WAINSCOTTING IN A WEEKEND

PROJECTS SHOP TESTED: DEWVALT'S NEW CONTRACTOR SAW

August 2000 #16 The Skill-Building Project Magazine for Practical Woodworkers

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ON THE COVER

After years of building furniture for clients, Troy Sexton took some time off to build this traditional secretary for his daughter.

Cover photo by Al Parrish



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Audit Bureau of Circulation membership applied for.

Every Good Teacher Assigns Homework

Oou've heard the expression about the difference between giving a man a fish and teaching him to fish. The man who learns to fish puts dinner on his table forever, while the other man eats for one day. But what about the guy who says he wants to learn but doesn't want to bait his hook, or loses his patience when the fish aren't biting?

In woodworking, I sometimes wonder if the hobby is attracting more folks who say they want to learn to fish but expect to be reeling fish in by the boat load as soon as the boat leaves the dock.

Anyone who really knows woodworking or fishing can tell you it doesn't work that way. It takes dedication and patience to learn the skills to routinely land big fish or complete satisfying projects. Until you reach that level it's easy to get frustrated.

My concern is for those newcomers whose expectations far exceed their skills. I fear they quickly conclude that all you need to build a project is a drawing, cutting list and instructions. What is perhaps more important is a foundation of basic skills. The fundamentals of construction, an understanding of wood movement and grain direction are all navigation devices on the road to a rewarding project.

Their unbridled enthusiasm has them taking on projects that are too complicated. And when they stumble, as most do, they sometimes write, call or e-mail us. Some have polite questions, some aren't so polite.

"You tell me to use a tenon for the joint, but you don't even tell me what a tenon is!" Or, "You say to square up the stock before cutting pieces, but you don't even say how or why." Or, "You say to make an allowance for the saw kerf. What's that?" All these are legitimate questions, and when the caller is working on a fairly simple project, we happily walk him or her through it. But when they tell us they're staring at \$500 worth of hardwood and are ready to start a Chippendale slant-front secretary, it's something else.

Sometimes it makes me wonder if we should rethink the mission of Popular Woodworking. Perhaps we'd be a magazine with more subscribers if we did. As it stands. I believe our mission is to be a teacher who challenges the students. And that our students would one day graduate and not require the steady coursework our pages offer.

We believe that giving readers every possible bit of information keeps them in the dark about the joy and satisfaction of finding their own solutions. The best woodworkers can adapt, create projects for their own needs and engineer and build furniture using techniques that suit their woodworking interests.

Or we could simply give our readers the fish, issue after issue.

But that's not for me. I respect our readers too much to produce a magazine with such a cynical point of view. To do so undermines one of the joys of woodworking: the supreme satisfaction that comes from figuring things out.

However, I will give you this: If you are a beginner, here's what you should do to start your hobby right.

- Buy a good book on joinery such as Bill Hylton's "Illustrated Cabinetmaking" (Rodale Press) or "The Encyclopedia of Joint Making" (Popular Woodworking
- Make sure your first projects require a small investment in time and wood.
- In the shower or on your way to work, build your projects in your head two or three times before you cut your first piece of wood.

And by all means, don't stop calling or writing us. We make it easy for you to get in touch because we want to help and we care about your woodworking. PW

5 kue Shanes

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SAFETY NOTE

Safety is your responsibility.

Manufacturers place safety devices on their equipment for a reason. In many photos you see in Popular Woodworking, these have been removed to provide clarity. In some cases we'll use an awkward body position so you can better see what's being demonstrated. Don't copy us. Think about each procedure you're going to perform beforehand. Safety First!

Procedures used to test screwdrivers are suspect

Magazine is Not Fooling Anyone With its Silly Tests

Just a note to tell you how thoroughly I enjoyed the April 2000 issue (#114).

However, I do have to comment on your test of the four-way screwdrivers on page 74.

While there were some gaffes in the testing process (everyone knows it's polycarbonate-impregnated graphite, not graphic-impregnated poly) no goof was as huge as attempting to test the screwdriver four ways. Even a junior-high shop student knows that there are only two ways to turn a screwdriver: clockwise and counter-clockwise. To test one to destruction by attempting to turn it four ways (as the name implies), simply goes beyond the bounds of editorial propriety.

I certainly hope your testers conduct future tests in a manner more suitable to the usual high quality of *PopWood!*

Ben Borok Novato, California

P.S. Happy April One!

When Did Alfred E. Neuman Become Editor of PW?

I have been enjoying your magazine for I don't know how long. I always read "Out of the Woodwork" first thing. After having read the Endurance Test on four-way screwdrivers in the April 2000 issue it has become apparent to me that I have wasted a lot of time and money reading *Mad* magazine when I needed some entertainment. Thanks for the laugh.

Michael J. Honer Clemmons, North Carolina

Reasons We'll All Miss R.J. DeCristoforo

When I subscribed to *Popular Woodworking* a couple years ago and began reading R.J. DeCristoforo's editorial contributions, I thought, "How nice. R.J.'s son is also a woodworking writer." After all, how could the guy that wrote a book I bought in 1956 for use with the ³/₄hp Shopsmith Mark 5 that I bought in 1953 still be writing? He had to be older than I was, and I'm 79.

Glad to see it's still the original you, R.J., because I'm still using that old Magna (Menlo Park, Calif.) Mark 5. Not so much as a table saw; I finally bought a cabinet saw about 10 years ago after I retired and moved to a new shop where I didn't have to keep all my power tools at the front of one side of a two-car garage.

Over the years since 1953, I've added the Shopsmith jointer, band saw, thickness planer, biscuit-cutting attachment and, recently, the oscillating sander (as my dad would say, now there's a "Boss Tool!"). The planer and band saw are now on their own power stands, but I still run the jointer on the basic machine and still use it as a drill press (where else can you buy a horizontal borer for home use?), lathe and disc sander.

I wouldn't hesitate to recommend this machine, used or new, to anybody who is starting out in woodworking and has limited space for tool storage. It'll last you the rest of your life and probably a lot longer.

Barney Howard Sisters, Oregon

Continued on page 10

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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LETTERS

Continued from page 8

Editor's note: As many of our readers may have noticed in the last issue, contributing editor R.J. DeCristoforo passed away. All woodworkers (particularly Shopsmith owners) owe R.J. a debt of gratitude for how much he taught us about our tools and all the amazing things we can do with them that isn't covered in the manuals.

Article on Death Row Woodworkers Doesn't Belong

I was disappointed with your article about death row (April 2000 #114). What place does an article about the lowest form of people in our society have in a woodworking magazine? Although you tried to walk on eggshells about their character, I feel you really missed the boat on this one.

Quite frankly, I don't care how ingenious convicted killers are. It seemed almost that you wanted to glamorize their exploits. What about the victims? If you want to write about the seriousness of our society go write for Time or Newsweek. I for one read your magazine for enjoyment, not to be reminded of the terrible things in the world.

> Mark Adams Charlotte, North Carolina

Death-Row Woodworking Article 'Despicable'

I just purchased the April issue of Popular Woodworking. It is my opinion that the article on death row woodworkers was despicable journalism. These inmates lost the privilege of recognition for their work the day they took a life.

I've taped those pages together so as not to have to look at them again. There are thousands of woodworkers in the United States that are far more deserving.

> James Pozorski Milwaukee, Wisconsin

I Was Suspicious of Your Tool **Reviews, But Not Now**

A few months ago your staff chose to review a particular sliding compound miter saw in your Tool Test column.

Earlier in the year I had purchased a different brand and had really put it through its paces. Much to my satisfaction it performed exceptionally well. It struck me that my choice of saw must have been omitted from the group you tested. This lead me to wonder about the validity of your procedures. In fact, I almost wrote to you on this matter to share my experience.

Then your April 2000 issue arrived. Within your current tool test a specific cordless drill/driver was shown. I was very impressed with the price, features and brand of this unit. After examination at a local dealer, I purchased it and am most pleased with its performance and balance. My choice to use your guide actually caused me to cancel an order for a unit of a different brand. PW

> Ralph H. Meinel Williams, Oregon

CORRECTIONS AND CLARIFICATIONS

In the November 1999 issue (#111), Popular Woodworking inadvertently violated a patent when publishing the plans for the Miter Sled on page 30. The method for setting the angle of the miter cut was patented by Jerry W. Cole, the inventor of the "Dubby" table saw fixture. Anyone who uses this method without Mr. Cole's permission will violate the Cole patent and be liable for money damages. If you are interested in purchasing the Dubby miter sled for your table saw, contact Jerry W. Cole at 800-533-6709 for more information.

In the Ice Box Entertainment Unit in the April 2000 issue a couple items were incorrect or missing. Attach the mitered base pieces to the front of the case with screws and glue. Use a biscuit in the miters. Attach the base pieces to the sides with screws in slotted holes to allow wood movement.

On the face frame, there's no shoulder on the top of the top rail. So the mortise on the stile is open on the end of the stile.

Ignore the door's mortise dimensions in the photo caption. Actual mortise dimensions are: 1/4" $\times 1^{3}/4$ " $\times 2^{1}/8$ " for the upper rail and 1/4" $\times 2^{1}/4$ " $\times 2^{1}/8$ " for the bottom rail. These are 3/8" in from the stile end. Tenon sizes are stated on page 65 of the article. The notch dimension is wrong. It should be 3/8" x $1^{3/4}$ ".

Scrapwood Scraper Plane

This plane helps takes the work out of handwork.

nce upon a time when I was new to woodworking, someone showed me how to cut my sanding time in half by using a hand-held scraper. I thought to myself, "It just doesn't get any better than this."

But it did. A few years later I was introduced to a cabinet scraper — a cast metal frame that holds a scraper at a fixed angle. This reduced my scraping chores considerably, and I thought, "It really can't get any better than this."

But it did. A few more years went by, and someone let me try out their old Stanley scraper plane, an adjustable holder for a scraper. A scraper plane, I quickly learned, is to a cabinet scraper what a Ferrari is to an Astrovan. "This," I thought to myself, "is as close to heaven as I am going to get."

And I was right. Scraper planes are not only one of the best smoothing tools ever invented, they are unfortunately as rare as hen's teeth. The old Stanleys are a collector's item, and they are priced accordingly. The reproductions that are beginning to appear aren't much less expensive.

Well, if you can't find it or you can't afford it, you can always make it. Not so very long ago, it was common for woodworkers to make their own planes — they aren't particularly difficult tools to make. And the scraper plane, it turns out, is one of the simplest. In fact, you can make one from scrapwood and a scraper or a worn-out plane iron.

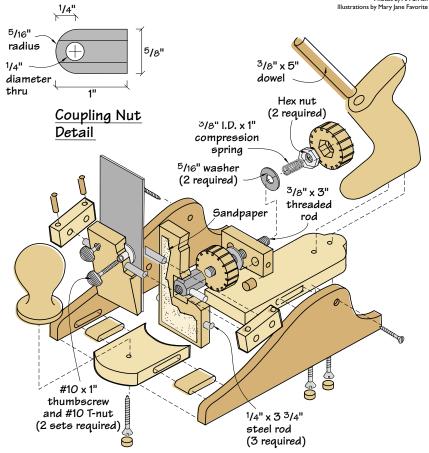
The plane holds a scraper against a wooden support. By turning the adjustor wheels, you can change the angle of the support to compensate for the angle of the burr on the edge of the scraper to get the cut you're after.

Building the Plane

I made this particular scraper plane from some scraps of exotic and figured woods

Nick Engler is the author of over 50 books on woodworking, plus countless articles and project plans. He makes many of his own tools because he's never made enough money at it to afford real ones.



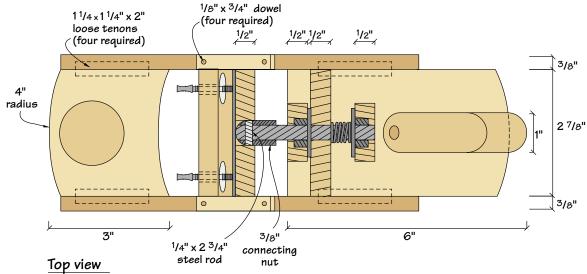


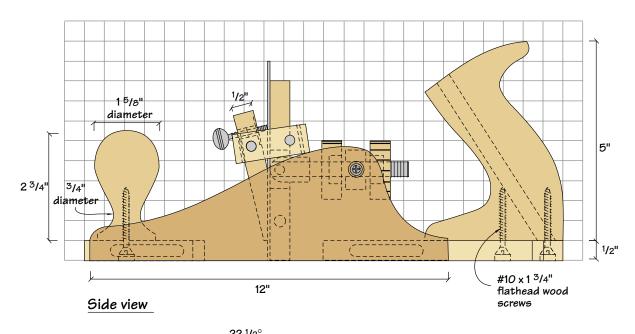


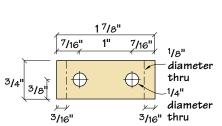


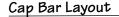
Shape the plane handle with a cabinet rasp, rounding over and blending the surfaces until it fits your hand comfortably (far left).

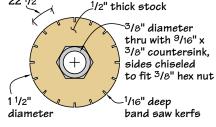
To round the coupling nut, use the pivot to swing it back and forth around the pivot hole as you grind away the end with a sander or grinder (left).



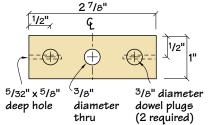






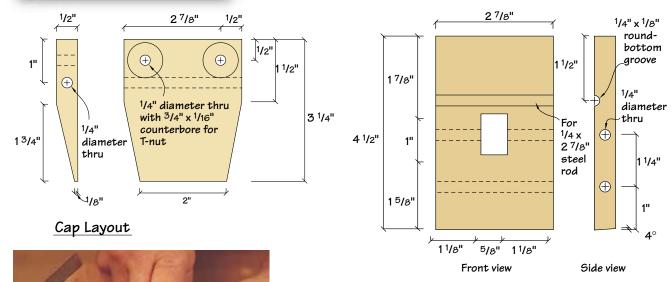


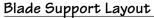
Adjustor Wheel Layout



Adjustor Bar Layout

Ingenious Jigs







that I just couldn't bring myself to throw away. (Like most woodworkers, I have an overactive packrat gland.) The sole requires an extremely hard wood to be as durable as possible, so I made that from Cocobolo. But any dense wood will do—rock maple was the traditional planemakers' choice. The other parts are made from curly maple and cherry, but any clear hardwood will work well.

Before you cut the parts, adjust the width of the plane so it's $^{1}/8$ " wider than the scraper between the sides. I used the blade from my cabinet scraper, which is $2^{3}/4$ " wide, making the plane $2^{7}/8$ " wide. I've also made these planes $2^{1}/8$ " wide, using 2" plane irons as scraping blades. The plane irons work like gangbusters, by the way.

Because of the loads applied to this tool when you're using it, several of the parts must be reinforced. I drilled a long hole through the back handle and inserted a 3/8"-diameter dowel to prevent it from splitting. I also used dowels to reinforce the ends of the cap bar and the adjustor bar. The cap bars are under considerable tension, and the steel rods will split out of the

ends if they are not strengthened. I put dowels in the adjustor bar at right angles to the wood grain because screws do not hold well in end grain.

I also reinforced the joints between the soles and the sides with loose tenons because Cocobolo is an oily wood and does not form an especially strong glue bond. If I had made the soles from rock maple, the tenons would have been unnecessary.

When gluing the sides to the soles, remember that you must put the support, support pivot, coupling nut and coupling nut pivot in position as you do so. The pivot rods are captured by the sides; you cannot insert them after you assemble the plane body.

Using the Scraper Plane

Place the plane on a flat surface. Insert the scraper blade between the support and the cap and slide it down until it touches the surface. Tighten the thumbscrews to lock

with a burnisher. Don't apply too much pressure; a small burr is less likely to grab and leaves a smoother surface than a large burr (left).

To change the angle of the scraper blade, turn the adjustor wheels. Steeper angles (as the blade approaches vertical) leave a smoother surfacer, shallow angles remove stock more quickly (far left). To sharpen the scraper blade, grind and file the ends at 30 degrees. Roll the burr

it in place — I adhere a piece of 100# sandpaper to the back of the support to keep the scraper from shifting in use.

Loosen the back adjustor wheel. As you make passes over a piece of wood, turn the front wheel until the blade begins to bite. Then tighten the back wheel and make another pass over the wood. The plane should be resting flat on its sole. If it's not, or you're not getting the cut you want, readjust the vertical position of the blade or the angle of the support. This takes a little futzing around until you get the hang of the tool and how it cuts. Tip: Use a rawhide mallet to tap the blade, making tiny adjustments in the vertical position. **PW**

SUPPLIES

Cabinet scraper blades Garrett Wade 161 Avenue of the Americas New York, NY 10013 800-221-2942

TRICKS OF THE TRADE

WINNER!

High Precision Miter Saw Trick

I'm currently installing interior door and window trim, and I insist on near-perfect miter joints. In the past I've taken the measurement, made the initial cut a bit long,

and "nibbled" off an end until I achieved the desired fit. Recently I stumbled on an idea to remove just a hair with my chop saw. After measuring the workpiece and making the rough cut a bit long, I sneak up on the final cut as follows. Position the workpiece against the fence, and then lower the blade to its lowest position, without turning on the saw. Then slide the workpiece until it touches the side of the non-moving blade (not the teeth). While holding the workpiece firmly in place, raise the saw

blade, still without turning on the saw. Still holding the workpiece securely, turn on the saw and make the cut in a normal manner. The amount of wood removed is simply the amount of the teeth's offset from the blade. Repeat the hair-cutting process until the desired fit is achieved.

WITH SAW OFF, WORKPIECE IS SET AGAINST BLADE WITH SLIGHT (c) PRESSURE. HOLD THE WOOD IN PLACE AS YOU LIFT THE BLADE, THEN MAKE THE CUT

> David Theriault Brewer, Maine



Beating Woodworker-Proof Caps

I have always had trouble with those cans of finish with the "push down and twist" caps. You can never open them easily a second time after they glue themselves shut from the residual finish on the neck and cap. I invariably ruin the cap trying to remove it with a pair of pliers. To solve this problem, I simply cut a 2" x 2" piece of plastic shopping bag, place it over the mouth of the open can and screw the cap back on. The bag material is quite strong and thin, and it allows a good seal while still letting you easily reopen the can several times. When necessary, cut a new piece of shopping bag to replace the torn old one.

> D. Dehn Union, Illinois

16-8" GAP **Anti-Lock Bit Trick** Reading an old router project article, the writer tells of beating on bits to get

them out of the collet. A simple way to keep the bits from locking up is to never tighten a bit that is bottomed out in the collet. Allow the bit to hit the collet's bottom, then raise it ¹/₁₆" or ¹/₈" before tightening. When removing, loosen the nut and push the bit all the way in to loosen it, then remove it. This works with all tools that have a collet.

> John Gould Ramona, California

BE AN INNOVATIVE THINKER AND WIN!

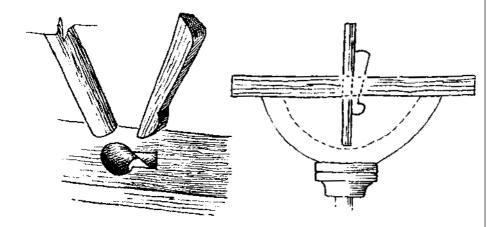
Turn your woodworking knowledge into a truly tricked-out tool from the Simpson Machine Tool Co. (www.smtco.com). Your best trick or shop tip can earn you a reproduction of the 19th Century Stanley Odd Job #1 — the original multi-tool — and a check for \$50.The Odd Job is an inside miter and try square, mortise scribe, layout tool, depth gauge, beam compass and bubble level, with a 6" and 12" brass-lined maple rule. This re-creation of a classic tool is cast from solid manganese bronze and is machined to within .0015 tolerance. One winner will be chosen each issue; published runners-up receive \$25.

To make things easier, you can e-mail your trick and daytime phone number to us at DavidT@FWPubs.com or mail it to:Tricks of the Trade • Popular Woodworking • 1507 Dana Ave. • Cincinnati, OH 45207. All entries become the property of Popular Woodworking.

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Illustrations: John McCormick



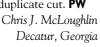
Shopmade Depth Gauge for Lathe Work

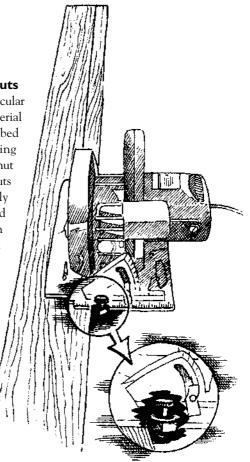
A depth gauge with a long stock is a valuable lathe accessory when turning large bowls. This shopmade one uses a piece of dowel rod that can be locked with a captive wedge — a useful method of locking a sliding part, much used in the past, but not so often seen now. Sizes can suit your needs, but stock 1" square and a $^{1}/_{2}$ " piece of dowel rod would be suitable. Drill for the rod and make a wedge that will pass through the hole. The wedge need not be more than $^{1}/_{8}$ " thick and a length of 3" will do. Give it a moderate slope and make the knob on the small end the same height as the thick end. Cut a slot so, with the wedge in place, the rod is free to move when the thin end of the wedge is within the thickness of the stock, then hand pressure or a light tap with a hammer secures the rod.

Percy W. Blandford Stratford-on-Avon, England

Nuts To Straight Circ-saw Cuts

Rip guides come with most new circular saws and work great until the material width is smaller than your saw's bed width. That's when I use a framing square nut to act as my guide. The nut offers accuracy with consecutive cuts that can't be beat. Usually I'll only mark the first 6" of the board and begin my cut without the nut. Then when blade placement is established in the wood I screw the nut on and rip away. Gang rips and plunge-cut rips are no problem with practice. Also, scribe the location of the nut with a pencil, remove the nut, then confidently and simply go back to your mark later for a fast duplicate cut. PW





The Deltagram

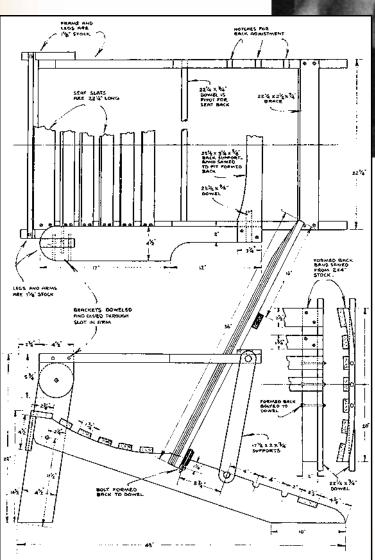
A nostalgic look back at plans published by Delta Machinery shortly after World War II.

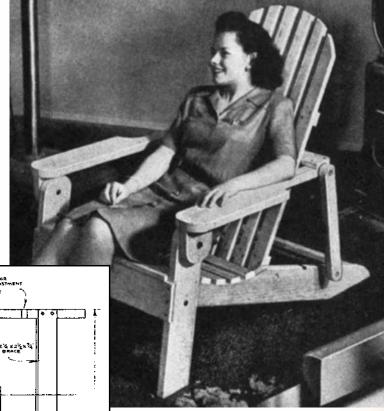
From Volume 14, Issue No. 4, 1945

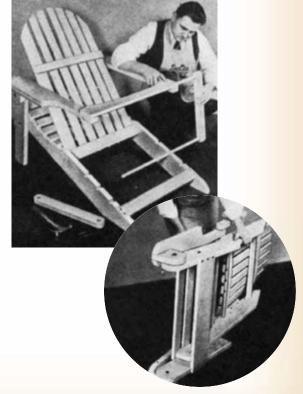


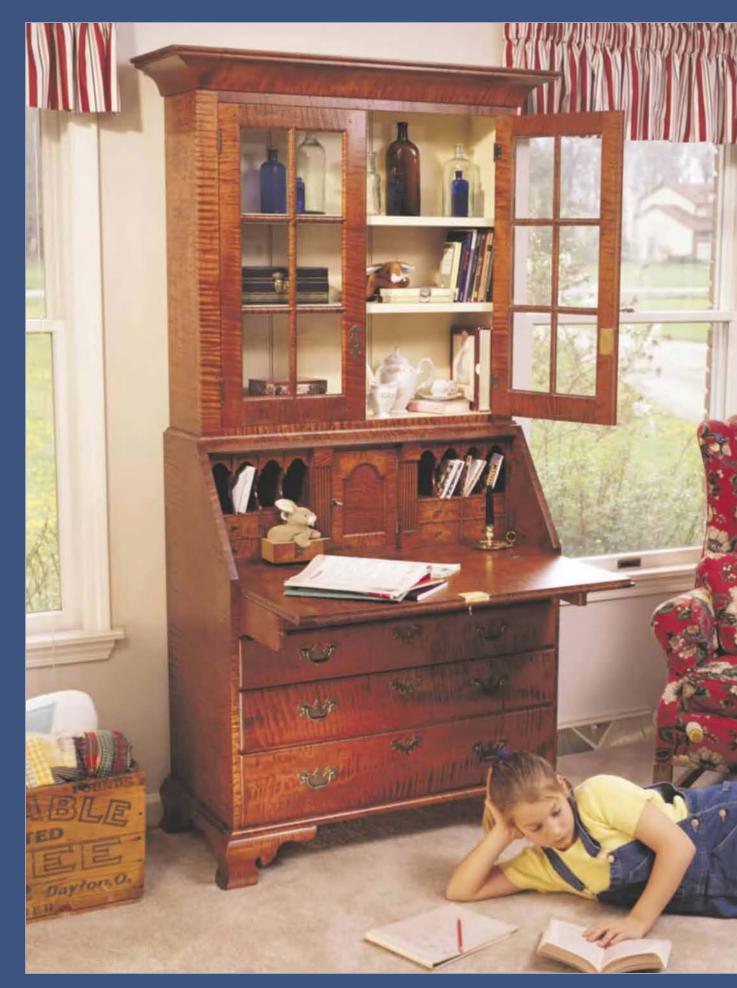
Folding Lawn Chair

The advantage of this design is the folding action which allows you to fold the chair into a compact space for storage. The back pivots on a $^{3}/_{4}$ " dowel, while the arms, front legs and seat unit pivot on carriage bolts. The curved rails for the back are band sawn from 2 x 4 stock and the slats are screwed to these. A $^{3}/_{4}$ " dowel is bolted to the bottom rail for the pivot. The chair is finished with two coats of linseed oil and then outdoor paint. **PW**









As I watched my daughter grow, I waited patiently for more than a decade to build this secretary. This year both she and I were ready for this ultimate heirloom.

Secretary Secretary

Back in 1989 a local sawmill owner passed away in these parts and his family went about auctioning off all his personal possessions, including a large quantity of lumber. Before the auction I went through the wood and found some 20"-wide curly maple that apparently had been milled in 1954. I wanted that wood, and so I went to the auction with \$1,000 in my pocket ready to to bid, but also ready to be disappointed.

When the curly maple lot came up, the auctioneer put one leg up on that pile of wood, spit out a huge wad of tobacco and said the words that would lead to the lumber purchase of a lifetime.

"Who wants to bid on this pile of oak?" he says.

Well, a few minutes and \$200 later that pile of the most amazing and wide curly maple was mine. For more than 10 years that lumber has sat in my shop. I've used a couple small pieces for important projects, but mostly I've been saving it for something very special: a drop-lid secretary for my daughter.

Now I've been a professional cabinetmaker for a long time, and have built just about every piece of reproduction furniture imaginable. But I've got to tell you that some aspects of this project were a real challenge. The beaded mullioned doors require a lot of tricky cuts that are dangerous if not executed carefully. If you're squeamish, I'd recommend you make the mullions flat instead of beaded. Most of all, don't get into a hurry with this project. It's going to take you a lot longer than you expect.

Lower Case

Some cabinetmakers build a separate base that the case rests on. After years of building Shaker and 18th century American furniture, I've found it's better to build the lower case and base as one. Instead of a separate base, I make my side pieces extend to the floor and attach the ogee feet to the sides and a build-up block on the front. We'll get to the feet later, but don't look for parts for a separate base.

The lower case is held together by mortise-and-tenoned framed panels that are attached to the two sides using sliding dovetails. The writing surface is also attached to the sides using sliding dovetails. And the top of the lower case is attached using half-blind dovetails. The lid is supported by two pieces that slide out beside the top drawer. The back is shiplapped and nailed into rabbets on the side pieces.

by Troy Sexton

Troy Sexton designs and builds custom furniture and is a private woodworking instructor in Sunbury, Ohio, for his company, Sexton Classic American Furniture.

Troy is a contributing editor for Popular Woodworking.

Begin by roughing out your parts and gluing up any panels you might need. First cut the sliding dovetails in the side pieces. These cross the entire width of the cabinet side. Build a jig from two pieces of plywood to do this. The jig, as shown in the photos, has a long slot in the top that is exactly the same width as the template guide on my router. The second piece of plywood keeps the jig square to the side. Chuck a

³/₄" dovetail bit with a 14-degree slope into vour router and set the router to cut $\frac{7}{16}$ " into the sides. Lay out the locations of all the sliding dovetails on the sides and make your cuts. Now cut the slant on the sides and top as shown in the diagrams and cut a $\frac{1}{2}$ " x $\frac{1}{2}$ " rabbet on the sides to hold the back pieces. Do not cut a rabbet on the top piece.

Now turn your attention to the stuff that goes between the sides. Start by cutting the material for the mortise-and-tenon panels that run between the sides. These panels (sometimes called dust panels or dividers) are much like a door, with rails, stiles and a flat panel that floats inside. The tenons are 1" long, and the groove to hold the panel is $\frac{3}{8}$ " x $\frac{3}{8}$ ". When you assemble the frames, glue the front mortises but not the rear ones. When you attach the assembled frames to the case, the divider fronts should be flush to the front of the case and the divider backs flush to the inside of the rabbet. This allows the case to expand with the seasons.

Fit your panels, then cut the male part of the sliding dovetail on the ends of the writing surface, the rails and the ends of the stiles. You'll need to use a router in a router table for this operation. Go ahead





Here you can see the jig that cuts the female part of the sliding dovetails. What you can't see is the board attached to the back of the jig (next to my stomach) that keeps the jig square to the side (left). Unless you taper the male part of the sliding dovetail, it's going to bind up as you knock it into the case. I made a little sanding block for just this purpose. One edge has the same angle cut on it as the dovetail (14 degrees). Wrap sandpaper around the block and sand both edges of the dovetail. Don't sand up near the front where the dovetail will show. You want that part of the joint to be tight (right).

and cut the sliding dovetails for the vertical dividers that house the lid supports.

Now sand the back section of the male part of the dovetail as shown above.

To attach the top to the sides, I used half-blind dovetails. I cut the pins using a homemade jig that was featured in the September 1999 issue. The pins should be 7/16" deep. Cut your pins and then dry-fit the case together. Now cut the tails on the top and knock that into place. When everything fits, disassemble the case and sand the inside of the desk. Glue up the case and clamp it.

Top Case

The top case is built similarly to the lower case. The top is attached to the sides using half-blind dovetails. The two shelves and bottom are attached to the sides using sliding dovetails. Then you build and nail a face frame to the case.

Cut your sliding dovetails in the sides in the locations shown in the diagram using the same dimensions and jig from the lower case. Then cut the pins for the half-blind dovetails in the sides and cut the $\frac{1}{2}$ " x $\frac{1}{2}$ " rabbet on the sides to hold the back.

Fit the top case together and then cut the top piece to size and cut the tails on the end to fit into the pins on the sides. Sand the interior, glue up the top case and build the face frame.

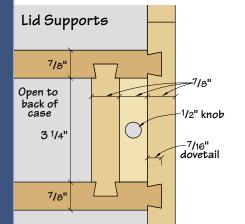
The face frame is built using mortiseand-tenon construction. Cut 1"-long tenons on the rails and 1½16"-deep mortises on the stiles. Glue up the face frame and attach it to the top case with nails.

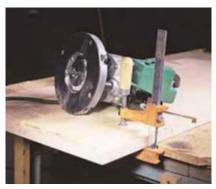
Finish sand the exterior of both cabinets because the next step is the moulding.

Moulding

There are custom mouldings on this project that require skill to cut, especially the ogee feet. Begin working on the feet by gluing a long block to the front of the lower case (below the lowest divider). You're going to nail your feet to this.

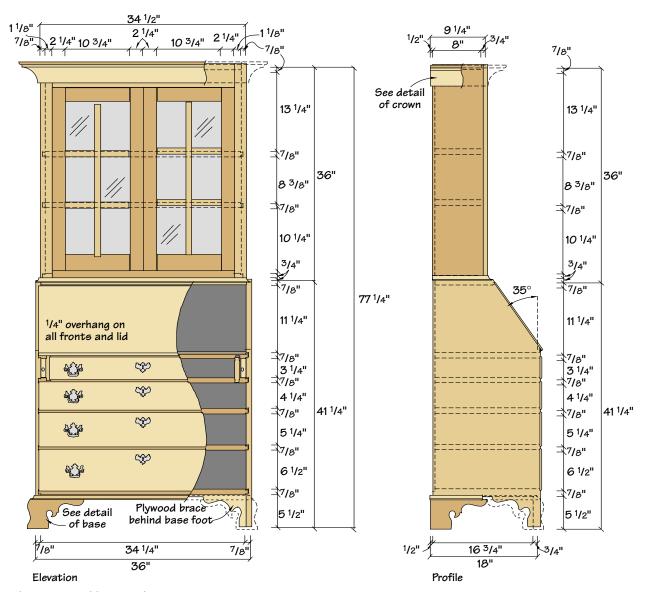
To make the ogee feet moulding, first make a cove cut down the middle of your







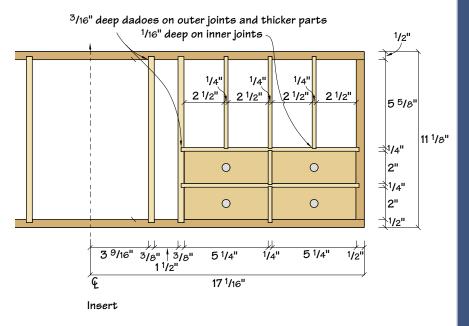
Cut the pins in the case sides using a custom-made jig and a template guide in your router. The jig is explained in the September 1999 issue (left). After the pins are cut, dry-fit the case and mark the tails for the top piece (right).



stock using your table saw in the same way you would cut cove moulding. It helps to draw the profile on the end of one of the boards to help guide your cuts.

After the cove cut is complete, round over the top of the moulding by running the moulding on edge against your rip fence, changing the blade's bevel as you nibble away at the edge until you can smooth the cuts with a sander.

Sand the feet and then miter the pieces. Trace the profile of the scrollwork from the diagram onto the glued-in block. Cut the scrollwork profile on the block using a jigsaw (it doesn't have to be pretty). Cut the scrollwork on the ogee feet on your band saw or scrollsaw and sand your cut (these have to be pretty). Nail the feet to your case sides and front. Then miter and nail ³/₄" cove moulding on top of the



ogee feet moulding.

You're done with the feet. Now put the top case on top of the lower case. Center it and attach ³/₄" cove moulding to the lower case around the base of the top case.

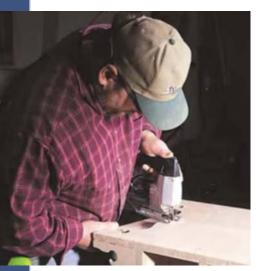
Attach cove moulding to the top case (I bought mine off the rack) and then add a $\frac{1}{2}$ "thick cap as shown in the diagrams.

Doors

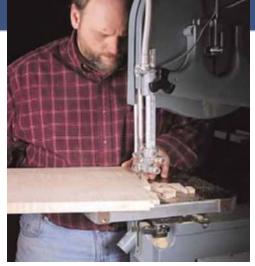
The doors are real tricky. In fact, you shouldn't feel bad about modifying the doors to suit your taste or skill level. The joints for the door are formed using a custom copeand-stick shaper profile. The rails and stiles are attached using loose tenons. The mullions are coped on the ends and glued between the rails and stiles. Coping these tiny pieces is the tricky part.

Begin by cutting the cope-and-stick profile on the rails and stiles. Now cut the cope on the mullions. Here's how: Take a block of wood that's about 4" wide and cope the ends, then rip your mullions from this wider board. Use a really wide pushstick to protect your fingers during this dangerous cut. Cut the beaded profile on the edges of the mullions and cut the $\frac{1}{4}$ "-deep x $\frac{5}{16}$ " wide rabbet on both back edges to hold the glass. Because this cut is so tricky, I recommend you use a special pushstick that you can see in action in the photo at right.

Fit the rails and mullions between the



Here you can see how I build my bases. I add a block at the front and attach the moulding to that. It's much like a kick on a traditional cabinet, except it's flush to the front of the case. Cut out the scroll pattern using a jigsaw (top). After you've cut out the scroll pattern on the ogee feet, nail them in place to the sides and the block at front (right).



Cut the tails on your band saw and clean them up with a chisel if necessary.

stiles and get ready to cut the loose tenons that hold the doors together. I cut the mortises in the rails and stiles using a straight bit in a router. Each mortise measures $\frac{3}{8}$ " wide x 1" deep x $1\frac{1}{2}$ " long. Cut your tenon material from shop scraps. Glue and clamp your doors.

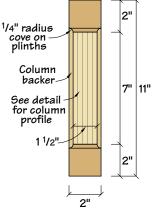
Drawers

The drawers are built entirely using solid lumber. The drawer fronts lip over the case and are rounded over on the front. The sides attach to the front with rabbeted halfblind dovetails and through-dovetails at the back. The bottom, which is a panel with beveled edges, slides into a groove in the sides and front.

Begin by cutting your parts to size and cutting a ⁵/₁₆"-wide x ⁷/₁₆"-deep rabbet all the way around the back of the drawer fronts. Then cut a roundover on the drawer fronts.

Cut your half-blind dovetails using the same type of jig you used for building the case. Now cut the $\frac{3}{8}$ "-wide x $\frac{1}{4}$ "-deep groove in the drawer front and sides for the bottom panel. Cut your bottom panel to size and bevel the edges so the panel will fit between the side pieces. Glue up your draw-





ers and slide the bottom panel into place.

Drop Lid

The drop lid is built using traditional mortise-and-tenon breadboard ends. Begin by cutting three 2"-wide x 1"-long tenons on each end of the panel. Use these to lay out the mortises on the breadboards. Cut the mortises a little wide, glue the center tenon in the mortise and peg your tenons through elongated holes in the tenons.

Now cut a rabbet on the sides and top of the lid and roundover the front edge like you did the drawers. Attach the lid to the lower case using the hinges listed in the supplies box.

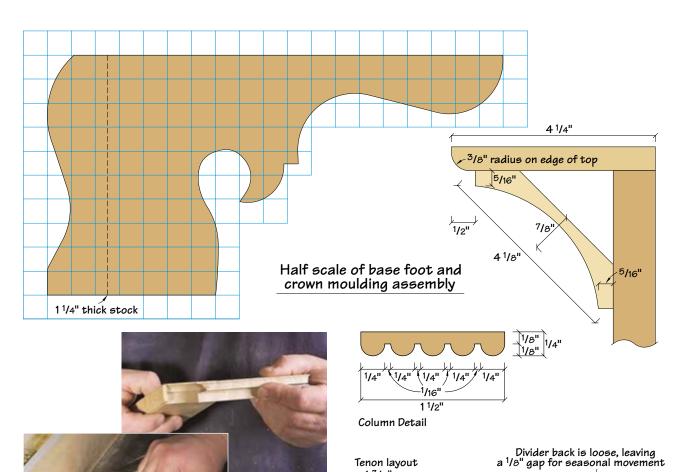
Build the slide-out supports for the lid. They are simply a piece of maple with a second piece of maple tenoned on the end to hide the end grain. Slide these into their holes and move onto the back pieces.

Back Pieces

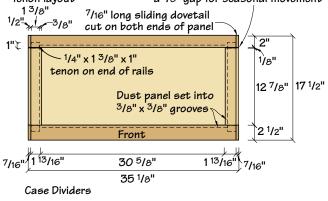
I made a traditional shiplapped back for this piece using ½"-thick material. Cut $\frac{1}{4}$ " x $\frac{1}{2}$ " rabbets on the edges and then cut a bead on the edges using a 1/4" beading bit in a router table. You'll nail these boards in place after finishing.

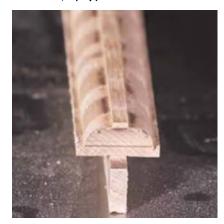
The pigeonholes add a lot to this piece. You might want to customize yours with more secret spaces than I did. First build the dovetailed box that slides into the desk. I used through-dovetails because the material is thin. Now use the diagram to lay out and cut the dadoes for all the dividers. I used a dado stack in my table saw for this.

Glue the dividers in place. Cut the pigeonhole scrollwork on a scrollsaw and



The mullions are tricky. Here you can see the special jig I rigged up to cut the rabbet on the mullions. One edge is shaped to hold the beaded side (far top). Then you simply put the mullion in the jig, set your table saw to make your cut and be careful (top).





When it's all said and done, this is what your mullion should look like. The cope for my set of knives is $\frac{5}{16}$ " deep.



Before you cut your loose tenon joints, make sure all your mullions fit between the door rails and stiles.



Here's a close-up look at the loose-tenon construction. Cut the mortises in the rails and stiles using a spiral bit in a router.

SCHEDULE OF MATERIALS: TRADITIONAL SECRETARY							
Lower Case			No.	ltem	Dimensions TW L	Material	
No.	ltem	Dimensions TW L	Material	1	Front B	$\frac{7}{8}$ " x $5\frac{3}{4}$ " x $3\frac{4}{3}$ "	Р
2	Sides	$\frac{7}{8}$ " x 18" x 41 $\frac{1}{4}$ "	Р	1	Front C	$\frac{7}{8}$ " x $\frac{4^3}{4}$ " x $\frac{34^3}{4}$ "	Р
lι	Case top	$\frac{7}{8}$ " x $10\frac{1}{8}$ " x $35\frac{1}{8}$ "	Р	1	Front D	$\frac{7}{8}$ " x $3\frac{3}{4}$ " x $31\frac{1}{4}$ "	Р
1	Desktop	$\frac{7}{8}$ " × $17\frac{1}{2}$ " × $35\frac{1}{8}$ "	Р	2	Sides A	$\frac{1}{2}$ " x 6 $\frac{3}{8}$ " x 17 $\frac{1}{4}$ "	S
4	Divider fronts	$\frac{7}{8}$ " x $2\frac{1}{2}$ " x $35\frac{1}{8}$ "	Р	2	Sides B	$\frac{1}{2}$ " x 5 $\frac{1}{8}$ " x 17 $\frac{1}{4}$ "	S
4	Divider backs	$\frac{7}{8}$ " x 2" x 35 $\frac{1}{8}$ "	Р	2	Sides C	$\frac{1}{2}$ " x $\frac{4}{8}$ " x $\frac{17}{4}$ "	S
6	Divider rails	$^{7}/_{8}$ " x $2^{1}/_{4}$ " x $14^{7}/_{8}$ "	Р	2	Sides D	$\frac{1}{2}$ " x 3 $\frac{1}{8}$ " x 17 $\frac{1}{4}$ "	S
2	Divider rails (top)	$\frac{7}{8}$ " x $3\frac{1}{2}$ " x $14\frac{7}{8}$ "	Р	1	Back A	$\frac{1}{2}$ " x 5 $\frac{3}{8}$ " x 34 $\frac{1}{8}$ "	S
2	Vertical rails	$\frac{7}{8}$ " x $\frac{3}{4}$ " x $\frac{4}{8}$ "	Р	1	Back B	$\frac{1}{2}$ " x $4\frac{1}{8}$ " x $34\frac{1}{8}$ "	S
4	Lid suppt guides	$\frac{7}{8}$ " x $\frac{3}{4}$ " x 12"	S	Ĺ	Back C	$\frac{1}{2}$ " x 3 $\frac{1}{8}$ " x 34 $\frac{1}{8}$ "	S
3	Lower panels	$\frac{3}{8}$ " x $13\frac{5}{8}$ " x $31\frac{3}{8}$ "	S	Ĺ	Back D	$\frac{1}{2}$ " x $2\frac{1}{8}$ " x $30\frac{5}{8}$ "	S
ĺ	Top panel	$^{3}/_{8}$ " x $13^{5}/_{8}$ " x $28^{7}/_{8}$ "	S	i	Bottom	$\frac{1}{2}$ " x $17\frac{1}{2}$ " x $30\frac{1}{8}$ "	S
li	Drop lid panel	$\frac{7}{8}$ " x $13\frac{7}{8}$ " x $32\frac{3}{4}$ "	P	3	Bottoms	$\frac{1}{2}$ " x $17\frac{1}{2}$ " x $33\frac{5}{8}$ "	S
2	Breadbords	$\frac{7}{8}$ " x 2" x 13 $\frac{7}{8}$ "	P				
2	Lid supports	$\frac{7}{8}$ " x $\frac{3}{4}$ " x 17"	P	Insert			
2	Support ends	$\frac{7}{8}$ " x 2" x 3 $\frac{1}{4}$ "	P	2	Sides	$\frac{1}{2}$ " x 8 $\frac{1}{2}$ " x 11 $\frac{1}{8}$ "	Р
Ιī	Feet support strip	$\frac{3}{4}$ " x 5 $\frac{1}{2}$ " x 34 $\frac{1}{4}$ "	Ply	2	Top & bott	$\frac{1}{2}$ " x 8 $\frac{1}{2}$ " x 34 $\frac{1}{8}$ "	Р
	Back	$\frac{1}{2}$ " x 35" x 41 $\frac{1}{4}$ "	s	4	Large vert dividers	$\frac{3}{8}$ " x 8 $\frac{1}{2}$ " x 10 $\frac{1}{2}$ "	Р
	Ogee feet	$1^{1/4}$ " x 5" x 7'	P	4	Shelves	1/4" x 8 1/2" x 1 1 1/8"	Р
	Cove mould	$\frac{3}{4}$ " x $\frac{3}{4}$ " x 14'	P	6	Dividers	$\frac{1}{4}$ " x 8 $\frac{1}{2}$ " x 5 $\frac{7}{8}$ "	Р
				4	Dividers	$\frac{1}{4}$ " x 2 $\frac{1}{8}$ " x 8 $\frac{1}{2}$ "	Р
Upper		-		8	Pigeonhole arches	$\frac{1}{4}$ " × 2" × 2 $\frac{1}{2}$ "	Р
2	Sides	$\frac{7}{2}$ 8" x 8 $\frac{1}{2}$ " x 36"	Р	6 1	n drawers		
4	Shelves and top	$\frac{7}{8}$ " x 8" x 33 $\frac{5}{8}$ "	Р	4	n drawers Front & back	$\frac{1}{2}$ " x $\frac{1}{1}$ 16" x 10"	S
2	Face frame stiles	$\frac{3}{4}$ " x 2" x 36"	Р	-		$\frac{1}{2}$ " x $\frac{1}{16}$ " x $\frac{8}{4}$ "	S
ı	Face frame top rail	$\frac{3}{4}$ " x 4" x 32 $\frac{1}{2}$ "	Р	4	Tops & botts	$\frac{72 \times 1716 \times 874}{\frac{1}{2}} \times 7^{3}/4^{1} \times 9^{3}/4^{1}$	S S
I	Face frame bot rail	$\frac{3}{4}$ " x $\frac{1}{2}$ " x $\frac{32}{2}$ "	Р	2	Sides		
İ	Back	$\frac{1}{2}$ " x 33 $\frac{1}{2}$ " x 36"	S	2	Column backer	1/4" x 2" x 1 1 1/16"	P
İ	Cove mould	$\frac{7}{8}$ " x $4\frac{1}{2}$ " x $6\frac{1}{2}$ '	Р	2	Beaded boards	$\frac{1}{4}$ " × 1 $\frac{1}{2}$ " × 7" $\frac{5}{8}$ " × 2" × 2"	P P
	Moulding cap	$\frac{1}{2}$ " x $4\frac{1}{4}$ " x $6\frac{1}{2}$ '	Р	4	Plinths	78" X 2" X 2"	Р
Upper Case Doors			Insert drawers and door				
Opper 4	Stiles	$^{3}/_{4}$ " x $2^{1}/_{4}$ " x $30^{1}/_{2}$ "	Р	8	Fronts	$\frac{1}{2}$ " x $1^{15}/16$ " x $5^{3}/16$ "	Р
2	Top rails	$\frac{3}{4}$ " x $\frac{2}{4}$ " x $\frac{13}{8}$ "	P	8	Backs	$\frac{3}{8}$ " x $1\frac{5}{8}$ " x $5\frac{3}{16}$ "	S
2	Bott rails	$\frac{3}{4}$ " x $\frac{2}{4}$ x $\frac{11}{8}$ "	P	16	Sides	$^{3}/_{8}$ " x $1^{15}/_{16}$ " x $8^{1}/_{8}$ "	S
2	Vert mullions	$\frac{3}{4}$ " x $\frac{3}{4}$ " x $\frac{2}{4}$ x $\frac{11}{8}$ "	P	8	Bottoms	$\frac{1}{4}$ " x $4^{13}/16$ " x 8"	S
8	Horiz mullions	$\frac{3}{4}$ " x $\frac{3}{4}$ " x $\frac{55}{8}$ "	r P	2	Door stiles	$^{11}/_{16}$ " x $1^{1}/_{2}$ " x $10^{1}/_{16}$ "	P
l °	HOUS IIIUIIIOUS	/4 X /4 X 3 /8	Г	1	Bott rail	$^{11}/_{16}$ " x $^{11}/_{2}$ " x $^{51}/_{4}$ "	P
Lower Case Drawers				1	Top rail	$^{11}/_{16}$ " x 3" x $^{51}/_{4}$ "	P
1	Front A	$^{7}/_{8}$ " x 7" x 34 $^{3}/_{4}$ "	Р	1	Panel	$\frac{1}{4}$ " x 5 $\frac{1}{8}$ " x 7 $\frac{3}{4}$ "	P
ĺ	•			P=Maple	e • S=Poplar		
				г-і іаріє	s - 3-1 Opiai		



The support end on the lid support, (attached with a haunched mortise), is a nice way to conceal the end grain.

The insert is merely slid into the desk after finishing. You don't need to attach it to the lower case if you don't want to. Here I'm fitting the pigeonhole scrollwork into the cubbyholes using spring clamps.

glue it in place using spring clamps.

Build the eight horizontal and two vertical drawers using half-blind dovetails. The vertical "drawers" open to the inside for hanging jewelry. Cut the column profiles and attach them and the plinths to the backer, then glue the whole assembly to the drawers.

To build the little door in the center I

used a cope-and-stick set in my router table. Then I band sawed out the curve in the top rail and cut the profile using the same router setup. The 1/4" panel is flat (not raised) and slides neatly into the groove created by the router cutters.

Details

Attach all the hardware and hang your

SUPPLIES

Horton Brasses Inc. 800-754-9127					
H-42	½" interior knobs (10)				
H-34	exterior pulls (8)				
H-34SE	escutcheons for drawers,				
	slant top (5)				
H-38	interior escutcheon (1)				
H-551	top door escutcheon (2)				
LK2	lock (2)				
Rockler	800-279-4441				
#29157	hinges for slant top lid				
	\$2.99/pair (1 pair)				
#25700	hinges for interior door				
	\$1.99/pair (1 pair)				
#31495	hinges for top doors				
	\$5.79/pair (2 pair)				
#15190	lock, interior door				
	\$18.99(1)				
	. ,				

doors. I used an aniline dye to color the piece followed by three coats of spray lacquer. After finishing, attach the back boards and add the glass using either silicone or traditional water putty.

The good news was that my daughter loved the new secretary. I'm sure she'll treasure it for years to come. The bad news is that now my wife wants one. PW

When lunch is served at the garden swing, simply pop up the center section of the seat to turn it into a handy built-in table.

garden SW1111







othing says summer like a glass of lemonade, relaxing in the shade and hoping to catch a breeze – or creating your own by giving your swing a kick. Of course, I always get so comfortable I'm looking for a place to put my drink down and close my eyes. Now I've got a swing designed to help. Integrated into the seat is a simple pop-up table that sits level to the ground while the swing keeps your back at a comfortable angle.

The swing is simple to build. Joinery consists of some simple tongue-and-groove construction, biscuits and screws. Most of the pieces are dimensional lumber sizes you can buy right off the rack. You will, however, need a planer to run the slats down to their proper thickness.

Start the project by heading to the lumber yard. The six-foot swing as shown required one 2x8, one 2x6, five 2x4s, and 10 1x4s all in eight-foot lengths. I chose western red cedar because it's a durable, lightweight, outdoor wood and is less expensive than redwood. At Midwest prices, the lumber cost about \$120.

Seat Frame

Once back in the shop, start construction by cutting the seat rails and stringers from the 2x4s. As you probably know, dimensional lumber comes with rounded edges. You'll need to get rid of them. Cut the pieces for the rails and stringers to their 3" thickness by first running one edge over the jointer until they have a square edge, then rip them to 3" wide. To give the seat a comfortable back angle, set your saw blade to an 7-degree bevel and run the back rail on edge to give a 7-degree angle to the back.

by David Thiel







With the seat frame assembled, nailing the slats in place was a cinch with a pneumatic finish nailer and stainless steel nails. Note the 7-degree bevel on the rear of the back seat rail.

11/2"

5 1/8"

(C)

23 1/2"

90° 199

11/2"

Seat slats "G"
spaced equally
7"
5/8"

7 degree angle on A, B, & E

11/2"

17"

11/2"

Profile

Now cut the pieces to length and screw the stringers between the rails, spacing them as shown. The center section spacing is critical because the pop-up table needs to be square so it can be lifted out and turned in place and the legs lowered. Use 2" galvanized deck screws when screwing the seat frame together.

Mill all the slats at the same time because they are essentially the same size. Cut the 1x4s into 24" lengths, and plane

the boards to $\frac{5}{8}$ " thickness. Then rip them to their $2^{1}/2$ " width and crosscut the seat slats to 20". To give the swing a finished look, cut an $\frac{1}{8}$ " roundover on all four top edges of each seat slat using a bit mounted in a router table.

Attach the slats for the permanent seats, running the slats from side to side. They should flush up in length to the outside edges of the stringers, and the front slat should be flush to the front rail. Use about

³/₈" spacing between the slats. I decided to attach the slats to the frame using finish nails and an air nailer. This left a much smaller hole than screws, and it was very quick.

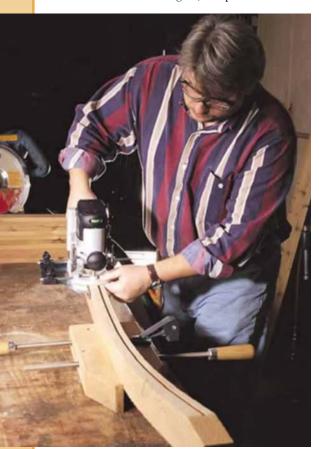
To finish the seat I decided to build the top surface of the

table at this point. The spacing works the same as on the side seats, but run the slats from front to back. The slats are attached to two table battens (3 /₄" x 1 /₂" x 19 /₈") that are held 1 /₁₆" or so away from the inside face of the front and rear rails. This gap should allow the table to lift out without binding, but some slight fitting may be necessary. Don't worry about the legs yet, we'll do that later.



Next, turn to the back of the swing. Mill the bottom back rail and two stiles to size as described earlier to leave crisp edges. Run the bottom edge of the bottom back rail and both stiles through the saw at an 83-degree angle to match the bevel on the seat. Then take the 2x8 top rail and lay

out the top arch of the swing by marking the center of the rail, then mark 2½" down from the top at the center. Tap a small brad nail into the board at this spot, then put two more brad nails into the board at the bottom corner of the board at either end. Then take an eight-foot strip of 1/4"-thick wood and bend it across the top nail, attaching the strip to the two lower nails with spring clamps. The arch formed by the strip can then be marked with a pencil, and then a second line $(2^{1/2})$ " above the first line), marked. Jigsaw the piece to the outside of these





Holding the arched top rail steady was the most difficult part of routing the top groove for the slats. Remember to make the cut in two passes on each side. In this photo you can see that the rail hasn't been cut for length yet, allowing extra support for the router at the beginning and end of the cut (at left).

With the miters cut on the top rail and back stiles, space the slats and use the top rail to mark the angle and length of each slat, (adding I") (above).

lines, then sand the piece smooth.

To determine the length of the top rail, lay the bottom rail and side stiles flat with the bottom rail between the stiles. Clamp these pieces in place, then lay the top rail across the tops of the stiles, flush to the top outside corner of each stile. With the top rail in place, mark the point where the inside curve of the rail intersects the inside edge of the stiles. Connect the two points and this is the angle to cut on the top edges of the stiles and on the ends of the top rail, to form mitered joints. The back frame will be held together with a double helping of biscuits, but first you need to cut the groove in the top and bottom rails to hold the slats.

Running the groove in the bottom rail is fairly simple. Set up a router with a straight bit (or an up-spiral bit) of either $\frac{3}{8}$ " or $\frac{1}{2}$ " diameter. Next set up a fence on the router $\frac{7}{16}$ " from the bit, and set the bit for a $\frac{1}{2}$ " depth. (The final depth is 1", but take it in two passes.) By running the router on both long edges of the rail, the groove will be centered on the piece. Check the fit of the back slats in the rail (or better, a test piece), then make the groove.

To cut the same groove in the arched top rail, see the photo at left. You will need to adjust the depth of the final cut a bit to compensate for the curve of the arch.

Miter the top rail to length, then check the fit of your slats in the grooves. The spacing between the slats should be about $2^{1}/4^{"}$, but double-check your dimensions.

After cutting the double biscuits at the joints, place the slats in the bottom groove and locate the top rail in position on the slats. Mark the height and curve on each



The back of the arm is simply screwed in place through the back stile, while the support is attached to the arm and seat with dowels and polyurethane glue. Notice the foamy squeeze-out of the glue at the joints.



With the notches cut in the support cleats, the two pieces can be glued in place in the seat frame.

slat. Remove the slats, numbering them as you do. Now add 1" in length to the marks on the slats and cut them to their finished length using the band saw. You're now ready to glue up. I used polyurethane glue for all my glued joints. The polyurethane adhesive provides a strong waterresistant bond in even long-grain to short-grain

joints. Don't glue the slats in place, however. Place them in the grooves in their approximate positions, then after the frame has dried, use a brad nailer to tack the slats in place with a single brad at top and bottom, from the back. To protect the lower

No. Ltr. Dimensions TW L Material Item Α Bottom back rail $1^{1/2}$ " x 5" x 55" Cedar $1^{1/2}$ " x $2^{1/2}$ " x $20^{7/8}$ " 2 В Back stiles Cedar $1\frac{1}{2}$ " x 8" x 60" C Top back rail Cedar $\frac{5}{8}$ " × $2\frac{1}{2}$ " × $20\frac{1}{2}$ D П Back slats Cedar $1\frac{1}{2}$ " x 3" x 60" 2 Seat rails Cedar 4 $1^{1/2}$ " x 3" x 17" F Seat stringers Cedar 21 $\frac{5}{8}$ " x $2\frac{1}{2}$ " x 20" Cedar G Seat slats $1^{1/4}$ " x 3" x 23 $^{1/2}$ " 2 Arms Н Cedar $1^{1/2}$ " x 4" x 12"** Cedar 2 Arm supports 2 $\frac{3}{4}$ " x $\frac{1}{2}$ " x $\frac{19^{7}}{8}$ " Cedar Table battens Ķ 2 $1'' \times 1^{1/4}'' \times 6^{1/2}''$ Cedar Table legs $1" \times 1^{1/4}" \times 8^{1/4}"$ 2 Table legs Т Cedar 5/8" x 1 1/4" x 1 3"** 2 Cedar М Table leg braces 2 Table support cleats I" x 2" x 20" Cedar *Longest slat, cut to fit. **Length oversize to allow fitting.

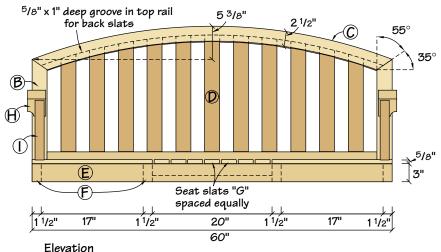
SCHEDULE OF MATERIALS: GARDEN SWING

rail from rot from standing water in the groove, cut blocks (called fillets) the size of the spaces and glue them in place.

You're now ready to glue and bolt the back to the seat. I used four ¹/₄" threaded bolts with washers to bolt the bottom rail of the back to the back rail of the seat. Hold the bottom edges of each flush, and again use polyurethane glue on this joint.

Next cut the two arms and arm supports from 2x4 material and cut them to shape using the scaled drawings on the next page. You may want to cut the angle on the bottom of the support and on the back end of the arms, then fit them in place and confirm the location and angle of the top end of the supports. Attach the arms to the back with a long deck screw through the back stile. Glue the support to the arm and to the seat with ½" dowels between.

The last step is to put the legs on the table, and to notch and fit the support



No Porch? NO PROBLEM

While most of us enjoy a porch swing, not all of us have a porch. So we designed this swing for the porch-challenged reader by including an A-frame structure that can be placed anywhere in your yard.

Rather than spend a lot of valuable swinging time notching the timbers, we went to the local home center store and picked up some playset hardware from Swing-N-Slide and some treated dimensional lumber.

The wood and hardware cost a little more than \$150, making it more expensive than the swing. So you may want to consider that in your planning. The pre-made brackets make assembly very easy. Screw two 96"-long 4 x 4 posts to the leg braces using 2" deck screws. By following the angle of the brackets, the 25-degree angle of the posts is simple to determine. Next cut a 96"-long 2 x 6 into two 48"-long pieces with 25-degree miters on each end. Screw these supports to the legs, measuring from the bottom of the legs to keep the supports parallel to the ground.

The top rail is the last piece, and the frame brackets will fit 6" between them, so I screwed a 2x4 to each side of a 4x4 post, finishing out at 6". The rest is simply laying the top rail on the leg assemblies, centering and squaring the legs to the rail and screwing and bolting the braces in place.

Last, but not least, drill 1/4" holes, 6" from the inside of each leg assembly, through the top 4 x 4 and insert the 6" eye bolts. Use washers and nuts to secure the eye bolts, then hang the chains with the "S" connectors.

Some swings will use one chain suspended from the top rail which divides into a "Y" close to the swing. However, the swing is much more stable by using individual chains for each attachment point on the swing.

SCHEDULE OF MATERIALS: SWING A-FRAME

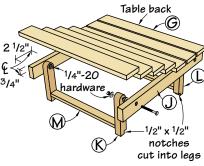
No.	Item	Dim.TW L	Material
4	Frame legs	$4 \times 4 \times 96$ "	PTP
ı	Top center rail	$4 \times 4 \times 96$ "	PTP
2	Top outer rails	$2 \times 4 \times 96$ "	PTP
2	Leg supports	$2 \times 6 \times 48$ "	PTP
4	Swing-N-Slide EZ	Frame Braces	

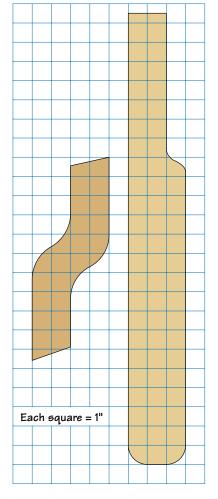
- Swing-N-Slide Leg top braces 2 $\frac{3}{8}$ " x 6" eye bolts
- 3/8" flat washers
- 3/8" nuts
- R S- connectors
- 6-foot lengths of chain

PTP = pressure treated pine



Last, but not least, bolt the table legs in place to the table battens. Note the notches on the ends of the legs which drop into the previously cut notches to stabilize the table.





cleats. Start by cutting the leg pieces to the sizes given in the Schedule of Materials. They are two different lengths to allow the table to sit parallel to the ground, even though the swing itself is angled back. Round over the top end of each leg to allow it to swivel without catching, then drill ¹/₄" clearance holes, ¹/₂" down and centered on the legs. Drill clearance holes in the table battens 1/2" up from the bottom edge, and 1" in from the inside corners. Attach the legs using $\frac{1}{4}$ " x $2\frac{1}{2}$ " bolts with two washers on either side of the leg and a nylon-lined nut to hold the legs tight, but not immobile.

Check the spacing between the legs (near the bolts) then cut the leg braces to fit, and screw them in place between the

Now head back to the saw and cut the two table support cleats to fit between the inside stringers. Clamp these in place, center the table in place left to right and mark the location of the legs.

Remove the cleats and cut ⁷/₈" x 1" notches on the leg locations. Then use a handsaw to trim the ends of the legs to form tongues to fit into the mortises you've just created in the cleats. Glue the cleats in place, and once dry, the table will drop into place in the cleats, holding the table steady.

After adding $\frac{3}{8}$ " x 4" eye bolts to the front and rear of the swing seat, the swing is ready to hang. If you've got a porch, find a sturdy joist and get the lemonade. If you happen to be missing a porch, use the information at left to build a simple A-frame structure to let you swing in style anywhere in your yard. PW





Less than one sheet of plywood and a long afternoon are all you need to build a functional and foldable floral display.

plant plant stand

hen you have a lot of plants to display, you are always looking for ways to show them off to their best advantage. Or maybe you just want to cover that hole where a gopher dug under the house. Either way this plant stand is a great way to make a few potted plants look like a huge display. And here's a bonus feature: the whole thing folds up flat so you can hang it on a garage wall in the off-season. You can make it using about three-quarters of a sheet of ³/₄" CDX plywood, which is essential for outdoor use. The term CDX refers to the quality of the two face veneers and the glue between the plys. So CDX has a "C" and a "D" side ("A" being the best grade) with the "X" referring to the exterior-grade glue. The plys themselves are the same as in any other pine plywood. The shelves are designed to hold 6" pots, but with care, larger pots are also okay.

Start with two four-foot square sheets of plywood, and begin construction by cutting out the back and supports from one sheet and the shelves from the other. Use the diagrams to lay out your cuts. To cut the shelves and supports from the ply, use a drill with a ³/16" bit to drill two overlapping holes for the jigsaw blade. Drill clearance holes at the outside corners of the back and supports to start the saw blade. If you clamp the parts to a table, you can cut the shapes in short order. Once you get the back and supports cut, you'll notice that the steps on the sup-

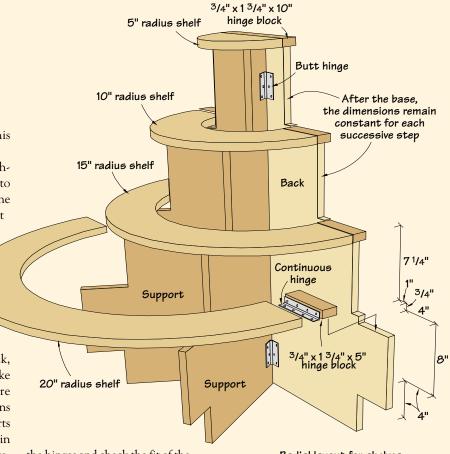
by Jim Stuard

port are ³/₄" shorter than the back. This helps everything fold flat for storage.

The next step is to cut $\frac{3}{4}$ " x 4" notches in the tops of the steps, at the back, to receive the hinge mounting blocks for the shelves. Use screws and water resistant glue to attach the mounting blocks. When installed, the blocks stick out 1" from the edge of the back and $\frac{3}{4}$ " from the surface. These locations line up with the shelves and give an offset to clear the supports when everything is folded. Adjust the fit until the supports fit into the notches on the back, then mount the supports to the back. Take four butt hinges and place them where they will be mounted. Mark the locations with a pencil and then take the supports off the back. You need to rout a recess in the support and the back for the hinge. Otherwise, there won't be enough clearance for the shelves to come down. Mount

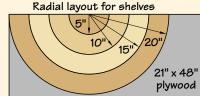


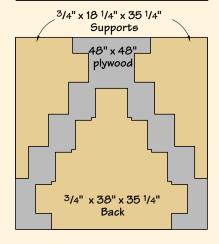
To set up the plant stand, lay it flat on its back and raise the shelves. Then fold the supports up.



the hinges and check the fit of the supports to make sure they clear the mounting blocks. At this time, go ahead and paint the back/support assembly. This is easier now than when everything is assembled. Also fill any voids and knots with a waterproof filler. I used a two-part auto body filler. It sets up quickly and sands easily.

The last thing to do is cut and mount the shelves. Begin the layout with a set of trammel points, with a pencil on one end. From the center of the other plywood panel, lay out concentric semi-circles at 5", 10", 15" and 20". Now rip the panel at about 21" to keep it manageable. Cut the shelves out using a jigsaw, taking it slow and stay on the line. When you're done, you'll have four concentric shelves ready for mounting. After filling the voids and knots, paint the shelves. Lay out and rout a recess on the bottom of the shelf ends to accept the hinge leaf, flush to the shelf. This also helps for the close tolerances when folding everything together. Go ahead and mount the shelves to the back. When you're all done, lay the unit on its back and fold the shelves so they're sticking straight





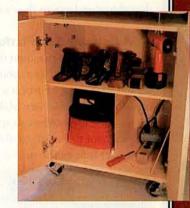
up. Fold up the supports and tip the entire unit upright. Touch up any paint problems and you're ready to lush up this display with the local flora. PW



Miter Saw Stand

Built from two sheets of plywood, this rolling cart makes surgical

crosscuts, automatically collects its dust and folds up to fit in a small corner.



hen I worked in professional shops, there was always a chop saw on some kind of cart. The less organized shops put the saw on the nearest work cart. It didn't take up much space, but it wasn't as useful as it should be. The better shops mounted the miter saw to a rolling cart and attached permanent wings to support long pieces and to hold a fence with stops for doing repetitive cuts. This setup was useful, but it took up a lot of space.

What I had in mind for Popular Woodworking's shop would have a dead-on stop system and collapsible wings so the stand would take up less space. The top of this stand adjusts up and down so you can line up the saw's table with the wings. (In fact, the adjustable table allows you to use a drill press or a mortiser on this stand.) It's got on-board dust collection that turns itself on and off. And the kicker to the whole thing is that the cart is made from one sheet each of ³/₄" and ¹/₂" plywood, with some solid wood trim.

Begin construction by cutting the parts out according to the Schedule of Materials and using the optimization diagram. You'll notice that the case top is in two pieces on the optimization diagram. That's because you have to edge glue the plywood together, then cut it to size. There isn't much scrap on this project.

One Ouick Cabinet

Begin by building the cabinet. To join the sides to the top, first cut \(^{1}/_{2}\)" x \(^{3}/_{4}\)" rabbets in the top and bottom edges of the sides. To hold the back, cut \(^{1}/_{2}\)" x \(^{1}/_{2}\)" rabbets in the back edges of the sides, top and bottom pieces. Now assemble the case. An old trade secret is to assemble the case with it face down on your assembly bench. This way you can en-

by Jim Stuard

sure the joint at the inside of the rabbet is flush all around. Set each joint with a couple nails, then screw the case together. Check your cabinet for square and make sure the back fits snugly. Attach the back with screws. Flush up the front edges of the cabinet with a plane and apply iron-on birch veneer tape. File the tape flush, sand the cabinet and mount the casters.

An Adjustable Saw Platform

Now is a good time to mount the leveling riser (or platform) to your cabinet and get the miter saw set up. First cut a 1½" radius on the corners of the riser. Make sure this cut is square so that you can apply veneer tape without too much trouble. Ironing on veneer tape to the riser in one piece

HARDWARE LIST

Leveling riser

4-41/2" x 3/8" stove bolts (coarse thread)

4-1/2"x11/2" fender washers

12-3/8" flat washers

4-3/8" lock washers

4-3/8" wing nuts (coarse thread)

8-3/8" jam nuts (coarse thread)

4-4"casters w/locking wheels 16-1/2" x #10 panhead-sheetmetal screws

16-1/4" lock washers

I-Six outlet plug strip

4-130° European-style cup hinges

Wing supports and fence

8-2"x1/4"-20 hex head bolts

16-1/4" flat washers

8-1/4" lock washers

8-1/4"-20 wing nuts

2-36" continuous hinge 3-36" sliding track

I-L to R reading tape (72")

I-R to L reading tape (72")

2-2" square sets of Velcro (hooks and

Stop |-¹/₄"-20 star knob

1-11/2"x1/4"-20 hex-head bolt

1-1/4" flat washer

Saw (fastening to leveling support)

4-21/2"x1/4"-20 hex head bolts

8-1/4" flat washers

4-1/4" lock washers

4-1/4"-20 wing nuts



Adjusting the height of the saw is as easy as loosening the wing nuts inside the cabinet and using the jam nuts on top of the cabinet to raise or lower the saw until it's flush with the wing

#31077). Drill the hinges' cup holes about 4" in from the top and bottom of the case.

Automatic Vacuum

is a real challenge, but it looks great. When

the riser is ready, center it on top of the

case and clamp it in place. Place your miter

saw in the center of the riser. With a pen-

cil trace the locations of your saw's feet

onto the riser. Also trace the holes in

the machine's feet that you'll use to mount

the saw to the riser. This is important

because the riser floats over the case on

four bolts, which allows you to adjust the

saw up and down. Now mark locations for

the bolts that attach the riser to the case.

Be sure to keep the bolts as close as you

can to the feet without them interfering

the riser bolts, drill your holes complete-

ly through the riser and the top of the case. Hold a piece of scrap inside the case where

the drill will come out to minimize tearout.

Ream out the holes a little to ease the riser

the holes for mounting the saw. Now you

can mount the riser to the case (see the

list of hardware you need at left). Put the

bolt through the fender washer, then into

the hole in the riser. Put another flat wash-

er on the other side of the riser with a jam

nut to set the bolt in place. Run a jam nut

up the bolt, leaving a 2" gap between the

riser and the loose jam nut. Place flat wash-

ers over the holes in the case and set the riser

washer on the bolt, followed by a lock wash-

er and wing nut. When you want to adjust

the riser height, simply loosen the wing nuts

and adjust the jam nut against the case

the doors. Make the doors from plywood

and nail a 13/16" solid maple edge with a

I'm fond of a \$30 jig that easily locates the

holes for the hinges and the mounting

plates (Jig-It System from Rockler item

To complete the case, build and hang

Use European hinges on your doors.

top to raise or lower the riser.

bullnose profile to the edges.

On the underside of the case, put a flat

Remove the riser from the case and drill

When you've marked the locations for

with each other.

adjustment.

in place on the case.

Now mount the saw and outfit the cabinet with the vacuum and electrical parts. When the saw and vacuum are hooked up properly, the vacuum will come on automatically when you turn the saw on (thanks to Craftsman's "Automatic Power Switch" #24031, \$19.99), and it will turn off a few seconds after you finish your cut.

closed the vacuum in a partition made from Lay out the height of the bottom edge of the Screw the shelf in from the top.

Now screw cleats to the inside of the case to make the partition and false front that conceals the vacuum. Notch your plywood pieces to wrap around the shelf cleat and the power cord for the vacuum. Turn the vacuum's switch to "on," place it in the new cubby and hook up the hose going

the case and run its cord through a hole in the back. Plug Craftsman's Automatic Power Switch into the outlet strip. Screw the partition and false front in place.

Start by drilling two 2" holes in the back near the bottom of the case. One hole is for the vacuum hose (locate it according to your vacuum). The other is for the wiring. I entwo pieces of plywood and the shelf. The shelf height in the drawing works for the Craftsman vacuum (model#17711, \$29.99). shelf. Mount a pair of cleats to these lines.

through the back.

Screw an outlet strip to the bottom of

round off the corners: 1" on the ends and 3½" on the brackets. Now mount the swing arm assemblies to the underside of the wings using a 10" piece of continuous hinge, with the notched end of the swing arm 1/4" in from the point where the wing meets the case. To keep everything from flopping around when the arms are down use adhesivebacked Velcro between the swing arms and wings. Reinforce the Velcro's adhesive with staples.

Half-lap joint (P)

and brace

Finish the wings by cutting a 3/8" x 3/4" dado down the middle of the wing for the extruded aluminum channel for the stop. Next to that dado, cut a second shallow dado that's 1/2"

1/2" x 3/4" rabbet in sides 24 3/4" 20" 3/4" 2" 2" 3/4" 1/2" x 1/2" Doors removed rabbet for clarity 10 3/4 10 3/4 for back Shelf cleat 1/2" 1/2" Dust 34 1/2" 34 1/2" 13 3/4" Shelf Vacuum cleat Partition vacuum area enclosure False 11 1/2" 1/4" 3/4" 3/4" 4" 4" 23 1/2" 19 1/2" 20" 25" Elevation Profile 13/16" Bullnose Measuring tape mouldina 3/16" Extruded aluminum track 3/8" x 3/4" dado for track Door (9) Detail of 3/4" Door Trim SCHEDULE OF MATERIALS: MITER SAW STAND Cabinet Continuous

Huge Wings

Flipout support

swings flat to

the rear

The wings are the last thing to do. Begin by gluing and nailing a 1/4"-thick solid wood edge to one end of the wings. This edging gives the piano hinge some meat to bite into. Finish the wings by applying the 1/2" x 11/2" trim to the other three edges.

Study the diagram to see how the wings are supported. First apply the upright ledges to the uprights. Cut the 2" radii on the brackets and then attach them.

Cut the swing arms, braces and flip-out supports. The swing arm and brace need a half lap joint that makes a "T" shape. Attach the continuous hinge to the top of the "T." The best way to cut this joint is with a dado head in a table saw. Cut a ³/₄" x ³/₄" notch on the end of the swing arms to mate with the flip-out support.

The last thing to do to the arms is to

3/4" x 121/16" x 273/8" Doors* E Ply. 3/16" x 13/16" x 16' Solid wood Door trim G 1/2" x 191/2" x 231/2" Shelf Ply. Shelf cleats 3/4" x 3/4" x 19" Solid wood 1/4" x 15" x 14" Partition Ply False front 1/4" x 15" x 11 1/2" Ply. 3/4" × 3/4" × $13^3/4$ " 2 Cleats Solid wood K Cleat 3/4" x 3/4" x 5" Solid wood Wings M 3/4" x 101/2" x 30" 2 2 N Uprights 3/4" x 111/2" x 141/4" 2 0 Upright ledges 3/4" x 23/4" x 111/2" Solid wood Swingarm braces 3/4" x 4" x 101/2" 2 Solid wood $3/4" \times 3" \times 20"$ Swingarms Solid wood Flip-out supports 3/4" x 47/8" x 73/4" Solid wood 1/2" x 23/4" x 15/4" Front brackets Solid wood 1/2" x 23/4" x 10" Rear brackets Solid wood Wing trim, 1/2" x 1/2" x 15" Solid wood Edge trim 50 4 1/4" x 13/16" x 24" Solid wood 3/4" × 3" × 161/4" Fences

Dimensions TW L

3/4" x 20" x 241/2"

 $\frac{3}{4}$ " × 20" × 27 $\frac{3}{4}$ "

 $3/4" \times 20" \times 24^{3}/4"$

1/2" x 233/4" x 271/4"

Material

Ply.

Ply.

Ply.

No. Ltr. Item

A

C Back

Top & bottom

Leveling riser

Sides

X Stop block

* Size before applying door trim.

 $\frac{3}{4}$ " x 2" x 3"

Solid wood



The easiest way to assemble the wing is to attach the hinge to the upright assembly. Then remove it and attach it to the wing. Clamp the upright in a vise and reattach everything. Make sure to mark each hinge's location. Otherwise you'll mess up how some parts go together.

wide and as deep as your tape is thick. Cut the channel to length and screw it in place.

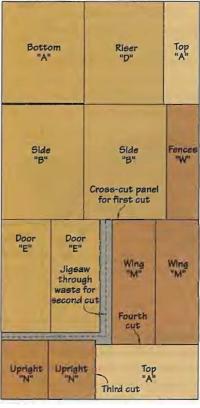
Now concentrate on the flip-out supports. After cutting out the mating notches for the swing arms, cut a $^{3}/_{16}$ " x $^{5}/_{8}$ " rabbet into the end of the support to accept a $4^{3}/_{4}$ "-long piece of continuous hinge. Lay out and mount the support to the upright, centered and flush to the bottom edge.

The last step on the wings is to attach the wing assembly to the upright. Do this carefully so that the surface of the wing is flush with the upright ledge. Now, if everything's OK, your wings should lock flush and square to the upright. If you didn't get it right the first time, add a flat-head screw to the inside of each notch to adjust the height of the wing.

To attach the wing assemblies, temporarily remove the saw/riser assembly and remove the wing from the upright assembly. Cut a spacer that's 2³/₄" plus the height of the saw's table. Clamp the spacer flush to the upright ledge. Lay the wing assembly on the edge of the case. On the saw/riser assembly, measure from the front edge of the riser to the saw fence. Subtract 13/4" from that number and mark it on the case, measuring from the front. This is where the upright should be mounted. It accounts for the thickness of the ³/₄" saw fence and the distance from the center of the stop to the fence. Mount the upright with the hardware listed. Make sure to counterbore the bolt heads and washers. This allows the flip-out support to fold flat against the upright. Re-attach the wings and flush the saw table up to the wings using a straight piece of lumber.

The last step is to make the fences and the stop and to attach the tapes. Rip a couple of $3^{1/2}$ "-wide sections of plywood from

Optimization Diagram



your scrap. Cut them to 1" longer than the distance from the blade to the outside edge of the upright. That should be about 16½" if everything was centered correctly. Cut ¾8" x ¾4" dadoes 1" to the center from one edge. The edge that the dado is closest to is the bottom edge. Repeat the ½" dado for the tape so it's above the dado. Glue in a 4"-long filler into the groove at the end next to the blade and attach a length of aluminum channel to fill the remaining length. Make a mirror part for the other side. This keeps your hands at least 4" away from the blade. Attach the fences by lowering the saw (as if you were making a cut)

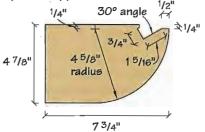


There is a lot of aluminum channel out there these days, but I chose this kind because a 1/4"-20 bolt head will fit in the channel. It comes predrilled and countersunk from Woodcraft and machines nicely. You'll probably have to file down some screws that pop out from the other side.



Here you can see how the stop works with the fence system. Note the thin guide strip that prevents your stop from wobbling as you set it.

Flip-out Support



and butting each fence against the blade. Clamp the fence pieces there and screw them in place. Cut the measuring tape to 16" and stick it in place. Use a square block to index off the 16" marks and, after cutting the tapes to length (around 46"), stick them in place, butting the end up against the block on each side.

The stop is a simple 2" x 3" block with a ½" hole in it. Make a guide strip that's about 5/16" x ½16". It's easier if you make the strip a little thick and plane it down to the ½16" thickness. Drill the ¼" hole through and test it with a bolt and star knob. **PW**



A simple design that stores a surprisingly large number of books and magazines.

ASIan coffee table

Most coffee tables are ill-equipped to handle the stresses of modern-day life. Company is coming, and your living room is strewn with books, woodworking catalogs and your spouse's catalogs. Most coffee tables offer you only a puny shelf to help you tidy up in a hurry. This coffee table does double-duty by giving you a shelf for books and two drawers that are big enough to handle all but the biggest magazines and catalogs. And

oh yes, you can serve coffee on it, too. Construction is simple but sturdy. You build the bottom case that holds the drawers out of plywood and biscuits. Then you screw the solid maple legs onto the case and cover all the plywood edges with moulding and veneer tape. Finally, you screw the top to the legs using figure-eight fasteners and build some quick drawers. And this project won't cost you a heck of a lot, either. You need about one-third of a sheet of maple plywood (birch will do just fine, too), about four board feet of % maple and about 10 bound feet of 14 maple. You'll also need a little Baltic birch ply and a small amount of 14° ply for the drawer bottoms.

Start at the Top

When you're at the lumberyard, be sure to pick through the racks of soft maple for this project. Soft maple (Acer rubrum) is

a little cheaper than hard maple (Acer soccharum) and is more likely to have some curl or other figure. After you plane your maple down to 1" thickness, get ready to glue up your top. I like to cut a few biscuit slots in the mating edges of the top pieces. This doesn't add to the strength of this long-grain joint, but it sure helps keep your boards in line when gluing up your panels. Clamp up your top and set it aside for the glue to dry.

Simple and Sweet Lower Case

The case that holds the drawers goes together really fast. Cut out the parts you need according to the Schedule of Materials. Then cut the biscuit slots to attach the sides, back and divider between the top and bottom pieces. Take some care when locating the center divider to save yourself a headache when making the drawers. See the photo on the next page for the trick to cutting biscuit slots in the middle

Now put glue and biscuits in all the biscuit slots and clamp up the lower case. When the glue is dry, sand the case to 150 grit and turn your attention to the legs. To make attaching the legs to the case easier, go ahead and cut some clearance holes in the case's sides where the case will be joined to the back legs. This is easier to do from the outside before the legs go on.

by Christopher Schwarz

Biscutting plywood into the middle of a panel can be a layout aightmare. Or it can be a breeze, Here's the breeze way Find the exact center of the panel and mark a line that's a hair stry of 1/2" off from that (plywood inn't 1/4" thick). Place the divider in place on the panel lying flat as shown in the photo. Clamp it in place and mark the divider for a couple biscusts. Retract or remove the fence from your biscutt joiner. Cut the slots in the divider with the biscutt joiner flat on the panel. Then turn your tool around as shown in the photo and cut the slots in the panel. Use the same marks on the divider to position your tool.

Eight Screws and You've Got a Table

Here's how to attach the legs: Mark on the leg where the case should meet the leg. Clump the leg into place on the lower case and then drill pilot holes and cleanance holes for #8 screws (I used a bit that drills both holes simultaneously). The holes should go through the case sides and into the legs. After the holes are drilled, screw the legs in place. Do three legs this way and clamp up the fourth leg but don't drill your holes yet.

You want to make sure that your table sits perfectly level - especially if you have hardwood floors. Place the table on a surface that you know is flat: your bench or a couple sheets of plywood. Then see if

the table rocks back and forth. If your fourth leg is a little short, tap the top of the leg with a hammer until the table stops rocking. If the fourth leg is too short, turn the table over and tap the bottom of the fourth leg. When the table sits flat, screw the leg into place.

Trimming the Table

Now you need to cover all the exposed plywood edges on the lower case with moulding or adhesive veneer tupe. I used ironon veneer tape to cover the plywood edges around the drawers, and 1/4" x 1/4" maple moulding for all the other edges. Attach the moulding with glue and brads, then sand its edges flush to your case.

To make the buck look a little more interesting, I added a piece of moulding to



make it look like the front (see the photoat right for how I did this).

Big Slab Top

Now trim your top to finished size, sund it and get ready to screw it to the table base. Your best bet is to use future-eight fasteners. They are quick, sturdy and let your top expand and contract with the seasons. To install them, chuck a 1/4" Forstner bit into your drill and cut a shallow hole in the top of the leg us shown in the photo at right. The depth of the hole should be the thickness of the fastener.

Screw the fasteners to the legs. Then turn your top upside down on a blanket and position the base upside down on the top. Drill pilot holes for the screws and then screw the top to the base.

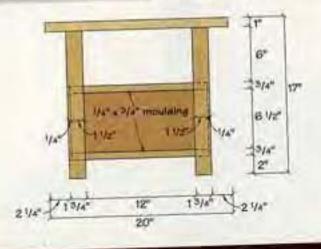
Drawers

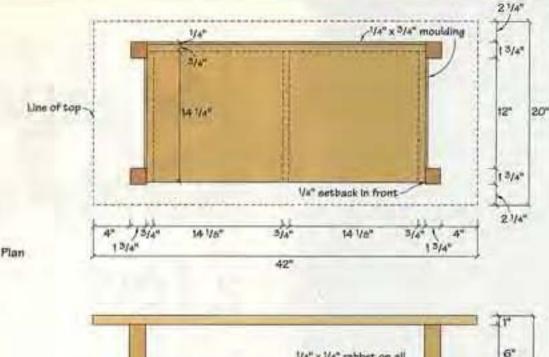
The drawers are simple plywood boxes with a solid maple drawer front screwed to the subfront. Here's how you make the plywood box. Curyout pieces to size. Then cur a 1/4" x 1/2"-wide tabbet on both ends of the sides.

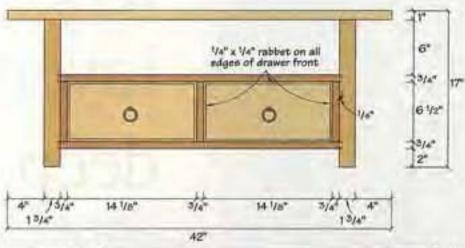
SCHEDULE OF MATERIALS: ASIAN COFFEE TABLE

loam		Legitorias
Too	1" x 20" x 42"	
Legs	1% × 1% × 16	P
The second second second	W x 15" x 30"/5"	Ply
		Ply
CONTRACTOR OF THE REAL PROPERTY.		Pfy
		p
		8
Drw frta		В
Drw sides		(77)
Drw backs		В
The Cold State Inc.	1/4" x 13/2" x 13/4"	Ply
Moulding	W x W x 10	P
ple + Ply=Maple or	birch ply + 8=Saltic hin	ch ply
	Top Legs Case top & bot Sides & divider Back False drw frts Drw frts Drw sides Drw backs Drw bots Moulding	Top

Getting the legs positioned so the table doesn't wobble is easiest to do before you screw the last leg in place (or you can spend a few hours cutting the legs with a hand saw after the table is completed; it's your choice). First clamp the fourth leg in place. Top the top until the toble sits flat. Screw the leg to the case.







To hold the bottom in place, cut a 1/4" x 1/4". groove on the plywood front and sides that's W up from the bottom edge. Nail and glue the plywood back and front between the side pieces. Slide the plywood bottom in place and nail it to the back.

Elevation

Now prepare the maple drawer froms. Cut a 1/4" x 1/4" rabbet on the front edges. It's a decorative detail that gives an extrashadow line around the drawers. Now screw the maple drawer fronts in place on the plywood baxes.

If you like your drawers to have a snug fit, attach a couple short pieces of veneer tape to the inside sides of the case. There's just enough space for a household iron.

Add a couple coats of clear finish and you're ready to load up your new coffee table with books, magazines and a cup of loe. PW

Figure-eight fasteners are perfect for this project. Be sure to cut the recess for the fastener in the position shown so the hardware will move when the top moves.



back of the coffee table to look as interesting as the front To mimic the divider on the front of the case, I pinned a piece of moulding in the middle of the back too.



SUPPLIES

Rockler 800-279-4441 Desk top fasteners • item # 21650 • \$3.99 for a pack of eight.

Lee Valley 800-871-8158 2 - 40mm ring pulls + item #01A61.40 - \$1.55 each

secret Coac

This amphibian won't turn into a prince, but he is still full of surprises.

Though there are more than 4,000 species of toads and frogs in the world, I decided there was still room enough for one more: the secret toad. Like its amphibian brethren, the secret toad is studded with warts and sports an enormous mouth. But instead of revealing a high-speed tongue that makes flies shaky in the knees, this toad's mouth holds a stash of candy. I keep mine stocked with Hershey's Kisses. Though if you steal a kiss from this toad, he's not going to turn into a prince.

Building this 12"-long toad is a precision job, but I'll show you some tricks to making the tedious parts (such as sanding) go quickly. Basically the toad is built from $\frac{3}{4}$ "- and $\frac{3}{8}$ "-thick stock that is cut according to a pattern, then stacked up and glued with other parts to create the toad's body and mouth. Roto-Hinges and O-rings allow the toad to scoot across any smooth surface.

There are half-scale drawings of all the parts that can be enlarged on a photocopier to full size, or you can visit the *Popular Woodworking* website to download full-size cutting patterns for free by going to: www.popwood.com/fixes/toad.html.

Begin With the Base

As with any construction project, it is best to start at the base and work out and up. Lay out three lower body "D" patterns on $^{3}/_{4}$ "-thick stock. These parts form the inside of the mouth and the belly. Drill all the $^{1}/_{8}$ " registration holes shown on the drawing before cutting. These registration holes are critical because you'll push nails through these holes temporarily while gluing a stack of these parts. Rough cut the





pieces, apply glue and align them with 8d finish nails through the ½8" registration holes. Clamp the lamination with bar clamps along the width of the assembly. Wipe off as much glue squeeze-out as pos-



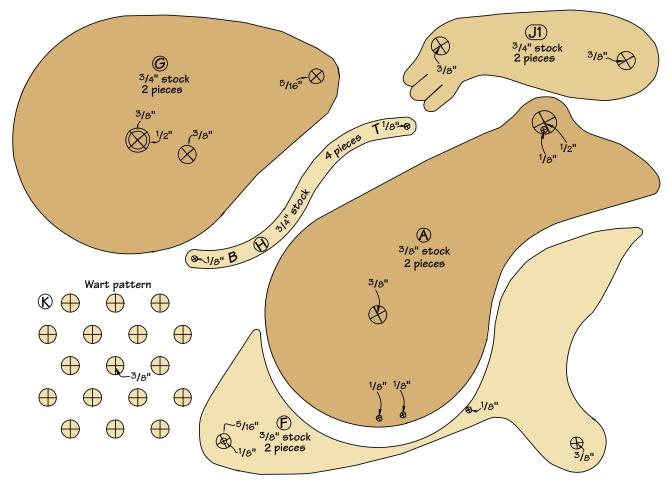
After you adhere your patterns to your wood, drill all the registration holes and then cut the shapes out. I prefer a band saw to a scrollsaw because I'm cutting wide of the line and prefer the speed over the accuracy (left). The trick to sanding the toad is to sand in stages. Once you assemble the first few layers, use your spindle sander to get to the spaces you won't be able to get to once you add the next layers (above).

sible. When this first three-part assembly is dry, remove the alignment nails and get ready for some selective finish sanding. Because the belly area between the front legs won't be accessible to the spindle sander after you add the outer "E" and "F" patterns, sand it now.

Lay out the "E" patterns on ³/8" thick stock. These parts add to the width of the belly and create stubs for the front wheels. Drill the registration holes. Cut, align and glue them to the outer surfaces of the belly assembly. Finish-sand the inner mouth surface that will be made inaccessible when the "F" plates are applied.

The outer profile "F" patterns, also cut from $\frac{3}{8}$ " thick stock, complete the lower body. Follow the same procedure as above. Finish sand all remaining surfaces. The seven layers of the lower body add up to a thickness of $3\frac{3}{4}$ ". This thickness gives a nice proportion to the toad and is just about the limit of my spindle sander.

Drill the axle holes in the lower body. Use the rear $^{1}/_{8}$ " alignment holes as the pilot for a $^{5}/_{16}$ " hole through the lamina-



tion for the 1 /4" dowel axle. Drill from both sides to make this long hole. The registration hole will go a long way towards guiding your bit straight through the body. Now drill the 3 /8"-diameter sockets on the front legs. These holes hold the 3 /8" Roto-Hinges for the front wheels. The holes are 1 /2" deep and made with a Forstner bit. Before drilling these holes, place a 2 1/4"-thick scrap block between the legs to prevent any inward bending.

The Head

The upper body is made from the "A," "B" and "C" patterns. Again, working from the center out, cut, laminate and sand the ³/₄"-thick "C" plates. Finish sand the head area that will be made inaccessible by the eye bumps on the "B" plate.

Follow the same procedure with the ³/₄"-thick "B" plates and finish sand all the inner surfaces that will be covered by the "A" plates.

Careful attention must be paid to drilling holes in the $\frac{3}{8}$ "-thick "A" plates. Mark the center of the $\frac{1}{2}$ " socket with an awl





Yes, you can use your spindle sander to smooth the tongue. Use a backing board as shown in the photo to make sure you're sanding it square (left). Once you get the tongue sanded and you've drilled the pilot holes, it's time to add the weight in one end that makes the toad work almost every time. I use polyurethane glue here because it expands as it cures, which locks the rod in place (right).

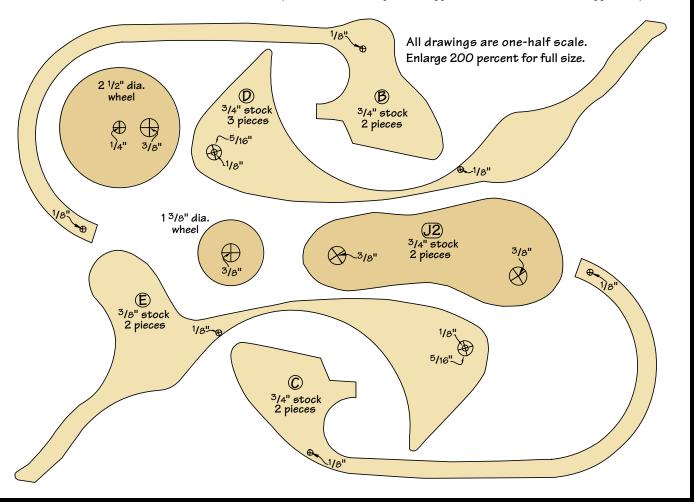
but do not drill at this time. Drill the ¹/₈" and ³/₈" through-holes. Following glue-up of the "A" plates to the body, finish sand all remaining outer surfaces.

In order for the upper body section to rotate freely between the hips, you need to reduce its overall thickness by ½16". Do this by sanding the flat surfaces on a stationary belt sander. To complete the upper

body, drill $\frac{1}{2}$ " sockets at the awl marks approximately $\frac{1}{4}$ " deep and glue in the screwhole-button eyes.

Warts and All

The warts come next. (Caution! Wash your hands thoroughly following this procedure. Only kidding.) Stick the wart pattern to the back of the upper body with a

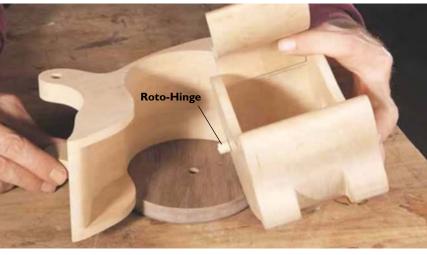


Here you can see how the two body pieces go together between the legs. It all works thanks to a carefully placed Roto-Hinge (right).

light application of spray adhesive. Use an awl to mark the centers. Use a ³/₈" Forstner bit to drill ¹/₄"-deep sockets. Finally, pop in the screw-hole-button warts.

Tongue Lashing

We're now down to the no-brainer construction steps. The tongue, "H," is a peaceful series of long, undulating curves. Adhere the pattern to $\frac{3}{4}$ "-thick stock with the long axis of the tongues parallel to the grain. Cut, laminate and sand the four tongue elements. As with the upper body, the overall width of the tongue must be reduced by ¹/₁₆" on the belt sander to allow free rotation in the mouth. To ensure snappy operation of the tongue, drill through the tip, or "T" end of the tongue as shown on the drawing, with a ¹/₄" Forstner bit and insert a ¹/₄" steel rod. Sand it flush to the sides of the tongue on a disk sander.

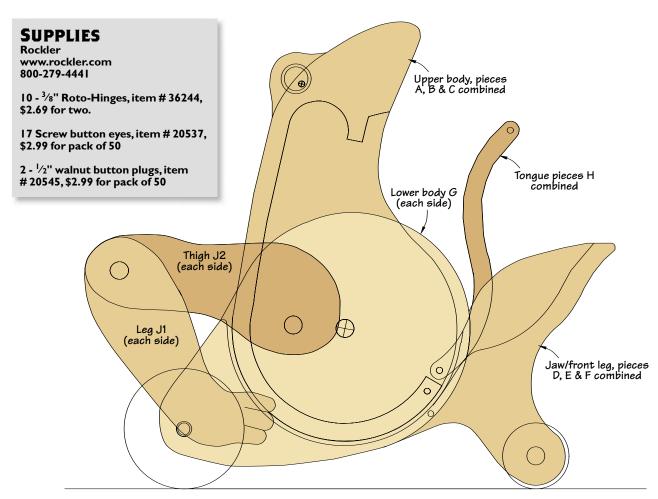


Leg Parts

The legs are simple cutouts, but drilling the pivot sockets demands some concentration because the pairs are handed (meaning they are left and right mirror images). Use a $\frac{3}{8}$ " Forstner bit to drill $\frac{1}{2}$ "deep sockets in parts "J1."

Moving to parts "J2," drill one ½"-deep socket on the front and one on the back.

The "G" hips cap and join the upper and lower body assemblies. After cutting and sanding, drill through the ⁵/₁₆" axle holes only. Perform the following operations on one of the pieces, then, on the other piece, reverse which side each hole is located on. At the center of the hip, using a ½" Forstner bit, drill a ½"-deep socket. Using the same point, continue a



³/₈" through-hole. At the offset ³/₈" mark, drill a ¹/₂"-deep socket on the opposite side. In case you're wondering about the ¹/₁₆"-deep sockets, they are made to contain the washer on the Roto-Hinges, allowing for an almost zero clearance between the rotating upper body and the fixed hips.

Cut the wheels from $\frac{3}{4}$ "-thick scraps using an adjustable hole saw. If the pilot bit for your hole saw is only $\frac{3}{16}$ " in diameter, re-bore the hole in the large wheels to $\frac{1}{4}$ " to accept the dowel axle. Also in the large wheels, bore the $\frac{3}{8}$ " offset sockets $\frac{1}{2}$ " deep. After cutting the small wheels, plug the pilot hole and again drill $\frac{1}{2}$ "-deep sockets. Grooving the wheels and stretching rubber O-rings over the grooves makes the wheels grip any tabletop surface. This kind of traction is necessary to make the legs operable (see photo at right).

Now apply the finish to all of the assemblies. I found that a wipe-on, semigloss polyurethane is ideal for the toad. Because most of the project glue-up is already complete, don't be concerned about applying finish to areas where glue will be applied. It's a simple matter to lightly sand the few surfaces involved.

Begin final assembly by placing the tongue between the outside cheeks of the upper body. Run a $3^{1}/2^{11}$ length of welding rod through the upper $1/8^{11}$ hole in the cheek, on through the $1/8^{11}$ hole in the base of the tongue, and out the opposite $1/16^{11}$ hole. Plug the $1/16^{11}$ holes with toothpicks, break them off, and cut flush. The tongue should pivot freely between the cheeks.

Glue one of the hips to the lower body assembly with the upper leg pivot hole facing out. While this is drying, slide Roto-Hinges into the ³/₈" through-holes in the upper body with the barrels of the hinges facing out. It is not necessary to glue the hinges in place because they will be captured between the body and the hips. Slide the hinged assembly toward the glued-on hip, seat the Roto-Hinge in the ³/₈" socket, and glue on the opposite hip while engaging the second hinge. Clamp your toad sandwich and allow it to dry. Round over the outside edges of the hips on the router table with a ¹/₄" roundover bit.

Install the front wheels by placing Roto-Hinges in the front leg sockets. Because the wood barrels on the hinges are exactly $\frac{3}{8}$ ", it's a snug fit. Use a small pistolgrip clamp to gently push the hinge into place. Now use the same clamp to slide

the wheel tight against the leg. The washer on the hinge will provide the necessary clearance.

Install the rear wheels by running a length of ¹/₄" dowel through the ⁵/₁₆" axle hole at the back of the lower body. Glue on the large wheels



Sanding the wheels can be tricky. If you chuck the wheels into a drill press and press sandpaper against the turning wheel, you're going to create an ellipse. That's because the end grain and long grain of the wheel will sand differently. To prevent this, use a backing board as shown in the photo.



I use an old flap sander chucked into a drill or drill press for the final sanding. An old used flap sander produces a better finish.

with the hinge sockets facing out. Orient the sockets on an imaginary line passing through them.

Assemble the leg pairs using the onehanded clamp to seat the hinges. Again, using Roto-Hinges, attach the feet to



While the wheel is chucked in your drill press, use a common scratch awl to cut a groove around the edge to hold the O-rings.



Before finishing, I like to rub the toad's body with a grey synthetic steel wool Scotch Brite® pad made by 3M.

the rear wheels and the upper legs to the hips.

Now take the little guy out for a spin. As a final refinement, install self-adhesive, clear nylon bumpers where the falling tongue strikes the toad's lower lip. **PW**



What You Must Know About Shelving

> Learn the simple but important rules to building sturdy shelves. Then build this handsome bookcase—or adapt the design using these easy-to-learn standards.

uilding shelves for muddy boots or a Chippendale secretary seems deceptively simple. First you install a horizontal surface between two sides. Then you load up your newly built shelf with Wellingtons or glass kitty cats. Finally you stand back and admire your work.

Then one day you decide to put encyclopedias on your shelf after you grow weary of the kitties. The shelf sags. The books don't fit under the shelf above, and the books' spines hang over the front edge. And you wish you had used a more rigid material and some sort of adjustable shelf pins so you could change your shelves to fit your needs.

Shelves, as you might have guessed, are not as simple as they appear. That's not to say they're hard to build. It's just that there's a whole set of rules to properly design bookshelves or display shelves that ensures they will hold a wide variety of common

This shelving unit is the perfect tutorial for etching these rules on your brain. You'll see how I followed the rules to design this project, and you'll get a down-and-dirty lesson in how to build shelving units that are quick, easy, rock solid and good-looking. First, here are a couple rules of thumb when you're putting your design on paper. It's accepted practice to build your cabinets in 3" increments. For example, the side units are 24" wide. If I wanted to make them wider, I'd jump to 27" wide, then 30". Another rule of thumb is that whenever a cabinet gets 42" wide, it needs a vertical support in the center. My cabinets are less than that, so that was no problem for me.

by Troy Sexton

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

PERFECTLY FLUSH FACE FRAMES

When you mill out your parts, here's a couple tricks to getting face frames perfectly flush to the cabinet without a lot of sanding. First, when ripping your stiles from wider stock, joint one edge on your jointer, then rip the stile /16" wider than your finished width. When you cut your mortises, make sure you cut them on the edge that you ran over your jointer — not the edge that has saw blade marks on it.

Then, after you attach your face frames to your case, use a router loaded with a flush trimming bit to trim the face frame flush to the plywood case.

The result: a face frame that is perfectly flush with no saw blade marks to sand out.



ANOTHER FACE FRAME TRICK

Here's another great trick for dealing with face frames. One of the biggest pains when attaching multiple shelving units together is getting them to line up when one is set back from another. Here's the easy way. First cut a $\frac{3}{4}$ "-wide x $\frac{1}{8}$ "-deep groove in the plywood case of the larger unit at the location where the two cases will meet. Then, when making the face frames for the smaller unit, rip one stile 1/8" wider (and don't trim it flush to the case). Let it hang over the edge of the case. Then, when you start attaching these cases, everything will line itself up as shown in the photo

Where to Begin: Face First

This large wall unit is essentially six plywood boxes with solid wood face frames on front. The part of the back that is visible behind the shelves is solid wood. The back behind the doors is plywood.

When building shelves, it's tempting to begin with the case because it goes together really fast. Resist this temptation. Begin your project by building your solid wood face frames. Your entire project is based off your face frame, so if you've got a problem with your design (or how you milled your parts) you're most likely to find out about it when you build the face frame. And I'd rather throw away a skinny piece of solid wood than a sheet of ply.

I make my face frames using 3/4" material (which is the standard) and mortiseand-tenon construction. First I cut my tenons on the rails, then I use those to lay out my mortises on my stiles. When working with 3/4" material, I always make my tenons 3/8" thick and 1" long. Usually I'll cut a 1/2" shoulder on the width of the tenon, but if the stock is narrow (less than 3") I'll use a 1/4" shoulder. I cut my tenons on my table saw using a dado stack.

Now lay out your mortises using your tenons. Cut your mortises (I use a hollow chisel mortiser) about 11/16" deep so



Drill your shelf pin holes before you assemble your case. I like to put mine on I" or 2" centers. Depending on what you're going to put on your shelves, you might not need that many holes.

your tenon won't bottom out in the mortise. Put glue in the mortises, clamp and set your face frames aside.

Plywood Boxes

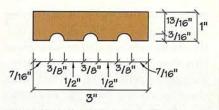
Make the cases out of 3/4" plywood. Cut 3/4" x 1/4"-deep dadoes on the sides to hold the bottom pieces. These should be flush to the top edge of the bottom rail. Cut 3/4" x 1/4" rabbets in the top edge of the side

SCHEDULE OF MATERIALS: SHELVING UNITS Center Case, Upper Unit					Side Case, One Upper Unit			
	Item	Dimensions TW L	Mat.		Item	Dimensions TW L	Mat	
10.	Bot rail	3/4" x 1 1/2" x 33"	P	1	Bot rail	$\frac{3}{4}$ " x 1 $\frac{1}{2}$ " x 21"	Р	
	Top rail	3/4" × 4" × 33"	P	i	Top rail	$\frac{3}{4}$ " × 4" × 21"	Р	
2	Stiles	3/4" × 43/4" × 50"	P	i	Int. stile	$\frac{3}{4}$ " x $2\frac{5}{8}$ " x 50"	P	
ĺ	7.6	3/4" x 163/4" x 391/2"	Ply	1	Ext. stile	$\frac{3}{4}$ " x $2\frac{1}{2}$ " x 50"	P	
3	Top	$*3/4" \times 16" \times 38^{3}/4"$	Ply	i	Тор	3/4" × 123/4" × 23"	Ply	
1	Bottom	$\frac{3}{4}$ " × $\frac{16}{3}$ /4" × $\frac{39}{2}$ "	Ply	3	Adi shalvas*	3/4" × 12" × 221/4"	Ply	
	Sides	3/4" x 17 ¹ /4" x 50"	Ply	I	Bottom	3/4" x 123/4" x 23"	Ply	
2		1" × 3" × 50"	P	2	Sides	3/4" × 131/4" × 50"	Ply	
2	Columns Back	1/2" x 391/2" x 50"	P	2	Back	1/2" × 23" × 50"	P	
	Баск	72 X 37/2 X 30	E		Dack	72 723 730		
Center Case, Lower Unit				Side Case, One Lower Unit				
	Item	Dimensions TW L	Mat.	No.	Item	Dimensions TW L	Mat	
1	Top rail	$\frac{3}{4}$ " × $1\frac{1}{2}$ " × 33"	P	1	Top rail	$\frac{3}{4}$ " x 1 $\frac{1}{2}$ " x 21"	P	
1	Bot rail	$\frac{3}{4}$ " x 5" x 33"	P	1	Bot rail	$\frac{3}{4}$ " x 5" x 21"	Р	
2	Stiles	$\frac{3}{4}$ " × $\frac{4^{3}}{4}$ " × 30"	P	1	Int. stile	$\frac{3}{4}$ " x $2\frac{5}{8}$ " x 30"	P	
ī	Bot	$\frac{3}{4}$ " × $16\frac{3}{4}$ " × $39\frac{1}{2}$ "	Ply	1	Ext. stile	$\frac{3}{4}$ " x $2\frac{1}{2}$ " x 30"	P	
î	Adj shelf*	3/4" × 16" × 38 $3/4$ "	Ply	1	Bot	$\frac{3}{4}$ " x $12\frac{3}{4}$ " x 23"	Ply	
i	Top rail	3/4" x 1 1/2" x 39"	P	-1	Adj shelfk	$\frac{3}{4}$ " x 12" x 22 $\frac{1}{4}$ "	Ply	
2	Sides	$\frac{3}{4}$ " × $17\frac{1}{4}$ " × 30"	Ply	1	Top rail	3/4" x 1 1/2" x 22 1/2"	P	
2	Columns	1" x 3" x 30"	P	2	Sides	$\frac{3}{4}$ " x 13 $\frac{1}{4}$ " x 30"	Ply	
-	Back	1/4" x 391/2" x 261/4"	Ply		Back	1/4" × 23" × 26 1/4"	Ply	
One Center Unit Door				One	One Side Unit Door			
No.	Item	Dimensions TW L	Mat.	No.	Item	Dimensions TW L	Mat	
2	Rails	$\frac{3}{4}$ " × $\frac{2}{2}$ " × $\frac{12}{2}$ "	P	2	Rails	$\frac{3}{4}$ " x 2 $\frac{1}{2}$ " x 16"	P	
2	Stiles	$\frac{3}{4}$ " × $2\frac{1}{2}$ " × $23\frac{1}{2}$ "	P	2	Stiles	$\frac{3}{4}$ " x $2\frac{1}{2}$ " x $23\frac{1}{2}$ "	P	
1	Panel	5/8" x 11" x 19"	P	1	Panel	$\frac{5}{8}$ " x $14\frac{1}{2}$ " x 19 "	P	

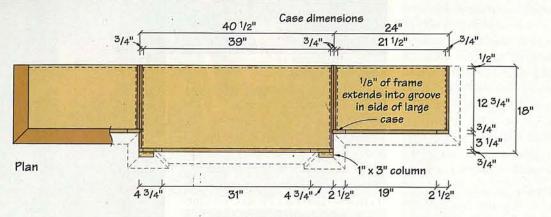
WHICH THICKNESS SHOULD I USE FOR THAT PART?

This might seem obvious to veteran cabinetmakers, but some beginning and intermediate woodworkers might wonder what thickness of lumber should be used for different parts of your standard face frame cabinet.

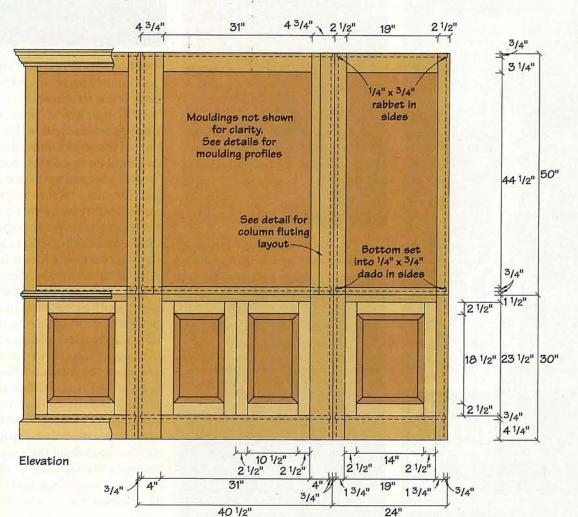
3/4" 1/2" Case parts (sides, tops, Drawer sides, backs bottoms, dividers etc.) subfronts 3/4" 1/4" **Drawer bottoms** Face frames 1/4" 3/4" Backs (plywood) **Drawer fronts** 1/2" to 5/8" Backs (solid)



Plan detail of column fluting



Face frame dimensions

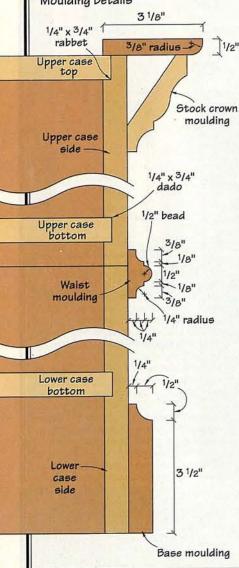


pieces to hold the top. This is also the time to cut the grooves in the sides of the center cabinet to line up all three cases. Read "Another Face Frame Trick" on a previous page for details. Now cut rabbets on the sides to hold the back. The size of the rabbet is determined by whether it's a plywood back or a solid back.

Now drill your adjustable shelf holes. I use a commercial jig, but you can make a template yourself from plywood. I drill my holes every 1" or 2" on center, which will allow a lot of adjustment. (The standard is to drill them every 2" on center or less and within 6" of the top and bottom of the cabinet.) For years I used shelf pins that required 1/4" holes. Then I switched to metric 5 mm because they're less conspicuous.

Now sand the inside of your case pieces with 180 grit sandpaper to knock off the fuzz and splinters. Be careful not to cut

Moulding Details



Get a friend to help you stack the cases on top of one another (left). Then use spring clamps at the back to hold everything together as you screw the upper cabinets together and the lower cabinets together. Be sure to screw right behind the face frame so the screw is less visible

through the veneer face.

Go ahead and put your cases together. Put glue in the dadoes and rabbets and nail through the outside of the cases into the top and bottom. Putty the nail holes. You don't need to clamp the case.

Now attach your face frames using glue and nails. Trim the face frames flush (see "Perfectly Flush Face Frames" on a previous page) and putty your nail holes. Now sand your face frames. I begin with 100 grit, then 120, 150 and finally 180. Sand the outside of the plywood case beginning with 120 grit and work up to 180.

If you're going to add columns to your center case, cut the details using a fluting bit in your router and attach the columns to your face frame with glue.

Finally, screw all the top units together and then screw all the bottom units together. Then turn your attention to the moulding.

Many Mouldings

There are five types of moulding:

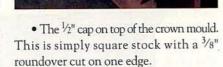
• The crown mould. Buy it pre-made from a hardwood supplier.

COMMON SIZES OF STUFF YOU PUT ON A SHELF

When building shelves for a specific purpose, say, for an entertainment center, you need to plan around the standard sizes of objects. Use these handy dimensions to figure out your shelf opening heights and depths:

Paperbacks Hardbacks Textbooks Vinyl LP Compact disk Cassette 41/8" x 71/2" VHS tape

Depth x Height 41/4" x 67/8" 7" x 91/2" 123/8" x 123/8" 5 1/2" x 5" 23/4" x 41/4" 51/2" x 71/2"



- The waist mould. This covers the seams between the upper and lower units. You can buy stuff like this off the rack, or you can make it. First cut your stock to size. Then use a beading bit to cut the center bead. Then use a 1/2" cove cutter in your router to cut the coves on the top and bottom. Be wary that as you make the second cove cut the moulding won't be as steady.
- The base mould. This is flat stock with a 1/2" cove cut on one edge.
- Shelf moulding. This goes on the front edge of the plywood shelves (which you'll make later). I used a rail and stile bit to make this mould in two passes. You also could use a Roman ogee bit and get the same effect. Cut a shallow rabbet on the back as shown in the photo at right.

Hand sand all your moulding before applying it. Attach the moulding with glue and nails. Start from the center and work out. One word about the waist mould. Position it so it sticks up 1/2" above the lower case (see photo at right) and nail it to the lower case.



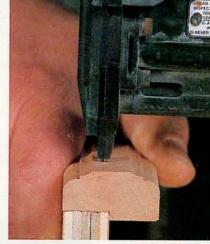
Build the doors the same way you built the face frames with one exception. You'll need to cut a 3/8" x 3/8" groove on the rails and stiles for the solid wood panel. That also means you'll need to cut haunches on your tenons to fit into the grooves.

With raised panels I allow a 1/8" gap on each side so the panel can expand and contract in the groove. To "raise" the panel, first cut the approximate angle on the panel's edge using your table saw. Then use an 8-degree raised panel cutter in your router to raise the panel. This way you'll only need to make one pass on your router table. Sand the panel, assemble the doors, then sand the rest of the door. Peg the tenons, cut the pegs 1/16" proud and sand them smooth but not flush to the doors.

Attach the pulls and fit your doors so there's a 1/16" gap all around. I use Amerock adjustable non-mortise hinges. These hinges are pricey (about \$3 each) but they are worth every penny because they are simple to install and are adjustable. See the Supplies box at the end of the story for details.

Back and Shelves

I used a shiplapped and beaded 1/2"-thick back on the top part of the case, and a plywood back on the lower section. Cut your $\frac{1}{4}$ " x $\frac{1}{2}$ " shiplaps, then cut the bead on the edge using a 1/4" beading bit in your



Here you can see what the shelf moulding looks like close up. Nail and glue the moulding to your blywood shelves.

router. Fit the back, being sure to leave space for seasonal expansion and contraction. Don't nail the back in place until after finishing.

Cut your shelves from plywood. Nail the moulding to it. Sand the shelves.

Finishing

I used a clear finish on this piece, sanding between coats with 3M sanding sponges (fine grit). Nothing gets into moulding and raised panels better. When everything's dry, nail your back pieces in place and hang your doors. PW

Attach the waist mould using nails. Nail it to the lower case and allow the top edge to cover the seam between the upper and lower cases.

KEEP YOUR SHELVES FROM SAGGING

You don't want your shelves to sag, yet you also don't want to overbuild them either. That wastes material. In general, here are the guidelines for how long your shelves can be before they start to sag, according to the Architectural Woodwork Institute. Typical shelves vary from 8" deep to 12" deep.

Material	Max span (¾" material)	Max span (11/16" material)
Solid wood	36"	48"
Veneer core ply	36"	48"
Medium density fiberboard	32"	42"

Of course, some woods (and manufactured wood products) are stiffer than others. The following chart shows you how much weight it takes to make a 12"-wide shelf bend 1/4" across a 36" span and a 48" span. As you can see below, solid wood makes the strongest shelves. That's followed by a manufactured shelf with a solid wood edge that's wider than the plywood is thick (they refer to this as a "dropped" edge). This is the shelf I used for

Shelf material	36" span	48" span	
Yellow poplar	284 lbs.	117 lbs.	
Hard maple & red oak	313	232	
Birch	348	146	
MDF Birch veneer- core ply	87 129	38 54	
Birch veneer MDF	109	46	
MDF with .05" thick laminate	205	87	
MDF with 1/8" wood edge	79	33	
MDF with 3/4" wood edge	90	38	
MDF with ³ / ₄ " x 1 ¹ / ₂ " wood edge, dropped	241	107	

Source: Architectural Woodwork Institute. Department of Wood Science, Division of Forestry at West Virginia University

SUPPLIES

Rockler • 800-279-4441 Non-mortising hinges #31300 • \$5.79 a pair.

Horton brass • 800-754-9127 Knobs, item #K-12 w/MSF (machine screw fitting). Call for pricing.

nakashima-inspired TABL

The first furniture to come from harvesting a backyard cherry tree pays tribute to master woodworker, furniture designer and national treasure, George Nakashima.

Most of the lumber used by George Nakashima was sawn from the log under his supervision, stacked in the order in which it was cut, then stickered and left to air dry before kiln drying. At his disposal then were thousands of boards which were sawn "through and through," retaining each board's waney or "free" edge and unique shape. And because the logs were not sawn for grade, which is when the log is turned time and again during the sawing to avoid defects like knots and splits, these "defects" were retained and often became an important feature in the use of the board.

Needless to say, most woodworkers don't have easy access to wood that has been processed this way. But I had the opportunity when a black cherry in my backyard fell prey to a hard, late frost and succumbed. Within a few weeks I engaged the operator of a Wood-Mizer portable band saw mill and had the log sawn where it fell. The going rate for this work is about 45 cents a board foot. About 18 months later, having stacked it carefully for air drying, I was ready to start working it. Now if you don't have access to lumber like this, you could always make a rectangular top.

From my boards I selected a shorter one that came from the top of the log where the tree began to branch. This area is referred to as a "crotch" and usually yields nicely figured material. But this part of tree also has a lot of stress in the lumber and often wants to split during drying. True to form, a wide check occurred on the end. Never mind, I decided, I'll work with it. The grain is just too pretty to toss in the scrap box.

The 17"-wide board was also cupped starting at the heart's center. To flatten the board, even if I had a jointer or planer that wide, would have sacrificed too much thickness. However, sawing lengthwise along the heart, splitting the board in two, rendered two relatively flat pieces. It was at this point that I decided to the use an open spline detail of contrasting walnut to join the pieces back together. The decision made the technical necessity of splitting the boards an interesting design element.

After the top was separated I smoothed and flattened the pieces using a Performax 22"-wide belt sander. When done, I routed a 1/2"

by Steve Shanesy

THE EXTRAORDINARY LIFE OF NAKASHIMA

Among woodworkers, none has expressed through design and use an unabashed reverence for wood as a material like George Nakashima. He strongly believed the objects he designed and built were giving a once-living tree a second life, and it was his objective to allow the natural beauty of the wood he was working to showcase itself.

His design skills in furniture were absolutely unique, forging crosscultural and cross-generational lines. You see in his furniture the western influence of modernism, Arts & Crafts and Shaker styles wonderfully blended with the simple yet powerful Japanese design. expression of materials and the exacting execution of woodworking

He was born in Spokane, Wash., in 1905, and was awarded a master's degree in Architecture from the Massachusetts Institute of Technology (MIT). Later he traveled by steamer to Paris and Japan where he lived for a number of years. While there he became immersed in his Japanese heritage and worked in the Tokyo office of an architectural firm owned by a Czech-American. He was sent to India by the firm to supervise the construction of a building at an ashram. He returned to Japan briefly before returning home in 1940. Two years later, he and his family were interned with most lapanese-Americans living on the West coast as the United States went to war with Japan. At the Idaho internment camp he learned traditional Japanese woodworking methods from an older resident.

He was released from the camp and moved to eastern Pennsylvania where he established a home, shop and design studio. Over the years his furniture was collected by numerous wealthy clients. His work was exhibited by most major art museums. In 1952 he was awarded the Gold Medal of Craftsmanship by the American Institute of Architects, and in 1979 he was named a fellow by the American Crafts Council, In 1989, the American Crafts Museum in New York selected his work as the first exhibit in a series called "American's Living National Treasures." He died the following year. His workshop and studio continue to operate today under the direction of his Harvard-educated daughter, Mira Nakashima-Yarnall. The expression of his work, design and philosophical approach to both is wonderfully captured in his book, "The Soul of a Tree" published by Kodansha International Ltd. In it he wrote, "Each plank... can have only one ideal use. The woodworker must find this ideal use and create an object of utility to man, and, if nature smiles, an object of lasting beauty."

x 5/8"-deep groove in the edges to be joined, and then I cut a walnut spline that was 17/16" wide. That left a 3/16" gap when the top was glued back together. Before gluing I used a block plane to make a slight chamfer on the top edges of the open joint.

Working the Free Edges

Needless to say, the bark had to be removed from the edges of the board down to the sap wood. With dry wood, the bark pops off quite easily. You can use just about any tool from a chisel to a screwdriver to knock or pry the bark off. Just be sure you don't gouge the surface you want to eventually display. To further prepare the rear edge of the top, sand it by hand with 120 grit paper. On what I considered the front edge, I used a gouge to make small facets in the surface to give the edge a more interesting visual and tactile surface. Afterwards I sanded the edge lightly.

I moved on to the area of the big check on the end of the board. The inside surfaces of the crack were rough and needed smoothing. While I didn't want to make the edges look like a polished surface, neither did I want the torn fibers and rough surfaces. My solution was to use 100 grit C-weight sandpaper to get into the crack any way possible. At this point, except for final sanding of the top and ends, the hardest part of the job was completed.

The Base

The base is absolutely simple to construct, even easier than a conventional table with legs and aprons. A slab end, a dovetail shaped beam and a tapered, angled leg is all there is to it.

To make the slab end I started with two panels that were about an inch thick each. My plan was to glue them together as a sandwich with a 5/16"-thick build up in the center that, when set back from the edge, created a reveal that mimicked the spline detail on the table top.

To do this, I first made a template of the gently curved convex taper for the slab edges. I then penciled the shape on to the individual pieces and cut the shapes on the band saw. Next I used the panel's edge to transfer the shape to the build up pieces to make the reveal. These were band sawn and the face edge cleaned up with a hand plane. I cut one additional piece of build



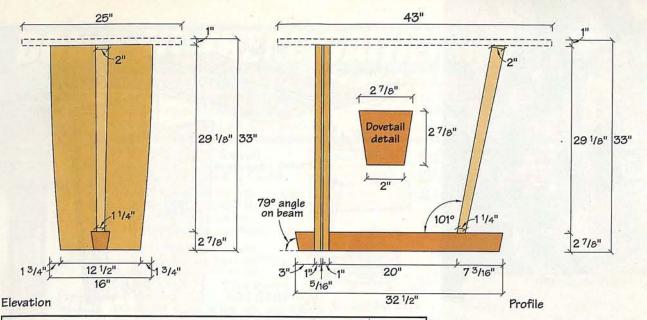
Mark the outline of the dovetail to be cut in the center of the bottom edge of the panel end using a trim piece of the actual beam. With the dovetail shape already cut on the beam, an accurate layout is assured.



Cut the dovetail sides using a saw without a back because the cut is nearly 3" deep. Also, make sure when starting the cut that the saw is properly aligned on both faces of the panel. Make the cut slowly until you've established the saw kerf following the layout line.

up to use in the center of the panel so that when cutting the through dovetail for the beam I'd have solid wood through and

Next I glued up the panels by first gluing and nailing the build up to one piece, maintaining a 5/16" setback at the edges, then gluing the second panel to it. I was

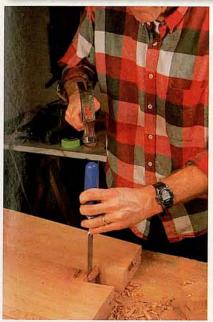


NAKASHIMA-STYLE TABLE

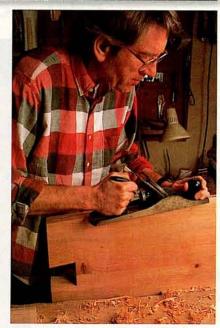
No.	Item	Dimensions TW L	
1	Тор	I" x 25" x 43 "	
2	Panel ends	1" x 16" x 32"	
2	Panel build-up	5/14" × 3" × 32"	

No. Item Panel build-up Leg Beam

Dimensions TW L 5/16" x 5" x 32" 2" x 2" x 31" $2^{7/8}$ " x $2^{7/8}$ " x $32^{1/2}$ "



After sawing out the bulk of the waste with a coping saw, chisel the remaining waste. Make certain your cuts are perpendicular to the face. After cutting halfway down, turn the panel over and work from the other side to avoid tear out.



Each edge of the leg panel has a slight bevel detail that's made with a handplane or a spoke-



The tapered leg is joined to the bottom beam with two 1/2" dowels. Although the spacing is tight, two dowels can be used. Use a doweling jig for alignment and, depending on placement, make sure you don't drill too deep.

careful not to apply too much glue to prevent a lot of squeeze-out in the reveal.

While the glue was drying I started making the hefty beam that ties the panel and leg together. I didn't have any stock thick enough to make the 3" x 3" blank size, so I glued up three pieces of 1" stock. After it dried I cleaned up and squared two op-

posing edges on the jointer then planed the remaining two. Next, I sawed the blank to the dovetail shape, sloping the sides to an 8-degree angle. At this point I sliced off a small piece of one end that served as a template for marking the cut to be made in the bottom edge of the panel.

After marking the centers of the tem-

plate and panel bottom edge I cut the sloping slides of the dovetail using the ripping teeth of my Japanese pull saw. Next I removed most of the waste with a coping saw then chiseled the edge flat. I found the fit of the beam just a bit tight so I pared the sides of the panel dovetail opening until achieving a fit that went together with just



Transfer the dowel hole locations using dowel centers. A slight tap on the top of the legs drives the center point of the dowel center into the beam. Then drill the holes.

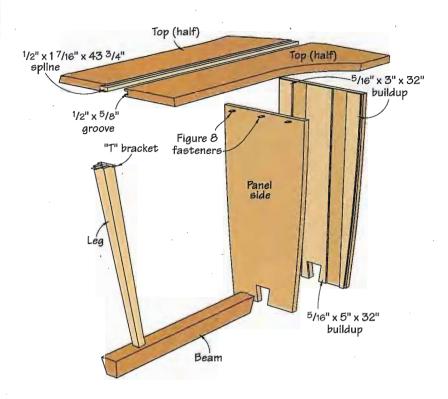
a slight amount of force. I then removed the beam and made the 11-degree bevel cuts on the ends. To complete the work on the panel I put a slight bevel on the panel edges. A hand plane was the tool of choice for this chore.

The leg that supports the other end of the table is simple enough to make. I started with a blank that was 2" square. I wanted the leg to taper from top to bottom so I penciled lines to follow on the band saw. After cutting, I cleaned up the edges with the jointer.

The leg cants at a 101-degree angle so I chopped the bottom edge at 11 degrees. To determine the length, I simply set the leg on the beam with the bottom edge seated evenly and the side touching the top edge of the panel. I made the mark there and made the final 11-degree cut on the top of the leg.

The leg is joined to the beam using two 1/2" dowels. First drill dowel holes into the bottom of the leg; then, after inserting dowel centers, mark the dowel locations in the beam. It is then a simple task to drill the holes.

To assemble the base I used polyurethane glue because of its superior bonding characteristics in gluing non-long-grain to long-grain joints. I first glued the beam to the panel making sure the beam and panel



were square. After this dried, I finished up gluing the leg to the beam using a band clamp with a little assistance from a pipe clamp to maintain the desired angle.

Fastening the top to the base was a snap. On the top edge of the panel end I used three figure eight fasteners, setting them flush. For the leg, I used a common "T" shaped bracket that I screwed down to the top of the leg, then up into the top.

To finish, I sanded everything to 150 grit and broke all the sharp edges. Next I mixed small but equal amounts of Olympic brand Early American and Red Oak oil stain and combined seven teaspoons of this blend with a pint of boiled linseed oil. The diluted color won't blotch the cherry but will give the

wood a nice color to start. Time will enrich the color more, encouraged by the linseed oil, which speeds the photochemical reaction that occurs naturally in cherry. After wiping away all excess oil I let the prefinish dry for two days. I completed the finish with a clear top coat of lacquer, although any clear coat will work fine.

I was quite pleased with the outcome of the table. Realizing this style may not be everyone's cup of tea, I think most wood-



To clamp the tapered leg in place, use a band clamp. The pipe clamp is essentially used to maintain the leg in the right position. The "T" bracket is later screwed to the top of the leg and is used to secure the leg to the underside of the top.

workers would have to agree on one thing. Using the free edge of boards sawn straight off the log and showcasing "defects" in the lumber clearly celebrates the material we all enjoy using so much. It instantly reminds us of just where all the wonderful wood we use comes from. **PW**



or years many American woodworkers have looked to Europe for quality hand tools. Chisels and saws from England, wooden planes from Germany, carving tools from Switzerland and Sweden. But we have usually stuck close to home when it comes to big power tools. We look to Delta, Powermatic, Craftsman and Jet for our table saws, band saws, jointers, planers and shapers. Though an increasing number of these are imports from Taiwan and China, these machines are almost all copies of home-grown models.

Given our admiration of European tools, it has long puzzled me why more Americans haven't adopted one of the most common fixtures of European shops, the combination machine. Merging from two to five basic woodworking machines in a single unit, these machines are ideal for home shops where space is often at a premium. And even if your shop is roomy, a combination machine can offer features, capacity and quality found only on top-of-the-line stand-alone machines.

European-style combination machines sold in the United States come in three

I grew up with American-style machines in my dad's shop and knew nothing of combination machines until I worked in English shops as a young man. Sold on their value, I looked for a combination machine when I moved back to the states in the mid 1970s. Finding none, I reverted to the readily available stand-alone models, still hoping I'd eventually find a combo.

In the early 1980s, I began to see ads for European combination machines in woodworking magazines. Since then, I have owned two 5-in-1 machines, one small and one mid-range. My experience leads me to believe that while combination machines aren't for everyone, many more American woodworkers ought to consider them seriously.

For years, working out of borrowed or rented garages, barns and basements, I used a Zincken Compact 21 (or ZC-21), with a 9" table saw, 8" jointer/planer, a shaper and a mortiser. It took up less space and weighed less than a Delta Unisaw and was only a few hundred dollars more expensive. Lightweight and compact, it is an ideal tool for workshops that share space

tables are short. A Delta Unisaw and 8" jointer are without doubt superior. But together they cost about \$2,500. Moving down-market, a 10" Grizzly contractor's saw and 8" jointer cost about \$1,100. Buy either pair, and you still don't have the planer, mortiser or shaper incorporated in the ZC-21.

My ZC-21 served me well in a number of less than commodious workspaces. But when I finally bought my own house and was able to build a 500-square-foot shop next to it, I found myself hankering for something bigger. Though I'm a fan of combos, I don't deny there are advantages to stand-alone equipment. Even Morrie Kilberg, whose company D-M International distributes Zinckens in North America, recommends stand-alone machines to people with the space and money. I didn't have a lot of money, so I bought a Grizzly 10" cabinet table saw and 8" jointer and refurbished an old Parks 12" planer. I kept the Zincken for shaping and mortising and for fine jointing and planing. In some ways, I had the best of both worlds.

But, a year ago when I got the chance

BO MACHINES

basic types. One combines a table saw and shaper. Another combines a jointer and planer, with an optional horizontal mortiser. The third merges all these tools: table saw, shaper, jointer, planer and (still an option) horizontal mortiser. These fivefunction machines are sometimes called 5-in-1s, and are available in a wide range of sizes and prices. The Zincken MIA4, for instance, offers a 6" table saw, 6" jointer and planer, a shaper and a horizontal mortiser, all run by a single 1hp motor and selling for about \$750. At the other end of the market is the Felder CF7-41. For about \$13,000 you get a 12" table saw with stateof-the-art sliding table; a 16" jointer and planer; a 1" reversible, tilting-arbor shaper; and (for an extra \$1,000 or so) a horizontal mortiser. Three separate 3hp motors drive the five tools.

Photo by Scott Landis

with ping-pong tables or cars. Mounted on a homemade rolling platform, mine easily wheeled out of the way when not in use.

Most important, it gave me all the basic machines I needed for solid-wood projects. The table saw ripped 1"-thick oak without lugging; 2" if fed slowly. Its simple sliding table crosscut accurately and conveniently. The 8" jointer/planer ensured that my material was flat and uniformly thick. The horizontal mortiser cut neat accurate mortises between $^{1}/_{4}$ " and $^{1}/_{2}$ " wide and up to 2" deep. And the shaper profiled edges, cut joints and also functioned as a router table. With this small machine I was able to build everything from jewelry boxes to 6'-long trestle tables, including cabinets and chests of all sizes.

Of course, the machine has its limitations. The table saw is small; the jointer

to buy a bigger combination machine, I jumped at it. Since I first saw the Robland X-31 advertised about a decade ago, I have wanted one. An 1,100-pound machine, the X-31 incorporates a 10" sliding-table table saw, 12" jointer/planer, a heavy duty shaper and a horizontal mortiser, all powered by three 3hp motors. After traipsing 600 miles (each way) and parting with about \$4,000 (a new machine costs \$6,000 plus shipping), I rolled my used X-31 into the shop and sold my stand-alone table saw, jointer, planer and the trusty old Zincken, recouping half the X-31 purchase price. The X-31 occupies about 36 square feet near the center of my shop. Selling the other machines opened up space for a drill press, band saw and dust collector (as well as room for the family's bicycles). Though it weighs half a ton, the machine

The Robland X-31 incorporates a 10" sliding-table table saw, 12" jointer/planer, a heavy duty shaper and a horizontal mortiser, all powered by three 3hp motors. The price? About \$6,000. Before you choke on your coffee, add up the total cost of the machines in your shop (or the machines

you intend to buy).

can be moved with relative ease by means of a threepoint caster system.

The X-31 is not without faults. But, taken individually, each of its machines are a step above every standalone equivalent I've ever owned. The machine is vibration free and the 3hp motors are more than adequate whether I'm ripping 3" maple or planing a 12"-wide piece of oak. The table saw and jointer fencing arrangement is problematic (more about that later), but the sliding table is a joy to use.

Advantages and Disadvantages

A comparison between the combination machines I'm familiar with and equivalent stand-alone machines is useful, but not always straightforward because woodworkers' needs and preferences are so varied. The strength of the Zincken ZC-21, for example, is not that it is a better table saw than the Delta 8" bench saw, but that it provides a good-quality jointer, planer and shaper as well, allowing you to store an entire woodworking machine shop along the wall of your garage.

It is easier, I think, to compare larger combination machines with their standalone counterparts. These combos offer 10" or 12" table saws and 12" jointer-planers and spindle shapers all powered by meaty motors. In my experience, these comparisons are at worst a draw and frequently yield a decided advantage to combos. The Robland X-31 outperforms stand-alones in several areas, and I'm confident that the Mini-Max. Hammer and Euro-Shop 5-in-1 machines of similar capacity and price share these advantages. In some instances, these machines exceed the X-31.

Table Saw

A sliding table is a standard feature of all these combos and of none of the Americanstyle cabinet saws — advantage clearly to the combos. (Some smaller bench saws now offer standard sliding tables.) The X-31's 3hp motor and heavy frame produce vibration-free operation, more so, I must say, than most Unisaw-style machines I've used. Other table saw features are, for the most part, a toss up.

The fencing systems on some combos, however, fall short of their stand-alone competition. As currently sold, the X-31 uses a single two-sided fence that slides on a round guide bar attached to the end of the jointer outfeed table. One side of the fence is a rip fence for the table saw, the other serves the jointer.

While accurate, the fence is ungainly, heavy and awkward to set up. This is better than some of the fences I've used, but it's no match for a Biesemeyer or a fence on a stand-alone jointer. (Not all combos have fence problems — Felder fences, for instance, are superb.)

This fencing arrangement, with its guidebar-mounted fence mimicking common American setups, is the latest in a series of attempts by Robland to adapt the fencing to American tastes. As a used machine, my X-31 came with the original European fencing, which I like better. A small but sturdy and accurate aluminum fence mounted to the front of the machine handles rips up to about 10" wide. Attaching a larger center-mounted fence to the edge of the jointer outfeed table accommodates rips up to about 2 feet wide. The same fence, mounted on the table saw table, serves the jointer.

Shaper

All these combos have powerful, versatile, large capacity shapers served by the sliding table. Combination shapers are equalled in stand-alone machines only in the mid to upper price ranges.

Jointer and Planer

In combos, these machines share the same cutterhead. To use the planer, you swing the jointer tables out of the way, rotate a blade-guard and dust-extraction head into place and wind up the planer bed. The change-over takes about 30 seconds. Both machines are sturdy, vibration-free and accurate. My X-31 planer takes a ¹/₈" cut on a 12"-wide maple board without lugging. You need to look among the midto upper-priced planers to find ones with similar capacity and durability. The Robland's 55" jointer tables are somewhat shorter than standard stand-alone models, but more than adequate. And its 12" width is unobtainable for less than \$2,000 in a stand-alone machine.

Mortiser

Horizontal mortisers are available on all the 5-in-1 machines discussed here. All run off the jointer-planer cutterhead, which is tapped for a chuck that holds the bits. Sturdy sliding tables with in-out, side-toside and up-and-down movement bolt to the jointer-planer frame. While heavy, the tables can be attached and removed in seconds. Stand-alone horizontal mor-

THE COMBO CHRONICLES

Despite the fairly recent appearance of European models in the American market, combination machines are not new here. Cincinnati's Parks Machine Co., for example, manufactured combination machines at least as early as the 1920s. The Parks Planing Mill combined a table saw, 12" jointer, 22" band saw, shaper, swing cut-off saw and hollow-chisel mortiser, all driven by flat belts connected to a 5hp motor.

This behemoth was not, of course, the kind of thing you'd put in your basement or garage. But the market for homeshop woodworking was incubating and in 1928 the Delta Specialty Co., a Milwaukee firm then just nine years old, offered the Delta Handi-Shop, which harnessed a 9" lathe, 8" disc sander and 6" table saw to a ½ hp electric motor.

A few other American manufacturers produced combination machines (most common were table saw-horizontal borer combos) for the industrial and home-shop markets but they didn't catch on. The Shopsmith is, of course, the exception, selling some half a million tools since its invention in the late 1940s. But the Shopsmith, with its combination of lathe, drill press, small table saw, horizontal borer and disc sander, addresses other needs than the European-style machines and does not include two of the tools basic to solidwood woodworking, the jointer and planer.

From the 1950s through the 1970s, there were sporadic attempts to market European combination machines here. But for the most part Americans who wanted one had to order a machine from Europe or go there and bring one back.

In the mid 1980s, Torben Helsjoy (pronounced Hels-hoy) began to sell the Belgian-made Robland machines. A Danish woodworker, Helsjoy came to the United States in 1982 on a hitchhiking adventure that ended in California, where he set up a small custom cabinet shop. Disappointed with the machines available here, he returned to Denmark and bought a container load of Roblands. Back in California, he began to market the machines out of his cabinet shop. In 1987, he became a full time machinery dealer. His company, Laguna Tools, sells a range of European machines, some stand-alone, some combination. Robland is his prime supplier. The X-31 is their most popular combo (they also sell 16" models) and Helsjoy estimates that he has sold about 3,000 X-31s to date.

A few years after Helsjoy set up Laguna Tools, Morrie Kilberg, general manager of D-M International in Canada, began selling Italian-made Zincken machines. Today he is Zincken's North American distributor. More recent additions include machines made by the Italian manufacturing giant SCMI (sold under the names MiniMax and EuroShop) and a Czech firm, Rojek. Garrett Wade sells the Swiss-made Inca jointer planer. A small but high quality benchtop model, it features a $10^{1/4}$ "-wide cutterhead and 42"-long tables.

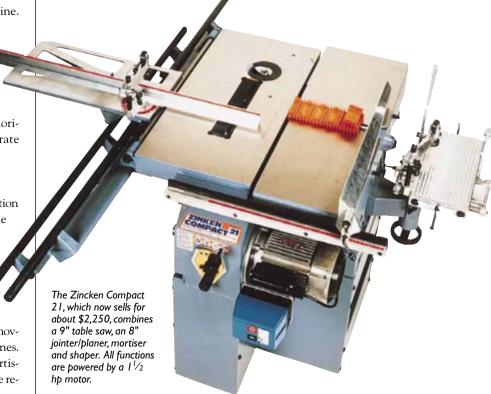
The Rolls Royce of combination machines sold in the United States are made by the Austrian firm Felder, which have been distributed here since the early 1980s and since 1996 by the manufacturer's subsidiary, Felder USA. Founded, like Robland, in the mid 1950s, Felder makes a full line of woodworking machines that it distributes around the world. They include 5-in-1 combination machines (12" and 16" machines, rated by jointer-planer capacity) as well as table saw-shapers and jointer-planers (with optional horizontal mortiser). Felders are beautifully designed and made machines with all sorts of refinements: micrometer-adjusted fences and planer tables; reversible, tilting shaper spindle; a marvelous sliding table. Such quality doesn't come cheap. The Felder CF 7-31 Ecoline C, a 12" 5-in-1 machine, runs about \$10,000 (with the horizontal mortiser), a big jump above \$6,000 you pay for a Robland X-31. I'm an admirer of the X-31, but I also think the prices accurately reflect the difference in quality between the two machines. It's no surprise that far fewer BF 6-31s have been sold in the United States than X-31s. But, what is intriguing is that 70 percent of the sales of both machines have been to amateur wood-

Felder has recently introduced a less-expensive line of machines made by its Hammer division to compete head to head with Robland. Felder used to be alone in the upper reaches of the price scale — a fully loaded Felder 16" 5-in-1 machine might easily fetch \$20,000. But Laguna has just jumped into this rarified market with an Austrian-made Knapp 5-in-1 that retails between \$20,000 and \$35,000 depending on options. They've already sold 10 — all to amateurs.

tisers are hard to find. Most woodworkers use some form of hollow-chisel machine. Among the hollow-chisel mortisers I've used, I find the horizontal mortiser preferable to drill-press attachments and to bench-top ramstyle mortisers and a toss up with industrial floor-model mortisers. The horizontal mortiser makes a clean, accurate cut with little burning.

Changing Machines

Isn't it a nuisance to shift from one function to another? Dealers tell me this is one of the most common concerns Americans have about combination machines. The answer is both yes and no. I won't pretend that shifting between the table saw, jointer and planer on either my Zincken or Robland is as convenient as moving between three stand-alone machines. There are the fences to deal with, mortising tables to attach and the little dance re-





an 8' sliding crosscut fence. Please wipe your drool from the page now.

But the inconvenience is slight and the time "lost" is insignificant to me. No change-over from one function to another takes more than a minute or two. Once set up, rotating a knob on the Robland selects the function you want to power. (Only one machine can operate at a time). The single-motor Zincken has an ingenious and well-engineered mechanism that engages the proper belt to select a machine. In short, the many advantages of the machines outweigh, for me at least, the minor inconveniences of changing tools.

Combo Recommendations

Combination machines have many attractions, but the one at the top of the list is space saving. If you need to squeeze an entire cabinet shop into a closet, a small combination machine like the Zincken C-21 or its little brother, the MIA4, is ideal.

Space considerations don't necessarily decrease as shop size increases. I appreciate the space I save with the X-31, but that's not why I bought the machine. I could buy (and have bought) less expensive machines. But the X-31 and other combos in its class provide better quality and capacity than other machines I could buy for the same money. (A Unisaw with aftermarket sliding table and a 12" Grizzly jointer alone would cost about \$4,000.)

Much as I like my 5-in-1 machine, I have to admit that I think the ideal combination machine setup would involve two machines: one a combination table saw and shaper, the other a combination jointer-planer-mortiser. Separated in this way, the fences cease to be an issue. I frequently move between the table saw and jointer — rip, joint an edge, then crosscut to length. Even if it only takes 30 seconds, changing over from table saw to jointer repeatedly can be irksome (you learn to plan your work better). Separating the machines eliminates this problem.

At this point, many readers may be saying, "Well, that sounds wonderful, but I'm

not made of money." No doubt about it, laying out \$5,500 to \$8,000 for an X-31 or similar 5-in-1 combination machine is a daunting prospect. A fair number of woodworkers have that much money (or more) tied up in machinery. But few of us spend \$6,000 all at once.

So how might a combination machine fit the budget as well as the dreams of the frugal majority among us? Many woodworkers already have a table saw and a great many do without a shaper or build a router table to cover their shaping needs. If they're unhappy with what they've got they're much more likely to upgrade to a \$700 Grizzly or \$1,500 Unisaw than a \$3,300 combination table saw-shaper.

When it comes to jointers and planers, however, I think far more American woodworkers should consider a jointer-planer combination. When working with solid wood, the importance of flattening stock in initial preparation can't be overstated.

For years 6" jointers were the largest af-

fordable option for most home shops. Recently Delta, Grizzly and several others have offered 8" machines for around \$1,000 or less. My 8" Grizzly was a good machine, as was the 8" jointer-planer on my Zincken. But neither was wide enough. I longed for at least a 12" jointer so I wouldn't have to rip up and reglue wide boards. The least expensive 12" machine I could find (a Grizzly) cost more than \$2,000.

But, for about \$2,700 I could buy the Robland 12" combination jointer-planer (and would have done that if the used X-31 hadn't appeared). Two equally heavy duty, high-quality 3hp stand-alone machines would cost considerably more. Grizzly's 12" jointer and 15" planer cost almost exactly the same. Delta's 8" jointer and 15" planer run about \$2,250. And the stand-alones take up twice the space. Finally, for an extra \$600, you get a dandy horizontal mortiser. Like I said, more woodworkers ought to take a serious look at combination machines. **PW**

COMBOS IN NORTH AMERICA

(manufacturer and distributor)
Zincken, D-M International
I 100 A Wallace Ave. N
Listowel, Ontario N4W IM5
519-291-5342

EuroShop & MiniMax (Italian). Eagle Tools, 2217 El Sol Ave., Altadena, CA 91001. 800-203-0023.

Felder & Hammer (Austrian). Felder USA, 1851 Enterprise Blvd., West Sacramento, CA 95691.800-572-0061. www.felderusa.com and www.hammerusa.com

Inca (Swiss). Garrett Wade, 161 Avenue of the Americas, New York, NY 10013.800-221-2942. www.garrettwade.com

Robland (Belgian) and others. Laguna Tools, 2265 Canyon Road, Laguna Beach, CA 92651. 800-234-1976. www.lagunatools.com

Rojek (Czech).Tech Mark Inc., 7901 Industry Drive, North Little Rock,AR 72117.800-787-6747. www.tech-mark.com

DeWalt 621 Plunge Router

he DeWalt 621 is the standard by which we measure all medium-sized plunge routers.

The tool is easy to adjust and use, has more than enough power and has an ingenious way of collecting dust. For those of you shopping for your first router or upgrading, here's a look at how this tool has held up in the last three years in our shop.

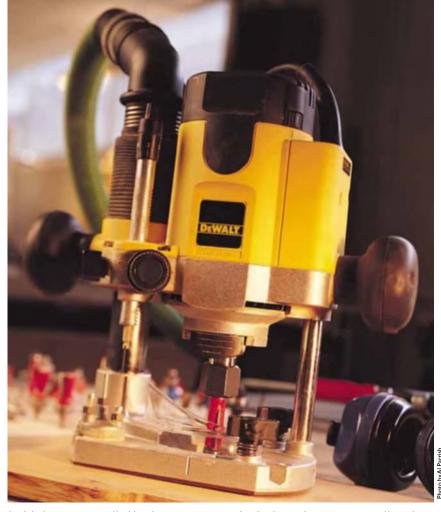
First a word about the power switch, which is built into the handle. You pull a trigger to turn on the motor; but to lock the switch "on," you pull the trigger and push a hold button. It's awkward at first, though it quickly becomes second nature.

The 10-amp motor (adjustable from 8,000 to 24,000 rpm) operates smoothly and never lagged in a cut. There's enough power to use this tool in a router table, though I have a philosophical prejudice against dedicating such a versatile machine to only one operation.

Our next test was on the collet, which has a feature that most routers should have: a spindle lock. About six months ago the springs holding the spindle lock button in place disappeared. Without the springs, the spindle lock would engage and not come back out, scoring the shaft. A quick trip to the store produced the two replacement springs we needed.

The depth stop system consists of a rod mounted on a rack and pinion that's adjustable to a few thousandths of an inch. At the base of the fine adjustment rod is a three-position turret depth stop. Though the fine-adjustment rod has never moved during a cut, adding a way to lock it would be great.

The motor plunges on two guide posts, with the larger post containing the return spring. This post also acts as a throughthe-base dust collection duct. The plunge



lock/release is controlled by the non-trigger handle, which rotates to lock the router at any plunge height. Very cool. The 2¹/₄" plunge depth is plenty for almost any task.

The integral dust collection is excellent in wood or manmade materials. The two-part plastic shroud proved to be fragile and cracked after only a few uses, but it still works.

Template guide work can be done easily with the cast aluminum insert provided. The base plate is quite small, making the router a bit tipsy when edge routing. If you do a lot of edge work, replace the stock base with a shopmade one.

POPULAR WOODWORKING

We really like this router, and it's the first tool we reach for when we need a plunger. While the DW621 is quite capable of router-table work, unless it's a necessity we think it's a waste of talent to tie this router down. PW

—Jim Stuard

RESULTS

DEWALT 621 PLUNGE ROUTER

NICE FEATURES

- Great dust collection
- Plunge and switch on handles
- Easy and accurate to adjust

RECOMMENDED MODIFICATIONS

- · Stop on fine adjustment rod
- Longer cord
- Beef up the dust collection shroud

DeWalt 800-433-9258 www.dewalt.com

ABOUT OUR ENDURANCE TESTS

When a new tool hits the market we do our best to tell you what the benefits and pitfalls are with that tool. While this is good information, we know that the question you really want answered is, "How long will the tool last?" That's what this column is for. We regularly pick a tool we've used in our shop for at least a year that has stood up to our regular use. We make sure the tools we've tested here are virtually unchanged from the versions in the store today. So when you see a tool written up in here, it has passed the Popular Woodworking Endurance Test. David Thiel, senior editor

Stripping Finishes from Wood

Learn the right techniques for using furniture strippers and how to avoid the most common problems people have when using them.

In the last issue I described the characteristics of all the common paint-andvarnish removers and how to choose among them. Here are the steps for using these products and dealing with the most common stripping problems.

Work outdoors in the shade or in a room where you have arranged crossventilation provided by fans. Don't work near an open flame (such as a gas water heater or furnace) or a source of sparks if you're using a flammable stripper.

Remove hardware and difficult-toreach wood parts that can be easily disassembled. Soak hardware that requires stripping in a coffee can filled with stripper.

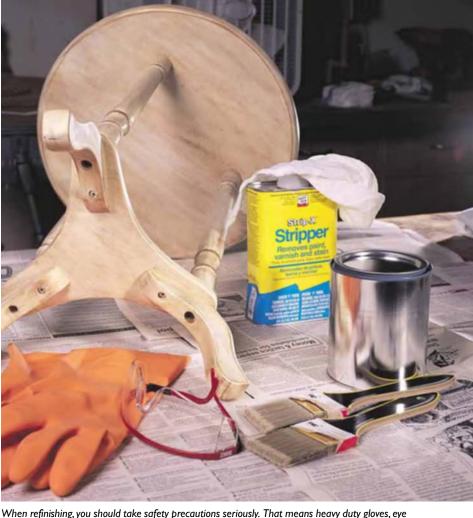
Wear a long-sleeved shirt, chemicalresistant gloves (butyl or neoprene) and eye protection.

Spread newspapers on the ground or floor to catch the waste.

Shake the container of stripper, then cover it with a cloth and open the cap slowly to allow the pressure inside to escape. Pour the stripper into a large can, such as a coffee can.

Brush the stripper onto the wood using an old or inexpensive paintbrush. Avoid unnecessary brushing; you want to lay on a thick coat, but also minimize solvent evaporation. (Be aware that some synthetic bristles will dissolve in methylene-chloride-based strippers.)

Allow the stripper time to work. Test the paint or finish occasionally with a putty knife to see if you can lift it from



protection and even long sleeves.

the wood. Apply more stripper as the original dries out. All strippers will lift many layers at once if the surface is kept wet so the stripper has time to penetrate.

Remove the dissolved, blistered or softened paint or finish using one or more of the following methods.

- Use paper towels to soak up and wipe off the dissolved finish.
- Use wood shavings from a jointer or planer to soak up dissolved finish. Then brush off the shavings with a stiff-bristle brush.
- Scrape the film off flat surfaces into a bucket or cardboard box with a plastic scraper or a wide, dull putty knife. Keep

the putty knife clean and smooth, and round its corners with a file so it doesn't scratch the wood.

- Break blistered or softened film loose from mouldings, turnings and carvings with #1 steel wool or a Scotch-Brite pad.
- Pull a coarse string or hemp rope around the recesses of turnings to work out blistered paint or finish.
- Pick the softened paint or finish out of cracks and recesses with sharpened sticks or dowels, which won't damage the wood as metal picks will.

Wash the wood with paint thinner, naphtha or lacquer thinner to remove wax residue left from strippers containing wax. You may also wash with a strong detergent and water, or simply with water if the stripper is "water-washable," which means it already contains the detergent.

Let the solvent evaporate out of the stripping sludge, then dispose of it in the trash unless local laws forbid this. (The dried sludge is what was on the furniture before you stripped it, so it is no more polluting than tossing the entire painted or finished object into the trash.)

Common Problems

If you've ever done any stripping, you know it's seldom as easy as the step-by-step instructions suggest. Here are some of the most common stripping problems and their solutions.

The Stripper Doesn't Work

If the stripper you're using doesn't dissolve, blister or break the bond of the paint or finish film, either you need to allow more time for the stripper to work or to use a stronger stripper.

First allow more time. Strippers work much slower in temperatures below 65 degrees. Keep the surface wet by applying additional coats of stripper or covering the surface with plastic wrap to prevent evaporation.

If you still have problems, try a stronger stripper. The only paint or finish that can't be removed with a solvent-based stripper is milk paint. It was used in the 18th century and in rural areas of the United States in the 19th century. You can remove it with lye.

Some modern coatings are very difficult to strip. Rough them up with coarse sandpaper to increase the surface area, then try again with a strong methylenechloride stripper.

You Can't Get Paint Out of the Pores

Paint is softened by the stripper but doesn't come out of the pores until some mechanical force is applied to it. Stripping shops often use water under high-pressure. You can use a brass bristle brush (available at paint stores), which won't damage hardwoods.

Apply more stripper to the surface, then scrub in the direction of the grain. Remove the gunk with rags or paper towels. Repeat until the wood is clean.

You Can't Get the Stain Out

There are several types of stain, and whether a stripper removes the stain depends on how that particular stain is affected by the stripper. If the stripper doesn't remove the stain, use household bleach to remove dye stains, or scrub the wood with a brass bristle brush together with more stripper to remove pigment stains.

You don't have to remove stain, however, if you intend to restain darker than the color of the stripped wood. Simply restain right over the remaining color.

You can tell that all the finish is off when there aren't any remaining shiny

Continued on page 78

FLEXNER ON FINISHING

Continued from page 77

places on the wood or in the pores when the wood is dry.

The Stripper Streaks and Darkens the Wood

Lye and any stripper containing an alkali may darken wood. The darkening often shows up as ugly streaks. To bleach out the dark stains, make a saturated solution of oxalic-acid crystals, available at pharmacies and many paint stores.

Brush the solution over the entire surface, not just over the stains. Let the oxalic acid dry back into crystal form. Then wash the crystals off the wood with a hose or well-soaked sponge or cloth. The crystals will cause an uncontrollable coughing if you brush them into the air and breathe them.

Oxalic acid will also remove black water rings and rust stains. It has little effect on the natural color of the wood.

Sandpaper Clogs After Stripping

Clogged sandpaper indicates that some finish remains on the wood, or that the stripper hasn't completely evaporated. As long as all the finish has been removed, sanding isn't necessary if the wood is smooth. Sanding will remove the wood's patina (the appearance of age brought about by light and use).

Wood Won't Stain Evenly

You may not have removed all the old finish. If this is the case, you'll have to resume stripping until all the finish is removed. Uneven stain penetration can also be caused by uneven density or swirly grain in the wood itself.

The New Finish Won't Dry, or it Peels After it has Cured

Both of these problems are caused by wax left on the wood by the stripper. All strippers based on methylene chloride and acetone, toluene and methanol (ATM) contain wax. The wood must be washed thoroughly (not neutralized as most directions suggest) with a detergent or solvent for removing wax. Flood the surface, then wipe with a dry cloth, turning it frequently so you lift the wax from the wood rather than

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

just move it around. PW

CARTOON



Illustrated by Bob Rech



Submit your caption(s) for this issue's cartoon on a postcard to *Popular Woodworking*, Cartoon Caption #44, 1507 Dana Ave., Cincinnati, OH 45207 by August 18. Winners will be chosen by the editorial staff.

The winner will receive a selection of Quick Grip clamps from American Tool Co. Inc. Newly redesigned, these one-handed clamps are a must-have tool.



Winners will receive five 12" clamps and five 24" clamps. A \$170 value!

The runners-up each win a one-year subscription to Popular Woodworking.



"I only build new projects in this shop.
I don't restore antiques!"

Ron Landall, from Omaha, Nebraska, is the winner of our Cartoon Contest from the April issue and recipient of the fine set of Quick Grip clamps. The following runners-up each receive a one-year subscription to Popular Woodworking:

"No way does she get the best room in the house."

Shirley R. Carp, Baltimore, Maryland

"I hope she is ready when the casket is." Steve Silva, Blaine, Washington

"Honey I didn't! I asked your mom if she wouldn't mind sweeping in here."
Paul Dorin, San Diego, California

Sponsored by **AMERICAN TOOL**

Tool Test

DW746 Table Saw: A Sweet Machine with the Sliding Table

Two years ago DeWalt entered the benchtop table saw market with a tool that proved innovative and popular. This year they stepped up even further and entered the stationary table saw market with the DW746. The 10" left-tilt saw actually exists in a couple of configurations, but let's start with the base model. It's got a 1³/₄hp (15 amp) motor with soft start that's mounted inboard so the saw has a small footprint. The two extension wings give it a table surface of $40^{3/4}$ " x 27", a 30" rip capacity to the right of the blade and a 16" capacity to the left. Priced just under \$900, the base model offers a clever and efficient dust collection system, an easy-to-use oversized switch, better than average smooth stamped steel extension wings and an excellent fit and finish. Also included is a smooth-operating rip fence with decent accuracy and re-

HOW WE RATE TOOLS

We test a lot of tools at Popular Woodworking, and while we don't often test tools until they fall apart, we do give them an honest, real-world workout. Each issue we share the results of our hands-on experience with you and offer insights to help guide your shopping decisions. The ratings reflect the opinion of the magazine's editorial staff.

Here's how our rating system works. Performance: A rating of "five" indicates we think this tool is a leader in its category — for now. (You won't likely see performance ratings of "one" or "two" in these reviews because we wouldn't publicize an inferior tool.) Value: "Five" is a great tool for the money; "one" isn't the mark of a value. However, a low "value" rating shouldn't prevent you from buying that tool. Some tools might be worth a little more because they're one-of-a-kind or just a really great tool.

If you have a question about a tool — whether it's been reviewed or not — you can contact me at (513) 531-2690, ext. 255, or by e-mail at DavidT@FWPubs.com.

And by the way, many of our past tool reviews appear on our website at www.popwood.com, including data on entire categories of tools (such as table saws). Check it out.

—David Thiel, senior editor



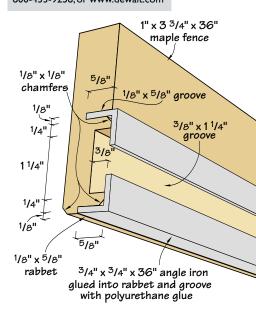
the fence later). Priced within \$50 of both the Delta and Jet $1^{1/2}$ hp contractor saws, the DW746 performs nicely. The competition offers better rip fence systems and solid cast wings, but the extra listed horsepower, low vibration and superb dust col-

lection make this a contender.

The saw really excels when you upgrade it with DeWalt's slick sliding table. The table adds another \$400 to the price tag, (totalling \$1,300), but this well-designed accessory moves effortlessly, locks in place when not in use and features a great miter fence from Osborne. The fence locks firmly to the sliding table in seconds and includes a flip-up stop for making repetitive crosscuts. Our only complaint with the sliding table system is that the fence is only 24" long, and you need 30" to crosscut a table leg. In addition to upgrading the table, you can add 52" fence rails (\$220) so you can tackle any piece of plywood.

We do have one gripe. Despite all the smart things DeWalt did with the 746, the aluminum facing on the rip fence isn't up to snuff. Out of the box, we were unable to square the fence face to the table top. The reason was the lightweight aluminum fence face had a slight crown that ran the entire length. A second fence DeWalt sent us was no better. DeWalt's engineers say their acceptable tolerance for fence flatness is .007", and indeed the fence matched that statistic. However, the fences on the four other table saws we have in the shop (from Grizzly to Powermatic) are all flat within .002". This is a critical point because if you use your table saw to cut joints (such as tenons or rabbets) the squareness of the fence is paramount. However, this is a problem you can

Performance: •••••
Value: ••••
Tested as shown above. DeWalt: 800-433-9258, or www.dewalt.com



easily fix. Either shim the fence's facing with strips of tape, which will get you close to the mark. Or you can make your own solid-wood auxilliary fence face (see diagram). This modification isn't more extreme than other adjustments we make to new machines that we test. While a good machine, we do, however, believe DeWalt's engineers should redesign the fence face to bring it in line with other table saws in this price range. With that change we would recommend the saw without reservation.

For more information, circle #160 on the Resource Directory Coupon.

Metabo's New **Line of Cordless Drills Prove Impressive**

We thought we'd seen every innovation possible in cordless drills (barring new battery technology), but then we tested Metabo's "impulse" function. Flip a switch on the back of the drill and the motor pulses in either forward or reverse. The pulsing breaks loose stubborn screws and starts screws or holes without letting the bit "walk."

We tested the BST 12 Plus, center-handled 12-volt drill/driver and were impressed by this German tool. Selling for about \$215, the BST 12 Plus features two 2-amp-hour batteries, a two-speed gearbox (0-450/0-1,600rpm), a ½" single-sleeve keyless chuck, variable speed control with an electronic brake, 20 torque settings and a whopping 466 inch/lbs. of torque. In all, the tool is balanced and a joy to use. One quirk of the drill is that the forward/reverse switch works the opposite from what you are used to. Left-handers will, as a result, love this drill.

The German-made line of new Metabo cordless drills also includes 15.6- and 18-volt drills and two hammer drills, priced from \$185 to \$290.

For more information, circle #161 on the Resource Directory Coupon.



Performance: ●●●●○ Value:

Knight's Toolworks: (503) 771-6180 http://www.knight-toolworks.com/

Surfing one of our favorite internet newsgroups the other day

Value:

Metabo, 800-638-2264

or www.metabousa.com

(rec.woodworking), I happenend upon some posts by a plane maker named Steve Knight. After checking out his

Performance: ••••

Handmade

Reasonable

Wooden Planes at

Prices

website (www.knight-toolworks.com), we had Knight send us a sample of his work. Most wooden bodied planes that come through our offices end up as paperweights. However his $8^{1/2}$ " smoother has earned a place in our shop. It comes out of the box

sharpened and ready to go. Proof of this are some test shavings taped into the planes mouth. A nice touch.

The plane body is made from White oak. The adjustable throat plate and sole are made from Ipe (pronounced "e-pay"). The strike plate is Ebony. While the plane's fit and finish doesn't match those of high-end tools, Knight's philosophy is that he wants to make a plane that works well and is inexpensive. Sacrifices are made in production to make an affordable tool, but he hits the nail right on the head because this plane functions very well. At \$85, with a cryogenically treated, ½"-thick iron, and an adjustable throat, this plane performs as well or better than planes costing much more. Once you learn how to set the iron, it is a breeze. This tool is for using, not admiring and it's a tool that you'll want to be buried with. PW

For more information, circle #162 on the Resource Directory Coupon.

TOOL SCOOP



MAKITA'S NEW ROUTERS A WELCOME ADDITION

Last issue we told you to look for a review of Makita's new routers in this issue. We've got 'em, we love 'em, but we're not done with testing yet. Suffice to say these are nice routers with lots of guts and are easy to use in or out of a router table. Next issue we'll be running a full review of the two-handle and Dhandle II-amp routers.

FEIN PLUNGE ROUTER AVAILABLE IN AUGUST

For years now we've been touting the performance virtues and durability of Fein's German-made random orbit sander, vacuum and cordless drills. We're now waiting impatiently for the company's first plunge router. This August, the model RT I 800 will be available in the United States. As you are reading this, we should have one in our shop for testing, and we'll give you the full report in our October issue. In the meantime, here are the statistics. The RT I 800 offers six speeds, ranging from 8,000 to 22,000 rpm. The motor features a soft start to reduce wear on the motor and to improve router control. The 17-amp motor also has electronic feedback control to maintain a continuous torque under load. With a 1/2" collet and a spindle lock for single-wrench bit changes, the router is user friendly. Offering a plunge depth of 3" and weighing 12 lbs., we're anxious to put some carbide to wood. The street price is expected to be about \$350 (which is a little on the expensive side), but if you haven't heard anything about Fein tools, they're worth the expense.

Tool Time for Toddlers

Some people don't think kids should be in the workshop. I say there are few places where they can learn as much.

My 3-year-old grandson loves offcuts. He'll play for a long while using one as a plow blade, scooping sawdust into various piles in some micro-world of his own devising. Unfortunately, he also loves buttons, especially buttons that do things, and his height puts the table saw, router table and scroll saw at eye level, with all these controls in easy reach.

Some say a shop is no place for little kids. I admit it's a challenge I can only take on for about an hour at a time. No real work gets done because I'm fully focused on his safety, but the time I take seems worth it.

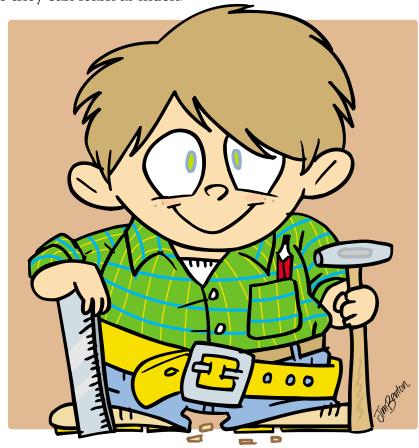
One of his favorite things in all the world is lifting the garage door key from my hand and inserting it in that magical slot to roll back the overhead door on this wonderland before him. The sight of it almost makes him shiver.

The offcut blocks are His. The little Stanley finger plane is His, as is the tack hammer and a 6" wood rule with marks on it he doesn't know how to read yet. He loves the thumb gear on the caliper, and stuffing foam earplugs into his ears and humming.

When he's with me, all power tools are unplugged and their cords wrapped up out of his way, but if I have to run the table saw or router, he stands across the room where I place his hands firmly around a support post on the lumber storage rack.

"Now, you hold that up while I run this saw," I tell him. "Because if you don't, all that stuff above your head might fall down." He's very good at it. If I pick up a power cord, he runs for his earplugs, then holds up the wood rack, and it's never fallen yet.

I let him sit on my lap and hold two pencils in his hands at the scrollsaw, using the erasers to guide wood through the blade. He concentrates so hard his tongue hangs out one corner of his mouth. When the half-moon shape popped free of the saw, it was a trophy to him, something he'd



made all by himself, using a real tool.

Very soon, we're going to make a bank with clear acrylic sides so he can see his (my) coins add up. He'll be sanding and tightening clamps at glue-up time. If I'm really patient that day, I'll let him paint it.

Aside from the fact that this is "quality time" together, and something he'll probably remember all his life, what he is learning is that he can make things.

As he grows, we won't be going in toy stores or furniture stores and opening our wallets. We'll look in his bedroom and say, "What you need in here is a desk, with at least one drawer..." and head for the garage.

I'll look at him and say, "I'll bet if you had a couple pairs of stilts around here, all the kids would come over to your house to play..." and we'll head for the garage.

Then, when he's old enough to really

help, in five or six more years, that big silver maple tree out front is just waiting with its branches spread for the ultimate tree-house project. Planning that one makes me shiver.

If I can give this little guy a sense of independence in making things the way he wants them with his own hands, maybe I can influence him to take pride in what he does. If I can teach him "precision" does count, and means a lot, I will have shown him something he isn't going to get anywhere else.

I hope when he's grown, and I trust him, we'll both be around for me to hand him his own key to that magical garage door. But whatever experience he gets out of my woodshop, I'm sure neither of us will ever question the very real value of it. **PW**

Barb Siddiqui works wood in Carson City, Nevada.