raised-panel doors made easy 3 bits do it all

11 GREAT PROJECTS

7 BANDSAWS TESTED
See which ones make the cut!

EXCLUSIVE
Kids’ bunk beds and dresser plans

18 WORKSHOP SOLUTIONS
- mobile rack organizes your lumber, p.72
- compact carousel holds tons of tools, p.64
- customized holders protect sharp tools, p.12
- new router bits for tricky joints, p.20
- plus 14 shop tips!

5 surefire ways to keep your shop cozy-warm this winter

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WOOD® magazine October 2002, Issue 144

PROJECTS
10 flush-trimming router fence
12 safe storage for chisels
14 turned salt and pepper shakers
48 kid-friendly bunk/twin beds
58 matching child's oak dresser
64 storage carousel for tools and bits
68 contemporary picture frames
72 mobile lumber storage
82 flag case
BONUS: pushsticks (see pattern insert)

TECHNIQUES
42 raised-panel doors made easy
See how a three-router-bit set can help you elevate your cabinetmaking and save time.

70 working with plastics
Learn how to cut, drill, and finish acrylic, polycarbonate, and phenolic laminate.

80 bandsaw tune-up
Follow this 10-step program to keep your bandsaw in tip-top shape.

TOOLS & MATERIALS
20 bird's-mouth router bits
Create multisided cylinders and curved lids with this new breed of cutters.

74 mid-priced bandsaws
We compared seven popular models under $900, focusing on power and performance.

92 shop-proven products
Check out the hot new woodworking tools.

FEATURES
24 guidelines for child-safe bunk beds

28 wood anecdote: bamboo
Considered grass, this wood-like plant has become all the rage in the flooring industry.

86 whole-shop heating systems
Decide which of the five approaches makes the most sense for your workshop.

97 birdhouse/bird feeder contest

DEPARTMENTS
6 editor's angle
8 sounding board
26 short cuts
30 shop tips
38 ask WOOD
40 at your service
112 what's ahead in our next issue

Visit our Web site at www.woodonline.com for free woodworking plans, tips, shop tours, and more.
editor's angle

What I’d like you to know about us

In today's business world of multi-national conglomerates and venture partnerships, it's getting harder to know just who stands behind the products you buy every day. But there's no mystery about the publisher of WOOD magazine: Meredith Corporation. It's a big company for sure, but one with a woodworker as chairman of its executive committee.

Have you wondered why the Better Homes and Gardens brand appears above WOOD on our cover? Or how our parent company, Meredith Corporation, got its start?

We include the BH&G brand above the WOOD logo because of the recognition and trust it carries for new readers who may not be as familiar with us as long-time subscribers. BH&G is the largest of many other publications about family life and improving homes produced by Meredith Corporation, a media company that also owns TV stations.

So why am I telling you this? I thought you might be curious, but also I want to let you in on an important anniversary that we're celebrating.

It was 100 years ago when E.T. Meredith founded his publishing company with the first issue of Successful Farming magazine (which is still published today). The next magazine in the Meredith stable came along in 1922 with the publication of Fruit, Garden and Home (which became Better Homes and Gardens in 1924).

Today, E.T.'s grandson, Ted Meredith, who I am happy to tell you is a dedicated woodworker, serves the company as Chairman of the Executive Committee. Ted has built some ambitious projects in his garage workshop over the years, including a biplane and two boats. His current project is the restoration of a 1930s-vintage plane, a task with no shortage of woodworking challenges, judging by the curved and veneered instrument panels on Ted's workbench.

As we mark this anniversary, it is my sincere wish that we continue to serve your needs for many years to come.

Bill Krier
Flag cases touch recipients and builders

I am a subscriber to your magazine, and have built many of your featured projects. Little did I know what was in store for me when I received the April 2002 issue. My roller coaster of emotions began when the magazine arrived.

In that issue, you featured an article (page 14) on Woodworkers United For America (WUFA). This group formed with the purpose of providing flag cases to any family member of those who perished as a result of terrorist activities on September 11, 2001.

I contacted Mr. George Dubois, the National Director of WUFA and expressed my desire to build a couple of flag cases. George assigned me the privilege of making flag cases for the family of Captain Victor Saracini: his wife, Ellen; two daughters, Kirsten and Brielle; and his mother, Anne. Captain Saracini was the pilot of United Airlines Flight 175, the second plane to hit the World Trade Center.

I can't begin to tell you how honored I was to share my love of woodworking in such a manner. Thank you for bringing this wonderful program to my attention.

Reader Ed Sallee (back left) was honored to build flag cases in memory of Captain Victor Saracini, and proud to present them to Ellen Saracini and daughters Kirsten and Brielle. A plaque in the upper left portion of each case bears a memorial and pilot's wings.

I delivered the cases to Mrs. Saracini this past spring (see the photo, above). She and her daughters were wonderful. I'd like to thank everyone who helped me with the cases. And thanks to my employer, McCollister's Transportation Systems, Inc. of Burlington, New Jersey, for transporting cases to New York from various WUFA chapters.

—Edward Sallee, Burlington, N.J.

A new woodworking contest that's literally "For the Birds"

Here's your chance to win great prizes and do a good turn for your fine-feathered friends as well. WOOD magazine has teamed up with Chevrolet and other prize sponsors to host our first-ever birdhouse/bird feeder contest, providing $8,000 in total prizes, with $5,000 being awarded to the Grand Prize Winner.

To enter, simply build a birdhouse or bird feeder that fits one of the seven prize categories explained with our entry form on page 97. Choose a favorite existing plan, or come up with something entirely original, we'll offer prizes for both types of projects. Include an entry form with each birdhouse or bird feeder (you can submit up to seven total entries) and mail it to WOOD magazine's "For the Birds" contest before the February 1, 2003 deadline.

After we judge the entries and award the prizes, we'll auction the birdhouses and bird feeders and turn the proceeds over to the National Wildlife Federation's Backyard Wildlife Habitat program.

Since 1973, this program has helped people garden for wildlife. The program encourages everyone—homeowners and community leaders alike—to plan their landscaping with the needs of wildlife in mind, while offering abundant help in how to do it.

The NWF ranks as the nation's largest member-supported conservation group, uniting individuals, organizations, businesses, and government to protect wildlife, wild places, and the environment. For more on the NWF and its programs, visit its Web site at http://www.nwf.org.

Write Us!

Do you have comments, criticisms, suggestions, or maybe even a compliment specifically relating to an article that appeared in WOOD magazine? Please write to:

Sounding Board
WOOD magazine
1716 Locust St., GA-310
Des Moines, IA 50309-3023

or, if you prefer, send us an e-mail message at soundingboard@woodmagazine.com.

Due to the volume of letters and e-mails we receive, we can respond to and publish only those of the greatest interest to our readers.
Flush-trimming fence

A simple router-table setup for putting a finished edge on plywood panels.

While building the child's dresser, shown on page 58, project builder Chuck Hedlund had to do a lot of flush trimming on the solid-wood edging that dresses up the plywood panels. He needed a foolproof way to get the job done. A handheld router with a flush-trim bit works, but it's easy to accidentally tip the router and gouge the edging and plywood. Chuck solved the problem with the router-table-mounted fence shown in the photo, above right.

Made of $\frac{3}{4}$" plywood, the fence sits perpendicular to the table, as shown at right. The lower edge of the fence is mounted 1" above the router-table surface, so it accommodates edging up to $\frac{3}{4}$" thick.

To build the project, cut its identically sized fence and base to 11 1/4" wide. Measure your router table to determine the length. Then cut matching notches in the base and fence, positioned to align with the bit hole in your table. Two triangular braces hold the base and fence together. The cleats at each end help position the assembly on your router table.

Chuck also added a support panel to the braces that stiffens the entire assembly. A hole cut into the support accepts a shop-vacuum hose to collect chips.

To use the fence, install a flush-trim bit in your table-mounted router. Align the fence face flush with the bit’s pilot bearing, and clamp the fence down. Hold the edged plywood firmly against the fence as you make each pass, and the edging comes out perfectly flush every time. 🌟

Written by David Stone
Project design: Charles I. Hedlund
Illustrations: Roxanne LeMoine
Photograph: Marty Baldwin

#8 x 1 1/2" F.H. wood screws
1" x 1" notches, centered

Inside width matches long leg of triangular brace.

Back face of fence sits flush with front edge of base.
Create a custom insert to protect sharp edges.

When we designed the "Craftsman's Pride Tool Chest" in issue 142, we lined the drawer bottoms with felt. Here's how to add extra protection for a set of chisels.

**Plan the layout**
Add up the handle diameters of the chisels you want to store, and subtract the total from the inside width of the drawer. Divide that number by the spaces that you'll need to get an approximate spacing distance. Our set includes 10 chisels, so we needed to account for 11 spaces. You can vary the spacing by making the end spaces bigger or smaller than the others.

**Make the supports**
Place your longest chisel with the handle flat on your workbench, and measure the gaps beneath the ferrule and the blade. Also measure the length of the blade. Now, make blade and ferrule supports to match those dimensions.

For the blade support, plane a board to 3/8" thickness, rip it to 4 1/4", then cut it to a length 3/16" less than the width of the drawer. For the ferrule support, rip a strip 1" wide. Plane it to 1/2" thickness, and cut it to the width of the drawer. Mark the handle center points on the edge of each support. Extend the points across the ferrule support.

Make a customized recess for each chisel by marking on the edge of the blade support the width of each blade plus 3/16", centered on the previously marked points. At your tablesaw, set a dado blade to cut 1/4" deep, and cut a dado between each set of marks. Use the appropriate chisel and a scrap of felt to test for a snug fit.

Using a bit of the same diameter as the ferrule (we used a 3/4" Forstner), drill a hole at each line on the ferrule support stock. To do this, clamp a fence on your drill-press table to keep the holes lined up, and locate the fence so that the holes will hold the ferrules at the desired height. (In our case, we centered the holes 1/2" from the edge to leave 3/8" of wood under each ferrule.) After drilling the holes, sand both faces. Rip the stock through the center of the holes to leave a series of notches.

**Add finish and felt**
Apply a stain or clear finish to match the tool chest or storage unit. Coat the top and sides of the ferrule support, but only the front edge of the blade support.

Cut an oversized piece of felt from the fabric store. Mask the edges of the blade support with tape, then spray adhesive on the top and ends. Remove the tape, and apply the felt, fitting it tightly into the dadoes and around the ends. After the adhesive sets, turn the support upside-down, and trim the felt along the edges and the ends with a knife.

If your drawer bottom is unlined, cut a piece of poster board 1/8" smaller in length and width than the inside dimensions of the drawer. Apply double-faced tape to the bottom of the poster board around its perimeter. Cut felt 2" larger in length and width than the poster board. Center the poster board, top down, on the felt, trim off the corners of the felt, and fold it onto the tape. Flip the poster board over, and press it into the drawer.

Place strips of cloth-backed, double-faced tape on the blade support bottom, and press it into the drawer. Finally, apply double-faced tape to the bottom of the ferrule support, and press it into place.
A quick turn-around project...

salt & pepper shakers

Dust off your lathe, choose any wood—ordinary to exotic—and you’ll have this set finished in an afternoon.

Ambrosia—bounty to woodturners

We made these shakers from ambrosia maple. Nothing more than soft maple, this wood derives its color and name from the ambrosia beetle, a wood-boring insect. The beetle in turn takes its name from its favorite food: ambrosia fungus.

The ambrosia beetle, only about 1/4" long, bores pin-hole tunnels into dying trees and freshly cut logs and lumber. It does not consume the wood. Instead, it introduces two types of fungus. One, the ambrosia fungus, grows in the tunnels and is eaten by the beetle. The other, a staining fungus, gives the wood its distinctive greenish-gray to bluish-black swirling bands.

Because it needs the moisture in green wood to survive, you won’t have to worry about beetles living in your dried turning square.

Add some spice to mealtimes with this pleasingly plump turned shaker set. All you need is a lathe, a couple of Forstner bits, and basic turning skills to form these attractive dining accessories in a dash. We turned this set from an unusual type of maple (see the sidebar, left), but any species will do.

For the items needed to build this project, see Tools and Accessories and the Buying Guide on page 18.

Continued on page 16
**Bore the blanks, and make a jam chuck**

### 1 Bore the chambers

From a 3x3x8" turning square, cut two 3⅛"-long shaker blanks. Find the centers by drawing diagonals on both ends of each blank. Chuck a 1⅞" Forstner bit in your drill press. Holding the blanks in a handscrew clamp, drill centered ¾"-deep counterbores in their bottoms. Change to a 1" Forstner bit, and set the depth stop to drill within ¾" of the bottom of each blank. Centering the bit in the counterbores, drill the chambers.

**Tools:** Drill press, 1" and 1⅛" Forstner bits  
**Speed:** 500 rpm for the 1" bit, 250 rpm for the 1⅛" bit

### 2 Fabricate a jam chuck

Laminate two ¾x3½x3¼" pieces of hardwood scrap to make a 1½"-thick jam-chuck blank. Center your 3" faceplate on the blank, trace around it, and bandsaw to the line. Drill pilot holes, and screw the faceplate to the blank. The screws should penetrate no more than ⅝" into the jam-chuck blank. Mount the faceplate on your lathe. Using your parting tool, make a gauging cut at the blank’s edge, turning a ⅛" shoulder that fits tightly into the shaker blank’s counterbore. Making overlapping cuts with your parting tool, widen the shoulder to ⅜", maintaining a snug fit in the blank’s counterbore.

**Tools:** Parting tool  
**Tool rest:** Center  
**Speed:** 800–1,200 rpm

### Turn the shakers

#### 1 Make the template

Make a copy of the shaker template full-size pattern on the WOOD PATTERNS® insert. Use spray adhesive to adhere the pattern to a ¾x2½x4" piece of tempered hardboard. Bandsaw and sand the template to the pattern line.

#### 2 True the blanks

Mount the first blank on the jam chuck. Make sure the blank sits completely flat on the chuck. Engage the tailstock center. Use your ¾" bowl gouge to shape the blank into a 3"-diameter cylinder.

**Tools:** Bowl gouge  
**Tool rest:** Below center  
**Speed:** 600–800 rpm

#### 3 Make gauging cuts

Lay the template on the blank, aligning the bottom of the shaker profile with the blank’s bottom edge. Mark the locations of the critical diameters. Using a parting tool and outside calipers, make gauging cuts in the blank to the diameters indicated on the template, as shown in the photo, right.

**Tools:** Parting tool, calipers  
**Tool rest:** Center  
**Speed:** 800–1,200 rpm

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WOOD magazine  October 2002
**Salt & Pepper Shakers**

### Form the side profile

Using a 3/4" spindle gouge, form the side profile on the shaker's lower section. Cut away the jam chuck, where shown, to provide clearance for your turning tool, and later for checking the profile with the pattern.

**Tool:** Spindle gouge  
**Tool rest:** Slightly below center  
**Speed:** 1,200–1,600 rpm

![Forming the side profile](image)

### Roll the beads

Roll the beads with your parting tool. Switch to your 3/4" skew chisel, and form the domed top, cutting as close to the tailstock center as possible. Disengage the tailstock, and finish the top of the dome. Form a slight V-groove at the base of the lower bead, as shown in the photo, left. Check your profile with the template.

**Tools:** Parting tool, skew chisel  
**Tool rest:** Slightly above center  
**Speed:** 800–1,200 rpm

### Finishing up

#### Drill the shaker holes

With the lathe running, use a pencil to mark the center and a 9/16"-diameter circle centered on the dome top. Stop the lathe. Using your toolrest as a straightedge, mark 90° "crosshairs" through the centerpoint to locate the holes for the salt shaker. (Draw a single straight line through the center for the pepper shaker.) Remove the shaker from the jam chuck. To keep the drill bit from wandering on the curved surface, mark hole locations with an awl at the center and where the lines intersect the circle. Chuck a 1/4" bit in your drill press and drill the holes through the dome into the chamber.

**HOLE LAYOUTS**

- **Pepper:** 9/16" diameter  
- **Salt:** 9/16" hole

### Roll the beads

Remount the shaker on the jam chuck. Sand the shaker with a progression of 120-220-320-grit sandpapers. Apply a clear finish. We used Mylands High Build Friction Polish, following the directions on the bottle. When the finish dries, clear the shaker holes by twisting a 1/4" drill bit through them. Repeat the turning and finishing steps with the other shaker blank. For quick recognition, stain the pepper shaker before applying the clear finish. We used ZAR no. 113 Fruitwood stain. To absorb the latent moisture in the wood and keep the salt and pepper dry, add a teaspoon of dry rice grains to the shakers when filling them. Push the rubber bungs into the bottoms of the chambers. See the Buying Guide for our source for the finish, bungs, and turning blank.

**Tools and Accessories:** 3" faceplate, 1/2" bowl gouge, parting tool, 1/4" spindle gouge, 1/4" skew chisel, outside calipers, and 1" and 1 1/4" Forstner bits.

### Buying Guide

**Finish and bungs.** Mylands High Build Friction Polish (4-ounce bottle) no. 949-4000, $5.50 ppd.; rubber bungs for 1" holes (2), kit no. 923-3148, $9.95 ppd. Available from source listed below.


Written by Jan Svec with Phil Brennion and Jeff Mertz  
**Project design:** Kevin Boyle  
**Illustrations:** Roxanne LeMoine, Lorna Johnson  
**Photographs:** Marty Baldwin

WOOD magazine October 2002
bird’s-mouth bits

Making cones, columns, or cylinders is a barrel of fun and requires little monkeying around when you use one of these unique cutters.

Wooden-boat builders have long used “bird’s-mouth” joinery to construct hollow masts and booms. We landlubbers can take advantage of this strong edge-to-edge joint, shown at top right, when making cylindrical objects, such as columns, arched chest lids, or turned vessels.

The bird’s-mouth joint tops a miter joint for a number of reasons: First, introducing the cutaway “mouth” creates more gluing surface. Secondly, the mouth cradles the mating workpiece, making it nearly impossible for the joint to slip out of alignment during a glue-up. Finally, you cut only one side of the joint, so you reduce your machining time—and chance for error—by half.

A router bit makes the joint foolproof

Boatbuilders make the bird’s-mouth joint on very long pieces using a tablesaw. As with any multi-faceted project, though, a tiny error in the cutting angle can become huge when compounded at each joint. You’ll reduce your error rate to near nil, however, when you machine your workpieces with a bird’s-mouth router bit (Lee Valley Tools, www leevalley com, or 800/871-8158). By fixing the cutting angle at the factory, these bits virtually guarantee your success when making 6-, 8-, 12-, or 16-sided cylinders.

So, how many sides do you need? That depends ultimately on the nature of the project. The more sides in your cylinder, the smoother the curve. If you plan to turn the cylinder blank round, more sides also mean less waste, because you can use thinner stock to construct the blank. On the other hand, if you want the cylinder to have an angular, faceted look, use fewer sides.

For a simple column, setting up to use the bit is as simple as the joint is strong. In your router table, install the proper bit for the number of sides (or staves) in your cylinder. Set the bit’s cutting height to leave a small (say, \(\frac{1}{2}\)”) flat bearing surface on the workpiece, as shown in the photo at left.

After routing all the staves for the cylinder, apply glue to the routed edges, stand the staves on end, and clamp them together with band clamps. If you have a lot of sides to assemble, a pair of scrapwood discs that fit inside the cylinder will help keep it round.

Think outside the cylinder

Want to be a little more creative? You can use the joint to decorate and “break” the edges of a case or chest, as shown in the photo on page 22. Or, if you’re up for a challenge, use bird’s-mouth bits to create tapered cylinders or cones, like the ones illustrated on page 22.

Things start to get a little tricky here, though, as the number of staves in the cone doesn’t necessarily match the number of the cutter. (For example, the 12-side cutter can be used to cut cones with 3–12 staves.) The fewer the staves,
WIN FLOOR SEATS AND BEAUTIFUL WOOD FLOORS—COURTESY OF VARATHANE.

Now you can achieve beautifully refinished wood floors by yourself with Varathane® Diamond Wood Finish premium polyurethanes. With Varathane the result is a professional finish with long lasting durability. And now, Varathane is giving you the opportunity to see your favorite pro basketball players in action. The America's Most Flawed Floor Contest will award one Grand Prize winner with everything needed to refinish their wood floors, including Varathane Diamond Wood Finish products, as well as two floor seat tickets to the most star-packed professional basketball game of the year (travel and hotel included).

Floors this beautiful have never been so easy.

Contest is open August 1 – November 30, 2002 to adults ages 18 and over. Enter online at varathane.com, or mail entries, including first and last name, date of birth, address (including zip code), telephone number, color photograph of your wood floor and a description in 100 words or less of why your wood floors need to be refinished. Mail entry in a stamped envelope to: America's Most Flawed Floor Contest, 200 E. Randolph Dr, 63rd Floor, Chicago, IL 60601. Entries must be postmarked by Saturday, November 30, 2002. No purchase necessary. Void where prohibited. For official contest rules visit varathane.com

varathane.com

Written by Dave Campbell with Jeff Mertz
Photographs: Marty Baldwin
Illustration: Tim Cahill

BIRD'S-MOUTH BITS CAN MAKE THESE SHAPES AND MORE

Use a bird's-mouth bit to soften (or highlight) the corner joints of a large project, such as an entertainment center.

Blades and bits

the flatter the cone—a 3-sided cone looks like a squashed pyramid, while an 11-sided cone is nearly a cylinder. You will need to do some figuring to determine the cutting angles for the staves. Detailed instructions and simple formulas for making the calculations come with the bits.

Before you buy, we encourage you to view the instruction manual on Lee Valley's Web site. At $26 each, these three bits (one for 8-, one for 16-, and one for 6- and 12-sided cylinders) aren't budget breakers, but you'll want to make sure you get the right bit for your project.
Safety standards for bunk beds were adopted by the U.S. Consumer Products Safety Commission in 1999. These standards apply to any bed having the underside of its foundation more than 30" above the floor. For the complete text of the standards, including methods of testing for compliance, go to the CPSC Web site at www.cpsc.gov. Click on search, and type in "bunk bed standards." Click on "Safety Standard for Bunk Beds." You'll need Adobe Acrobat to view the document.

To make it easier to understand these standards, we've boiled them down to nine key points:

1. Two guardrails are required. If a ladder is attached to one side, the guardrail on the other side must be continuous.
2. The gap between the continuous guardrail and the end structures cannot exceed 3/8".
3. A maximum gap of 15" in one guardrail is allowed for ladder access.
4. Guardrails must be attached to the bed in a manner that prevents accidental dislodging or intentional removal by a child.
5. The top of the guardrails must be at least 5" above the top of the mattress.
6. The upper edge of the upper bunk end structures must be at least 5" above the top of the mattress for at least 50 percent of the distance between the corner posts.
7. With the mattress removed, any opening in these areas on both side and both end structures of the upper bunk must be small enough to prevent the passage of a 3 1/2"-diameter rigid sphere.
8. With the mattress removed, any opening in this area of the end structures of the lower bunk must be small enough to prevent the passage of a 3 1/2"-diameter rigid sphere or large enough to allow the passage of a 9"-diameter rigid sphere.
9. With the mattress removed, any opening in this area of the end structures of the lower bunk large enough to allow the passage of a 9"-diameter rigid sphere must be configured to avoid the entrapment of a child's neck.

Note: While not a requirement of the CPSC standard, we recommend screwing the mattress platforms to the bedrails.

Illustration: Roxanne LeMoine, Lorna Johnson
short cuts
News and notes from the woodworking world

Do you have a yen for yesterday’s tools?

Your father gave you an old wooden molding plane; your great-uncle left you a century-old handsaw. At a garage sale down the street, you bought up a pair of wooden handscrews for next to nothing. Somewhere along the way you caught the antique-tool-collecting bug, but where do you go from here? Try the Mid-West Tool Collectors Association.

Begun in Chicago in 1968 with just 16 members, the M-WTCA has since blossomed into an organization of 4,000. But don’t let the name fool you: Membership spans all 50 states and six countries.

According to the mission statement, the M-WTCA dedicates itself “to the study, preservation, and understanding of the early tools, implements, and devices used by our ancestors in their homes, shops, on the farms, and on the seas, and to a better perception of the industries and crafts in which these tools were used.” That means more than just woodworking tools, though these tools play a significant part.

A membership fee of $25 per year ($33 for Canada and $40 for other countries) entitles you to several worthwhile benefits. You get a subscription to THE GRIST-MILL, a quarterly magazine containing educational articles on tool collecting. You receive reprints of out-of-print tool-related literature, trade manuals, and catalogs. And, finally, you can attend the area meetings held in any of the 18 geographic locations, or the biannual national meetings.

These meetings include tours to museums and restorations, lectures, seminars, and films and demonstrations of early crafts. They also provide space where members can display their special collections, and bring along antique tools for sale and trade.

For an application form, or more information on M-WTCA, write to Mid-West Tool Collectors Association, Inc., P.O. Box 8016, Berkeley, CA 94707, USA, or go to their Web site at www.mwtca.org and see their home page.

Photograph by John G. Wells

As a member of the M-WTCA, not only can you research antique tools, such as these, you develop friendships with like-minded collectors that can last a lifetime.
Bamboo
The “wood” that comes from grass

FEW Westerners think of bamboo as anything but a houseplant, garden accent, or snack for a panda. But throughout much of the world, bamboo provides durable building material. Soon, more of us in the United States may find bamboo right under our feet, literally, as bamboo flooring is a hot new trend.

Surprisingly, bamboo isn’t even wood—it’s grass, and an amazing grass at that. These prolific, tree-like plants (hundreds of varieties exist) grow incredibly fast. Plants reach harvesting size (around 20’) in 3–5 years, then regrow after cutting.

Bamboo flooring, above, consists of stalks (called culms) cut into strips, planed to about 3/8” thick, and glued into planks.

In the “horizontal” style, strips about 1” wide are laminated in two-or three layers. In “vertical” planks, the strips are face-glued, which exposes the culms’ edges. Planks join using tongues and grooves.

The result is a beautiful, even-toned floor without knots or wild grain. Instead, just thin, straight lines remain, interrupted only by subtle markings at the culm joints.

More surprising than bamboo’s looks is its strength. A bamboo floor provides 50 percent more dimensional stability than red oak, and rivals maple in hardness.

Bamboo has a light hue, but takes on a caramel tone when the stalks are heat “carbonizes” and darkens them. The flooring cross-sections, top, show “vertical” planks (left) and “horizontal” (right). Planks measure 3/4”x36”.

Bamboo flooring, above, consists of stalks (called culms) cut into strips, planed to about 3/8” thick, and glued into planks.

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More surprising than bamboo’s looks is its strength. A bamboo floor provides 50 percent more dimensional stability than red oak, and rivals maple in hardness.

Bamboo has a light hue, but takes on a caramel tone when the stalks are heat “carbonizes” and darkens them. The color runs throughout, eliminating the need for stain.

Not all flooring retailers stock bamboo, but it is getting more common. Pricing compares to maple, at $5–$7 per square foot, uninstalled.

As bamboo gains popularity, look for more products made from these versatile plants, such as door panels, veneered plywood, and even laminated “boards” for furniture.

Written by David Stone with Peter J. Stephano
Photographs: Marty Baldwin
Sander swings into action, swivels to stow

Sometimes a benchtop power tool, such as a drum sander, stores efficiently facing one direction, but must be rotated to go to work. Other times, such as with a belt/disc sander, there are two working positions. I solved these problems by creating a benchtop platform that rotates on a lazy-Susan bearing. Here's how you can, too.

Cut the platform from 3/4" plywood. Drill holes through it for the mounting bolts, and install T-nuts on the underside of the platform. Test-fit the tool, making certain that the bolts don't protrude more than 1/4", or they will drag on the bench. If they do, buy shorter bolts or hacksaw them to length.

Remove the tool, and screw the lazy-Susan bearing to the bottom of the platform. Drill 1" access holes through the platform, and screw the assembly to your bench. Mount the tool, and rotate it into its working position. Drill a 9/16" hole near one corner of the base and into your bench to accept a bolt that keeps the platform from turning while you're working.

--Ken Prill, Chippewa Falls, Wis.

You might think a guy who designs and builds high-end custom furniture for a living learned his art at the side of a master craftsman. But Ken Prill learned it all by reading. "I'll bet I have 500 books and magazines on woodworking," our Top Shop Tip winner says.

Ken often adorns his work with hand-carved features. And business must be good because he has little time to pursue carving for pleasure, as with the elk relief he started three years ago (shown above). We're glad he took the time to send in the Top Shop Tip, at left, and we think you will be too.

For sending this issue's Top Shop Tip, we're sending Ken Prill an HTC Multi-Fence 50" tablesaw fence system. Attaboy, Ken!

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shop tips

Foolproof hanging with keyhole slots

Keyhole slots are a great way to affix wooden hangings, such as a shelf or picture, to a wall. But if the mounting screws aren't perfectly level, or spaced exactly the same as the slots, the job can become a nightmare. Here's a solution that works great.

I attach short pieces of masking tape to the top of my level and, using the keyhole slots themselves, I mark the locations of the slots on the tape, as shown in Step 1. If I want to center the wall hanging between two objects, I also make a third mark, centered between the two marks.

After finding the mounting location for the shelf, I mark the center of the shelf at the correct height. I place the level's center mark on that mark, make certain it's level, then mark the screw locations using the other two marks, as shown in Step 2. Finally, I drive the mounting screws on those marks. My hangings are always right on the money and level.

—Bill Vanderhoof, Hanover, Pa.

Continued on page 34

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INFORMATION WORTH WRITING FOR

See Page 104

shop tips

Pine plugs solve particleboard puzzler

I recently was faced with installing hinges on the lid of a toy box made of particleboard—a material notorious for not holding screws well. After puzzling over it for awhile, I finally decided to give the screws something more substantial to bite into.

After marking the hinge locations, I used a Forstner bit to bore ¾" holes at each screw location, just deep enough to accept ⅜" flat-top, tapered, pine plugs at each location. (Plugs work better than dowels because, with dowels, you're screwing into end grain.)

I glued the plugs in place and tapped them flush, then immediately marked and drilled pilot holes for the screws, and installed the hinges. As I drove the screws, they spread the plugs just enough to form a tight bond with the particleboard. I expect these joints will outlast the toy box itself!

— Jon Murphy, Auburn, Wash., via WOOD ONLINE®
Card trick prevents hammer dents

Whenever I get an unsolicited plastic card in the mail, I save it, sometimes using it as a spreader for glue or spackling. But my favorite use is as a nailing shield to prevent hammer dents on wood surfaces.

Preparing a card for use is easy: Simply drill or punch holes larger than the finishing nails or brads you’ll drive. After driving the fastener flush with the card, use a nail set to slightly bury the head.

A security note: Old phone cards and membership cards are good candidates for this application, but credit cards should be completely destroyed.

—Joe Carlino, Plainfield, Ill.

Fixture steps up to lend a hand

To support workpieces, I made a simple T-shaped fixture that secures to my portable clamping workstation. By adjusting the height of the fixture, I can use it with various tools, such as my tablesaw, radial-arm saw, router table, etc.

To instantly adjust to the proper height for each tool, I added hardboard "steps," as shown below. Each step sets the correct height for a different tool. Now when I need to support a long or wide workpiece, I simply clamp the fixture between the jaws of the workstation, resting it on the appropriate steps, and the height is spot-on every time.

—Al Finch, Baltimore, Md.
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**Chute sanding dust right into vac hose**

Grab a scrap piece of 2x10 and make a drill-press accessory that helps make drum-sanding a less dusty operation. Use a holesaw to drill the centered 3" hole, and cut the chute with your bandsaw or jigsaw. Then, clamp the jig to your drill-press table. Air currents created by the spinning drum direct dust into the chute, and the vacuum system takes over from there.

—Ernest Peters, Brighton, Ontario
Lay it on the line for precise cutoffs

Take a few minutes to build this cut-off jig in your shop, and you'll take accuracy with you anywhere. The jig, shown in the top drawing, was designed for 6" deck boards, but you can easily scale the concept to any size—or any miter angle—you need.

After building the jig a little oversized, use your circular saw against the fence to trim the end of the jig to final length. The end now represents the cut that particular saw will make.

Simply mark the board where you want to cut it, position the stop against the edge of your workpiece, and align the end of the jig with the marked cutline. Push your saw across the jig, and you'll slice the board right on the money.

—Richard Rose, Durham, Maine

CUT-OFF JIG

Post notes on project updates and hints

An issue or two after a project appears in a woodworking magazine, you'll sometimes read suggestions from readers who have built it. When I run across these items, I jot them on self-adhesive note paper and stick the notes on the first page of the original article. Or, if there's an accompanying drawing, I photocopy the magazine update and tape that to the original article. That way, if I build the project later, I'll have the benefit of others' experience right at hand.

—Mike Brenton, Chemainus, B.C., via WOOD ONLINE

shop TIP

ask wood

Answers to your questions from letters, e-mails, and WOOD ONLINE®

Matching aged cherry can be the pits

Q I know cherry darkens as it ages, but I’m wondering how to cope with that fact in two different situations: If you add cabinets alongside some that were recently built and installed, will the color difference even out? And what about placing new cabinets next to some that were built back in the 1970s?

—Don Borden, via WOOD ONLINE

A We have good news and bad news, Don. Cherry starts to darken immediately after it’s surfaced and exposed to light, but new projects should “catch up” to projects that have been finished within the past year or so. That’s assuming that the lumber used in both projects was the same shade to begin with, and finished the same way.

Now, the bad news. It’s not likely that new cherry will ever match cherry that has been darkening for 20 or 30 years. Your best bet is to find some aged cherry, and build with that.

Other options include some big challenges. You can’t lighten up the wood in old projects by sanding; Lou Irion, longtime builder of period furniture and now the owner of the Irion Lumber Co. in Pennsylvania, points out that cherry darkens beneath the surface over the years. As for darkening new boards, Lou has tried some chemical aging methods, but hasn’t been satisfied with the results.

That leaves you with the possibility of staining. But if you stain the new wood to the perfect color, the look will change as years go by. And if you set out to stain both new and old wood to a matching color, “You would have to go so dark that the stain would cover up the natural look of the wood. That would defeat the purpose of using an inherently beautiful wood like cherry,” Lou says.

Of course, there’s another way to get old and new to match perfectly. You could remove the face frames, doors, and drawers from your old cabinets, and build replacements from the same batch of cherry you use for the new cabinets.

—WOOD magazine
For the router that's lost its grip

Q I've been using my faithful router for over 20 years, but now the bits are starting to work loose. With the router mounted in a table, the bit gradually rises up and bites deeper into the wood as I work. Can this problem be fixed?

—James Peterson, Akron, Ohio

A Jim, you probably can solve it by replacing or cleaning the collet. To remove the collet for examination, turn the locknut as usual, but keep turning until it comes free of the router and releases the collet. Use a round brush with fine bristles made of brass or copper to clean dirt and rust from the inside of the collet, then spray on a light coat of WD-40 or other light oil to protect against future rusting. Wipe off any excess with a rag or paper towel.

Keep your router collets clean so that they'll keep a firm grip on your bits. We went to a gun shop to find a bristle brush that fits this 1/4" collet.

Reinstall the collet and do some routing. If the slippage continues, you might need a new collet. Check with your dealer or call Tools On Sale, a division of Seven Corners Hardware, at 800/328-0457. They carry collets for most brands and models. A final tip: Get in the habit of removing the bit after completing each router operation. That helps to keep the collet flexible.

—WOOD magazine

Taming a bit that's born to wander

Q I need to drill several 3/32" holes in the edge of a disc, but can't keep the drill bit from wandering. I know a brad-point bit would help, but I don't know if they make one that small. Any other ideas?

—Steve, via WOOD ONLINE

A Woodworker's Supply carries a 3/32" brad-point bit with a hex shank, Steve. Call 800/645-9292 and order item number 824-192 for $7.99. They also have 1/8" and 5/32" brad-points. In most cases, however, you should be able to keep almost any drill bit where you want it by marking the hole location with a sharp awl before you drill. When using a straight-shank bit, place it deep into the chuck to keep it from wobbling.

—WOOD magazine

Got a question?

If you're looking for an answer to a woodworking question, write to Ask WOOD, 1716 Locust St., GA-310, Des Moines, IA 50309-3023 or send us an e-mail at askwood@mdp.com. For immediate feedback from your fellow woodworkers, post your question on one of our woodworking forums at www.woodonline.com.
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Circle No. 1953
Raised-panel doors are a hallmark of quality cabinets and furniture, and they’re not difficult to make. If you have a variable-speed, 1½-hp or bigger router and a router table, you need only buy a set of three router bits designed for the task.

The bits could cost well over $100. Still, if you plan to make or remodel several cabinets, or construct a special piece of furniture featuring raised-panel doors, we think they’re worth the investment. Of course, you could choose to cut raised panels on the tablesaw instead, but we’ve found that router bits save lots of time and add quality with their smooth cutting and well-designed profiles.

We used a horizontal panel-raising bit that cuts with the workpiece lying flat on the router table. You also can buy vertical router bits, which cost less and demand less power. However, they don’t allow you to raise a panel with a curved edge, as the horizontal cutter does.

In this article, we’ll guide you through the process of making a door for a typical cabinet. The same techniques apply to building a door or panel for a piece of furniture, or traditional wall panels. Along the way, we’ll point out a few details that have nothing to do with router bits, but everything to do with getting the most striking results.
Two bits for the door frame ...

A set of door-making router bits makes it easy to build professional-quality cabinet doors. One bit cuts the cope shape at the ends of the rails; one cuts the sticking shape to match; and one cuts a raised field on the panel.

Choose a cool profile

We chose a rail, stile, and panel set from Freud, item number 97-102. You can buy it from www.toolcrib.amazon.com for $144.99, and from other sources as well. This set contains a coping bit to cut the ends of the rails, a sticking bit to cut a matching profile and panel-holding groove on the inside edge of each rail and stile, and a 3/4"-diameter bit that "raises" the panel with a gently sweeping cove. The bits have 1/2" shanks, which we strongly recommend for this operation.

See Photos A, B, and C for the shapes made by our rail-and-stile cutters, and how the results mate together. Photo D shows one of the many panel-raising bit profiles available from Freud and other manufacturers. Choose the one you like best, or the one that matches the style of your home's existing cabinetry.

Select the best stock

A great door depends on great lumber. You want wood that shrinks and swells as little as possible, and resists warping. Rift-sawn or quartersawn lumber fills the bill.

Go through the stack of boards at your lumber supplier, and look at the end grain on each one. Select the ones with grain lines running straight from face to face, not from edge to edge or in a semi-circle. These prime boards also feature straight face grain, which played an important role in our door, as you'll see.

You might find quite a bit of variation in one wide board, as shown in Photo E. In that case, elevate your work above the ordinary by selecting the straight grain lines for your doors. The cathedral grain won't go to waste; use it for less visible cabinet parts or other projects.

Once you've found a good board, don't just chop it into convenient lengths. Take one more big step toward master craftsmanship by cutting each individual piece with the straightest grain possible, as shown in Photo F.

Straight-grain rails and stiles seem to flow naturally around a door. We recommend straight grain for the panels, too. It lends an architectural-quality look.

We used red oak for this article because it's a popular cabinet choice and its prominent grain lines emphasize the difference in appearance between straight grain and random "cathedral" grain. Check out the two versions in Photo G. When you go to a retail outlet to look at oak cabinets, you see lots of figure, and maybe you prefer it that way. The choice is yours.

www.woodonline.com
**raised-panel doors made easy**

**Plan and cut carefully**

We built an overlay door for a standard-sized wall cabinet, a common situation. We planed 4/4 stock to 3/4" for our rails and stiles, and ripped them to 2 1/8" in width, a dimension that looks good, feels solid, and allows enough room for any style of hinge. You might choose a width anywhere from 1 1/2" to 2 1/2". Pick stock that's perfectly flat for the rails and stiles.

The door itself should fall between 9" and 18" in width. Too narrow, and it just won't look right. If you build it wider than 18", you're more likely to have trouble with twisting. The door must be absolutely flat to look good when it's closed.

An overlay door is typically used on cabinets without face frames. Size each door to nearly cover the cabinet box, and plan for a 1/8" gap between adjoining doors. The sample door in Drawing 1 will help you keep track of the slots and coped rail ends as you figure the dimensions of your door. Check your crosscutting setup for accuracy before you cut the pieces to length, because the rails must be perfectly square for good results. Prevent chip-out with an auxiliary fence on your miter gauge, or a sacrificial piece of straight stock on the back fence of your crosscut sled. Cut an extra rail and an extra stile to use when setting bit heights.

To make the panel, choose boards with compatible color and figure, and plane them to a thickness of 3/8". Once you fit the panel into place, its surface will sit flush with the front of the frame.

**Rout the rail ends**

With your router mounted in a table, install the coping bit. It's the bit with a pilot bearing sandwiched between the two cutters. Hold a straightedge against the router table fence, and slide the fence until the straightedge contacts the pilot bearing, as shown in Photo H. Now make sure the fence sits at a right angle to the miter gauge; butt a piece of scrap against the fence at one end, clamp it to your miter gauge, then slide the miter gauge along the fence. The scrap should maintain contact along the length of the fence.

Use your test rail to set the height of the bit, as shown in Photo I. Place your test rail face side down on the table, one edge flat against the miter gauge auxiliary fence and one end touching the router-table fence. Hold the workpiece firmly against the auxiliary fence and down on the table, and rout the profile.

Check the test cut for a smooth, consistent shoulder about 3/16" thick on the face side of the rail. The rabbet on the opposite side will be about 1/4" deep. Run another test, if necessary, and when you're satisfied, make a set-up piece to keep for future projects. Now, rout both ends of each rail, as shown in Photo J.
Use the coped end of a rail to set up the sticking cuts. Match the slotting cutter to the tongue, and if the curved profiles don't mate, re-shim the bit.

Again, line up the pilot bearing of the sticking bit and the router table fence to ensure accuracy.

Now, the inside edges

Remove the coping bit and install the sticking bit (the one with the pilot bearing on top) in your router. In one pass, this bit makes the frame look better by rounding over the edge next to the panel, while simultaneously cutting the groove to receive the panel. Use one of the rails that you just routed to set the height. Match the slot-cutter with the tongue on the rail end, as shown in Photo K. Again, align the fence and pilot bearing with a straightedge, as shown in Photo L.

Place your extra stile face side down against the router table fence, and make a test cut, as shown in Photo M. Check its fit with the already routed rail. Place both pieces flat on your workbench or tablesaw top, face sides up, and check the resulting joint with your fingertips. You want a perfectly smooth joint, because anything less means a lot of sanding after assembly. So do as many tests as it takes to get it right, and then cut a set-up piece for future reference. See the Shop Tip below for another way to save your settings.

If you can't get a perfect fit with the rails and stiles, you may have to adjust the bits themselves with very thin, washer-like, metal shims. Shims allow you to fine-tune the height of the profile cutters or the location of the tongue on the rail-end bit. Our bits came pre-shimmed from the factory, with extra shims held under the nut at the end of each bit. Write down each step if you do any shimming, so you know the original arrangement as well as each adjustment that you make. When your test joints are right, rout the inside edge of all four frame pieces.

Shop Tip

Make your bits self-aligning

Wouldn't it be nice to keep your rail-and-stile profile cutters permanently aligned with one another, avoiding all those test cuts every time you use them? Our master craftsman, Chuck Hedlund, came up with a way to do just that.

Slip a 1/2" stop collar onto the shank of each bit, and tighten it in place against the cutter body, as shown in the photo at right. Install the first bit into your router, and proceed to find the right height. Unplug the router, loosen the set screw on the collar, let it slide down to the collet, and retighten the set screw. Without changing the router height, do the same with the second cutter. The next time you use the cutters, use a saved set-up profile to set the router height for the first cutter, and the second cutter will match automatically.

Look for stop collars at your home center or hardware store, or buy a seven-piece set that includes one 1/4" collar from Woodcraft. Call 800/225-1153 to order item number 142562 for $7.99.

For safety, Freud recommends that you place at least 80 percent of a router bit's shank inside the collet. We achieved that with collars that are 9/16" thick.
raised-panel doors made easy

**Time to raise the panel**

For the final step in the milling process, we used a panel-raising bit that measures 3½" in diameter. The large diameter means that it cuts more wood per revolution than the average bit, its outer edge travels faster than most, and it demands extra clearance in the table and fence.

For safety and efficiency, use a variable-speed router with at least 1½ hp. That’s enough power to do the job, and running it at a low speed makes the operation safer.

Even if you have a split fence that opens wide enough to accommodate the bit, it’s safer to shape a smaller opening in an auxiliary fence. A wide gap causes problems if the workpiece slips into it.

To add an auxiliary wood fence, cut a piece of straight wood to size, and mark the shape of the bit on it. Cut the opening on the bandsaw, and smooth it with sandpaper. Attach the auxiliary fence to the existing fence, and check the bit clearance.

Align the bearing and fence, and make a test cut, as shown in Photo N. If the router bogs down, adjust the fence so that the bit cuts less than the full width of the profile on the first pass. Then realign the bearing and fence, and shape the complete profile in another pass.

Test the fit of the panel tongue in the groove of a rail or stile. It should slide in easily. If you have to force it into the groove, raise the bit. If it rattles inside the groove, lower the bit.

**SHOP TIP**

**Give your router a break as you raise a panel**

Here’s how reader Robert Reed of Roaming Shores, Ohio, minimizes the amount of wood removed by his panel-raising bit. Take a piece of scrapwood, and trace the profile of your panel-raising bit on it. Use a sliding bevel gauge to find an angle that cuts away most of the waste, without touching the desired profile. Set up your tablesaw with the sliding bevel, and run each side and end of the panel through as shown. Now you have much less wood to rout.

Note that you’ll set the rip fence away from the tilt of the blade. You can add a tall fence to the rip fence to support the workpiece while you machine it on edge.
Stain the panel

With the door parts milled, you’re ready to prepare for assembly. You allowed for wood movement in the solid panel, during the planning phase. Carry through by installing spacers, as described in “No-rattle panels,” below, and by staining the panel, as in Photo O, if stain is part of your finishing plan. Stain the back first, then place it on a support while you stain the face.

By staining the panel before assembly, you ensure that the stain completely coats the tongue of the panel. If you waited until after assembly, areas of the tongue might remain unstained, and become visible when the panel shrinks in dry weather.

Don’t stain the rails and stiles just yet. If stain got onto the gluing surfaces, it could prevent the glue from adhering properly.

After the stain on the panel dries, insert the spacers, and apply yellow glue to all of the surfaces that you milled on the rail end. Use only a light coating near the inside edge to keep squeeze-out away from the panel; even a weak bond there could cause problems.

Assemble the door, and place it on two bar or pipe clamps, located to apply pressure across the width of the door at each end, as shown in Photo P. Measure diagonally between both pairs of opposing corners, also shown in the photo, to make sure the door is square. The two measurements should be equal. If not, loosen the clamps, slightly angle them to pull the frame into alignment, and retighten. Let the glue dry before staining the frame.

Written by Jim Pollock with Charles I. Hedlund
Photographs: Marty Baldwin
Illustrations: Roxanne LeMoine; Tim Cahill

If you plan to stain your cabinet door, do the panel before assembly. The clear topcoat can wait until after assembly.

When you cut the rail ends square, and accurately match the coped and sticked profiles, assembly becomes almost automatic.

No-rattle panels

Solid-wood panels must have room to move, as they absorb moisture in humid weather, and lose it in dry times. But if you simply leave a gap, you wind up with a door that rattles and sounds poorly made. You can use various kinds of plastic foam to fill that gap, but we like “Space Balls.” These firm rubber spheres, about 1/4” in diameter, do the job quickly and neatly. Woodcraft sells a package of 100 for $4.99; call 800/225-1153 to order item number 142284. Use two Space Balls on each side and each end of a small door, or three per side on a bigger one. They’ll compress when the panel expands, and return to full size as the panel shrinks, holding it tightly in its grooves all the while.

Push the Space Balls into the grooves as far as you can with your finger. The panel will seat them during assembly.

Written by Jim Pollock with Charles I. Hedlund
Photographs: Marty Baldwin
Illustrations: Roxanne LeMoine; Tim Cahill

www.woodmagazine.com
kid-friendly beds

Build them as bunks or twins.

These traditionally styled bunks kick off our latest children's bedroom set.
Children will enjoy sweet slumber for years to come with this versatile design. In this article, you'll learn how to make a single bed—to build bunk beds, just make two of these beds, stack them one atop another with bed-joining dowels, and add the ladder and guardrails as described. If the kids grow out of bunk beds at some point, simply slip out the unglued dowels and, voilà, you have a pair of twin beds.

**Start with the legs**

1. From $\frac{1}{2}$"-thick stock, cut six headboard leg parts (A) to $2\frac{3}{4} \times 42$" and six footboard leg parts (B) to $2\frac{3}{4} \times 33$". The legs are initially oversized $\frac{1}{4}$" in width and 2" in length. The edges are jointed or ripped and the ends are trimmed after the legs are laminated, where shown on Drawing 1.

2. Cut the notches in two leg parts (A) and two leg parts (B), where dimensioned, using a bandsaw or a tablesaw fitted with a $\frac{1}{4}$" dado blade. The notches form mortises in the finished laminated legs.

3. To assemble the legs, first refer to the Shop Tip, page 50, bottom right. Then, apply glue and assemble the legs (A, B) in the configuration shown on Drawing 1, keeping the ends and edges flush. (We used white glue, which has a longer working time, to assemble the legs.) Clamp the legs together, as shown in Photo A. Remove excess glue from the edges and inside the mortises.

**Note:** This bed design accommodates a 39"x75" twin mattress. You'll need to adjust bed dimensions accordingly for a different-size mattress. If you make other modifications, be sure to see the article about designing safe bunk beds on page 24.

For the items needed to build this project, see the Cutting Diagram and Materials List on page 55.

1. **LEG ASSEMBLIES**

<table>
<thead>
<tr>
<th>Component</th>
<th>Trim to finished length after laminating and trimming bottom.</th>
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<tbody>
<tr>
<td>Headboard Leg</td>
<td>$2\frac{3}{4}$ initially, trim $\frac{1}{8}$&quot; off edges after laminating for $2\frac{3}{8}$&quot; finished width</td>
</tr>
<tr>
<td>Footboard Leg</td>
<td>$4$ notch, $\frac{3}{4}$&quot; deep initially, $\frac{1}{2}$&quot; deep after trimming</td>
</tr>
<tr>
<td>Headboard Leg</td>
<td>$7$ notch, $\frac{1}{4}$&quot; deep initially, $\frac{1}{2}$&quot; deep after trimming</td>
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</tbody>
</table>

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After laminating the legs, clamp them together with the mortises up, making sure that their top edges are flush.

Joint or rip \( \frac{1}{4} \)" from two sides of each leg, where shown, for a 2\( \frac{1}{4} \)"-square lamination. Then, trim the bottom of each leg 7\( \frac{1}{4} \)" below the 7" mortise. Now, cut the legs to the finished lengths by trimming the tops. Finally, rout \( \frac{1}{4} \)" round-overs on all edges, where shown on Drawing 2.

Make the hole-drilling jig, shown on Drawing 3. Using the jig and a stopblock on your drill bit, as shown in Photo B, drill \( \frac{1}{4} \)" holes 2" deep, centered in the top of the legs, where shown on Drawing 2a, to receive the post-cap dowels (O). Also, drill a \( \frac{3}{4} \)" hole \( \frac{3}{8} \)" deep to receive the post-cap alignment pin (N).

Note: For bunk beds, position the jig on the bottom of the legs and drill \( \frac{1}{4} \)" holes 2" deep to receive the bed-joining dowels (S), where shown on Drawing 2.

**Shop Tip**

**An easy way to keep face-glued parts aligned**

Face-glued parts, such as the laminated legs in this project, have a tendency to slip out of position when you clamp them. To prevent this, cut the parts slightly oversized (as you did for the legs), and drive a couple of nails through the waste area as you assemble them. Keep the nails away from the cutline so you won't hit them with your saw blade.
Next up: the headboard and footboard

1 Cut the top rails (C) and bottom rails (D) for the headboard and footboard to the size listed in the Materials List. Then, cut a 1/2" groove 1/2" deep, centered in the rails, to receive the footboard panel assemblies (E/G) and headboard panel assemblies (F/H), where shown on Drawing 2. To ease insertion of the rails into the legs and provide room for glue squeeze-out, rout 1/4" chamfers on the ends of the rails, where shown.

2 Lay out the arch on the top rails, where shown on Drawing 4. To do this, first clamp two 1/4"-dia. round-over stopblocks to a rail, one at each end of the intended arch, with the stopblocks’ bottoms positioned 4" from the bottom of the rail and their inside edges positioned 2" from the ends. Rip a 1/4"-thick wood-fairing strip 42" long. Place the strip against the stopblocks, and flex it so its bottom is flush with the top edge of the rail at its center. Mark the arch. Then, using a compass, mark the 31/4" radius at the top of the rail, where dimensioned.

3 Bandsaw the top of the rail to shape. Use a fence for the 2" straight cuts into the ends of the rail to ensure the tenons make a good fit in the legs. Sand the cut edges smooth. Then, use this rail as a template to mark the contour on the other top rail. Now, cut and sand it to shape.

4 Using the same process as for the top rails, lay out the arch on the bottom rails, where shown. Cut and sand to shape.

5 Rout the 1/4" stopped round-overs on the top and bottom rails, where shown on Drawings 2 and 4. For an easy way to do this, first refer to the Shop Tip, below, to make a round-over stopblock jig. Then, with the applicable stopblock positioned on an end of a rail, as shown, ease the 1/4" round-over bit into an edge at the center of a rail and rout to the stopblock. Repeat on the opposite end. Reposition the stopblock at the other end of the rail and repeat the process to complete the round-overs.

6 From 1/4" oak plywood, cut the footboard panels (E) and the headboard panels (F) to size. From 3/8"-thick oak, rip four 3/8x11 1/2" blanks for the footboard edging (G) and four 3/8x20 1/2" blanks for the headboard edging (H). Glue the edging to the panels with a 1/8" overhang on each face. After the glue dries, trim the edging flush to the panels. (For an easy way to do this, make the flush-trimming fence, shown on page 10.)

7 Cut four spacers (I) and eight spacers (J) to size. Mark the center of the spacers (I) across the grain on one of their faces. Also, mark a centerline across the grain on one face of each rail. Now, glue
Assemble the headboard and footboard with 37"-long spacers to ensure exact leg positioning for bed alignment.

From scrap, make two 37"-long spacers. Referring to Drawing 2, dry-assemble (no glue) the headboard members (A, C/I, D/I, F/H, J) with the spacers, as shown in Photo C. After verifying the fit of the assembly, glue and clamp the members together, checking for square. Following the same process, assemble the footboard members (B, C/I, D/I, E/G, J).

Cut the cleats (K) to size. Drill countersunk shank holes in each cleat, where shown. Position a cleat on the inside face of the footboard and headboard bottom rails, 3" from the top and centered end to end, where shown. Using the holes in the cleats as guides, drill pilot holes in the rails; then screw the cleats in place.

How to cut post caps in 4 quick steps

1. Chuck a ⅛" round-over bit in your table-mounted router. With your fence(s) flush with the bit's pilot bearing, round over all edges of the blank at both ends. Use a backer board to prevent tear-out.

2. Cut a ¼" length from each end of the blank to separate two post cap pieces. Use a gauge block for consistent cuts. Position the block behind the saw blade so the cap cannot become pinched.

3. Without moving your router table fence, refit your router with a ¼" round-over bit. Now, with each cap vertical, round over its corners, again using a backer board for support and to prevent tear-out.

4. Using the same router table setup, place each cap bottom face down on the table, and rout a ⅛" round-over on its bottom edges. Repeat Steps 1-4 to shape additional caps.

Fashion the post caps

From ¼"-thick oak, cut the post cap bases (L) to size. To form the caps (M), first laminate three ¼"-thick pieces to form a 2¼×2¼×18" blank the same way you made the legs. Then, form the caps from the blank as shown in the sidebar, "How to cut post caps in four quick steps," below left. Make a few extra cap blanks in case any get damaged during machining.

Sand the edges of the caps and the transitions from the ¼" to ½" round-overs smooth. Then, glue and clamp a base (L), centered, on the bottom of each cap.

Clamp a cap in the hole-drilling jig with the base against the jig handle. Drill ¼" and ⅛" holes ⅛" deep in the cap to receive an alignment pin (N) and a cap dowel (O), where shown on Drawing 2a. Repeat for all caps.

From oak dowels, cut the ¼"-diameter alignment pins and ⅛"-diameter cap dowels to the lengths listed. Glue a pin in each cap, using a vise or clamp to squeeze the pin into the hole. Then, glue a cap dowel in each cap.

Add the bedrails and mattress platform

1. Cut the bedrails (P) to size. Using a stopblock with a 1"-long notch, rout ¼" stopped round-overs on all edges of the bedrails except for the bottom inside edge, where shown on Drawing 2.

2. Cut the cleats (Q) to size. Rout a ¼" round-over on the bottom inside edge of the cleats, where shown. Drill countersunk shank holes in the cleats for the mounting screws, where shown. Position a cleat on the inside face of a bedrail (P) with the bottom edges flush and centered end to end. Using the holes in the cleat as guides, drill pilot holes in the bedrail, and drive in the screws. Assemble the other cleat and bedrail.

3. Position the bedrail fittings on the bedrails and legs, where dimensioned on Drawing 5. Centering on the holes in the fittings, drill pilot holes in the bedrails and legs to the depths shown, and drive in the mounting screws.

4. On a flat surface, assemble the bedrails to the headboard and footboard by engaging the bedrail fittings. Now, cut the mattress platform (R) to size, and lightly sand all edges. Cut a ⅛×2¼" notch in each corner of the platform, where shown on Drawing 2. Drill
countersunk shank holes in the platform, where shown; then position it on the cleats. Using the holes in the platform as guides, drill pilot holes in the cleats to the depth shown, and drive in the screws. (You'll need to slightly angle your drill to clear the bedrail when drilling the holes.)

**For bunk beds, make dowels and guardrails**

1. From \( \frac{1}{2} \)"-diameter oak dowel, cut the bed-joining dowels (S) to the length listed. Sand a light chamfer on both ends of the dowels to ease insertion into the legs.

2. From \( \frac{3}{4} \)"-thick stock, cut eight \( 2\frac{1}{8} \times 17\frac{3}{4} \) blanks for the guardrail outside legs (T) and four \( 2\frac{1}{8} \times 14\frac{1}{4} \) blanks for the inside legs (U).

3. Cut the notches in the inside legs, where dimensioned on Drawing 6. Now, apply glue and assemble the legs (T, U) in the configuration shown, keeping the ends and edges flush. As explained in the Shop Tip on page 50, nail only through the waste at the top end as you assemble the legs. Clamp the legs together, as in Photo A. When the glue is dry, joint or rip \( \frac{1}{8} \)" of material off two edges of each leg for a \( 2\frac{1}{4} \)"-square lamination, and cut the \( 1 \)" of waste off the top. On the outside leg (T) of each leg assembly that will go inside the bed, trim \( \frac{3}{4} \)" off the bottom, where shown, to clear the mattress platform. Rout \( \frac{1}{4} \)" round-overs on the edges of the legs, where shown on Drawing 7. Then, drill countersunk shank holes in the lower face of the shortened outside legs (T) for attaching the legs to the bedrails.

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4 Cut the long rails (V) and the short rails (W) to size. Cut a ⅛" groove ⅝" deep, centered in the rails, to receive the long and short panels (X, Y), where shown. Now, rout ⅛" chamfers on the ends of the rails, where shown. Using a stopblock with a 2⅝"-long notch, rout the ⅛" stopped round-overs on the edges of the rails, where shown.

5 From ⅛" oak plywood, cut the long panels (X) and the short panels (Y) to size. From ⅛"-thick oak, rip eight ⅝×5⅛" blanks for the edging (Z). Glue the edging to the ends of the panels with a ½" overhang on each face; then flush-trim the edging.

6 Using the spacers (I, J) that you set aside earlier, glue and assemble the rails, panels, and legs to complete the long and short guardrails. Assemble these as you did the headboard and footboard, using a 68 ⅝"-long spacer for the long guardrail and a 53 ⅝"-long spacer for the short guardrail to set the leg spacings.

To reach the upper bunk, make a ladder

1 Cut the ladder sides (AA) to size; then crosscut the bottom ends to form the 10° angle, where shown on Drawing 8. On each side piece, mark the dado locations for the steps, where shown. Referring to Drawing 8a, mark the 2½" radius at the top of each piece and the 10° angle on the back edge. Note that the sides are mirror images of each other.

2 Using your tablesaw fitted with a dado blade and a long auxiliary extension attached to your miter gauge, cut ⅜" dados ⅛" deep at a 10° angle in each side piece, where marked. Bandsaw the radius and angled back on each piece, and sand smooth. Now, rout a ⅛" round-over on all edges of the sides except for the angled back.

3 Mark screw-hole centerpoints on the outside face of the sides, 1" in from the outer edges and centered over the dados. Now, drill a ⅜" counterbore ⅜" deep with a ⅝" shank hole centered inside at each location.

4 From ⅜"-thick stock, make four 3⅝×14" blanks for the steps (BB). Bevel-rip the front and back edges of the blanks at 10°, leaving a finished width of 3½". Lightly sand the edges. Then, dry-clamp the sides and steps together. Using the screw holes in the sides as guides, drill pilot holes in the steps to the depth shown. Now, glue and screw the steps in place.

5 From a scrap piece that matches the color and grain of the side members, cut sixteen ⅜"-diameter plugs ⅛" long using a plug cutter. Glue the plugs into the counterbores in the sides, aligning the grain of the plugs with the ladder sides; then sand flush.

6 Cut the spacer (CC) and catch (DD) to size. Referring to Drawings 8 and 8a, position the spacer on the back of the side members with the top edges flush. Drill pilot and countersunk shank holes through the spacer and into the sides, where shown. Then, glue and screw the spacer in place. Now, position the catch on the spacer with the top edges flush. Drill holes, where shown, and glue and screw the catch to the spacer. Rout ⅛" round-overs on the edges of the spacer and catch, where shown.

Finishing and final assembly

1 Remove the mattress platform and bedrails. Finish-sand all parts, and remove the dust.

2 Apply a stain. (We used ZAR Provincial stain.) Then, apply two coats of a clear finish, sanding between coats to 320-grit. (We brushed on polyurethane.) With the finish dry, realassemble the bed, and add a mattress.

Setting up bunk beds

1 Assemble the lower bed using both headboard assemblies, and assemble the upper bed using both footboard assemblies.
2 Position the guardrails on the bedrails of the upper bed with the short, drilled leg member on the inside. (You can mount the long and short guardrails on either side of the bed to suit your needs. Also, you can position the short guardrail toward either end of the bed, depending on where you want the ladder.) Using the holes in the legs (T/U) as guides, drill pilot holes on the inside face of the bedrails, and drive in the screws, shown on Drawing 7.

3 Insert a bed-joining dowel (S) in each of the lower bed's legs; then, with the aid of a helper, position the other bed on top. Attach the ladder to the upper bed. Finally, add mattresses; then call the kids and have them try out the beds.

Written by Owen Duvall
Project design: Kevin Boyle
Project builder: Charles J. Hedlund
Illustrations: Roxanne LeMoine; Lorna Johnson
Photographs: Marty Baldwin

**materials list**

<table>
<thead>
<tr>
<th>Parts for one twin-size bed</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Legs</strong></td>
</tr>
<tr>
<td>A: headboard legs 4½&quot; 2½&quot; 40&quot; 0 6</td>
</tr>
<tr>
<td>B: footboard legs 4½&quot; 2½&quot; 31&quot; 0 6</td>
</tr>
<tr>
<td><strong>Headboard and footboard</strong></td>
</tr>
<tr>
<td>C: top rails 4½&quot; 7½&quot; 40&quot; 0 2</td>
</tr>
<tr>
<td>D: bottom rails 4½&quot; 7½&quot; 40&quot; 0 2</td>
</tr>
<tr>
<td>E: footboard panels 1½&quot; 13½&quot; 11½&quot; 0P 2</td>
</tr>
<tr>
<td>F: headboard panels 1½&quot; 13½&quot; 20½&quot; 0P 2</td>
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<tr>
<td>G: footboard edging ½&quot; 1½&quot; 11½&quot; 0P 2</td>
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<tr>
<td>H: headboard edging ½&quot; 1½&quot; 20½&quot; 0P 2</td>
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<tr>
<td>I: spacers 1½&quot; 1½&quot; 3½&quot; 0 4</td>
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<td>J: spacers 1½&quot; 1½&quot; 4½&quot; 0 8</td>
</tr>
<tr>
<td>K: cleats 3½&quot; 3½&quot; 35½&quot; 0 2</td>
</tr>
<tr>
<td><strong>Post caps</strong></td>
</tr>
<tr>
<td>L: bases 1½&quot; 1½&quot; 1½&quot; 0 4</td>
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<tr>
<td>M: caps 1½&quot; 2½&quot; 2½&quot; 0 4</td>
</tr>
<tr>
<td>N: alignment pins ¼&quot; diam. ¼&quot; 0D 4</td>
</tr>
<tr>
<td>O: cap dowels ¼&quot; diam. 2½&quot; 0D 4</td>
</tr>
<tr>
<td><strong>Bunk bed parts</strong></td>
</tr>
<tr>
<td>P: bedrails ¼&quot; 6½&quot; 73&quot; 0 2</td>
</tr>
<tr>
<td>Q: cleats 3½&quot; 3½&quot; 70½&quot; 0 2</td>
</tr>
<tr>
<td>R: mattress platform ¾&quot; 38½&quot; 74½&quot; 0P 1</td>
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</table>

<table>
<thead>
<tr>
<th><strong>Guardrails and bed-joining dowels</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>S: bed-joining dowels ¼&quot; diam. 3½&quot; 0D 4</td>
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<tr>
<td>T: outside legs ¼&quot; 2½&quot; 16½&quot; 0 8</td>
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<td>U: inside legs ¼&quot; 2½&quot; 13½&quot; 0 4</td>
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<tr>
<td>V: long rails ¼&quot; 2½&quot; 7½&quot; 0 4</td>
</tr>
<tr>
<td>W: short rails ¼&quot; 2½&quot; 5½&quot; 0 4</td>
</tr>
<tr>
<td>X: long panels ¾&quot; 29½&quot; 6½&quot; 0P 2</td>
</tr>
<tr>
<td>Y: short panels ¾&quot; 21½&quot; 6½&quot; 0P 2</td>
</tr>
<tr>
<td>Z: edging ½&quot; 1½&quot; 6½&quot; 0 8</td>
</tr>
<tr>
<td><strong>Ladder</strong></td>
</tr>
<tr>
<td>AA: sides ¾&quot; 3½&quot; 55½&quot; 0 2</td>
</tr>
<tr>
<td>BB: steps ¾&quot; 3½&quot; 14&quot; 0 4</td>
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<tr>
<td>CC: spacer ¾&quot; 3½&quot; 14&quot; 0 1</td>
</tr>
<tr>
<td>DD: catch ¼&quot; 5½&quot; 15½&quot; 0 1</td>
</tr>
</tbody>
</table>

**Buying Guide**

No-mortise bedrail fittings. Set of four (2 sets needed for bunk beds), no. 142496, $9.99 (per set) plus shipping. Order from Woodcraft, call 800/225-1153 or go to www.woodcraft.com.

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traditional oak
child's dresser

Fresh styling joins with ample storage in this five-drawer piece.

Part of our children's bedroom ensemble, this dresser matches the bunk beds on page 48, featuring the same groove-and-panel construction and decorative arch details. Its modest styling makes it a good fit in any setting.
For the items needed to build this project, see the Cutting Diagram and Materials List on page 63.

**Start with the legs**

1. From \( \frac{7}{8} \)-thick stock, planed to \( \frac{1}{2} \)". cut eight \( 1\frac{1}{2} \times 50\frac{1}{2} \)" blanks for the outside legs (A). From \( \frac{3}{4} \)-thick stock, cut four blanks of the same size for the inside legs (B). All of the blanks are oversized \( \frac{1}{8} \)" in width and \( 2" \) in length. The edges are jointed or ripped and the ends are trimmed after the legs are laminated, where shown on Drawing 1.

2. Cut the two notches in the inside legs, where dimensioned, using a bandsaw or a tablesaw fitted with a \( 3\frac{1}{2} " \) dado blade. The notches form mortises in the finished laminated legs.

3. To assemble the legs, first refer to the Shop Tip in the Bunk Beds project, page 50, for an easy way to keep the leg pieces aligned during lamination. Then, apply glue and assemble the legs (A, B) in the configuration shown on Drawing 1, keeping the ends and edges flush. (We used white glue, which has a longer working time, to assemble the legs.) Clamp the four legs together, as shown in Photo A in the Bunk Beds project, page 50. Remove excess glue from the edges and inside the mortises.

4. Joint or rip \( \frac{1}{8} " \) from two sides of each leg, where shown, for a \( 1\frac{1}{4} \)-square lamination. Then, trim the bottom of each leg \( 2" \) below the lower mortise. Now, trim the top of each leg to the finished length of \( 48\frac{1}{8} " \). Finally, rout \( \frac{1}{8} " \) round-overs on all edges except the top.

**Complete the side-panel parts, and assemble**

1. Cut the top rails (C) and the bottom rails (D) to the size listed in the Materials List. Then, cut a \( \frac{1}{2} " \) groove \( \frac{1}{2} " \) deep, centered in the rails, to receive the panel assemblies (E/F), where shown on Drawing 1. To ease insertion of the rails into the legs and provide room for glue squeeze-out, rout \( \frac{1}{8} " \) chamfers on the ends of the rails, where shown.

2. Lay out the arch on the bottom rails, where shown. To do this, first clamp two \( 3\frac{1}{2} \times 1\times 2" \) stopblocks to a rail, one at each end of the intended arch, with the stopblocks' bottoms flush with the rail's bottom and their inside edges positioned \( \frac{1}{4} " \) from the ends. Rip a \( \frac{1}{8} " \)-thick wood fairing strip 20" long. Place the fairing strip against the stopblocks, and flex it so that the center is \( 1\frac{1}{4} " \) from the rail's bottom. Mark the arch; then bandsaw and sand smooth. Using this rail as a template, mark the arch on the other bottom rail. Now, cut and sand it to shape.

3. Using a \( \frac{1}{4} " \) Forstner bit, drill two holes \( \frac{1}{8} " \) deep in the top edge of each of the top rails (C) for the desktop fasteners, where dimensioned on Drawings 1 and 1a. Chisel out the corners to allow the top (R) to move. Then, at the centerpoints of the \( \frac{1}{4} " \) holes, drill the pilot holes for the mounting screws.

4. From \( \frac{1}{2} " \) oak plywood, cut the panels (E) to the size listed. From \( \frac{3}{4} " \)-thick oak, rip four \( 3\frac{1}{2} \times 37\frac{1}{8} " \) blanks for the edging (F). Glue the edging to the panels with a \( \frac{1}{8} " \) overhang on each face. After the glue dries, trim the edging flush to the panels. (For an easy way to do this, make the flush-trimming fence, shown on page 10.)
Cut a $\frac{3}{8} \times \frac{3}{4} \times 36$" blank for the spacers (G); then cut them to size. Mark a centerline across the grain on one face of each top and bottom rail. Mark a centerline with the grain on one face of each panel at the top and bottom. Assemble a bottom rail and a panel, and glue spacers in the groove in the rail, as shown in Photo A. Clamp the spacers to the rail, remove the panel, and set the rail aside. Repeat to install the spacers in the other rails.

Apply glue in the grooves in a top and bottom rail and in the mortises in two leg assemblies. Assemble the rails, a panel, and the legs. Clamp the assembly, and check for square. Remove excess glue, and set aside. Repeat to assemble the other side panel.

With the panel and rail centerlines aligned, glue and clamp spacers in place, tight to the panel and flush with the ends and top surface of the rail.
Time for the carcase

1 From ¾” oak plywood, cut the carcase sides (H) and top and bottom (I) to size.

2 From ¼”-thick oak, cut four ¾x45” blanks for the side edging (J), and cut four ¾x31” blanks for the top and bottom edging (K). Glue edging (J) to the sides, and glue edging (K) to the top and bottom, and trim flush when dry.

3 Cut a ¼” groove ¾” deep and ¼” from the back edge in the sides (H) and top and bottom (I) to receive the back (L), as shown on Drawing 2. Then, cut the back and the dividers (M) to size.

4 To help you assemble and square the carcase, see the Shop Tip, below. Apply glue in the grooves in the sides, top, and bottom, and assemble the carcase with the back located in the grooves. Drill pilot and countersunk shank holes through the sides and into the top and bottom, where shown, and drive in the screws.

5 Make two spacers for positioning the dividers (M) in the carcase, as shown in Photo B. Starting at the bottom of the carcase, position the first divider on top of the spacers. Mark screw-hole centerpoints on the outside face of the side panels centered over the divider, where dimensioned on Drawing 2. Drill pilot and countersunk shank holes at the centerpoints, and drive in the screws.

6 Finish-sand the carcase and the side-panel assemblies to 220 grit, and remove all dust. Mask mating 1”-wide glue-joint areas on the carcase sides and side-panel legs, where shown in Photo C. Now, stain the inside of the side-panel assemblies; the outside of the carcase sides and the back (L); the front edges of the carcase; the dividers (M); and a 1”-wide area around the inside of the carcase at the front edge. (We used ZAR Provincial stain.)

7 With the stain dry, remove the tape. Position the carcase upside down on your workbench, and apply glue to the previously masked areas. Now, mate the side-panel assemblies to the carcase with the top edges flush and a ¼” leg reveal at the front and back. Then, clamp the assembly.

Make the drawers

1 Edge-join enough ¼”-thick stock for the drawer sides (N) and fronts and backs (O). Plane to ½” thick; then cut the parts to size.

2 Cut a ¼” dado ¾” deep and ¼” from the ends of the sides (N) on their inside faces, where shown on Drawing 3. See Drawing 3a for the setup we used.
Using the setup shown on Drawing 3b, cut a ¼" rabbet ¼" deep along the ends of the fronts and backs (O) on their outside faces. Finally, cut a ¼" groove ¼" deep and ¼" from the bottom edge of the sides and the fronts and backs to receive the bottoms (P). Cut the bottoms to size. Now, glue, assemble, and clamp the drawers, and check for square.

Position the full-extension slides on the drawer sides, where shown in Photo D, and attach with the supplied screws. Then, disconnect the larger cabinet-member part of the slides from the drawer member.

Install the cabinet-member part of the slides in the carcase, working from top to bottom. To do this, first measure from the top surface of the carcase bottom (I) to the top of the upper divider (M). From ¼"-thick scrap, cut a 2"-wide spacer to your measured length plus ¼". Also, make two 1"x2" spacers ⅛" thick from cardstock or plastic laminate, and set one spacer aside. Position a slide in the carcase, where shown in Photo E, and drive in the screws. (Note that the photo shows installation of a slide near the bottom with the wood spacer trimmed accordingly.) Repeat to install a slide on the opposite side. Then, repeat the process, trimming the spacer as necessary to install the remaining slides except for the bottom pair. For these, set them on the two ½"-thick spacers. Now, install the drawers.

Place a slide on a drawer side flush with the bottom and front edges. You'll need to open the slide a little to drive in the screws.

Edge-join enough ¼"-thick stock for the drawer faces (Q). Then, cut the parts to size. Apply double-faced tape to the drawer fronts (O). Center each face in a carcase opening, and...
Top it off

1. Edge-join enough 3/4"-thick stock for the top (R), and cut to size. Rout a 1/4" round-over on the top edges and a 1/8" round-over on the bottom edges, where shown on Drawing 2.

2. Cut the crest (S) to size. Mark the arch on the crest, where shown. (Use the technique that you used to mark the arch in the bottom rails, except you'll need a 40"-long fairing strip.) Using a compass, mark the curve in the center of the crest, where dimensioned. Bandsaw the top of the crest to shape, and sand to remove saw marks. Now, rout 1/4" round-overs along the top edges and ends, where shown.

3. Position the crest on the top, where shown. Drill pilot and countersunk shank holes through the top into the crest, and drive the screws.

Note: We found it easiest to stain the drawer faces (Q) before installing them.

Finally, apply two coats of a clear finish on all stained areas, sanding between coats. (We brushed on polyurethane.) Then, install the drawer knobs with 1 1/2" machine screws.

Final touches

1. Finish-sand any parts not previously sanded to 220 grit. Remove all dust. Then, apply stain to these parts and to the unfinished surfaces of the side-panel assemblies.

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A ton of storage in a tidy space tool carousel

We packed all these tools and bits—135 pieces total—into an instant-access storage unit that takes up just 2x2' of wall space. Think of how it will help organize your shop!

Spin the entire carousel to access each of its six tool-holding wings ...

... and rotate each wing to access both of its sides and the center column.
Start with the carousel

To make the top (A) and bottom (B), stick together two 1/2x16x18 1/2" pieces of plywood with double-faced tape. Mark the top one “A” and the bottom one “B.” Referring to Drawing 1, lay out the hexagonal shape and location of the holes on the top (A). Bandsaw close to the line, then sand the top and bottom to shape.

Drill the six 7/8" holes around the perimeter and the four 3/4" holes around the center through both parts. Countersink the center holes on the top surface of part A and the bottom surface of part B. Drill the 1" hole at the center. Make indexing marks across one edge of the joined parts for later reference. Separate the parts. Enlarge the perimeter holes in the bottom (B) to 9/16".

Cut the core sides (C) to the size given on the Materials List. Glue and clamp the core together in the configuration shown on Drawing 2. Make sure the ends are flush. Drill pilot and countersunk shank holes where shown, and drive in the screws. Remove the clamps.

Position the core between the top (A) and bottom (B), cut two 3/4x5 1/2x13 1/4" spacers. Make the spacers from poplar. [You can rip them later to 5" wide for the brackets (G).] Clamp the core between the top and bottom, positioning it as shown in Photo A. Using the countersunk shank holes in the top and bottom as guides, drill pilot holes into the ends of the core, and drive in the screws.

For the items needed to build this project, see the Materials List and Cutting Diagram on pages 66 and 67.
Add rotating panels

1. From \( \frac{1}{4} \)" tempered hardboard, cut the six panels (D) to the size listed.

2. Cut the panel cleats (E) to the size listed. Mark, bandsaw and sand the \( \frac{1}{8} \)" radii on their ends, where shown on Drawing 2. For the six upper cleats, drill \( \frac{3}{4} " \) holes, centered on the length and the \( \frac{1}{2} " \) thickness, where shown. For the six lower cleats, drill centered \( \frac{1}{4} " \) holes \( \frac{1}{4} " \) deep. Cut six \( \frac{1}{4} " \) dowels \( \frac{1}{4} " \) long and glue them in the holes in the lower cleats.

3. Glue and clamp the cleats (E) to the panels (D), where shown. Set the panels aside.

Make the wall bracket

1. Laminate two \( \frac{3}{8} \times 5\frac{1}{4} \times 22\frac{1}{2} " \) boards for the back (F). With the glue dry, joint one edge and rip and crosscut it to size. Install a \( \frac{3}{8} " \) dado blade in your tablesaw, and form the notches for the brackets (G), where dimensioned on Drawing 3, as shown in Photo B.

2. Retrieve the boards used earlier for spacers, and cut the brackets (G) to the size listed. Mark the angled cuts, where dimensioned on Drawing 3. Bandsaw and sand to the lines.

3. Cut the lower arm (H) and upper arm (I) to size. Using a Forstner bit, drill the \( 1 " \) hole \( \frac{1}{2} " \) deep in the lower arm, and the \( 1 " \) hole in the upper arm, where shown on Drawing 3. The holes are centered on the widths of parts H and I.

4. Glue and clamp the brackets (G) to the back (F). Drill pilot and countersunk shank holes, and drive in the screws. Remove the clamps. In similar fashion, glue, clamp, and screw in place the lower arm (H) and upper arm (I).

Finish and mount the carousel

1. Sand all the parts to 220 grit, easing the edges with a sanding block. Apply the finish of your choice. We brushed on two coats of satin polyurethane, sanding lightly with 220-grit sandpaper between coats. You can also prime and paint to match existing cabinetry.

2. Cut two \( \frac{3}{4} \times 3\frac{1}{4} \times 3\frac{3}{4} " \) hardboard blanks for the washers (J). Mark their centers, and draw \( 3 " \) -diameter circles. Drill centered \( 1 " \) holes, and bandsaw the washers to shape.

3. Cut the cover plate (K) to size. Drill countersunk shank holes at the four corners, where shown on Drawing 3.
**Adding your tools and bits**

**HOW MANY OF THE HUNDRED-PLUS SMALL ITEMS THAT CLOG THE DRAWERS IN YOUR SHOP CAN YOU FIT ONTO YOUR CAROUSEL? TO PLAN THE ARRANGEMENT OF YOUR TOOLS AND BITS, PLACE THE PANELS (D/E) ON YOUR WORKBENCH, AND POSITION THE ITEMS, AS SHOWN IN PHOTO C. YOU CAN STORE ITEMS ON BOTH SIDES OF EACH PANEL, AND ALSO ON THE CORE.**

**NOTE:** For the panels to rotate, there must be clearance between each panel and the core. No bit, tool, or tool holder may protrude beyond an imaginary 8"-diameter cylinder, centered on the panel. Items stored on the core must not interfere with the panels' rotation.

**FOR TOOLS THAT CAN HANG FROM A PEG OR PEGS, MARK THE LOCATIONS, AND DRILL HOLES THROUGH THE PANELS. INSERT MACHINE SCREWS, AND THREAD ON NUTS, AS SHOWN ON DRAWING 4.**

**FOR DRILL BITS AND OTHER TOOLS THAT FIT IN ROUND HOLES, MEASURE THE BIT OR TOOL CENTER-TO-CENTER DISTANCES, AND TRANSFER THESE DIMENSIONS TO BLOCKS OF WOOD. DRILL HOLES SLIGHTLY LARGER THAN THE BIT-SHANK OR TOOL DIAMETERS. CLAMP THE HOLDERS TO THE PANELS. DRILL PILOT AND COUNTERSUNK SHANK HOLES FROM THE OPPOSITE SIDE, AND DRIVE IN SCREWS, WHERE SHOWN. (WE DIDN'T GLUE THE HOLDERS IN PLACE, JUST IN CASE WE EVER NEED TO REARRANGE OUR LAYOUT.)**

**Materials Key:** BP—birch plywood, P—poplar, H—tempered hardboard, LP—laminated poplar.

**Supplies:** #6x¾" flathead wood screws (4), #6x1½" flathead wood screws (32), #6x2" flathead wood screws (4), #8x1½" roundhead wood screws (8), #8 flat washers (12), #8 lag washers (2), #8 lag screws 3½" long (2), ¾" dowel, 1" dowel.

**Blades and bits:** Stack dado set, 1" Forstner bit.

**Buying Guide**

**TOOL HOLDERS.** Look for spring-clip tool holders and magnetic tool holders at your local hardware store, home center, or woodworking specialty store.

**www.woodonline.com**
With well-chosen scrap, try a whole new way to display your favorite photos.

quick & slick photo frames

These great-looking photo frames are so easy to make, you'll be turning them out for everyone on your gift list. We've designed frames to fit single 5x7" photos, shown below in cherry, and the increasingly popular 4x11½" panoramic photos, shown above in bird's-eye maple and wenge; but it's easy to custom-build a frame of any size. Cut the acrylic panes (C) to the dimensions of your photo plus 2" in length and width. Allow 1" between multiple photos in the same frame. Then, make the cap and base (A) 1½" longer than the width of the panes. All the other dimensions remain as shown on the Materials List.

Make a cap and a base

1. Cut the cap/base (A) to the size shown on the Materials List. Install a chamfering bit in your table-mounted router, and adjust it to cut a ¼" chamfer. Set the fence flush with the bit's pilot bearing. Using your miter gauge fitted with an auxiliary extension to back the cuts, rout the end chamfers. Then remove the miter gauge and chamfer the edges.
2. Resaw and plane a ¾x2x12" piece of stock to ¾" thick for a blank for the feet (B). Cut the feet to size. Glue and clamp them to the base, where shown. Sand the edges of the base and feet flush. Finish-sand the cap and base to 220 grit.
3. Acrylic sheet comes with a protective covering. Leaving it in place, cut two pieces of ½"-thick (0.093") clear acrylic ½" larger in length and width than the size listed for the panes (C). Joint ½" off all four edges of both pieces. Use a sanding block and 320-grit sandpaper to remove the sharp edges.
4. Cut a ¾x1x10½" blank for the brackets (D). Make four copies of the bracket full-size pattern on the WOOD PATTERNS® insert. Adhere the patterns side-by-side to the blank with spray adhesive. Align all four bottom edges. With your drill press, drill the ⅜" holes, where shown on the patterns.
5. First testing your cuts in a piece of scrap the same thickness as the bracket blank, cut a ¾" groove ¾" deep centered in the blank, as shown in Photo A. The two acrylic panes with their protective covering in place should make a snug fit in the groove. (The photograph will compensate for the thickness of the covering when it is removed.)
6. Bandsaw the brackets (D) from the blank, cutting close to the pattern lines; then, sand to the lines. Remove the patterns, and finish-sand to 220 grit.

Note: For information on cutting, edging, and drilling acrylic sheet, see the article on page 70.
Glue and clamp the brackets to the cap and base, where shown on Drawing 1. Use a strip of wood to keep the brackets aligned, as shown in Photo B. Wipe off any glue squeeze-out with a damp cloth.

**Cutting Diagram**

- **A** x 3 1/2 x 36" Cherry (5x7" frame) *Plane or resaw to the thickness listed in the Materials List.
- **A** x 3 1/2 x 36" Bird's-eye maple (Panoramic frame)
- **B** x 1 x 10 1/2" Wenge (Panoramic frame)
- "Panoramic" x 12 x 24" Clear acrylic
- "Panoramic" x 16 x 20" Clear acrylic

**Materials List**

<table>
<thead>
<tr>
<th>Frame</th>
<th>T</th>
<th>W</th>
<th>L</th>
<th>Mat.</th>
</tr>
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<tbody>
<tr>
<td>5x7&quot;</td>
<td></td>
<td></td>
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<td>C</td>
</tr>
<tr>
<td>B&quot; feet</td>
<td>1/4&quot;</td>
<td>2&quot;</td>
<td>2&quot;</td>
<td>C</td>
</tr>
<tr>
<td>C&quot; panes</td>
<td>1/4&quot;</td>
<td>7&quot;</td>
<td>9&quot;</td>
<td>A</td>
</tr>
<tr>
<td>D&quot; brackets</td>
<td>1/4&quot;</td>
<td>1&quot;</td>
<td>2&quot;</td>
<td>C</td>
</tr>
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</table>

**Panoramic 3 1/2" Frame**

<table>
<thead>
<tr>
<th>Frame</th>
<th>T</th>
<th>W</th>
<th>L</th>
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<tr>
<td>3 1/2&quot;</td>
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<td></td>
<td></td>
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<td>2&quot;</td>
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<td>C</td>
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<tr>
<td>C&quot; panes</td>
<td>1/4&quot;</td>
<td>6&quot;</td>
<td>13 1/4&quot;</td>
<td>A</td>
</tr>
<tr>
<td>D&quot; brackets</td>
<td>1/4&quot;</td>
<td>1&quot;</td>
<td>2&quot;</td>
<td>C</td>
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</table>

*Parts initially cut oversize. See the instructions.

**Materials Key:** C=cherry, A=acrylic sheet, M=bird's-eye maple, W=wenge.

**Supplies:** Spray adhesive, #8-32 threaded rod (4 pieces 1" long for each frame), #8-32 nickel-plated cap nuts (8 for each frame).

www.woodonline.com
working with plastics

It's great stuff for jigs and projects, but you need the right approach for the best results.

Plastic may not possess the character and beauty of wood, but you'll never find a species of wood that's 100 percent waterproof; splinter-resistant; stable; and, depending on the type of plastic, transparent. When you need some or all of those characteristics for a jig or project, let this material see you through.

Here we'll focus on three types of plastic—acrylic, polycarbonate, and phenolic laminate—and how to machine, bond, and finish them. Acrylic is crystal-clear and rigid; polycarbonate looks like acrylic, but offers much greater resistance to impact; and phenolic laminate is opaque, has more strength than the other two, and won't melt as you machine it. When you need plastic, choose the best type with the help of the chart at right. Then adjust your cutting and shaping operations accordingly.

Cut with care
You can cut plastic with any of your power saws, or shape it with a router. Here are the keys to top results.

Table saw: An 80-tooth, triple-chip blade does an excellent job of cutting acrylic and polycarbonate on your table saw, as shown in Photo A. When you cut phenolic laminate, however, avoid fine particles by using a 40-tooth or coarser blade, wear a dust mask, and provide good ventilation, because the dust irritates the lungs. The coarse blades also cut acrylic and polycarbonate, but leave a rougher edge and can chip the surface. If you have to use a coarse blade on

<table>
<thead>
<tr>
<th>GUIDE TO THREE COMMON PLASTICS</th>
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<tbody>
<tr>
<td>TYPE</td>
</tr>
<tr>
<td>Acrylic</td>
</tr>
<tr>
<td>Polycarbonate</td>
</tr>
<tr>
<td>Phenolic laminate</td>
</tr>
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</table>
Any tablesaw blade will slice through plastic. However, a blade with many fine teeth, such as this 80-tooth, triple-chip model, gives you a much smoother result.

those plastics, cut the workpiece oversize and trim it on the jointer. Or, use a straight router bit and router table; set the fence for a ¼" cut.

**Bandsaw:** Use a skip-tooth blade, and match the coarseness to the thickness of the plastic. A blade with 10–14 teeth per inch (tpi) works great with ¼" stock, while ½" material calls for only 6–8 tpi. If the plastic melts as you cut, you need a sharper blade or one with fewer teeth.

**Scrollsaw:** Melting can be a problem here, because you're always cutting with the same portion of the blade, and the friction heats it rapidly. Scrollsaw expert Rick Hutcheson recommends a speed of 1,000 strokes per minute or slower, a #5 double-skip-tooth blade, and two or three layers of masking tape or clear packing tape to absorb heat.

**Router:** You can shape plastic parts quickly with templates and a handheld router, as shown in Photo B, where we're using an old router table insert plate to shape a new one. Use bushings and straight bits or bits equipped with pilot bearings. Carbide bits spinning at high speeds give the smoothest results.

**Drill clean holes**

Slightly modify any twist bits that you want to use with plastic by carefully reshaping the cutting edges at the tip of the bit. Work both sides of the bit equally on the side of a fine grinding wheel, as shown in Photo C, to form a vertical scraping surface, as shown in Photo D. Now the bit will bore without chipping the edges of the hole.

Lubricate the bit with a light oil, such as WD-40, and run your drill at a low speed. To drill a ¼" hole, for example, use a speed of about 1,800 rpm; for a ½" hole, set the speed at 900 rpm. These steps prevent heat build-up that can melt the plastic.

**Bond with solvent**

Check at hardware stores, home centers, or specialized plastics outlets (look under "Plastics" in the Yellow Pages) for methylene-chloride solvent, labeled as a cement for acrylics. It bonds acrylic to itself or polycarbonate to itself by dissolving a thin layer of plastic on the adjoining surfaces. The plastic flows together and hardens to make a joint.

When joining an edge to a face, make the edge smooth and straight. As shown in the photo opposite, rest one piece on the other, with a backer board behind each, and clamp in place. Keep the vertical backer board separated from the joint line so it doesn’t contact the solvent.

Use a solvent applicator, like the long-needled model shown, or a syringe to place a small amount of solvent all along the joint. It will flow between the pieces, dissolving plastic as it goes.

You can handle the assembly after it has hardened for several minutes, but the bond continues to get stronger for about a week. We left a small tongue protruding, as you can see in the photo, then shaved it off later with a bearing-piloted flush-trim bit in a router table.

**Smooth and polish**

If you're making a quick jig for the shop, the edges that you saw, joint, or rout should be satisfactory as they are. But if you want a more finished look for a display piece, you can easily smooth and even polish the edges.

Smooth it to a matte finish with a hand scraper. To refine it further, use a sanding block and fine, wet/dry sandpaper, starting with 320 grit and moving up through finer grits until you're satisfied with the appearance. For total clarity, charge a buffing wheel with a tripoli buffing compound, and polish the edge as shown in Photo E.

Photographs: Marty Baldwin; Hetherington Photography
Just like clamps, you never seem to have enough storage. And this easily built project will serve your needs in spades. Use it for lumber storage in the shop or as a catchall in the garage or basement. Plus, using 1/2" plywood and 2x4s for its construction, you'll find this project very affordable.

Note: Our unit measures 99" long and rests on four casters for mobility. Size the unit to suit your needs and omit the casters if mobility is not a requirement.

1. Cut the 2x4, plywood, and perforated hardboard parts A, B, C, D, E, F to the sizes listed in the Materials List.
2. On a flat surface drill countersunk mounting holes, and screw the shelf supports (A, B) together to form four rectangular 2x4 frames. Note that the bottom frame uses four Bs and the other frames use just two.
3. Glue and screw the four plywood shelves (C) to the 2x4 frames. Check each for square. Sand or rout slight round-overs to break the sharp edges along the top edges of the 1/4" plywood shelves.
4. Glue and screw the four uprights (D) to what will be the bottom shelf assembly (A, B, C). Use a framing square to ensure squareness and plumb of the uprights to the shelf assembly.
5. Screw the bottom four vertical supports (E) to the inside faces of the uprights (D).
6. Position the next shelf assembly on top of the shelf supports, as shown in Photo A.
7. Repeat Steps 5 and 6 to secure all the supports and shelf assemblies
One level at a time, glue and screw the 2x4 vertical supports into position, and add a shelf assembly. Continue the process to the top of the project.

Project design: Charles I. Hedlund
Photograph: Baldwin Photography
Illustration: Roxanne Lamoine; Lorna Johnson

to the uprights. Before screwing the top four supports (E) in place, make sure the top of the top shelf sits flush with the top ends of the uprights (D). Trim the top four vertical supports if necessary.

Cut the perforated hardboard (F) to fit between two uprights for additional storage on one or both ends of the unit. Add hooks for hanging tools, accessories, or supplies.

Lay the unit on its side and attach 4" heavy-duty swivel-lock casters to the bottom if desired. Paint the completed project if desired.

**Materials List**

<table>
<thead>
<tr>
<th>Part</th>
<th>Finished Size</th>
<th>Material</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>A horiz. front &amp; back supports</td>
<td>18&quot; x 31&quot; x 96&quot;</td>
<td>C</td>
<td>8</td>
</tr>
<tr>
<td>B end supports</td>
<td>18&quot; x 31&quot; x 20&quot;</td>
<td>C</td>
<td>10</td>
</tr>
<tr>
<td>C shelves</td>
<td>18&quot; x 23&quot; x 96&quot;</td>
<td>PL</td>
<td>4</td>
</tr>
<tr>
<td>D uprights</td>
<td>18&quot; x 31&quot; x 71&quot;</td>
<td>C</td>
<td>4</td>
</tr>
<tr>
<td>E vertical supports</td>
<td>18&quot; x 31&quot; x 18&quot;</td>
<td>C</td>
<td>12</td>
</tr>
<tr>
<td>F end panel</td>
<td>18&quot; x 16&quot; x 71&quot;</td>
<td>PH</td>
<td>1</td>
</tr>
</tbody>
</table>

**Materials Key:**
- C - choice of pine or fir 2x4, PL- plywood, PH- perforated hardboard.

**Supplies:**
- 1/4" lag screws 1 1/2" long (16), 4" heavy-duty swivel-lock casters (4), #12 x 1" panhead screws, #8 x 3" flathead wood screws, #8 x 2 1/2" flathead wood screws, #8 x 1 1/2" flathead wood screws.
How much machine can you buy for $500 to $900?
Quite a bit, according to our tests.

7 mid-priced bandsaws

To test cutting power, we mounted a stopwatch to a pushblock and timed a 12”-long cut in 6”-wide red oak.

READERS’ TOP 5
We surveyed woodworkers at www.woodonline.com to find out what matters most in a bandsaw. They told us:
1. Power
2. Resawing capacity
3. Blade-guide system
4. Blade-changing ease
5. Table adjustments

We’ll take a close look at each area in this article.
The bandsaws in this test meet the requirements of most home woodworkers: Their throat (ripping) capacities range from 13 1/4" to 16 1/2"; all have enough power to handle most resawing tasks; and all but one of the models can be wired to a 110- or 220-volt power supply.

Our first testing step was to assemble and align the tools, according to the tune-up procedure described on page 80, and make note of any problems out of the box. Using new 3-teeth-per-inch (tpi) Lenox carbon-steel blades in each saw, tensioned identically, we resawed 6"-wide red oak, pushing each saw hard, but not to the point of stalling. We averaged the results of three tests, as described at left and shown in the Plowing Power chart below.

Next, we resawed the widest piece of red oak that would fit on each saw. (We installed riser blocks on the three saws that offer them as an option. See “What you need to know about riser blocks” on page 76.) With some patience, all of the saws could resaw their maximum.

The Laguna LT14’s heavy cast-iron wheels (left) act like flywheels to muscle the blade through hard woods and difficult cuts faster than the typical cast-aluminum, spoked wheels (right).

The top five bandsaw buying points

1 Power. The manufacturer-rated horsepower of the tested saws ranges from 3/4 hp to 2 hp, but those ratings don’t necessarily match up with true cutting power. For example, the Laguna LT14 has only a 1/2 hp advantage over the Jet JWBS-14CS, but the LT14 cut more than twice as fast in our 6" resaw test. (See the chart at left.) In addition to its stout, 220-volt-only motor, the momentum of the LT14’s massive cast-iron wheels, shown above, carry the blade through tough cuts without bogging down.

2 Resawing capacity. Two factors contribute to a bandsaw’s resawing capacity: the distance between the table and the fully raised blade guides, and power. Maximum resawing capacity for the tested saws ranged from 6" to 12 1/4". (See the chart on pages 78-79.) Even with riser-blocks installed, we could resaw 12"-wide red-oak stock at an acceptable rate for home woodworking (about 12" per minute). If you work under production conditions that require faster resaw speeds in wide stock, you may need a more powerful bandsaw than those we tested.

3 Blade-guide system. Guide blocks keep the blade from twisting and deflecting left or right, and a thrust bearing backs up the blade to keep...
FOUR TYPES OF GUIDES PROVIDE VARYING BLADE SUPPORT

Laguna ceramic guides
Jet Euro-style guides
Round guides
Square guides

Blade Width

1/2" 1/4" 3/8"

A micro-adjustment knob, like this one on the Delta, moves the thrust bearing forward or backward for precise positioning behind the blade. The lower knob controls the location of the guide blocks.

Blade-changing ease. Here, we rated all aspects of blade changing: releasing the tension, and removing, reinstalling, and retensioning the blade. None of the saws in our test have knuckle-busting tensioning knobs: all clear the top wheel housing easily. The Shop Fox W1673 has a nifty lever, shown on page 79, that relaxes blade tension instantly. It’s not enough to remove the blade, but it eliminates much of the cranking required by the other saws.

We prefer to use as few tools as possible when swapping blades, and the Jet JWBS-14CS and Ridgid saws rank high here, requiring only a Phillips screwdriver. Some need hexhead wrenches and/or open-end wrenches to move, or remove, guides or guards.

5 Table adjustments. All of the tables on the tested saws pivot smoothly on a pair of sturdy trunnions. All of them also tilt 45° to the right and at least 10° to the left (a must-have for bandsawn dovetails). However, only two saws—the Grizzly and Laguna—let you tilt the table left without resetting the 0° stop.

what you need to know about riser blocks

To increase a bandsaw’s resawing capacity, some manufacturers offer an optional “riser-block”—a cast-iron block that you bolt into the middle of the saw’s frame. The extra 4–6” can double the distance between the table and blade guides, adding enough capacity to make book-matched 22”- to 26”-wide panels, or rough out a deep bowl blank for turning.

A riser-block kit typically includes the block, extended blade guards, and a longer guide post. The Jet and Ridgid kits we tested also include a longer 6-tpi, general-purpose blade. Installation takes less than 30 minutes with a helper.

If you think you’ll eventually want a riser block for your saw, consider buying a kit when you buy the saw. (It’ll add $60–$90 to the price.) We know many woodworkers who waited, and now have bandsaw blades too short for their riser-block equipped saws.
meet the bandsaws in our test

**Delta 28-293, $780, www.deltamachinery.com, 800/438-2486**

**High points**
- Virtually tied as second fastest-cutting bandsaw in the test.
- Lower blade guides are close to underside of table for outstanding support and reduced blade deflection.
- Micro-adjustment knobs for lower blade guides access easily from the front of the table.

**Low points**
- Guide post can drop when loosened unless supported.
- Thumbscrew to adjust tracking is small and uncomfortable to use.

**More points**
- Although you need a hexhead wrench to secure guide blocks, the set screws provide an unobstructed view of blade. (See photo at left.)
- In late June, Delta introduced the 28-241, an updated version of the 28-293 we tested. According to a Delta official, they've boosted the power to 1 1/2 hp and fixed the guide-post problem. The new model will sell for about $700, and also comes in an open-stand version (model 28-231) costing $625.

**Jet JWBS-14CS, $600, www.jettools.com, 800/274-6848**

**High points**
- No tools required for frequent adjustments; changing blades requires only a Phillips screwdriver to remove rear blade guard.

**Low points**
- When resawing, the 1-hp motor struggled to maintain constant speed unless we backed off the feed pressure.

**More points**
- The JWBS-14CS is identical, except it has a 3/4-hp motor and open stand. It sells for $530.

---

**Grizzly G1073, $695, www.grizzly.com, 800/522-4777**

**High points**
- Virtually tied as second fastest-cutting bandsaw in the test.
- The large table tilts left without resetting 0° stop.
- Price includes a good-quality rip fence and miter gauge.

**Low points**
- To remove the rip fence, you must disassemble one end of the front fence rail.
- The thin drive belt slipped off the pulleys twice during our testing.
- Rubber feet helped dampen vibration, but set the machine swaying during heavy cuts.

**More points**
- At 408 pounds, it's heavy! You’ll need a strong friend (or two) to help you mount the saw to its base.
- Open-stand version (G1073) sells for $625.
- This machine has three blade speeds, but we found no advantage to the lower speeds.

---

**Grizzly G0555**

- This machine has three blade speeds, but we found no advantage to the lower speeds.
- The riser-block ready, 1-hp G0555 will sell for $375, and the 2-hp, dual-voltage, G0513 will go for $750. (Prices do not include shipping where applicable.)

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**New bandsaws due in October**

Just as this issue went to press, officials from Delta and Grizzly told us of new mid-priced bandsaws they're bringing to the market. Delta announced a new line of Asian-made saws modeled after the USA-made saws, described at left, that also include a quick-release blade tensioner and a 4" dust-collection port. The open-stand, 3/4-hp 28-276 sells for around $400; the closed-stand, 1-hp 28-206 runs about $600.

Meanwhile, Grizzly introduced two new mid-priced saws, the 14" G0555 and the 17" G0513 (shown at right). Both offer ball-bearing blade guides, extruded aluminum fences, and miter gauges as standard equipment. Like Delta's new models, they too sport quick-release blade tensioners and 4" dust ports.

The riser-block-ready, 1-hp G0555 will sell for $375, and the 2-hp, dual-voltage, G0513 will go for $750. (Prices do not include shipping where applicable.)

High points
- Its 10" resawing capacity is the largest in the test without going to a riser-block equipped model.
- The rack-and-pinion guide post has a scale for no-fall setting of guide height.
- Offers excellent dust collection, including the only 4" dust port in the test. (Others range from 2¼" to 3½".)
- Euro-style blade guides provide good support for blades ¼" or wider.

Low points
- Upper blade guides have micro-adjust knobs, but lower guides don't.
- Access to lower blade-guide assembly is rather tight.
- Wraparound blade guard limits line-of-sight to the blade and cutline.

More points
- Tension adjustment is easy to reach, owing to its location below the top wheel housing, but we needed two hands to turn it because of the size of the adjustment wheel.
- The model we tested was a pre-production sample; Jet officials expect the saw will be available later this fall.


High points
- The LT14 cut 50 percent faster than the next fastest tested saws.
- The large throat plate has leveling screws (similar to some tablesaws) for flushing the throat plate to the tabletop.
- Table tilts 15° left without having to reset 0° stop.
- Four-point ceramic blade guides (see photo on page 76) offer excellent support for all blade widths.

Low points
- Adjusting blade guides and bearings requires three different sizes of hexhead wrenches, slowing blade changes.

More points
- The motor requires 220-volt electrical service.
- A high-quality fence comes with this saw, but removing it requires partial disassembly of front fence rail.
- After we made an adapter for the unusually sized port (3¾"), the dust collection effectiveness was excellent.
- If you’re buying a bandsaw for resawing, the LT14 is by far the best of the bunch.

Ridgid BS1400, $500, www.ridgidwoodworking.com, 800/474-3443

High points
- All adjustment knobs and screws have a comfortable soft-grip coating.
- Up-front scale eases setting table angle.
- At $500, it's the least-expensive saw we tested, and a good value.

Low points
- We couldn’t push this saw very hard and get good results. It took several cuts before we found the right feed pressure for the fastest resawing.

More points
- It comes with a narrow sanding belt and platen to turn your bandsaw into a strip sander.

How the

<table>
<thead>
<tr>
<th>BRAND</th>
<th>MODEL</th>
<th>MOTOR VOLTAGE (1)</th>
<th>RATED HORSEPOWER (FEET PER MINUTE)</th>
<th>BLADE SPEED (2)</th>
<th>RESAWING (3)</th>
<th>RESAWING WITH RISER BLOCK INSTALLED (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DELTA</td>
<td>G1073Z</td>
<td>110/220</td>
<td>1</td>
<td>2,725</td>
<td>16½</td>
<td>7%</td>
</tr>
<tr>
<td>GRIZZLY</td>
<td>JWBS-14CS</td>
<td>110/220</td>
<td>1</td>
<td>3,000</td>
<td>13½</td>
<td>6½</td>
</tr>
<tr>
<td>JET</td>
<td>JWBS-16</td>
<td>110/220</td>
<td>1</td>
<td>3,000</td>
<td>16¼</td>
<td>10</td>
</tr>
<tr>
<td>LAGUNA</td>
<td>LT14</td>
<td>220</td>
<td>1½</td>
<td>3,500</td>
<td>13¼</td>
<td>8½</td>
</tr>
<tr>
<td>RIDGID</td>
<td>BS1400</td>
<td>110/220</td>
<td>¾</td>
<td>2,800</td>
<td>13¼</td>
<td>6</td>
</tr>
<tr>
<td>SHOP FOX</td>
<td>W1673</td>
<td>110/220</td>
<td>1½</td>
<td>2,300</td>
<td>19¼</td>
<td>8½</td>
</tr>
</tbody>
</table>

NOTES:
1. Dual-voltage machines pre-wired for 110 volts unless otherwise noted.
2. Distance between blade and frame.
3. Distance between table and fully-raised blade guard.
4. (*) 0° table stop must be reset to tilt table left.
5. (C) Ceramic
   (E) Euro-style
   (GP) Graphite-impregnated plastic
   (RS) Round steel
   (SS) Square steel
Choose the saw by how you'll use it

In this price range you won’t find a bandsaw with more cutting power than the Laguna LT14, so it’s our first choice for a resawing machine. It does, however, require 220-volt service. The Delta 28-293 isn’t as powerful as the Laguna, but it’s more user-friendly, runs on 110 volts, and costs about $115 less. If those machines make your pocketbook pucker and you don’t plan to do a lot of resawing, Ridgid’s BS1400 is an excellent value at $500.

Written by Dave Campbell with Jeff Hall
Photographs: Marty Baldwin Illustration: Tim Cahill

Talk about these tools on our special bandsaws forum, or find specifications on other types of tools, by clicking on the "Tool Comparisons" tab at www.woodmall.com.

TESTED BANDSAWS GRADE OUT

<table>
<thead>
<tr>
<th>BLADE</th>
<th>TABLE</th>
<th>GUIDES</th>
<th>PERFORMANCE REPORT CARD (7)</th>
<th>ACCESSORIES (9)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LENGTH (INCHES)</td>
<td>MINIMUM MAXIMUM BLADE</td>
<td>SIZE (INCHES)</td>
<td>TILT RANGE (RIGHT, LEFT, DEGREES)</td>
<td>EASE OF ASSEMBLY</td>
</tr>
<tr>
<td>93¼-1/2</td>
<td>1½-2</td>
<td>14-14</td>
<td>45-50</td>
<td>44½</td>
</tr>
<tr>
<td>115</td>
<td>1½-1½</td>
<td>16-16</td>
<td>45-50</td>
<td>42½</td>
</tr>
</tbody>
</table>

NOTES:
6. 2½" port fits standard 2½" vacuum hose.
7. A Excellent
   B Good
   C Average
8. First measurement is saw under no load.
   Second measurement is while resawing red oak.
9. (B) Mobile base
   (BG) Ball-bearing guides
   (C) Circle-cutting jig
   (D) Fence
   (FG) Fiber guides
   (F) Light
   (G) Miter gauge
   (R) Riser-block kit
   (SB) Sanding belt and planer
   (SK) Three-speed kit
10. (LIFE) Lifetime warranty against factory defects.
11. (B) Belgium
    (C) China
    (T) Taiwan
    (U) United States
12. Prices current at time of article’s production, and do not include shipping where applicable.

www.woodonline.com
79
10-step tool tune-up: bandsaws

Just as with your car, a few minutes of regular maintenance on your bandsaw can save you time and money over the long haul. The next time you change blades on your saw (or right after you’ve assembled your new saw), take ten minutes to ensure your tool’s in tip-top shape and running true. Here’s how.

1. Unplug the saw, then remove the blade as you normally would. Release blade tension, back out the blade guides and thrust bearings, and remove guards if necessary. Remove the guide blocks, and clean and square their contact surfaces, if necessary.

2. Clean the wheels. No matter how effective the machine’s dust collection, some debris always gets mashed between the blade and tire. Hold 100-grit sandpaper against the surface of the tire and rotate the wheel by hand until the tire is residue-free. Brush or vacuum accumulated dust from inside the wheel housings.

3. Install and tension the blade. If the blade is brand new, first wipe it with a paper towel or cloth to remove any oil. Although most bandsaws have a tension indicator, we’ve always had better luck tensioning by hand (or by ear—more on that in a moment). With the upper guard 6” above the tabletop and the guide blocks reinstalled, push on the side of the blade with your pinky finger about 3” above the table. If the blade deflects more than 1/4” under moderate pressure, add more tension.

Some woodworkers pluck the bandsaw blade like a guitar string to set the tension. To do this, increase tension and keep plucking until the tone turns from a dull buzz into a clear tone. If the tone begins to deaden again, you’ve overtensioned the blade: Back it off until the blade sings again.

Once satisfied with the tension, make an index mark somewhere on the blade-tensioning mechanism. You want to be able to return to the same tension while you continue with your tune-up.

(By the way, any time you don’t plan to use the saw for a few days, relax the blade tension. That will help extend the life of the wheels and wheel bearings.)

4. Align the wheels. It’s not enough for the wheels to be parallel; they must also be on the same plane, a condition called “coplaner.” To make them so, begin by removing the table from your saw (or at least tilting it as far...
ALIGNING BANDSAW WHEELS

Top wheel

Tilt top wheel until wheels are parallel.

Bottom wheel

Remove shims here or add shims here until straightedge touches all four rims.

WHEELS NOT COPLANER OR PARALLEL

WHEELS PARALLEL, BUT NOT COPLANER

WHEELS COPLANER

right as it will go.) Open or remove the wheel covers and lay a long straightedge against the rims of the wheels, as shown above or in the photo opposite, staying as close to the hubs as you can. If the straightedge touches all four edges of the wheel rims, skip to Step 7. If not, you'll need to align the wheels, as described in Steps 5-6.

5 Start by making the wheels parallel. With the straightedge against both wheels as in Step 4, tilt the top wheel until the straightedge contacts both rims of either wheel. (Follow the manufacturer's instructions for this adjustment.) Maintaining contact with that wheel, keep tilting the top wheel until the gap between the straightedge and the other wheel is parallel.

6 If the straightedge isn't touching all four rims at this point, you'll need to move one wheel in or out the distance of the gap. Again, follow the manufacturer's instructions for this adjustment. Some bandsaws require adding or removing shims behind the wheel to make them coplaner. Ordinary washers work fine for these shims, or make your own from sheet metal. If you had to remove the blade to shim the wheels, reinstall and retension it.

7 Now it's time to check the blade tracking. If you've done everything properly so far, little adjustment should be needed. Rotate the top wheel by hand, watching the blade's position on the tire surface. If the blade works its way to one edge or the other, tweak the wheel-tilt slightly until it travels true. Don't worry about keeping the blade dead-center in the tire; it should just find a line and stick to it. Replace or close and secure the wheel covers.

8 Got a dollar? It's the cheapest feeler gauge you'll find. Fold the bill, place it between the upper thrust bearing and the back edge of the blade, as shown in the Photo A, and adjust the bearing location until it just holds the bill in place. Secure the bearing, and repeat for the lower thrust bearing.

9 Position the upper guide-block assembly so that the front edge of the blocks are just a whisker behind the blade's gullets (the valleys between the teeth). Repeat for the lower guide-block assembly.

Place one thickness of your dollar-bill feeler gauge between the upper left guide block and the blade, and adjust the block so that it pinches the bill between block and blade without deflecting the blade. Secure the left block. With the bill still in place on the left, thread the other end between the right block and the blade, snug the right block up against the bill and blade (as shown in Photo B), and lock it into place. Now, repeat this process for the lower guide blocks.

10 Reinstall the table. Raise the upper blade-guide assembly as high as it will go, and use a drafting triangle or combination square to ensure the table is perpendicular to the blade, as shown in Photo C. If not, adjust the table's 0° stop (usually a bolt under the table) in or out until it is.
flag case

A hero's memorial

Designed for a 5x9½' American flag, this case preserves the carefully-folded symbol of our nation and honors the memory of a loved one. You can set this case on a tabletop or shelf, or hang it on a wall courtesy of a clever pair of bevel-edge cleats.

Making a flag case usually requires cutting long, narrow 22½° miters where the sides meet the base. By fitting the base between the sides, our design eliminates these difficult cuts, leaving you with easy 45° miters all around.

For the items needed to build this project, see the Materials List and Cutting Diagram on page 85.
First, make the triangular frame

1 Plane a 3/4" x 4" x 72" board to 1/2" thick for the sides (A) and the base (B). Cut these parts to the width and about 1" longer than the lengths listed in the Materials List. Save the extra stock for testing the spline-kerf cuts later. Take care to plane your material accurately. It must be exactly 1/2" thick for all the frame dimensions to work.

2 Miter-cut parts A and B to length, to the dimensions shown on Drawing 1. Note that all the miter cuts are 45° and that the base fits between the sides. Miter the ends of your test piece for use later when setting up your table saw to cut the spline kerfs in the sides (A).

3 Referring to the three steps shown at right, cut the spline kerfs in the mitered ends of parts A and B. Use your test piece to verify the accuracy of your saw setups before cutting the kerfs in the parts.

4 Rip a 3/4" x 12" strip of 1/4" hardboard, then crosscut three 3 1/2"-long splines. Test the fit of the splines in the kerfs. We had to lightly sand our splines for a good fit. Dry-assemble the sides and base with the splines to check the fit, then apply glue to the miters and splines, and clamp the frame together, as shown in Photo A.

Add the trim, back, glass, and liners

1 From the edge of a 3/4"-thick, 25"-long board, rip six 1/2"-wide strips for the side trim (C) and base trim (D). Laying the strips on their 3/4" faces, plane them to 3/4" thick. Miter-cut two sets of trim to length, one set each for the frame's front and back. The trim miters match those of the frame. The outside edges of the trim and frame are flush, as shown on Drawing 2.

2 Glue and clamp one set of trim (C, D) to the frame's front edge. With the glue dry, clamp (do not glue) the other set to the frame's back edge, and set the assembled frame on a flat surface, and draw its mitered corners together with a pair of band clamps.
and drill pilot and countersunk shank holes, where shown on Drawing 3. Set the back trim aside.

3. To lay out the back (E), place the frame's back top 90° corner on the 90° corner of a piece of 1/4" hardboard. Trace a line onto the hardboard along the inside edge of the base (B). Bandsaw and joint to the line. Have a piece of single-strength glass cut to fit inside the frame, leaving a 1/4" space all around. (You also can use clear acrylic sheet, and cut it with an 80-tooth carbide-tipped blade.)

4. Resaw a 3/4x3/4x36" board in half, and plane it to 1/4" thick for the side liners (F) and base liner (G). Cut these parts about 1/4" wider and 1/4" longer than the dimensions listed. Miter-cut the parts to fit inside the frame. The fit should be snug, but not tight. To determine the exact width for the liners, place the frame facedown on your bench, and lay in the glass and back. Slide the liners into the frame, and mark their finished width by striking a line even with the back edges of the frame. Remove the liners, and trim them to width.

5. Plane a 3/4x2x10" board to 1/4" thick to make a blank for the back cleat (H) and wall cleat (I). Make a 45° bevel rip along one edge, where shown on Drawing 4. Cut parts H and I from the blank where dimensioned. Drill a countersunk hole in the wall cleat (I) for attachment to the wall later.

6. Assemble the glass, liners (F, G), and back (E) in the frame. Screw the back side trim (C) in place. Glue and clamp the back cleat (H) to the back with its 90° corner nested in the corner formed by the trim, and the bevel oriented as shown on Drawing 2. With the glue dry, remove the back, drill a pilot and countersunk shank hole in the back and cleat, and drive in the screw.
Apply finish and assemble the case

1. Remove the liners and glass. Sand all the parts, except the back, to 220 grit. Ease any sharp edges with a sanding block. Apply two coats of satin polyurethane, sanding lightly with 220-grit sandpaper between coats.

2. With the finish dry, lay the frame facedown on your workbench. Place the glass in the frame, insert the liners, then the folded flag. Add the back, and screw the rear side and base trim (C, D) in place. If you need to fold your flag to fit the case, see the sidebar, “The correct way to fold the American flag” at right.

3. Fasten the wall cleat (I) to the wall, either screwing into a wall stud, or using a wall anchor. Check the cleat for level. Hang the case. Note how the back cleat (H) and the wall cleat (I) interlock in Photo B and on Drawing 2.

Materials list

<table>
<thead>
<tr>
<th>Part</th>
<th>T</th>
<th>W</th>
<th>L</th>
<th>Mat. Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>A' sides</td>
<td>1/4</td>
<td>3/4</td>
<td>18 1/2</td>
<td>2</td>
</tr>
<tr>
<td>B' base</td>
<td>1/4</td>
<td>3/4</td>
<td>24 1/2</td>
<td>1</td>
</tr>
<tr>
<td>C' side trim</td>
<td>1/4</td>
<td>3/4</td>
<td>18 1/2</td>
<td>4</td>
</tr>
<tr>
<td>D' base trim</td>
<td>1/4</td>
<td>3/4</td>
<td>23 1/4</td>
<td>2</td>
</tr>
<tr>
<td>E' back</td>
<td>1/4</td>
<td>16 1/2</td>
<td>16 1/2</td>
<td>1</td>
</tr>
<tr>
<td>F' side liners</td>
<td>1/4</td>
<td>3/4</td>
<td>16 1/2</td>
<td>2</td>
</tr>
<tr>
<td>G' base liner</td>
<td>1/4</td>
<td>3/4</td>
<td>22 1/4</td>
<td>1</td>
</tr>
<tr>
<td>H' back cleat</td>
<td>1/4</td>
<td>2</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>I' wall cleat</td>
<td>1/4</td>
<td>2</td>
<td>7 1/4</td>
<td>1</td>
</tr>
</tbody>
</table>

*Parts initially cut oversize. See the instructions.

Materials Key: C—cherry, H—hardboard.

Supplies: 1/4" hardboard, #4 x 1" brass flathead wood screws (12), #8 x 1 1/2" flathead wood screw, #8 x 1 1/2" flathead wood screw, wall anchor, single-strength glass.

The correct way to fold the American flag

Our flag case is shaped to hold a properly-folded 5x9 1/2 American flag. Here’s how it’s done.

Step 1
Fold the flag in half. You now have open and closed edges.

Step 2
Fold in half again toward the open edge, forming a triangle.

Step 3
Fold the closed corner toward the open edge, forming a triangle.

Steps 5-11
Continue folding until you have one square of the field left.

Steps 12-13
Fold the open corner of the square toward the closed edge. Tuck the resulting triangle into the rest of the flag.

Cutting diagram

1/4 x 24 x 24" Hardboard

3/4 x 5 1/2 x 96" Cherry *Plane or resaw to the thickness listed in the Materials List.

3/4 x 5 1/2 x 96" Cherry
Whole-shop heating systems

No matter what Old Man Winter brings in the months ahead, your shop will be warm and comfortable with one of the practical solutions offered here.
We woodworkers love the winter, when outdoor chores end and nasty weather drive us indoors to where we wanted to be in the first place—our workshops. But if our shops lack heat, we could be sidelined for much of the woodworking season.

To fix the problem, many people turn to portable space heaters for warmth. But these units often are marginally effective at best. For real comfort, consider a dedicated shop-heating system.

For about the price of a good cabinet saw, say $1,500, you can buy the components to heat a 24x24’ workshop. You might even find a used appliance for a fraction of that cost by checking with local heating contractors. Professional installation will cost in the range of 20-30 percent more. Here are some smart, widely-available options. (For a quick overview of the types, see the chart and sources at the end of the article.)

Burning issues
Shops share some of the same heating concerns as homes, but significant differences exist, as well. Keep the following in mind as you plan a heating system.

- **Insulation:** You can't bring warmth effectively in until you keep the cold out by sealing and insulating your shop. The up-front expense is small compared to what you'll save in the long run.

  This difference is easy to see looking at heating requirements, figured in British Thermal Units (BTUs) per hour. For a 24x24’ shop in the upper Midwest, where winter temperatures dip below 0 degrees Fahrenheit, manufacturers quote an average of about 25,000 BTUs per hour for an insulated shop, and more than 50,000 for one without insulation.

- **Air quality:** Fill the air in your shop with enough fine sawdust or finishing fumes, and you'll have the potential for an explosion. So stay away from open-flame heaters and from electric units with exposed heating elements. Choose a unit that, if electric, has shielded elements, or, if gas-powered, draws outside air for combustion rather than shop air.

- **Insurance and permits:** Before you install a heating system, check out local code requirements governing the types of heaters you can use, installation restrictions, and required permits. Talk to your insurance company, as well. Skirting these steps could lead to fines, or to denied claims if you have a fire—even one unrelated to the heating system.

The old reliable: a gas-fired, forced-air furnace
Forced-air heaters fall into a couple of categories: Self-contained heaters that mount to the wall or hang from the ceiling and the traditional ducted furnace, found in many homes.

Self-contained heaters, such as the model shown in the photo, have been standard issue in shops and garages for years. They don't eat floor space, and are relatively easy to install because they don't require ducting. These heaters produce heat from economical liquid propane (LP) or natural gas. Most circulate warmed air using a fan. Unlike older versions, some modern units draw combustion air from the outside, as shown in the drawing, below middle.

A traditional furnace distributes air through a series of ducts to just where you want it. Installation involves more challenges, but a furnace also accommodates central air conditioning.

If you choose a furnace that doesn't draw outside air for combustion, install it in a separate room to minimize dust and fume hazards. The drawing, bottom, shows one way to do this.

A ceiling-mounted heater, such as this unit from Reznor, installs easily, provided you have access to LP or natural gas.

Direct-vent intake and exhaust system

Most direct-vent and separated-combustion heaters feature a 2-in-1 pipe that draws intake air and exhausts waste through a single opening in the wall.

Forced-air furnace shop heating

Locating the furnace in an adjoining, unheated room eliminates potential for a dust or fume explosion. A filtered cold-air return traps shop-generated dust.
whole-shop heating systems

Radiant tube heaters, such as this Re-Verber-Ray unit, are available in several sizes, and can be configured in straight, "U" and "L" shapes to fit the space.

**Turn on the tube**
If you have access to gas, but don’t want forced-air heating, check out a ceiling-mounted radiant tube heater, shown in the photo and illustration, above.

Tube heaters burn LP or natural gas, which warms the air inside a long metal pipe. Heat radiates downward, warming objects it strikes. The system has no external fan to stir up dust in the shop.

**Heat under feet**
When building a new shop (oh yeah, it’s a “garage,” we won’t tell), you might consider hydronic, in-floor radiant heating. These systems are becoming more affordable and increasingly popular in homes, shops, and buildings of all types.

As shown in the photo, bottom left, the heart of a hydronic system is a network of plastic tubes, usually imbedded in a concrete floor. Hot water pumped through the tubing heats the concrete, which acts as a giant radiator and warms everything above it.

You can power a hydronic system for a two-car-garage-sized shop with a small water heater. (If it’s a gas unit, you still need to isolate the flame from shop air, of course.) You can build a “closed” system filled with antifreeze, or run a water supply to the shop and let the heating system provide hot water, as well.

**Electric options**
Electricity has traditionally been an expensive heat source. Even so, the setup costs with other systems may make it worth considering, especially if your BTU needs are low or you spend limited time in the shop during cool seasons.

Unless you’re dedicated to very traditional woodworking, you already have electric service to your shop, so chances are you won’t need anything more to run an electric heater. Units that run on 220 volts generally produce more heat.

Electric heaters come in many sizes and styles, and it’s easy to add more based on need. Portables don’t require special insurance, and even permanent units seldom require a permit.

Radiant panels, such as the ones shown below, from Radiant Electric Heat, Inc., pass electricity over a large metal plate to produce warmth. These heaters are fairly immune to dust and fume dangers.

According to the manufacturer, heating with radiant electric panels costs about the same as using a natural gas or LP forced-air system. Electricity costs more per BTU but, because radiant heating warms objects and not just the air, electric panels heat using fewer BTUs.

Other electric options include in-floor, ceiling-mounted, and simple “plug-and-play” baseboard units.

In a radiant-slab floor, water flows through flexible plastic tubing that gets routed and secured before pouring concrete. Electric in-floor radiant systems exist, as well.

Contined on page 90
While a wood stove seems perfect for heating shops, modern gas and electric systems are simpler and safer to use.

**Is wood good?**

A wood-burning stove seems like the ultimate romantic source of shop heat for many woodworkers. After all, you’re making fuel all the time in the form of scraps and (heaven forbid) mistakes. But wood stoves do have drawbacks.

First, those kiln-dried scraps burn up pretty quickly, so you’ll need a supply of split firewood. Even with good wood, an inexpensive stove can be hard to regulate, causing wide temperature swings. And unless you make special trips to stoke the fire, you’ll lose your heat when not in the shop.

Insurance companies may balk at a stove’s open flame and hot surfaces. Also, some communities with strict air standards regulate the use of wood-burning stoves and fireplaces. A stove may look great in the shop, but isn’t the safest heat source.

Written by David Stone
Illustrations: Kim Downing; Lorna Johnson; Roxanne LeMoine; Jim Stevenson
Photographs: Marty Baldwin; Reznor, Inc.; Radiant Electric Heat, Inc.; Radiant Floor Co.; Craig Carpenter

For additional help with setting up a heating system in your shop, contact a local heating contractor, or take a look at the products offered by these companies:

- **Detroit Radiant Products Co. (Re-Vber-Ray)**
  Overhead radiant tube heating systems
  800/222-1100/www.reverberray.com

- **Radiant Electric Heat, Inc.**
  Radiant electric cove, wall-mounted, and baseboard heating systems.
  800/774-4450/www.electricheat.com

- **Radiant Floor Co.**
  Hydronic floor heating systems
  866/927-6863/www.radiantcompany.com

- **Reznor, Inc.**
  Ceiling-mounted, self-contained heating systems
  800/695-1901/www.reznoronline.com

**A heated debate:**

**Deciding how many BTUs you should use**

Whatever type of heating system you choose, answer these questions before you shop. Discuss the answers with a heating contractor or salesperson to ensure that you select the size and type of system that best suits your needs.

1. Does your shop stand alone or is it attached to another heated structure?
2. How many exterior walls does your shop have, and are they currently insulated?
3. Is it a dedicated shop, or a space also used for a garage or other purposes?
4. What are the shop dimensions?
5. How high are the ceilings?
6. What construction materials make up your shop (wood, brick, concrete block, etc.)?
7. Do you know the insulation values in the walls and ceiling?
8. How many windows does the shop have, and are they single-pane or high-efficiency units?
9. How many exterior doors are there?
10. Does the shop have overhead garage doors? If so, are they insulated?
11. How many hours per week do you spend in the shop during cold seasons?
12. When not in the shop, will you heat it to at least above freezing?
13. Do you have a gas line near the building, or will you have to run one?

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**Shop Heating Systems at a glance**

<table>
<thead>
<tr>
<th>Type</th>
<th>Available BTU range</th>
<th>Unit Cost</th>
<th>Installation Cost</th>
<th>Operating Cost</th>
<th>Pros/Cons</th>
</tr>
</thead>
</table>
| Conventional forced-air furnace  | 25,000–100,000      | Moderate/high ($1,500–$3,000) | Moderate/high ($800–$1,500) | Low/moderate | - Available in a range of styles and prices.  
- Requires gas line, ducting, and venting.  
- May dry out shop air and stir up dust.  
- Requires isolation of flame from shop air.  
- Ducting can be used for air conditioning. |
| Self-contained forced-air heater | 30,000–125,000      | Moderate ($900–$1,200) | Moderate ($400–$600) | Low/moderate | - Available in a wide range of sizes.  
- Requires gas line and venting.  
- May dry out shop air and stir up dust.  
- Requires isolation of flame from shop air.  
- Units with fans may be noisy. |
| Overhead radiant tube heater      | 25,000–50,000       | Moderate ($750–$1,100) | Low/moderate ($250–$1,000) | Low | - Not distributed as widely as other systems.  
- Requires gas line and venting.  
- Can interfere with overhead garage doors.  
- Requires ceilings at least 8’-high.  
- Not available in low-BTU sizes. |
| Hydronic floor heater             | 5,000–100,000       | Moderate/high ($900–$1,500) | Moderate ($300–$500) | Low | - Provides even heating throughout space.  
- A small gas or electric water heater can power most shop-sized systems.  
- Can provide hot water, if desired.  
- Requires new construction or new floor. |
| Electric heater                   | 500–2,500           | Low ($75–$500) | Low ($30–$500) | Moderate/high | - Many styles available in home centers.  
- Easy to install: plug in or hard-wire.  
- Portable models can be expensive to operate.  
- Effective in low-BTU-need regions.  
- Requires ganging small individual units. |
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(By Frank K. Wood)

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**DeWalt’s multi-base router kit gets it right**

I have a personal rule against buying multi-anything tools because each function typically compromises the others. DeWalt’s new DW618PK multi-base router kit is an exception to the rule.

The heart of the system is the fixed-base DW618K, boasting soft-grip handles and a 2/4-hp, soft-start, electronic variable-speed motor. That removable motor also snaps into a matching plunge base or D-handle base. I cut some hefty mortises using the plunge base and detected no hint of strain from the machine.

Instead of rotating the motor in the fixed base to adjust the height, the DW618K’s twist ring smoothly threads the motor up and down without rotating it. That means the power switch stays in one place: within easy reach of your thumb. To a thoughtful nod to left-handed users, DeWalt engineers designed the motor so you also can mount it with the switch on the left side.

Speaking of user-friendly engineering, the DW618K’s detachable power cord makes the changeover to the D-handle base hassle-free. Simply twist the base of the cord to remove it from the motor, plug it into the base on the handle, then plug the D-handle’s short cord into the motor, as shown above.

The true test of a multi-base kit is its plunge base, and this one proved fluid-smooth and steady. It also has through-the-plunge-post dust collection, which effectively cleared the chips from even deep mortises. My only gripe about the plunge base is that the beefy depth-stop rod hides a fair amount of the depth scale.

Almost as impressive as the performance is the number of accessories that come with the DW618PK. In addition to the fixed and plunge bases, the $250 kit includes a carrying case, ¼” and ½” self-releasing collets, two clear Lexan subbases (one that accepts Porter-Cable-style guide bushings, and one with a larger ½” bit opening), and a neat concentricity tool—the cone-shaped gadget in the foreground of the photo—that centers the subbase (or your router table insert plate) over the collet.

The fixed-base router also comes in a 1/4-hp, fixed-speed configuration (model DW616K) for $30 less. It’s also available in kit form with plunge- and D-handle bases.

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Tested by George Graseneth

Continued on page 100

WOOD magazine October 2002
Eliminate bandsaw tension headaches

Bandsaw manufacturers recommend relaxing the tension on your bandsaw blade between jobs, but few of us do because it’s a pain. Carter’s Quick Release Bandsaw Blade Tension Toggle is just the tonic to relieve that pain.

Fitting 14" bandsaws from Craftsman, Delta, Jet, and Ridgid, a pull of the Quick Release lever slackens all blade tension; pushing the lever back up instantly retensions the blade. Installation requires disassembling the saw’s tensioning mechanism, drilling mounting holes with the bit that comes with Quick Release, and reassembling the tensioning mechanism.

If you change blade sizes, you’ll still have to retension for the new blade. Quick Release helps here, too. I found that I could center the new blade on the wheels, temporarily tension the blade by lifting (not locking) the lever, then spin the blade by hand to check tracking.

At a price of $150, Quick Release may not be for the economy-minded woodworker. But, if you have limited hand strength, or want to maximize the life of your bandsaw and blades, you’ll find it money well spent.

—Tested by Jeff Hall
Protractor angles for position with precision

I was skeptical when I saw Grizzly advertising a dial protractor for only $40. That's why I was pleasantly surprised to find the angle-setting gauge dead-on accurate at every angle I measured with a set of machinist’s precision angle blocks.

You can use the G9900 Dial Protractor to measure an unknown angle by matching the beam and blade to the workpiece and locking them in. Or, if you’re trying to set up a machine fence, table, or blade to a specific angle, first lock in the angle on the protractor and set the machine to match it.

The G9900 Dial Protractor’s large face is marked in 5-minute (\( \frac{\pi}{12} \)) graduations—plenty accurate for any woodworking task. For measuring angles smaller than 11°, an acute angle attachment (not shown) attaches to the beam.

—Tested by Garry Smith

Grizzly G9900 Dial Protractor

| Performance | ★★★★★ |
| Price       | $40   |
| Value       | ★★★★★ |

Call Grizzly Industrial at 800/523-4777, or visit www.grizzly.com.

About our product testers

George Granseh runs the architectural millwork program at a community college. Jeff Hall teaches woodworking and other technical skills to high-school students. Garry Smith is a machinist. All are avid woodworkers.

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WOOD magazine October 2002

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**Projects for your home, shop, and holiday gift giving**

**One-day workbench**
Add storage and work surfaces to your shop with a minimal investment in time and materials.

**Child's desk**
Here's the perfect complement to the bunk beds and dresser found in this issue.

**Pendulum doll cradle**
Want a big hug from that special little girl in your life? Here's just the ticket.

**Festive decorations**
Add a craftsman's touch to your home's holiday atmosphere with this winter scene and ornaments.

**Hall bench and coatrack**
Build one or both of these matching traditional home accents.

**Arched candle holder**
A few scraps of wood are all you need to build this classy centerpiece.

**Tools, Techniques & Features**

**Get your money's worth in a random-orbit sander**
There's no sander more useful than one with random-orbit action. We tested a baker's dozen to see which ones work best.

**Timber framing**
Rough carpentry and precision woodworking come together in this time-honored home-building approach.

**Rub out your finishing headaches**
Apply your favorite finish, then use these rubbing-out techniques with fine abrasives to remove imperfections and achieve a dazzling sheen.