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#119 January 2006

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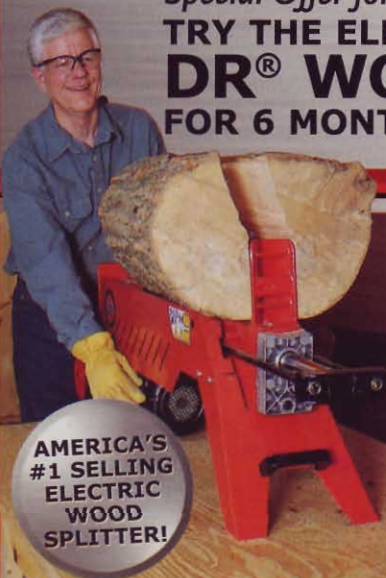
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LEFT TILT

LEFT OR RIGHT TILT?

Q Can you advise me on the pros and cons of right- versus left-tilting tablesaws?

A Tablesaw blades tilt for making beveled cuts. Twenty years ago, blades almost always tilted toward the rip fence—a right tilt. Blades that tilt away from the fence, called left-tilt blades, are now almost as popular.

Both tilt directions have advantages, so the choice ultimately depends on personal preference. While weighing the pros and cons, it's good to remember that the vast majority of your cutting will be done with the blade at 90 degrees—not tilted at all.

A left-tilt blade is more user-friendly, because it allows working consistently on the right side of the blade, a practice most woodworkers prefer. It provides a clear view during the cut, because the blade guard angles away from the fence. This orientation also means the guard doesn't interfere with feeding stock that's less than 6 in. wide.

In addition, a left-tilt blade allows cutting *mitered pieces face side up*. This eliminates any chance for the face to be scratched during the cut. Also, any bottom-side tear-out caused by the blade occurs on the inside edge of the bevel, where it's most likely to be hidden.

A right-tilt blade allows you to use the rip-fence scale no matter what kind of blade is

installed. The blade installs against a fixed washer mounted on the arbor. On a right-tilt saw, this washer is on the same side as the fence, so the blade's dimension, whether it's a regular kerf, thin kerf or dado set, doesn't change the distance between the edge of the blade and the fence.

The blade height-adjustment wheel is more convenient on a right-tilt saw, because it's on the left side of the saw. Many woodworkers build storage cabinets on the right side, under the saw's extension table.

Kickback is possible with either orientation. A right-tilt blade can trap the workpiece between the blade and the fence. If the workpiece happens to drift over a left-tilting blade, the teeth can catch and throw it up and back—the most dangerous type of kickback.

The biggest left-tilt inconvenience is having to reset the scale when you change blades. Guard interference is the right-tilt bane. To bevel-rip narrow stock, you have to move the fence to the other side of the blade.

A good way to test your tilt preference is to consider how you would make a beveled crosscut using the miter gauge. If you would make the cut with the blade tilting away from the miter gauge, you'll probably prefer a left-tilt blade.

WHAT WHEEL DRESSER SHOULD I USE?

Q I just replaced one of the gray wheels on my grinder with a softer, white wheel for my woodworking tools. Do I need a new wheel dresser, too?

A Dressing your grinder wheels is important maintenance. Wheels tend to get a glazed surface from imbedded metal particles. This glazing hampers the cutting action of the wheel and leads to excess heat buildup from friction. Dressing your wheels also keeps them flat and round. A soft-bond white wheel is recommended for grinding woodworking tools. For a soft wheel, the best tool for the money is a square, diamond dresser. It is much easier to use than a single-point diamond dresser, because the 1/2-in.-wide x 1-3/4-in.-long head is imbedded with 36-grit diamond chips, allowing you to uniformly dress your wheel with nothing more than light contact on the wheel.

For the hard, gray-colored wheel, use a star wheel dresser. Star wheel dressers are aggressive and would turn your 8-in. white stone into a 6-in. white stone before you knew it. On the hard gray stones, though, they're just the ticket.

Source Woodcraft, (800) 225-1153, www.woodcraft.com Diamond dresser, #124670, \$15. Star wheel dresser, #03A11, \$20.

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IS MY FORSTNER BIT RUINED?

Q While drilling hardwood, the rim of my high-speed steel Forstner bit turned blue. Doesn't blueing indicate that the steel has lost its temper? Did I ruin my bit?

A Your Forstner bit should be fine, for a couple of reasons. First, blueing on a bit made of high-speed steel (HSS) doesn't indicate a loss of temper. (Tempering is a heating process used to make metal tougher and less brittle.) HSS is tempered at temperatures higher than 1,100



degrees Fahrenheit. To lose its temper, and its hardness, your bit would have to reach the same incredible temperature during use, which is highly unlikely. At 1,100 degrees Fahrenheit, your bit would turn a dull red, as in red-hot, and the wood you're drilling would probably catch fire.

Second, the rim on a Forstner bit doesn't actually drill the hole. The cutting flute does that job by shaving wood from the surface as the bit spins. The rim scores the wood and guides the bit. Turning blue is normal, the result of friction generated from constantly rubbing against the side of the hole. To reduce friction, make sure your bit's cutting flute is sharp, operate your drill press at slow speed and use a steady feed rate.

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DEWALT

If you have a question you'd like answered, send it to us at **Question & Answer, American Woodworker**, 2915 Commers Drive, Suite 700, Eagan, MN 55121 or e-mail to qanda@readersdigest.com. Sorry, but the volume of mail prevents us from answering each question individually.

CUTTING ALUMINUM CHANNEL ON A MITER SAW



Q The manual for my new miter saw recommends positioning aluminum channel like a tent for cutting. I've always held one leg of the channel against the fence and the other against the table. Which is correct?

A Both methods work. The tent position's advantage is that you only cut through the 1/8-in. thickness of each leg. This is easy on your saw and your blade. Before cutting, though, you must secure the leg with a V-notched block of wood (see photo).

Using your old method, cutting through the horizontal leg is difficult, because the blade has to plow through its entire width. This produces long metal shavings that can jam in the blade's gullets, creating friction and heat.

No matter which method you use, spray some WD-40 on the blade before you cut to reduce friction and prevent metal chips from adhering. If you regularly cut nonferrous metals like aluminum, brass, bronze and copper, you can't beat a specialized metal-cutting blade (see Source).

Source Freud Tools, (800) 472-7307, www.Freudtools.com, Metal-cutting blade, for stock 1/8 in. and thicker, #LU89M010, \$69 to \$79; for thin-walled stock, like aluminum storm window frames, #LU90M010, \$79 to \$89.

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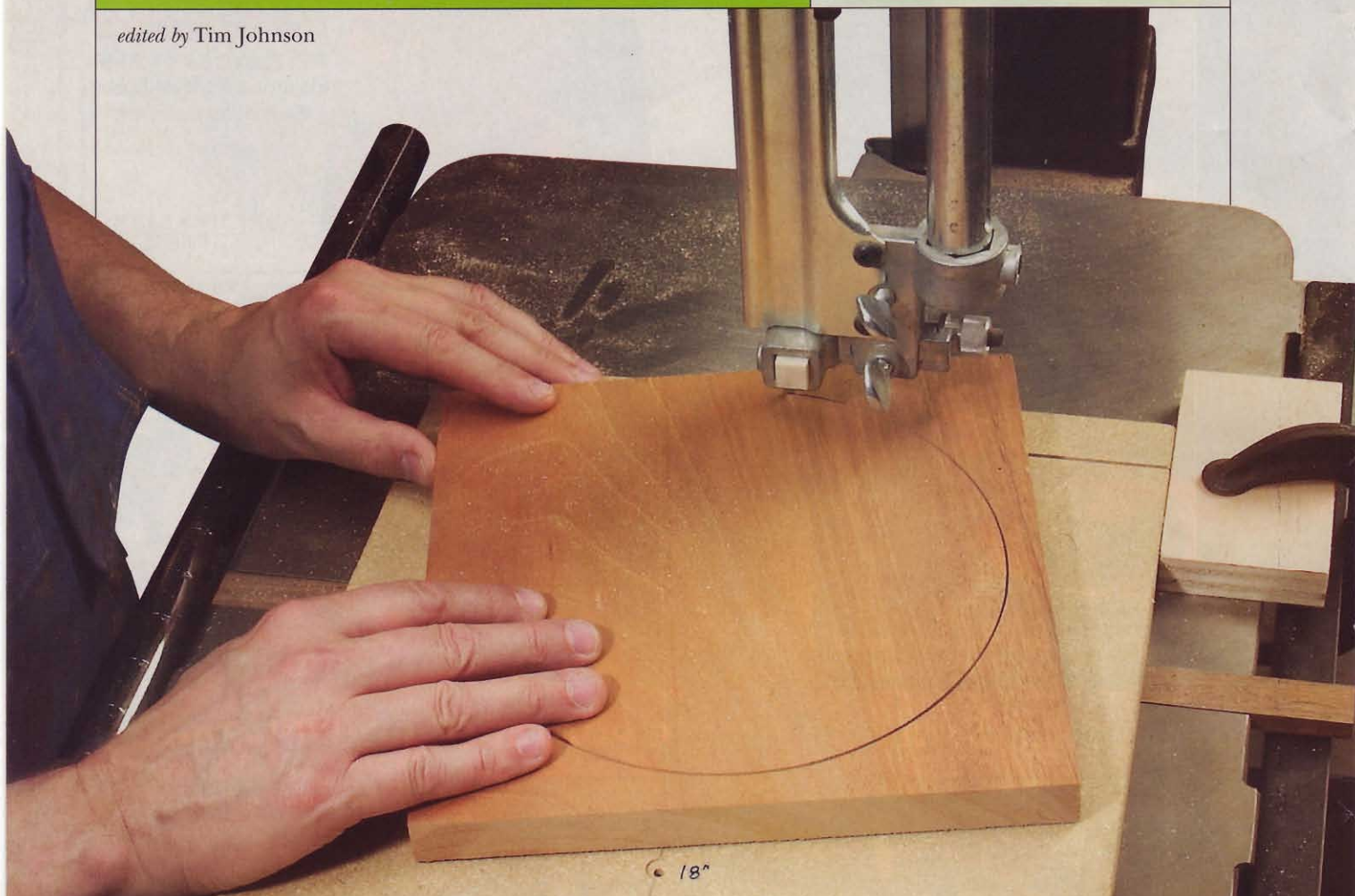


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Circle No. 36

edited by Tim Johnson



POP RIVET CENTER PIN

I make lots of lazy Susans in my cabinet business, so I cut circles of many diameters. Changing diameters is easy on my circle-cutting jig, because I use a pop rivet as a removable center pin.

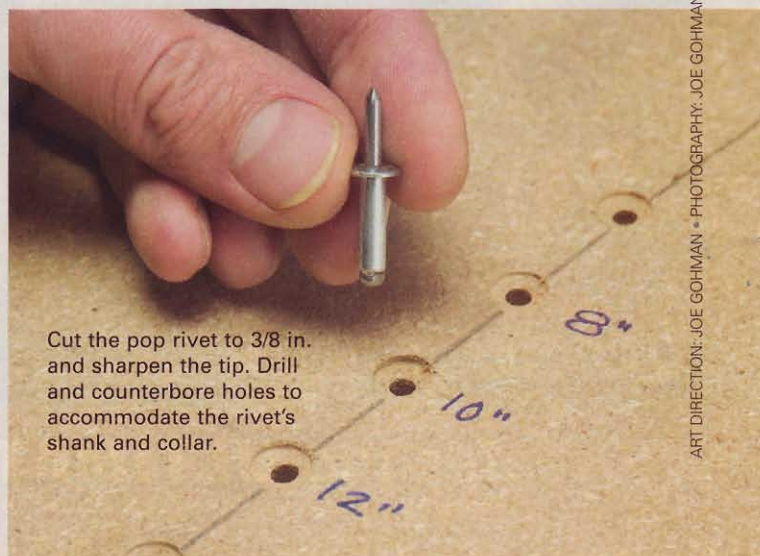
The jig is an MDF piece with an attached rail that's sized to slide in the miter gauge slot. Draw a perpendicular line on the MDF. Install the jig, cut to the line and clamp on a stop block. Remove the jig and drill holes for the pop rivet center pin, measuring from the cut you've made (see photo, right).

To use the jig, fit the pop rivet in the appropriate hole and install a blank. Its bottom must have a center hole sized for the pop rivet. Make a straight cut to the stop

block. Rotate the blank clockwise to cut the circle. When I cut large circles, I support the jig with an adjustable roller stand.

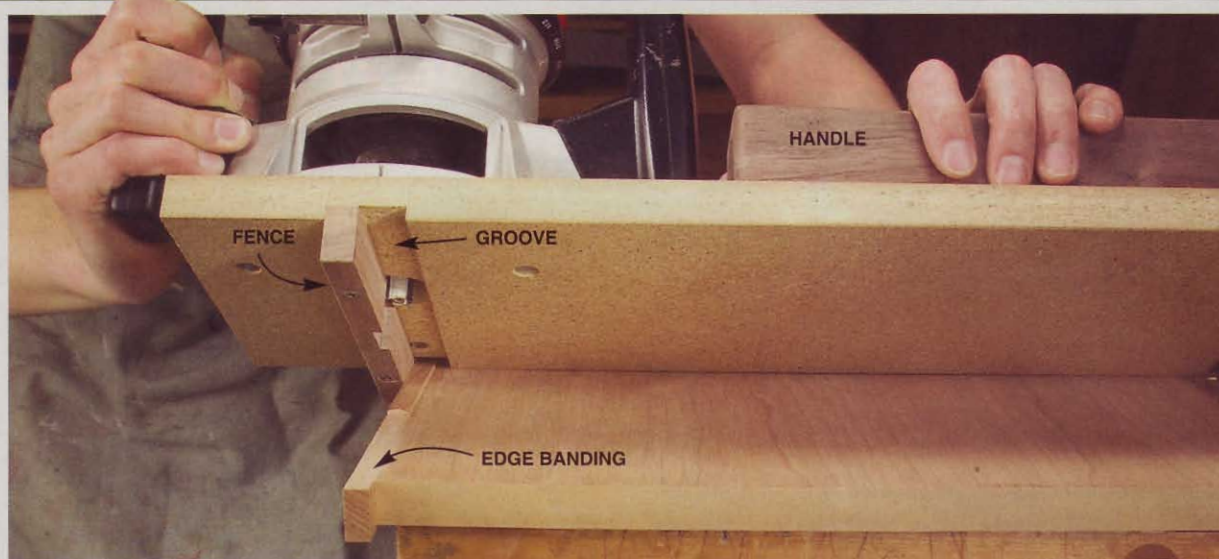
Jerry Syfert

- 18"
- 20"
- 22"
- 24"
- 26"
- 28"
- 30"
- 32"
- 34"
- 36"



Cut the pop rivet to 3/8 in. and sharpen the tip. Drill and counterbore holes to accommodate the rivet's shank and collar.

ART DIRECTION: JOE GOHMAN • PHOTOGRAPHY: JOE GOHMAN UNLESS NOTED



VERN JOHNSON

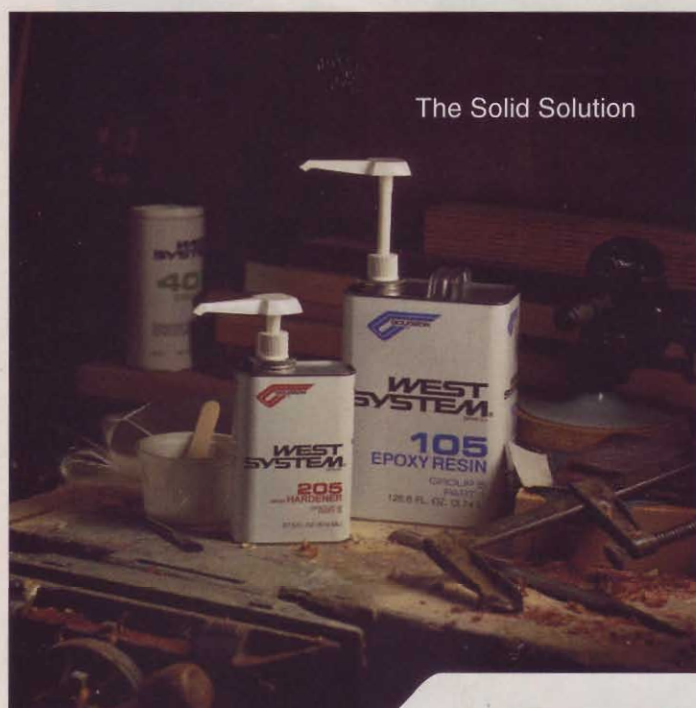
EDGE BANDING LEVELER

Leveling edge banding is easy with my router, a 1/2-in. straight bit and a simple jig. The jig has a groove to house the edge banding, a fence to ensure the bit can't accidentally cut into the plywood top and a handle for two-handed control. I remove the router's baseplate and mount the router directly to the jig. Then I set the bit to cut just above the plywood.

The fence determines the cut's width: The distance between the fence and the bit's far edge must be the same as the edge banding's thickness. On my jig, the fence registers against the groove, so I have to plane it to the proper thickness. By changing fences, I can trim edge banding of any thickness. To edge-band a panel on all four sides, I glue and level the side bandings first and then band the ends.

Randy Johnson

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A button allows a solid-wood top to expand and contract through the seasons. When the top's grain runs parallel to the rail, the button slides in and out of the slot as the top slowly moves. When the grain runs at right angles to the rail, the button slides side to side.

To make the buttons, cut dados in a long block (see photo, above). Drill and countersink holes for the screws and then chamfer the long edges. Saw apart the blocks and chamfer the ends with a file or disc sander.

Tom Caspar



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Dave Munkittrick

If you have an original Workshop Tip, send it to us with a sketch or photo. If we print it, you'll get \$100! Send to *Workshop Tips, American Woodworker*, 2915 Commers Drive, Suite 700, Eagan, MN 55121 or e-mail to workshoptips@readersdigest.com. Submissions can't be returned and become our property upon acceptance and payment. We may edit submissions and use them in all print and electronic media.



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by George Vondriska



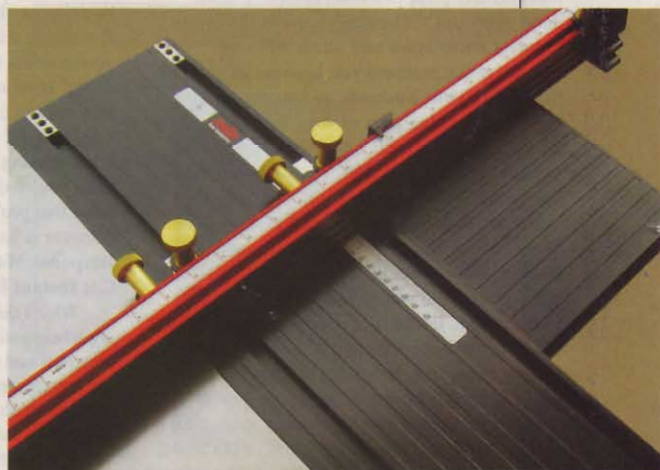
SMALL-FOOTPRINT SLIDING CROSSCUT TABLE

A sliding crosscut table is a wonderful addition to a tablesaw. It provides a safe, easy way to crosscut big panels, like cabinet sides. The new Mast-R-Slide crosscut table from JessEm, \$550, doesn't eat up acres of floor space in your shop and it operates with silky smoothness.

The Mast-R-Slide replaces the left extension wing on your saw. Unlike some other sliding tables, this one has no need for a supporting leg. The leveling system is well-engineered to allow fine-tuning the top of sliding table to be even with the tablesaw. The fence can be easily located in one of three positions, depending on the crosscut you need to do. With the fence in the front position holes, the crosscut capacity is 34 in., in the middle holes, 25 in., and in the rear position holes, 36 in. While this doesn't allow crosscutting full sheets of plywood, it's more than ample for cabinets. The 28-in.-long fence extends to 48 in. and includes a stop. The fence can be angled up to 45 degrees for mitering.

The Mast-R-Slide can be mounted to cast-iron tables only.

Source JessEm Tool Co., (866) 272-7492, www.jessem.com
Mast-R-Slide, \$550.



EDITOR: RANDY JOHNSON • ART DIRECTION: JOE GOHMAN • PHOTOGRAPHY: MANUFACTURER, UNLESS NOTED



NEW LEIGH JIG

Leigh Jig has taken lots of the great features of its D4 jig and put them into a smaller version called the D1600. The price tag is smaller, too, \$300. Compared with the D4, the D1600 may stress your wallet less, but it also offers a bit less capacity and adjustability.

The D1600 has a 16-in. capacity and, like its 24-in. sibling, can be used to cut through, half-blind and sliding dovetails. The fingers are infinitely adjustable for spacing so you can set the jig up for a half pin on the edge of any width of board but, unlike the D4, the fingers can't be adjusted to

change pin width. So, pins will always be the same width as your dovetail router bit. The maximum board thickness the D1600 will handle is 1 in., whereas the D4 can take material up to 1-1/2 in. thick. The setup and cutting of joints is nearly identical for the two jigs.

Source Leigh Jig, (800) 663-8932, www.leighjigs.com Dovetail jig, #D1600, \$300.

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Getting a clamp that also acts as a spreader isn't news, but Bessey has put a new twist on the idea with its DuoKlamps. Just a twist of a knob changes the clamp's function from squeezing to pushing. No need to remove and reverse the head. The removable jaw pads can slip onto either side of the clamp heads, keeping the jaws padded and protecting your work. You can easily operate the clamps with one hand. Four sizes of DuoKlamps are available.

Source James Morton Clamping, (800) 828-1004, www.besseyclamps.com DuoKlamps, 6-in., \$22; 12-in., \$23; 18-in., \$24; 24-in., \$25.



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PATRICK HUNTER

DREAM SHARPENING MACHINE

by Tom Caspar

"What? A \$600 machine that just sharpens hand tools?" That's the reaction I've heard when introducing my pals to the latest in sandpaper-sharpening technology, the Lap-Sharp LS-200. It's the brainchild of a single-minded engineer, Don Naples, who has spent years testing and refining what he considers the ultimate sharpening machine. Naples wouldn't settle for second-best in design, materials or abrasives, which accounts for the high price. So, does it measure up?

I've used this machine for a few months now and I'm a believer. It delivers an incredibly sharp edge very fast. It's virtually impossible to overheat a tool. But just as important, I can use it to flatten and bring the back side of any chisel or plane iron to a mirror polish much faster than I can by hand. That's the "Lap" in Lap-Sharp. It's a critical and often over-looked step in sharpening a hand tool, new or old, and this machine does it better than any other. I am also able to sharpen my cabinet scraper and scraper-plane irons, no matter how thick they are, in no time flat.

The Lap-Sharp works like an old-fashioned record player. Instead of LPs, you interchange coarse, medium and fine platters. Additional super-fine grits are also available. Each platter is an aluminum disc covered with an easily replaceable adhesive-backed abrasive. To start and stop the machine, you step on or off a foot switch. This allows you to keep both hands on a tool, which is essential for accurate lapping. I highly recommend using an optional tool guide bar and holding jig (\$80, see photo above). For more technical information, visit the company's Web site or request a free DVD that includes a complete demonstration.

Source Wood Artistry, (707) 838-1976, www.lapsharp.com Lap-Sharp LS-200, \$600. Tool guide bar and holding jig, \$80.

TWO NEW SLIDING MITER SAWS

Hitachi and Metabo have hit the miter saw market with two new saws, both with interesting features.

Hitachi has made a saw that slides but requires absolutely no clearance behind the saw. Its new C12LSH 12-in. dual-compound sliding saw, \$650, uses a unique rail system. Unlike rails on other sliding saws, the Hitachi's rails are fixed and the head of the saw slides. This eliminates the need that most sliding saws have for lots of space behind the machine. And I gotta say, it's a cool-looking machine.

This machine is tricked out with others bells and whistles, too. It has a digital readout that shows both angle cuts and bevel cuts. The digital readout can swivel to nearly any position convenient to the operator. The saw has a laser that can be positioned on the right or left of the blade and fine-tuned for accuracy. It also has micro-adjust knobs on the angle and bevel settings. Use the main angle and bevel handles for big adjustments and the micro-adjust knobs to fine-tune the setting.

The C12LSH has a 15-amp motor. It angles 57 degrees right and 46 degrees left and bevels 45 degrees left or right. It will cut through a 4-in.-thick, 12-in.-wide board at 90 degrees.



Source Hitachi Power Tools, (800) 706-7337, www.hitachipowertools.com
12-in. dual compound sliding miter saw, #C12LSH, \$650.



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PATRICK HUNTER



The new Metabo KGS 255, \$399, is an 8-1/2-in. sliding compound miter saw that offers an unusual approach to dust collection. With a single port, you get dust collection through both the blade guard and the table. Metabo's dual dust collection goes a long way toward eliminating the typical dust cloud that erupts when you use a miter saw. If miter saw portability is an issue for you, you'll love this machine; its light weight makes it easy to carry.

The KGS 255 has a 9-amp motor and angles 47 degrees left or right. It bevels up to 45 degrees left. It will cut through a 2-5/8-in.-thick, 10-in.-wide board at 90 degrees.

Source Metabo, (800) 638-2264, www.metabousa.com
8-1/2-in. sliding compound miter saw, #KGS 255, \$400.

American Woodworker JANUARY 2006 31

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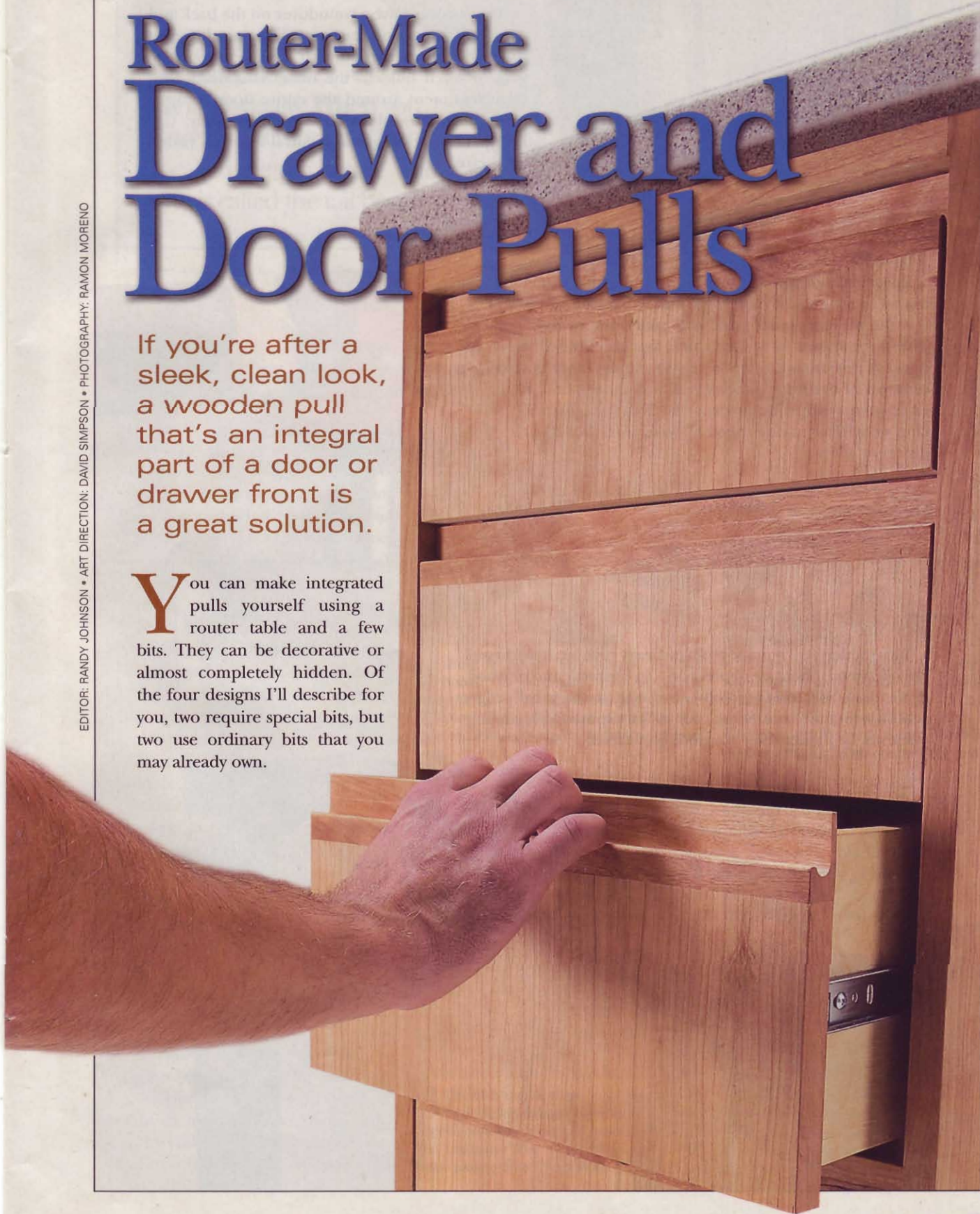
Circle No. 175

Router-Made Drawer and Door Pulls

If you're after a sleek, clean look, a wooden pull that's an integral part of a door or drawer front is a great solution.

You can make integrated pulls yourself using a router table and a few bits. They can be decorative or almost completely hidden. Of the four designs I'll describe for you, two require special bits, but two use ordinary bits that you may already own.

EDITOR: RANDY JOHNSON • ART DIRECTION: DAVID SIMPSON • PHOTOGRAPHY: RAMON MORENO





Finger-Pull Door Lip

These doors have a roundover on the back and a decorative cove on the front. The roundover on the back creates just enough room for your fingers to catch hold of the door. This decorative edge treatment around the entire door complements a frame-and-panel style quite nicely. Use European-style hinges and you'll have no visible hardware.

THE BIT

Specifically designed for creating pulls, this router bit has no bearing and is quite large with a diameter of 1-3/4 in. Use the bit in a router table and take three or four passes. The door shown is 3/4-in. thick, but this bit will work on doors as thick as 1-1/4 in. Be sure to test the bit on scrap pieces of wood of the same species you're working with and to experiment with different speeds. Some species will chip or splinter at one speed but may work well at a different speed.

Source Freud Tools, (800) 472-7307, www.freudtools.com
Finger-pull door-lip bit, #FRD 99-065, \$49.



Hidden Cove

This hidden pull is made by an ordinary cove bit. It works well on solid wood, fibercore or plywood. On fibercore and plywood, first add a 1/8-in. to 1/4-in. solid-wood edge to the panel's edges and then rout the cove. Some core will be exposed after routing, but it will be hidden after the door is installed.

THE BIT

For this cabinet, I used a 1/2-in. cove bit with a bottom bearing. This bit works equally well in a handheld router or a router table. Leave about a 1/4-in. flat lip on the front of the panel.

Source Oldham, (888) 678-7278, 1/2-in. cove bit, #3164COV, \$34.



Dovetail Bevel

This visible decorative pull is made using an ordinary dovetail bit. The entire length of the door's inner edge can be used as a pull. I used a shop-made template as a guide to create a circular design in the middle to complement the cabinet's modern look.

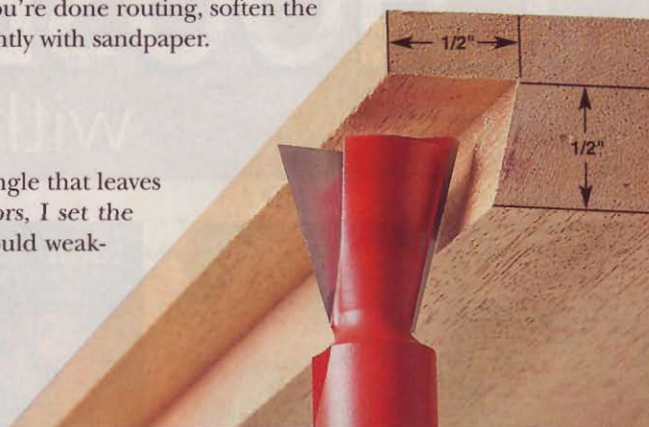
THE SETUP

Use a router with a guide bushing to follow the template. The template can be made in whatever shape you choose. I chose a circle to add some interest to the simple shape of the cabinet. I used a handheld router so I could easily see when the semicircle was completely cut out. When you're done routing, soften the edges slightly with sandpaper.

THE BIT

This 3/4-in.-dia. dovetail bit has a 14-degree angle that leaves an easy-to-grip edge. On these 3/4-in.-thick doors, I set the bit to cut 1/2 in. deep. Any deeper than this would weaken the door's revealed back edge.

Source Freud Tools, (800) 472-7307, www.freudtools.com
3/4-in.-dia. dovetail bit, #FRD 22-134, \$20.



Finger Grip

This visible decorative pull is made by a specialty bit. The shape is routed into an applied solid-wood edging. Use stock at least 1-1/2 in. wide. This will result in a nearly 1-in. space for your fingers. You can make it wider if you like, so run a couple of test cuts to figure out how much space is comfortable for you. You don't want to end up scraping your knuckles every time you open the drawer.

THE BIT

This bit is designed specifically for creating pulls. The bit has a 3/4-in.-dia. cutter and a 1/2-in. shank. You can use it in a router table or a handheld router. It leaves a smooth, rounded-over front edge, which is easy for your fingers to grip. This bit removes a lot of wood, so make the cut in several light passes, especially as you get closer to your final dimension. It's a real drag to hear a big splinter pop out on the "final" pass. Another option is to first remove the majority of waste with a dado blade on your tablesaw.

Source Amana Tool, (800) 445-0077,
www.amanatool.com Drawer-pull door-lip bit,
#53806, \$76.



by Tim Johnson



GET GREAT-LOOKING RESULTS AND AVOID FINISHING DISASTERS.

Gel stains should be a part of your finishing arsenal, whether you're a first-time finisher or an experienced pro. Gel stains don't need to be stirred and won't splash or drip, so they're easy to apply. Gel stains don't soak deeply into the wood, the way traditional liquid oil stains do. Instead, they soak in very little, drying on the wood's surface to form an even layer of color, like translucent paint.

GEL STAIN WIPES ON LIKE GEL VARNISH

Gel stain is nothing more than pigmented gel varnish. It has the same pudding-like consistency. And it's applied the same way: Load up a lint-free cotton rag and rub the wood's surface in a series of overlapping circles to spread the stain. Use the same circular motion to wipe off the excess. Finish by wiping with the grain to remove any streaks. That's all there is to it.

Just because gel stains are easy to apply doesn't mean you can take it easy when you prepare the surface, though. You must sand thoroughly, because gel stains highlight surface blemishes, such as sand-

ing scratches. Sand up to 180-grit paper and examine the surface with a raking light to make sure no scratches remain from coarser grits.

GEL STAINS HAVE LIMITATIONS

Gel stains set up faster than liquid oil stains, so divide staining into manageable sections. For example, stain and wipe the panels on a large door first; then tackle its stiles and rails. Using gel stains on large flat surfaces, such as a desktop, is a challenge. Work at a steady pace and maintain a wet edge to avoid lap marks.

Gel stains slightly obscure the wood's figure, because, like paint, they contain pigments. For this reason, you shouldn't use them directly on bird's-eye maple, quartersawn oak or other highly figured woods. Also, putting more than one coat of gel stain on finely grained woods, such as maple, can completely hide the grain.

Gel stains need to be topcoated. Wiping on several coats of gel varnish is the easiest approach; brushed or sprayed on polyurethane is more durable.

COLOR WOOD EVENLY

Gel stain doesn't soak into wood nearly as much as liquid oil stain does; it stays near the surface, the way paint does.

This is important to remember when you stain unevenly porous woods, such as maple, birch, pine and cherry. These woods contain randomly located pockets of super-absorbent grain that are virtually invisible—until you stain. Liquid oil stain makes these woods look blotchy and unattractive. Gel stain colors them much more evenly. In the photos at left, both samples have one coat of walnut-colored stain made by the same manufacturer.

End grain is also super-absorbent.

Liquid oil stain soaks in and turns end grain black. Gel stain keeps end grain looking like face grain.

In the photos at right, both samples have one coat of walnut-colored stain made by the same manufacturer.

LIQUID OIL STAIN
ON HARD MAPLE

GEL STAIN
ON HARD MAPLE

GEL STAIN
ON BUTTERNUT

END
GRAIN

LIQUID OIL STAIN
ON BUTTERNUT

ACCENTUATE PORES

If you want to show off oak's grain, use gel stain. Thick-bodied gel stain lodges in the wood's pores, almost like paste filler. When used on such woods as oak and ash, which have large, open pores clustered in the earlywood, gel stain highlights the pattern more effectively than liquid oil stain can. In the photos at right, both samples have one coat of walnut-colored stain made by the same manufacturer.

You can clearly see that gel stain colors oak's hard latewood more effectively than liquid oil stain. A second coat of gel stain will darken the overall color, but make the pores less prominent.

DARKENED
PORES

GEL STAIN
ON RED OAK

LIQUID OIL STAIN
ON RED OAK

EARLYWOOD

LATEWOOD



BRIGHT YELLOW

WALNUT BROWN

RICH GOLDEN BROWN

MAKE NEW OAK LOOK ANTIQUE

If you've ever tried to stain new oak to match an antique, you know it's not easy. Oak turns yellow as it ages, and that yellow color enhances the appearance of the old finish. If you don't start by giving new oak the same yellow color—finishing pros call this the ground color—it will never look antique.

Gel stains form a film, like paint does, so applying different colors, one over the other, with adequate drying time between coats, creates a simplified version of a

professional's layered finish.

Staining oak with bright yellow gel stain first (see photo, left) and then walnut brown gel stain (see photo, center) results in a rich golden brown (see photo, right), created by the yellow glowing through the brown.

Mixing the two colors together before staining won't give you the same result. The mixed stain turns everything the same color, so the surface would look flat.

GET GREAT-LOOKING CHERRY

If you want to bedevil your favorite woodworker, ask him or her to make new cherry look like aged cherry. Then show off this finishing technique. I guarantee the person will shout, "Eureka!" Here's what to do:

1. Wipe on a coat of General Finishes' Gel Topcoat (see Source, below). After it has thoroughly dried, lightly scuff the surface with #0000 steel wool.
2. Wipe on a coat of General Finishes' Candlelite gel stain.
3. Protect the color layer by wiping on additional coats of gel varnish. Build a more durable finish by brushing or spraying on coats of liquid polyurethane.

Here's why this simple process makes cherry look so great: Gel stain is colored gel varnish, so the two are interchangeable. When gel stain is used on top of gel varnish, it adds uniform overall tone, just as toned lacquer does over a clear base coat. Additional coats of gel stain deepen the tone.

You can change the wood's tone by using a different gel stain color in Step 2. Stains with names like brown, mahogany, walnut or mission oak make cherry browner. Mahogany and cherry stains make cherry redder. You should always choose gel stain by its color, not by its name. In my opinion, a cherry-colored gel stain doesn't make cherry look its best.



1. GEL VARNISH

2. GEL STAIN
OVER GEL VARNISH

Staining raw cherry doesn't have the same effect as applying gel stain on top of gel varnish. Cherry's surface is covered with legions of tiny pores that are almost impossible to see. Staining the raw wood turns them dark. To an experienced eye, the tiny dark spots are a giveaway; on naturally aged cherry, they wouldn't be there.

Source General Finishes, (800) 783-6050, www.generalfinishes.com Gel Topcoat, \$9 a pint, \$14 a quart. Gel Stain Candlelite, \$9 a pint, \$14 a quart.

SAPWOOD

HEARTWOOD

1. GEL VARNISH ON ALL

2. GEL STAIN OVER GEL VARNISH ON SAPWOOD ONLY

3. SECOND COAT OF GEL STAIN ON ALL

CREATE AN AGED LOOK

Gel stain dries to a hard film, so it can be used for another classic technique: antiquing. You can do this with gel stain alone, but it works best to apply a coat of gel varnish first and then apply stain. Instead of completely wiping off the excess stain, leave some in crevices and corners to imitate the accumulation of years of grime and soot. Rub some areas harder to imitate wear spots or use a dry brush. Experiment. If you hate the look you're getting, just wipe off the stain and start again. You can create this type of finish all at once or in steps, adding a little more "age" with each coat of gel stain.

COLOR SAPWOOD TO MATCH HEARTWOOD

Used on top of gel varnish, gel stain allows you to blend sapwood and heartwood, plywood and solid wood, and color variations between boards. Begin by sealing the entire surface with a coat of gel varnish (see photo, left top). In addition to preparing the surface, this coat of varnish shows the wood's natural color, so you can choose the most complementary color of gel stain to use. When the varnish has dried, apply gel stain to the light-colored sapwood only (see photo, left center). Gel stain is perfect for this job, because its thick, no-drip consistency makes it easy to control. When the first coat of stain has dried, apply a second coat of the same gel stain over the entire surface (see photo, left bottom).



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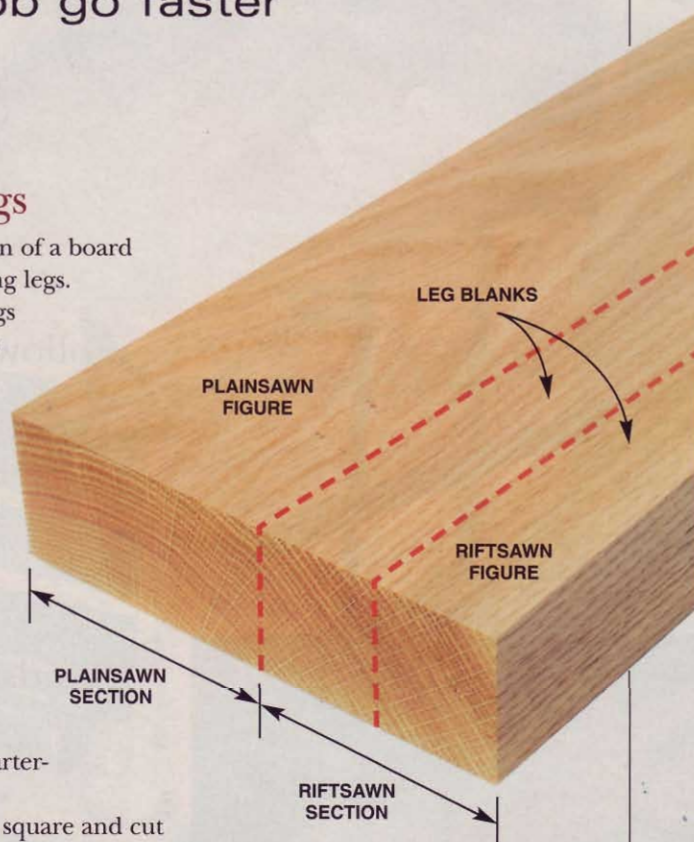
BANDSAWN TAPERED LEGS

Tips and tricks to make
your legs look better
and the job go faster

1 Cut Riftsawn Legs

The riftsawn section of a board makes the best-looking legs. Here, the growth rings run about 45 degrees to the surface. This makes all the leg's faces look pleasingly similar, with straight grain lines on all sides. By contrast, legs from the board's plainsawn section have very different faces. Two are plain-sawn and two are quarter-sawn.

Mill the leg blanks square and cut them to final length. Lay out and cut the joints in the legs before you cut the tapers. This prevents you from mixing up inside and outside faces later on.





2 Lay Out the Tapers

Draw tapers on both outside faces of each leg. I mark the outside faces on the top of the leg, where they won't be removed by sawing or sanding.

Begin the taper 1/2 in. to 1 in. below the spot where the rail joins the leg. A short flat spot above the taper is barely noticeable. You need a small cushion here to make sure that after all the sawing, jointing and sanding is done the taper doesn't accidentally run too far up the leg.

If it does, you may get an unsightly gap between the leg and the rail's end.

OUTSIDE
FACE MARK

LINE OF
TAPER



WOODEN
STRAIGHTEDGE

3 Use a Red Medium-Tip Marker

Use a marker and a wooden straightedge to draw the tapers. When you're sawing, red is much easier to see than a pencil line, particularly on dark woods. This marker draws a line that's about 1/16 in. wide, which serves as a guide for both sawing and jointing. You'll saw along the line's outside edge, then joint down to the line's inside edge. This is easier than trying to saw a straight line 1/16 in. away from a thin pencil line.

SLOPE OF
GRAIN

4 Follow the Grain

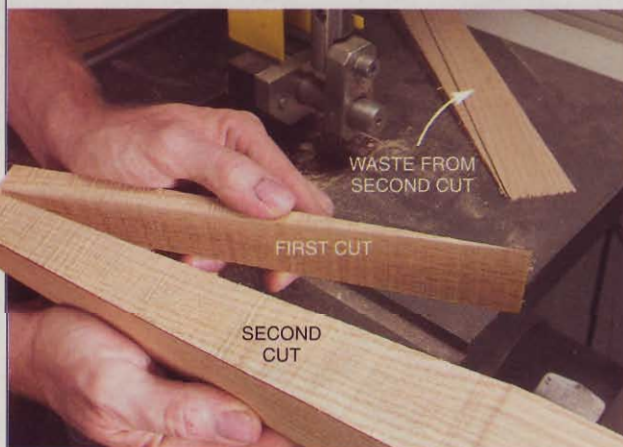
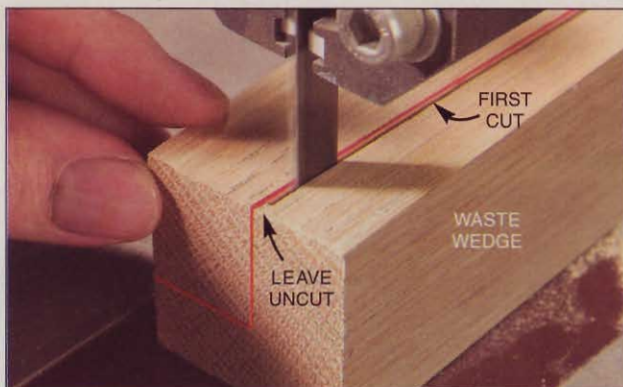
When you draw the tapers, follow the grain's slope on both outside faces, if possible. This makes not only a better-looking leg but a stronger one, too. If this taper slanted the opposite way, cutting across the sloping grain, the leg would be weak.

5 Bandsaw the First Taper

Saw the first taper, staying on the outside edge of the line. Begin at the thin end of the wedge, at the top of the leg. You'll get a smoother cut here than if you start at the leg's bottom and exit at the top. If you were to cut in that direction, going from bottom to top, the blade could prematurely slide out of the cut as it approaches the thin edge of the wedge, leaving a bump that's awkward to remove.

WASTE
WEDGE





6 Stop Short, Flip, Cut Again

On the first cut, stop before you reach the leg's end; then back out. Leave a 1/8- to 1/4-in.-long portion of the leg uncut. The waste piece will remain attached to the leg and help support it during the next cut. Rotate the leg so the second taper's layout line faces up; then make the second cut. Saw all the way through without stopping. Discard the second waste piece.

7 Snap Off the Waste

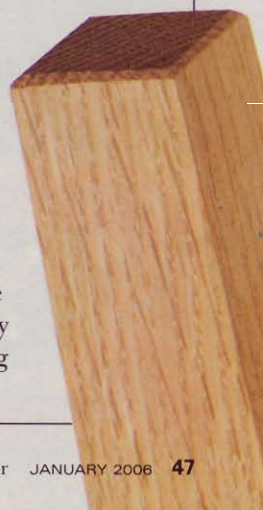
Snap off the waste piece from the first cut. It comes off quite easily, leaving a very small, rough ridge at the leg's end. Remove the ridge with a file or chisel. This production-shop method of leaving the first waste piece attached is very fast—faster than cutting the piece off and reattaching it with tape or hot-melt glue. This strategy also works well with cabriole legs.

8 Joint the Bandsawn Surfaces

Joint the leg. Set the jointer to take a very light cut, about 1/32 in. Use a narrow push stick with a hook cut on the end to keep your fingers out of harm's way. Take two passes to joint down to the inside edge of your layout line. You may need an additional pass to remove all the bandsaw marks, but that's OK. There's a built-in safety margin in the taper's layout.

9 Chamfer the Leg

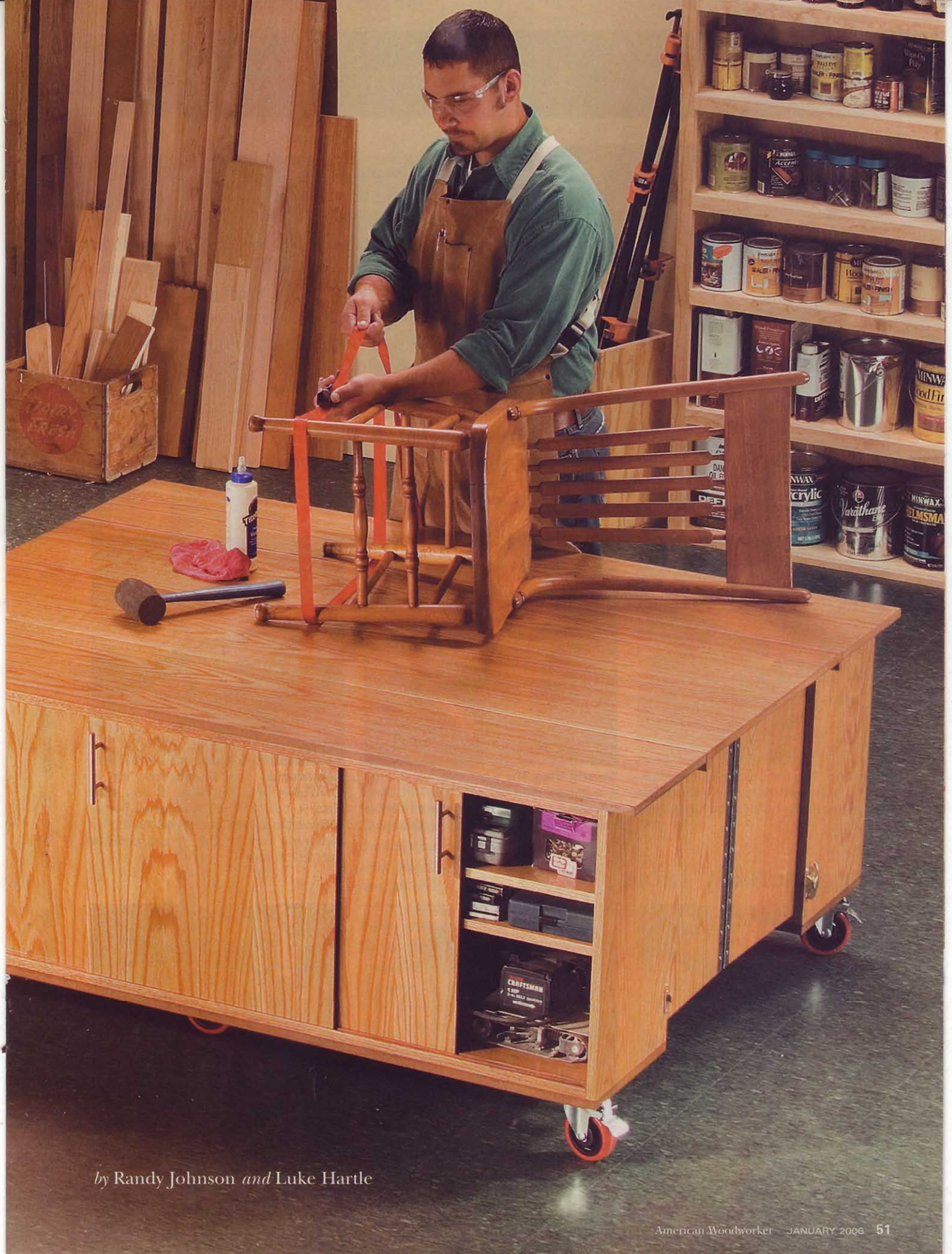
Chamfer the leg's end with a file or a block plane. I do this on all types of legs to keep them from splintering when pushed across the floor, but it's particularly important on a tapered leg with a thin end.





Torsion-box Workbench & Expandable Assembly Table

Double your work space without doubling your shop space.



by Randy Johnson and Luke Hartle

A dynamic duo for the shop



In our shop, we used to pile tools, parts and hardware on top of a wobbly workbench made from 2x4s. When we had to glue a project together, we shoved everything aside. Finally, we got tired of searching for tools and space and set out to make a new style of workbench.

Our new workstation is two benches in one. The best part is a rolling storage unit that opens into a huge assembly table. Closed, it tucks right under the bench. We built the bench's top as a torsion box, so it can span the distance over the assembly table without sagging. Both parts are made from home-center materials using simple joinery. Two work surfaces, lots of drawers and shelves—what a great excuse to buy more tools!

The Workbench



Rigid Top. This bench's top is amazingly strong, although it's only plywood. The secret is easy-to-build torsion-box construction.



Sturdy Vise. The front vise has a large 4-in.-tall by 15-in.-wide by 10-1/2-in.-deep clamping capacity. The hardware comes as a kit and you make the jaw to fit.



Replaceable Top. The bench's top is removable and reversible. If you ever wear it out, drill out the screw plugs, remove the screws and lift off the top by pushing a stick through access holes in the torsion box.

The Assembly Table



Expandable! This assembly table opens like an accordion. The top comes off the two cabinets and doubles as a table leaf, giving you a huge mobile work surface.



Lots of Storage. The base cabinets provide loads of storage space. Sliding doors won't get in your way when they are opened.



Perfect Height. The large work surface is at a comfortable height, perfect for assembling furniture and cabinetry projects.

ART DIRECTION: VERN JOHNSON • PHOTOGRAPHY: MIKE KRIVIT • ILLUSTRATION: FRANK ROHRBACH

The Bench

BUILD THE TORSION BOX

1. Cut out the parts according to the Workbench Cutting List, page 57, and the plywood cutting diagrams (Fig. E, page 57). Cut the top and bottom skins (A) to width on your tablesaw. Because this skins are so long, we found it easier to rough-cut them to length with a circular saw and then trim them to final length with a router and straightedge, rather than wrestling with them on our tablesaw.

2. In the skins, drill the screw holes that will be used to attach them to frame boards (Fig. A, page 54).

3. Lay the bottom skin on a pair of plywood I-beams (Photo 1) and glue and clamp on the outer torsion-frame parts (B, C). The I-beams guarantee that the parts clamp up flat (see "Working with I-beams," page 55). It's OK to glue and clamp one outer frame part to the skin at a time; just keep at least one clamp at each corner of the skin to keep it flat on the I-beams.

4. Cut the inner torsion-frame parts (D, E) to size and use a dado blade to cut the bridge joints on your tablesaw (Photo 2). Make sure to cut test joints first. You want these joints to interlock perfectly, so the parts line up flush on the top and bottom. You also want them to go together smoothly. It's better to have joints that are a little loose rather than tight.

5. Screw the short inner torsion-frame parts (E) to the long center one (D) with a screw at each bridge joint.

6. Test-fit this grid assembly in the outer frame that's glued to the bottom skin (Photo 3). When you are satisfied with the fit, predrill holes through the outer torsion frame, glue the inner torsion-frame assembly to the bottom skin and drive screws through the outer frames into the ends of the inner frame parts.

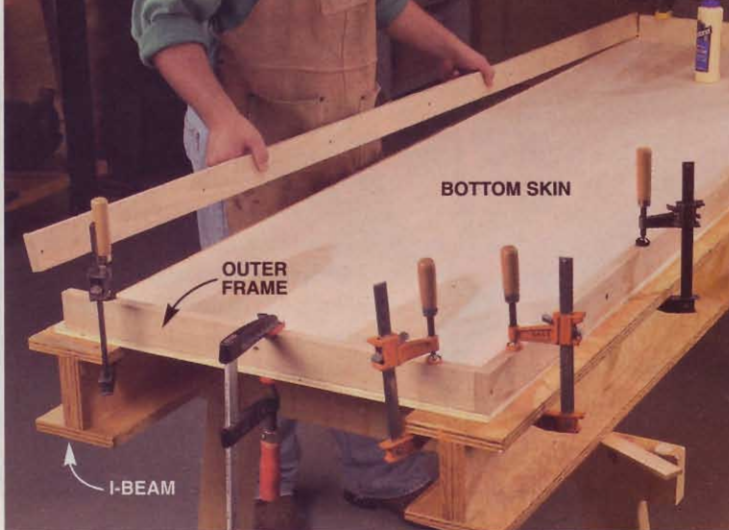
7. Flip the assembly and add screws through the bottom skin into the inner grid frame parts (Photo 4).

8. Now flip the torsion-box assembly back and glue the vise screw blocks (F) in the front left corner of the top (Fig. A).

9. Next, add the top skin with glue and screws.

10. Drill the access holes through the torsion box (Fig. A). Should you ever need to remove the top, you can push a stick through these holes to lift it.

11. Cut the side trim boards (G, H) to final size. Double-check the size of your torsion box and then cut the trim boards to fit. Attach them with glue and clamps (Photo 5). Use a biscuit at each corner to help them line up. Note that the trim's top edge



1 A torsion box is composed of two sheets of plywood, or skins, separated by a frame. The first step is to glue the outer frames to the bottom skin. Clamping the parts to a flat surface, such as these wooden I-beams, guarantees that the top will turn out flat.



Caution: The blade guard must be removed for this operation.

2 Cut the bridge joints on the inner torsion-frame parts with a dado blade. You can cut them as a group by clamping them against an auxiliary fence on your miter gauge.



3 Test-fit the inner torsion-frame assembly. It should slip into place using hand pressure only. Then remove it, add glue and reinstall it. Hold it in place by adding screws through the outer frame parts.

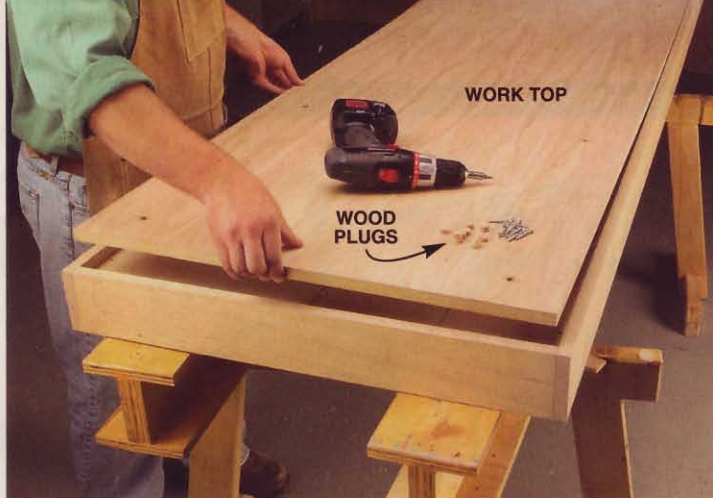


5 Glue the trim boards to the torsion box. Install them flush with the torsion box's bottom. This will create a recess on the top side for the removable work top to fit into. Make long clamps by joining short clamps with couplers.

Cost: Approximately \$700

This exploded view diagram illustrates the assembly of a kitchen island. The components are labeled as follows:

- J**: Top countertop panel.
- G**: Upper support panel.
- A**: Main island base panel.
- H**: Side panel for the island.
- F**: Front panel for the island.
- E**: Internal support structure.
- D**: Side panel for the island.
- C**: Side panel for the island.
- B**: Internal support structure.
- V**: 3" x 3" L-BRACKET.
- R**: Internal support structure.
- Y**: Internal support structure.
- S**: Internal support structure.
- P**: Internal support structure.
- N**: Internal support structure.
- AA**: Cabinet leveler.
- BB**: Cabinet leveler.
- CC**: Cabinet leveler.
- T**: Cabinet leveler.
- AA**: Cabinet leveler.
- M**: Back panel for the island.
- K**: Front panel for the island.
- Q**: Front panel for the island.
- S**: Front panel for the island.
- T**: Front panel for the island.
- U**: Front panel for the island.
- L**: Front panel for the island.
- 1"-DIA. ACCESS HOLE**: Callout for a hole in the island base.
- 3" x 3" L-BRACKET**: Callout for a bracket used in the island base.
- #20 BISCUIT**: Callout for a biscuit used in the island base.
- CABINET LEVELER**: Callout for a leveler used in the island base.
- 1/4" x 1/4" DADO**: Callout for a dado cut in the island base.



6 Install the work top. Screw it to the torsion box and use wooden plugs to hide the screws. The top should fit loosely into the recess, so it's easy to remove if you wish to replace it.

stands 3/4 in. above the torsion box. This space provides a recess for the work top (J).

12. Screw the work top into place (Photo 6). For a nice finished look, counterbore the screw holes and add wood plugs. Trim the plugs flush using a router, chisel or belt sander. When the top gets worn and you want to flip it or replace it, simply drill out the plugs and remove the screws.

13. Now is good time to glue together the three parts (L) for the vise jaw. When the glue has dried, drill the holes through which the vise will fit (Fig. B, page 56).

BUILD THE BASE CABINETS

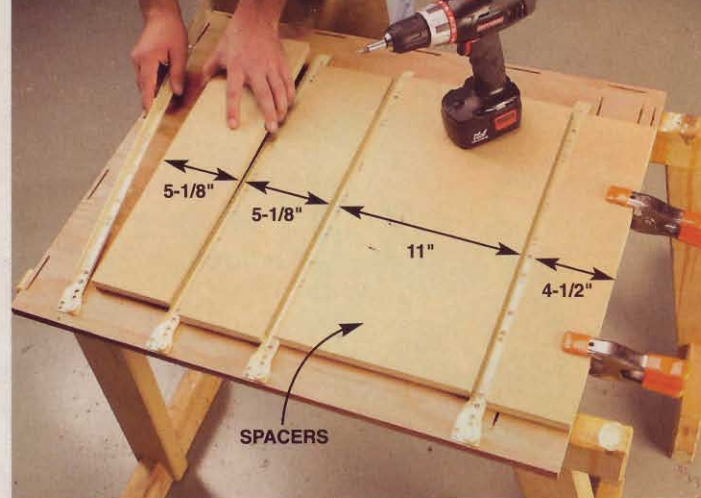
14. Cut out the sides, top and bottom, and back (M, N, P) for the base cabinets. Add iron-on edge banding to the front edge of Parts M and N (see the Workbench Cutting List, page 57, and "Iron-on Edge Banding," AW #113, March 2005, page 26).

15. Cut slots for biscuits in the cabinet parts (Fig. A).

16. Because these cabinets are only 10-1/2 in. inside when complete, it's easier to install the drawer slides (see Sources, page 61) before the cabinets are assembled. Spacers (DD, EE, FF) simplify the job of positioning the slides (Photo 7).

17. Assemble the cabinets with biscuits, glue the cabinets and install levelers (Photo 8).

A strong
and practical
alternative
to a solid-wood
workbench



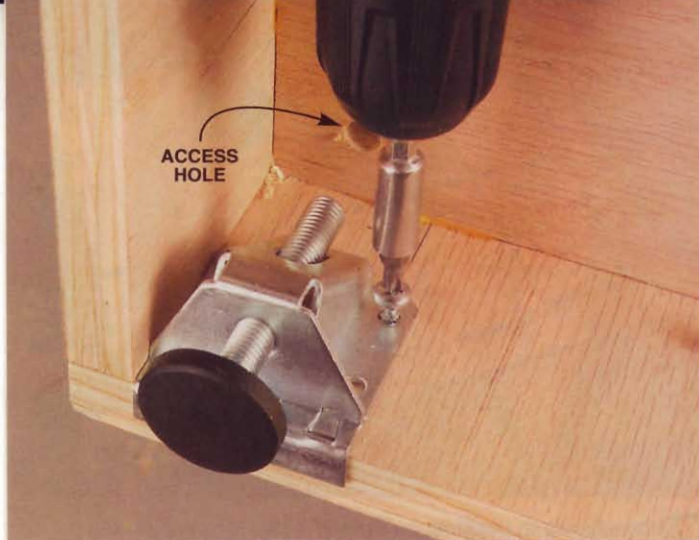
7 Use spacers to position the drawer slides for mounting to the sides of the base cabinets. It's best to mount the slides before the cabinets are assembled, because it's hard to fit a cordless drill inside cabinets after they are put together.

Working with I-beams



I-beams provide a flat, strong surface to work on. They are great to have around the shop and are very easy to build. It only takes one sheet of plywood to make a pair of them. Mill eight 3/4 x 5-3/4 x 96-in. pieces out of birch plywood. Glue and screw the middle boards together first. After the glue is dry, trim a little off the edges to make sure the two parts are perfectly flush with each other. Complete the I-beams by gluing and screwing the top and bottom parts to the middle parts.

Sight down a pair of winding sticks to level the I-beams and use a shim to raise on the low corner. Then clamp the I-beams to sawhorses to keep them in place. As long as you don't move the horses, the I-beams provide a flat and sturdy place to work. The I-beam lip is particularly useful as a clamping edge.



8 Add levelers to the base cabinets if your shop floor is uneven. These heavy-duty levelers are easily adjusted from inside the cabinet through an access hole in the bottom.

ASSEMBLE, INSTALL THE DRAWERS

18. Cut out the drawer boxes' parts (V through CC) and assemble them with biscuits and glue. Screw on the remaining drawer-slide components and slide the drawer boxes into the cabinets.

19. Cut out the filler front (Q, Fig. C, right), which fits around the vise mechanism. Cut out the drawer fronts and toe kicks (R, S, T, U). Apply iron-on edge banding to these parts.

20. Install the toe kicks first. Then add the drawer fronts, starting at the bottom. Place a 1/8-in. spacer on top of the toe kick. Set the bottom drawer front (T) on top of the spacer. Attach the drawer front with a couple drops of hot-melt glue and then add screws from inside the drawer. You can scrape off the hot-melt glue when you remove the drawer front for finishing. Reuse the spacer and repeat this step for the rest of the drawer fronts.

ASSEMBLE THE BENCH, ADD THE VISE

21. Place the torsion box on top of the base cabinets. The cabinets should be flush with the back of the torsion box and set in 3/4 in. from the ends.

22. Remove the drawers and screw the cabinets to the torsion box.

23. Install the vise mounting board (K) to the torsion box's bottom with screws and glue (Fig. D, page 57).

24. Mount the jaw to the vise mechanism and screw the vise to the vise mounting board.

25. With the building complete, you can disassemble the workbench, do a final sanding and then stain and varnish it.

26. When the finish has dried, reassemble the entire workbench, level it and attach it to your shop wall by a couple of L-brackets screwed to wall studs.

FIGURE B WORKBENCH VISE JAW DETAIL

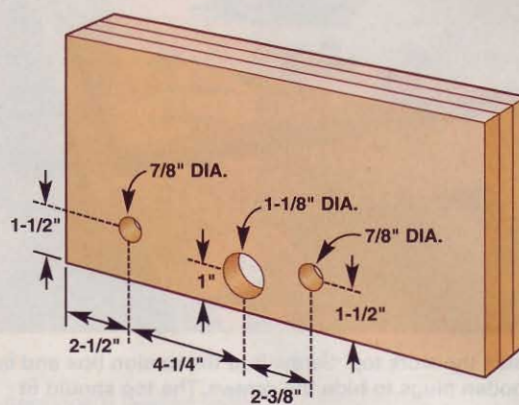


FIGURE C WORKBENCH VISE FILLER DRAWER FRONT DETAIL

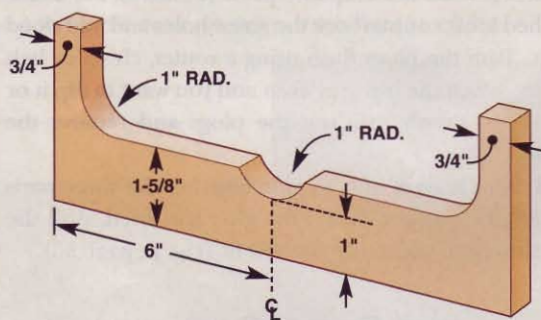


FIGURE D WORKBENCH VISE MOUNTING BOARD DETAIL

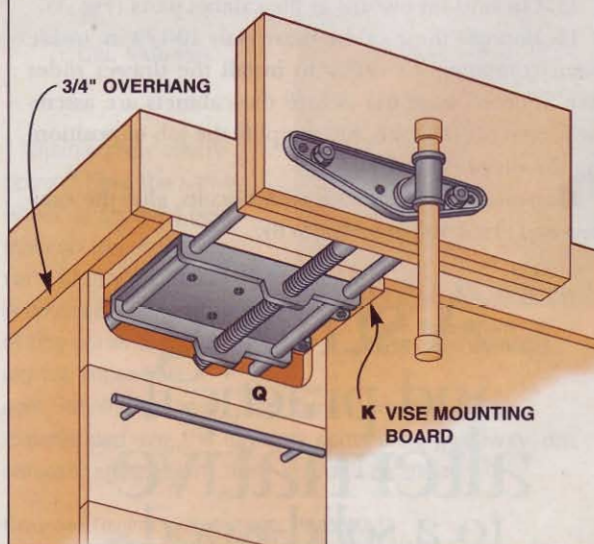
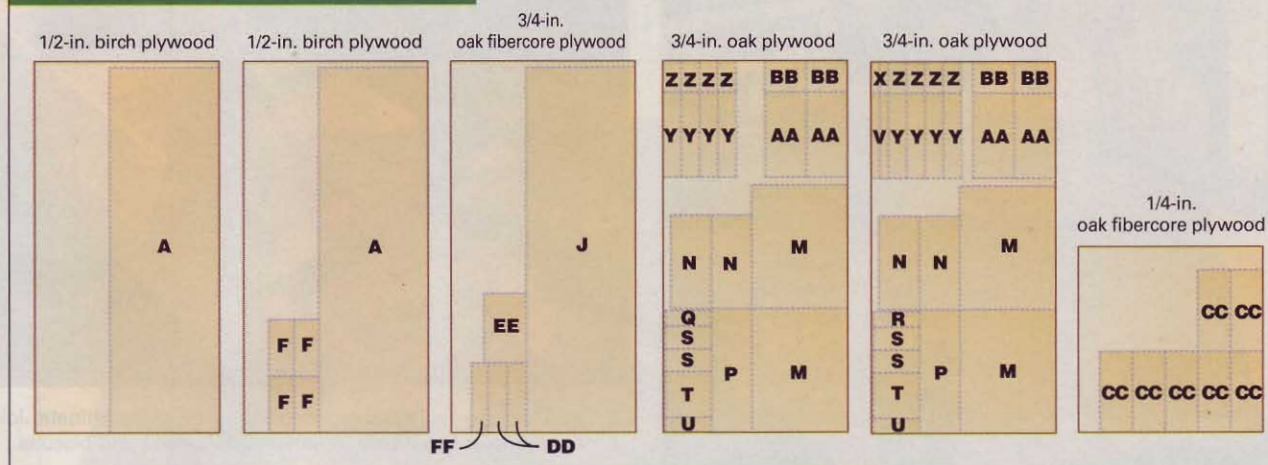


FIGURE E WORKBENCH PLYWOOD DIAGRAMS


Torsion-box construction allows
the workbench to **span a distance**
while maintaining its
strength and stability.

**WORKBENCH
CUTTING LIST**

Overall Dimensions: 36"H x 96"L x 34"D with vise, 30" without vise

Part	Name	Qty.	Material	Dimensions (TH x W x L)
Torsion-box workbench top				
A	Top and bottom skins	2	Birch plywood	1/2" x 28-1/2" x 94-1/2"
B	Long outer torsion frames	2	Oak	3/4" x 2-1/4" x 94-1/2"
C	Short outer torsion frames	2	Oak	3/4" x 2-1/4" x 27"
D	Long inner torsion frame	1	Oak	3/4" x 2-1/4" x 93"
E	Short inner torsion frames	5	Oak	3/4" x 2-1/4" x 27"
F	Vise screw blocks	4	Birch plywood	1/2" x 6-1/2" x 14-5/8"
G	Long trim boards	2	Oak	3/4" x 4" x 96"
H	Short trim boards	2	Oak	3/4" x 4" x 28-1/2"
J	Work top	1	Oak fibercore plywood	3/4" x 28-7/16" x 94-7/16"
K	Vise mounting board	1	Oak	5/8" x 5" x 10-1/2"
L	Vise jaws	3	Oak	3/4" x 7" x 15"
Base cabinets				
M	Sides	4	Oak plywood	3/4" x 25" x 32" *
N	Top and bottom	4	Oak plywood	3/4" x 10-1/2" x 24-1/4" *
P	Back	2	Oak plywood	3/4" x 10-1/2" x 32"
Q	Vise filler front	1	Oak plywood	3/4" x 12" x 4" *
R	Top drawer front	1	Oak plywood	3/4" x 12" x 3-3/4" *
S	Middle drawer fronts	4	Oak plywood	3/4" x 12" x 5-7/8" *
T	Bottom drawer fronts	2	Oak plywood	3/4" x 12" x 11-3/4" *
U	Toe kick	2	Oak plywood	3/4" x 12" x 4" *
V	Top drawer sides	2	Oak plywood	3/4" x 2-1/4" x 22" *
X	Top drawer front and back	2	Oak plywood	3/4" x 2-1/4" x 8" *
Y	Middle drawer sides	8	Oak plywood	3/4" x 4-3/4" x 22" *
Z	Middle drawer ends	8	Oak plywood	3/4" x 4-3/4" x 8" *
AA	Bottom drawer sides	4	Oak plywood	3/4" x 10-3/4" x 22" *
BB	Bottom drawer ends	4	Oak plywood	3/4" x 10-3/4" x 8" *
CC	Drawer bottoms	7	Oak plywood	1/4" x 8-1/2" x 21"
DD	Top drawer slides spacer	2	Oak fibercore plywood	3/4" x 5-1/8" x 18"
EE	Middle drawer slides spacer	1	Oak fibercore plywood	3/4" x 11" x 18"
FF	Bottom drawer slides spacer	1	Oak fibercore plywood	3/4" x 4-1/2" x 18"

* Dimensions include the iron-on edge banding.



1 The assembly table is composed of two identical cabinets. Joinery is simple; it's all held together with dados and biscuits.

The Expandable Assembly Table

BUILD THE BASE CABINETS

1. Cut out the parts for the base cabinets according to the Assembly Table Cutting List, page 61, and the plywood diagrams (Fig. C, page 61)

2. The cabinet subtops and subbottoms, ends, partitions, and backs (A through D) are assembled using dado and biscuit joinery (Photo 1; Fig. A, page 59).

3. Apply iron-on edge banding to the front edges of the end panels (B) and the partitions (C).

4. Assemble the partitions, subtop, subbottom and back first. Then add the end panel (Photo 1). Make sure the cabinets are clamped squarely.

5. Attach the bottom (F) and top (G) with screws and glue.

6. Add the top and bottom door guides (H, J, Fig. B, page 59; Photo 2).

ADD THE HINGED PANELS

7. Make three sets of hinged panels by attaching the center hinge to pairs of panels (E). It's important that the hinges be perfectly centered on the joint between the two panels. Any variation will cause the hinges to bind and prevent the two cabinets from closing evenly when folded together. The best way to accurately install the hinges is to draw a line 1 in. inside the edge of each panel. Clamp the hinge to the panels, aligning it with the line. Use a self-centering bit (see Sources) to drill pilot holes for the screws. Don't remove the clamps until you've installed the screws.

8. Add hinges to the outer edges of the panels. They go on the opposite side from the center hinges (Fig. A). Install these outer hinges the same way as you did the center hinges.

9. Mark the locations for the hinged panels on the back of

the cabinets (Fig. A). Center the middle panel and then space the two end panels 28-1/2 in. away from the center panel (Fig. A). When the end panels are installed, you should have a small gap between them and the cabinet end (B). This small gap helps accommodate any slight out-of-squareness that exists in the cabinets. It's very important that the hinged panels be installed at a 90-degree angle to the bottom (or top) of the cabinet. Use a framing square to draw these lines, using only the top or bottom for reference, but not both. If you do and they are not perfectly square to each other, it will throw off the accuracy of your hinge installation. Getting the hinges to operate smoothly is not difficult, but you do have to pay careful attention to the installation.

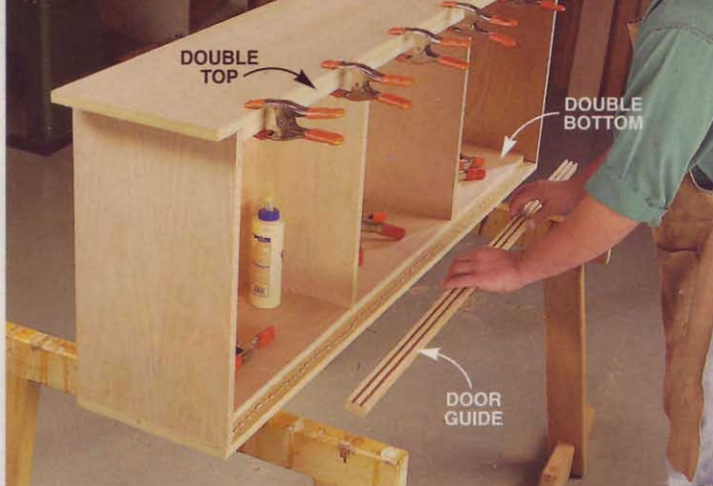
10. Attach the pairs of panels to one cabinet first (Photo 3). Use a 1/16-in. spacer to center the hinged panels between the subtop and subbottom (A).

11. Next, attach the panels to the back of the other cabinet (Photo 4).

The assembly table keeps everything handy when you need it and tucks neatly out of the way when you don't.

12. With the hinged panels installed, fold the cabinets together and add the sash lock to the ends.

13. With the cabinets locked together, roll them over onto their tops and add the wheels (Photo 5). Install the corner wheels so the foot lock is easily accessible from the ends and sides.



2 Glue and clamp the door guides to the doubled-up top and bottom. Doubling the top makes the work surface extra solid. Doubling the bottom provides a strong place to attach the wheels.



3 Install the hinged panels to the back of one cabinet, using spacers to center the panel between the top and bottom. The hinged panels must be installed perpendicular to the bottom so they open and close square to the cabinets.

PROJECT REQUIREMENTS AT A GLANCE

Materials:

Three sheets of 3/4-in. oak plywood
One sheet of 3/4-in. oak fibercore plywood
One sheet of 1/4-in. oak fibercore plywood

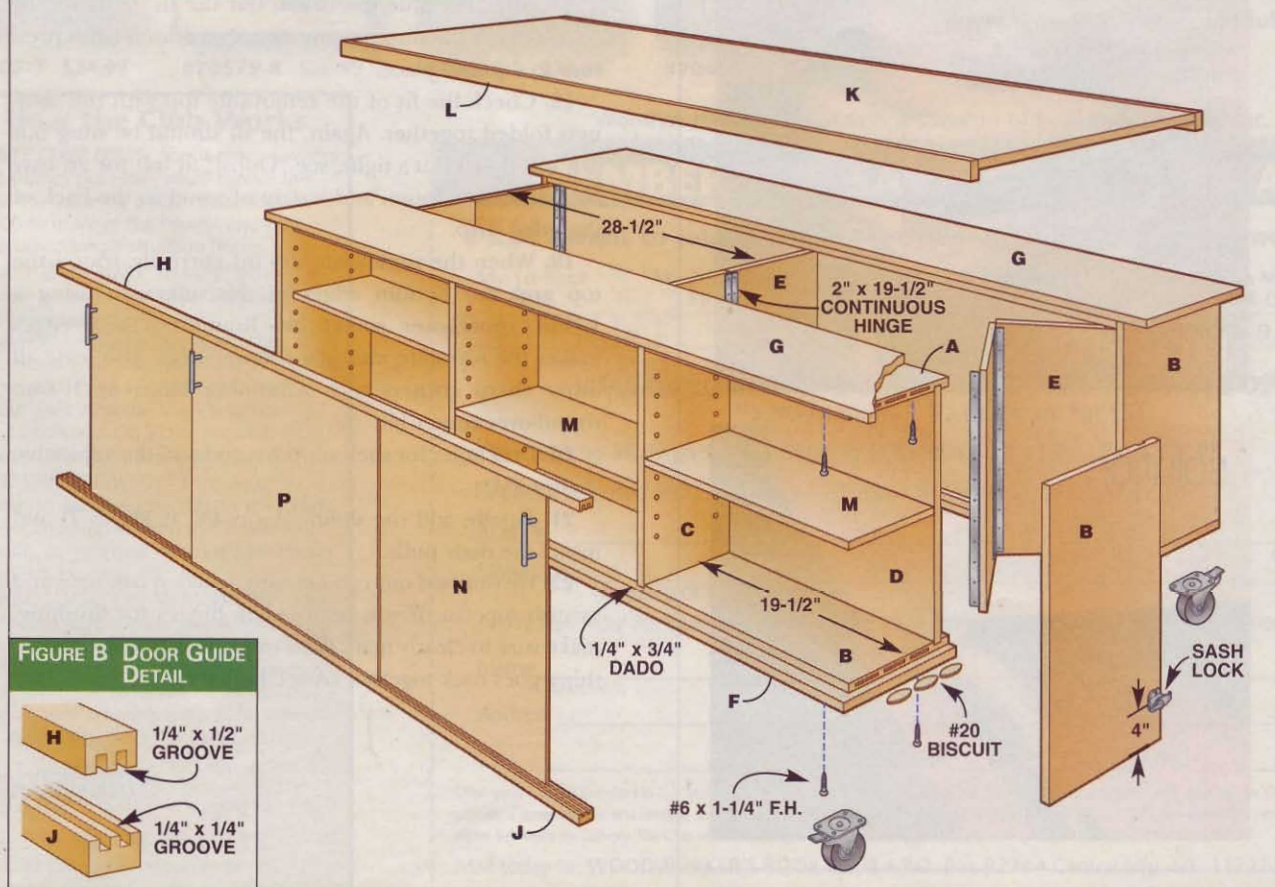
One sheet of 3/4-in. MDF
8 bd. ft. of 4/4 oak lumber
Stain and varnish

Tools: Tablesaw, dado blade, biscuit joiner, router

Hardware: Nine continuous hinges, six double-locking 4-in. casters, six door pulls

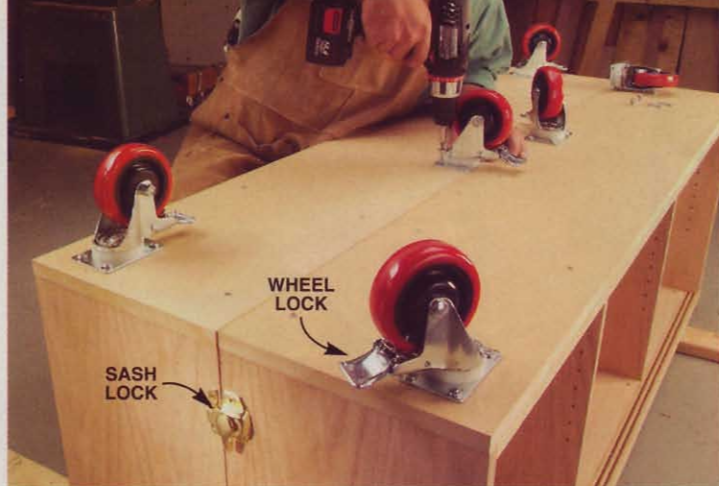
Cost:
Approximately \$500

FIGURE A ASSEMBLY TABLE EXPLODED VIEW





4 Attach the hinged panels to the back of the second cabinet. Make sure the spacing between the hinged panels on the second cabinet is identical to the spacing on the first cabinet or binding will occur when you fold the cabinets together. When the panels are folded together, the panels fold into the recess at the back of the cabinets.



5 Install the wheels. The center wheels provide support for the back of the cabinets and are offset from the middle of the cabinet so they don't hit each other as they swivel. Sash locks hold the cabinets together when the table is folded up.

Oops!

Our removable top doesn't fit over the base cabinets. Small variations in materials and assembly can cause this fit to be too tight. The fix is easy. Simply saw some material off the inside of one of the trim boards.



solution



ADD THE REMOVABLE TOP

14. Roll the cabinets back upright and unfold them.

15. Carefully measure the opening width for the removable top (K, Photo 6). Measurements for this part are in the Cutting List, but variations in materials and assembly may require you to adjust the size of this part.

16. Glue the edge strips (L) to the removable top panel.

17. After the glue has dried, test the fit. It should fit snugly in the opening, requiring only medium hand pressure to slip into place.

18. Check the fit of the removable top with the cabinets folded together. Again, the fit should be snug but not too tight. If it's tight, see "Oops!" at left for an easy fix. If the fit is loose, add a strip of wood to the back of the edge strip.

19. When the removable top fits correctly, round the top and two bottom edges of the side trim using a 1/4-in. round-over router bit. Rounding these edges makes the top slide into place more easily. Also, ease all other sharp corners with a sanding block or 1/8-in. round-over router bit.

20. Drill holes for shelf supports and add the adjustable shelves (M).

21. Finally, add the sliding doors (N, P, Photo 7) and install the door pulls.

22. We finished our cabinet with a golden oak stain and varnish topcoat. If you remove the hinges for finishing, make sure to clearly mark their original locations so everything goes back together correctly aligned.

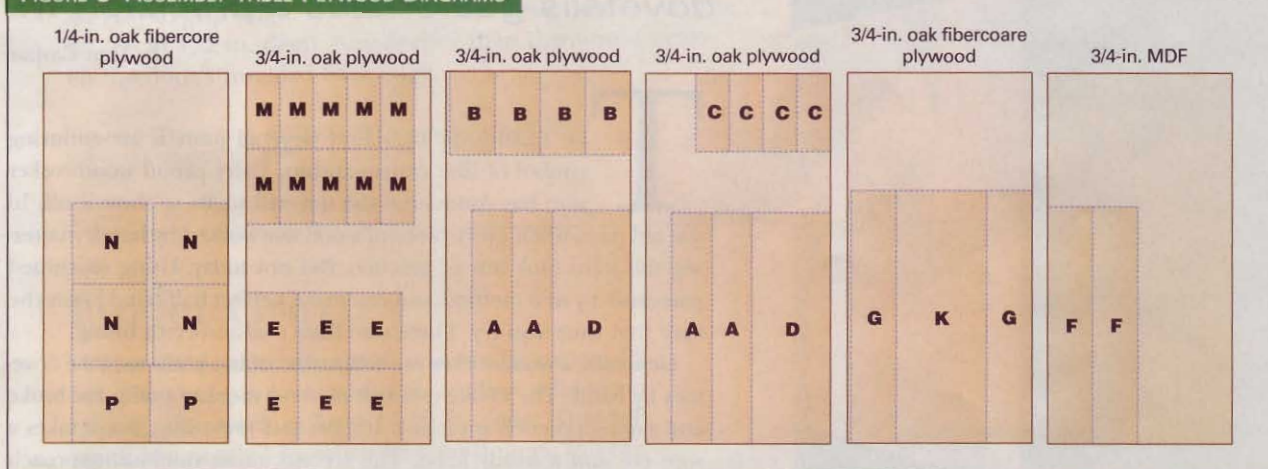


6 Measure for the removable top. You want the top to fit snugly, yet be just loose enough to be pressed into place using hand pressure.



7 Slip the sliding doors into the slotted guides. The doors go into the deeper upper slot first and then drop down into the shallow bottom slot. If the doors don't slide freely, reduce their thickness by sanding the back of the top and bottom edges.

FIGURE C ASSEMBLY TABLE PLYWOOD DIAGRAMS



ASSEMBLY TABLE CUTTING LIST

Overall Dimensions: 28"Th x 25"W x 60"L

Part	Name	Qty.	Material	Dimensions (TH x W x L)
A	Subtops and subbottoms	4	Oak plywood	3/4" x 10-1/2" x 60"
B	End panels	4	Oak plywood	3/4" x 11-3/4" x 21-1/4" *
C	Partitions	4	Oak plywood	3/4" x 8-3/4" x 20-1/4" *
D	Backs	2	Oak plywood	3/4" x 20-1/4" x 60"
E	Hinged panels	6	Oak plywood	3/4" x 13-13/32" x 19-5/8"
F	Bottom	2	MDF	3/4" x 11-3/4" x 61-1/2"
G	Top	2	Oak fibercore plywood	3/4" x 11-3/4" x 65-1/2"
H	Top door guides	2	Oak	3/4" x 1-1/4" x 60"
J	Bottom guides	2	Oak	3/4" x 1-1/4" x 60"
K	Removable top	1	Oak fibercore plywood	3/4" x 23-5/8" x 65-1/2"
L	Edge strips	2	Oak	3/4" x 1-9/16" x 65-1/2"
M	Adjustable shelves	6 to 12	Oak plywood	3/4" x 8-3/4" x 19-7/16" *
N	Outer sliding doors	4	Oak fibercore plywood	1/4" x 20-1/4" x 20-3/16"
P	Center sliding doors	2	Oak fibercore plywood	1/4" x 21" x 20-3/16"

* Dimensions include the iron-on edge banding on the front edge.

Sources Woodworkers Hardware, (800) 383-0130, www.woodworkershardware.com Workbench hardware kit, includes seven drawer pulls, seven sets of drawer slides, eight cabinet levelers, two L-brackets and all mounting screws, with 9-7/8 in. stainless steel pulls as shown in story, #KIT0601, \$124, which includes shipping and handling; same kit with 5-in. dull chrome pulls, #KIT0602, \$89, which includes shipping and handling. Assembly table hardware kit, includes six 4-in. double-locking casters, nine 2-in. x 19-1/2-in. continuous hinges, two sash locks, six door pulls and all mounting screws, with 5-1/4 in. stainless steel pulls as shown in story, #KIT0603, \$170, which includes shipping and handling; same kit with 5-in. dull chrome pulls, #KIT0604, \$160, which includes shipping and handling. • Woodcraft, (800) 225-1153, www.woodcraft.com Quick-release front vise, #17A11, \$160. Self-centering hinge-drilling vix bit, 7/64-in., #16141, \$11. Large wooden vise handle, #17E52, \$7.

Precise Hand-Cut Dovetails

A new approach to half-blind dovetails guarantees a precision fit.

by Tom Caspar

The handmade half-blind dovetail joint is an enduring symbol of fine craftsmanship. Every proud woodworker who has conquered the dovetail wants to show it off. In the old days, when every piece of wood was worked by hand, mastering this joint took lots of practice. But not today. Using machined parts and my new method, you can make perfect half-blind joints the very first time you try. There's no fussy trial-and-error fitting.

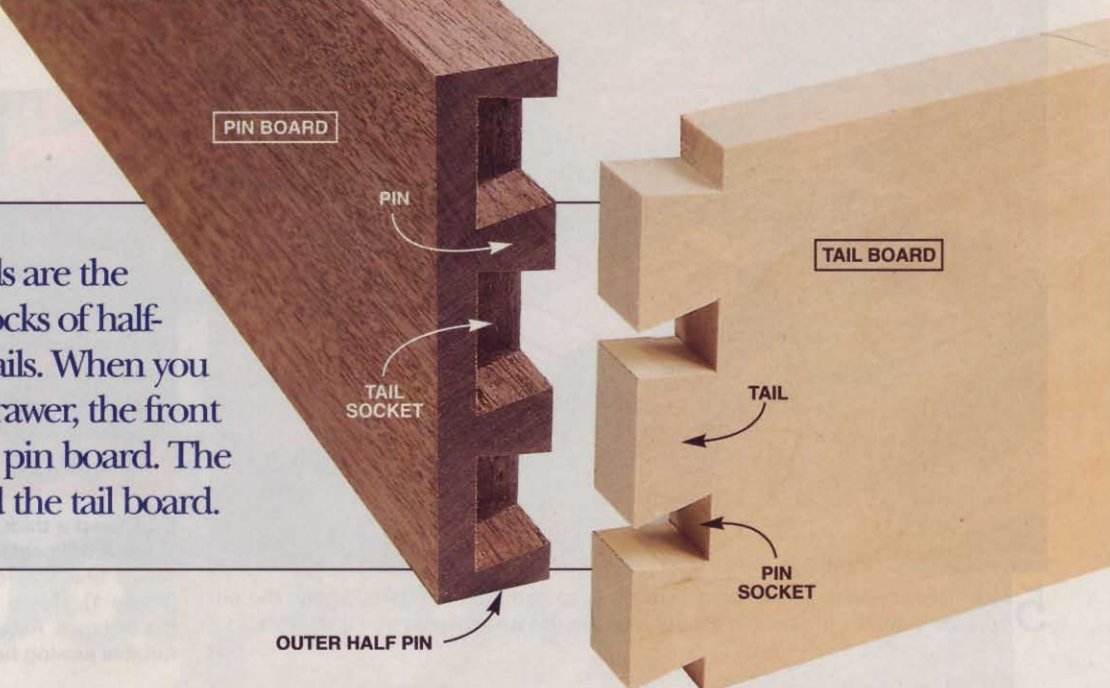
Generally, a woodworker can follow one of two paths to make dovetails by hand. The classic artisan's method requires going for broke and sawing precisely on a line. It's fast and rewarding, but it takes a sure eye and a steady hand. The second, more cautious, approach allows you to saw away from a line, then pare to the line using a chisel. It's slower, but by guiding the chisel with a jig, anyone can do it. That's the method I'll show you here. The secret is to use very sharp chisels with specially ground sides (Photo 16), and stick to the directions. Have any questions? E-mail me at tom_caspar@readersdigest.com.

My method relies on a few simple jigs to guide your chisel. Every paring cut is straight and square. It's not the fastest way to cut dovetails, but when you use it, I can promise you precise joints, even your first time.



ART DIRECTION: VERN JOHNSON • PHOTOGRAPHY: RAMON MORENO • ILLUSTRATION: JOE GOHMAN

Pins and tails are the building blocks of half-blind dovetails. When you dovetail a drawer, the front is called the pin board. The side is called the tail board.

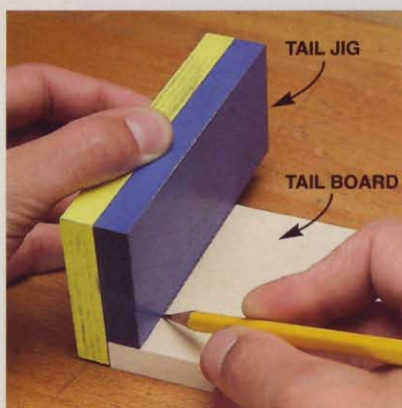


TOOLS AND MATERIALS

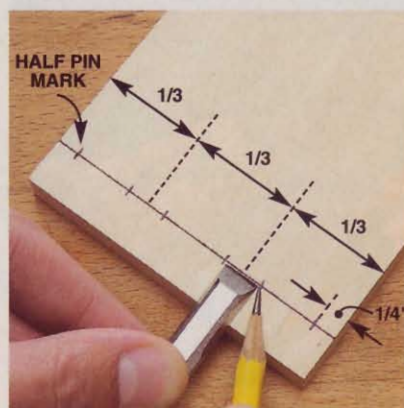
You'll use 3/8-in. (10-mm) and 1-in. (26-mm) chisels for paring. These should be high-quality tools, so their edges stay razor-sharp (see Source, page 68). For chopping end grain, it's best to use a 1/2-in. firmer chisel (see Source), but a bench chisel will do. For paring into corners, grind a 12-degree skew angle on a 3/8-in. or 1/2-in. standard bench chisel (Photo 36). You only need a left or a right skew, not both. You'll also need a sliding bevel gauge, a small square, a Japanese dozuki saw (see Source) or a dovetail saw, a coping saw with a 10-tpi blade and a mallet or hammer.

Wood selection is important. For easy paring, the drawer front, or pin board, should be straight-grained and moderately dense. Walnut, cherry and mahogany are excellent choices. The drawer side, or tail board, should be light in color and also easy to pare. Basswood is the best choice, but white pine and yellow poplar are good, too.

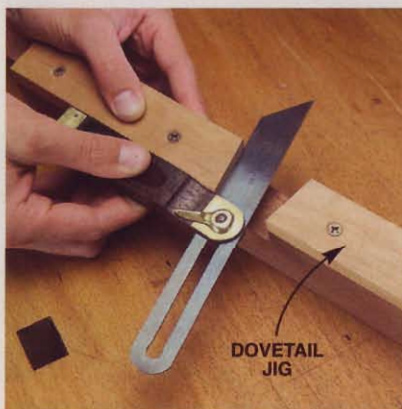
To start, machine each piece flat and square. Make the three guide jigs (Figs. A, B and C, page 68). Orient the drawer side so the grain on its face runs toward the back. This makes the completed joint easier to plane flush. Sharpen your chisel, and let's begin.



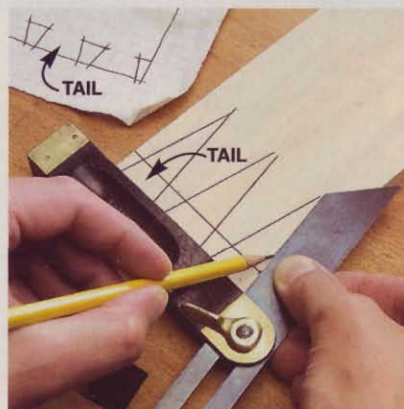
1 Draw a pencil line across the tail board to indicate the dovetail lengths. Here, you'll use the first of three simple jigs (Fig. A). This is the tail jig. I've painted its components so they're easy to see.



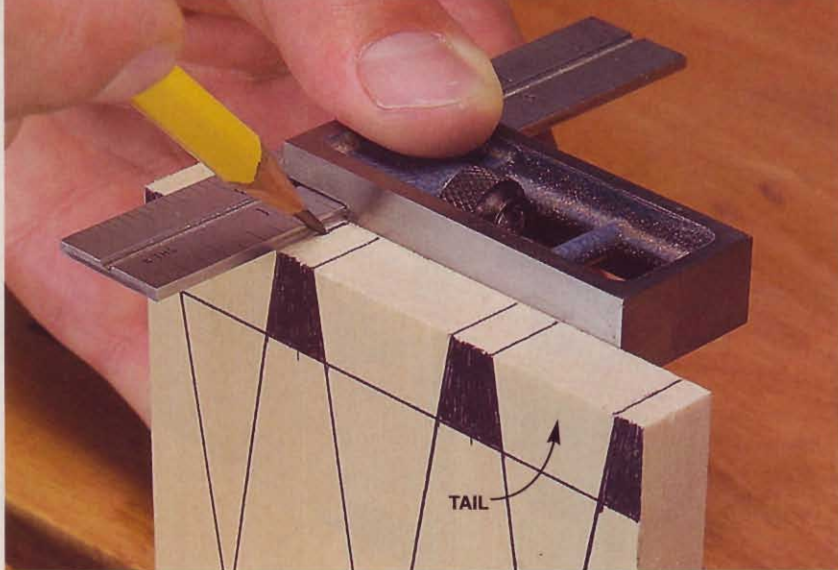
2 Draw a pair of marks for each pin socket. Evenly space the sockets by eye. Make each mark 1/32 in. on either side of a 3/8-in. chisel. This ensures that the chisel will fit inside a completed socket. Draw marks for the outer half-pins.



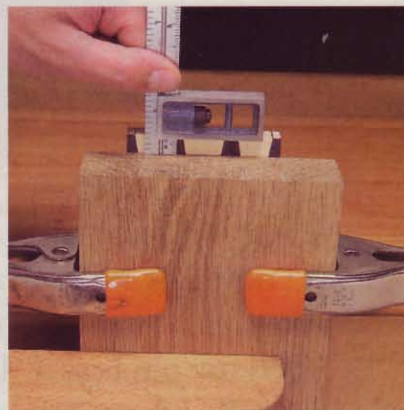
3 Transfer the dovetail angle from a jig to a sliding bevel gauge. The dovetail jig has two equal angles precisely cut on the tablesaw (Fig. C). This jig will guide your paring cuts in the final steps.



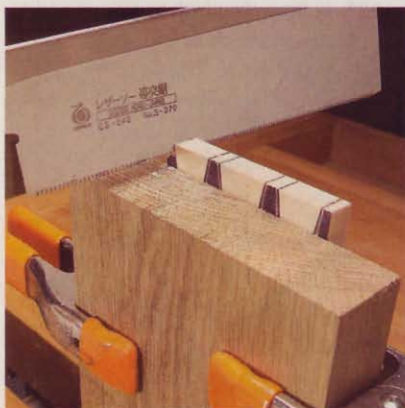
4 Lay out the tails. Draw long, fine lines through each pin mark to make triangles. Each one forms a tail. Refer to a sketch so the lines angle the right way. Flip the square as needed, so most of its handle always butts against the board's end.



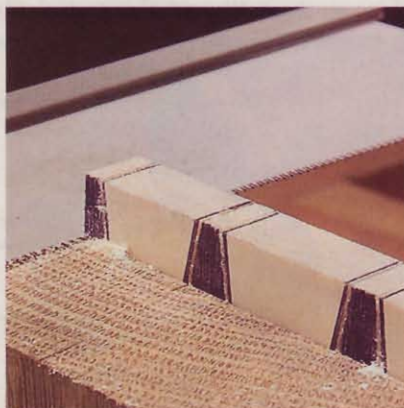
5 Draw square lines across the board's end to complete the tails. Shade the pin sockets between the tails to clearly indicate the waste areas you'll remove.



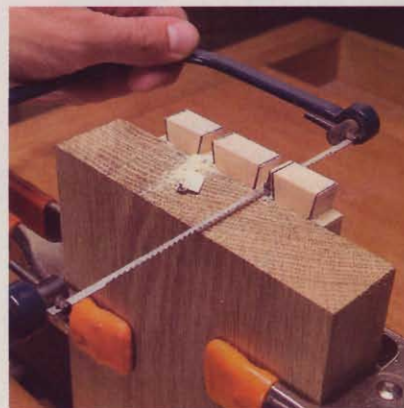
6 Clamp a thick, wide board to the tail board. Position it 1/16 in. above the pencil line you drew in the first step (Photo 1). Use a small square to check the distance. Raise the boards to a comfortable sawing height.



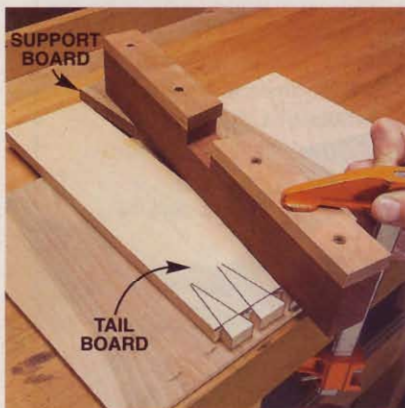
7 Rough-cut the tails. Saw 1/32 in. inside each pencil line, within the darkened waste area. Keep the saw level and stop when you reach the guide board.



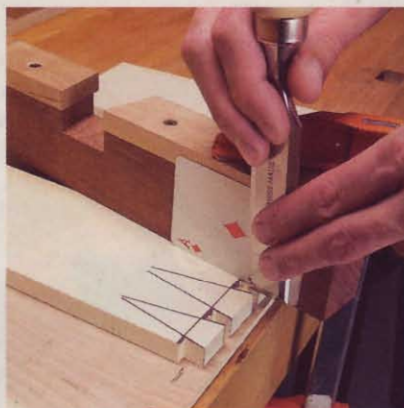
8 Remove the half-pin waste pieces at both ends of the tail board. Like the last saw cuts, these cuts are approximate. Saw level along the top of the guide board, being careful not to cut into the tails.



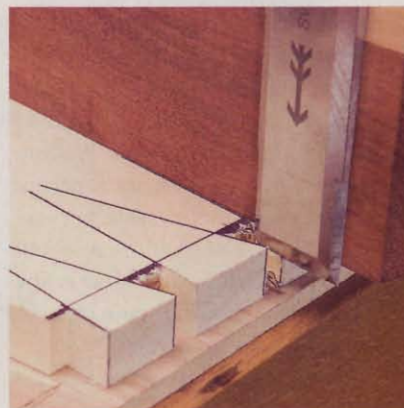
9 Remove the full-pin waste pieces with a coping saw. First, make one diagonal cut. Then come back across, flush with the guide board, to release the waste piece. Now you're ready to pare the tails exactly on the layout lines.



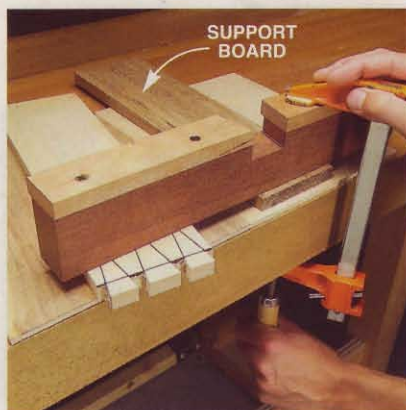
10 Set up the tail board for paring. Place a piece of scrap plywood under it to protect the bench. Clamp the dovetail jig precisely along one of the angled layout lines. Support the jig, if needed, with another piece that is the same thickness as the tail board.



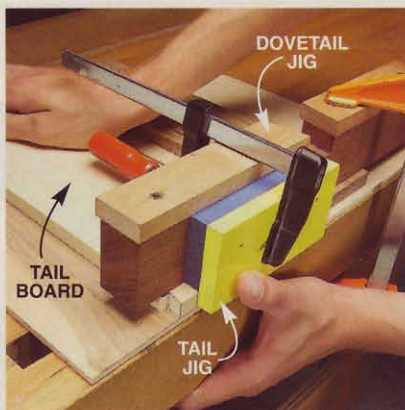
11 Pare the tail using a 1-in. chisel. It's easy to balance along the jig's side. The thinner the shaving, the better. To control each shaving's thickness, begin with one or more playing cards against the jig. Remove one card after each stroke.



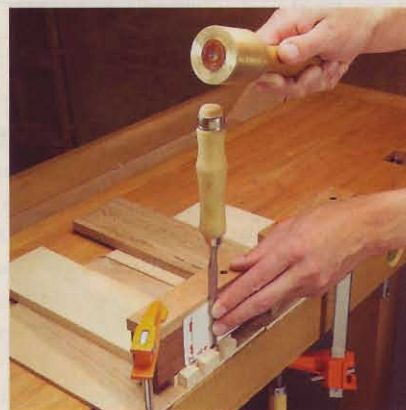
12 Pare the last shaving with the chisel against the jig. For a super-smooth cut, work your way in from the end of the tail, taking one-third of a full shaving's width at a time. Reposition the dovetail jig on the other layout lines to pare both sides of each tail.



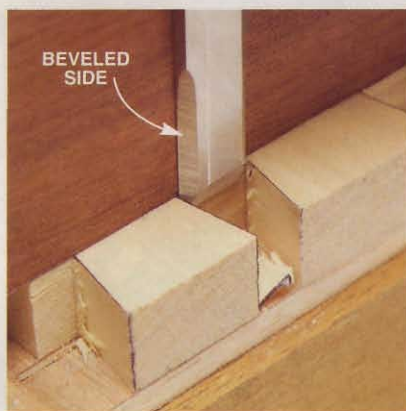
13 Set up the jig to pare each socket's end grain. First, loosely clamp the dovetail jig on top of the support board.



14 Clamp the tail jig to the dovetail jig. Slide the tail board to butt up against the tail jig. Place and tighten a clamp to the left of the tail board and remove the tail jig. Tighten the support board clamp.

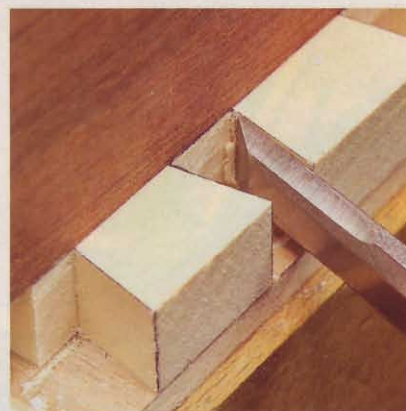


15 Pare the end grain. Use playing cards again to minimize each shaving's thickness. You may have to start with three or four cards. Drive the chisel with a mallet, if necessary.

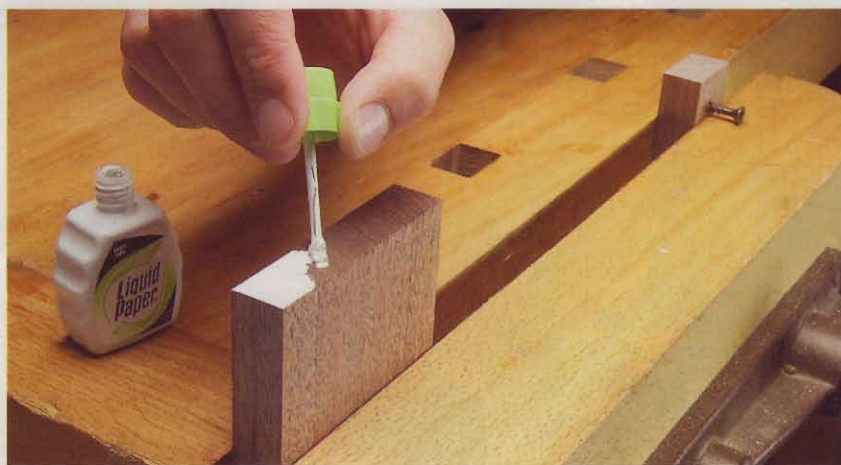


16 Bear against the jig on the last cut. To pare into these acute corners, grind 12-degree bevels on both sides of your chisel. Extend the bevels back 3/4 in. A 12-degree bevel is slightly steeper than the 10-degree dovetail angle.

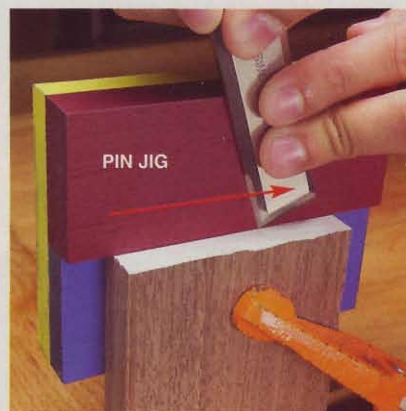
Handmade
dovetails
are a
woodworker's
pride
and joy.



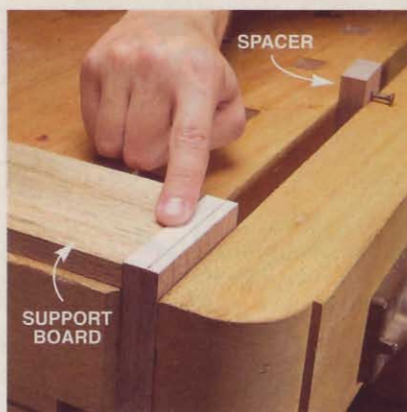
17 Clean the corners by paring from the end. Then pare from above, as in the last step, to release the shaving. Your tails are now perfectly straight, smooth and square to the board's face. They almost look machine-made!



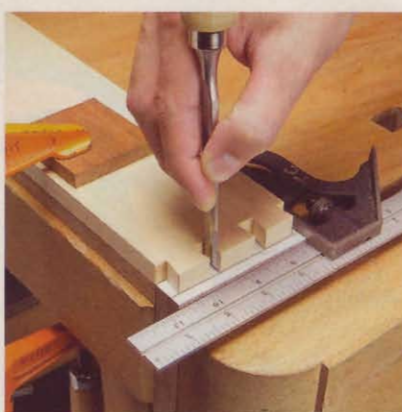
18 Prepare the pin board to make very fine layout lines easier to see. Coat its end with a primer coat of shellac or varnish, followed by white correction fluid. Primer prevents the white fluid from penetrating into the end grain.



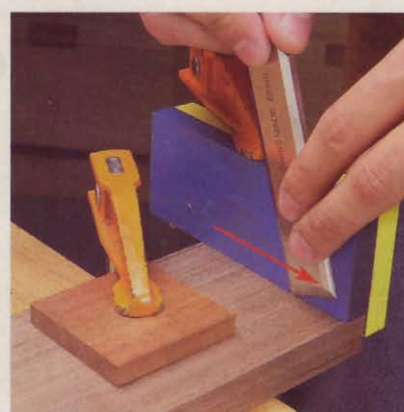
19 Clamp a third jig, the pin jig (Fig. B), to the pin board's outside face. Score a fine line across the board's end with the corner of the wide chisel. One light pass will do it. This is the baseline for the tail sockets.



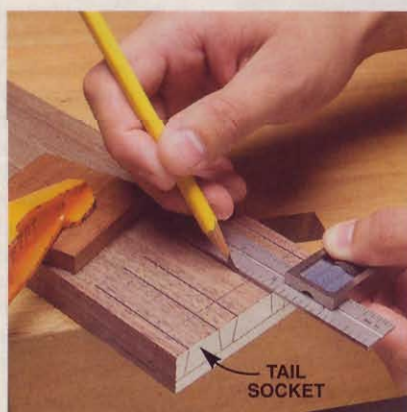
20 Clamp the pin board level with the support board from Photo 10. The pin board must be rock-solid for laying out the pins. Prevent the vise from racking by inserting a spacer that's the same thickness as the pin board.



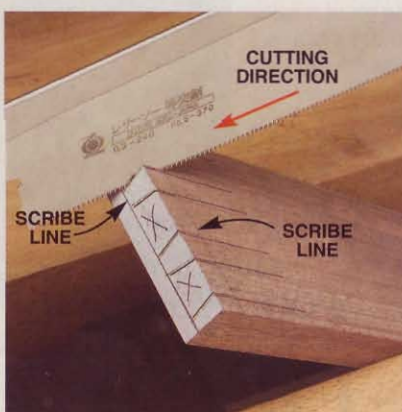
21 Mark the pin board by lightly pushing on a chisel butted to the side of each tail. This leaves a distinct, super-thin line. Butt the tail board's end to the scribed line (Photo 19). Use a square to align the pin and tail boards.



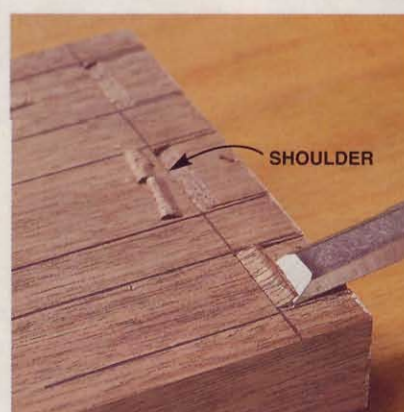
22 Clamp the tail jig to the pin board's inside face and scribe another line with your chisel. This line indicates the pins' depth. After assembly, the pins will be flush with the tails, which makes gluing and clamping easier.



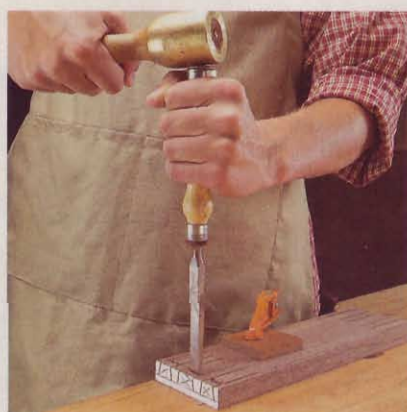
23 Draw the pins on the board's inside face. Go well beyond the scribe line. The longer the lines, the easier they will be to follow when you saw. Shade or mark Xs in the waste areas, or tail sockets, between the pins.



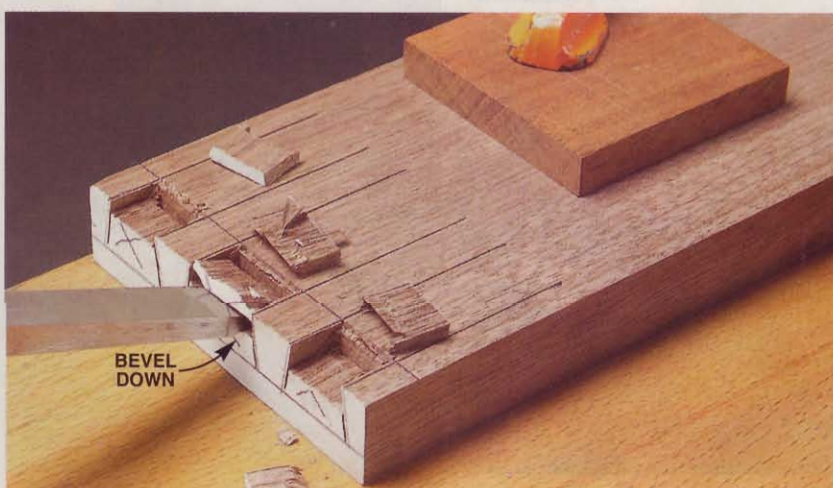
24 Saw the pins. Stay 1/32 in. inside the lines. Stop short of both scribe lines. Clamp the pin board diagonally in the vise so you can see both faces. This enables a pull saw to cut smoothly, because it's cutting with the grain.



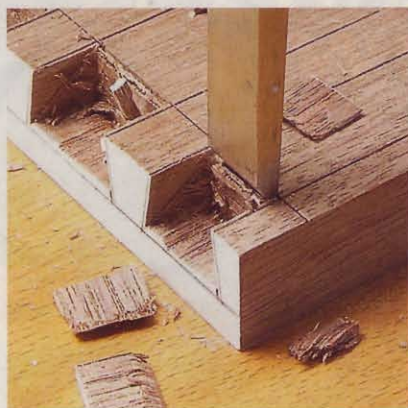
25 Pare at a shallow angle to create small shoulders in each tail socket. Clamp the board down, push almost to the scribe line, twist and lift out a thin chip. These shoulders will guide the chisel in future paring cuts.



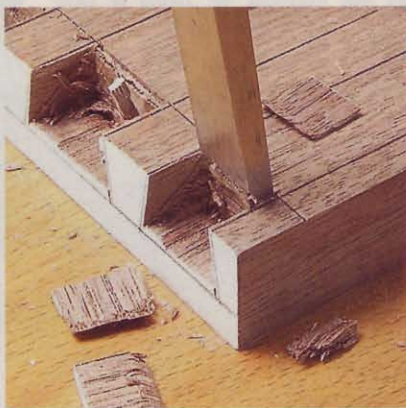
26 Chop the tail sockets. Hit the chisel once, straight down, 1/32 in. away from the shoulders. Switch to a 1/2-in. firmer chisel for this heavy-duty work. Reserve your bench chisels for paring. Sharpen the firmer chisel at a durable 35-degree angle.



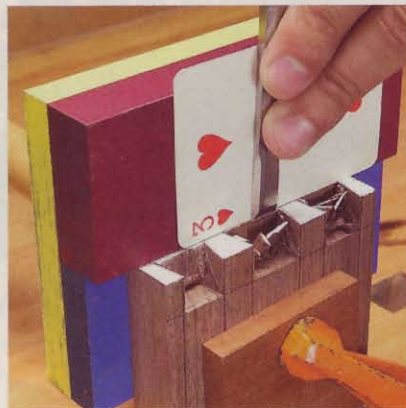
27 Make chips! After each downward chop, lower the chisel, bevel down and split off a thick chip with a single blow into the end grain. Twist the chip to pry it loose. Continue chopping downward and sideways until you're within 1/16 in. of the lower scribe line.



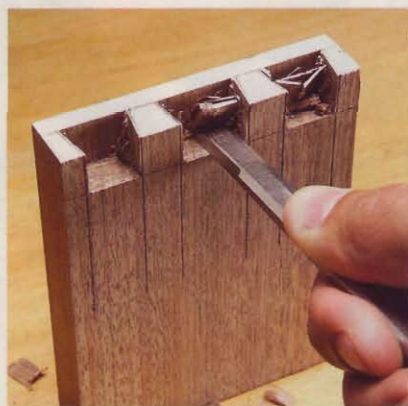
28 Finish chopping the shoulders right on the scribe line. Rest the chisel against the small shoulder (Photo 25), hold it plumb and strike one blow. By taking a thin shaving, you'll make a crisp, clean, deep shoulder.



29 Lean the chisel a few degrees on the second blow; continue at that angle to the bottom of the tail socket. This traditional undercut ensures the joint goes together without any gaps along the scribed line.



30 Pare to the scribe line. Clamp the pin jig to the pin board once more, and use the playing card technique to remove thin shavings. Pare into the corners with the bevel-sided chisel.



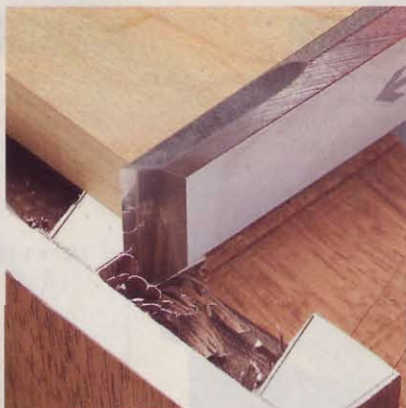
31 Remove the shavings by cutting them off at the base. Push hard and give a little twist; they'll pop right out. Don't bother for now with the shavings stuck in the corners.



32 Pare the pins with the dovetail jig. Clamp it to the pin board. Align one side of its notch with one of the saw cuts to remove a thin shaving with the wide chisel. This will be a sneak-up-to-the-line approach, without using playing cards.



33 Tap the dovetail jig after each shaving to shift the notch closer to the pin layout line. Pare again. Each shaving should be very thin, so you can easily make an accurate cut. You don't have to loosen the clamp, because the jig shifts so little.

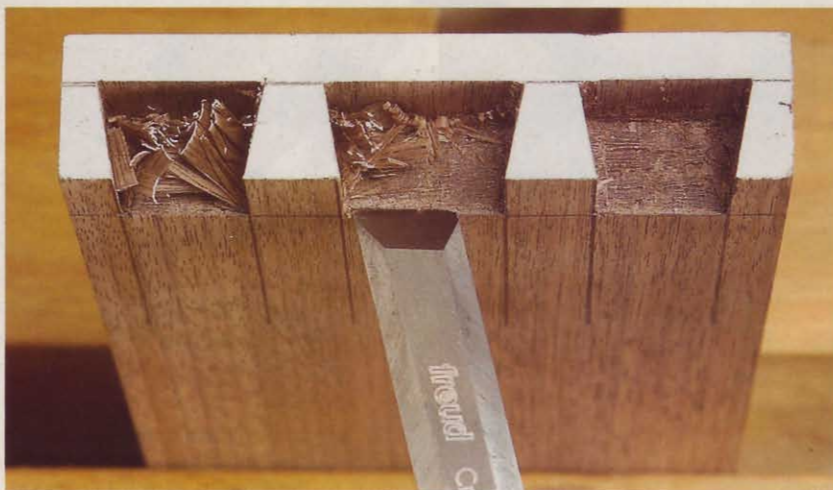


34 Make the last paring cut right on the layout line. This method is so precise that you can split a hair, which is about the thickness each of these layout lines cut into the paint. Pare all the pins this way.

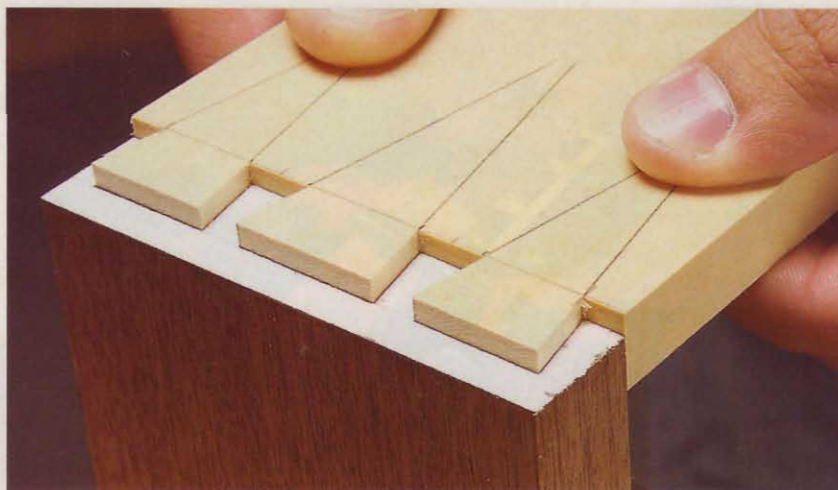
The finer
the
shaving,
the
more
accurate
the joint.



35 Pare the corners from above. The chisel's beveled edge lets you get right into this tight angle.



36 Clean out the corners with a homemade skew chisel. Push the chisel into the corner, twist it and pop out the shavings. For a right corner, flip over the chisel and use it bevel down. This tool does the job very quickly.



37 Test the joint's fit. The pin and tail boards should go together without any additional work and end up flush. If seating the joint requires more than light hammer taps, use the dovetail jig to pare the pins that are tight.



38 Even up the joint after it's glued. It only takes a light sanding or a few plane strokes to remove the white paint and make the pins flush with the tails. Now you'll see how tight the fit really is!

FIGURE A TAIL JIG

The secret to success with these jigs is to use actual pieces from your drawer. The blue piece below is an offcut from a drawer side, or tail board. In drawer making, a tail board is typically 1/2 in. thick, but any thickness will work with this system. Glue or nail the pieces together with brads.

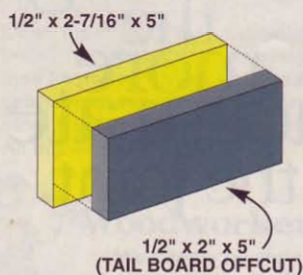


FIGURE B PIN JIG

The accuracy of this jig is also based on using offcuts. The red piece is an offcut from a drawer front, or pin board. In drawer making, a pin board is typically 3/4 in. thick, but any thickness will work. The blue piece is a second offcut from a tail board.

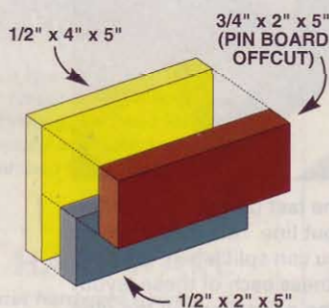
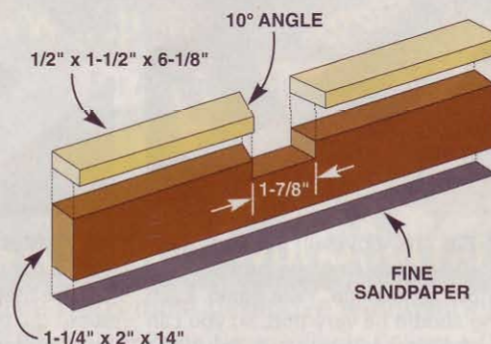


FIGURE C DOVETAIL JIG

After gluing the parts together, cut the angles in this jig on the tablesaw. Check the cuts with a sliding bevel gauge to make sure the angles are exactly the same. Glue a piece of sandpaper to the jig's bottom. This prevents the jig from moving when you clamp it to a workpiece.



Source Woodcraft Supply, (800) 225-1153, www.woodcraft.com 10-mm (3/8-in.) Pfeil bench chisel, #05T18, \$28. 26-mm (1-in.) Pfeil bench chisel, #05T22, \$32. 1/2-in. Sorby firmer registered chisel, #13R61, \$41. Dozuki Z saw, #12F27, \$42.

shaker table

A perfect blend of classic lines and modern joinery

When I first saw a drawing of this table 20 years ago in a book by Thomas Moser, I knew I had to make it (see Sources, page 76). It perfectly captures the essence of classic Shaker design. Taut, lean and elegant, Moser's reproduction has become an American icon.

Here's an up-to-date version that retains the Shaker spirit. They used mortise-and-tenon joinery, but I've substituted biscuits. For this table, the biscuits are just as strong and can be made much faster. The Shakers planed their wood by hand. For my version, you can machine all the parts and then give them a few licks with a hand plane. The Shakers also hand-dovetailed their drawers. You can make machine-cut dovetails if you wish, but I prefer the look of handmade joints. Don't be intimidated by handmade dovetails, though. I've worked out a new dovetailing system that puts a handmade drawer within reach of anybody, including a first-time woodworker, who has a sharp chisel (see "Precise Hand-Cut Dovetails," page 62).

If you've never planed wood or cut dovetails by hand before, this project is a great way to get started. I built this table in walnut, a wood that is easy to work with hand tools. Cherry, mahogany, red oak or other woods of equal density would also be good choices. The pieces are small and easy to handle. I used a No. 4 smooth plane, a No. 5 jack plane and a No. 6 fore plane, but all three aren't necessary. A single No. 4 or No. 5 is OK.



**PROJECT
REQUIREMENTS
AT A GLANCE**

Materials:

2 bd. ft. of
5/4 walnut
10 bd. ft. of
4/4 walnut
2 bd. ft. of
4/4 basswood

Tools:

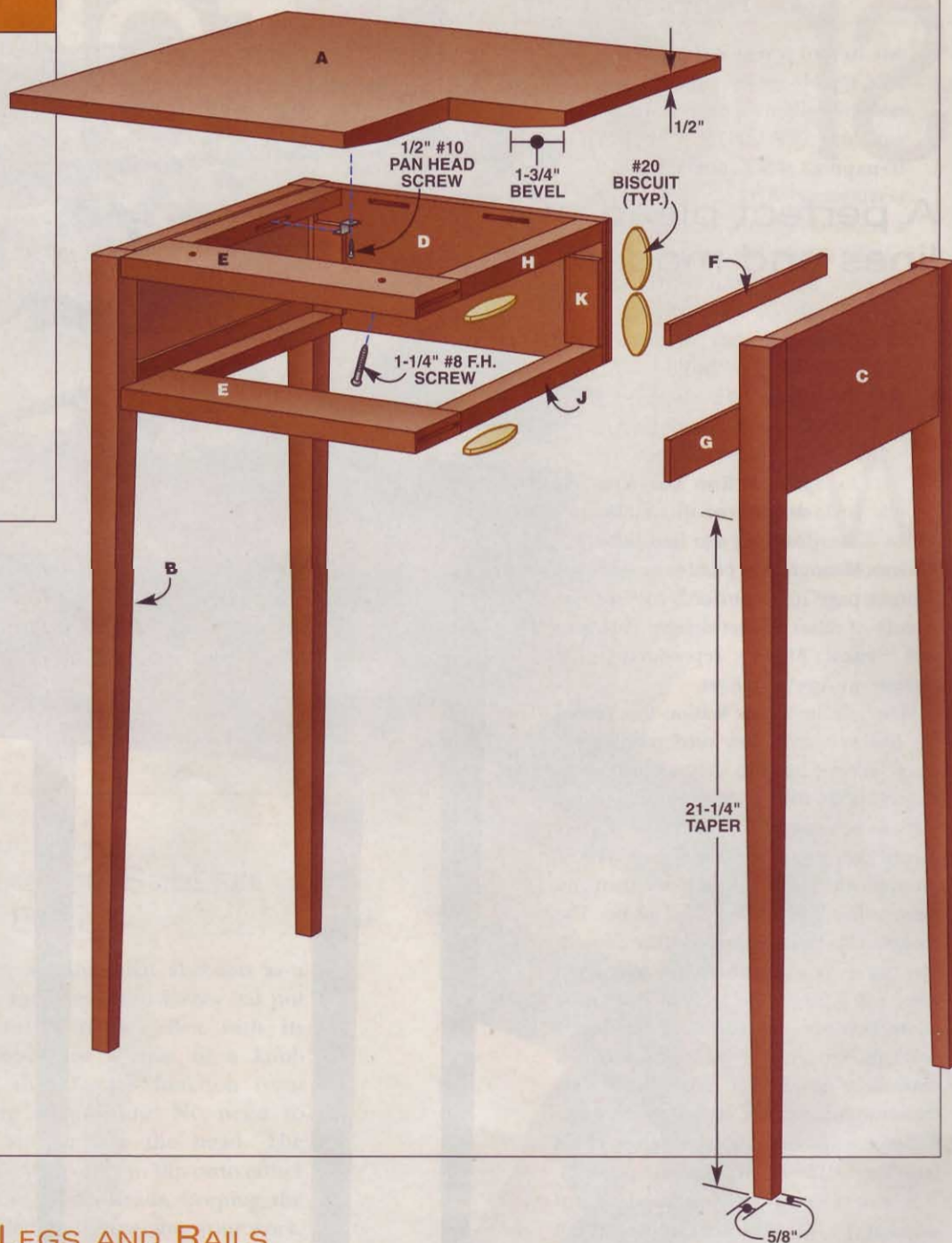
Jointer
Planer
Tablesaw
Bandsaw
Plate joiner

Hardware:

Walnut knob
Six tabletop
fasteners

Cost: \$100

FIGURE A EXPLODED VIEW



MAKE THE LEGS AND RAILS

1. Select straight-grained wood for the legs (B) (see "Bandsawn Tapered Legs," page 45). Mill the wood into square blanks (see Cutting List, page 76). Lay out the tapers and cut them on the bandsaw (Fig. A, above). Note that the legs only taper on the two inside faces. Joint or hand-plane the sawn surfaces.

2. Mill the side rails (C), back rail (D) and front rails (E). Cut all these pieces the same length. Mark reference lines for biscuit slots in the legs and rails (Fig. B, page 74). Note that the front legs only have one set of slots.

3. Cut No. 20 biscuit slots in the legs and rails with their face sides down. Use the bottom of the plate joiner, not the fence, as a reference surface. Place a 1/8-in. piece of hardboard under the plate joiner when you cut leg slots (Photo 1). This automatically creates an 1/8-in. offset between the legs and rails.

4. Plane or sand the outside faces of all the rails (Photo 2). Sand with 180- or 220-grit paper to remove any small ridges left by the plane iron. Plane the outside faces of the legs.



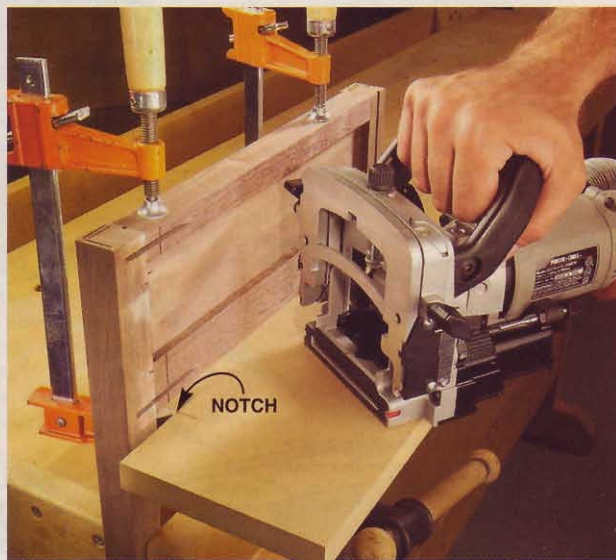
1 All the joints in this table are made with biscuits. They're plenty strong for this job and can be made very fast. Cut the joints while each piece is still perfectly flat and square.



2 Plane or sand the side rails to remove machining marks. Planing is quicker, quieter and a lot more fun than sanding. This small project, though primarily built with power tools, is a good opportunity to put your planes to work.



3 Plane two strips flush with the legs. They're glued to the completed side assembly. These strips provide level surfaces for the front rails' biscuit joints. Planing these pieces by hand is more precise than milling them with a planer.



4 Cut a biscuit slot to receive the lower front rail. Clamp a notched board under the side rail for support. This rig guarantees that the slot is square to the leg and the same height as the corresponding slot in the lower front rail.

BUILD THE CASE

5. Glue the side legs and rails together. Be careful to align the top of the legs with the top of the rails. Make sure the legs are square to the rails. Check this with a straightedge placed across both legs. The leg's faces must be in the same plane.

6. Make the top and bottom spacers (F, G). Glue them to the sides. Plane them exactly even with the legs (Photo 3).

7. Mark biscuit centerlines on the front rails (Fig. C, page 74). Mark corresponding centerlines on the sides. Note that the front rails are set back 1/8 in., like the side rails. Mark the top face of the upper front rail and the bottom face of the lower front rail. Cut biscuit slots in the rails, referencing from

the bottom of the plate joiner, with the marked faces down.

8. Stand each side assembly upside down and cut biscuit slots for the top front rail. Cut slots for the bottom front rail (Photo 4).

9. Plane and sand the front edges of the front rails.

10. Glue the case together. Check the 1/8-in. setback of the front rails with a combination square, or temporarily tape a piece of 1/8-in. hardboard to the front of each rail. The setback is correct when the hardboard is flush to the legs.

11. Mill the kickers (H) and drawer supports (J). The kickers prevent the drawer from tipping when opened. Glue these parts to the case (Photo 5).

FIGURE B SIDE RAIL ASSEMBLY

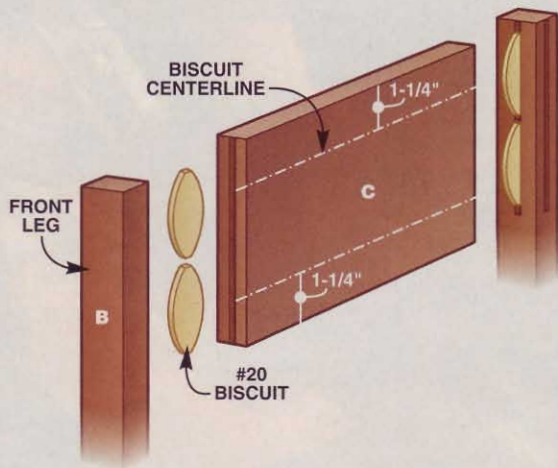


FIGURE C FRONT RAIL ASSEMBLY

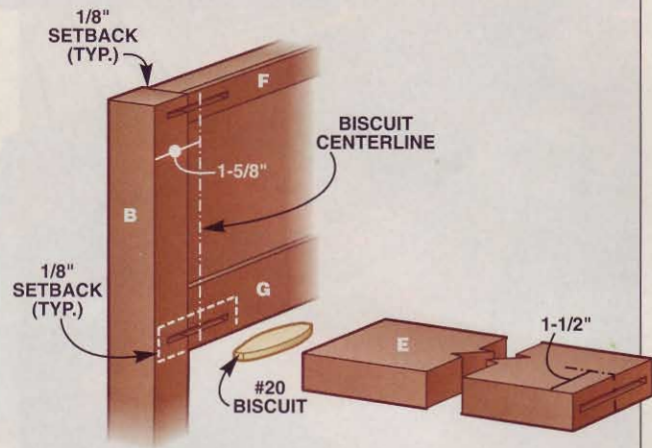
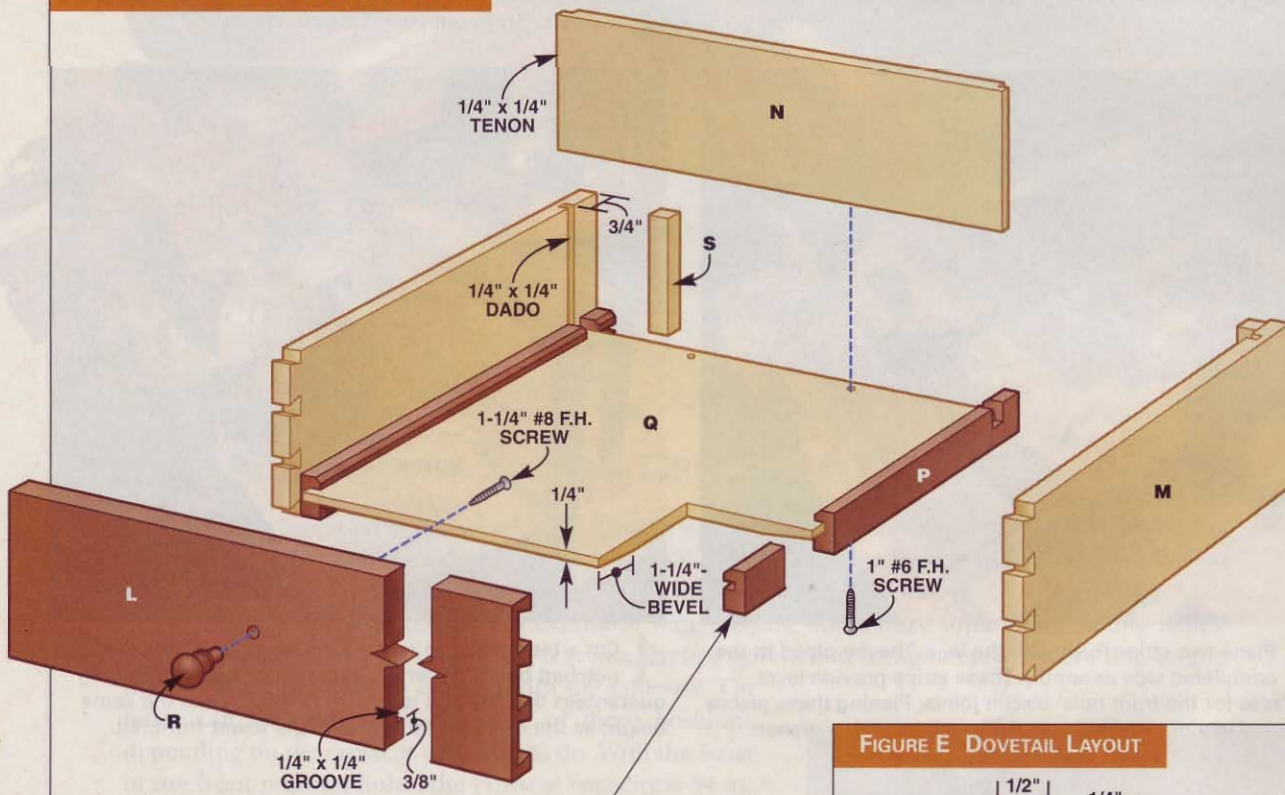


FIGURE D DRAWER EXPLODED VIEW



DETAIL 1 DRAWER SLIP

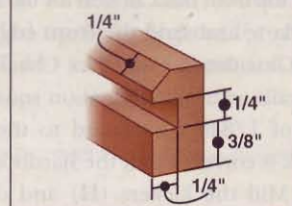
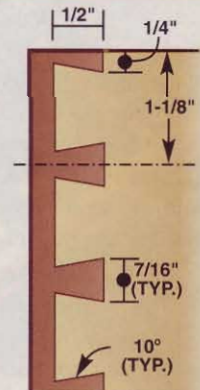
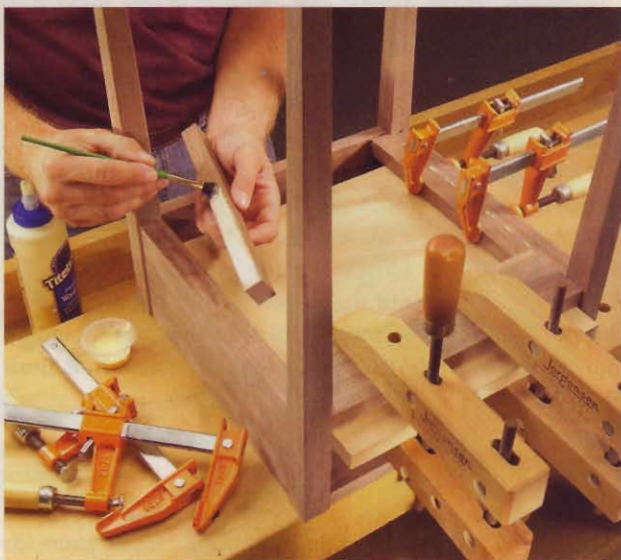


FIGURE E DOVETAIL LAYOUT





5 Glue drawer supports to the sides. Both supports have to be parallel so the drawer doesn't rock. Clamp a board to the front rail to make sure both supports are in the same plane.



6 Add slips to widen and strengthen the drawer sides. The drawer sides are basswood, a soft wood that's easy to cut and pare for dovetailing. The slips, made from a hard wood, prevent the soft sides from wearing prematurely.



7 Plane the drawer to perfectly fit the case. The drawer should be about 1/32 in. narrower across the back than across the front, to make it easier to slide. Support the drawer with a board and a spacer.



8 Bevel the top's underside by hand or on the tablesaw. Planing goes quickly—about as fast as setting up a tablesaw—if you use a slightly curved iron set for a heavy cut. With a plane, you'll have no saw marks to remove.

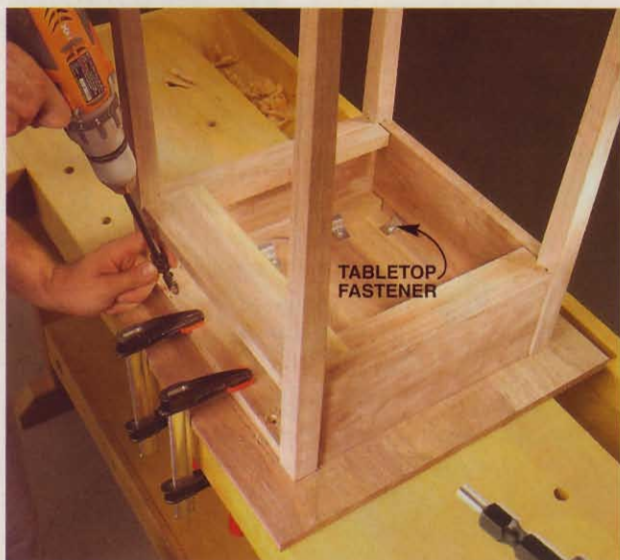
BUILD THE DRAWER

12. Mill the drawer front (L). Crosscut it to exactly fit the opening from end to end. For successful dovetailing, all the drawer parts must be perfectly flat and straight. Machine these parts 1/8 in. larger than final thickness and let them sit for a few days, in case they bend or twist. Then rejoin the face sides and take the pieces down to their final thickness. Mill the drawer sides (M) and back (N). Rip the front, sides and back 1/32-in. narrower



than the drawer opening. For now, cut the back to the same width and length as the sides.

13. Dovetail the sides to the front (see "Precise Hand-Cut Dovetails," page 62, and Fig. E, page 74). Cut a groove in the front for the drawer bottom (Fig. D, page 74). Cut dados across the sides to receive the back. Assemble the sides and front without glue; then measure, crosscut and rip the back to fit. Cut rabbets in the back to fit the



9 Attach the top with angled screws. Drill the pilot holes with an extender and a bit with a built-in countersink (see inset photo). Use the plate joiner to cut slots inside the table for tabletop fasteners. The fasteners allow the top to shrink and swell without cracking.



sides' dados. Drill the drawer front for the knob's tenon and screw (see Sources, below right).

14. Glue the drawer. Strengthen the rear joints with glue blocks (S).

15. Install the drawer slips (P) (Photo 6; Fig. D, Det. 1). Make them from a wide blank (see Cutting List). Groove the sides of the blank for the drawer bottom. In addition, cut a groove of the same width in a scrap of wood to use as a test piece for fitting the drawer bottom. Plane a chamfer above each groove. Rip the slips from the blank. Notch the back of each slip to fit under the drawer's back; then glue the slips to the drawer.

16. Glue up the drawer bottom (Q) and cut it to fit. Use a hand plane to chamfer the underside to fit the drawer's grooves. As you're planing, test the chamfer's fit in the extra grooved piece. Stop planing when the bottom slides freely. Slide the bottom into the drawer and fasten it to the back.

17. Plane or sand the sides flush with the drawer's front. Install the knob (R) and test-fit the drawer in the case. It should be tight from side to side. Plane the sides so the drawer's rear fits loosely in the opening (Photo 7). Continue planing until the drawer's front is only a paper thickness narrower from side to side than the opening. Glue stops (K) to the back rail so the drawer front is flush with the rails.

MAKE THE TOP

18. Glue up the top (A) and cut it to final size. Mark the bevels under the top (Fig. A) and use a hand plane or tablesaw to trim to the lines (Photo 8).

19. Cut slots in the kickers and back rail for tabletop fasteners (Fig. A) using a plate joiner. Clamp the base to the top and drill angled holes in the top front rail (Photo 9).

APPLY A FINISH

20. Remove the top from the case and the bottom and knob from the drawer. Finish the top, the case and the drawer separately. On the drawer, only the front needs finish.

21. Assemble the table. Rub a few strokes of paraffin wax on the drawer sides to make the drawer slide easily.

Sources

Thos. Moser's *Measured Shop Drawings for American Furniture* by Thos. Moser from www.amazon.com Paperback, 2001, \$23. • Horton Brasses, (800) 754-9127, www.horton-brasses.com Walnut knob, 13/16-in.-dia., #WVK-9, \$1.50.

CUTTING LIST Overall Dimensions: 27-1/2"H x 18"W x 18"H

	Part	Name	Qty.	Material	Dimensions (Th x W x L)
Case	A	Top	1	4/4 walnut	3/4" x 18" x 18"
	B	Leg	4	5/4 walnut	1-1/8" x 1-1/8" x 26-3/4"
	C	Side rail	2	4/4 walnut	3/4" x 5" x 11-3/4"
	D	Back rail	1	4/4 walnut	3/4" x 5" x 11-3/4"
	E	Front rail	2	4/4 walnut	3/4" x 3" x 11-3/4"
	F	Top spacer	2	4/4 walnut	1/4" x 3/4" x 11-3/4" ¹
	G	Bottom spacer	2	4/4 walnut	1/4" x 1-1/2" x 11-3/4" ¹
	H	Drawer kicker	2	4/4 walnut	3/4" x 1" x 10"
	J	Drawer support	2	4/4 walnut	3/4" x 1" x 10"
	K	Drawer stop	2	4/4 walnut	1/4" x 1-1/2" x 3"
	L	Front	1	4/4 walnut	3/4" x 3-1/2" x 11-3/4"
Drawer	M	Side	2	4/4 basswood	1/2" x 3-1/2" x 12-1/2"
	N	Back	1	4/4 basswood	1/2" x 2-7/8" x 11-1/4"
	P	Slip	2	4/4 maple	1/2" x 7/8" x 12" ²
	Q	Bottom	1	4/4 basswood	5/16" x 11-3/4" x 11-1/4"
	R	Knob	1	Walnut	13/16" dia.; see Sources
	S	Block	2	4/4 basswood	1/2" x 1/2" x 2-1/2"

¹ Mill pieces to 9/32 in., glue to side rails and then plane even with the legs. ² Rip from a 1/2-in. x 3-in. x 12-in. blank.

Tool Test CYCLONE Dust Collectors

The latest models are better and cheaper than ever. *by David Munkittrick*

There has never been a better time to buy a cyclone dust collector. The new generation of cyclone machines is more powerful, more effective, more convenient—and less expensive. It is now possible to get a very fine 2-hp cyclone for less than \$750. You can thank a competitive field and a growing demand from woodworkers for driving the innovations and prices.

For this test, we looked at all the 2-hp and 3-hp cyclones we could get our hands on. Many of these machines are newly designed. Some were so new the manufacturer couldn't get a stock model to us in time for testing (see "Others You Should Know About," page 91).

ADVANTAGES OF A CYCLONE DUST COLLECTOR

PERFORMANCE AND FILTRATION

The cyclone is a two-step mechanical separator that, unlike a single-stage collector, drops solids from the air stream before they get to the impeller or filter (Fig. A, page 86). This allows the filter to run clean for long intervals. A clean filter allows greater airflow. Compare that to a single-stage collector in which the collection bag doubles as a filter and constricts airflow as the bag fills.

Because cyclone impellers handle relatively clean air, they can be designed to maximize airflow. A single-stage impeller, on the other hand, must be built to withstand the impact from debris; efficient airflow is secondary.

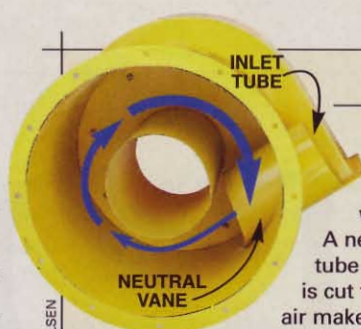
Cyclones tend to have larger impellers and inlets than single-stage collectors do. That makes cyclones better suited for central dust collection systems with large-diameter multiduct runs.



THE NEW-GENERATION CYCLONES

BOOSTING PERFORMANCE

A cyclone collector is a deceptively simple-looking machine. Hidden inside the best machines is some clever engineering that enhances airflow and increases separation performance. Separation performance is simply a measure of how much debris falls out of the air stream into the collection barrel compared with the amount sent to the filter.



SHAWN NIELSEN

Improving Airflow

A neutral-vane design smoothes the airstream inside a cyclone. The result is better airflow and more efficient separation of woodchips and dust from the air.

A neutral vane is basically an extension of the inlet tube into the cyclone body. Normally, the inlet tube is cut flush with the interior wall of the cyclone. As the air makes its first circuit around the cyclone, it smashes back into itself. That results in turbulence that, in turn, causes drag on the airflow.

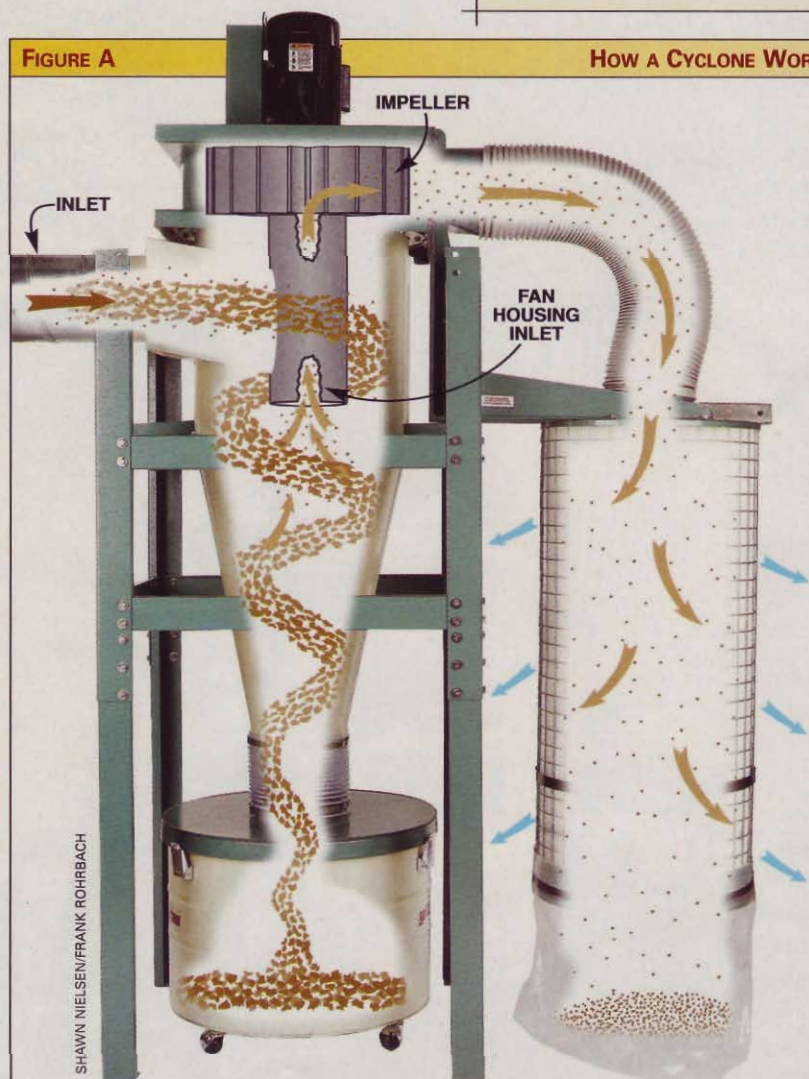
Oneida's patented neutral-vane design (above) was the first on the block.

Grizzly's patent-pending internal air ramp (right) functions like a neutral vane. It directs the air stream downward as it enters the chamber.



FIGURE A

HOW A CYCLONE WORKS



SHAWN NIELSEN/FRANK ROHRBACH

A cyclone is a two-stage dust collector. During the first stage, the collection stream enters the cyclone at the inlet and debris is flung to the outside of the canister, where it spirals down into the collection drum, just like water draining out of your bathtub.

The fan-housing inlet tube begins the second stage. The tube hangs down in the middle of the cyclone body clear of the spiraling debris stream. The relatively clean air is pulled into the impeller, then pushed through the filter. The filter scrubs out the remaining fine particles. Dust that doesn't lodge in the filter media is collected in a separate bin, bag or barrel beneath the filter.

NEUTRAL-VANE DESIGN

The best-performing cyclones have what's called a neutral-vane design (see "Improving Airflow," above). Machines with a neutral-vane design seemed to push a whole lot less dust through their impellers and filters (see photo, page 87). This allows the use of highly efficient cartridge filters that would quickly plug with the dust sent through a machine without a neutral-vane design.

HIGH-EFFICIENCY IMPELLERS

Backwardly inclined impellers (see photo, below) reduce noise and improve airflow and static pressure performance. A cyclone separates most of the debris before it hits the impeller, so manufacturers can use an impeller designed for maximum airflow. Not all manufacturers take advantage of this fact. Some use standard single-stage collector's impellers, which are designed for impact resistance as well as airflow.



Impellers with backwardly inclined fins move more air with less noise than straight-finned impellers do.



The best machines can ingest a barrel-load of sawdust and only leave a spoonful of very fine dust in the filter collector. The cyclones in our test that had the best separation performance all also had a neutral-vane design.

CARTRIDGE FILTERS AND SHOP SPACE

Cartridge filters not only do a better job of filtering the small stuff; they take up less shop space as well. The compact cartridge filter combined with a smaller drum allows manufacturers to build a cyclone that fits under an 8-ft. ceiling. That's really good news for basement or garage shop owners. Smaller drums are also a lot easier to manage when full.

MOTORS

A class F temperature-rated motor is best for a dust collector. A dust collector motor runs longer and works harder than any other tool in your shop. Whenever any tool is used, your dust collector is running. And unlike your table saw, it's under continuous load, so excessive heat can be a problem.

Motors with an F temperature classification can really take the heat; they're rated to handle 311 degrees Fahrenheit. A class E motor has a lower temperature classification of 248 degrees Fahrenheit.

RECOMMENDATIONS

The 2- to 3-hp cyclone dust collectors we recommend are Oneida's Gorilla line and Grizzly's new generation of cyclones. Both manufacturers offer machines that incorporate a neutral-vane or similar design, cartridge filters, backwardly inclined impellers and class F motors. They both have high airflow performance (Fig. B, below). Very simply, they are fabulous machines at excellent prices.

We are also impressed with the new JDS cyclones and Penn State's new S series cyclones.

FIGURE B TEST RESULTS COMPARISON

AIRFLOW TEST RESULTS: HOW MUCH SUCTION DO THE CYCLONES HAVE?

Judging how hard a dust collector sucks is more difficult than you might think. Horsepower of the motor doesn't tell you enough. The usual way of showing performance is with a fan curve, which shows the amount of air moved, in cubic feet per minute (CFM), as the static pressure in the ductwork increases. (You can think of static pressure as the resistance of your ductwork.) At a given static pressure, some machines will move more air than others will.

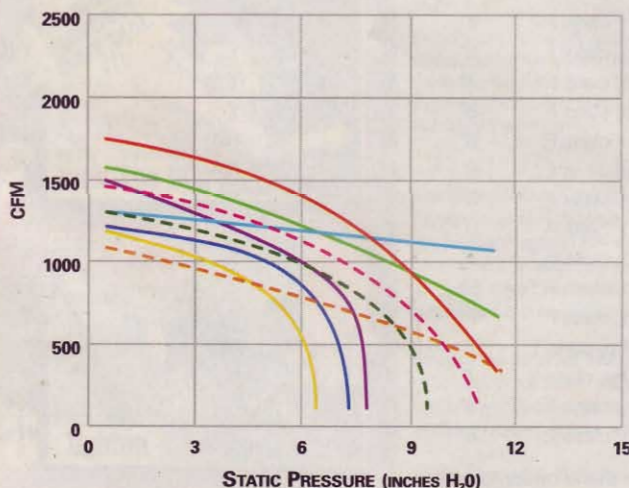
Unfortunately, there are several ways to measure the airflow and produce a fan curve, and manufacturers who provide this information often don't say how their tests were done. We tested dust collectors for this article using one commonly used approach and present the fan curves in the graph below, at left. Fan curves available from manufacturers are presented below, at right. They are sometimes quite different from ours, presumably because different testing methods were used or the machines have changed in the meantime.

Manufacturers are constantly working to improve their fan curves, and although CFM is important, designing your system to lower static pressure is just as important—and often neglected.

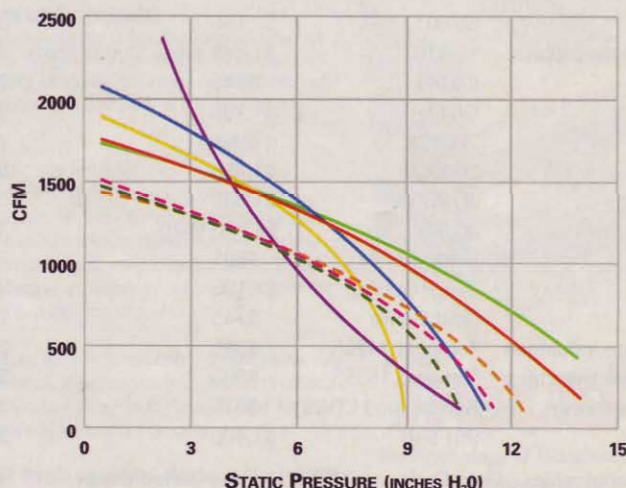
- Penn State 2.5hp
- Oneida 3hp
- Oneida 2hp
- JDS 3hp
- Grizzly 3hp*
- Grizzly 2hp*
- General 3hp
- Delta 3hp
- Bridgewood 3hp

* see Note, page 89

AW TEST RESULTS



MANUFACTURERS' TEST RESULTS



Oneida 2-hp Dust Gorilla, \$745
2-hp Super Gorilla; \$895
3-hp Super Gorilla, \$1,195

Oneida's specialty is cyclones. Dust collection is all the company does and cyclones are the only type of dust collectors it offers. Its new Gorilla line delivers top performance at a competitive price.

Separation in each model is excellent, with only a trace of dust ending up in the filter bin after the cyclone sucked up a barrel-load of shop dust. A high-quality pleated filter catches 99.9 percent of particles from 0.2 to 2 microns in size. Third-party filter ratings are available on Oneida's Web site, as is a host of other useful information.

Oneida's Super Gorilla line is the exact same cyclone as the Dust Gorilla with two upgrades: a U.S.-made Baldor motor and a higher-grade, longer-lasting filter material. The Super Gorillas and Dust Gorillas still have the same filter performance, because Oneida uses more square feet of the less-expensive filter media to make up the difference. All Oneida's filters can be cleaned by backwashing them with compressed air.

In addition to being backwardly inclined, Oneida's cast-aluminum impellers have airfoil-shaped fins for added airflow performance.

Oneida adds a foam silencer that greatly reduces exhaust noise. Its cyclones are still primarily made in the United States.

Pros

- Free ductwork design is available from staff engineers.

Height less than 8 ft.	✓
Neutral-vane design	✓
Cartridge filter	✓
Backwardly inclined impeller	✓



- Collection bin under filter seals well and is easy to take on and off. Plastic bags can be used in the bin for easy disposal.
- Optional Bag Gripper (\$140) allows use of a plastic bag in collection barrel.
- Optional floor stand (shown), \$160, has a small footprint.

Cons

- No protective metal cage surrounds the Super Gorilla filter.

Manufacturer	Model	Price	HP, rating	Inlet dia.	Neutral vane design	Backwardly inclined impeller	Cartridge filter
Delta	50-901	\$2,150	3 hp, class F	8"	N	N	N
General International	10-810	\$1,449 (bag), \$1,999 (cart)	3 hp, class E	8"	N	Y	Y (Opt.)
Grizzly	G0440	\$745	2 hp, class F	7"	Y	Y	Y
Grizzly	G0441	\$1,195	3 hp, class F	8"	Y	Y	Y
JDS	2000CK	\$995	2 hp, class E	8"	N	NA	Y
JDS	3000CK	\$1,495	3 hp, class E	8"	N	NA	Y
Jet	JC-3BF	\$1,300	3 hp, class A	8"	Y	Y	N
Jet	JC-3CF	\$1,700 (cart)	3 hp, class A	8"	Y	Y	Y
Oneida	Super Gorilla	\$895	2 hp, class F *	7"	Y	Y	Y
Oneida	Super Gorilla	\$1,195	3 hp, class F *	8"	Y	Y	Y
Oneida	Dust Gorilla	\$745	2 hp, class F	7"	Y	Y	Y
Penn State Industries	Tempest 1425S	\$845	2.5 hp, class E	7"	Y	N	Y
Penn State Industries	Tempest 1535S	\$995	3.5 hp, class E	7"	Y	N	Y
Wilke Machinery	Bridgewood CDC3	\$675	3 hp, class E	8"	N	N	N
Woodtek	961-948	\$1,400	3 hp, class E	8"	Y	Y	N

NA Not applicable Opt. Optional * Made in the United States ** Floor stand option available

Grizzly G0440, 2 hp, \$745
G0441, 3 hp, \$1,195

Grizzly has produced a really great new line of cyclones. The icing on the cake is the built-in remote-control magnetic switch with timer. This convenience feature is worth more than \$70 and is exclusive to the Grizzly cyclones.

The Grizzly cyclones have a ramped inlet design that acts like a neutral vane. As a result, they achieve excellent separation and airflow performance. A mere spoonful of fine dust enters the filter bag from each barrel-load of shop dust.

Grizzly's cartridge filter material captures 99.9 percent of particles 0.2 to 2 microns in size.

Independent performance rating tests for the pleated filter material can be found on Grizzly's Web site.

Grizzly offers a built-in filter brush that moves up and down inside the filter like a chimney sweep's brush. This bonus feature makes filter cleaning convenient and fast.



Height less than 8 ft.	✓
Neutral-vane design	✓
Cartridge filter	✓
Backwardly inclined impeller	✓



Pros

- Free ductwork design is available.
- Remote-control magnetic switch is included.
- Collection barrel rides on casters.
- Sturdy metal floor stand is available (shown) for \$170.
- Gasket on filter bag flange prevents dust leaks.

Cons

- Plastic bag on the filter is more cumbersome to take on and off than a bin would be.

Note: Grizzly has recently redesigned its cyclones with new filter brushes and with new impellers designed to boost CFM performance. Unfortunately, the new models were not available for our test; however, they will be on the market at the time of publication.

Collection drum type	Dimensions (W x D x H)	Floor stand or wall mount included	Contact
55-gal. drum, not included	76-3/4" x 35-5/16" x 122"	Floor stand	(800) 438-2486, www.deltawoodworking.com
55-gal. drum, not included	64" x 55" x 94" (118" with bag)	Floor stand	(514) 326-1161, www.general.ca
35-gal. steel drum	59" x 37-3/4" x 93-1/4"	Wall mount **	(800) 523-4777, www.grizzly.com
35- and 55-gal. steel drums	60-1/4" x 38-3/8" x 93-5/16" (109-1/8")	Wall mount **	(800) 523-4777, www.grizzly.com
Basket w/35-gal. plastic bag	51" x 34" x 72"	Floor stand	(800) 480-7269, www.thejdscompany.com
Basket w/55-gal. plastic bag	52" x 33" x 87"	Floor stand	(800) 480-7269, www.thejdscompany.com
55-gal. drum, not included	78" x 44" x 94" (110")	Floor stand	(800) 274-6848, www.jettools.com
55-gal. drum, not included	78" x 44" x 94" (110")	Floor stand	(800) 274-6848, www.jettools.com
35-gal. fiber drum	50" x 24-1/2" x 91"	Wall mount **	(800) 732-4065, www.oneida-air.com
35-gal. fiber drum	48-1/2" x 26-3/8" x 93"	Wall mount **	(800) 732-4065, www.oneida-air.com
35-gal. fiber drum	50" x 24-1/2" x 91"	Wall mount **	(800) 732-4065, www.oneida-air.com
26-gal. fiber drum	48" x 20" x 94"	Wall mount **	(800) 377-7297, www.pennstateind.com
26-gal. fiber drum	48" x 20" x 94"	Wall mount **	(800) 377-7297, www.pennstateind.com
55-gal. drum, not included	65" x 36" x 121" with filter bag	Floor stand	(800) 235-2100, www.wilkemach.com
38-gal. fiber drum included	52" x 30-1/2" x 94"	Floor stand	(800) 645-9292, www.woodworker.com

Other Models We Tested



JDS 2000CK, 2-hp, \$995
3000CK, 3 hp, \$1,495

Height less than 8 ft.	✓
Neutral-vane design	✓
Cartridge filter	✓
Backwardly inclined impeller	NA

The JDS cyclones are so new that we were only able to test the 3000CK.

Separation is good on the JDS. The 2 qt. of fine dust in the filter bag were far less than the gallons of dust in the some of the other cyclones' filter bags.

The JDS comes with a plastic bag to collect under the cyclone. An interior metal frame fits inside the bag and keeps it from being sucked into the cyclone. Bags are a real boon for people who put their wood dust out with the trash.

Pros

- You can use plastic collection bags under the cyclone.
- The 2-hp unit is only 6 ft. tall.

Cons

- Getting the frame out of a full 55-gal. bag of dust takes some twisting and tugging.



Penn State 1425S, 2-1/2 hp, \$845; 1535S, 3.5 hp, \$995

Height less than 8 ft.	✓
Neutral-vane design	✓
Cartridge filter	✓
Backwardly inclined impeller	✓

With the new S series, Penn State Industries continues to make significant improvements to its line of cyclones. The 1425S we tested had excellent separation, with only a trace of dust remaining in the filter bins. In the higher static pressure range, its airflow performance was better than that of many 3-hp models. Penn State's cartridge filter is free standing. The filter collection bin cannot be removed for clean-out. Instead, a blast gate is set in the bin so you can vacuum out the bin. For this to work well, you'll need to have a high-quality shop vacuum that won't send all that fine dust back into your shop.

Pros

- Free duct design service is available.

Cons

- Filter bin clean-out is awkward.



Bridgewood CDC3, 3 hp, \$675

Height less than 8 ft.	✓
Neutral-vane design	✓
Cartridge filter	✓
Backwardly inclined impeller	✓

Wilke Machinery's Bridgewood model is a solid, classic design at a great price. The price gets even better when you consider it includes the tripod floor stand. While the Bridgewood's price is small, its physical stature is not. Since it's 121 in. tall, you need a shop ceiling higher than 10 ft. to house it.

Bridgewood uses a high-quality singed felt to construct the bag filter. This type of material does a decent job of filtering the fine dust and shedding dust buildup on the inside of the bag.

Pros

- Price is great.
- Filter bag is good.
- Drum dollies are included.

Cons

- Height reaches over 10 ft. with filter bag.



Delta 50-901, 3 hp,
\$2,150

Height less than 8 ft.
Neutral-vane design
Cartridge filter
Backwardly inclined impeller

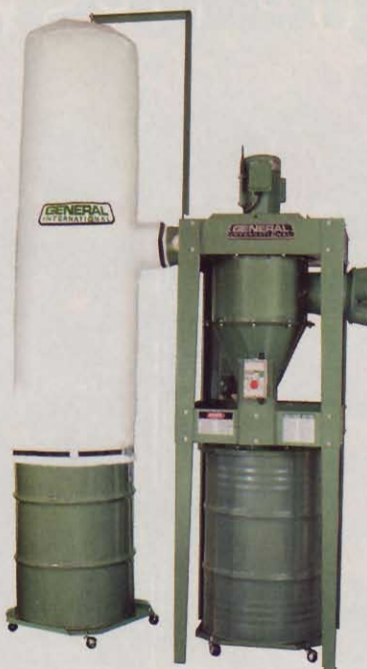
The Delta is by far the quietest machine we tested and it's built like a tank. The 50-901 uses an acceptable filter bag, although it's not as efficient as a felt bag. The Delta comes with its own, sturdy tripod floor stand, but you must provide a drum for both the cyclone and filter. The Delta is primarily made in the United States.

Pros

- Quietest cyclone in our test.

Cons

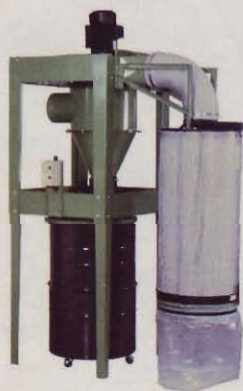
- Height is high.
- You must wire in your own switch.



General International
10-810, 3 hp,
\$1,449 with bag filter,
\$1,999 with cartridge filter

Height less than 8 ft. (with cartridge filter only)	✓
Neutral-vane design	
Cartridge filter	Opt.
Backwardly inclined impeller	✓

We tested the General cyclone with the basic bag filter. We strongly recommend going for the cartridge filter, because the dust literally blew through the thin, woven fabric filter.



Cons

- Bag filter is a real dust spewer.

Pros

- This model holds a 55-gal. collection drum and still fits under an 8-ft. ceiling.
- Drum dollies are included.

Others You Should Know About



Jet JC-3BF, 3 hp, \$1,300,
JC-3CF, 3 hp, \$1,700



Woodtek 961-948, 3 hp,
\$1,400

Jet and Woodtek have each come out with 3-hp cyclones. This is a first for both companies and reflects cyclones' growing popularity. Unfortunately, these machines are so new that we were unable to get them in time for our test.

Jet states that its cyclone features a cartridge filter. Woodtek tells us its new models are designed to fit under an 8-ft. ceiling. The companies have provided information for these new models; see Chart, page 88.

SMALL SHOP TIPS

HOLD IT! ROLL IT!
HANG IT! STORE IT!

edited by Tim Johnson



SLIDING MOBILE BASES

My mobile bases slide on low-friction, ultrahigh molecular weight (UHMW) polyethylene pads. Fastened to these sliding bases, my tools glide easily over the concrete floors in my shop, yet there's enough resistance to keep them stationary during use. The bases are compact, so I don't whack my toes on them, and I don't have to worry about forgetting to lock or unlock casters.

Each sliding base costs about \$20 to make, much less than a caster-equipped mobile base. The pads (see photo, left) cost only about \$2 apiece, because they're cut from a sheet of UHMW polyethylene (see Source, below).

I've found that a push-pull method keeps top-heavy tools, like my drill press, stable. I push lightly with my top hand to keep the tool from tipping forward and pull with my bottom hand to slide it.

Vick Carsten

Source Lee Valley Tools, www.leevalley.com, UHMW polyethylene sheet, 3/4-in. x 4-in. x 24-in., #46J90.14, \$17 ea.



ART DIRECTION: JOE GOHMAN • PHOTOGRAPHY: JOE GOHMAN AND VERN JOHNSON



SAFETY CENTER

I'm much more likely to wear safety gear if I don't have to track it down. So I made a custom-fit holder for each piece of equipment: safety glasses, hearing protectors, dust masks and a face shield. The holder consolidates the pieces in a handy spot on the wall.

R.B. Himes

If you have an original Small Shop Tip, send it to us with a sketch or photo. If we print it, you'll get \$100! Send it to Small Shop Tips, American Woodworker, 2915 Commers Drive, Suite 700, Eagan, MN 55121 or e-mail to smallshoptips@readersdigest.com. Submissions can't be returned and become our property upon acceptance and payment. We may edit submissions and use them in all print and electronic media.

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OVERHEAD EXTENSION CORD

I have a love-hate relationship with my extension cords. I love how they bring power where I need it. But I hate tripping over the cords or trying to wheel carts over them.

One day while tying up an extension cord for storage with one of those hook-and-loop wraps, I got an idea. I installed a handful of eye-hooks and hook-and-loop fasteners (\$3 for a box of five at the hardware store) in the ceiling joists. Whenever I need power in a remote spot now, I run my extension cord overhead.

Dave Munkittrick

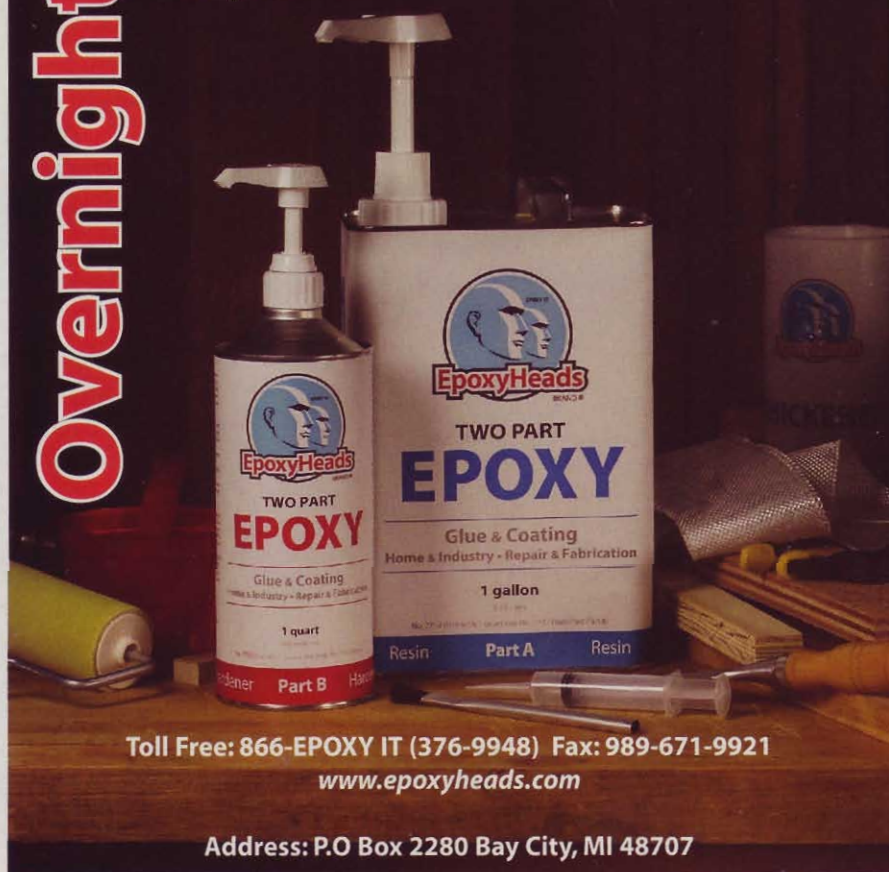
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Circle No. 10

edited by Tim Johnson

SALMON SAW

My neighbor, an avid fisherman whose wife won't allow fish in the house, gave me a half dozen beautiful king salmon. They were expertly cleaned and frozen, so all I needed was an appropriate way to cut them into steaks for future grilling. "Aha!" I thought, "My bandsaw is perfect!" I thoroughly cleaned the saw and sterilized the table and the blade. My trusty old saw cut through the salmon effortlessly.

In a day or two, something else came through—the nauseating aroma of rotting fish. It didn't take long to pinpoint the source. The inside of my bandsaw was caked with putrid salmon dust. Even though I've cleaned the saw several times since then, a faint, foul smell still lingers, so my shop remains a popular destination for the neighborhood cats.

R. Lynn
Matson



If you have a wood-working blunder that you're willing to share, send it to us. You'll receive \$100 for each one we print. Send it to **AW Oops!**, American Woodworker, 2915 Comers Drive, Suite 700, Eagan, MN 55121, or e-mail to oops@readersdigest.com. Submissions can't be returned and become our property upon acceptance and payment. We may edit submissions and use them in all print and electronic media.

POCKETED DOOR

While installing a custom-built work center in the lab at a doctor's office, I had to fasten the base cabinets to the wall. I predrilled holes and drove in all the screws. Although they felt a bit funny going in, the screws eventually secured the cabinets. I left, satisfied that the installation had been successful.

That afternoon, I received a phone call from the doctor's office, saying the staff members could no longer close the door to the lab. I had no idea what they were talking about, because I hadn't seen a door.

Then I figured out they were referring to a sliding pocket door, the kind that stores inside a wall. Unknowingly, I had anchored the base cabinets to the hidden door, making it impossible to close. Needless to say, that job required a second trip.

Brian Sabo