed for very limited use (or for spraying latex paint) and may provide disappointing results on fine furniture. With this in mind we set an upper price for test units at $500. Five units made the cut, and we took them into the *Popular Woodworking* shop to see how they performed.

Determining the system or systems to recommend proved difficult. After evaluating each unit for amperage draw, noise level, construction materials and general ergonomic quality, the real question was how they worked. The good news is, they all put on a decent finish with little difficulty. In an effort to test the units as we would recommend they be used, each of the turbine units was set up and used by multiple editors. All have finishing experience, much of which is with high-pressure finishing systems, so their quality expectations were exacting. We sprayed a waterborne lacquer from M.L. Campbell called Ultrastar (which we happily recommend) that we did not thin.

We didn't test these units with a heavier fluid, such as latex paint. Paints need a lot of power. And though you can paint the rooms in your house with these systems (usually with a larger fluid orifice and needle), we think you'll be better off renting an airless sprayer for big jobs like that.

Of the units tested, three (the Wagner, Fuji and Campbell-Hausfeld) are three-stage turbines, while the others are two-stage. What's the difference? Three-stage units have three fans that accelerate the air; two-stage units have two fans. The more stages you have, the more air is pushed to the gun and the better atomization you get. Though with a lightweight finish material such as lacquer, a two-stage unit was enough for the job.

All but one of the guns tested (the Wagner) are what are called "bleeder" guns, with air continuously blowing through the nozzle of the gun when the turbine is on.

by David Thiel

Questions or comments? You can contact David at 513-531-2690 ext. 255 or at DavidT@FWPubs.com.

Campbell-Hausfeld HV3000

Despite its low price, the Campbell-Hausfeld HV3000 has a three-stage turbine, which helps improve atomization. The gun, however, has more plastic parts than we'd like. The hose fitting on the turbine, and the nozzle ring, handle, fluid adjustment knob and air connectors are all plastic. And though they all worked fine, we wondered how they would hold up after years of hard use. We're not entirely opposed to plastics, but the fact that many of the critical parts that need to be cleaned and adjusted (especially the threaded hose connection and nozzle ring) were plastic gave us pause. The gun gives you the option of locating the hose either high at the rear of the gun, or at the base of the handle. Also, the cup-release lever is mounted to the rear on the Campbell-Hausfeld unit while all the other units have theirs mounted to the front. It's awkward to reach around the trigger to release the cup. The instructions were thorough and reasonably easy to follow, including tips on spraying and clean-up. Our overall opinion of the unit is that it does a good job of applying a finish, though the quality of the gun makes it feel less like a quality tool, giving us some concern about longevity of the gun.

Fuji Super

The Fuji system has some nice things going for it, but we expected a little more for the price. The three-stage turbine is housed in a light-gauge steel box and is the only system we tested with a built-in circuit breaker to reset the unit. There are two filters for the Fuji. One fine filter for protecting the turbine (and your airflow) from dust. And a second coarser filter that protects the fan cooling the motor. Don't get the two mixed up. We were a little disappointed with the spray gun. The gun is mostly metal, with a few key components made of plastic: the fluid adjustment knob, the nozzle adjustment ring and the fitting for the air hose. And though the gun sprayed just fine, the fit and finish were less than stellar when compared to the Wagner, Lex-Aire and Lemmer. The instructions provided with the system are adequate and provide a reasonable amount of instruction about spray finishing, but they assume a certain level of knowledge about adjustment of the gun and maintenance. All told, the systems works well, but for the same price you can get a more refined gun with more metal parts.

Lemmer T-55

The Canadian-made Lemmer unit is the least expensive unit we tested. Except for the two-stage turbine it has the features of the more expensive units. In fact, the steel turbine housing is nearly identical to the Lex-Aire model. It uses a large pleated filter and a good-quality gun that is all metal except for a plastic nozzle ring. The only disappointment with the gun was in the fluid-adjustment knob. Once you dial in your setting, you have to lock it in using a second threaded ring. If you don't, the fluid balance can change while you're spraying. The air-control valve is located on the hose and is a lever action for easier control than the dial-style on some of the other units. The instruction manuals were the best of any of the test units. The manuals offered explanations of the workings of a turbine unit as well as of the gun itself, offered finishing advice and gun adjustment with good diagrams, as well as good information for cleaning and maintenance. Overall the performance was good, but with some slight clunkiness in adjusting the nozzle and, as mentioned, in adjusting the fluid knob. The metal handle did allow some transfer of heat to the users hand, but the gun felt of reasonably sturdy construction. All in all, for the price this system is a good one and would do well in most shops.

This in no way impacted the finish provided, but it did make the Wagner feel like a more professional gun (pull the trigger the air comes out; let go and it stops) and it kept us from accidentally stirring up dust around the project.

A couple of quick comments on some of the features that helped us determine our preferred turbine system. Hoses and cords make a difference. Though our preferences were not driven entirely by this feature, longer air hoses and power cords make the units easier to use. Also, the flexibility of the air hose can make a large difference in the ease of use when spraying larger and multi-sided pieces. When it comes to filters, all our units employed adequate filtration to allow the units to perform without difficulty. The pleated-style filters (on the Lemmer and Lex-Aire) are more efficient at removing dust particles from the air than the open-cell style filters, but they also restrict the air flow around the motor, causing a delicate balancing act to cool the unit. Again, we didn't see this affecting performance.

When our testing was complete, we preferred the Wagner unit over all others for its almost entirely metal gun (but for the plastic handle wrap which is a ben-

Sources

Campbell-Hausfeld - Harrison, Ohio
www.chpower.com or 800-626-4401

Fuji - Toronto, Ontario
www.fujispray.com, or 800-650-0930

Lemmer - Calgary, Alberta
www.lemmer.com/HVLP.htm,
or 800-561-6908

Lex-Aire - North Billerica, Massachusetts
www.lexaire.com/index.html,
or 800-539-2473

Wagner - Minneapolis, Minnesota
http://www.wagnerspraytech.com,
or 800-328-8251

Editor's Choice

Lex-Aire LX 30C

The U.S.-made Lex-Aire unit is essentially priced the same as the Wagner and Fuji models, making it the most expensive two-stage model. Housed in a steel case that is almost identical to the Lemmer, it uses the same large pleated filter but offers an all-metal and better quality gun (in patriotic colors, too). The fluid knob has a location mark on it that helps you accurately adjust the fluid output. To protect your hands from the heat from the turbine, Lex-Aire provides a plastic handle cover (but it requires some effort and overnight soaking in thinner to allow enough flexibility to attach it). The instructions were similar to those on the Lemmer, adding a nice exploded view of the unit, but providing less information on maintenance and troubleshooting. Overall the unit performed well. The gun felt substantial in our hands and is well made. The two-stage turbine had enough umph to atomize the water-base lacquer. We did notice some fluid leakage around the cup seal, which may have been due to a faulty (but easily replaceable) seal in our test unit.

efit for reducing heat transference); its very flexible hose, 3-stage turbine performance, non-bleeder gun and overall feel during use. Oh, and it laid down a very nice finish as well. Priced at $499 it ties as the most expensive of the units tested.

For a little less money, there are some good guns here to choose from, including the Campbell-Hausfeld and the Lemmer units. We give a slight edge to the lower priced Lemmer because of its better quality gun, though it might be possible to make a case for the superior three-stage system and upgrading the gun on the Campbell-Hausfeld unit down the road. **PW**

Wagner 2600

When we opened the box for the Wagner, we were disappointed at first. The unit is $500, but the case for the three-stage turbine is plastic (everyone else's is metal). Plus the turbine seemed on the small side. After looking at all the systems, our opinion of the U.S.-made Wagner went up. The turbines in all the systems are small — they're just packed into larger cases. And when we started using the system, we were pretty impressed. The all-metal gun has a smooth trigger and nice balance. Unlike all the other guns, it's a "non-bleeder," which means air isn't gushing out the front constantly — only when you pull the trigger. Another advantage this gun has over all the others is it's the only one that allows you to change the air flow with a control on the gun. All the others have the control on the hose. Plus the hose was the most flexible of all those tested. The turbine has a sealed rocker switch (which can be a little awkward to use but it keeps the dust out), external fuse access and open-cell foam filters. The instruction manual fell short on information about the turbine, but it provided adequate directions on using the gun and spraying. The three-stage atomization was excellent and provided a nice finish. The power cord is much too short, requiring an extension cord for most applications.

	CAMPBELL-HAUSFELD HV3000	FUJI SUPER	LEMMER T-55	LEX-AIRE LX -30C	WAGNER 2600
STREET PRICE	399	499	375	495	499
TURBINE					
DESIGN	3-stage	3-stage	2-stage	2-stage	3-stage
MATERIAL	Steel	Steel	Steel	Steel	Plastic
AMP DRAW	12.8	12.4	9.2	9.4	12.5
PSI @CFM	6@65	5@100	3.9@55	3.9@50	6@50
DB	90	88	86	84	88
CORD FT/MATERIAL	6'/Pl	7'/Pl	14'/R	7'/Pl	5'/Pl
TEMP @ 15 MINUTES	83°	81°	82°	80°	84°
FILTER					
NUMBER	2	2	1	1	2
TYPE	Open cell	Open cell	Pleated	Pleated	Open cell
SIZE/INCH	8 x 8	6 x 5	8 x 9	8 x 9	5 Dia.
GUN					
TYPE	Bleeder	Bleeder	Bleeder	Bleeder	Non-Bleed
MATERIAL	Al	Al	Al	Al	Al
HANDLE MATERIAL	Pl	Al	Al	Al	Pl
CAP MATERIAL	Al	Al	Al	Al	Al
NOZZLE SIZE	#2 (.7mm)	#3 (1mm)	#4 (1.4mm)	#3 (1mm)	#3 (1mm)
HOSE					
LENGTH	25	25	25	20	20
FLEX	GOOD	GOOD	GOOD	GOOD	EXCELLENT

Key: Al=aluminum, Pl=plastic, R=rubber; features listed in red indicate this tool has the most desirable characteristic in that category.

Photo by Al Parrish

A good project for an aspiring beginner this table squeezes a bit of storage from a place that is usually wasted.

modern occasional table

There is space and need in almost everyone's home for an occasional table. But to sweeten the concept we've come up with a dual purpose for this design. Every family room has those certain items you need only occasionally (is that where the name came from?), but there's never a good place to keep them. You know, the remote control you rarely use, the Scrabble dictionary, or the coasters for when company's around. Well, lift the top off this table and you've uncovered a storage space for those occasionally needed items.

Getting Started on the Legs

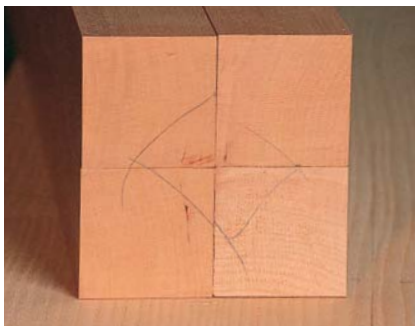
Construction begins by cutting out the parts according to the cutting list. Start with the tapered legs. There are many methods for doing this, but the simplest is just laying out the taper on each leg, cutting it out with a band saw and planing the taper with a bench plane.

First determine which sides of the legs will face out, choosing the best figure for those faces. The tapers are only on the two inside faces of each leg. To keep the legs correctly oriented, place the legs as they will be on the finished table, then hold them together and mark a diamond across the intersection of all four legs at the top.

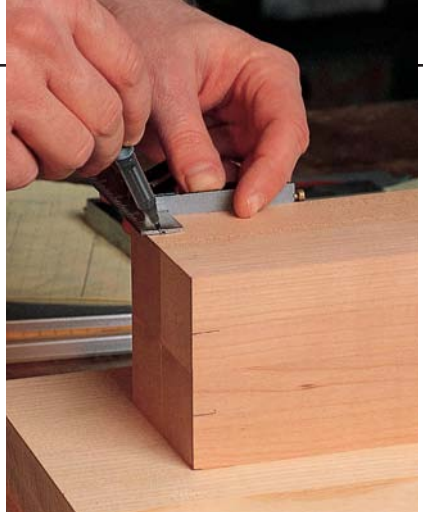
Next, mark each leg on the inside face (where the aprons will butt against) at $4\frac{5}{16}$" and $4\frac{13}{16}$" down from the top. The $4\frac{5}{16}$" measurement is the location of the bottom edge of the apron, which leaves $\frac{1}{16}$" of the leg protruding above the top, adding a nice detail. The $4\frac{13}{16}$" measurement is the starting location of the leg taper.

Now move to the bottoms of the legs and using a combination square, mark a 1" square on each leg, measuring from the outside corner. This indicates where the in-

by Jim Stuard



The diamond marked on the tops of the four legs will always allow you to recognize the inside and outside faces of the legs.



To mark the foot of each leg, a combination square is used to locate the 1" mark. I use a pen when laying out these measurements so they won't fade or be easily obscured during the clean-up process on the tapers.

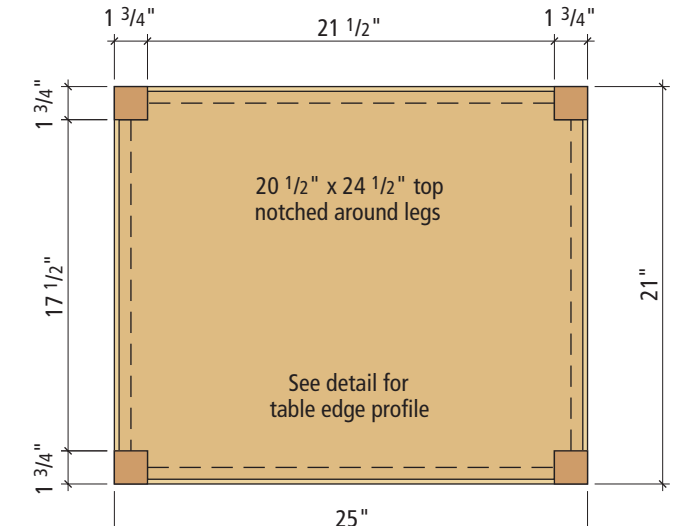
side tapers will end on each leg. Connect the marks from the top to the bottom of the legs, then cut the tapers on a band saw, cutting as close to the line as you can. To smooth out the band saw cut, use a bench plane and a bit of muscle to remove the rough-sawn edge.

The term "occasional table" implies that this table won't be expected to carry a lot of weight. In that spirit, the joinery doesn't have to be extraordinarily strong. Two #20 biscuits in each joint provides plenty of strength for the base. The 1/4" plywood bottom screwed in place will add to the base's strength.

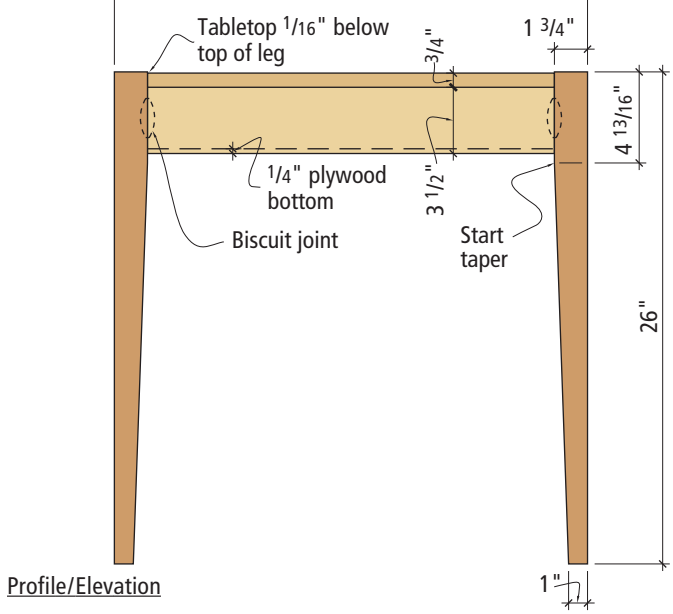
Set up the joinery by marking each leg 2 9/16" from the top (the center point for the aprons). Adjust the biscuit joiner to space two biscuits evenly in the thickness of each apron and to position the aprons flush to the legs.

After cutting the biscuit joints, set up a router to run a 1/4" x 5/8"-wide rabbet in the bottom edge of the aprons for the bottom. With the rabbets cut, start assembling the base by gluing the short aprons between the legs. Dealing with fewer clamps on any procedure makes the glue-up easier.

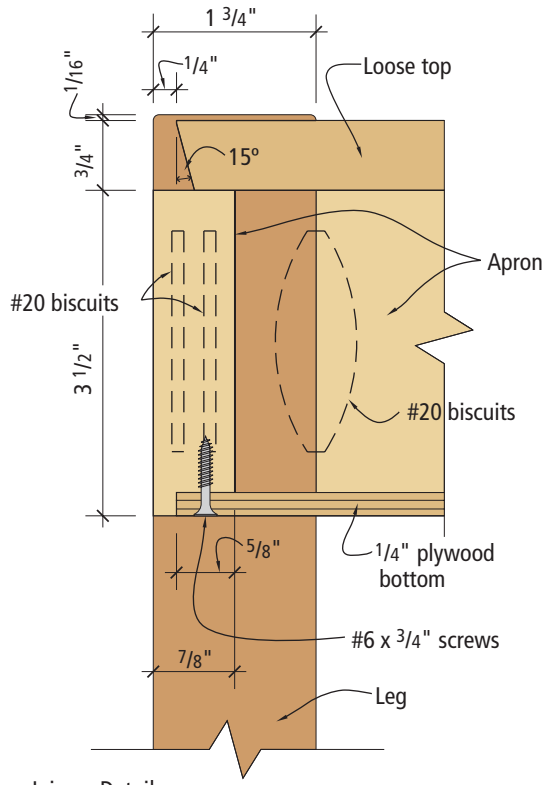
Check for square on each glued-up end by measuring from the top corner of one leg to the bottom corner of the other, making sure the measurements are equal. After about an hour, glue up the rest of the base, again checking the base for square on the sides and across the width and length of the apron. For the loose top to fit accurately, you have to be on the money.



Plan

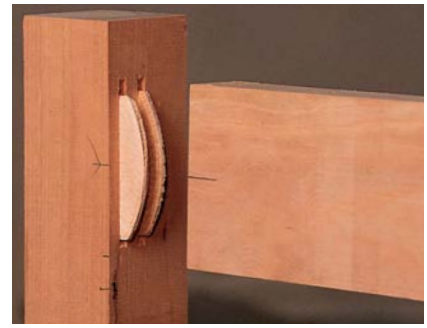


Profile/Elevation



Joinery Detail

The simplest way to cut the tapers is on a band saw. Cut as close to the line as you can, leaving a little extra to the outside of the line. A bench plane does a nice job of cleaning up the tapers after being band sawn, but there's no sense leaving too much work.



The double biscuits in the apron/leg joint will provide adequate strength for an occasional table. The biscuits are carefully located to keep the apron flush to the leg, while still providing even strength across the joint.

Modern Occasional Table

	NO.	ITEM	DIMENSIONS (INCHES) T	W	L	MATERIAL
❑	4	Legs	1¾	1¾	26	Cherry
❑	2	Aprons	⅞	3½	17½	Cherry
❑	2	Aprons	⅞	3½	21½	Cherry
❑	1	Top	¾	20½	24½	Ash
❑	1	Bottom	¼	20½	24½	Plywood

Take the time to wipe off any glue that you see before it dries. The inside of the table gets finished, so you have to keep squeeze-out to a minimum.

Cut out a ¼" bottom to fit the dimensions between the rabbets in the aprons. To let the bottom fit in place correctly, notch the corners around the legs using the band saw. Don't install the bottom until after finishing.

The last construction step is the top. I made mine from quartersawn ash to create an interesting contrast to the cherry base. The top's width was achieved by gluing up four thinner boards. The grain on quartersawn ash is so straight that it's hard to find the glue joints. After the top is glued up and dry, cut it to the same size as the outside dimensions of the table base, which is a bit bigger than the finished size of the top.

Referencing off the table base helps you cut accurate notches in the top. Mark the notch locations by laying the top upside down on a clean surface, then turn the base upside down and lay it on the top, flushing the corners. Mark the leg locations for the notches.

To notch the top using a table saw, clamp a ¾" spacer board to the rip fence about 3" back from the leading edge of the blade. Set the blade's height and the distance from the fence (including the blade) to the size of your notch and add about 1/16" to the cut to allow room for wood movement.

The top is run on edge against the saw's miter gauge. It's a good idea to add a sacrificial board to the miter gauge as well to add some extra height for support, and to back the top behind the notch to reduce tear-out. The top is pushed up to the spacer block on the fence, then pushed past the blade, holding the top tightly against the miter gauge. The spacer block allows you to properly align the piece for the cut, but keeps the notch (once cut free) from binding between the blade and fence, causing a dangerous kickback. Check the fit of your top. To allow you to lift the top, it needs to be a little loose. Next, cut the bevels on the top's edges by setting your table saw's blade to 15°. Set the rip fence so the cut is almost flush to the top edge of the top, leaving about a 1/32" flat on the edge. This cut will remove about ¼" off the underside of the edge. Repeat this cut on the other edges, then finish sand the top.

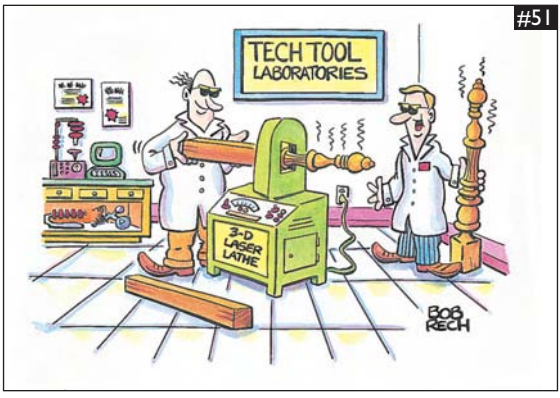
After sanding the base, apply a mix of boiled linseed oil and stain. The recipe is as follows: Mix ½ teaspoon of Pratt and Lambert Tonetic Cherry Bark stain (S7441) and ½ teaspoon of Minwax (#223) Colonial Maple stain with 4 ounces of boiled linseed oil. This gives the impression that the cherry's color is already darkened. The top gets no stain. Apply three coats of clear finish to the base, top and bottom. When the final coat is dry, screw in the bottom with some #6 x ¾" flathead screws.

Notching the top on the table saw can be an easy process. Notice the gap between the top and the saw's rip fence. This is the space left when the top is pushed beyond the spacer block attached to the fence. The gap will keep the notched piece from binding. Also notice that the top is clamped to the miter gauge. This is a good idea to hold everything in place.

Cartoon

Illustrated by Bob Rech
bobrech@juno.com

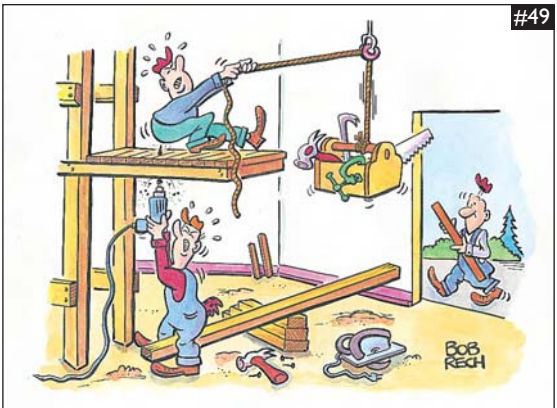
#51



Submit your caption(s) for this issue's cartoon on a postcard to *Popular Woodworking*, Cartoon Caption #51, 1507 Dana Ave., Cincinnati, OH 45207 by **December 7**. Winners will be chosen by the editorial staff.

The winner will receive a four-piece router bit set from Freud, including a flush trim bit, straight bit, roman ogee and beading bit, plus a bearing to convert the beading bit into a 5/8" roundover bit. The runners-up each win a one-year subscription to *Popular Woodworking*.

#49



"For every action there is an equal and opposite *rear*-action!"

Jeffrey D. Olson, of St. Louis Park, Minnesota, is the winner of our Cartoon Contest from the June issue and recipient of a fine set of Freud router bits. The following runners-up each receive a one-year subscription to *Popular Woodworking*:

"Drop outs from the Rube Goldberg Technical School of Design and Engineering." **Larry Scalph, Tacoma, Washington**

"Yup, I think I'm just about through." **Ben Pack, Kodak, Tennessee**

"Hey, watch it! You hit the wrong stud!" **Charles F. Nutaitis, Pen Argyl, Pennsylvania**

The Inheritance

When it comes to our dearly departed woodworking relatives and their tools, my family has a system that Darwin could write a book about.

We are all woodworkers — some of us are of the powered variety, others demand that their equipment be meat-driven. But, in the final analysis we all need tools. The only question that remains is, how do you go about getting them? While some spend hours perusing the local hardware emporium, others burn endless Saturdays at every swap meet, garage sale and dog fight in their state to find a piece of equipment at "just the right price."

This not withstanding, no tool in our shop is as treasured as one we have inherited from a respected craftsman.

I have no doubt your family has its own traditions and techniques for passing on cherished heirlooms... and I'm sure they're good ones. But, in my family, after years of evolution, we have devised an approach that can only be described as... unique.

We call it, "The Best Man Principle."

The title alone evokes visions of our elder craftsmen sitting in a darkened star chamber adjudicating who among the surviving family members is the most worthy. However, this is not entirely accurate.

Recently, "The Best Man" has been the one who can outwit, outsmart or overpower (usually the latter) the other contenders and haul off as much of the "Loved One's" stuff as he can before the remaining relatives get their shotguns loaded.

For the past 30 years, my Uncle Bill had been the undisputed King of the Best Men. He wasn't the biggest or the meanest; his power lay in his ability to sense when the hour glass was running out on another, better-equipped family member. In the event that the unthinkable did happen, he was always the first on the scene to console the widow and help her avoid the unpleasant wrestling matches associated with settling the departed's woodworking estate.

As you might imagine, there comes a time in every man's life when he has to lay down his cards for the last time. And a few years back, Old Bill was forced to fold his hand.

All of us knew that Bill had untold booty tucked away in his underground workshop. At last count, there were three jointers, half a dozen stationary drill presses and enough edged hand tools to shave Colorado flat without stopping to resharpen. Of course, this was all the stuff of legend since Bill wouldn't let so much as a cricket into the basement.

Out of decency, we knew we had to wait until after the wake to descend on the treasure trove of our forefather's tools.

So we all waited and grew edgier as the three long days before the funeral expired and the evening of the wake was upon us. We arrived early, in somber nervousness and then we waited some more. In a stroke of genius, Aunt Juanita had locked the doors to the basement.

It was around 10 p.m. when she unlocked the basement. I know because I was looking at my watch when I felt my wife's hand wrap around my wrist.

"You should go over and talk to her...."

Helga's grip tightened. Although she was seven months pregnant with our second child, she was still very agile. I knew that if I didn't comply, her next step would be to slam me on the floor and put me in a "half-Nelson."

I tightened my necktie and did the right thing... under duress. Now, it would be fair to say that my Aunt Juanita liked to talk... a lot. We sat quietly as she spoke... at length... about everything. In honesty I must admit, tears welled up in my eyes — particularly at the sound of three pickup trucks, a mini-van and (if I'm not mistaken) a forklift pulling down the driveway and into the workshop only to lurch away moments later under a heavy burden.

It wasn't until around midnight that Juanita had cleansed her system. By then, the rest of my family (the better men) had returned from downstairs. I moved tentatively toward the basement door, only to meet the discouraging glance of my cousin Mike, as he shook his head solemnly.

It was over.

Well, it goes without saying that the ride home with Helga was a long, quiet one. Oh sure, she was right. But we're talking about a family tradition here. I fumed in silence.

Some 20 minutes later, she finally broke the silence to say, "Juanita said to give these to you." And with that she shoved a folded grocery bag in my lap.

For a brief moment I felt dirty... this was a clear violation of a long-standing principle. This feeling was short lived and I had recovered completely by the time the paper bag was unfolded.

Two Estwing hammers: a framer and a tack. They had been my own Old Man's.

I don't want to go into too much detail here... Suffice it to say that I had to pull off the road and let my wife drive. Some surface rust would later have to be removed from the hammers.

Oh, I know two hammers ain't much. But, it is something and they are special. Besides, I'm staying in good shape; I'll have another crack at the big stuff. **PW**

Walt Akers is eating right and exercising regularly in Seaford, Virginia.