MAKE SHORT WORK OF BIG PLY SHEETS

NEW $600 TABLE SAW AIMS AT THE BIG BOYS

April 2001 #121

Popular Woodworking

Portable Planer Showdown

We shop test 9 models and separate the mighty from the meek

Face Frame Face-off

4 great joints compared

Plus

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Popular Woodworking

TOOLS & TECHNIQUES

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On the Cover

We spent weeks tweaking and working with nine portable planers. Find out who makes the best machine in this special report.

Cover photo by Al Parrish

In Every Issue

Projects

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Plane Truth

Don't go too far in pursuit of your hobby's roots.

Without a doubt, I now enjoy woodworking more than ever. It's much different now. I'm not trying to earn a living making furniture and cabinets. No clients, no payroll, no rent, no problem. When I start a project now, there's no clock ticking, the scorekeeper of profit and loss. I'm the architect/designer. Changes are easy, and I don't have to get anyone's approval. Finish not a perfect color match? I just check with myself for a waiver.

I still have high standards, really. But I can take my time and not worry about that darned clock. I now find that I can just relax and appreciate sharpening my chisels and plane irons. If I want, I can hand cut some joints. There was a time when I would rail against such chores.

I think I'm finally learning the more subtle aspects of tool selection and use. Sometimes it really is more efficient and satisfying to pick up a hand plane to pare an edge. I've learned a scraper can level a joint quicker than a belt sander. And best of all, I find a certain satisfaction from using hand tools that I never get with power tools.

All this said, however, I don't think I'm about to sneak off, join some cave clan and forsake my power tools. I know these groups are out there, and I don't mean to put them down. More power to them (I couldn't resist). For me, there are just some tasks that need some horses to get the job done, usually between one and three, as in good ol' horsepower.

I know this in my heart. But every once in awhile I like to do a reality check. My dose of reality in this case came in the form of unplugging my jointer and planer and flattening a board with hand tools.

It wasn't a big board, just about 9" wide by 30" long. How much reality can one take? But to be fair, I didn't grab some "pansy" board like pine, I went for birch. However I was lucky to have the right tools for the job: a sharp scrub plane and an equally sport-tuned smoothing plane.

So I went to work. After five minutes I was making real progress with the scrub plane. It hogs off material. I inspected my work as I stripped down to my T-shirt since I was breaking a sweat. Back at it, I continued working diagonally in each direction across the board to remove the high spots. Every few minutes I'd check the surface with a straightedge to measure my progress. After about 15 minutes, the birch board was pretty flat. About five minutes later the smoothing plane had cleaned up the surface and my grand experiment looked presentable. Total elapsed time, about 20 minutes. Sure, I felt a little exercised, but I wasn't going to need the Ben-Gay at bedtime.

After five minutes I was making real progress with the scrub plane. It hogs off material. I inspected my work as I stripped down to my T-shirt since I was breaking a sweat.

I concluded a couple of things. I really like my jointer and planer and can be at peace with the noise and dust they create. While flattening a rough board by hand may be an interesting experiment, there's no way I'd work this way regularly. Lastly, if I were a joiner or cabinetmaker in 18th-century America, I'd make sure my shingle was hung out in a colony where indentured servants were quite legal.

If you're like me and want to keep your scrub plane on the shelf, I think you're going to enjoy our review of portable planers and the tricks to getting the most out of them in this issue. **PW**

Steve Shanesy

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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!**

Readers find relief from compound miters

Yes, it's True, Contributing Editor Nick Engler is Psychic

Recently I made a four-sided pitched roof for my bird feeder. I made models out of cardboard to see what angle would produce the desired pitch.

To make a long story short, I got it done with a lot of trial and error. Then I tried to figure out the math. I think I got close, but the more I tried, the more confused I got. I was thinking of writing to *Popular Woodworking* to see if you could produce in your magazine a formula for figuring compound angles.

I never got around to writing, and I was surprised to see just what I was looking for in the December 2000 issue ("Compound Miters for Dummies" by Nick Engler, issue #119). It was like you were reading my mind. The only thing that wasn't clear was where the slope angle was measured from. An illustration would have been helpful.

George F. McCullough
Peabody, Massachusetts

Editor's note: We've received an enormous amount of mail thanking Nick Engler for writing this article. You can download Nick's Excel spreadsheet calculator for compound miters from our website at www.popularwoodworking.com.

As to explaining the slope, I think you're right, an illustration would have been helpful. Check out our website to see a drawing that explains how the slope is measured from the horizontal.

Save Money When Buying Timberwolf Band Saw Blades

I enjoyed seeing Timberwolf band saw blades mentioned in the latest issue of *Popular Woodworking* (Endurance Test, December 2000, issue #119). I was very disappointed to see you give credit to PS Wood as the source. If you want much better prices, go to the source at Suffolk Machinery. You can check out their direct pricing, which beats (by a mile) the price anyone else sells their blades for, at www.suffolkmachine.com.

The site is also chock full of information on band saw blades in general and lots of detail on the company. When I ordered a batch of blades for my Jet 14" band saw with riser block, I got a 20-minute detailed lecture on the history of the company and how to get the best results from their blades. I paid less than $15 for a ¾" x 105" resaw blade and less than $12 for a ¼" x 105" blade.

I think your magazine excels in helping woodworkers get the most for their money, but this is one time when you missed the mark.

Craig Daymon
Lakemoor, Illinois

One Reader Gets Started on His Woodworking Homework

I picked up the August 2000 issue of *Popular Woodworking* for the hundredth time. I don't know why, because I've been like many others in thinking the projects in this magazine were too complex for a beginner, and I have no formal training, just a lot of time and expensive equipment. I read "Out on a Limb" ("Every Good Teacher Assigns Homework," issue #116) and it answered my questions. Don't know why it didn't set in earlier. I just ordered the two books you recommended. I appre-

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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- **Fax: 513-531-0919**
- **Mail carrier: Letters • Popular Woodworking • 1507 Dana Ave., Cincinnati, OH 45207**

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ciate you taking the time to write about making things a little easier.

Larry A. Barry, DDS
Amarillo, Texas

Editor's note: Many beginners are frustrated by the complexity of casework; it's easy to bite off more than you can chew. And that's why I recommend beginners use woodworking books to supplement what they learn from magazines. In addition to the two books I recommended in that column (Bill Hylton's "Illustrated Cabinetmaking" [Rodale Press] and "The Encyclopedia of Joint Making" [Popular Woodworking Books]), I also recommend you check out "Nick Engler's Woodworking Wisdom" (Rodale Press).

Why are the Parts for the Dovetail Jig So Big When the Jig is Small?

I want to compliment Jim Stuard on his dovetail jig article in the December 2000 issue. I am anxious to make and use this jig. But I do have a question. In the article Jim calls for a ¾"x 6" x 36" "sandwich" of plywood and hardwood. My question is: Why do you need a 36" length? The jig is 6" long. Thanks for publishing such an informative magazine.

Richard Johnson
Wytheville, Virginia

Editor's note: We neglected to mention why we made such a big "sandwich," and it's confused some readers. Essentially, by making a 36"-long piece you will have a lot of stock left over that you can use to make more jigs or replace the first one. You could, for example, make a jig that cuts joints with a greater or lesser slope. Also, the extra length makes the angles safer to cut when using your table saw and miter gauge. **PW**

CORRECTIONS

In the "Dovetail Jig" article in the December 2000 issue, there is one correction. The two 2⅛" dimensions on the drawing should be 1⅝". The cutting list is accurate.

In the "Best New Tools of 2000" article, also in the December issue, we listed the model number for Dremel's new scrollsaw incorrectly. It is a model 1680.

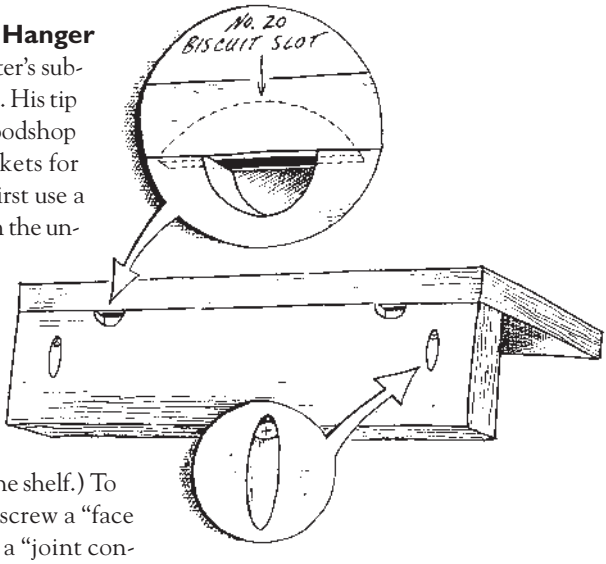
Illustrations: John McCormick

Hang a cabinet without hardware or French cleats

THE WINNER:

Invisible Cabinet and Shelf Hanger

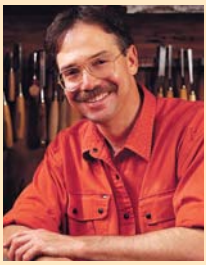
A man of few words, Robert Porter's submission included mostly drawings. His tip is to use a couple of common woodshop tools to make flush-mount pockets for hanging cabinets and shelves. First use a biscuit cutter to make a #20 slot in the underside of the shelf or cabinet top. Then use a 3/4" Forstner bit to make an access hole in the shelf support or cabinet back. (As shown in the drawing, Porter uses pocket screws, which are commonly used in face-frame joinery, to attach the support to the shelf.) To mount the shelves on the wall, screw a "face frame" screw (sometimes called a "joint connector screw") into a stud in your wall. The screw has an oversized 9/16" head that will nest right into your biscuit slot.



Robert Porter
Clinton, Ohio

TRICKS OF THE TRADE FROM THE AMERICAN WOODSHOP

GREETINGS FROM 'THE AMERICAN WOODSHOP'



As host of "The American Woodshop" I've collected a lot of tips, tricks and great woodworking ideas over the years. Some are basic helpful hints, while others are just good common-sense solutions to everyday problems. I'm happy to share these with you here. In addition to my ideas, we pick the best tip or trick sent in by a reader and publish it on these pages as well. Delta Woodworking Machinery is the sponsor for the Tricks of the Trade column, and the company is giving away a model 46-250 Midi-Lathe (shown at left) to the best "trickster."

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

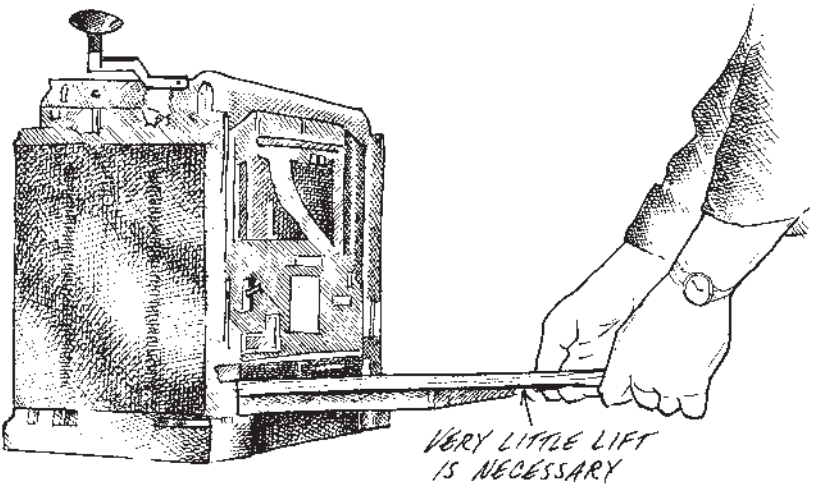
- Scott Phillips

DELTA MACHINERY

A Little Pressure Removes a Lot of Snipe

Good news! There is an easy way to reduce (and usually eliminate) snipe from your planer. What's snipe? That's when your planer takes a little bigger bite off the ends of your boards. Here's what to do: First tune up the planer according to the instruction manual. Then, if you still get snipe, try gently lifting the end of the board being planed as it starts on the infeed side of the planer. Snipe occurs when only one feed roller is holding the board and the board is lifted into the rotating cutterhead. This happens during the initial infeed and the final outfeed — approximately the first 3" of infeed and last 3" of outfeed.

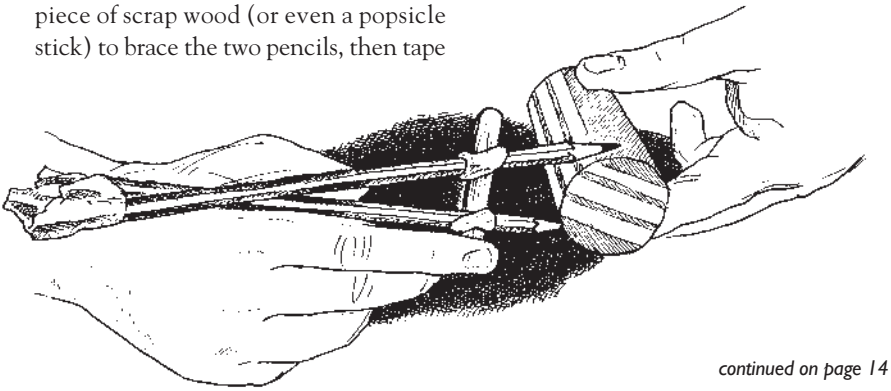
So if you lift the far end of the board (that is the section farthest away from the planer knives) to gently coax the board to stay flat on the planer bed, snipe will be minimized. And remember never to reach under the planer body at any time while it is running. Always keep your hands and fingers safely on the far ends of the board. Try this tip — it works.



My Duct-Tape Tool

Dividers and calipers are useful tools that every woodworker needs from time to time for various jobs. Here is a quick and cheap divider that works. Grab two sharp pencils and about 12" of duct tape. Tape the two eraser ends together with a short piece of the tape. Spread the two taped pencils to the desired width by using a ruler to set the distance from point to point. Use a small piece of scrap wood (or even a popsicle stick) to brace the two pencils, then tape this low-cost divider together at the joints.

This is an inexpensive way to make many marking dividers for layout work. Each can be set and labeled for different dimensions. I also recommend a trip to the local office supply store to buy white marking pencils. White lines are much easier to see on dark woods such as walnut.



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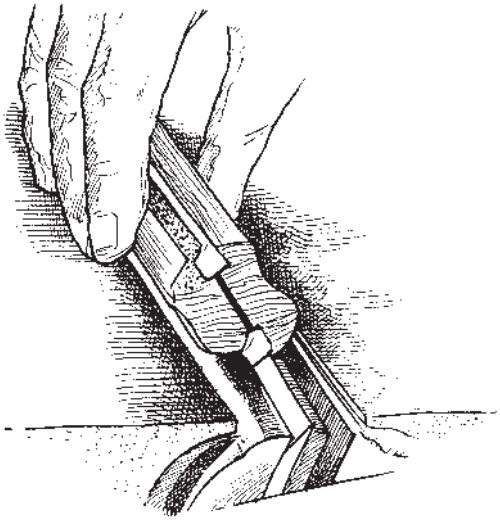
Keep Your Knives Super Sharp

Grinding planer or jointer knives is a job best left to professional sharpening shops. Yet many times the home woodworker can use a 600-grit diamond sharpening stone to touch up the knife bevels without removing the knives from the cutterhead.

Get yourself a honing jig for planer and jointer knives that sells for about $30. The diamond ones are worth the money. These jigs are small enough to fit on planer and jointer knives without removing them. The trick here is to hold the diamond stone flat on the bevel of the knives and stroke the bevel until the cutting edge is sharp.

First you need to lock the cutterhead in place. A great way to stop it from rotating on a planer is to clamp the drive pulley to a block of wood. Make sure you have a spray water bottle to keep the diamond stone moist, yet not dripping wet. And don't get water between the machine head and the knives. The resulting rust could become a real problem.

Most of these honing jigs are designed so that one part of the stone sharpens the bevel, and the other edge sharpens the back of the knife. Sharpening the back removes the burr you create when you sharpen the bevel. After you're done, remember to dry all the parts. I also recommend spraying the knives and cutterhead with a Teflon spray product to reduce the cutting friction, keep the blades cooler and reduce resin build-up. All this adds up to a machine that works better and knives that stay sharp longer. **PW**



Bridgewood Shaves $150 off the Price of a Premium Table Saw

We've commented a number of times on the bargains available on contractor table saws in today's market. The performance of these machines continues to improve, and a number of manufacturers now offer quality units with a premium rip fence for about $750, so it's a great time to be shopping for a table saw. But hold on! The market just got a little more competitive. Bridgewood has just introduced a left-tilt 1½-hp contractor table saw with a Biesemeyer-style rip fence for less than $600! We've tested it, and it's a great buy.

The TSC-10CL performed nicely in our shop, especially considering its price. The handles, which are cast metal instead of plastic, moved smoothly. The motor performed well in a variety of cutting applications. The switch is conveniently mounted on the left side of the fence rail, and forward enough to be easily accessible. The fence system moves smoothly and is accurate, plus it has aluminum faces on both sides that have a T-slot for attaching stops or fixtures. (While the T-slots in the fence are very handy, they seem milled for a metric bolt, so be aware of that necessity.) And Bridgewood even includes a 4" dust port for the underside of the saw.

I did run into a few things worth mentioning that aren't a real surprise considering the low price. The saw included only one solid cast wing (which was dished .01" at the center); there's no wing or support table to the right of the blade. The drive belt supplied had a serious kink in it, though the machine's vibration was still within acceptable levels. The saw was shipped without a blade, which I consider a wise decision on price-driven saw models as the blade included is usually disposable. The overall fit and finish of the saw wasn't pristine, but was within the acceptable range.

The fence system met my expectations very well, though I did have to add some masking tape behind the faces to adjust them to square with the tabletop. The scale on the fence is easily readable with the built-in magnifying lens, and is graduated in 1/16" increments. It was necessary to shim the fence's infeed bar with washers during assembly to raise the fence to an appropriate level, but this adjustment is covered in the assembly instructions and caused little problem.

Overall, I rate the TSC-10CL as a great saw for the price. If you require a few more niceties, you'll have to look to the $750 models, but this saw isn't missing much. And if a left-tilt saw is important to you, this is the only one below the $740 level.

— David Thiel

SPECIFICATIONS:

TSC-10CL Contractor Saw

Street price: $595, plus shipping
Motor: 1½ hp/18 amp, 110/220v
Max. cut depth: 3¼"
Dado width: 13/16"
Table size: 27" x 30"
Weight: 297 lbs.
Fence: 30" Align-A-Rip
Performance: ●●●●○
Value: ●●●●●
Wilke Machinery 800-235-2100, or www.bridgewood.com

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

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How We Rate Tools

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

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

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

—David Thiel, senior editor

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Vaughan Adds Mini-Bear Saw to Line of Japanese-Tooth Pull Saws

When cutting dowels flush to a cabinet, there's no better tool than what the Japanese call a "kugihiki" saw — a flexible-blade tool that has no set to its teeth. Because there's no set, the teeth won't mar the surface.

Now Vaughan & Bushnell Manufacturing has added one of these saws to its respected line of Japanese-style saws. The Mini-Bear Saw has teeth on both edges of the saw, which is a tad unusual, but it works great. Like the rest of the company's line of pull saws, the Mini-Bear has a replaceable blade and the tool is tough and rugged. Unfortunately, the handle is hard plastic, instead of the soft rubber grip we prefer on the other Bear Saws. Priced at $16.50, this is one of the less expensive kugihikis on the market (most are $20 to $25). If you're still using a belt sander to cut down your dowels, get one of these for your tool box.

— Christopher Schwarz

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

SPECIFICATIONS:

Vaughan Mini-Bear Saw
Street Price: $16.50
Material: Spring steel, plastic handle
Size: 10" saw with 5½" blade
Teeth: Two sides, 21 tpi/17 tpi
Performance: ●●●●○
Value: ●●●●○

Vaughan 815-648-2446, or www.vaughanmfg.com

Woodcraft 'Drill Sargent' Drill Press Hold-down is Ingenious but Expensive

The one machine that most woodworkers have but don't think much about is the drill press. It's always there for those times when we need it, but we don't spend a lot of time building jigs for it. Well Woodcraft has come up with a way to get us to use it more often. The Drill Sargent (yes, that's the correct spelling) is a hold-down that eliminates the need for a lot of clamps around the drill press.

It is essentially a spring-loaded piston (with a foot mounted to one end) that's attached to the quill of your drill press. When the quill is lowered, the foot moves with it and engages the workpiece before the tip of your bit does, holding the work in place. When the quill is raised, the foot holds the workpiece in place until the bit exits the wood. We think it's simple, smart and a great extra hand for working with flat pieces to keep them from spinning, or for chain-drilling mortises without having to move the clamps after each plunge.

The tension on the spring can be adjusted between 30 and 180 pounds, and the foot can be adjusted to accommodate brad-point or Forstner bits. Assembly is fairly simple, but will be a little different on each drill press. In my case the jam-nut depth gauge on our Ryobi had to be removed to mount the Drill Sargent, but that's OK because there is a jam-nut depth stop mounted on the threaded rod of the Drill Sargent. Adding this accessory also reduces the throw of the quill by ¾".

The location of the Drill Sargent's foot must be adjusted as you change bits. This is accomplished by loosening and retightening an Allen-head cap screw at the front of the fixture. Because this is an operation that will be done fairly often, I'd suggest adding a ratchet handle to this screw so it becomes a toolless operation. While I found this fixture a great addition to the drill press, the $90 price tag made me think twice about its value. If you could attach this to a mortiser, then almost any price would be acceptable. In the end, you'll need to decide if the price fits your wallet.

— David Thiel

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

SPECIFICATIONS:

Drill Sargent Hold-down
Street price: $90
Bit capacity: Up to 2" in diameter
Clamping pressure: 30-180 lbs.
Drilling depths: Up to 2½"
Materials: Cast iron and aluminum
Performance: ●●●●○
Value: ●●●○○

Woodcraft: 800-225-1153, or www.woodcraft.com

Bench Dog RT100 Router Table

I learned to use a shaper a decade before I used a router table, so my expectations of router tables have always been a little demanding. While today's routers are up to most tasks short of running stair banisters and making frame-and-panel doors for a production shop, the router tables haven't always been that versatile.

Recently, high-end router tables have become popular in the home shop because they offer many of the functions of a shaper for less money. However, a lot of these tables seemed too pricey. Then, two years ago, we got a look at Bench Dog's ProTop RT100.

From the moment we took the tool out of the box we knew that the manufacturer had done something right. The attention to detail was impeccable and the table went together like a piece of finished furniture. The knockdown hardware was easy to use, strong and fit perfectly. Even the European hinges used to hang the cabinet door were well thought out.

When we got to the important part — the table and fence — the quality continued. Twelve independently adjustable levelling screws ensure the insert is flush to the tabletop. It takes a little time to get the plate set perfectly; but once done, it's very nice. The well-machined aluminum extrusion fence offers easy adjustability front-to-rear and side-to-side with no tools required. The replaceable MDF subfences are of good quality, and also adjust without tools. A simple plastic shroud fits into the back of the fence, offering easy connection to dust collection. A safety shield that slips into one set of aluminum T-slots on the fence provides protection from spinning bits. The T-slots also do double duty for featherboards (available as an accessory) and an aluminum track mounted to the front of the table also provides hold-down space for other featherboards, or as a miter-gauge track that is adjustable to provide a snug fit. Another nice feature of the fence is the ability to offset the fence to use it as a jointer.

Why We Still Like This Tool

The portability of this tool is great. Light enough to slip under the workbench when not in use, it quickly sets up in minutes. The precision continues to be unquestionable, with no loosening of parts. The cabinet has held up to our less-than-dainty handling, proving the materials and construction are quality.

While new router tables crop up fairly often, we continue to be impressed with the quality and performance and very reasonable price of the Bench Dog. The company continues to offer accessories to upgrade the unit, including a fence riser attachment and insert plates that are predrilled for individual router models.

We have only a few recommendations for improvement. A bottom with more overhang at the base of the table would make it easier to clamp it to a work surface. Though the insert plate levels out very precisely, the hole in the center is of a fixed size. An adjustable opening (like on the Rousseau inserts) would be an excellent addition, or cut the recess so the Rousseau plates would fit. Also, some provision for a starting pin on the insert plate would be helpful. **PW**

— David Thiel

SPECIFICATIONS:

Bench Dog ProTop RT100

Street Price: $200
Dimensions: 16" w x 22" x 18" w/fence
Weight: 35 pounds w/o router
Materials: MDF, laminate, aluminum fence
Insert: 3/8" thick acrylic
Jointer Settings: 1/32" or 1/16"
Fence Length/Height: 22" x 3 5/8"

NICE FEATURES:

- **Great versatility**
- **High quality, reasonable price**
- **Very easy assembly, well designed**
- **Portable**

RECOMMENDED MODIFICATIONS:

- **Larger clamping area**
- **Starting pin for insert plate**
- **Adjustable opening on insert plate, or make adaptable to existing accessories**

Bench Dog: 800-786-8902, or www.benchdog.com

ABOUT OUR ENDURANCE TESTS

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

POPULAR WOODWORKING
APRIL 2001

Hitachi FDS10DVAL Cordless Drill Kit

I first wrote nice things about this drill/flashlight set in our very first e-mail newsletter in May 1999 (visit www.popularwoodworking.com to subscribe for free). I've been using the tool since November 1998, and it still deserves a place of honor in my shop. It's not the most powerful 9.6v drill on the market, but I paid $85 for it two years ago, and the darn thing is great.

The model FDS10DVAL has plenty of power for any household chore and everything but the most demanding workshop applications. It has all the features of a much more expensive tool, and it comes with an adjustable-head flashlight that is better than many stand-alone flashlights.

After two years of use the set is holding up well. Even after hundreds of charges, the batteries still take and hold a good charge, and the gears still perform well on all the clutch and speed settings. I've dropped the thing I don't know how many times, and I've finally managed to crack one of the battery casings, though the battery still functions fine. Though I've not had any problems with it, the forward/reverse switch seems a little fragile, and the plastic skin of the drill can be slippery in the cold or when wet. And lastly, the battery's footprint is a little small, which makes this drill tricky to balance on your bench when you set it down. Save yourself some frustration and learn to set it down on its side instead of on the battery. In all, however, these are minor quibbles that shouldn't stop you from purchasing this set.

What should stop you from purchasing this drill is if you have unrealistic expectations. I recently read a review of this tool on the Internet by a guy who was pleased with his purchase but was disappointed with the drill's performance when using a masonry bit. Let me clear this up. *No* 9.6-volt cordless drill should be used with a masonry bit. To expect that of this or any other low-voltage cordless drill is just silly. However, if you're looking for a drill up to the task of drilling up to ½" holes in wood, driving home a good number of 2" x #8 screws, or just putting together a piece of knockdown furniture from the store, a 9.6-volt drill is a fine choice. And as 9.6-volt drills go, the Hitachi FDS10DVAL is a great performer at an amazing price.

At press time, I went on-line and found this drill/driver kit for sale at Coastal Tool (www.coastaltool.com) for $70 plus $5 shipping — the lowest price we've seen. **PW**

— David Thiel

Photo by Al Parrish

SPECIFICATIONS:

Model FDS10DVAL
Drill/Driver & Flashlight

Street Price: $70 - $85
Battery: 9.6 volt, 1.2 amp hour (2)
RPM: 0-280/0-850
Max. torque: 130 inch-lbs.
Clutch settings: 5
Charger time: 1 hour
Weight: 3.3 lbs.
Chuck: ⅜" keyless
Brake: Yes

NICE FEATURES:
- **Great price, flashlight, two batteries, two speeds, electronic brake, quality construction, only five clutch settings**

RECOMMENDED MODIFICATIONS:
- **Add a soft skin for improved grip**
- **Beef-up the forward/reverse switch**

Hitachi: 800-706-7337, or
www.hitachi.com

Sawing Particleboard and Plywood

Precision cutting with a hand-held circular saw.

I'd like to know who it was that decided that plywood was best sold in 4-foot by 8-foot sheets. I've always thought that it was a practical joke in questionable taste to take such a wonderfully useful woodworking material and manufacture it in sheets that are bigger than most woodworkers.

More to the point, sheet materials are larger than the capacity of most woodworking machines. You can't cut them safely on a garden-variety table saw without first chopping them into smaller pieces. Consequently, making precise cuts in sheet goods is a two-step process for most woodworkers. First you cut the sheets into manageable sizes with a circular saw, then you trim the pieces to precise dimensions on a table saw. You can buy a panel saw or a sliding table for high-end table saws, but these are expensive pieces of equipment. And even if you can afford them, do you have space to use them? A panel saw, for example, takes up an enormous amount of wall space that most of us don't have. I would much rather preserve the walls of my workshop as God intended – hung floor to ceiling with unfinished projects.

Photos by Al Parrish

Making a Circular Saw Guide

Fortunately, there is an inexpensive, space-saving and ridiculously simple solution to this problem. You can make precision cuts in plywood and other sheet materials with an ordinary circular saw using a jig that that relies on the straightness of the outside edges that come with every piece of plywood.

The outside edges of a sheet of plywood as it comes from the manufacturer are commonly called factory edges. They are too rough to use in assembly, but they are usu-

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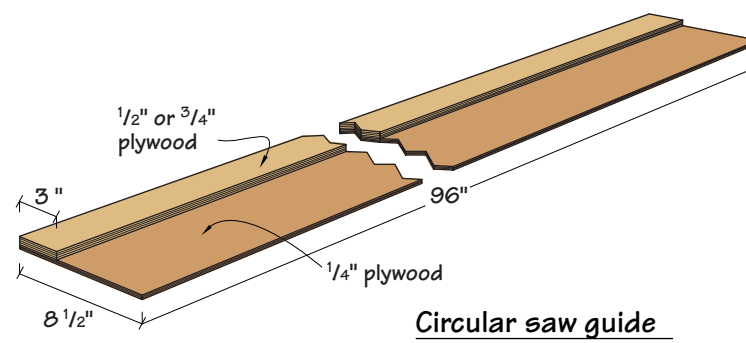

Circular saw guide

After measuring the plywood and marking the beginning and end of the cut, align the base of the saw guide with the marks. The saw guide should be on the "save" side of the cutting path, and the tommy bars of the clamps must point down. If the bars stick up, they may interfere with the circular saw.

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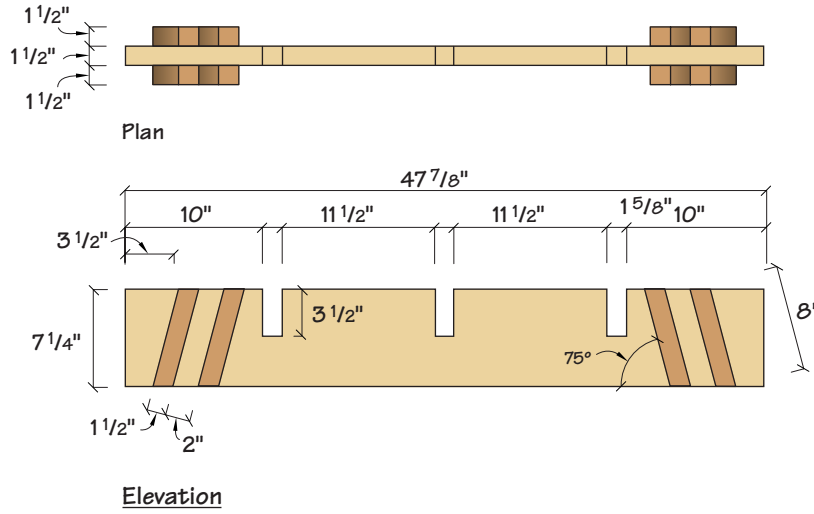


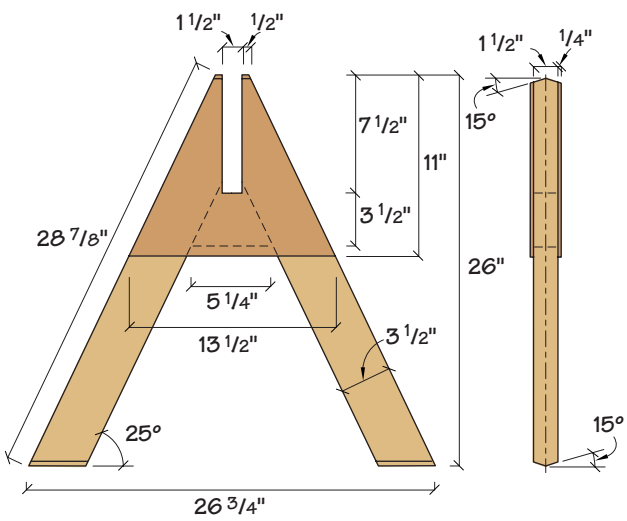
The cutting grid breaks down when you're not using it and stores against a wall, along with the circular saw guide. The grid is so useful however, that mine is set up more often than not.

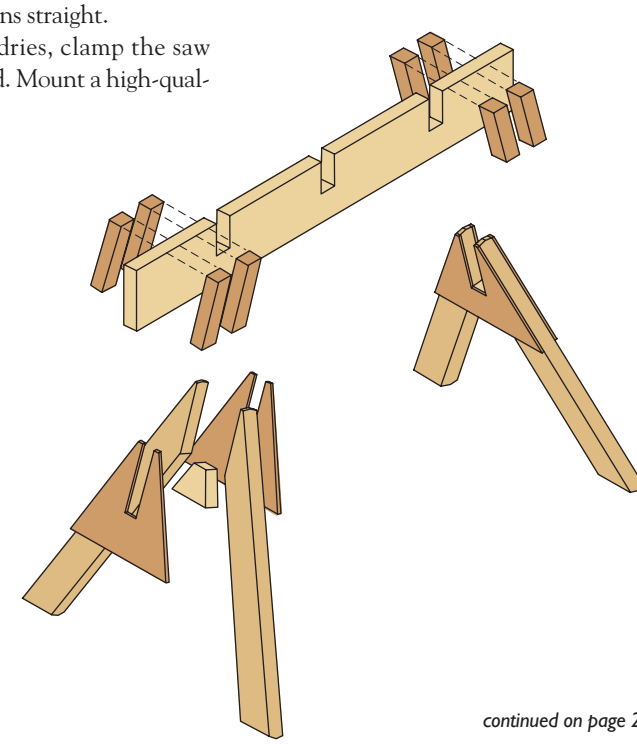
ally dead straight. Consequently when you buck up a sheet of plywood to trim on a table saw, it's a good idea to make sure each piece has a factory edge. Most craftsmen begin trimming operations by guiding this factory edge along the table saw rip fence – this creates another straight edge.

Instead of using the factory edge as a guide to trim the plywood on a table saw, I skip the trimming altogether and use a factory edge to guide a circular saw. To do this, you must make a circular saw guide.

Select a sheet of cabinet-grade ½" or ¾" hardwood plywood. With a circular saw, trim a 3"-wide strip from one of the 8'-long edges – this is the guide. To make the base, trim another strip 8½" wide from a sheet of ¼" plywood. Glue the guide and the base together with the sawed edge (not the factory edge) of the guide aligned with one of the edges of the base. Tip: The 3"-wide guide is narrow enough to bend, so check the assembly as you glue the parts together. Sight along the factory edge (or better yet, stretch a string along it) to make sure the guide remains straight.

When the glue dries, clamp the saw guide to a long board. Mount a high-quality carbide-tipped combination blade on your circular saw. This is important! For you to make precision cuts with any saw, you need a precision blade. Place the shoe of the saw on the base with the edge against the guide. The saw motor should overhang





Leg Assembly

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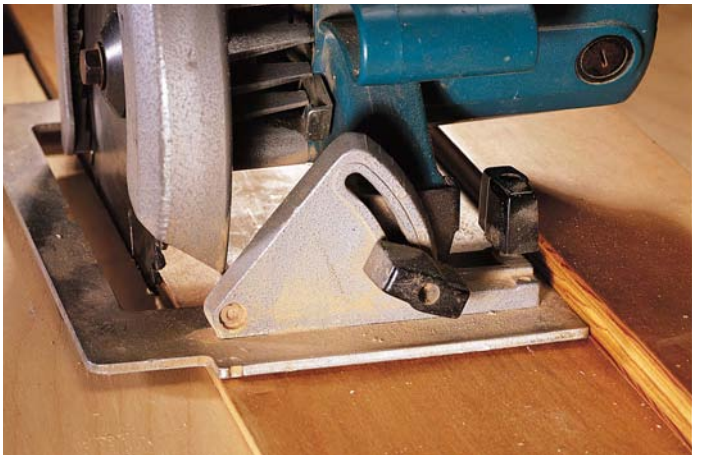


Make the cut with the circular saw motor hanging over the guide – this arrangement provides the most support for the saw and keeps it from tipping.

the guide. Trim the base so the distance from the guiding edge to the base edge is exactly the same as the distance from the edge of the shoe to the saw blade. This makes it a cinch to set up for a cut, as you'll see in a minute.

Making a Cutting Grid

Before you get to the cutting, however, I suggest you make one more jig – a cutting grid to properly support the plywood while you're laying out the parts and sawing them. My "grid" consists of two knock-down sawhorses. The horizontal beams of these sawhorses are notched to hold ordinary 8'-long 2 x 4s. When set up, the top edges of the beams are flush with the top edges of the 2 x 4s. This arrangement supports a sheet of plywood of any size edge-to-edge and end-to-end to keep it from sagging.

This grid is one of those truly indispensable jigs. Once I made one, I couldn't imagine how I did without it. Not only is it useful for sawing, it also makes a great assembly table for large projects. On occasion, I've used it as a clamping grid for odd-shaped assemblies. And I always seem to employ it as a drying rack when I'm finishing a project. Even though I made the cutting grid to break down, it spends most of its time set up.

Making a Cut

Place the plywood on the cutting grid. If it's a small piece, rest it over a sawhorse beam and a stringer so it's supported in both directions. Measure the plywood and make two marks to indicate the beginning and end of the cut. If you were to draw a line through these marks, there is a "save" side of the line (the piece you're going to save) and a "waste" side. Place the saw guide on the plywood over the "save" side and align the trimmed edge of the base with the marks. Clamp the guide to the plywood with two small (2") C-clamps.

Adjust the depth of cut of the circular saw so the blade protrudes just 1/16" to 1/8" below the underside of the plywood as you make the cut. The saw will bite into the top surfaces of the cutting grid; this can't be avoided. But it won't weaken the supporting structure as long as the cuts are shallow. Tip: When cutting across the surface grain of a sheet of plywood, you can prevent the veneer from splintering or "feathering" by scoring along the edge of the base with a utility knife before you make the cut.

Just how accurate is this system? Very, which some folks will find surprising given the simplicity of the jigs and tools involved. I have now built the cabinets for two complete kitchens and scores of shelving systems using a circular saw as my primary cutting tool. I'm convinced that I couldn't do any better with a sliding table or a panel saw. **PW**

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

Inlaid Rocker

When I decided to build an Arts and Crafts rocker, I wanted something a little lighter in looks than most recognized Arts and Crafts pieces. Many of the chairs can look a little chunky and heavy for my taste. This design was produced by the Limbert Furniture Co. of Grand Rapids, Mich., about 1910. Charles Limbert was a contemporary of Gustav Stickley, but much of his work had a stylized appearance, adding cutouts, sweeps and inlays to separate his work from more austere Arts & Crafts designs.

Design and Layout

First draw a full-scale side and top view of the chair. The drawings help answer questions about construction and what joints to use. They also let you make mistakes that an eraser can correct. I suggest you take the information from the Schedule of Materials and the diagrams and make your own full-size elevation and plan view drawings.

Building the Legs

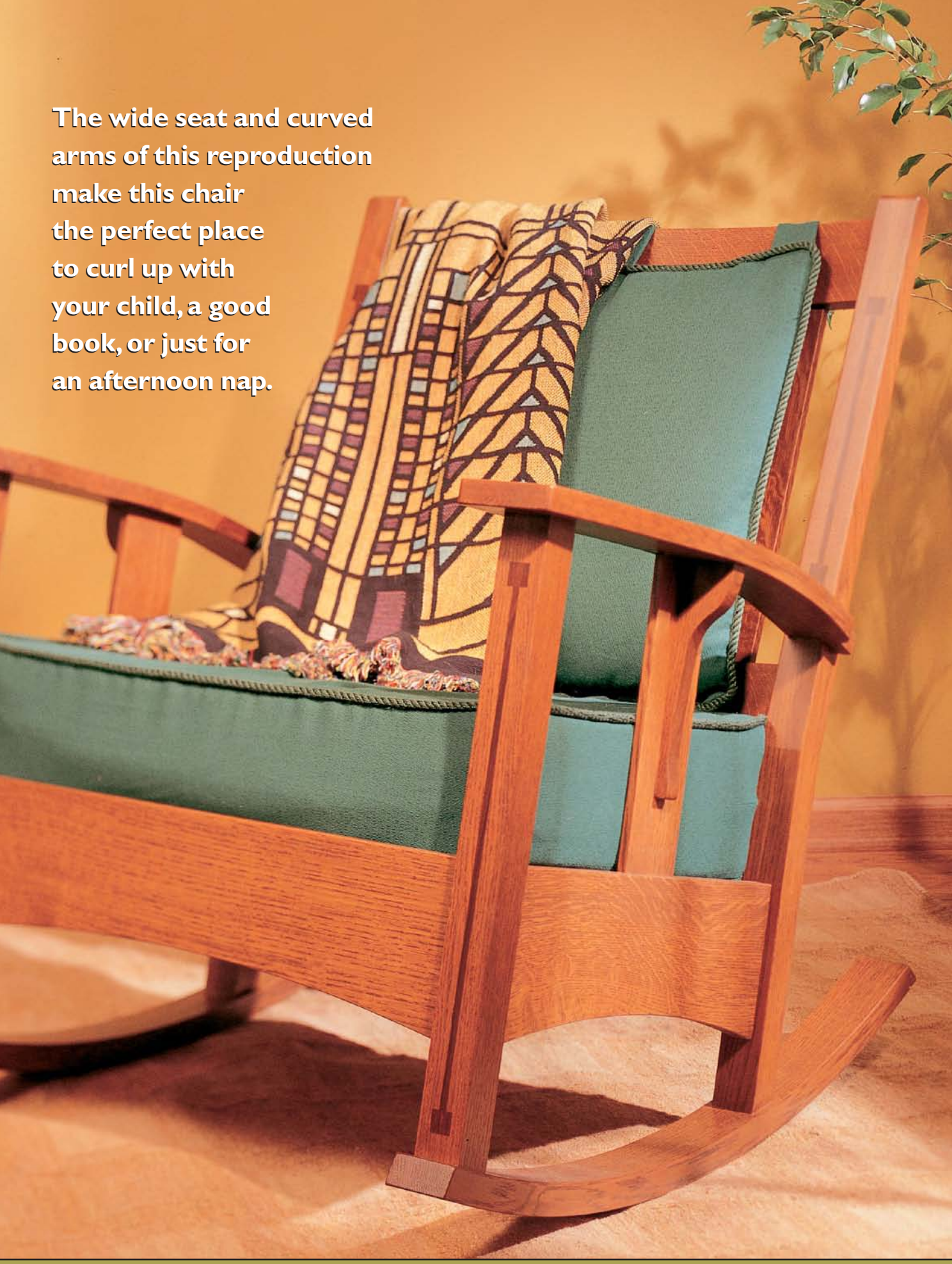
Start construction with the legs. The front legs are simple, but remember to orient your wood to show the most attractive face forward. The back legs, with their dog-leg shape, require a routing template. Start by rough-cutting a blank for each leg on the band saw. Next, lay out a ½"-thick plywood template using the dimensions given in the diagrams, then attach it to the blank with flat head screws on the inside of each leg. Put the screws at the mortise locations so the holes won't be seen. Use a router with a template routing bit to shape each leg, and be sure to make one right and one left leg.

Routed Inlays

With the legs shaped to size, lay out the location for the inlays on the front faces of each leg. Start the inlay work by routing the ⅛"-deep x ¼"-wide groove using a straight bit in a plunge router. Next, cut the inlay strips to ¼" x ¼", to fit a little snug in the width for fitting. This also leaves the inlay proud, to be leveled out once the inlay is glued in place. Walnut works well for the inlay. To glue it in place, put glue into the groove, insert the inlay, and then use a caul and clamps to press the inlay into place. Set these pieces aside to dry for several hours or overnight. After leveling the inlay flush to the leg with a plane, I used a mortiser to create the ¾" x ¾" square holes to finish the inlay pattern.

by Jim Stack

Photo by Al Parrish



The wide seat and curved arms of this reproduction make this chair the perfect place to curl up with your child, a good book, or just for an afternoon nap.

Start the inlay work on the four legs by using a router with an edge guide to rout the ¼"-wide channels for the inlay.

The square ends of the inlays can be done with a mortiser, as shown here, or you can use a router with a template and use a chisel to square out the corners.

Laminated Bending

Now comes the fun part, bending. All the radii are the same, so you have to make only one bending jig for the rockers, arms and back rails. Medium-density fiberboard (MDF) is a stable and affordable material for a bending jig. The longest bent pieces are the rockers, so cut the six ¾"-thick jig pieces about 42" long and 8" deep. Next, use a set of trammel points to strike the radius (shown on the diagram) on one of the MDF panels. Rough cut to the outside of the line and then sand to the line. Then use a flush-trim router bit and this first jig part to duplicate the radii on the other five pieces. When the matched layers are placed together, the 4½" width works well for the arms. Layers can be removed as needed to glue up the narrower parts.

Lamination bending is simply bending thin strips of wood over a form and gluing them together. This is a good way to bend wood because the wood remains stable, the grain patterns of the original face remain when bent, and the final lamination is very strong.

Start the lamination process by cutting pieces for the rockers, arms, and back rails. Cut them ¼" wider and longer so you can trim them to size after glue-up. Resaw the blanks into strips a little thicker than ⅛", keeping the pieces in order as they come off the band saw. Next, drum sand or plane the strips to ⅛" thick.

Glue Up the Lamination

At glue-up time, have your clamps handy. Be sure to wax or seal all the surfaces on the jig that will come into contact with glue, so the dried glue can be easily removed. With the wood strips in order, apply thinned wood glue to each strip. Then put the whole assembly on the form with a ½"-thick piece of plywood to serve as a caul to even out the clamping pressure. Put the first clamp in the center of the assembly, with the next clamps working out to either end. The clamps should stay in place for *at least* two hours.

In gluing up the laminations, I use a brush to cover every square inch of the wood face. I thin the glue with a little water to make it easier to spread.Thinning will not affect the holding power of the glue. The glue run out on the sides is a good sign that all surfaces are bonding.

Gluing and Cutting the Back Rails

Because the back rails are 3½" wide, I used only five MDF layers for the bending jig. You'll need seven ⅛"-thick strips for each of the rails. Apply glue and put the rail assembly in the center of the jig. When the laminations are dry, scrape the glue off one edge and use a jointer to flatten and square that edge. Then cut the blanks to 3½" wide using the table saw.

Gluing and Cutting the Rockers

The rockers are 2¼" wide, so I left four layers in the jig. I used 10 strips for each rocker. Glue the strips as before, and when dry, square and cut them to width. Next, lay the rockers on the full-size drawings and mark the angles on each end. Cut these angles on the table saw using a miter gauge with a 30" wooden fence attached. Hold the rocker on its side, tight against the fence with the curve arching away from your body. Adjust the miter gauge angle until it matches the angle you want to cut on the end of the rocker. Do this for both ends of the rockers, then set them aside.

Gluing the Arms

Each arm requires seven ⅛" x 4½" strips, and I used all six layers of the bending form. The arms are radiused only on the back half of the arms, so I clamped to only 13" at one end of the radius form (see photo).

When the arms are dry, scrape the glue off one edge, joint that edge, then cut the blanks to 4¼" wide on the table saw.

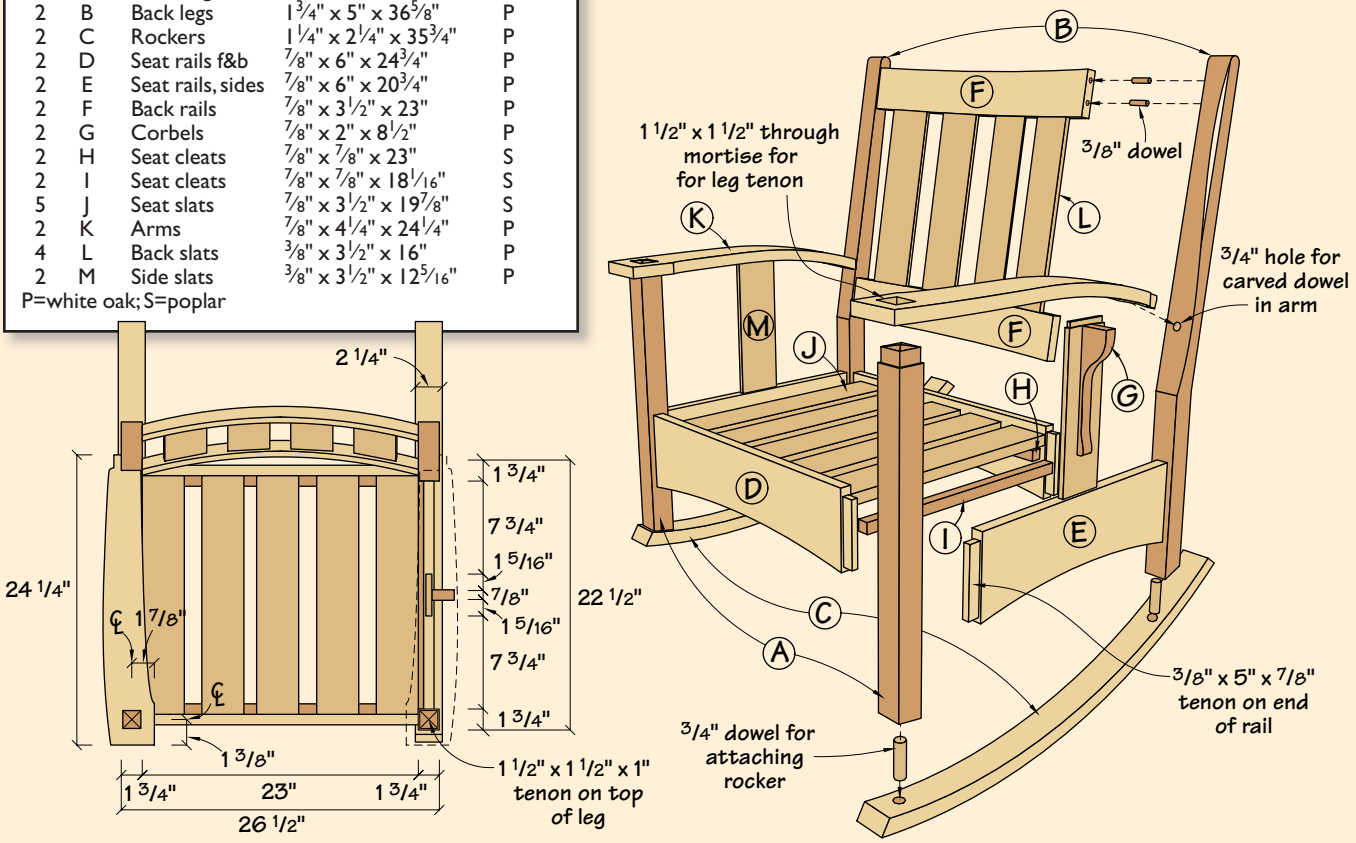
Seat Rails and Back Slats

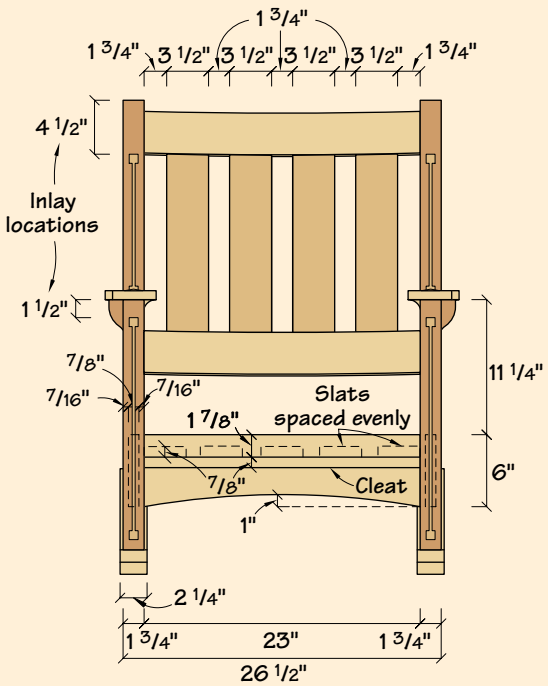
The rails and slats are straight, solid wood pieces. Size them as given in the Schedule of Materials. While you're cutting square wood, also machine and cut the seat slats and cleats. The arches on the bottom of the seat rails will be cut after the tenons are cut on the rails.

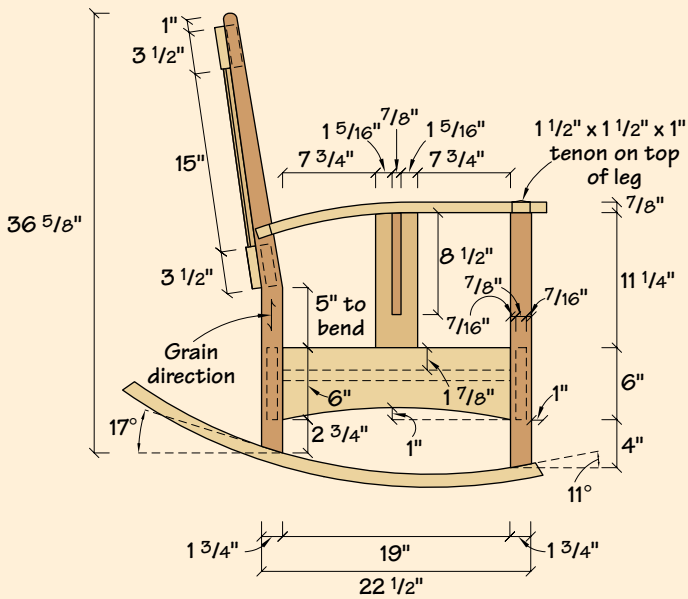
Schedule of Materials • Inlaid Limbert Rocker

No.	Lett.	Item	Dimensions T W L	Mat.
2	A	Front legs	1 3/4" x 1 3/4" x 22 1/4"	P
2	B	Back legs	1 3/4" x 5" x 36 5/8"	P
2	C	Rockers	1 1/4" x 2 1/4" x 35 3/4"	P
2	D	Seat rails f&b	7/8" x 6" x 24 3/4"	P
2	E	Seat rails, sides	7/8" x 6" x 20 3/4"	P
2	F	Back rails	7/8" x 3 1/2" x 23"	P
2	G	Corbels	7/8" x 2" x 8 1/2"	P
2	H	Seat cleats	7/8" x 7/8" x 23"	S
2	I	Seat cleats	7/8" x 7/8" x 18 1/16"	S
5	J	Seat slats	7/8" x 3 1/2" x 19 7/8"	S
2	K	Arms	7/8" x 4 1/4" x 24 1/4"	P
4	L	Back slats	3/8" x 3 1/2" x 16"	P
2	M	Side slats	3/8" x 3 1/2" x 12 5/16"	P

P=white oak; S=poplar





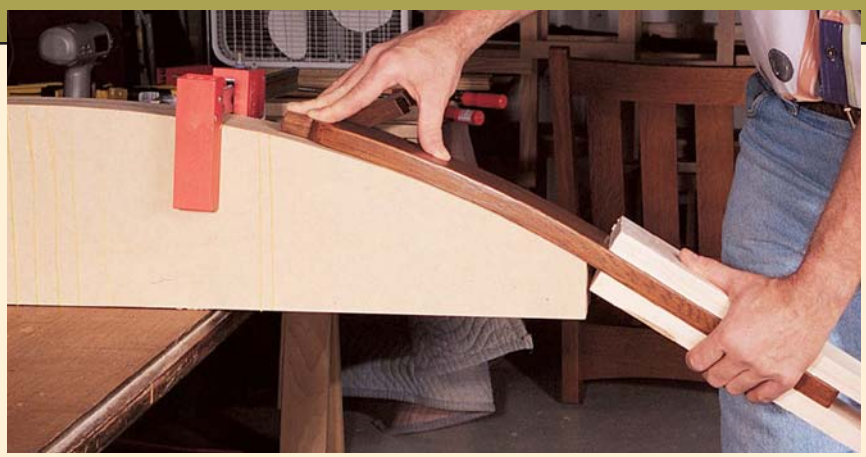


Mortises and Tenons

As with most solid chairs, the secret to longevity is in the joinery. One of the best possible chair joints is a mortise and tenon. Using the diagrams, lay out the 1/2" x 5" x 15/16"-long mortises for the seat rails on the front and back legs.

Next cut 1/2" x 5" x 7/8"-long tenons on both ends of the seat rails. Where the tenons meet at the corner of the leg mortises you need to cut a 45-degree bevel on the ends of the tenons.

The back rails are held in place with dowels. To determine the length of the back rails, measure the distance from cheek to cheek on the back seat rail. Then draw a line that same length on a piece of paper. mark the center, then also mark the cen-



To glue up the arm, the curved end was clamped to the jig while the other half was sandwiched between two straight boards. I found it helpful to glue-up the straight part first, then quickly move the arm to the end of the jig. You may need an assistant to help with this step.

Use a pattern to trace the layout of the arm. The tenon and wraparound can be made by using the band saw to cut away most of the waste. Use a chisel and file to make the final shape. Check the fit to the back leg as you progress.

ter of the back rail. Lay the rail on the paper, and square over from the ends of the line. To cut the curved rails, I laid them (convex side down) against the miter gauge fence. I then put a spacer under the rail, (between the blade and the center point of the rail), to support the rail as the cut is made. This cut is safe as long as you adequately support the rail during the cut. Expect a little tear out on the underside of the cut, so take your cut slowly. Turn the rail and cut the other end the same way. Cut the other rail to match the first.

With the back rails cut to length, it's time to lay out the mortises for the slats on the upper and lower back rails. Start by spacing the slats equally along the rail. Because the rails are curved, and the tenons are straight, using a fence as a guide to make the mortises won't work. Draw ¼" x 3¼" mortises centered on the rail, using a 4" wide piece of wood as a straight edge.

To cut the 9/16"-deep mortises in the back rails, I again used the mortiser, but without a fence, cutting the mortises freehand following the straight lines as a guide. The mortise needs to be tight, not pretty, as the shoulder of the slat tenon will hide the mortise.

Using the same dimensions as on the back rail mortises, cut the mortises in the two seat side rails for their side slats. Then cut the tenons on all the back slats and just the bottom tenons on the side slats. The tenons on the tops of the side slats will be cut later.

Dry Fitting the Chair

This is a good point to dry-fit the chair and get a look at how it's all going to go together. The two front legs and front seat rail form a subassembly. The two back legs, the back seat rail, the two back rails and the four slats form another subassembly. These two sub-assemblies are joined to one another with the two side seat rails.

While the chair is clamped together dry, put the back rail/back slat assembly in place between the back legs and clamp it with enough pressure to hold it in place. Adjust the fit of the back slat section to its finished position, and mark the top and bottom back rail locations for the dowels.

A router with a guide bushing and a template works very well for making the through-mortise on the arm. Take it slow and make it tight, then use a file to square out the corners.

Doweling the Back Rails

Using the marks made on the back legs, mark the two back rails for two 3/8" dowels in each end. It's probably just as easy to drill the dowel locations in the rails freehand (rather than making a jig) to keep them perpendicular to the end faces of the rails. Then reassemble the back rail/back slat assembly and use dowel centers to locate the dowel locations in the back legs. Use a drill press to drill the holes in the back legs, then put it all back together again to check the fit.

Fitting the Arms

I used a photo in an auction catalog to determine how the arms would fit into the front and back legs. Refer to your working drawings and the diagram of the rear part of the arm to make a full-size paper or cardboard template of the arm. Square over the front of the arms on the table saw, then lay the template square to the front of each arm. Trace the pattern onto the blanks.

Cut out the arms on the band saw leaving the pencil marks, then sand to the pencil marks. Don't cut the tenon and "wraparound" on the back of the arm yet. Instead, just leave the arm about ½" long. By holding the arm blank alongside the front leg and the side of the dry-assembled chair, I was able to mark the arms to length, where they would join the back legs and also draw the angle of the arm at this joint.

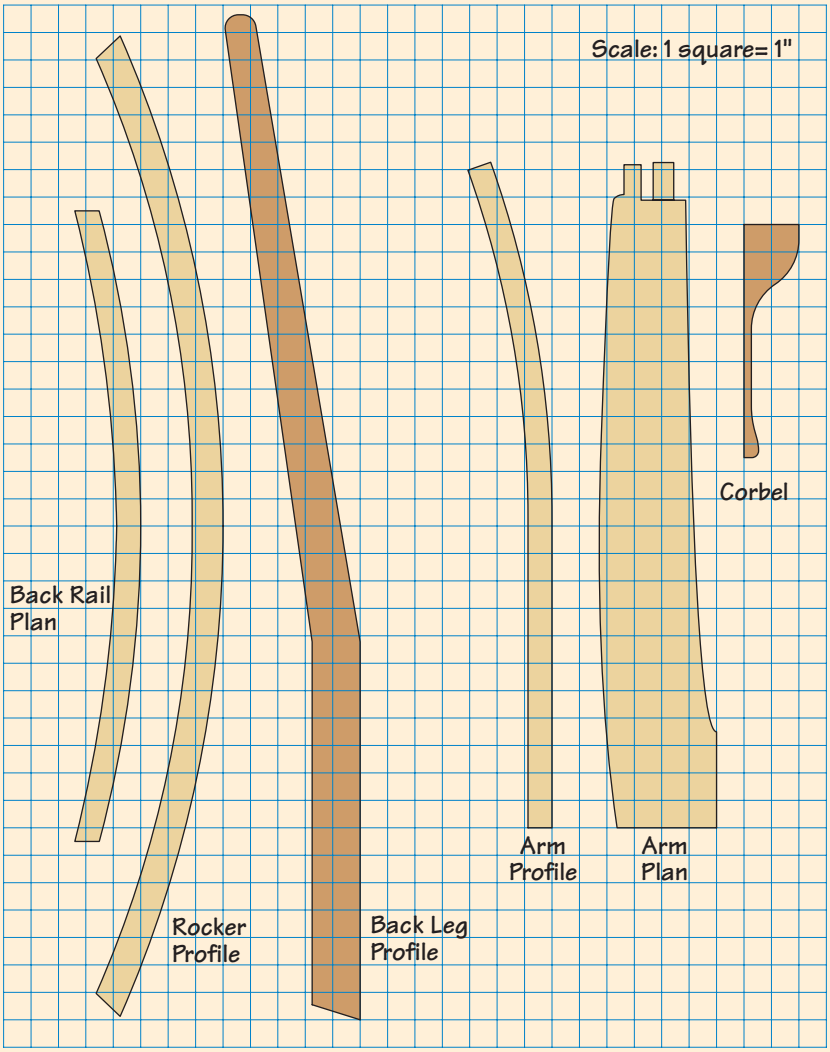
With the arm location and angle marked, drill a ¾" hole in each back leg, matching the angle of the arm. Then cut the back end of the arms (see photo at right).

With the chair still dry fit, hold the arms in place allowing the shoulder of the round-tenon joint to flush to the back leg of the chair. Then measure the distance from the back leg to the top of the front leg and transfer this measurement to each

arm. Use this location to mark where the through-mortise is to be cut for the front leg's through-tenon.

The top of the front leg serves as a through-tenon for the arm and a 1/8" shoulder is cut on all four sides of the leg, 1" from the top, reducing the thickness of the leg to 1 1/2" at the tenon. But first, make the through-mortise in the arms. Then use the through-mortise to mark the top of the front leg. Set your table saw to cut the top of the leg to fit the mortise. Cutting the peak on the front leg is done on the table saw with the blade set at 7 degrees.

With the chair again dry assembled, fit the arms to the front and back legs. Then mark the underside of the arms for the slat mortises. Cut this 1/4" x 3" x 1/2" deep mortise free-hand as described earlier with the back slats. Then scribe the curve of the arm to the top edge of the side slat, (leaving 1/2" for the tenon) to the underside of the arm and cut the curve on the band saw. Next, cut the tenon on the table saw to match the curve of the end. Cut out the corbels on the band saw using the template in the diagrams. Then do one more dry fit to check all the parts, and you're ready to start sanding.



Scaled Patterns

Sanding and Finishing

Sand all parts to 150 grit with a random orbit sander. I chose to finish all the pieces prior to assembly to avoid runs. This gave me a very even and clean-looking finish. I first taped off all the glue joint areas, then applied a gel stain with a predominant red tint, wiping the stain to an even color. I then applied a medium-brown glaze, wiping it to an even color that I liked. I let this all dry for four hours, then sprayed on three coats of lacquer, sanding between coats.

After letting the finish cure overnight,I assembled the chair. To secure the rockers, I used a 2 1/2" x 3/4" dowel slotted on both ends at right angles to each other. These slots are for wedges. The first wedge is put into a slot and cut so 1/8" is left sticking out. When the dowel is driven into the hole with the slot and wedge going into the hole first, the wedge will be forced into the slot and will spread the dowel inside the hole in the leg, locking it into place. Another dowel is driven into the other slot and driven home to wedge the rocker in place. (See photo.)

For extra holding power where the arms join the back legs, I drilled a pilot hole and put a screw into the tenon on the arm. I plugged the hole with the same wood that I used for the inlays.

Seat and Back Cushions

The seat is a 6"-thick firm foam pad with a sewn upholstery cover. The back pad measures about 2" thick and is filled with a batting material. The back cushion hangs over the back rail of the chair on straps which button to the back of the cushion to hold it in place. **PW**

A 3/4" dowel with slots and wedges will hold the rockers in place for many years to come.

Portable Planing Powerhous

We pitted nine of the most popular brands against one another to find out who's got the right stuff.

Portable planers are an easy sell to most home woodworkers for four reasons. These machines produce a cut that is equal to those on stationary machines. Portables can all be adjusted so snipe (the bugaboo of the planer world) is minimized during most operations. Third, many of the gee-whiz features on portables aren't available on the big daddies. And best of all, portable planers cost one-third to one-fourth of what you'd pay for a 13" or 15" stationary planer.

So what do you sacrifice when you buy a portable planer? Reliability and guts. The universal motor that powers a portable planer isn't going to stand up to the long-term use you can expect from an induction-motor stationary planer. And it's easier to bog down a portable planer than a stationary one. But we dare you to casually toss a 15" cast iron behemoth into the back seat of your car, or find a home for it underneath your bench. For the home woodworker, portable planers have a lot going for them.

A Test of Guts, Cuts and Features

For this test, we took a close look at nine portable planers. We declined to test models that have recently been discontinued (such as models from Ryobi, Woodtek and Powermatic) and others that haven't made it to market yet (such as a new model from Tradesman and an updated version of Ryobi's machine). At press time, you could buy all the models reviewed here.

Each planer was tested (and re-tested) on what we consider to be the three most important factors when buying one of these machines. In our opin-

Photo by Al Parrish

by David Thiel and Christopher Schwarz

Comments or questions? Contact David at 513-531-2690 ext. 255 or DavidT@FWPubs.com.

ES


RIDGID
13" THICKNESS PLANER
LARGE CAPACITY • HIGH PERFORMANCE • Sure-Cut™ SNIPE REDUCTION
JET
RIDGID
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Sure-Cut™
UNLOCK
LOCK
Repeat-A-Cut™

Simplest Table Adjustment
With the exception of the Makita, all of the planers in our test have infeed and outfeed tables that are fussy. Essentially, each side has a nut that changes the height of one side of the table and a locking nut that holds it in place. It's hard to lock the nut in place without changing the setting of the table. To add insult to injury, we found that many of these will shake loose after running the planer for a few hours. With Makita's table, all you need to do is turn an Allen-head screw and the table moves up and down. It's the little details on this machine that make it nice.

ion, the most important factor is the guts (or power) of the machine. Rough, thick or heavy timbers can quickly push a portable to its limit, and if you're not careful, you can bog down or even stall your machine. Second in importance is the quality of the cut. All of the planers in the test produced excellent finished results. And all could be adjusted so that snipe (where the extreme ends of the board are thinner than the middle) was minimized. Third in importance are the features on each machine. How easy is it to change blades? How easy is it to adjust the infeed and outfeed tables? And what other niceties are included to make planing a bit easier?

As you look over all these statistics, keep in mind that for us, the two most important factors in choosing one machine over another were the motor and the quality of the finished cut.

Guts: Your Motor is Your Friend

All of the motors on these nine planers are rated for 15 or 16 amps. However, that number doesn't tell you a lot about the motor. The amp rating is simply how much juice the motor sucks from the wall under a heavy (or occasionally impossible) load. To get a better feel for the efficiency of a motor, we looked carefully at two factors: how much the cutterhead would slow down under load and how much more amperage it would draw from an outlet under load. In our opinion, the most efficient motors were those that didn't slow down much under load and didn't need a lot of extra amps.

To measure the speed of the cutterhead, we first used a spectral tachometer to measure the revolutions per minute of the cutterhead without wood running through the machine. Then we measured the speed of the cutterhead while the planer made a 1/16"-deep cut on a 3 1/8"-wide red oak board that was 25" long.

To measure the amperage needs of the planer, we used an amp meter to measure how many amps the planer consumed without wood running through it, and then we measured how many amps it used while making a 1/16" cut on a poplar board that was 6" wide and 4' long.

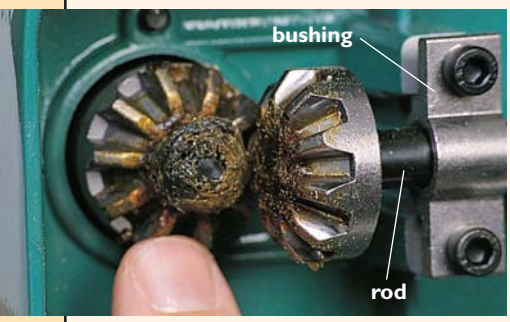
Then we got out our graph paper and plotted the results. The DeWalt and both Delta planers all scored well on this measure. However, it must be said that all of the planers handled ordinary planing chores without complaint.

Cut Quality: Snipe is a Snipe-Hunt

Everybody seems worked up about snipe, including readers who call us and woodworkers who chat on the Internet. We're here to tell you not to make too much of the issue. All of the planers tested will snipe in certain situations. It's almost an unavoidable part of planing.

Snipe occurs on the ends of a board when only one part of the board is held down by a feed roller. If the board is long or heavy, it has a tendency to rise into the cutterhead at the start of a cut until it contacts the outfeed roller. This produces a depression on the end called snipe.

You can adjust your machine so snipe is minimized during many typical planing operations. After adjustments, you might be able to see some snipe, and you might



Many of the planers we tested have these gears on the underside. To adjust the head parallel to the bed, loosen the Allen-head screws that hold in the horizontal gear. Now pull the gear away from its mate (be careful not to turn this gear when you do it). Now rotate the other gear clockwise or counterclockwise. Moving one tooth usually changes the head about .004".

It's Your Choice:
Check Your Cutterhead or Make

Your cutterhead must be parallel to the bed of your planer or your wood is not going to be the same thickness across its width.

To determine if the cutterhead is parallel to the planer's bed, most manufacturers recommend you use a block of wood. This works, but not as well as a dial indicator. You can buy a dial indicator at a flea market for $10. We mounted ours in a block of wood with a strong magnet on the bottom.

We tried to get all of the cutterheads within .001" across the length, though some planers had to be adjusted in .004" increments. The good news is that all of the cutterheads can be adjusted, the bad news is that some are easier than others.

There are several methods. The most common involves gears on the underside of the planer. Turn your planer on its back and take a look. If your planer uses this method there will be two gears that are attached to the posts that adjust the height of the cutterhead, and two gears on a rod that runs between them. To adjust the parallelism, you loosen the bushing that holds one end of the rod in place, lift the teeth of the gears on the rod free of those on the posts, turn the

be able to feel it with your fingers. But it will be only .001" deep — about the thickness of this page. You can sand that out easily.

To test how prone each planer was to sniping, we first adjusted the infeed and outfeed tables so they were perfectly level with the bed of the planer. We then ran a 6"-wide poplar board through the planer and took a 1/16" cut. Then we measured the snipe on the infeed and outfeed ends of the board using a dial caliper.

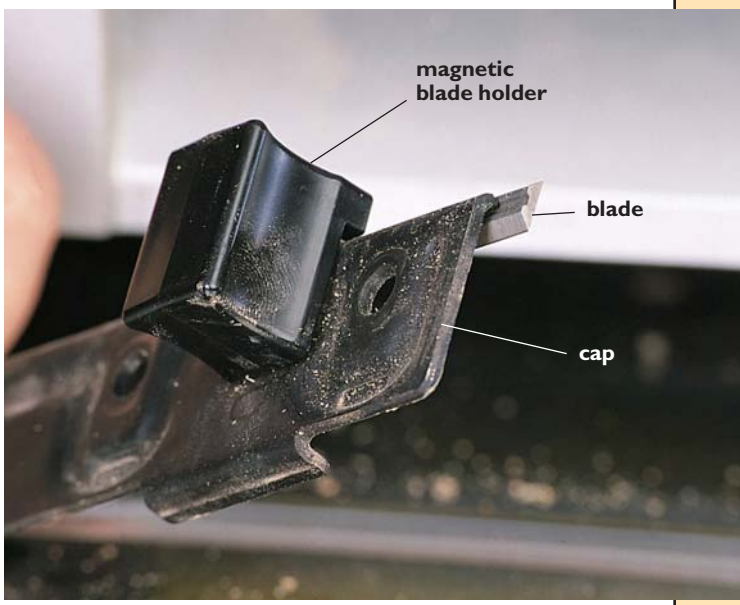
If the planer had a fancy cutterhead lock, we engaged that, took another 1/16" pass and measured the results. If the planer didn't have that feature, we raised the infeed and outfeed tables slightly and took another pass.

In all cases snipe was greatly minimized or eliminated on a 4'-long board. In fairness, however, all of the planers had a tendency to snipe more with thicker, heavier and longer boards. That is unavoidable without using support stands on the infeed and outfeed ends of your planer.

Features Push up the Price but Make Planing Easier

Some of the planers we tested were stripped down and priced to sell, such as the Delta 22-540 at $254, the Jet JWP12-4P at $289 and the Grizzly G8794 at $279. With these models you get a planer with a scale that tells you roughly how thick the board is that's passing under your cutterhead. And that's about it.

On the other end of the spectrum are planers such as the new Makita 2012NB, the Ridgid TP1300, the Craftsman 21713 and the DeWalt 733. All of these planers have a depth stop so you'll know when your wood is 3/4" (or another thickness). They also have gauges that tell you how much wood you're about to remove at a certain setting, and they include other nice touches, such as on-board tool storage.



Changing the Makita's Knives
The Makita planer has one of the easiest systems for changing the knives. The small blade has a ridge running down the center that the cap nestles into. When you bolt the cap to the cutterhead, the blade is then perfectly aligned. You can change the knives in less than 10 minutes.

Honestly, these features are nice to have, but they don't make the wood any flatter or smoother.

However, one feature that is critical is how easy it is to change the blades. Some planer's blades can be resharpened like those on a stationary machine, and some can be turned around to expose a fresh edge and then thrown away.

There are a wide variety of ways to change blades. Some of the more difficult methods use springs, jackscrews or a combination of the two. With these systems, you loosen six or seven bolts to remove the dull knife, put the sharp knife in and use a setting gauge to hold the knife in position as you turn the bolts to lock the knife in place. It's easy to cut yourself (just ask David), so take care when changing knives using that system.

Easier methods use a system where the knife drops onto pins or is held in place using magnets as you tighten the bolts.

WEDGES

A few planers use this bicycle chain setup. Loosen the chain, rotate one of the gears and then reassemble everything.

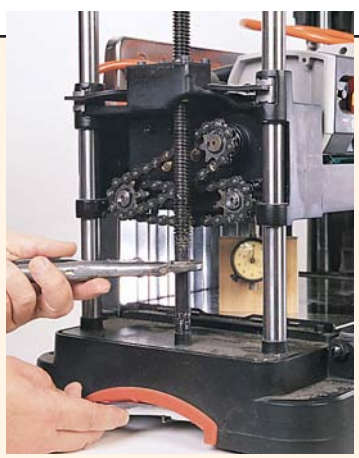
gear attached to the posts and put everything back together.

Other planers use a system where the gears on the posts are joined by a bicycle chain. The idea is the same: You remove the chain, turn one of the gears and reassemble the mechanism.

The Delta 22-560 has a nut on the underside of the cutterhead that you turn to easily dial in your adjustment.

Then there's the Ridgid TP1300. On this machine you loosen two nuts on the underside of the planer and then turn the planer's height adjustment rods until the cutterhead is parallel to the bed. It's not an easy job, and if you muck it up, you'll find it difficult to raise and lower the cutterhead.

If you're not sure how to adjust the cutterhead, or don't feel confident doing so, we recommend you contact the manufacturer. But rest assured, it can be done.



The Ridgid TP1300 is adjusted by moving the height adjustment rods. We found it to be a delicate procedure, but it's doable by any home woodworker. Contact Ridgid for assistance.

Troubleshooting

After you replace the knives, put some dry lubricant on the planer's bed and run a couple of big boards through the planer to check your work. If your boards slow down or have to be pushed or pulled through the machine, it's likely your knives aren't at the same height. Check them with a dial indicator (or block of wood) and adjust.

Another possible problem when your lumber bogs down is with the knives being bowed. During heavy use, sawdust will build up behind the knives on some portable planers, causing the knives to bulge slightly. If you're suffering performance problems, this is another thing to look for.

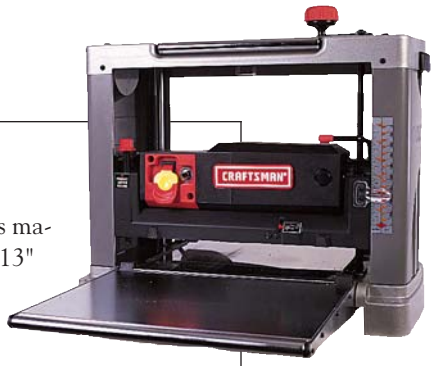
If your cutterhead becomes difficult to move, look for chips inside the machine around the adjustment posts and get a dust collector for your machine.

Finally, except for the Makita, the nut-and-bolt system that holds up the infeed and outfeed tables on all these planers is fussy. You need two wrenches to get the nuts tightened correctly. If, after a few planing jobs, you start to see more snipe on your finished work, check your tables. The vibration of these machines tends to shake the nuts loose, causing the tables to droop and leaving you vulnerable to sniping. **PW**

	Craftsman 21713	Delta 22-540	Delta 22-560 (Best Value)	DeWalt DW733 (Editor's Choice)	Grizzly G1017	Grizzly G8794	Jet JWP12-4P	Makita 2012NB	Ridgid TP1300 (Editor's Choice)
Street price	$389	254	299	379	369	279	289	489	399
MOTOR									
Amp load/no load	15/8.3	15/8.8	14.3/8.6	13.6/8.7	15.6/9.3	15/8.6	15.8/8.5	11.8/5.7	10.5/7.4
RPM load/no load	8K/9.5K	7.3K/8.4K	7.5K/8.4K	8.3K/9.1K	8.1K/9.4K	8K/9.2K	8.2K/9.5K	7K/8.4K	8K/9.4K
dB level@3 ft.	97	92	94	98	93	91	93	88	94
Peak dB @3 ft.**	102	99	102	100	94	101	99	98	102
Overload switch	Yes	No	No	Yes	Yes	Yes	Yes	No	Yes
CUTTERHEAD									
Knife change (1-5)*	2	2	5	4	3	3	3	5	4
Knives/type	13"/2x D	12"/2x D	12½"/2x D	12½"/1x S	12"/1x S	12½"/2x D	12"/2x D	12"/2x D	13"/2x D
Lateral knife adj.	No	¼"	1/16"	No	¼"	⅛"	¼"	3/32"	No
Blade thick/width	.059" x 7/8"	.07" x ¾"	.058" x 7/16"	.125" x 1 1/16"	.12" x ¾"	.063" x ¾"	.125" x ¾"	.077" x 5/16"	.068" x ¾"
Snipe @ 1/16" outfeed:/infeed:	.001"/.009"	.005"/.007"	.000"/.000"	.005"/.006"	.005"/.007"	.001"/.008"	.004"/.012"	.001"/.002"	.005"/.008"
Corrected Snipe outfeed:/infeed:	.001"/.009"	.000"/.005"	.000"/.000"	.000"/.003"	.000"/.003"	.004"/.005"	.001"/.001"	.001"/.002"	.001"/.002"
Cutter shaft lock	Yes	No	Yes	Yes	No	No	No	Yes	Yes
FEATURES									
Ease of adjusting height of head (1-5)*	4.2	3	3.4	3.4	4.4	3	3.8	4	3.4
Table Adj.(1-5)*	2.8	3.4	3.4	2.6	3.2	3.2	3	4.2	3.8
Table W" x L"	15½ x 37½	12½ x 23½	12½ x 23¾	13½ x 33⅛	15 x 21½	12⅞ x 25	15 x 23¼	13 x 30⅜	14 x 34
Fit and finish (1-5)*	4.4	2.8	4	4.2	3.4	3.2	3.4	4.4	4.4
Ergonomics (1-5)*	3.8	2.2	3.4	3.4	3	2.6	3	3.8	3.8
Scale readability (1-5)*	3	2.8	3	2.6	4.6	2.8	2.4	3.4	2.8
Feed rollers?	Yes	No	No	No	Yes	Yes	Yes	No	No
Cord length/type	8'6"/P	6'/P	6'/P	10'/R	5'/P	6'/P	6'/P	8'/R	10'/P
Weight in lbs.	85	62	65	80	78	75	67	60	82
Warranty	1 yr	2 yrs	2 yrs	1 yr	1 yr	1 yr	2 yrs	1 yr	Lifetime

KEY: P=plastic; R=rubber; 2x D= two-sided, disposable; 1x S=single-edged, sharpenable * On a scale of 1 to 5 with "1" being "unacceptable" and "5" being "outstanding." ** Peak dB is measured at 3' while making a 1/16"-deep cut on a 6"-wide poplar board. Always wear hearing protection when planing.

Craftsman 21713



The Craftsman machine is comparable to the Ridgid and DeWalt in detail and features.

It offers on-board tools, a place to wrap your power cord, return rollers, a pre-set depth gauge, a material removal indicator and a cutterhead lock to reduce snipe. This is the only machine that gives you the option of which side the height adjustment handle is located. In testing the cutterhead's parallelism, we found it to be out .01" from the factory, which is a lot. But with the instructions in the manual we were able to easily adjust the nylon-geared mechanism underneath the machine to within .001". In changing the blades, we appreciated the cutter shaft lock, but we found the six Allen-head bolts on each blade tightened within an inch of their lives (we ended up stripping one). This machine gets high marks for its 13" cut capacity and having the longest bed, which assists with snipe reduction. In testing, the rpm dropoff under load was the highest of any machine tested, while the amperage spike during the same test also showed a larger strain on the motor. Overall it's a nicely appointed machine at a reasonable price that competes well on many measures.

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

Delta 22-540

The most affordable (by $25) planer tested, the Delta 22-540 is a no-frills machine and does an adequate job.

Features include an extra set of high-speed steel knives, a wrap for your power cord under the infeed table and a lightweight knife-setting jig. In testing for parallelism we found the cutterhead out .002". The metal-geared adjustment teeth mounted under the machine would only swing the measurement to .002" the other way, so we called it done. The knives are spring-mounted and held in place with seven gib screws, which we found over-tightened. We rounded the head off of one before we were able to break it loose. Knife-changing wasn't difficult after lowering the cutterhead onto a block of wood to keep the head from moving during the procedure. Snipe was a little worse than on the best machines, but not unacceptable after aligning the tables using the standard nut-and-bolt system. The machine tested well for noise, coming in as the third quietest. This is a utilitarian machine that performs OK for most needs. Just take care when releasing the knife bolts for the first time and keep the tables aligned and you'll have a decent machine for a good price.

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

Delta 22-560

Best Value

Priced below the middle of the pack, the 22-560 offers a few more refinements than its older brother, the 22-540.

On-board tools, a cutterhead lock, a combination return roller/handle and a place for your power cord are only the beginning of the differences. We checked the head for parallelism to the table and found it perfect. However, if necessary, the adjustment can be made from underneath the cutterhead by adjusting a nut with a hex wrench. Changing the blades was goober-proof and rated a tie (with Makita) for best by our staff: the self-aligning disposable mini-knives simply drop onto pins on the cutterhead. Thoughtfully, the 22-560 lets you adjust the knives side-to-side 1/16" to cancel out nicks in the blades. In testing we found the motor to be gutsy; rpms were maintained without consuming much more amperage under load. Early versions of this machine had a problem with a nut coming off the cutterhead's pulley. Delta has fixed this problem. If you have an older machine, contact Delta for details on how to fix it.In all, this machine is a bargain for what you get, but it falls short of being a luxury model. Price is a strong factor, so we consider the Delta 22-560 to be the best value for your money of any of the machines tested.

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

DeWalt DW733

Editor's Choice

This machine performed well out of the box, with the cutterhead perfectly parallel to the table.

Features on this popular planer include an extra drive belt, an extra set of blades, a head lock, a cord wrap, on-board tools, a turret-style depth-of-cut gauge, a material removal gauge, a 10' rubber cord and some excellent infeed and outfeed tables. If the cutterhead had been out of parallel, we could have adjusted it simply by loosening the bike-style chain and turning a metal gear. Snipe was in the average range, but the planer's head lock almost negated that snipe without adjusting the tables. The knives on the DW733 are single-edged high-speed steel and are designed to be sharpened. Blade change was fairly easy. Springs and magnets hold the knife in place as you tighten the bolts to lock the knife in place. Unfortunately the knife arrangement does not allow for lateral adjustment. In our tests, the motor performed very well under load. It had the lowest drop in rpms and didn't consume a lot more amperage. Overall this is a very nice machine with good performance and is well appointed with features. The price is well within reason for what you get, and all these factors combined lead us to rate this machine an Editor's Choice.

Contact DeWalt at 800-433-9258 or www.dewalt.com

Grizzly G1017

This is an older model that has been left somewhat behind in today's planer race when you compare features.

However, the machine performs well across the board. On the positive side, the cutterhead was within .001" tolerance out of the box, and there seems to be a lot more metal in this planer than any other tested. The unit offers resharpenable knives, and the blade-changing system uses both jackscrews and springs. You can adjust the knives side-to-side ¼". It is the only model tested that uses an open-post design with protective plastic boots on the posts. The 1017 has the ignominious honor of having the shortest table bed of any tested model, but on the positive side it was the quietest under load. One feature that is unique to this model that it has an actual tape measure that shows your depth of cut that's readable through a small window. The tape is easier to read than the scale on other models, but the attached end of the tape is exposed on the side of the machine and looks vulnerable to damage. Another difficulty is that the height-adjustment handle obscures the label that tells you which way to crank for up and which way for down. In general, our opinion is that this is a machine that performs well, but it seems pricey when you compare it to the Delta 22-560.

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

Grizzly G8794

Introduced last year, this planer is the second least expensive model in our test, and it compares closely with the rock-bottom-priced Delta 22-540.

Offering a 12½" cut and the third-best snipe control, this machine also offers a good noise rating and lateral knife adjustment. In testing we found the cutterhead to be out of parallel by .004" which was corrected to .001" by adjusting the steel gearing mechanism under the machine. The motor performance on this machine was average. The sound ratio without load was the second-best tested, though the underload dB rating was a little louder than average. The knife-changing system was again, average, requiring the release of seven bolts to remove the spring-mounted dual-edged disposable blades. When considering purchasing a planer under $325, this Grizzly model performs a hair ahead of the Jet machine, but it still falls behind the Delta 22-560 in performance.

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

Jet JWP12-4P

By the time this article is on the newsstands, this model should be sporting longer infeed and outfeed tables, a depth gauge, dust chute and cutterhead lock.

Jet officials say the guts will stay the same, so our test is still germane (check our website for a photo of the new machine). The JWP12-4P isn't long on frills. It includes tools for changing the knives and return rollers mounted on the top of the machine.

In testing we found the cutterhead to be out of parallel to the bed by .007". The manual included instructions on how to adjust the nylon-geared mechanism, and we were able to correct the parallelism to within .001". Blade changing was not high-tech. There's no cutter shaft lock, and springs and a jig hold the knife in position as you tighten the gib screws. However, you can adjust the knives side-to-side by ¼", which is as good as it gets. And the machine was pretty quiet under load. Motor performance was somewhat disappointing statistically, but the finish of cut and general performance showed no obvious flaws. This is an adequate machine that does not perform as well as some of its direct competitors, but should be more competitive after its impending upgrade.

Contact Jet at 800-274-6848 or www.jettools.com

Makita 2012NB

This is the most expensive machine in the test, but we were pleased with so many other aspects of its performance that we had to keep reminding ourselves of its price.

The 2012NB offers a number of features, including on-board tool storage, a material removal gauge and a depth-stop gauge similar to those found on plunge routers. This machine also offered the best table height adjustment mechanism, allowing adjustment from above using Allen screws, with the tables in the "down" position. In testing we did find the cutterhead to be out of parallel by a significant amount, but we were able to correct it to .002" by adjusting the metal meshed gears from underneath the machine. Overall, this is the quietest machine tested. Sniping was near perfect thanks to Makita's automatic cutterhead lock. The blade changing process is one of the best with dual-edged mini-knives that have a ridge running the length of the blade to make set-up simple while still offering lateral adjustment. Despite all these nice features and Makita's great reputation, it was the price of the machine that kept it from being one of our editors' favorites.

Contact Makita at 800-462-5482 or www.makita.com

Ridgid TP1300

Editor's Choice

Should we start with the lifetime guarantee? Guess we just did. Now let's talk about the machine.

This is a feature-heavy tool, offering an extra set of dual-edged disposable knives, an eight-position depth-stop mechanism, head lock, a material removal gauge and a cord wrap. In testing we found the TP1300's cutterhead to be out of parallel by .006". We were able to correct it, but not without a lot of work. The blade-changing process was almost pleasant, as the TP1300 is designed to allow the entire top to lift off, giving easy access to the interior. The blades themselves are dual-edged disposables held in place by seven bolts, and they drop over pins for a no-fuss setup, but they don't offer any side-to-side adjustment. The Ridgid's motor performed well in our tests and we had few problems with snipe. Except for the difficult way you adjust the parallelism of the cutterhead, this machine performed well and offered lots of features. We would have preferred some lateral adjustment in the knives, but in the end we still awarded this machine an Editor's Choice award for its overall quality, price and features. **PW**

Contact Ridgid at 800-474-3443 or www.ridgidwoodworking.com

USING

YOUR PLANER THROUGH Thick AND Thin

Get the most out of the few things your planer does well.

If I had to liken the wood planer (also called a surfacer) to a barnyard animal, I'd have to choose the ox. It is not known for its versatility, but it can work hard all day at a few simple tasks that save your back and lots of time. For the home-shop woodworker, the advent of the portable or "suitcase" planer has brought this highly useful machine into the realm of economic reality. Thousands and thousands have been sold since Ryobi introduced the first of its kind in 1985.

You won't need a week-long course to get the most out of your planer, but there are some fundamental techniques that will make sure your lumber comes out looking great. There's also a handful of jigs to help you get more out of your machine than you may have thought possible.

Fundamentals First

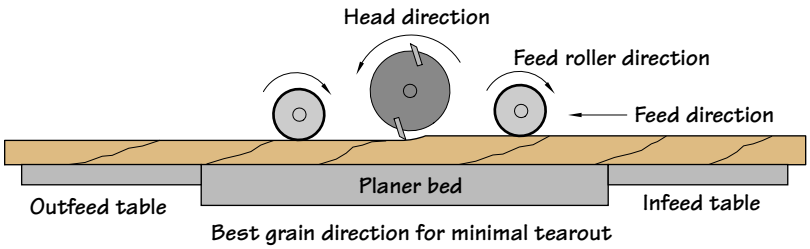
With most suitcase-style planers there's little to do in making sure the machine is properly set up. Most allow adjustment of the cutterhead to make sure it is parallel with the bed, and those with infeed/outfeed tables may allow some adjustment to combat snipe. Many even use disposable knives that are installed on indexing pins, which eliminate any need for adjustment.

The bigger stationary cousins of the portable planer allow you to adjust the upper feed rollers, bed rollers, knives, chip breaker, pressure bar and the parallelism of the cutterhead. Regardless of the type of planer you own, review your owner's manual to make sure you have your machine set just right. Once adjusted, there's little need for change, although an occasional checkup is usually in order. Remember, the best techniques can't overcome problems caused by a machine that's out of whack.

On any planer, it's important to monitor the quality of cut from the

by Steve Shanesy

Comments or questions? Contact Steve at 513-531-2690 ext. 238 or SteveS@FWPubs.com



Read the grain for less tearout

knives. Dull knives cause tear-out where none should be and ultimately lead to a lot more sanding of your project before finishing. Using dull knives also puts more stress on the machine's motor. If you are using a portable planer with a universal motor, dull knives can significantly shorten the lifespan of your machine. Induction-style motors used on stationary machines stand up to light abuse much better.

You should also be aware that the planer is not designed to remove defects in your lumber such as warping, cupping or twisting. For this, you need a jointer. The reason is the feed rollers that propel the stock past the cutterhead force the stock flat on the planer's bed. Once the stock is released from the rollers, it returns to its original shape. Face-jointed stock should always be run with the jointed surface (the flat surface) down on the planer table or bed. This results in the cutterhead making a parallel cut on the uneven, top surface. You should continue planing with the jointed face down until the top surface is at least as flat as the bottom, if not completely smooth. At that point, the face-jointed surface can be turned and run face up.

For those who have experience face jointing and planing rough lumber, you know several passes are often required before the lumber reaches the desired thickness. During these multiple passes, remember that once the rough face has been planed flat, the board should be planed so you take roughly equivalent amounts from each face. This is a precaution against introducing warp. New warping can be caused by planing more material from one side than the other. The removal of material can release stress in the grain of the board in the same way that you have observed straight lengths of wood warping as the pieces are ripped on the table saw.

Planer Safety

There are just a few important safety rules to follow when working with a planer/surfacer. While some are obvious, others may be a bit surprising to you.

- The obvious ones include not standing directly behind the machine while stock is running through. Occasionally a knot or chunk of wood can come flying back at you. Likewise, don't look into the cutterhead while the machine is in use.
- Don't run stock that's shorter than the distance between your planer's infeed and outfeed rollers plus 2".
- Don't run stock with loose knots or other defects that can separate from the board during planing.
- When feeding shorter stock into the machine, keep your hands clear of the planer bed to avoid getting your fingers pinched under the stock when the front feed roller starts pressing the board down.
- If a board gets stuck, turn the machine off and let the cutterhead come to a complete stop before lowering the bed or raising the cutterhead.
- And one last word about planer safety. Your most likely chance of injury just might be when the machine isn't even running. Very serious lacerations can occur when setting or adjusting knives or anytime your hands are near the cutterhead. There's been many a trip to the emergency room following a hand slip from a wrench while resetting a freshly sharpened planer knife.
- After you change or adjust your knives, it's also a good idea to check and retighten the fasteners that hold the knives in place after running a couple boards through the machine.

Everyday Techniques

- Follow your owner's manual for determining the amount of cut your planer can handle, usually about 1/16" for portable planers. Try to make the last pass a light one to avoid tear-out. To further avoid tear-out, which is sometimes called "pick-out," plane with the grain. View the edge of the board and determine how the grain is running toward the face. Run the board so it will feed into the rotation of the cutterhead with the grain (see illustration).
- At the beginning of every project, plane all the lumber you'll need — and a little more. Making your project from lumber with uniform thickness will make joinery and cutting parts to size much easier and ensure a greater degree of accuracy. The extra stock is for the often inevitable mistake or oversight on your cutting list.
- If your stock is long and you are working alone, use a roller stand on the outfeed side of the planer.
- If you have parts on your cutting list that are either square or of equal width that's within the capacity of your planer, take the parts to their finished


This piece of crotch walnut has great figure, but it also is almost impossible to surface without tear-out.


To help reduce tear-out, wipe the board with a wet rag before planing and allow the water to soak into the fibers.

dimension using the planer. This saves time and will produce more consistent results than using the table saw or table saw and jointer. Table legs are a good example of parts that often start out square.

• To plane stock that has been glued into a slab, first remove all the hardened glue. Select the face that is most flat and run it face down, taking very light passes. After the top face is flat, turn the slab and plane the other side. If your planer has an adjustable feed rate, set it to slow.

Planer Tricks

There are a few tricks for squeezing a little extra utility from your machine (remember the ox analogy?). Check out the three jigs at right to stretch your planer's capabilities. And I'll give you a simple trick or two to help you plane highly figured wood with minimal tear-out.

With curly maple, bird's eye maple, flame birch, crotch figure of any specie, or most any other highly figured wood, you know tear-out can be a problem even with the sharpest of knives. The grain changes direction so often that running the board one direction or another simply won't work.

To produce a decent surface, do one or both of these tricks: Skew the board so that it goes through the planer at an angle to the knives. This effectively creates a shearing cut that follows the same principle as angling your hand plane's blade as you push it along the grain. The second trick is to wet the surface of the board. See "Planing Figured Stock" below. **PW**

With any luck, your next pass will result in a board that is virtually free of tear-out.

Planer Tricks

Planing Thin Stock

Any time I need to run stock down to ¼" or less (but not less than ⅛") I use an auxiliary bed board. Some planers will not let you plane to this thin a dimension so you need a bed board to make it possible.

Even planers that adjust for as little as ⅛" benefit from a bed board. Sometimes thin boards can explode while passing under the cutterhead. A bed board protects the bed of a portable planer, which isn't as stout as the cast iron bed on a stationary model.

Planing a Bevel on Stock

I've used this trick many times to produce a simple moulding. It works for small pieces or even to fabricate a handrail for a deck or stairway.

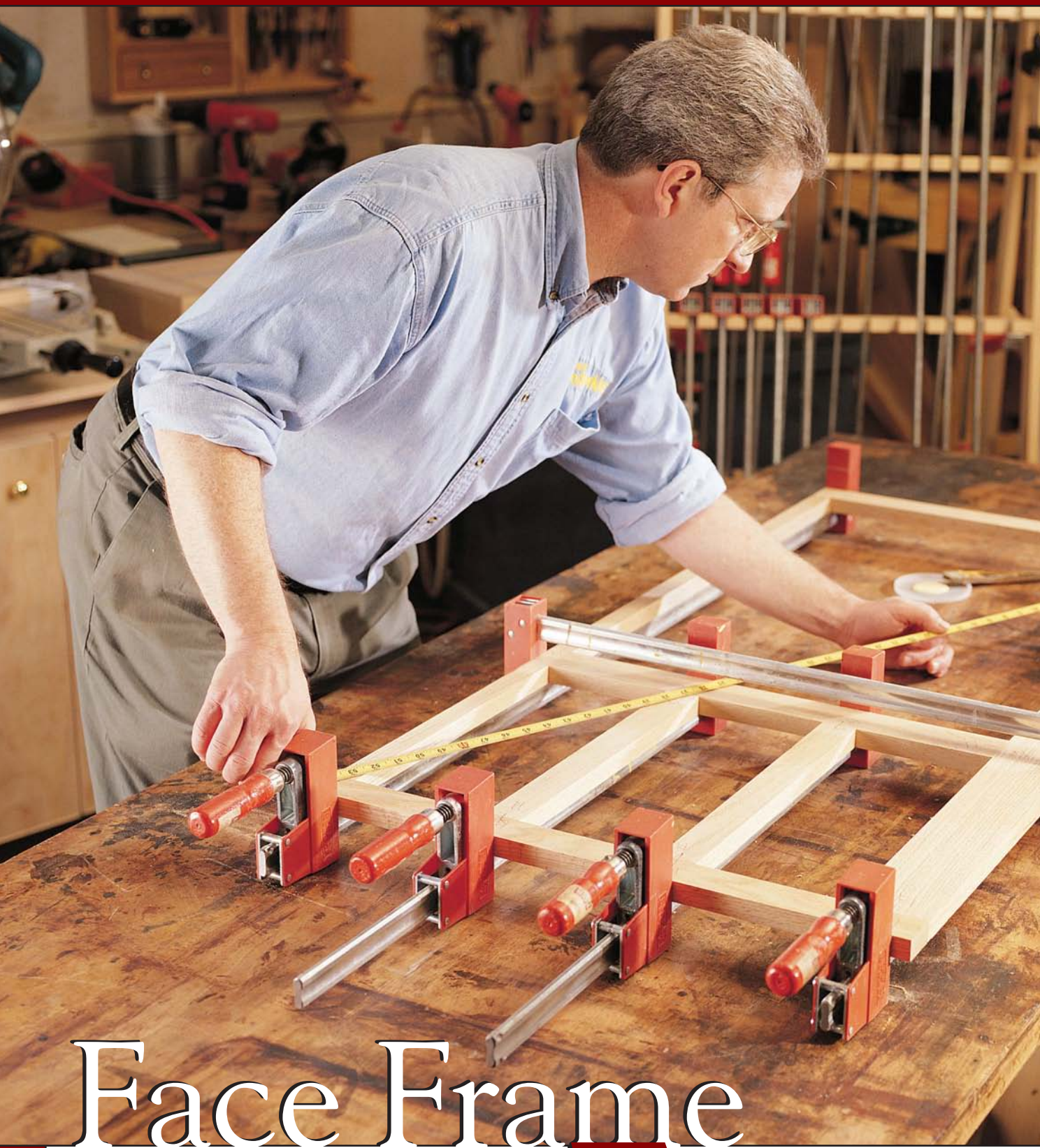
Make a bed board, then add a long, angled piece as shown above. Add a "fence" to the low side of the angled piece. Plane half the width of the board, then turn it and run the other half. You'll produce a nice profile!

Plane an Octagon

Again, start with a bed board. This time, add a "V"-block setup that runs perpendicular to the cutterhead. This planes the corners from square stock to produce a perfect octagon-shaped piece. This can be quite helpful for turners who want to start with stock closer to round than square. Ease the sharp corners from the stock before planing so they don't harm the rubber feed rollers.

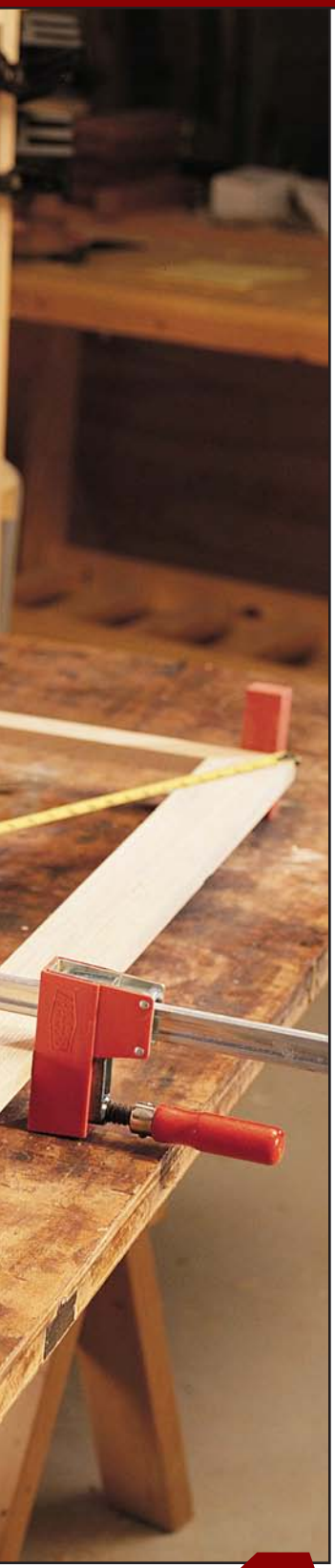
Planing Figured Stock

To overcome tear-out in figured wood try this trick. Take a rag that is wet (but not dripping wet) with clean water. Thoroughly wipe the face of the board to be planed, adding more water to the rag as needed. Repeat, then give the water a minute to soak in and soften the wood fibers. I usually wet a board, then run another one while waiting. Each pass will require wetting. I've had excellent results using this technique.



Face Frame Face

Learn how and why face frames are commonly used in cabinets and then decide which method of making them suits your wallet and weekend free time.



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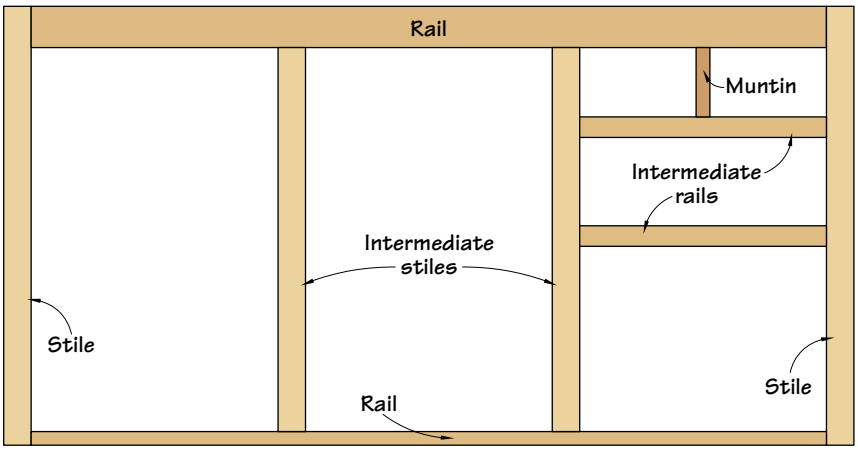


Today, many woodworkers move freely between building frameless cabinets and those with face frames, viewing one style or the other as a design consideration only. But to do so and disregard the engineering advantages and disadvantages of each method is a significant oversight.

The assembled components of any cabinet that lacks a face frame or back have an enormous propensity to shift from side to side with only a slight bit of force. Add a face frame to the cabinet and the structure has integrity. Take away the face frame but add a sturdy ½" or ¾" back, and the frameless case is structurally sound.

So now we know that face frames add structural integrity and suggest a certain style (albeit still generic) cabinet. But there's more. The face frame also provides openings with square corners that make fitting doors and drawers a predictable task. There's nothing more aggravating than tediously fitting a door in an opening that's out of square.

Lastly, face frames cover the front edges of the cabinet's sides and partitions, which are often made from plywood or particleboard.

Face-Frame Components

Face-frame parts have specific names and orientations within the frame. Stiles always run vertically; rails are always horizontal. Stiles always run through, and rails always run between stiles. Intermediate stiles (sometimes called muntins) and intermediate rails are always located within the main frame surrounding the cabinet. An intermediate stile will run between a top and bottom rail, and intermediate rails will always run between stiles.

These arrangements of parts help provide a rigid structure that gives the case parts strength. To derive this structural integrity, face-frame components need to be of a certain size. You'll find that most face-frame base cabinets (the kind you would find in kitchens) have 2"-wide stiles, 3¼"-wide top rails, ⅝"-wide bottom rails and 1½"-wide intermediate rails.

Smaller cabinets can have somewhat narrower parts, but functionality suffers, with stiles less than 1½" and rails less than 1¼".

Face frames are attached to cases in several ways, and the method used has often been one of the important factors in determining the quality grade of the cabinet work. Face frames with mitered end stiles glued to mitered cabinet sides are a premium grade. Next, frames that overlay the sides and are only glued and clamped would be the next best grade. Lower grades would include frames glued and nailed, on and frames nailed on only.

The following pages show you four common ways to join rails and stiles and compare the ease and expense of each method. All four methods are used in commercial shops and are appropriate for face-frame construction at home.

by Jim Stuard and Steve Shanesy

Comments or questions? Contact Jim at 513-531-2690 ext. 348 or JimS@FWPubs.com.

Mortise and Tenon

A traditional and tough joint that's time-consuming

Lay out a practice mortise

First mark a centerline down the edge of the part getting mortised. Place the part into the mortiser and line up the point of the bit in the mortising chisel on the line. Always do a practice cut on scrap and use that to check the tenons you'll make on the saw.

Cutting a practice mortise

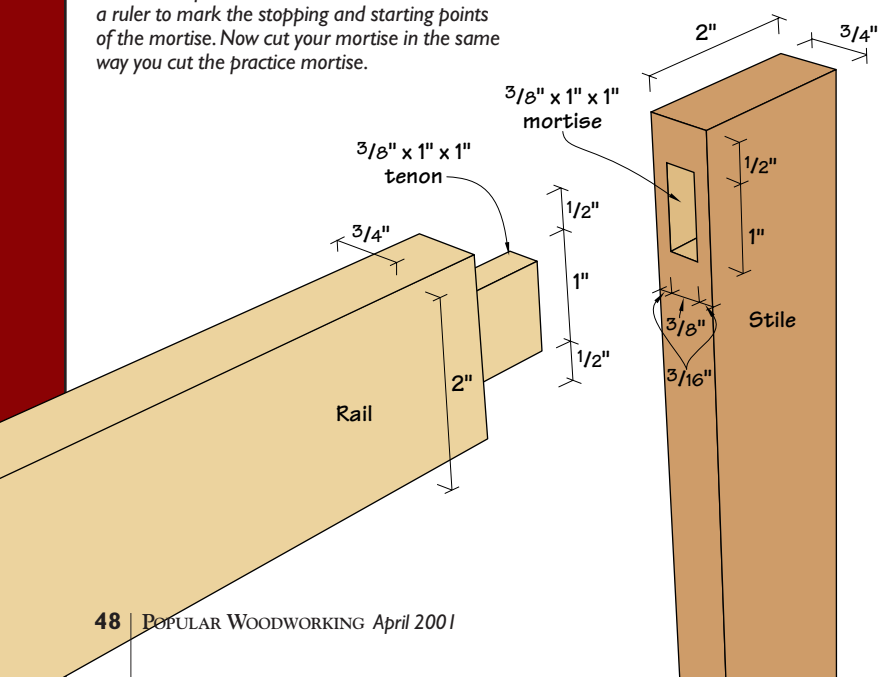
Be sure your work is clamped down well. Mortising bits are prone to stick and require serious pressure to keep the piece in place. After making the first hole, the drilling gets easier. Use a hole-skipping technique. That's drilling one hole, then skipping over one chisel width and making another.

Cutting tenon cheeks

Using a dado head in a table saw is easy. Set a ¾"-wide dado stack to the height of the shoulder on the mortise. Set the saw fence to the length of the tenon (in this case, 1"). Always do a test cut, using the test mortise from the mortise setup. Cut the shoulder first. This keeps tear-out on the shoulder to a minimum. Cut the rest of the tenon and check the fit with the mortise. Next, set the dado stack to ½" high for cutting the top and bottom shoulders. Cut the shoulder first, then finish the cut. Check the fit. It should be snug without being tight.

Lay out the mortise

Take the tenon you've cut and lay it right on the stile that requires the mortise. Use the tenon like a ruler to mark the stopping and starting points of the mortise. Now cut your mortise in the same way you cut the practice mortise.



Pros

+ **More wood-to-wood contact makes it a stronger joint: If you actually measure the wood-to-wood contact that takes place in a mortise-and-tenon joint, there is a greater area of contact here than any other joinery style.**
+ **Can be made entirely with hand tools: If necessary, this joint can be made with only a layout tool, a saw and a couple chisels. That makes it one of the cheapest joints to make. However, it is also the most labor- and skill-intensive method.**
+ **Appropriate for reproduction furniture: Mortise-and-tenon joinery shows up in the coffins of Egyptian mummies that are thousands of years old. It was used extensively and almost exclusively on furniture made from the Middle Ages up to around the 1850s.**
+ **Easy glue-up: There's no chance of your parts bowing under simple clamping pressure. The tenon provides a solid backbone to the joint.**
+ **No material size constraints: You can make any size joint that you want. The tenons on some wider materials will have to be split up to keep wood movement down.**

Cons

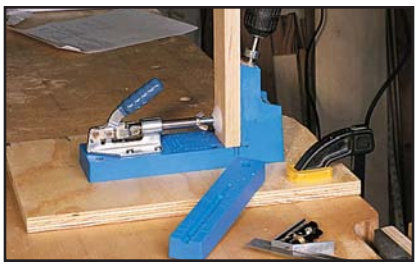
− **Highest skill level required: Cutting one of these joints by hand requires a great deal of time and talent before it can be done with any kind of regular accuracy.**
− **Can be the most expensive method: The machine method shown is very accurate and easy to learn. It also can be the most expensive. Add up the cost of a table saw, mortiser and tooling for both and you can easily go over $1,000.**
− **The slowest method: Either by hand or machine, the layout and setup time required to do mortise-and-tenon joinery is the longest of all the techniques.**
− **Unnecessary amount of strength for a face-frame cabinet: Mortise-and-tenon joinery was necessary back in the days of hide glue and no screws, dowels or biscuits. These days, modern fasteners and glues make this an unnecessary joinery style for face frames. Do it if you like, but there's a time consideration to be paid for all that historical accuracy.**

Pocket Screws

Say farewell to your clamps with this high-tech method

Lay out a joint

The instructions for the Kreg jig are simple and few. There just isn't that much to learn. All you really have to do is line up the center on the back side of the part being drilled between the best spacing of the three holes on the jig. To do this, mark a centerline down the middle of the part to be machined.



Drilling pockets in the rail

Place the rail in the jig and with the bit set for the proper frame thickness, drill the angled hole. The bit makes a stepped clearance hole for the special screws used to attach the frame together. The screws drill their own pilot holes into the stile.

The Tale of the Indestructible Face Frame

Contributing editor Troy Sexton is a connoisseur of pocket screws and contends they are a fast and strong way to keep his commercial shop humming.

One day when we were up at his shop in Sunbury, Ohio, he handed us a face frame for a small wall cabinet.

"Here," he says, "try and break it."

Troy had made the face frame with pocket screws and glue (Titebond to be exact) but then realized the frame was the wrong size or something, so he backed out the screws to use them again.

However, no matter how we twisted, pushed or pulled, we couldn't break the frame apart. Of course, we didn't drop it off a building. We concluded two things: First, glue technology has come a long way. And two, pocket screws give you amazing clamping pressure.

Clamping and screwing

There are different types of screws. Screws with coarse threads are for softwoods such as pine. Fine thread screws are used for hardwoods. A third type of screw works for both. All three types drill their own pilot holes thanks to a milled notch in the shank that works like a drill bit.

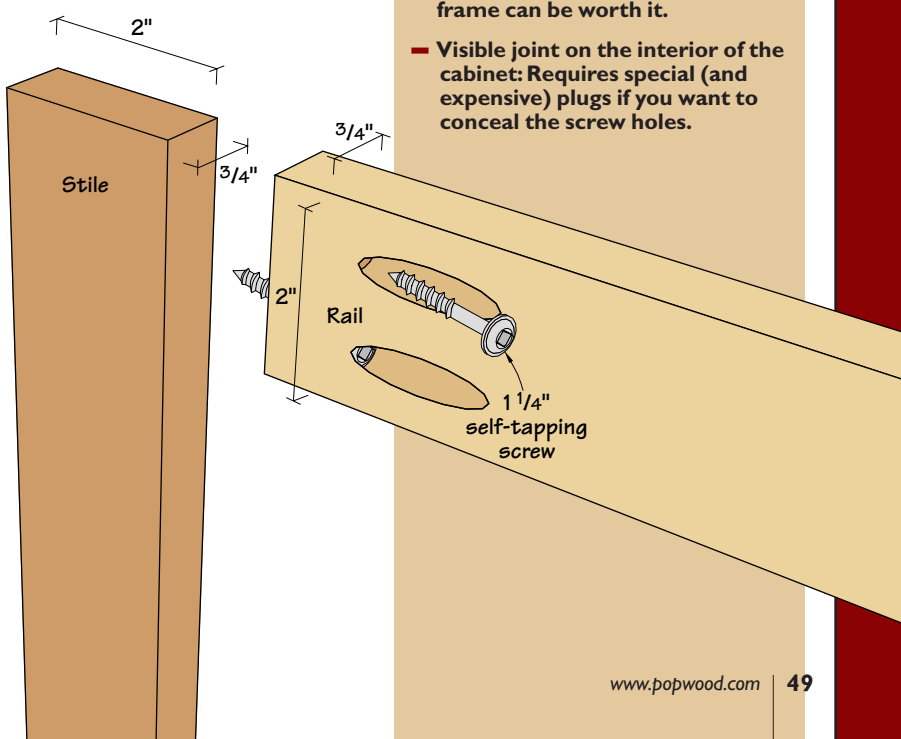
Supplies

Woodcraft 800-225-1153 or www.woodcraft.com

Kreg K2000 jig kit, item #141941, $139.99

Face frame screws: Troy Sexton recommends QuickScrews from S & G Specialty Fasteners Inc. 800-743-6916 or www.quickscrews.com

Sexton recommends S & G's #7 x 1¼" Hi-Lo thread all-purpose screws (part #7622). Call S & G for a distributor near you.



Pros

+ Few width restrictions: The only width restriction you'll possibly face is a rail that's too small for one hole (about ¾"). If you're using rails the same thickness as the cabinet sides, you might as well nail the parts on and call it a frameless cabinet.

+ No clamping required: Outside of using the supplied Vise-grip to align the joint for assembly, if the parts are cut square and the correct screws are used, there is no need for clamps.

+ Fastest joint from layout to finished product: I timed every operation using this jig; without a doubt, it makes a ready-to-apply frame in the shortest time. I came up with less than a minute for each joint. The learning curve is almost non-existent for this method. It's very easy to pick up.

+ Self-contained system — except for the drill: The Kreg 2000 kit that we used came with everything you need to get started, except for a corded drill. The kit's price, about $140, put it in the mid-range for equipment costs when compared to other joinery methods.

Cons

– Cost per joint is high: If you don't want to plug your screw holes, each joint is going to cost you about 8 cents (less if you buy your screws in bulk). If you want to plug your holes, the cost goes up to about 36 cents a joint. Biscuits and dowels cost between 2 and 3 cents. If you're in a big hurry, saving at least 30 minutes of time when clamping up your face frame can be worth it.

– Visible joint on the interior of the cabinet: Requires special (and expensive) plugs if you want to conceal the screw holes.

Biscuits

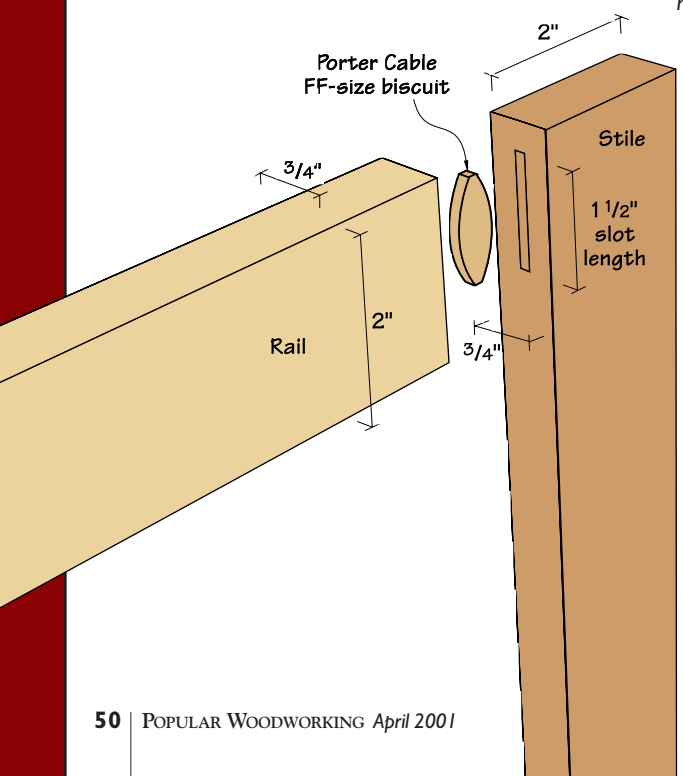
Like pocket screws, biscuits are quick, accurate and easy

Marking the joint
When marking the joint for the biscuit slot, butt the pieces together and measure over roughly half the width of the rail and mark a line across the joint. A combination square holds everything square for an accurate mark. Mark your parts all face up or face down so your slots will align.

Setting the joiner
Most biscuit joiners have a scale that shows you where the center of the blade is. Some, such as this one, even have a setting for the center of a 3/4"-thick part. Set the joiner and make a test cut on some scrap to make sure you aren't cutting past the width of the end of a rail.

Make the cut
If you use Porter Cable's face-frame biscuit cutter in the Porter-Cable 557, be sure to use a clamp to hold the parts in place. Place gentle pressure on the fence to make sure the joiner remains square to the part.

Glue up
One of the many uses I've found for plastic lids is as small glue pans. I cut up a disposable cardboard-handled paint brush for applying the glue. Use a small brush with somewhat stiff bristles to spread the glue. This gives you more control of the glue during application. Paint glue on half of the biscuit and press it into one slot of the joint. Then paint glue on the exposed part of the biscuit and assemble the joint. Clamp up your work and measure across the corners to check for square.



Pros

+ **Fast joint: With the exception of the pocket screw jig, biscuit joinery is the fastest method going. All you do is mark a centerline on a rail and stile. Set the joiner and you're off to the races. This was the first time I'd used the face-frame blade in the Porter- Cable 557 joiner, and I had some problems with the parts moving around. A clamp did the trick.**
+ **Most forgiving technique: Pocket screws aside, this is the most forgiving technique. The slots are bigger than the biscuits, so you routinely get almost a 1/4" of slop in the joint for alignment.**
+ **Learning curve is low: It takes little time to learn how to make one of these joints. While it's been awhile since I learned how to use a biscuit joiner (over 15 years), I'm always amazed at how easy these tools are to use.**

Cons

− **Biscuits can telegraph through the joint: A biscuit is like a sponge and will wick up moisture in glue. If a biscuit is installed too close to the surface of a joint, it can expand and create a bump in the surface. You see the bump and flush it up. When the biscuit dries, it takes the surface of the joint with it, creating a hollow. Avoid this problem by cutting your slots in the middle of the thickness of the parts.**

− **Stock dimensions have limitations: There is a limit on the smallest width of rail you can use. With the Porter-Cable's face-frame biscuits, I could only make a rail about 1 5/8" wide before cutting through the sides of the rail. You can get smaller dimensions using Ryobi's Mini Biscuit Joiner. Here are the maximum widths of the rails for common biscuit sizes.**

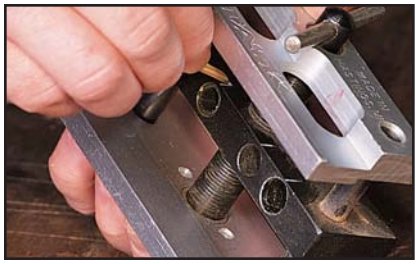
Biscuit #	Width
Ryobi R1	1"
Ryobi R2	1 3/16"
Ryobi R3	1 3/8"
Porter-Cable FF	1 5/8"
#0	2 3/8"
#10	2 1/2"
#20	2 3/4"

− **Biscuits are high-maintenance fasteners: Store them in a dry environment, such as a resealable jar or airtight bag. Here's a tip for biscuits that won't fit in their slots: try microwaving them.**

− **Watch for bending: If you use too much clamping pressure, it's possible to bow the parts. Ease off on the pressure and compensate by placing clamps on both the front and back sides of the frame.**

Dowels

This joint replaced the mortise and tenon and is still a favorite method of some



Improving the jig

Most doweling jigs have marks that are obviously meant to be seen only under a microscope or by a test pilot with 20-15 vision. Improve the visibility of your jig by painting a contrasting paint on the increments. This self-centering jig had a black painted finish so I used white paint. Make a "brush" from a pine splinter whittled to suit the job.

Marking the joint

Use the same technique for marking dowel joints as you would use for biscuits. You have to be pretty accurate. Mark in about 1/2" from both sides. On a joint that's wider than 3", put a third dowel in the center.

Drilling the stile

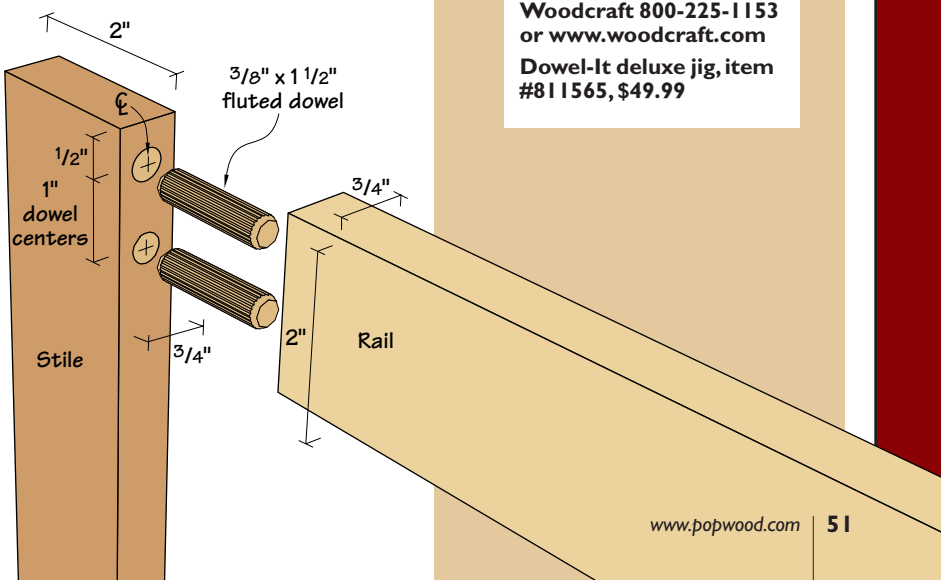
Use 3/8" dowels in 3/4"-thick material. Clamp the stile so that enough of the edge protrudes from the clamp to attach the doweling jig. Line up the 3/8" hole on the layout mark. You want the hole depth to be 1/16" deeper than the dowel will go. Use a brad point drill with a stop collar. You'll find that you get better results when you use a corded drill with its higher speed and torque than you will with a cordless drill.

Drilling the rail

Clamp the rail so its end is sticking straight up in the air. This is when it can get dicey. You have to make sure the jig is clamped to the end of the rail and square with the part. If not, you'll get a hole that's out of parallel with the holes on the stile. You might have to transfer the layout marks to the other side of the part and turn the jig around to get the jig to stay put.

Gluing

Dowels are made with small splines that discourage the joint from "going hydraulic." What this means is that a dowel without splines (or a spiral cut in the side), can act like a piston when clamped. The dowel effectively plugs the hole, and the resulting back pressure can actually keep a joint from clamping together (or at least make it very difficult to clamp). Put just a small amount of glue in the hole and be sure to apply glue to the dowel as well.



Pros

- **No material size restriction: Like the pocket hole jig, you can use almost any width of stock for your rails.**
- **Modest equipment costs: All you need is a jig (costing $40 to $70), some dowels and a drill.**
- **Good solid joint for face frames: With the extra gluing area (more than a biscuit but less than the mortise and tenon) this is a very strong joint that is just right for face frames.**
- **Easier than mortise and tenon to learn: The only critical skills are the ability to lay out the joint correctly and holding the jig square with the parts.**

Cons

- **Tricky to align: If you botch the alignment of the holes even the slightest bit, the joint will be difficult or impossible to assemble. Always double-check the jig's position on your work.**
- **You need good equipment: A good jig and stop collars are paramount to getting good results. Dowel-it and Stanley both make good jigs.**
- **Dowels must stay dry: If they get any moisture on them, they're subject to the same problems as biscuits in getting them into a hole.**

Supplies

Woodcraft 800-225-1153 or www.woodcraft.com

Dowel-It deluxe jig, item #811565, $49.99

Photo by Al Parrish

All-in-one Cabinet FOR THE SMALL SHOP

This shop cabinet squeezes 13 cubic feet of tool storage into less than 3 square feet of floor space.

If you're like most woodworkers, your shop is packed to the gills with tools, tooling and accessories. Storing power tools on open shelves is no good; dust will get into the windings and shorten the life of your motors. You need an enclosed cabinet, and you need one that takes up less floor space than a band saw. This cabinet has a place to store routers, all the bits a woodworker could need and other accessories such as edge guides, bases and template guides. There's also room for other tools such as jigsaws, sanders, biscuit joiners and even a portable planer.

Build the Case

Here's the simple jig to rout the dadoes. It uses a bearing-on-top straight bit to guide against the edges of the jig. Clamp the jig right on the marked lines and rout the dado.

Before cutting the plywood, check out the optimization diagram on our web site (www.popwood.com), which shows you how to lay out the parts on two sheets of plywood. After the parts are cut to size, cut ½" x ¾" rabbets on the ends of the sides to hold the top and bottom pieces. Unless your shop has high ceilings, you'll need to cut the rabbets with a plunge router, straight bit and an edge guide. First set the router for the finished depth using your turret depth stop. Now raise the bit halfway and make a pass that defines the shoulder of the rabbet. Now climb cut (which is basically routing in reverse, moving the router backwards) the waste out to the edge of the board. Finally, plunge to the full depth of your rabbet and repeat the above procedure.

The next step is to cut the ¼" x ¾" dadoes in the sides. Mark the location of the dado and make a simple jig to rout it. The jig uses a bearing-on-top straight bit to guide against the edges of the jig. To make the jig, take the fixed shelf and place two strips of plywood against it on a flat surface. Place all this on top of two cross pieces on either end of the strips and glue and nail them in place. Leave a little room (about ½") across the length of the dado cut to adjust the jig. Clamp the jig on the marked lines and rout the dado in two passes. Finish machining the sides by cutting the ½" x ¼" rabbet for the back on the back edge of both sides, top and bottom. (If the cabinet won't be attached to the wall, use a thicker back for stability.) Check the top, bottom and fixed shelf for a good fit, then glue and nail or screw the cabinet together. Fit the back and set it aside. Place the case on a flat work surface and add iron-on edging. Finish the case by gluing and nailing the hanging rail into the top of the case, flush with the rabbet in the back.

by Jim Stuard

Comments or questions? Contact Jim at 513-531-2690 ext. 348 or JimS@FWPubs.com

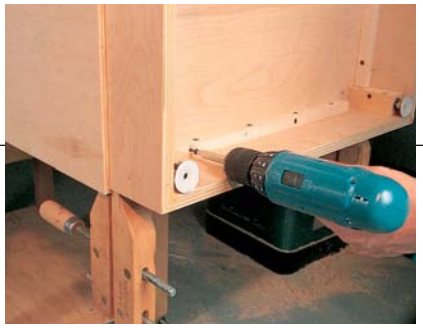
Build the Base

Now comes the adjustable base. When I made custom cabinetry, we often added an adjustable-height base to cabinets so we could compensate for uneven floors or walls. The base is a simple plywood rectangle. You attach the adjustable feet to the inside corners and drill holes in the case above the feet. This allows you to adjust the base with a screwdriver while the cabinet is in place.

The base itself is a simple mitered frame, with biscuits added at the miters. Cut the miters, then glue and clamp the base together. Make sure the base is square by measuring across the corners.

While the glue dries, cut out the blocks that hold the adjustable feet. They're just 1½" x 1½" x 3¼" blocks. Drill a centered, 7/16" hole through the length of the block for a T-nut. Drill holes at right angles to one another in the block that will be used to screw the blocks to the base. Hammer in the T-nuts. With the feet threaded into the blocks, the entire assembly is about 4" long. It should flush up with the top and bottom of the base frame.

Use screws and glue to attach the levelers to the inside corners of the base frame. The top of the block (the end opposite the foot) should be flush with the top edge of the base frame.



With the case on its back, take two hand screws and attach them to the back lip of the case, 1/4" in from the back. This provides a little offset for the moulding on our walls. If you have larger base moulding where you are, make the base a little taller or less deep to accommodate the larger moulding. Place the base up against the case bottom. Center it on the bottom and temporarily screw it into place with four 1 1/4" screws.

Now it's time to attach the base. Cut out four ¾" x ¾" cleats that fit between the levelers and drill mounting holes in the cleats for attaching the case bottom. Screw them in place about 1/32" down from the top edge of the base. Make sure to Position the base on the bottom. Temporarily screw the base in place with four 1¼" screws.

Take out all the feet and use a pencil to mark the location of the top of the leveler hole. Drill the holes using a piece of scrap to back up the hole or you'll tear out the veneer on the inside of the case bottom. When you re-attach the base, you'll be able to adjust the levelers using a straight-bladed screwdriver.

Build the Doors

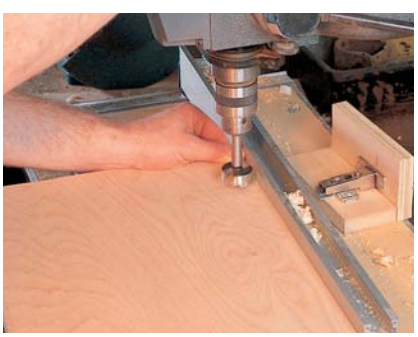
The doors are plywood slabs with a mitered moulding nailed to the edges. The moulding is a 3/16" x 13/16" solid wood edge with a bullnose routed on the front (see diagram). The bullnose is referred to as a cockbead, which is a common detail on period furniture from the 18th and 19th centuries. It's an easy way to dress up a door or drawer front.

After the edging's been applied, it's impossible to sand into the corners, so begin making the doors by finish sanding the fronts of the doors and drawer fronts. Next, attach the moulding. First apply two opposite pieces, then fit and attach the last two pieces.

Use a sharp pencil to mark the location of the miter cuts. Place the piece on the miter saw and cut to the line. You don't always get the cut right the first time. Make your cut a little long and nibble away at the miter until you get a snug fit, then glue and nail the edges in place. We use Accuset's micropinner to attach the mouldings. The 23-gauge pins don't split the edge, and they leave a hole about the size of a period on this page. Putty the holes if you like. Rout off any overhang on the back side with a router and straight bit. Finish sand the backs.

After making the stock according to the diagram, take a piece and cut a miter on one end. Be sure to make the first cut with the bullnose up. This isn't important for the first two edges, but it's very important for the last two. Use a piece of scrap with a miter cut on both ends to test the fit of the miters.

When fitting the second set of edges, start by cutting the miter on one end. Flip the edge over and place what will be the bottom edge of the miter into the miter on the right. Gently press the flat edge up against the other miter. Mark the location of the miter and make the cut.



Drill the holes for the hinge cups on your drill press. Always make a test piece with a hinge and mounting plate to test your setup.

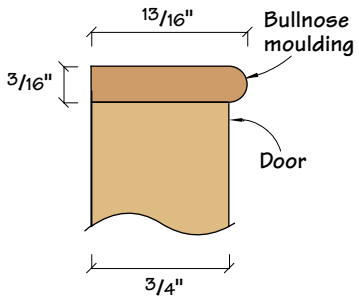
Take out all the feet and use a pencil to mark the location of the top of the leveler hole. Remove the base and drill ½" holes into the case bottom.

SUPPLIES

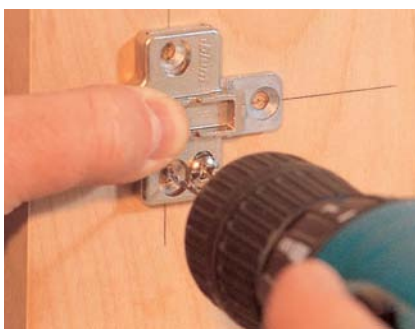
Lee Valley Tools
800-871-8158 • www.leevalley.com
4-107° Full overlay hinges, 00B10.01
1-14" Full ext. drawer slides, 02K10.14
4-4" Swivel leveler, 01S06.04
4-⅜"-16 T-nuts (10 pc.), 00N22.24
5-4" Wire pulls, 01W78.04
1-Coat hook, 00W80.01
24-Shelf pins (50pc.), 94Z03.02
1-25' Maple edge banding, 41A05.01
2-25mm x 15mm hinges, 00D30.08
8-#1 x ⅜" screws (10pc.), 91Z01.02

This is offered by Lee Valley as a package priced at $72. Ask for item #05D1510

Note: The screws supplied with the hinges use a #1 (square) drive. You'll need a small #1 square drive bit.



Bullnose Moulding



Lay the plate on the marks and drill pilot holes into the cabinet.

You're ready to hang the doors. The cups for European cabinet hinges are usually 35mm or really close to 1 3/8".

Using the instructions supplied with the hinges, derive a drilling location for the hinge cup. I've always drilled hinge cups about 3" or 4" in from the top and bottom of the door. This leaves enough room to adjust the hinge when mounted. The first thing is to drill the hinge cup holes. Set your drill press to drill the holes a little deeper than the cup.

Now transfer the layout holes to the door on the cabinet. Attach the mounting plate and screw the hinges in place. European hinges can be adjusted in three dimensions: in-out, up-down and left-right. When the cabinet is level and plumb, adjust the hinges to make the doors even.

Drill the 1/2" and 1/4" holes. Nail in a couple of rails on the inside of the drawer and simply drop the panels in place. The panel for 1/2"-shank bits is drilled all the way through and the panel for 1/4"-shank bits is drilled down 5/8".

Build the Router Bit Drawer

After attaching the slide to the drawer, mark the location of the cabinet part of the slide on the cabinet side. Use a framing square to run a line back from this mark and mount the slide 1/16" back from the front of the cabinet.

The drawer uses standard construction. Cut 1/4" x 1/2" rabbets on the ends of the sides. Cut a 1/4" x 1/4" groove in the bottom inside edges of all the parts to hold the bottom. Glue and nail the drawer together with the bottom set into the groove.

After the glue is dry, take apart the commercial drawer slides, scribe a line on the sides and attach the small part of the slide to the drawer box. Make sure it's flush to the front of the drawer box. Measure from the mounting line and add 3/4" to that for the lid, hinges and gap. Measure that distance down from the inside, underneath the fixed shelf. Mark the location and mount the slide. The slides have two different mounting holes. The drawer has slots that allow up and down adjustment, and the cabinet parts have slots that allow forward/backward adjustment. Insert the drawer into the slides on the cabinet.

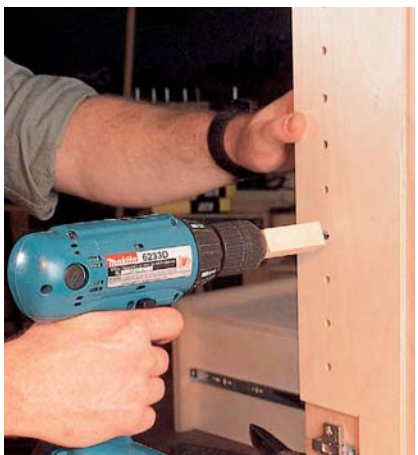
Before mounting the front on the drawer box, nail two finish nails through the front of the drawer box until they just protrude from the outside. Place the front against the drawer box and space it so the gaps on the top and bottom are equal. Push the front against the nails in the drawer box and gently push the drawer out. Drill some clearance holes and attach the front.

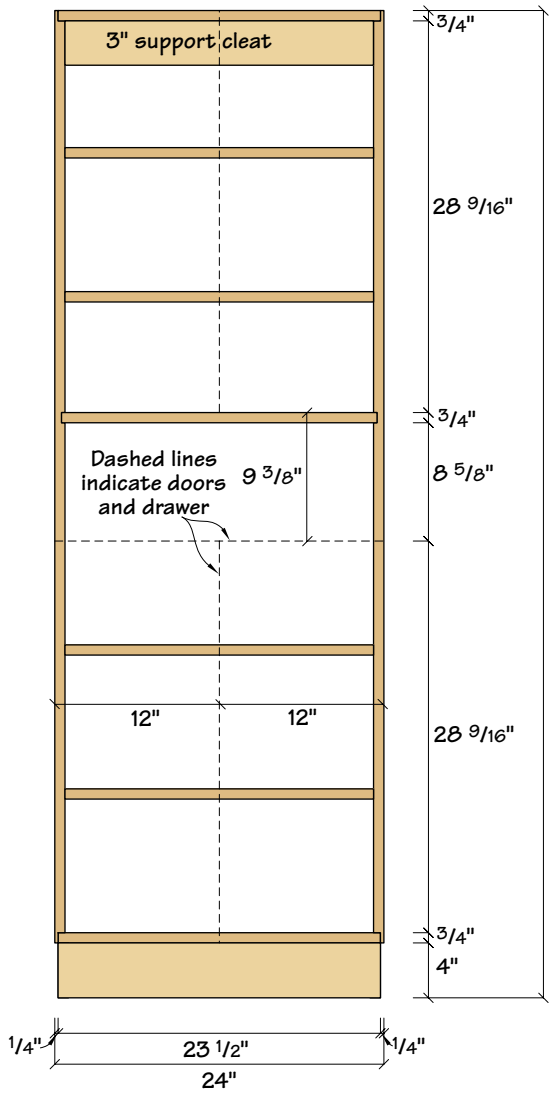
Now nail on the drawer lid's back rail and attach the lid with two hinges. Drill a 1" hole in the lid so you can lift it easily. Cut out, drill and attach the two router storage inserts.

Position the drawer front and place a couple of clamps on the drawer box to hold it in place. Drill countersunk clearance holes into the drawer box and attach the front with 1" screws.

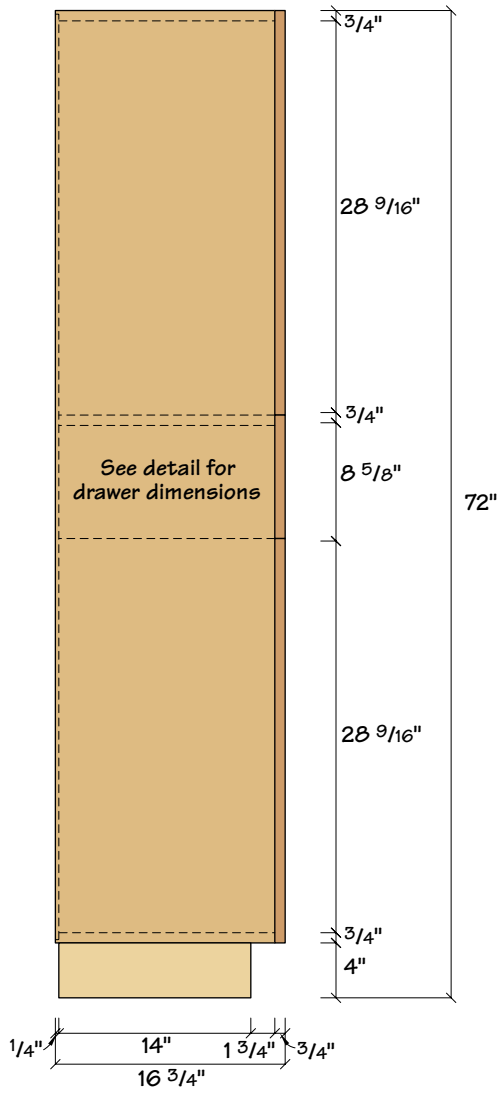
Finish up the project by drilling a series of 7mm holes for the shelf pins. Make a template from scrap for this. Lee Valley sells metal sleeves for the shelf pins, but I deemed them unnecessary. You could probably get away with using a 1/4" bit to make these holes, but it makes the pins fit a little sloppy. Attach the back with #6 x 1/2" flathead screws. Check the fit of all the doors, drawer and shelves, then disassemble all the loose parts for sanding. Apply three coats of clear finish and reassemble all the parts. **PW**

Use a stop collar on your drill bit when drilling holes for the shelf pins. I made this drilling jig from shop scrap.





Elevation

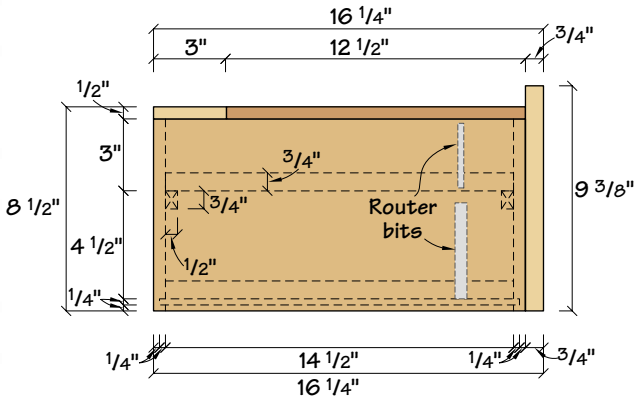


Profile

SHOP STORAGE CABINET

No.	Item	Dimensions T W L	Material
2	Sides	3/4" x 16" x 68"	Birch ply
2	Top and bottom	3/4" x 16" x 23 1/2"	Birch ply
1	Fixed shelf	3/4" x 15 3/4" x 23"	Birch ply
4	Shelves	3/4" x 15 1/2" x 22 1/2"	Birch ply
1	Back	1/4" x 23 1/2" x 67 1/2"	Birch ply
4	Doors*	3/4" x 12" x 29 1/4"	Birch ply
2	Base front and back	3/4" x 4" x 23 1/2"	Birch ply
2	Base sides	3/4" x 4" x 14"	Birch ply
1	Cleats for base	3/4" x 3/4" x 96"	Solid wood
4	Leveler blocks	1 1/2" x 1 1/2" x 3 1/4"	Solid wood
1	Support cleat	3/4" x 3" x 23 1/2"	Birch ply
1	Drawer front*	3/4" x 9 3/8" x 24"	Birch ply
2	Drawer sides	1/2" x 8" x 15 1/2"	Baltic birch
2	Drawer front and back	1/2" x 8" x 21"	Baltic birch
1	Drawer bottom	1/4" x 15" x 21"	Baltic birch
2	Drawer rails	1/2" x 1" x 20 1/2"	Baltic birch
1	Drawer insert slider	3/4" x 14 1/2" x 12"	Birch ply
1	Drawer lid	1/2" x 12 1/2" x 21 1/2"	Baltic birch
1	Lid back rail	1/2" x 3" x 21 1/2"	Baltic birch

* Finished size with bullnose edging attached



Profile of Drawer


ELVIS PRESLEY THE NUMBER ONE HITS
R.E.M. OUT OF TIME
WARNER BROS.
NEIL YOUNG - HARVEST MOON
REPRISE

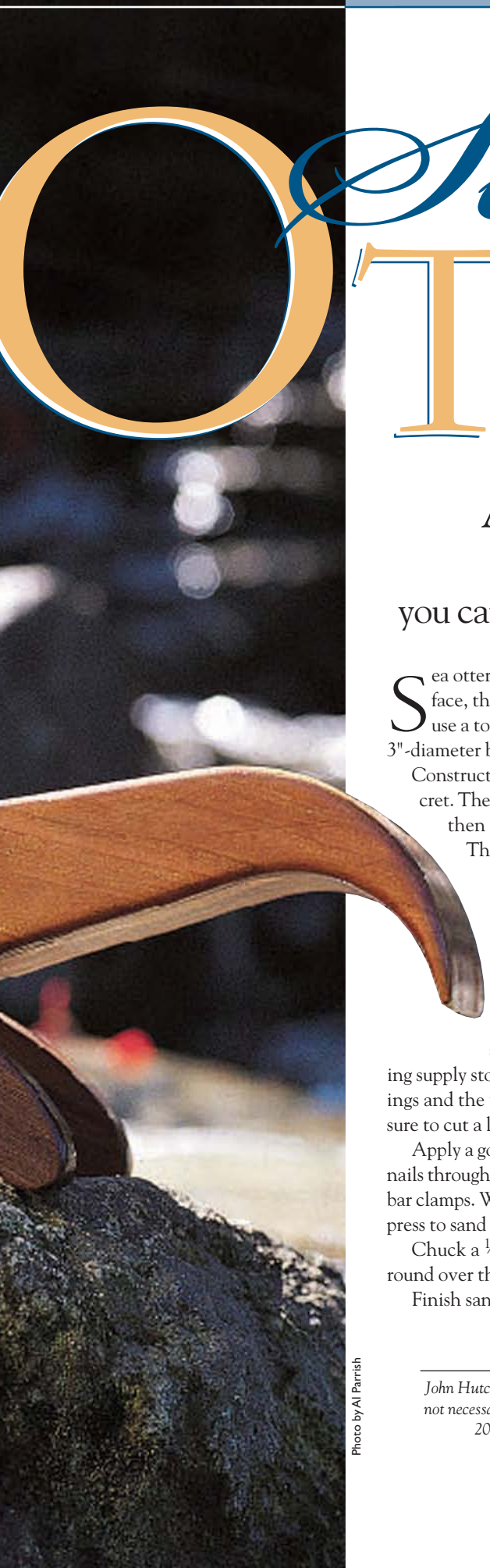


Photo by Al Parrish

Sea-D OTTER

Armed with a band saw and a free weekend,
you can easily complete this jolly CD holder.

Sea otters can dive to 120-foot depths to find food. When they come to the surface, they lie on their backs and use their stomachs as a table. Sometimes they use a tool, such as a rock, to open the hard shells of their prey. This otter uses a 3"-diameter ball to help organize a growing CD collection.

Construction of the Sea-D Otter is easy even for beginners once you know the secret. The otter is made by cutting out several layers of wood on your band saw and then gluing them together like a sandwich to produced the finished shape. There's no carving or complicated joinery.

On the following pages you'll find scale drawings of the parts of the otter. You can enlarge these on a photocopier. Free full-size drawings (in pdf format) are available for downloading at our website, www.popularwoodworking.com.

Construction

Begin by adhering the body patterns to ¾" cherry by using a light application of spray adhesive, which is readily available at art or drafting supply stores. Drill all the ⅛"-diameter registration holes according to the drawings and the ⅝" nose socket. Cut out the shapes on your band saw or scroll saw; be sure to cut a little wide of the lines.

Apply a good carpenter's glue to the "A" and "B" plates, align them with 8d finish nails through the registration holes, and clamp the assembly with pistol-grip or f-style bar clamps. When the glue is dry, use your spindle sander or drum sander in your drill press to sand down to the lines and smooth all the edges.

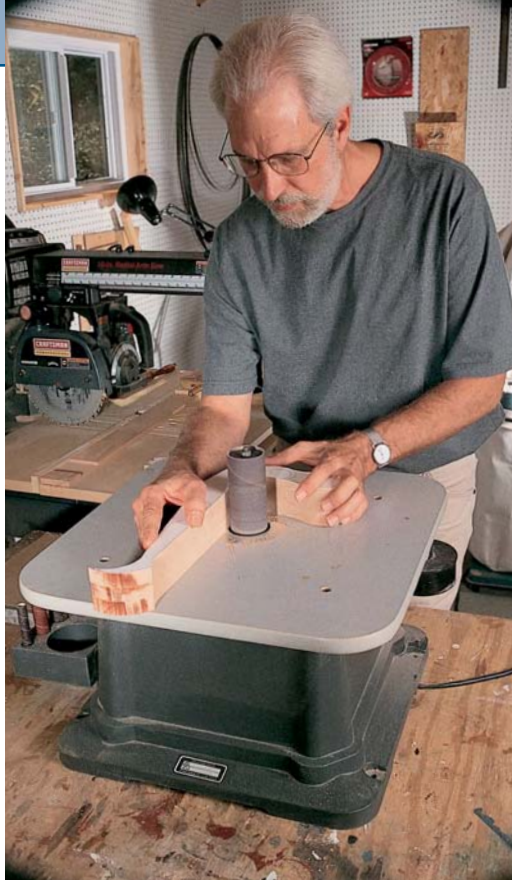
Chuck a ¼" roundover bit into your router and put it in your router table. Now round over the edges of just the head area.

Finish sand the shoulders on the outer body "C" plates because they will be rela-

by John W. Hutchinson

John Hutchinson, an architectural detailer, has found that the joy derived from woodworking is not necessarily proportional to the size of the project. His "Secret Toad" appeared in the August 2000 issue. Word has it that other beasties are currently incubating in his shop. You can contact John at SeaDOtter@aol.com

After you adhere the patterns to your wood, drill all the holes shown on the patterns using your drill press.



An oscillating spindle sander makes quick work of sanding smooth all the curves on the body pieces.

tively inaccessible after final assembly. Align the "C" plates with the "A" and "B" stack using the registration holes and glue them in place. Use your spindle sander to sand the "C" plates flush with the inner body assembly. Round over the perimeter of the outer plates using your router table.

The body is now complete and ready for hand sanding. Although your parts will be bruised from stopped roundovers and router burn marks, don't be discouraged. I have found that backing up 100-grit sandpaper with a 3M Scotch-Brite pad provides just the right balance of rigidity and flexibility needed for smoothing out rough spots. When you're satisfied with your sanding, switch to using the pad alone to perfect the finish.

Cut out the arms and legs from ¾" walnut. Mark the registration holes with an awl, but do not drill them at this time. Make the arms left- and right-handed by marking them on opposite sides. Ease the edges of these small parts with the sandpaper/pad technique described above. Before final assembly, apply the finish.

Finish

This otter deserves a silky smooth finish. With 600,000 to 1 million hairs per square inch of body surface, otters have the finest fur of any animal. Humans, on the other hand, have only 20,000 hairs on their whole head. (The author who wrote this article, unfortunately, now has about half that number.) For a velvet finish, I have come to rely on hand sanding with 3M pads, followed by General Finishes' wipe-on Sealacell clear tung oil sealer capped with General Finishes' semi-gloss heavy-duty oil and urethane top coat. Lay the top coat on sparingly, in long strokes, with a wide camel-hair brush.

Final Assembly

Re-bore the registration holes on the outer body "C" plates to a depth of ½" for 3/16"

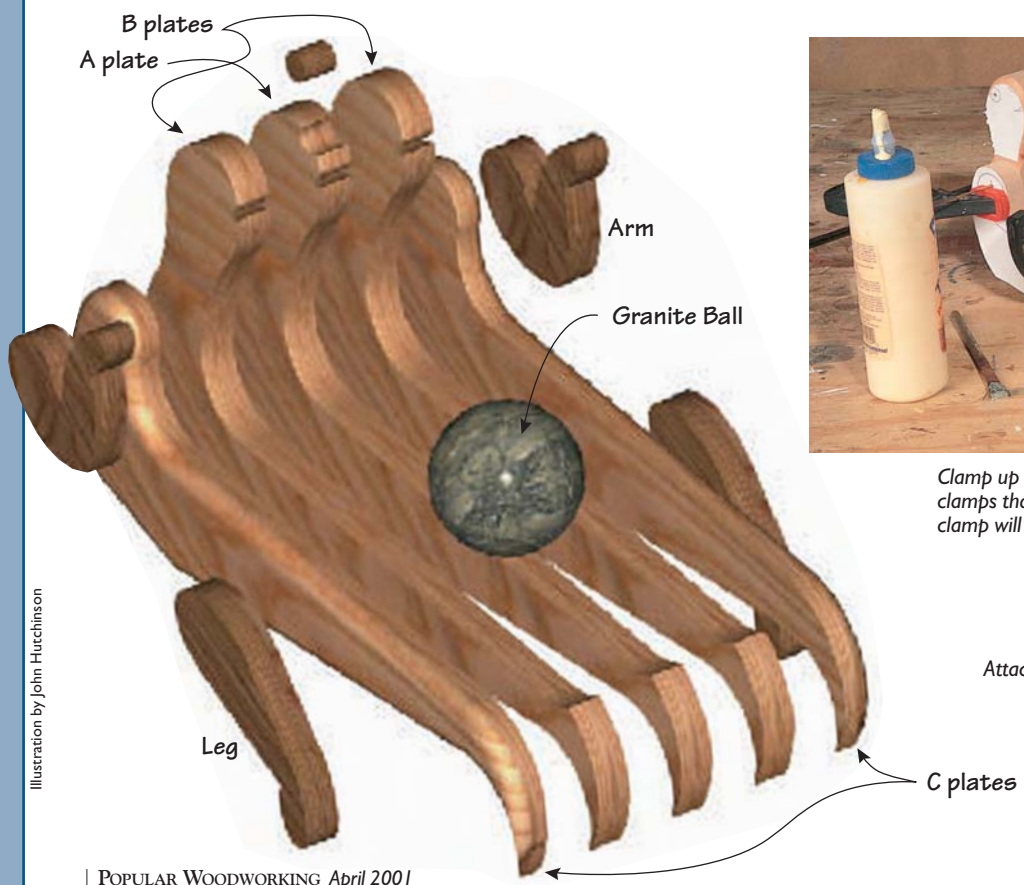
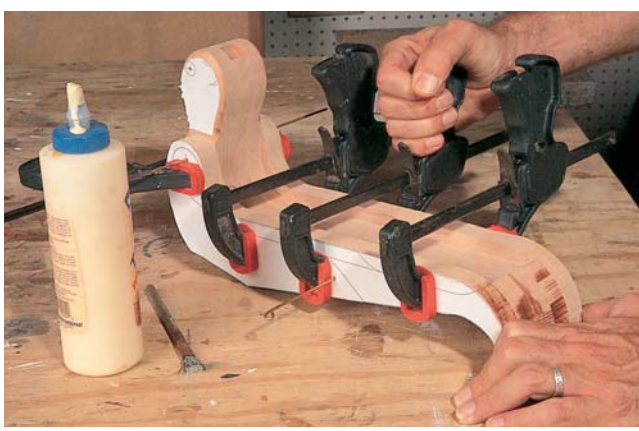
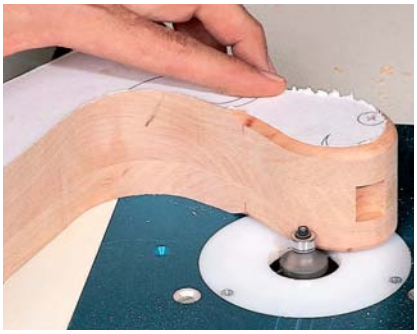


Illustration by John Hutchinson



Clamp up your assembly. I like the one-handed clamps that are so popular today. Just about any clamp will do the job.

Here's a trick to sanding small parts (something I do quite a bit of). Attach your sandpaper to a piece of granite or flat glass and rub the parts on that.



Here you can see the 1/4" roundover bit at work on the head area. Be sure to roundover just the head on the "A" and "B" assembly.

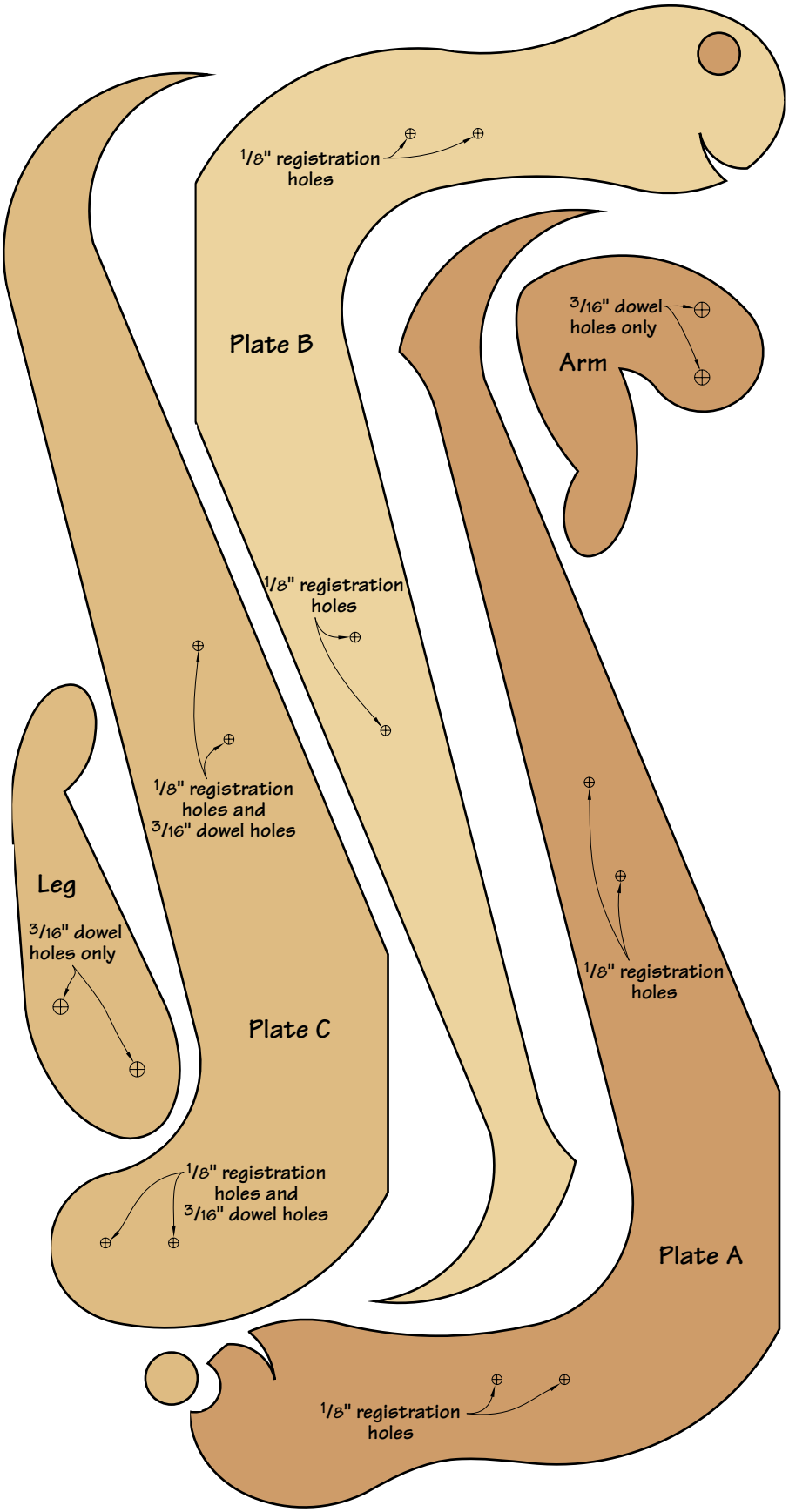
dowels. Drill the same holes in the arms and legs at the awl marks. Glue 1" lengths of dowel in the body holes. Glue the arms and legs to the protruding dowels. Next, with a 3/8" Forstner bit, drill the eye sockets and glue in screw-hole buttons. Finally, glue in the nose, a 3/4" length of 5/8" walnut dowel.

Final Thoughts

The rolling ball snaps the CDs to attention. This is the accessory that presents unlimited possibilities. It can range from a simple wooden ball to the most exotic gemstone sphere. Looking for the right ball can become an interesting project in itself.

One final note: There's more than one way to build this project. Decreasing the scale of the otter makes it a computer disk holder. Increasing it makes it a bookrack. Someone even suggested that increasing the scale further (with a slight adjustment to the arms) could lead to a terrific chaise-lounge. So many projects, so little time. **PW**

Drawings are at 50% scale. To enlarge these plans 200%, photocopy them once at 150% and then a second time at 133%.



wright-PRINT

The celebrated architect

in 1908, but it was never built during

For the last seven years, every time I opened the book "In the Arts & Crafts Style" it fell open to the same page. There, perched on a broad-armed settle, is a print stand that was originally designed by architect Frank Lloyd Wright in 1908 but never built during his lifetime.

The print stand shown in the book was built in 1990 by a company owned by Thomas A. Heinz, a Chicago-area architect and the author of more than 15 books about Wright. Apparently Wright designed the stand to display Asian prints, of which he was an avid collector. However, the stand in the book displays only a single rose, no prints. Even stranger, over the years I've noticed this design appear in several different forms. In one, the proportions of the stand have been altered and the space above the spindles houses an 8 x 10 photo. Other companies have built the stand in a much bigger form and turned it into a floor lamp.

As I set out to build my own version, I wanted it to look as "Wrightian" as possible, and be functional as a print stand. So I added the stubby stops on the table to prevent prints from sliding off the stand. I also made the top cap (above the spindles) a little longer to lock into the mitered frame. Finally, I pushed the legs out toward the edges of the table just a bit. The first prototype I mocked up seemed a bit wobbly to me.

You can build this print stand using thin pieces, shorts and offcuts that are hiding in your scrap pile. And here's the amusing part. Versions of this project sell for about $500 these days. Some days it feels great to be a woodworker.

by Christopher Schwarz

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

style STAND

designed a very similar print stand
his lifetime. Now you can complete the job.

Build the Mitered Frame

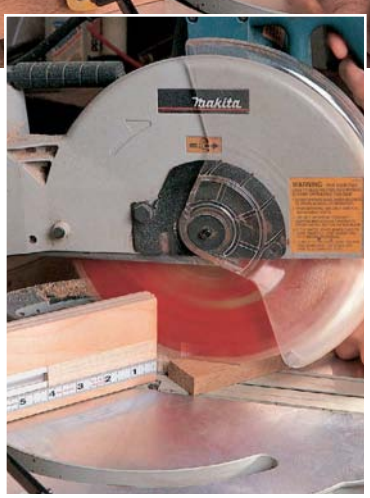
All of the parts of this project are wedged inside the mitered frame, so the frame is a good place to begin construction. Cut your pieces to rough size and then head to your miter saw or table saw.

If you're new to cutting miters, here's a piece of good advice: let geometry be your guide. Most beginning woodworkers will cut the first miter with their saw or miter gauge set 45° in one direction, and then turn the gauge or saw to 45° the other way to cut the adjoining miters. This is a mistake.

Your equipment probably isn't precise enough. You'll end up sanding your miters to fit, cutting them over and over or learning to live with your mistakes. Instead, let complementary angles help you out. Set your miter gauge or saw to 45° and cut one-half of the joint on the left side of the blade and one-half on the right side of the blade. If you are off by a degree or so it won't matter because the piece cut on the other side of the blade will cancel out the error. (If you do this with your table saw's miter gauge, you're going to need to screw a long accessory wooden fence to your gauge.) When your miters are complete, cut biscuit slots, dowel holes or a spline to reinforce these joints. Glue the frame together using a band clamp or miter clamps.

Table and Top Cap

The spindles are attached to the table and the top cap using mortise-and-tenon joinery. Lay out the location of the ¼"-wide x ½"-deep x 1"-long mortises on the table and top cap using the full-size drawing on the next page. Cut your mortises using a mortiser, drill press or chisel. When done, go ahead and cut the tenons to match on the spindles. I cut



*I used a miter saw and stops to cut the miters for the frame. First I cut the miters on the short ends on the left side of the blade **(above)**. Then I cut the miters on the long pieces on the right side of the blade **(left)**. The result? Tight miters.*

When you sand the spindles, you will save yourself a world of headaches by clamping them all together and sanding them at once. Not only will you save time, you'll also ensure that all the edges are crisp and line up perfectly when glued in place.

mine on the table saw. Dry-fit the spindles and make sure everything lines up. Take the assembly apart and set everything aside.

Legs and Notches

I attached the legs to the table using #20 biscuits. Cut the slots using a biscuit joiner and set the parts aside.

Now it's time to make the most critical cut in the whole project: the notches in the table and top cap. These notches allow the table and top cap to squeeze inside the frame. You want the fit between these pieces to be nice and tight because it's a highly visible area.

I cut the 5/8" x 1/2" notches using a dado stack in my table saw. Make several test cuts and shim the dado stack until you get just the right fit on the frame. Then, to make sure the height of the dado stack is correct, cut notches on a piece of scrap the same size as the table and see if it all fits.

Cut the notches on the sides, then cut the same size notches on the ends of the table to hold the two stops, which you'll glue in later.

Sanding and Finishing

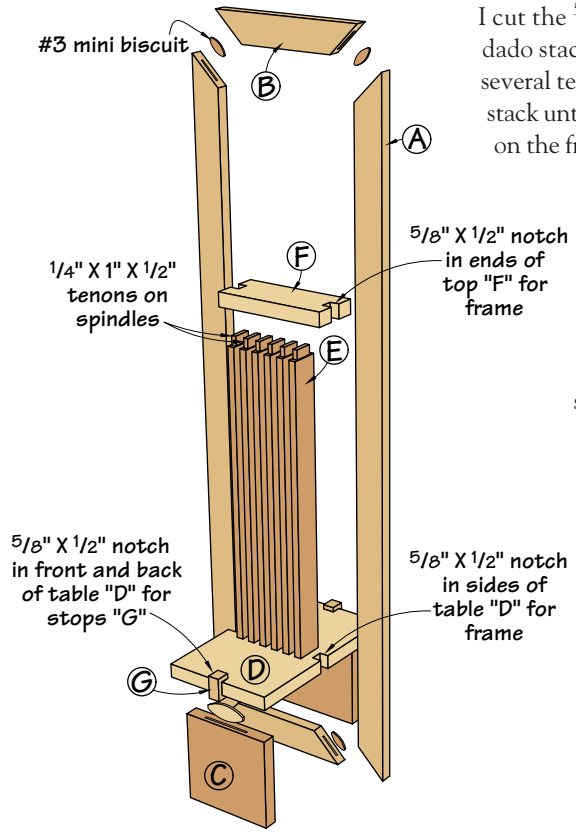
It's best to sand all the parts, finish them and then assemble the project. Getting finish between the spindles would be no fun. Begin sanding with 100-grit paper and sand up to 180 grit. Now glue the stops into their notches, clamp and allow the glue to dry.

To prepare for finishing, cover all the tenons with masking tape and stuff packing peanuts into the mortises to keep finish off them.

A varnish, wiping varnish or oil/varnish blend will give the bare oak a nice warm tone that was typical of many of Wright's pieces. Add as many coats as you need to get a nice sheen.

Assembly

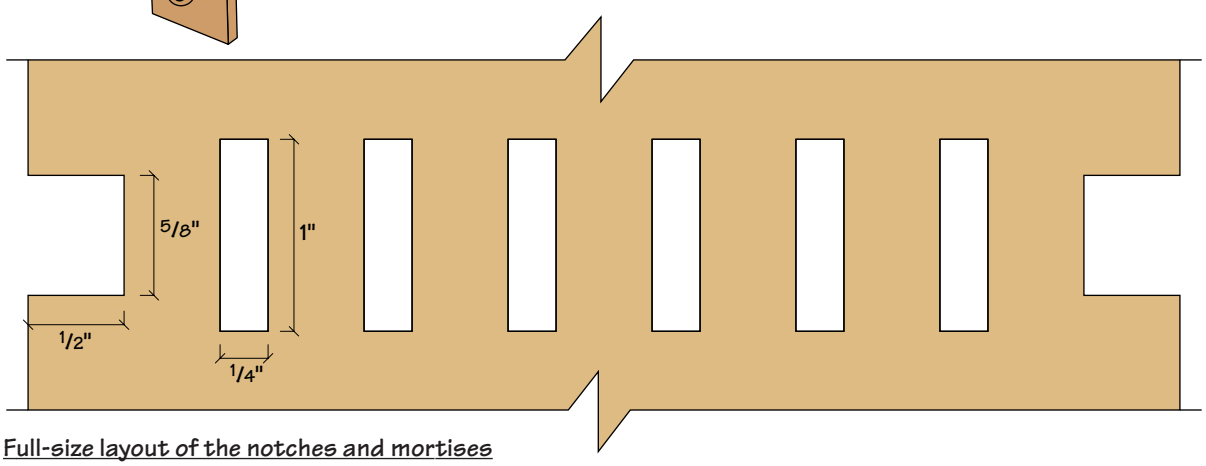
Begin assembly by gluing the feet to the table. Clamp and allow the glue to dry. Now place this assembly inside the frame, and glue the spindles between the table and top cap.



WRIGHT-STYLE PRINT STAND

No.	Ltr.	Item	Dimensions T W L	Material
2	A	Frame, long parts	5/8" x 1 1/2" x 36"	White oak
2	B	Frame, short parts	5/8" x 1 1/2" x 8"	White oak
2	C	Legs	3/4" x 5" x 5"	White oak
1	D	Table	3/4" x 6" x 10"	White oak
6	E	Spindles*	3/8" x 1 1/2" x 17"	White oak
1	F	Top cap	3/4" x 2 1/2" x 6"	White oak
2	G	Stops	5/8" x 3/4" x 1 1/4"	White oak

*Measurement includes 1/2"-long tenon on both ends

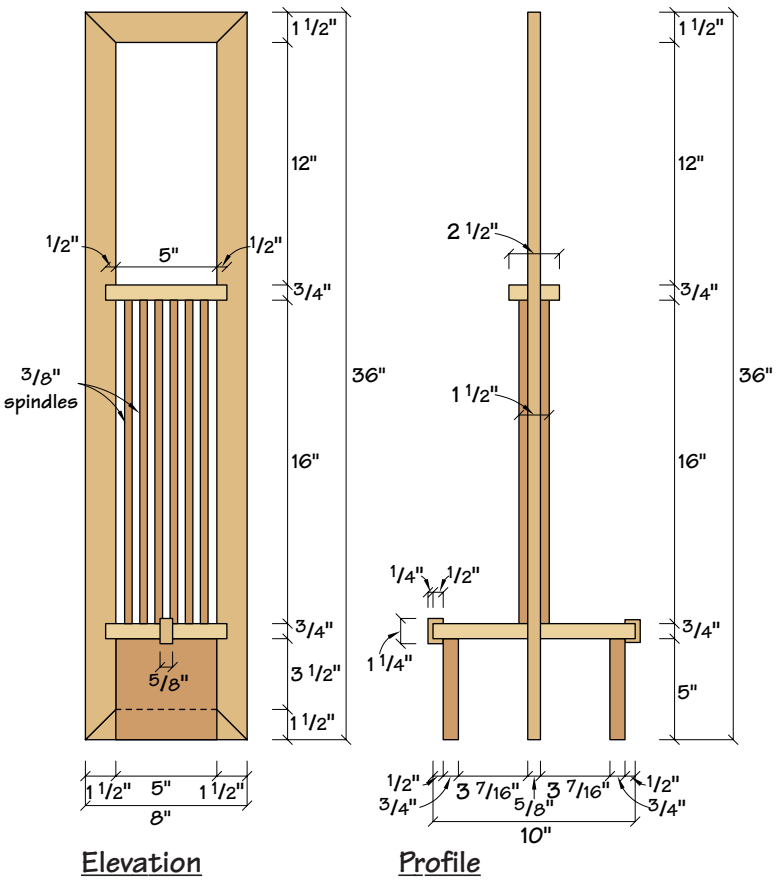


Full-size layout of the notches and mortises

Around Christmas everything seems to come packed in foam peanuts. I kept a few handfuls of them for just this purpose. Before finishing the individual parts, stuff peanuts into your mortises to keep finish off the sides of the mortise.

When the glue is dry, nail the table and top cap to the frame. Nail at an angle on the underside of the table and top cap. If any of your nail heads are sticking out when you are done, cut them off or sink them with a nail set.

Completing this project didn't solve the historical mystery of what Wright's print stand would actually have looked like, but it does solve the problem of where I can display my own collection of Asian prints. **PW**



*After finishing, it's time to assemble the print stand. Carefully place the table assembly between the sides of the frame **(left)**. If you are cautious you can avoid scratching the finish. Now glue the spindles in place. After the glue is dry, remove the clamps from the print stand and nail the table and top cap to the frame **(above)**. I used Accuset's micropinner to do the job because the brads are tiny. Any small-diameter brads will do, however.*

How to Remove Watermarks

A wet drinking glass can make an ugly white or dark ring on your project. Here's how to fix the damage.

Watermarks occur on furniture with finishes that have aged. These marks, also called water rings when they're round in shape, rarely occur in newly applied film-building finishes, even those such as shellac that have reputations for weak water resistance.

There are two types of watermarks: light and dark. Light marks are milky-white and are caused by moisture getting into the finish and creating voids that interfere with the finish's transparency. Dark marks are brown or black and are caused by water and metal residue penetrating through cracks in the finish and getting into the wood.

Both types are easy to remove, but the finish usually has to be stripped before removing dark watermarks. Don't confuse heat damage with light watermarks or ink stains with dark watermarks – both are usually very difficult to remove.

Light Watermarks

To remove milky-white watermarks, you need either to consolidate the finish (eliminate the voids) to the point that the transparency is reestablished or cut the film back to below the damage. Success is not predictable, but, in general, a white watermark is easier to remove in the following circumstances: 1) the finish is newer, 2) the shorter the time the watermark has been in the finish, and 3) the shallower the damage goes into the finish.

Here are the best ways to remove milky-white watermarks, arranged in order from the least damaging (and generally least effective) to the potentially most damaging.

• Apply an oily substance, such as furniture polish, petroleum jelly or mayonnaise, to the damaged area and allow the liquid or gel to remain overnight. The oil will often restore some of the transparency (by filling some of the microscopic voids) but seldom all of it.

• Heat the finish with a blow dryer or heat gun to soften the finish so it consolidates. This may restore some of the transparency if you get the temperature just right, but if you get the finish too hot, it will blister. Avoid getting the finish any hotter than is comfortable to touch.

• Dampen a cloth with denatured alcohol and wipe gently over the damaged area. The trick is to dampen the cloth just enough so it leaves the appearance of a comet's tail of evaporating alcohol trailing as you wipe. (You can practice by wiping across a more resistant surface such as polyurethane or plastic laminate.)

If you get the cloth too wet, the alcohol may soften the finish too much and dull the sheen or smear the finish. This is especially likely if the finish is shellac (used on most furniture finished before the 1930s), which dissolves with alcohol.

• Cut through the damage by rubbing with a mild abrasive such as toothpaste, or with rottenstone (a very fine abrasive pow-

To remove dark water stains, you'll usually have to first remove the finish from the piece. Oxalic acid crystals can be bought at better hardware and paint stores. Sometimes it's labeled "wood bleach."

Brush on the oxalic acid solution over the entire board. The dark marks will begin to fade immediately, though it might take 15 minutes or longer for them to disappear completely.

After the board has dried, remove the crystals using a wet rag or a hose. Never brush the crystals off the surface.

Photos by Al Parrish

der available at most paint stores) mixed with a light oil. Fine #0000 steel wool lubricated with a light oil, such as mineral oil, is more effective because it cuts faster, but steel wool will leave noticeable scratches in the surface. Use steel wool only as a last resort.

Rub the damaged area until the water damage is gone, being careful not to rub through the finish. Then, if the sheen is different from the surrounding area, even it by rubbing the entire surface with an abrasive that produces the sheen you want.

• Spray on a lacquer retarder, such as butyl Cellosolve. There are companies that package this solvent in easy-to-use aerosol cans and market them to the professional refinishing trade. The product is also available from Constantine's (800-223-8087 or www.constantines.com) as "Blush Eraser." ("Blushing" in lacquer is the same microscopic-void phenomenon as a watermark.)

Lacquer retarder will soften almost any film finish enough so the water damage clears up. But use this solvent sparingly. Too wet a coat may cause the finish to blister.

• French polish over the damaged area using padding lacquer. The lacquer-thinner solvent in the padding lacquer will soften the finish (the same as if it were wiped or sprayed on separately) and often clear up the damage. Often, it will be necessary to continue polishing the entire surface to get an even sheen.

This technique works fairly well on surfaces in good condition, but it is risky on crazed or deteriorated surfaces. If the water marks don't come out entirely with your initial application, you will seal in the remaining milky whiteness and make removing them more difficult.

If you have no experience removing milky-white watermarks, I recommend you try wiping with an alcohol-dampened cloth or rubbing with an abrasive. Both techniques are usually effective, and the risk of serious damage is minimal.

Dark Watermarks

The easiest and least damaging way to remove dark watermarks is to bleach them out of the wood with oxalic acid. This chemical is available in crystal form at pharmacies and at many paint and hardware stores. Don't confuse this bleach with household bleach, which removes dye, or with two-part bleach, which takes the natural color out of the wood.

Dissolve some oxalic-acid crystals at a ratio of one ounce to one quart of warm water or, to make it easier, just make a saturated solution by adding the crystals to warm water until no more will dissolve.

A glass jar makes a good container, but leave some air space at the top for gases to collect if you store the solution. Never use a metal container, because it rusts.

Brush a wet coat of the solution over the entire surface, not just over the stains, to keep the color even. If you are working on mahogany or cherry, which usually darken as they age, the oxalic acid may lighten the wood back to its original color.

Let the oxalic acid dry, then wash the crystals off the wood with a hose or well-soaked sponge or cloth. Don't brush the crystals into the air because they will cause you to choke if you breathe them in.

Usually, one application will remove the black marks, but you can always try a second if the first doesn't work. Often, a light brown mark will remain after the black has been removed. It can be removed easily with a light sanding.

CAUTION: Oxalic acid is toxic, capable of causing severe skin and respiratory problems. Wear gloves and goggles when using it, and don't generate airborne dust.

Oil Finishes

Dark watermarks occur easily in oil finishes because they're too thin to be effective against water penetration. Milky-white watermarks are very rare, however. The lighter watermarks you sometimes see in oil finishes are almost always caused by random light reflection from raised grain telegraphing through the thin oil.

To repair light, raised-grain watermarks in oil finishes, level the raised grain with sandpaper or steel wool and apply more oil finish. Abrade the damaged area as little as possible to avoid lightening the color of the wood. **PW**

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

The Wood Collector

Like everything in woodworking, it started out so innocently, so simply. It ended with a bone-crushing crash and a scowl from my wife.

"When are you going to get rid of some of this junk?" asked my wife.

It was the dreaded question I had expected sooner or later. I tried not to panic, though I could feel the sweat beading up on my forehead. My thoughts were beginning to stutter even before I spoke, for this "junk" my wife was referring to was my beloved collection of wood.

It began innocently enough, with just a few pieces of pine and basswood for carving out the odd decoy or two. They fit nicely in the corner of the garage and everyone was happy. Then there were those fine-looking crate boards at work that someone had the audacity to think about throwing out, so I saved them from a horrible dumpster death and envisioned them as a beautiful pair of Adirondack chairs; I would get around to pulling out all the nails "some day."

Next, those sheets of plywood my neighbor didn't want would surely make some great shelving and flooring for the rafters of the garage. It had to be thought out, though, so for now they stood in the opposite corner of the garage so I could still get at my pine and basswood.

Several months later, both sides of the garage were engulfed in a shroud of fence boards, 2 x 4s, plywood, cherry and maple logs to be resawn, and rough-cut cedar fence posts. My hobby had become a part-time business, and of course I needed to buy more stock. The car still fit in the garage, though, and everyone was still content.

Then came the phone call. A friend of a friend knew of a cabinet shop that discarded highly usable scrap pieces that were just there for the taking. A visit proved to be nothing short of a woodworker's Shangri-la. There it was, a bin full of cherry, oak, mahogany, maple, walnut, poplar and butternut. Long pieces, short pieces, wide and narrow pieces. All kiln dried and all mine. I loaded it up.

If you ever doubt your imagination, try

stashing too much of something that you haven't got room for. I had wood in the rafters, under the workbench, on the floor, under tarps outside, in the basement and in every empty box. It accumulated faster than I could use it up, and the garage soon became a giant storage shed. The car barely fit in the garage now, and discontent was beginning to brew.

The final straw came this past summer. When my children wanted their bikes out, it took me over two hours to move a 6'-high by 4'-deep wall of wood so I could get them out. Just when I got it all moved back, my youngest daughter noticed her helmet was missing. Needless to say, she got a new helmet.

Then came the incident my kids refer to as "the avalanche." I needed a shovel that was hung on the wall of the garage, but a stack of oak and ash strips that were "still usable" was leaning on all the garden utensils. I figured one quick swipe of the shovel would free it from the menagerie of lumber. I was wrong. I set off a chain reaction of shovels, wood, extension cords, weed trimmers, fishing tackle and assorted tools that still has the neighbors buzzing.

I tried paring down the stash to only the bare essentials, but every piece I picked up seemed just right for so many unique projects. After hours of sorting, I could only bring myself to throw two split pieces of maple into the firewood box.

I still don't have an answer for my wife, but I am working on my storage problem.

I checked out the attic, and if I stack everything just so.... **PW**

Angelo Paino has been woodworking for 20 years and resides in London, Ontario. He enjoys carving wildlife subjects and writing about the humorous side of life.