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#103 October 2003
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Furniture Repair Tips

15 tricks to cure
the wobbles
and shakes

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Serving Tray
Jigs and a Router Table
make this project goof-proof

Mahogany and its
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Sometimes fixing something old is as satisfying as making something new. With these 14 slick methods you can take it apart and put it back together better than new.

Bow-Front Bookcase **56**

You'll love the look of the curvy front, and sandwich construction and simple joinery make it easy to build.

Serving Tray **68**

With a little handsome wood and some clever jigs you can make one—or a dozen—of these attractive trays.

TOOL TEST

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To your health. After central at-the-source dust collection and your shop vacuum, an air scrubber is your third line of defense against shop dust. Find out which scrubbers move the most air and have the best filters to trap the tiniest particles.

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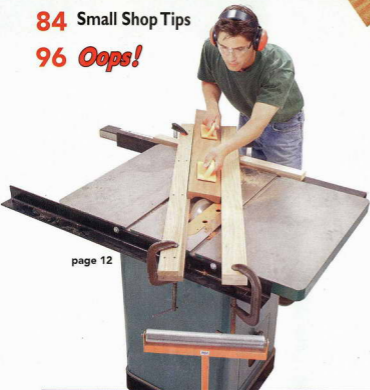
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Question & Answer

Unusual Coves Made Easy

Q. I'm stuck trying to copy an old-fashioned cove molding for a new bookcase. I know about cutting coves by angling a board to a tablesaw blade, but I can't figure out how to get the elliptical shape I need. Any ideas?

A. There are four different settings on a tablesaw that can determine the shape of a cove molding. Two are quite familiar: the angle of the guide boards and the height of the blade. The others are pretty clever and not widely known. You can tilt the blade and tilt the workpiece.

The first two settings make symmetrical curves (curves having the same shape on either side of a vertical centerline). Tilting the blade and workpiece allows you to make more complex asymmetrical curves, where the left side is different than the right side. To make the elliptical molding at right, we set the guide boards at 30 degrees to the blade, tilted the blade 45 degrees and ran one edge of the workpiece on a 3/4-in.-high ledge.

You might go crazy trying to figure out all the combinations necessary to make your molding, though, and chew up a lot of scrap stock in the process. Fortunately, you can buy a pamphlet to give you a head start (see photo, below right).

The pamphlet does not contain any photos showing the general procedure for setting up and using your saw. If this is your first time cutting cove molding, refer to a more detailed how-to story, such as "Tablesaw Coved Panels," AW #95, September 2002, page 34.

Source

Klausz-Tech, (908) 658-4396

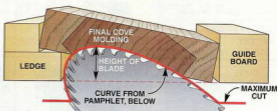
Box 7B

Pluckemin, NJ 07978

Cove Cutting pamphlet; \$10, plus \$2 shipping and handling.



Caution: You must remove your blade guard to make these cuts. Be sure to use push blocks and only raise the blade about 1/16 in. at a time.



Set up your saw on paper before cutting complex coves. Create a worksheet by copying a profile given in the cove cutting pamphlet, shown below. These profiles are full-size and show the entire curve made by raising the blade to its full height. The angle of the guide boards and tilt of the saw blade are given with each profile.

If you must tilt the workpiece, as shown above, you'll have to figure out the height of the ledge.



Save hours of trial-and-error setup work by ordering this \$10 pamphlet (see Sources, at left). It contains profiles of curves made by 56 different combinations of tipping the saw blade and angling the guide boards. The author is Frank Klausz III, son of master woodworker Frank Klausz II.

A Stacked Dado Set With No Shims Needed?

SD608
Dial-A-Width Dado Set



Introducing Freud's New Dial-A-Width Stacked Dado Set

Choose Freud's Dial-A-Width Stacked Dado Set, which is a must for fast, easy, and accurate flat-bottom dado cuts.

No More Shims

For a perfect fit every time, all you need to do is dial. Freud's SD608 Dial-A-Width Dado Set performs like an ordinary stacked dado set, but the shims have been replaced with a patented dial system, which allows you to adjust the width via an exclusive dial hub capable of micro adjustments. Each "click" of the dial adjusts the blade by .004" - that's thinner than a sheet of paper. The adjustable width range for the dial is 1/4" to 29/32".

Easy and Accurate

Freud's innovative adjustable-hub design not only eliminates the need for shims, but allows you to fine tune the width of the dado without ever removing the dado cutter from your table saw. No more wasted time making adjustments and re-adjustments. A simple click of the dial ensures accuracy the first time.

Flawless Finish

The SD608 features the same premium materials and quality as all of Freud products. The blade bodies are laser cut for extreme accuracy, and the precision-ground arbor holes ensure precise blade alignment on any table saw. The MicroGrain carbide is manufactured specifically by Freud for splinter-free, flat-bottom grooves in all materials—including problem materials like veneered plywood or melamine.

Choose the dado set that produces the best finish and highest-quality cuts of any dado set today—choose Freud. Whether you're a production shop, custom woodworker, or serious woodworker, Freud makes it easy for you to endlessly create dadoses with flawless flat-bottom grooves.

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(CANADA) 1-800-263-7016

1 Loosen



2 Turn The Dial



3 Tighten



Question & Answer



Longer Lasting CA Glue

Q. CA glue is terrific for quickly bonding small pieces without clamps, but how do you make it last longer? My bottles clog up and the glue hardens way too soon.

A. Once opened, the shelf life of cyanoacrylate (CA) glue is a short three to six months. But if you zip it into an air-tight plastic bag and store it in your refrigerator (out of the reach of children), the glue will last indefinitely. Cold doesn't affect the bonding properties of the glue, but you should allow the bottle to reach room temperature before using it.

To keep your nozzle from clogging, "burp" your CA bottle after each use. Set the bottle upright and squeeze it until the glue reaches the top of the nozzle. When you let go, you'll create a vacuum that will suck the glue back into the bottle. Next, tap the bottom of the bottle on your workbench several times to force the last drop or two of glue to fall back into the bottle. Then put the cap back on.

If your tip gets clogged anyway, unscrew it from the bottle and soak it in acetone. Use an awl or needle to pry off loosened pieces of glue.

Question & Answer

Contact Cement for Veneer?

Q. I'm about to start my first veneering project, a small box. Is contact cement okay to use?

A. Contact cement is easy to use because you don't need clamps, but for the best results, go with plastic-resin glue (see Sources, below), the choice of plywood manufacturers and veneering pros.

What's not so good about contact cement? It's risky. First, bubbles, bumps or ridges in the glue can show or "telegraph" through to the surface. Second, some finishes, especially wipe-on oils and varnishes, can soak through the veneer, loosen the glue and cause the veneer to lift. Lastly, contact cement stays flexible, but a rigid bond is more durable. The veneer may come loose and its joints may separate, causing the veneer to crack or split.



If you still want to try contact cement, you can minimize these risks by using veneers that are dead flat, laying the veneer on a stable substrate (such as MDF), using a contact cement formulated for veneer (see Sources, at right), and sealing with shellac before applying a top coat of finish.

Plastic-resin glue is generally sold as a powder that you mix with water. When it's dry it makes a very rigid bond.

Yellow glue works okay, but when it dries it's not as rigid as plastic-resin glue. It's also more susceptible to heat and water damage.

Sources

DAP, (888) 327-8477, www.dap.com
Weldwood Plastic-Resin Glue, #00203,
1 lb.; \$7.

Constantines, (954) 561-1716,
www.constantines.com
Veneer Glue (contact cement), #12VGP,
1 qt.; \$9.25.

Shop Insurance



Q. I sell some of my woodworking projects so I can buy new power tools. Will homeowner's insurance still cover my shop?

A. Only your insurance agent can tell you for sure. All insurance carriers will accept a "hobby" shop as a normal part of your homeowner's coverage, but you may move into a different category if your shop becomes the home of a cottage business.

Pull out your policy and look for limits on personal property used for business purposes. If you can't make heads or tails of the fine print, call your agent. Be honest. Coming clean can save you a lot of grief if you ever have to file a claim.

If your agent comes to visit, it pays to show him a tidy and orderly layout, a dust-collection system, fire extinguishers and proper storage of flammable finishing supplies (that usually means a metal cabinet).

Whether you make money from your woodworking or not, you should have a record of all your tools in case they're damaged or stolen. Most of us have way more woodworking stuff than we can remember, and it may well add up to more money than a normal household policy will cover under the blanket category of "tools." Ideally, you'd have kept all your receipts, but the next best thing is to take a complete tour of your shop with a still or video camera and make a visual record of all your tools.

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.

Question & Answer

Why Coat Sawblades?

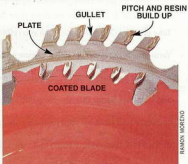
Q. Why are some saw blades covered with a slick coating when only the teeth actually touch the wood?

A. All the parts of a blade come into play when it's cutting. The purpose of a coating, beyond preventing corrosion and rust, is to keep a blade running cool and straight so it makes a smooth cut.

As the teeth cut, a swirl of sawdust moves around the plate and inside the gullets. This dust contains pitch from solid wood or resins from plywood. The dust is constantly rubbing against the blade, producing friction and adding to the heat made by the blade's teeth. The hotter the blade gets, the more this gummy stuff clings to the sides of the teeth, the gullets and plate. When the pitch and resin start to build up, the reduced clearance behind the teeth creates even more friction. It's a vicious cycle. Too much heat causes a blade to slightly distort and wobble, making a noticeably rougher cut. Thin-kerf blades are particularly prone to this problem.

A coating reduces the friction between the sawdust and the plate. Plus, it resists gummy build-up, just like a coated frying pan. Both factors help a blade run true. Coated blades still get *some* gummy build-up. A coating doesn't eliminate the need to regularly inspect and clean your blade.

M



RAMON MORENO

Workshop Tips

Fingertip Protection

I discovered the hard way that sanding on a lathe can be hard on the fingers. Now, to protect my fingers, I cut the fingertips off a latex-dipped work glove and wear one or two of the fingertips while sanding. Not only does this protect my fingertips, it also makes it much easier to hold onto the sandpaper.

I found a pair of these gloves at a hardware store for about \$4, or you can order them (see Source, below). Caution: Don't wear the whole glove while working on your lathe. You could be seriously injured if the glove got caught on your turning project or lathe.

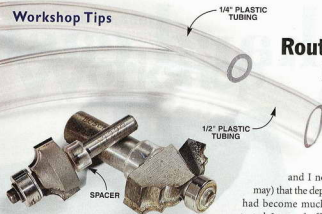
S.J. Chant

Source

ABC Safety Mart, (800) 646-5346
www.abc-safetymart.com
 Dipped rubber gloves, #ml-K57PM;
 \$11 per dozen pair.



Workshop Tips



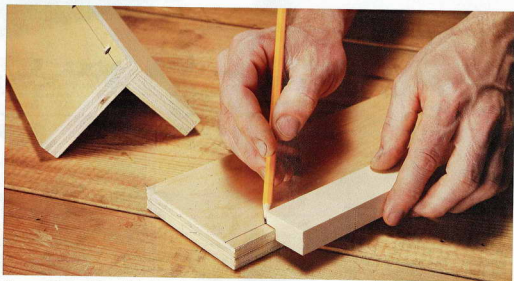
Router Bit Spacers for Peace of Mind

Recently I was routing a decorative edge on a large round tabletop. About halfway around, my router started to vibrate and I noticed (with great dismay) that the depth of the routed pattern had become much deeper than when I started. I turned off the router and when I lifted it off the table the router bit fell out and hit the



floor. After uttering a few choice words, I called a friend for help. He diagnosed that I had installed my router bit too far into the collet. He said that the shank of some router bits flares out just under the cutting head and if you tighten the collet against this flared area it's likely to come loose during use. Sure enough, the shank of my router bit was in fact flared below the cutting head. Never wanting to experience such a costly mistake again, I added a short section of plastic tubing to each of my router bits to prevent them from going too deep into the collet. I found the tubing in the plumbing section of the hardware store for 50 cents per foot.

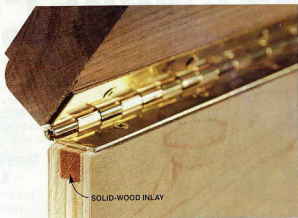
Paul Johnston



Surefire Marking Gauge

Screwing plywood pieces with drywall-type screws is quick and easy, but drilling holes in a straight line can be tricky. That's why I made this handy little marking gauge that allows me to quickly and accurately mark a line on my plywood for drilling screw holes. To make it, simply cut a 3/8-in. by 3/8-in. rabbet into a board that is about 1-in. wide by 8-in. long. You now have a marking gauge to make a line that will put your screws exactly in the centered edge of your 3/4-in. plywood.

Jacques Paquette



Reinforce Plywood for Hinge Screws

Plywood edges don't provide a very good anchor for hinge screws. So while building a wooden toy box that had a piano-hinged lid, I reinforced the plywood edge by routing a groove and gluing in a strip of solid wood. This provides a strong place for the hinge screws, and should hold tight for many years.

Frank Campagna



Playing Cards in the Shop

A deck of playing cards can be very useful around the woodshop. One of my favorite uses is for shimming my dado set. I drill a 5/8-in. hole in the center of several cards and keep them with my dado set so they're ready when I need them. Playing cards are also handy as disposable glue spreaders and for leveling the feet on my rolling workbench. Waiting for a finish to dry? How about a game of solitaire?!

Larry Presneall

Workshop Tips

Easy-Tighten Bar Clamp

Bar clamps are great tools, but sometimes it's tough to get a good grip on the small wood handle. To get extra torque, I drilled a hole in the handle and inserted a dowel. It gives me a lot more twisting oomph with a lot less hand strain. I drilled the 3/8-in. hole 3/4-in. from the bottom end of the handle to avoid hitting the bolt that extends into the top of the handle.

Jon Stumbras
JW



The Well-Equip

Feature-Packed Planer

DeWalt's new DW735 13-in. planer is quite a machine. For \$480, you get a three-knife cutterhead, two feed speeds, an automatic carriage lock and a fan to clear chips. All these features lead to exceptionally smooth surfaces.

The three-knife cutterhead is a breakthrough in small planer design.

This is the first 120-volt benchtop planer with a universal motor to have three knives, rather than two. Most benchtop planers feed material at a single speed and produce 50 to 80 cuts per inch (cpi). Adding one more knife boosts the DW735 to 96 cpi. (Higher cpi generally means less sanding.) Slowing down the feed rate by flipping a switch on the DW735 bumps cpi way up to 179, perfect for planing tear-out-prone figured wood. Only one other benchtop planer, the Delta 22-580 (\$420), has two feed speeds, producing 60 and 90 cpi.

The automatic carriage lock helps minimize snipe (the slight depression most benchtop planers cut into the leading and trailing ends of a board). This lock is automatic—there's no lever to pull. Only one other planer, the Makita 2012NB (\$500), has this feature.

The chip-ejector fan isn't intended to replace a dust collector, but it helps to keep a board smooth by quickly removing chips from the cutterhead. (Excess chips circulating around a cutterhead can result in blemishes on a board's surface.) Two Craftsman planers, the 21722 (\$300) and 21743 (\$440), have a similar feature.

At 20-in. deep and 92 lbs. the DW735 is best suited to a dedicated spot in the shop. The bed on the DW735 is long enough to adequately support 4-ft. boards. Additional tables for supporting longer boards are a \$45 accessory. The knives are indexed, double-edged and disassemblable. Replacement knives cost \$45.

Source

DeWalt (800) 433-9258, www.DeWalt.com
DW735 13" Planer; \$480.
DW7351 Folding tables; \$45.
DW7352 Replacement knives; \$45.



PHOTOS COURTESY OF MANUFACTURER



There's plenty of room to change knives on the DW735. Remove the top and you've got free access to the innovative three-knife cutterhead.

ped Shop

By
George Vondriska

New Tools, Supplies and Materials

Quick-Change Jointer Knives

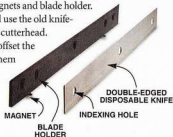
Dispoz-A-Blade is a foolproof system for retrofitting virtually any jointer or planer with new indexed knives. Indexed knives snap right in place on pins, so there's no need for fussing with measuring equipment. The new knives are double-edged and disposable.

This convenience doesn't come cheap. A Dispoz-A-Blade system for a 6-in. jointer is \$198. An 8-in. system is \$226; a 15-in. planer system is \$298.

Installing a Dispoz-A-Blade system is straightforward. Take one measurement from your cutterhead and send that number to Dispoz-A-Blade. They'll send you a blade holder to fit your machine and a set of Posi-Set rare-earth magnets to position the holder in the cutterhead. Remove your old knives, jack screws and springs, then drop in the magnets and blade holder.

One thing that doesn't change: you'll still use the old knife-locking bars to secure the knives in the cutterhead.

If a knife is nicked, shift it slightly to offset the nick. When the knives get dull, flip them over. Only Dispoz-A-Blade knives can be used as replacements. A new set of double-edged 6-in. replacement knives costs \$22.



Dispoz-A-Blade is a drop-em-in-and-go indexed knife system that takes the @#%&! out of changing knives on jointers and planers.

Source

Esta USA, (800) 557-8092, www.estausa.com
Dispoz-A-Blade 6" jointer knives; \$198.

Adjustable Slot Cutter

There's nothing to lose with the new EZ-Dial Slot Cutter, \$100, from Amana. No shims, that is. Other adjustable slot cutters rely on replacing shims to vary the thickness of the cut, but not the EZ-Dial. Adjusting this cutter is as easy as turning the volume knob on a radio. Just dial in the slot width, cinch the lock nut, and you're good to go. Shimmed slot cutters are less expensive and offer a greater range of adjustment in one cutter, but are more difficult to set up.

The EZ-Dial is available in two sizes; 1/8 in. to 1/4 in., and 1/4 in. to 1/2 in. One full turn of the adjustment dial changes the slot width by only 1/32 in., so fine adjustments are easy. This simple system is a great way to make the slots required for slipping undersized plywood into frames, or custom-cutting grooves for tongue-and-groove joints.

EZ-Dial Slot Cutters are carbide tipped, come with 1/2-in. shanks and cut grooves up to 1/2-in. deep.



Rotate the knob to tweak the width of a slot. This cutter is split in two halves. Turning the knob raises or lowers one half.

Source

Amana Tools, (800) 445-0077, www.amanatool.com
EZ-Dial Slot Cutter
#55500 1/8" to 1/4"; \$100, #55510 1/4" to 1/2"; \$100.



Chip Catching Gouge

Turners typically have to settle for letting the chips fall where they may, and turning produces plenty of them! The ingenious CleanTurn Vacuum Gouge, \$48, collects all those chips by sending them directly to a vacuum.

This gouge is best for roughing bowl and spindle blanks, green or dry. It can be used for shearing or scraping cuts, too. For best results, connect the gouge to an extra-flexible hose (see Sources, below).

This gouge's unique round shape presents some problems. Chips disappear down the tube so fast that you can't see them. Observing how chips are formed is important feedback for modifying your technique. In addition, turning a long, straight spindle is more difficult than with a conventional roughing gouge.

The business end of the Vacuum Gouge is high-speed steel, like many good lathe gouges. It's a 2-1/2-in.-long piece of high-speed steel pipe bonded to a 24-in.-long piece of carbon steel pipe. Both pieces of pipe have a 1-3/8-in. outside diameter. The Vacuum Gouge is close in price to other high-speed steel chisels.

This is a handy tool, but bear in mind that a vacuum turns a quiet pastime into a noisy one.

Sources

Woodworker's Supply, (800) 645-9292
www.woodworker.com
12' extra-flexible hose, #897-457; \$28.

CleanTurn Tools, (800) 883-4077
www.cleanturn.net
Vacuum Gouge \$48,
plus \$7.50 shipping and handling.

The Way Wood Works

By Tom Caspar

Mahogany and Its Look-Alikes

Are less-expensive African and Philippine “mahogany” just as good?

Stunning grain. Huge boards. Highly rot resistant. A dream (or a nightmare) to work. What one wood fits this bill? Mahogany, of course.

Even the plainest mahogany boards are quite beautiful, because the color is usually a deep, rich coppery red (Photo 1). Mahogany trees are huge, towering up to 150 ft. over the rain forest floor, and are often sawed into very wide boards up to 4-in. thick. The bombé chest, above right, was made from one 24-in.-wide board, 3-in. thick and 16-ft. long!

With all these good qualities, why aren't we all lining up at the lumberyard for mahogany boards? Because it's expensive, about \$5 to \$9 per bd. ft. It's so expensive that exporters of other woods have worked “mahogany” into the street names of their products and succeeded in confusing the heck out of woodworkers (Photo 2). Let's clear the air a bit and compare these species side by side.



CHEST BUILT BY
RANDY JOHNSON



KHAYA

SAPELE

LAUAN

1 American mahogany is one of the world's most beautiful woods. Its price has been rising slowly but steadily as these South American trees become more expensive to fell, process and export. No wonder everybody's looking for substitutes!

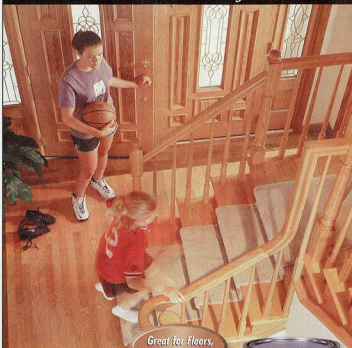
2 Common mahogany look-alikes include Khaya, Sapele, and Lauan. (They're pronounced Kigh-yah, Sah-pee-lee and Loo-ahn.) Khaya and Sapele are often called African mahogany and are in the same botanical family, Meliaceae, as American mahogany. Lauan is sold as Philippine mahogany, but it's not in the same botanical family.

The Way Wood Works

Fig.A Guide to Mahogany

Common Name	Also Known As	Species	Cost/bd.ft.
American mahogany	Honduras mahogany	<i>Swietenia macrophylla</i>	\$5-9
African mahogany	Khaya	<i>Khaya ivorensis</i>	\$4-8
African mahogany	Sapele	<i>Entandrophragma cylindricum</i>	\$5-10
Philippine mahogany	Lauan	various species of <i>Shorea</i>	\$3-4

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3 American mahogany has long been favored for its outstanding working qualities, especially with hand tools. It's easy to clearly mark with a knife or pencil, smooth with a hand plane and pare with a chisel. Dense boards are usually better for handwork than lightweight boards.

American Mahogany

This is the real McCoy. American mahogany comes from Central and South America, and has been prized for fine furniture and boat building since the eighteenth century (Photo 3).

There are actually two different kinds of American mahogany: Cuban or Santo Domingo mahogany (*Swietenia mahoganii*) and Honduras mahogany (*Swietenia macrophylla*). It was the denser, darker Cuban variety that first excited furniture makers 300 years ago, but there's very little of it left today. When selling mahogany, most lumber dealers are referring to the Honduras type.

Honduras mahogany primarily comes from South America. The best and densest grades, those most like the legendary Cuban mahogany, are exported from the rain forests of Peru. Honduras mahogany is still readily available, but it's been logged very heavily, often at the expense of a healthy forest. There's been quite an international effort to certify more responsible logging practices. For more on certified and plantation-grown mahogany, go to www.certifiedwood.org.

The Way Wood Works

Plainsawn



American Mahogany



Sapele



Khaya

Quartersawn



4 Quartersawn boards often have a ribbon-striped appearance, caused by the grain or fibers periodically changing direction. This means that quartersawn boards often have tear-out problems. American mahogany is generally plainsawn, but Khaya and Sapele are usually quartersawn to show off their strong ribbon-stripe figure.

Quartersawn Mahogany is Harder to Work

Many mahogany trees have an unusual internal structure called “interlocked grain” (see page 46). When boards are plainsawn (with the growth rings more or less parallel to the wide face),

interlocked grain makes beautiful swirling patterns. When boards are quartersawn (with the growth rings at right angles to the wide face), interlocked grain makes a ribbon-stripe figure (Photo 4).

Plainsawn mahogany is generally a

pleasure to work, but quartersawn mahogany can be a bear. Each ribbon in a quartersawn board indicates a change in grain or fiber direction. When planing or jointing, you can't win. Whatever direction you feed a quartersawn board, you may get nasty tear-out.



5 A wide range of figure and color is available in American mahogany and other closely related veneers. Few other woods have so many different faces. With careful staining, all these veneers can be blended with solid American mahogany, Khaya or Sapele. Color and pattern "trade names" vary with different suppliers. To buy the veneers shown above, see Sources, page 46. Prices are given per square foot. These pieces are 9-in. wide.



BILL BAY

6 Outdoor furniture made of American mahogany will last many years because it's naturally rot resistant. Like all woods, it slowly turns a silvery gray color outdoors unless it's stained or varnished. Khaya and Sapele are also good choices for outdoor projects, but won't last as long.

Color, Density and Figure Are All Over the Map

Looking over a pile of roughsawn American mahogany, you might think all the boards are pretty much the same. Pick up a few, however, and you notice that some are a lot heavier than others. Plane their surfaces, and you'll see an astonishingly wide range of color.

Few woods are as variable in density, color and figure as American mahogany. In addition to their lower cost, that's why so many other woods can be marketed as "mahogany," or blended with American mahogany as showy veneers or secondary solid woods (Photo 5).

Steer away from the least dense boards. Often they have the blandest color, but more importantly, the wood is softer and doesn't surface well. You'll get patches of fuzzy grain that are difficult to smooth (Photo 7, page 44).

Mahoganies from Africa: Khaya and Sapele

Khaya and Sapele have long been used as fine furniture woods, particularly in Europe. Both are less durable for outdoor furniture than American mahogany (Photo 6). Khaya and Sapele are available from many lumber dealers. See Sources, page 46, for a dealer who'll ship through the mail.

Khaya is a gorgeous wood, and a good substitute for American mahogany. In fact, with many boards, it's darned hard to tell the two woods apart. Khaya is generally quartersawn to produce a distinctive ribbony appearance.

Fig. B Rot Resistance

Type	Degree of rot resistance
Teak	Durable
White Oak	Durable
American mahogany	Durable
Khaya	Moderately durable
Sapele	Moderately durable
Dark red Lauan	Moderately durable
Light red Lauan	Not durable

The Way Wood Works



7 Fuzzy grain is an annoying problem with all of the mahogany-related woods, especially in less-dense boards. Every once in a while you'll come across a lightweight board that you just can't get smooth, even with power sanding. Before giving up, try stiffening the fibers with a wash coat of shellac, and then sanding.

Quartersawn Khaya is often sold as "Ribbon-Striped African Mahogany."

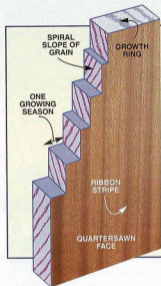
Khaya works well, but it's not on par with the best grades of American mahogany. It's more prone to tear-out, and there's a greater chance you'll get some boards with fuzzy surface patches that are very hard to smooth (Photo 7). Khaya is generally softer, too, and won't hold as crisp an edge as American mahogany. That means it's not as good for fine detail in moldings and carvings.

Sapele has a finer texture than American mahogany. It's easier to tell the two apart, but Sapele is still a good substitute. Like Khaya, Sapele is often quartersawn to reveal a ribbon-stripe grain pattern, but its ribbons are often narrower and closer together. With tighter interlocked grain, Sapele is also more prone to tear-out than American mahogany.

Philippine Mahogany: Lauan

Lauan is inexpensive, plentiful and widely used in plywood, trim moldings and commercial furniture. But it's not a true mahogany. Lauan is one of many woods that are loosely called "Philippine mahogany." They all come from the Far East, are generally identified by their color, and have varied properties. The redder varieties are heavier and much more rot resistant than the lighter varieties, for example.

Most of the Lauan sold in the U.S. as lumber and plywood is pretty consistent. It's a softer and lighter wood than American mahogany, dents easily with your fingernail and has a tendency to splinter. It has little of the beautiful figure of American mahogany and a much coarser texture. For the most part, you shouldn't use it as the show wood on a piece of fine furniture, but you can use it on the inside of a piece made from American mahogany or Khaya.



What Is Interlocked Grain?

The ribbon-stripe appearance of American mahogany and its look-alikes comes from a peculiar cell structure called "interlocked grain." The striping is most noticeable when boards are quartersawn, that is, when the growth rings are at right angles to the wide face of the board.

Each stripe reflects a change in the slope of the grain, or fiber direction. Many tropical trees grow in a spiral pattern (rather like the threads of a wood screw). The spiral pattern periodically reverses direction from one growing season to another.

Interlocked grain is both an opportunity and a challenge. It's an opportunity to create a visually stunning effect, where each stripe can change from dark to light as you walk around a polished piece of wood. The challenge is in planing and sanding the wood without tear-out, because its fibers run in two completely opposite directions. Fortunately, today's high-speed benchtop planers and random-orbit sanders have made this job a lot easier. **AW**

Sources

Certainly Wood
(716) 655-0206, www.certainlywood.com
Mahogany and related veneers

West Penn Hardwoods,
(888) 636-9663
www.westpennhardwoods.com
Solid American mahogany, Khaya and Sapele,
plainsawn or quartersawn

A man with short brown hair, wearing safety glasses and a red t-shirt, is working on a dark-stained wooden chair in a workshop. The chair is positioned on a light-colored wooden workbench. The man is using a hand saw to cut through a wooden block that is clamped to the chair's seat. Several other wooden blocks are clamped to the chair's backrest and legs. A bottle of wood glue is visible on the workbench. The background shows a workshop environment with various tools and equipment.

**Tricks for
taking it apart
and getting
it back
together.**



by Randy Johnson

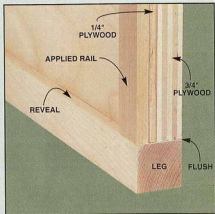
Sandwich Construction

Sandwich construction uses readily available thicknesses of plywood to create thicker panels. It also lets you produce a panel that has two very good-looking sides because the best side of each piece of plywood faces outward.

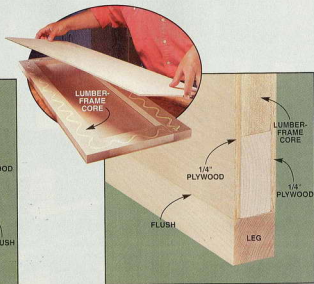
There are two basic ways to create a sandwich panel. The first is to simply glue two pieces of plywood back to back. This is the approach we used for the end panels in this bookcase (see photo, below left). This approach works well for cabinet parts that will be fastened to other

cabinet parts, such as the ends of this bookcase, which are biscuited and glued to the subtop and the bottom shelf. The reason for fastening these end panels is because the plywood parts that make up the panels are different thicknesses (1/4 in. and 3/4 in.), so there is a risk of warping. However, if the sandwiched plywood parts are the same thickness, the chance of warping is greatly reduced. Such panels can even be used where they won't be fastened down, as for cabinet doors or adjustable shelves.

The second way to create a sandwiched panel is to use a center core with a layer of plywood glued to each side (see photo, below right). The center core can be either a lumber frame or another piece of plywood. The lumber-frame approach has the advantage of letting you produce a panel of precise thickness that weighs less than one made with a plywood core. Either core will make a sandwich that is resistant to warping.



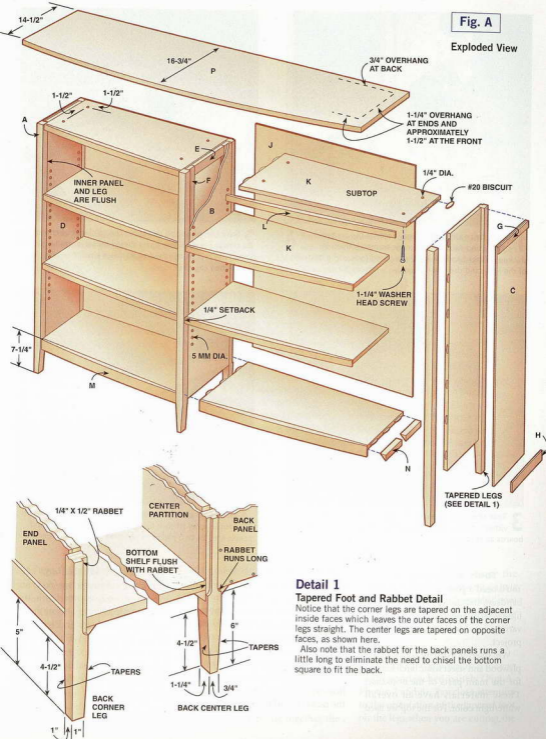
Gluing together a 3/4-in. and a 1/4-in. piece of plywood creates the end panels for this bookcase. This sandwiched panel is then trimmed to final size, and the legs and applied rails are added. The final result is an end panel that is flush on the inside with a frame-and-panel look on the outside.

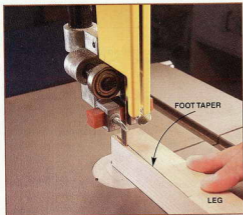


Gluing two pieces of 1/4-in. plywood over a lumber-frame core creates the center panel for this bookcase. This creates an extra-thick but lightweight panel that is exactly the same thickness as the legs. With a lumber frame on the inside, you can custom-make panels any thickness you want.

Fig. A

Exploded View

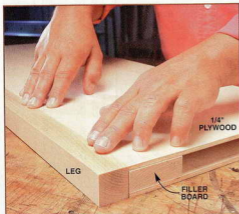




1 Start by making the legs, because the center sandwiched panel will be made to match them in thickness. After band-sawing the tapered foot at the bottom of the legs, sand the taper smooth.



2 Saw the plywood parts for the sandwiched end and center panels. These parts should be cut oversize at this point. They will be trimmed to final size after they are sandwiched together.



3 Test the center panel to make sure it is flush on either side of the leg. Adjust the thickness of the filler boards as needed.



4 Glue and clamp together the sandwiched panels. The center panel (shown here) uses filler boards. The end panels are just two pieces of plywood sandwiched together.

Tools and Materials

You'll need a planer, jointer, tablesaw, bandsaw, belt sander, biscuit joiner, jigsaw, drill and finish sander, plus various hand tools, to complete this project.

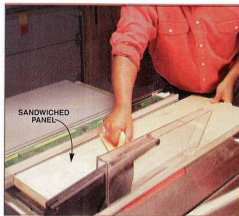
We used uniform light birch plywood and select white birch lumber for the main parts of the bookcase. These materials have an overall white/light color. For the top we used

flame white birch that has a wonderful figure and grain pattern.

It takes about 2-3/4 sheets of plywood and 30 bd. ft. of lumber to build this bookcase. The wood costs about \$350 (see Sources, page 67). If you use natural birch instead, it will cost about half as much to build. Natural birch contains darker heartwood and is what you find on the racks at most home centers.

Start with the Legs

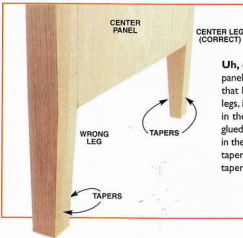
Joint, plane and cut the legs (A) to final size. Then band-saw and finish-sand the tapered feet (Photo 1). Note that the center legs and the end legs have different sides tapered (Fig. A, Detail 1, page 59). The legs are done first because the center sandwiched panel will be made to match the thickness of the legs (Photo 3).



5 Trim the glued-up sandwiched panels to final width. Cut a little off each edge so both edges are straight and parallel to each other.



6 Saw the sandwiched panels to final length. This is easy to accomplish with the help of a tablesaw sled. Cut a little off both ends so they are parallel to each other and square to the edges of the panels.



Oops!

Uh, oh. We glued the wrong leg to the front of the center panel! This is an easy mistake to make when working with parts that look very similar. To avoid this blunder, carefully mark the legs, indicating which ones go on the ends and which ones go in the center. Also, mark which edges get cut for biscuits and glued to the panels, because it's also easy to cut the biscuit slots in the wrong edge of a leg. The center legs on this bookcase have tapers on opposite sides of the leg, whereas the end legs have tapers on the inside surfaces.

Build the Sandwiched Panels

Saw the plywood parts for the center partition and the end panels (parts B, C and D, and Photo 2). See the Cutting List, page 67, for dimensions and the Plywood Layout (Fig. F) for a recommended cutting plan. Pay attention to which side of the plywood looks best. You want to pick the best side to face out on the glued-up sandwiched panels.

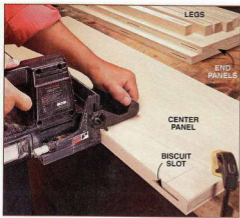
Next make the fillers (E and F) for the center partition and check that they're the correct thickness (Photo 3). It's tempting to use 3/4-in. plywood for these fillers because $3/4$ plus $1/4$ plus $1/4$ equals $1-1/4$, right? Not when it comes to plywood. Plywood is often $1/32$ in. or more thinner than its specified thickness. This can have a noticeable effect on the final thickness of a sandwiched panel.

Proceed with gluing together the

plywood parts that form the sandwiched center and end panels (Photo 4). When the glue is dry, trim the sandwiched panels to final size (Photos 5 and 6).

Add the Legs

Use biscuits and glue to attach the legs to the sandwiched panels (Fig. A, Photos 7 and 8). Pay close attention to the orientation of the tapered foot on the legs when you are cutting the



7 Cut slots for biscuits in the edges of the panels and the corresponding sides of the legs. The biscuits help keep the legs and panels aligned when they are glued together.



8 Glue and clamp the legs to the panels. The center panel is flush on both sides of the legs but the end panels are flush only to the inside of the legs. It's not necessary to put glue on the biscuits since they are mainly for alignment.



9 Rout the rabbets in the back of the rear legs. The plywood back fits into this rabbet once the case is assembled. The center leg gets two rabbets and the side legs get only one rabbet.



10 Taper the front edge on the shelves: using a tablesaw tapering sled. This is necessary because the bowed front of the bookcase makes the shelves wider at one end than the other.

biscuit slots (Fig. A, Detail 1). It's easy to make a mistake here and cut slots in the wrong face of the legs (see Oops!, page 61). Also note that the legs are flush with both sides of the center panel but are flush only with the inside of the end panels.

After the legs are attached to the end panels, add the applied top and bottom rails (parts G and H, Fig. A). Complete the three panels by routing the rabbets in the back legs (Photo 9

and Detail 1). The 1/4-in. plywood backs (J) will fit into these rabbets once the case is assembled.

Make the Curved Shelves

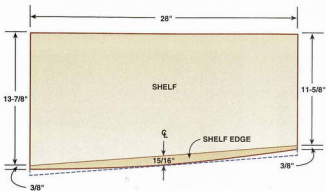
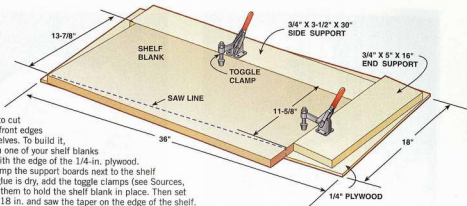
The curved front shelves and subtops start out as rectangular plywood parts (K) and are tapered on the front edge using a tapering sled (Fig. B) on your tablesaw (Photo 10). To make left and right tapers on the same sled, cut four of these parts best-side up and four

best-side down. This gives you three left shelves and three right shelves, all with their best side up, plus a left and right subtop.

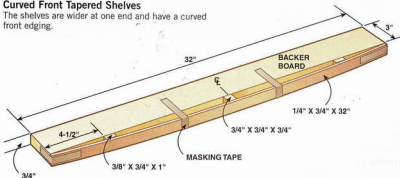
Next, glue the solid-wood edging (L and M) to the tapered edge of the shelves and subtops (Photo 11 and Fig. C). Pay attention that the edging is flush with the good (top) side of the shelves. It doesn't matter which face the edging overhangs on the subtops, just be sure you make one left and one

Fig. B**Tablesaw Tapering Sled**

This sled is used to cut the tapers on the front edges of the plywood shelves. To build it, draw a saw line on one of your shelf blanks and line this up with the edge of the 1/4-in. plywood. Then glue and clamp the support boards next to the shelf blank. When the glue is dry, add the toggle clamps (see Sources, page 67) and use them to hold the shelf blank in place. Then set your saw fence to 18 in., and saw the taper on the edge of the shelf.

**Fig. C****Curved Front Tapered Shelves**

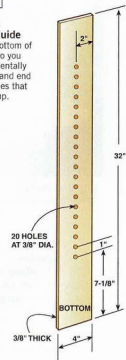
The shelves are wider at one end and have a curved front edging.

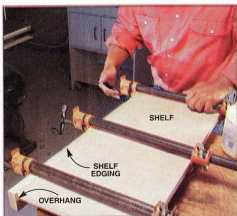
**Fig. D****Curved Tracing Jig**

This jig is used to draw the curves on both the shelves and the bookcase top. The small spacer blocks can be glued to the backer board and then the thin wood strip can be held in place with masking tape.

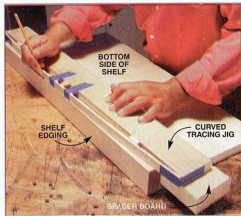
Fig. E**Shelf Pin Drilling Guide**

Mark the bottom of the guide so you don't accidentally flip it over and end up with holes that don't line up.

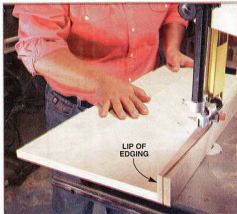




11 Attach the solid-wood edge to the shelves and subtops. Let the ends of the wood edging run a little long. After the glue is dry, use a hand saw to trim the overhanging ends flush with the ends of the shelves.



12 Use a tracing jig to draw a curved line on the bottom side of the shelf edging. Drawing it on the bottom side makes band-sawing easier (Photo 13). Use a spacer board to support the tracing jig while drawing.



13 Use a bandsaw to cut the curve into the shelf edging with the lip of the edging pointing up.



14 Sand the curved edging smooth. Start with a belt sander and finish up with an orbital sander or by hand.

right. Use the curved tracing jig (Fig. D) as a guide to draw the curves on the bottom of the edging of the shelves and subtop (Photo 12). Then band-saw and sand the edging to final shape (Photos 13 and 14).

Assemble the Bookcase in Stages

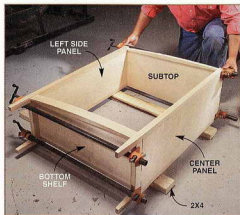
Start by cutting biscuit slots in the ends of the bottom shelves and subtops, and the joining surfaces of the center and

end panels (Fig. A). Remember that the shelves are flush with the rabbet at the back of the legs (Detail 1) and set back 1/4 in. from the front of the legs (Fig. A).

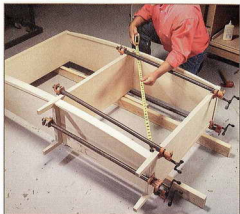
Gluing and clamping these parts together is a two-stage process (Photos 15 and 16). Practice each stage without glue to make sure the parts line up correctly and to get a feel for how they go together. Get a helper to assist with holding the parts. Make sure the case is square before leaving it to dry.

After the case is glued up and dry, flip it over on its top and add glue blocks (N) to the under side (Photo 17). Glue blocks are an easy way to add strength to the case. After the glue is dry, turn the cabinet right-side up and drill the shelf-pin holes using a self-centering bit (see Sources, page 67) and a shop-made drilling guide (Photo 18 and Fig. E).

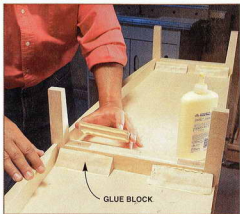
Now is a good time to take the four remaining shelves back to the tablesaw



15 Glue and clamp together one half of the bookcase first. It's a good idea to test-assemble these parts before you use glue. Propping up the cabinet on a couple of 2x4s makes it easy to check that the parts are correctly aligned on the back edges.



16 Add the second section of the bookcase once the glue in the first section is completely dry. Again, check that everything is square before leaving it to dry.



17 Flip over the bookcase and add glue blocks to the bottom. They add an extra measure of rigidity and strength to the legs and case.



18 Drill 5mm holes for the shelf pins using a self-centering bit and a drilling template. Align the template flush with the front legs and the rabbets at the rear.

and cut 1/16 in. off one end of each shelf. It doesn't matter which end, because you're just trying to provide some clearance so they're easy to install and remove from the cabinet. A regular tablesaw sled makes this step easy and safe. Add a 1/4-in. plywood spacer under the bottom of the shelf to accommodate the overhang of the edging and cut the shelves good-side up. This way, if any chipping occurs, it will be on the under side of the shelf.

Complete this phase of assembly by attaching the plywood back panels (J) (Photo 19).

Make the Solid-Wood Top

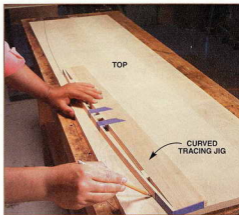
After selecting the boards for the curved top (P), plane them to thickness and joint the edges square. Use boards long and wide enough to produce a glued-up top that is about 1 in. oversize in length and width. You will cut the top to final size after these boards are

glued together.

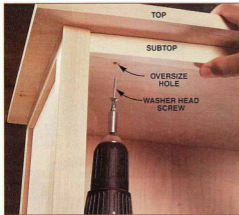
Cut biscuit slots about every 6 in. along the joining edges. Keep the slots in a couple of inches from the ends so you don't expose them when trimming the top to final length. Biscuits help keep the boards aligned during clamping, but don't expect to have perfectly flush joints everywhere. You will most likely have a few ridges that will need to be scraped or sanded. Also, don't worry if the top develops a little



19 Attach the back with pan head screws. Drilling pilot holes first makes driving the screws a lot easier. The back is now removable, which makes finishing easier later on.



20 Draw the curve on the top of the bookcase using the same tracing jig you used for the shelves. Draw one side of the curve first and then the other.



21 Attach the top using washer head screws. The holes in the subtop are oversized to allow for seasonal movement of the solid-wood top.



22 Disassemble the bookcase and finish it with your favorite finish. A clear satin varnish looks great on white birch.



Washer head screws are commonly used to attach drawer fronts to drawer boxes, but they also work great for attaching tops to cabinets. The large washer head holds tight without digging into the plywood. Once you've tried them you'll find many uses for them. They're available in 1-1/4, 1-1/2 and 1-3/4 in. lengths (see Sources, page 67).

twist after it's glued up. Our top ended up about 1/2-in. high at one corner but easily pulled flat when we screwed it onto the bookcase.

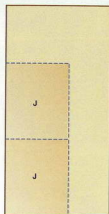
After you have the boards for the top glued up, cut it to final length. Next, mark the final width at the middle and use the tracing jig to draw the curve (Photo 20). Cut the curve with a jigsaw and sand it smooth. Attach the top to the subtop with washer head screws (Photo 21).

Finishing

Now that you have the bookcase all together you get to take it apart for finishing (Photo 22). Remove the top, the adjustable shelves and the backs. This makes finishing the parts easier and putting it back together simple, since you know all the parts fit correctly. We used a clear satin varnish on our bookcase. It brought out the grain and gave it a warm natural look. **AW**

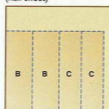
Fig. F

Plywood Layout

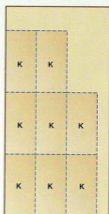


1/4" White Birch Plywood

(half sheet)

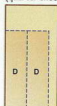


1/4" White Birch Plywood



3/4" White Birch Plywood

(quarter sheet)



3/4" White Birch Plywood

Cutting List Overall Dimensions 62-1/4" W x 42" H x 16-3/4" D

Part	Name	Qty.	Dimensions			Material	Notes
			T	W	L		
A	Legs	6	1-1/4"	1-1/4"	41-1/4"	6/4 birch	
B	Center partition panels	2	1/4"	12-1/4"	36-1/4"	birch plywood	Add 1/2" to width and length for rough sawing
C	Outer end panels	2	1/4"	10"	36-1/4"	birch plywood	Add 1/2" to width and length for rough sawing
D	Inner end panels	2	3/4"	10"	36-1/4"	birch plywood	Add 1/2" to width and length for rough sawing
E	Short filler boards	2	7/8"	2-1/2"	7-1/4"	birch	Plane thickness to fit (see Photo 3)
F	Long filler boards	2	7/8"	2-1/2"	36-1/4"	birch	Plane thickness to fit (see Photo 3)
G	Applied top rails	2	5/16"	1"	10"	birch	Plane thickness to be flush with side of legs
H	Applied bottom rails	2	5/16"	2-1/4"	10"	birch	Plane thickness to be flush with side of legs
J	Back panels	2	1/4"	29"	34-3/4"	birch plywood	
K	Tapered shelves and subtops	8	3/4"	14"	28"	birch plywood	Rough width, finished width is 13-7/8" at wide end and 11-5/8" at narrow end
L	Edging for shelves and subtop	6	1"	1"	29"	5/4 birch	Rough length, trim to final length after gluing to shelves and subtops
M	Edging for bottom shelves	2	1"	2-1/4"	29"	5/4 birch	
N	Glue blocks	8	1"	1"	3-1/2"	5/4 birch	
P	Curved top	1	3/4"	16-3/4"	62-1/4"	4/4 flame birch	Glue up from narrower boards

Sources

Paxton Woodcrafters' Store,
(800) 325-9800
6/4 select white birch: \$6.40/bd. ft.

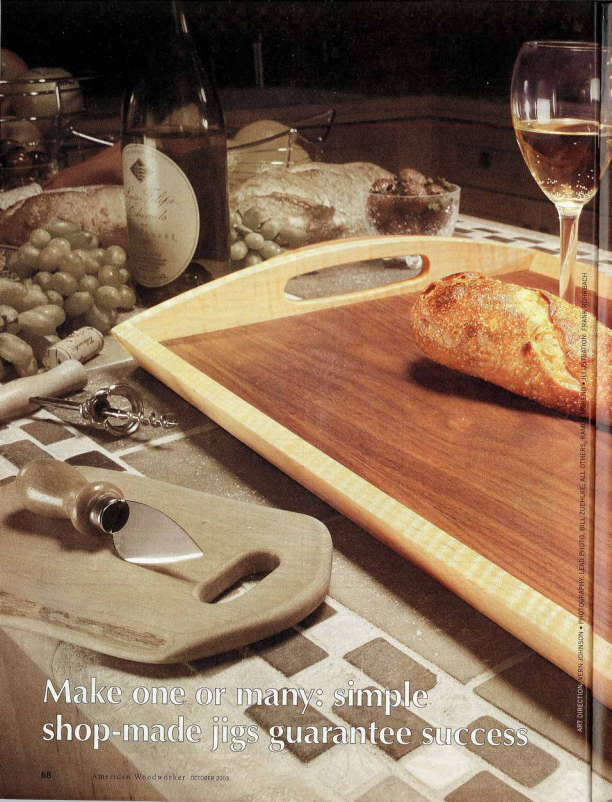
Youngblood Lumber, (800) 933-1335
www.youngbloodlumber.com
3/4" uniform light birch plywood; \$75 per full sheet, \$21 per quarter sheet.
1/4" uniform light birch plywood; \$46 per full sheet, \$25 per half sheet.

West Penn Hardwood, (888) 636-9663
www.westpennhardwood.com
4/4 flame white birch; \$5/bd. ft.

Woodworkers Hardware, (800) 383-0130
www.wwhardware.com
1" washer head screws, #SCLP8X1;
\$4 per 100
1-1/4" washer head screws, #SCLP8X114;
\$4 per 100
1-1/2" washer head screws, #SCLP8X112;
\$4 per 100
5mm steel shelf pins, #G402BN; \$3 per 20.

Woodworkers Supply, (800) 645-9292
www.wwsupply.com
Rabbeting router bit, #819-647; \$18 ea.
Toggle clamp, #173-001; \$10 ea.

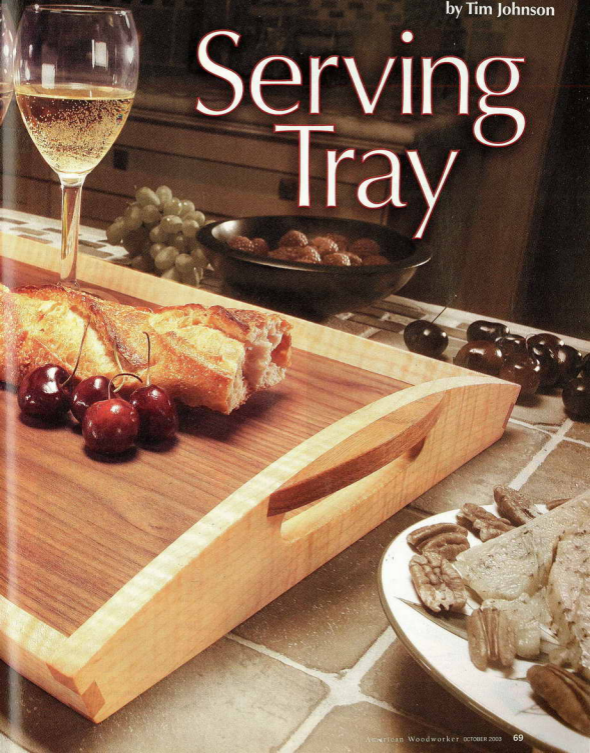
Lee Valley, (800) 871-8158
www.leevalley.com
5mm self-centering drill bit, #04J05.05;
\$7 ea.

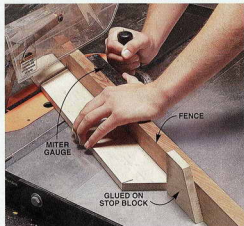


Make one or many: simple shop-made jigs guarantee success

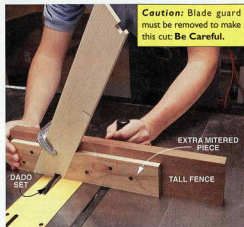
by Tim Johnson

Serving Tray





1 Miter the end pieces, using a stop block, so they're all the same length. From the same setup, miter the extra pieces you'll need to make the jig for the next step (Photo 2).



Caution: Blade guard must be removed to make this cut: **Be Careful.**

2 Cut dados in the mitered ends, using a dado set. A jig made from extra mitered pieces makes dadoing safe, precise and repeatable.



Caution: Blade guard must be removed to make this cut: **Be Careful.**

3 Cut beveled edges on the sides and angled grooves to house the plywood bottom. Use a regular blade to cut the groove, making two or three passes, so the plywood fits snugly.

Snacks, hors d'oeuvres or breakfast in bed: this tray delivers the goods in style. It weighs almost nothing, but it's built to last, and it requires so little wood that you probably won't even have to go to the lumberyard.

The jigs we've designed allow you to make these elegant trays in multiples. It's a good idea to make a practice tray as you make the jigs, so you can test the results and make adjustments.

The cool-looking corner joints are easy to make on the tablesaw, thanks to a simple miter gauge jig and a couple of fences. Shop-made routing sleds allow you to template-rout the arched ends, rounded cutouts and curvy handles on the router table. We've even devised a surefire clamping procedure, for gluing. If you follow our how-to, you're sure to succeed.

Tools

You'll need a dado set for your tablesaw and a pattern bit for your router table (a pattern bit is a flush-trim bit with the bearing mounted between the cutting flutes and the shank; see Sources, page 75).

You'll also need a planer to mill the 1/2-in.-thick sides and ends, a jigsaw to rough-cut the curves, and a drill press with a 7/8-in. Forstner bit to establish the curved ends of the handle cutouts.

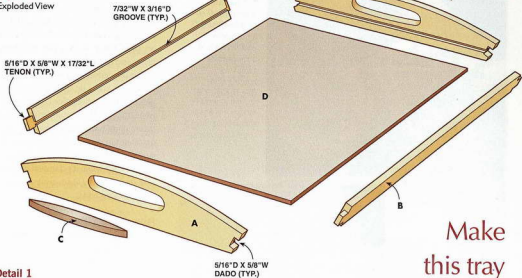
We used a disc sander and a half-round file to true the roughsawn arches and cutouts on our 1/4-in.-thick routing templates. If you don't have a disc sander, smooth out the arches with a sanding block.

Miter the Ends First

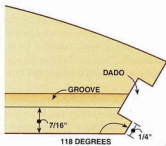
Cut the blanks for the sides, ends and handles (Fig. A, Parts A through C). Make extra parts of each, for testing your setups and to use in the jigs you'll be making.

Set your miter gauge 28 degrees from perpendicular (at either 62 degrees or 28 degrees, depending on how your miter gauge is calibrated) and attach a long fence. Then miter one end of all your end blanks (A).

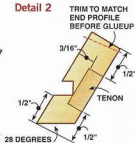
Fig. A
Exploded View



Detail 1



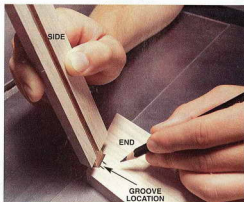
Detail 2



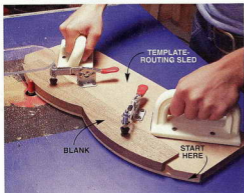
Make
this tray
from a couple
precious pieces
you've been
saving.



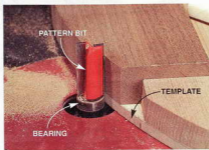
4 Cut half-lap tenons on the sides, using the miter gauge, a sacrificial fence and your dado set. The fence setting determines the tenon's length. The tenon's width and thickness are determined by blade height.



5 Transfer the location of the groove from the side to the end, after assembling the corner joint. This method is more accurate than using a ruler.



6 Rout both handles from one piece of wood, using a flush-trim pattern bit and a shop-made template-routing sled (Fig. B, page 75).



On the bottom edge of one end blank, mark the 13-3/4-in. final length, measuring from the mitered end. Use this marked blank to install a stop block on your fence so you can miter the other end of the blanks (Photo 1).

Cut the dados (Fig. A, Detail 1) with a dado set and a jig that holds the end piece on its beveled edge (Photo 2). To make the jig, attach a tall fence to your miter gauge and fasten two of your extra mitered pieces to the fence. Be sure the end's bottom edge rests flat on the saw table when it's clamped in place. The dado starts 1/4 in. away from the end's bottom edge.

Bevel the Sides

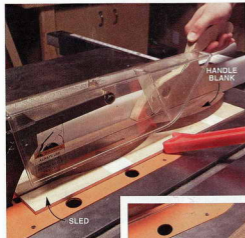
Tilt the table saw's blade to 28 degrees so you can bevel the bottom edges of the sides (Fig. A, Detail 2). The bevel angle is the same as that on the mitered ends. To get a smoothly sawn surface, make two beveling passes. First establish the bevel by setting the rip fence to leave the blank slightly wide (about 1/16 in. oversize). Then reset the fence and make a light clean-up pass to final width.

Leave the blade at the same angle to cut the grooves for the plywood bottom, starting 1/2 in. from the bottom edge (Photo 3).

Fit the Corner Joints

Set up the saw to cut the half-lap tenons on the sides. You have to remove the blade guard for this procedure, so be careful. Install the dado set and lower it below the saw table. Then make a sacrificial fence to house the dado set, so you can crosscut the tenons to length (Photo 4).

Setting the blade height to cut the cheeks and bottom faces of the tenons is fussy, because the tenons have to fit just right. Use the dados on one of the end pieces to mark the location of the tenons on an extra side piece. Then cut the tenon cheeks, starting out "fat," and adjust the blade height until you get the proper fit. Cut the back face of the



7 Saw the handles from the blank, using a sacrificial sled—nothing more than a scrap of plywood. Fasten the blank to the sled with double-faced tape, so the small handles stay attached and stable after the cut.



tenon last. This cut removes the slot for the plywood bottom, so it won't show when the tray is assembled.

Fit the Plywood Bottom

The last joinery step is to cut grooves in the end pieces for the bottom. Dry-fit the sides and ends so you can transfer the location of the grooves (Photo 5). Cut these grooves straight, not angled like the ones in the sides, but use the same multiple-pass technique to make them wide enough.

Dry-fit the tray's bottom, to make sure it fits. Lay one of the ends flat on your bench and insert the bottom into the groove. Then engage the bottom in the side's grooves and slide them down to meet the end. If the bottom is too wide, the tenons won't fit. If the bottom is too long, you won't be able to install the other end.

Make Sleds for Routing the Curves

All of the curved shapes are template-routed, using two shop-made sleds, for safety (Figs. B and C, page 75).

Each sled consists of a template, a fence and two stops. Toggle clamps hold the blanks securely and push blocks give you excellent control of the sled (see Sources, page 75).

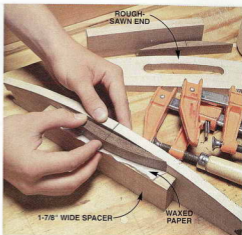
Use a photo copier to enlarge the patterns (1 and 2, page 74) for the templates by 256 percent. Because copiers aren't always accurate, check your enlargements and make necessary adjustments so your patterns match the stated dimensions.

Saw the Blanks Oversize

Install each blank in the sled and mark the curves and cutouts. Then rough-saw the blanks to within 1/16 in. of the lines. To cut out the handles, you'll have to drill a pilot hole for your jigsaw blade on the end pieces. If you have a drill press, install stop blocks and drill 7/8-in.-dia. holes near each end of the cutout. Then simply saw out the middle.

8 Glue the handles on the roughly-sawn ends.

Use centerlines and a spacer to hold the handle level and at the right height. Waxed paper keeps the spacer from accidentally getting glued on.

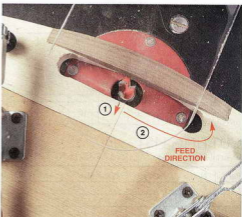


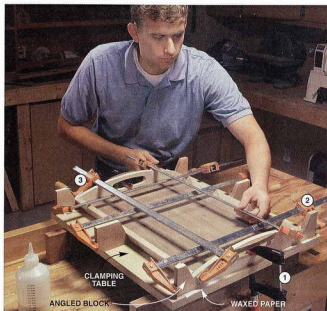
9 Rout the arched end and the handle at the same time, using a sled and a pattern bit (Fig. C, page 75). Be especially careful not to blow out the protruding front end of the handle.



10 Rout the handle hole.

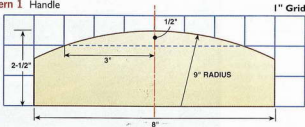
With the power off, center the bit in the hole. Make sure the sled doesn't move when you power up. Push the sled forward into the bit (1) and advance the cut counterclockwise around the inside of the hole (2). Make very light passes and go slowly.



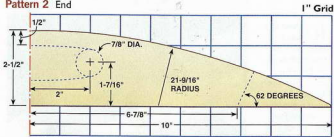


11 Angled blocks and a flat surface put clamp pressure on the joints. First clamp the ends to a piece of MDF (1). Then clamp the sides to the ends, using angled blocks (2). Finally, clamp the ends to the sides (3).

Pattern 1 Handle



Pattern 2 End



CUTTING LIST

Overall Dimensions: 2-1/2" H x 14-15/16" W x 21-15/16" L

Part	Name	Qty.	Blank Size	Final Size	Notes
A	End	2	1/2" x 2-3/4" x 18"	1/2" x 2-1/2" x 13-3/4"	*length of bottom edge
B	Side	2	1/2" x 1-3/4" x 22"	1/2" x 1-5/8" x 21"	**17/32" L tenons on ends
C	Handle	2	3/4" x 2-3/4" x 16"	3/4" x 1/2" x 6"	***two handles per blank
D	Bottom	1	1/4" x 14" x 21"****	1/4" x 13-7/16" x 20-1/4"	****plywood

Make the Handles

Both handles are routed and sawn from a large blank, because they're too darn small to safely machine individually (Photos 6 and 7).

You have to rout into the grain on the front side of each arch, so make light passes and go slowly to avoid tear-out. The routing sled is a big help, because it gives you such great control of the workpiece.

Sawing the narrow, rounded handles free from the blank is easy and safe when you use a simple plywood sled (Photo 7). Without the sled to stabilize the small off-cut handles, it's possible for them to spin back into the blade and kick back.

It's important to saw the handles accurately, 1/2-in. wide at the center. Sawing a bit wider makes them a lot longer; sawing a bit thinner makes them a lot shorter.

When you set the fence, remember that the handles are offcuts—you have to compensate for the saw kerf.

Attach the Handles to the Ends

Cut 1-7/8-in.-wide spacer blocks to hold the 3/4-in.-thick handles at the right height for gluing (Photo 8). Mark centerlines on the handles. Apply a thin bead of glue and rub the handle back and forth against the end. Let the joint sit for a couple of minutes before clamping, so the pieces won't slide around when you apply pressure.

Rout the Arches and Handle Holes

Routing the arches is similar to routing the handles. Be careful on the front side of the arch and take advantage of the control the sled gives you (Photo 9).

To rout the handle hole, move counterclockwise around the inside edge (Photo 10).

Assembly

Dry-fit the tray, including the bottom. The sides will be slightly taller than the ends (Fig. A, Detail 2, page 71). Plane or sand them flush. Finish-sand all of the parts prior to gluing and clamping.

It's best to glue the tray together all at once (Photo 11). This requires careful clamping, so use glue that sets up slowly. Gluing the bottom in addition to the corner joints makes the tray very rigid. Don't go crazy with the glue, or you'll have a lot of squeeze out to clean up. Just coat the mortises in the ends and run a bead in all the grooves for the bottom.

You'll need a 20-in. x 22-in. clamping table (we used 3/4-in. MDF), five 24-in.-capacity adjustable clamps and two small clamps to hold the ends flat to the clamping board. We used 2x4 risers to make room for the end clamps. Our angled clamping blocks were offcuts.

Spray on the Finish

After gluing, you'll have to do some touch-up sanding to flush the joints and round any sharp edges. Vacuum the tray, wipe it with a tack cloth and it's ready for finishing.

Aerosol-spray polyurethane is a perfect finish for this project. Set the tray upside-down and spray the bottom and outer sides first. After the poly is dry, turn the tray over and spray the inside and the top edges. Spray three coats on each side, sanding between each coat. *AW*

Sources

Seven Corners Hardware, (651) 224-4859
www.7corners.com
Top bearing flush-trim pattern bit, 1/2-in. dia.; 1-in. flute; 1/4-in. shank, Freud 50-102; \$26.

Highland Hardware, (800) 241-6748
www.highlandhardware.com
Toggle clamps (2; use for both sleds) #166104; \$6 ea.
Push blocks (2; use for both sleds) #031039; \$10/pair.

Routing Sleds

Shape the templates, using Patterns 1 and 2 (page 74). Fasten the fences at the bottom of the templates, exactly parallel. Then fasten the stops so they cradle the blanks dead-center on the template.

Fig. B Handle Routing Sled

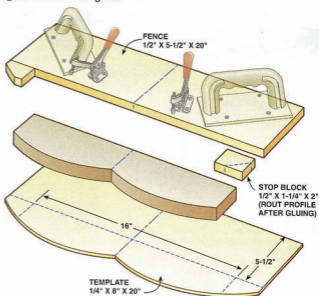
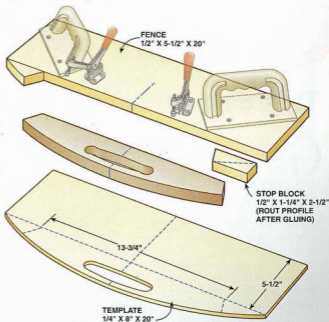


Fig. C End Routing Sled





Tool Test:

Shop Air Cleaners

by Dave Munkittrick

Take dust control to the next level

Gone are the days when a dusty shop was considered a productive shop. Now, a dusty shop is a hazardous shop. Fine dust makes a mess of everything, including your lungs. Due to this heightened awareness, dust collection has become a fast-growing area for manufacturers of woodworking equipment. Air cleaners are designed to hang from the ceiling where they can reduce the amount of fine dust suspended in your shop's air (Fig. A).

Common Misconceptions About Air Cleaners

Air cleaners are not dust collectors. They are simply not designed to collect large quantities of dust. Most air cleaners use disposable heating and air conditioning filters. These filters are designed for relatively clean, slow moving air. Filters on dust collectors are designed to take heavy dust loadings and repeated cleaning.

Don't Put the Cart Before the Horse

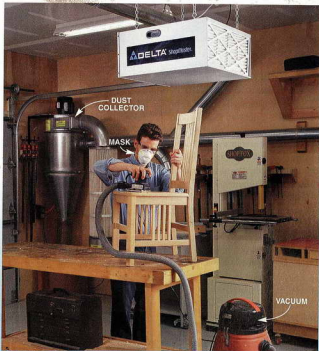
Before rushing out to buy an air cleaner, get a high-quality dust collector with proper filters first (for more on this, see AW #80, "Tool Test: Dust Collectors," page 80 and AW #100, "Central Dust Collection," page 54). Add a shop vacuum to collect from your hand-held power tools (see AW #80, "Tool Test: Shop Vacuums," page 69). Together, these two systems will capture the vast majority of the dust your shop produces. An air cleaner



Air cleaners are not dust collectors. They are designed to filter small amounts of fine dust from the air in your shop.

Air cleaners are the last line of defense in the war on wood dust. First comes a high-quality dust collector that captures the dust directly from your machines. Next comes a vacuum to capture the clouds of dust from your hand-held power tools. Finally, add an air cleaner to get what's left.

Don't forget a dust mask to protect your lungs from the dust that's on its way to your air cleaner.



How Do They Work?

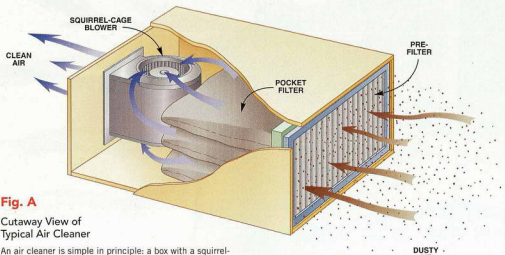


Fig. A
Cutaway View of
Typical Air Cleaner

An air cleaner is simple in principle: a box with a squirrel-cage blower run by a small (fractional hp) electric motor. The blower pulls air through two or more filters, typically a pre-filter and a pocket filter. The pre-filter protects the more expensive pocket filter from getting prematurely plugged with debris. The pocket filter captures the finest particles.

The amount of air that passes through an air cleaner is measured in cubic feet per minute (cfm).

will help capture the fugitive dust that escapes your other systems.

The Balance of Air Flow and Filtration

Effective air cleaning is a race against time. Once a dust particle becomes airborne, it's only a matter of time before it settles in your shop or lungs. To get the dust before it can settle, an air cleaner must circulate *all* the air in your shop every six minutes.

So, lots of airflow, measured in cubic feet per minute (cfm), is a good thing. But the cfm capacity of an air cleaner is only half the equation. You also need a top-notch filter to capture the fine dust. Only a few of the machines in our test successfully combined good cfm and good filtration (Fig. B).

Some machines have great filters but are less than robust in the cfm department (Fig. C). Others had lots of airflow but less efficient filters (Fig. D).

Testing Air Cleaners

Because of the technical expertise required to accurately test air filters, we took all the cleaners to Particle Tech, Inc., a professional testing lab in Minneapolis. Before the test we installed self-stick weather strip on the filter flanges of each machine to reduce leaks (see "Air Cleaner Tips" page 81). Each machine was set in a sealed test chamber where a total of 80 grams of standardized test dust was introduced in 16-gram increments called "loadings." The standardized dust we used was made up of particles that ranged in size from 100 microns to less than 1 micron. Dust that got through the machines was captured and weighed to determine how much dust the air cleaner let through.

With each loading, cfm readings were also taken to track how the airflow degraded as the filter got dirty.

Filtration

The "Blow Through" heading in the chart, page 82, tells you how many grams of the test dust got through each machine. It is a direct measure of filtration performance.

The blow through numbers are quite small, but keep in mind that this represents the smallest, most harmful particle sizes. So, a small difference in weight is actually a big difference in performance. For example, our worst performing machine let 68 times as much harmful dust through as our best performing machine. That's huge.

Manufacturers often use percentages to rate filter performance but this is misleading. In our test, the worst performer captured 91.5 percent of the dust and the best captured 99.875 percent. Long years of schooling have conditioned us to look on a 90 percent score as a great success. But that's just not the case with filtration.

Balancing Air Flow with Filter Efficiency

Fig. B

**High CFM/
High-Efficiency
Filter**

The most effective air cleaners strike a balance between high airflow (cfm) and high-efficiency filters. The higher the airflow, the faster your shop air will be cleaned. High-efficiency filters complete the equation, capturing almost all of the airborne dust sucked into the air cleaner.

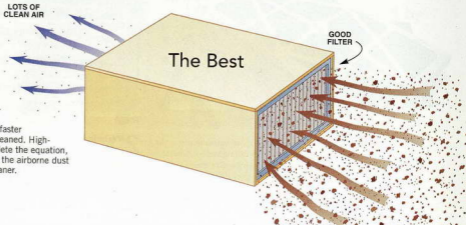


Fig. C

**Low CFM/
High-Efficiency
Filter**

Air cleaners with low cfm can't get all the dust before it settles out of the air. Even the best filter is useless if the blower fails to bring in enough air.

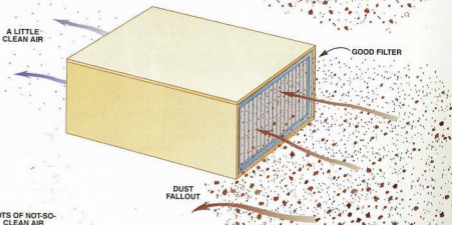
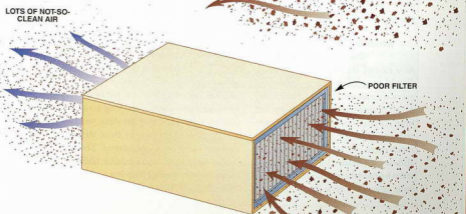


Fig. D

**High CFM/
Low-Efficiency
Filter**

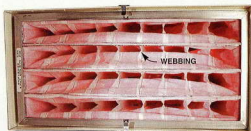
Air cleaners with low-efficiency filters allow too much dust-laden air to be circulated back out into your shop and lungs.



Features



1 Disposable pre-filters do a better job than washable pre-filters. However, washable pre-filters offer greater convenience: simply wash clean with water, dry and reuse.



2 Webbing or stitching is used on the best performing pocket filters, allowing the filter to open up like a parachute into the air stream. The webs also prevent the individual pockets from contacting each other for uniform airflow through the filters.

Real World CFM

Avoid using the manufacturer's cfm numbers when comparing air cleaners. These are often based on the blower running without the filters installed. Not a very realistic number.

We took a total of six cfm readings on each machine, starting with clean filters and once for each 16-gram loading of test dust. As the filter loads with dust, the cfm decreases. The "Dirty Filter CFM" rating in the chart is the last reading taken after all 80 grams of dust have been run through the machine. The "Average CFM" in the chart represents the average of all six readings and is a good working number to use when determining what size machine you need for your shop.

What Size Air Cleaner Do I Need?

As a rule of thumb, your air cleaner should filter all the air in your shop every six minutes. This is a minimum. An air cleaner that can do the job in less time is better because it will clean the contaminated air in your shop that much more quickly. To determine the size or how many cleaners you need, start by calculating the cubic feet of your shop (L x W x H). Divide that

number by 6 and you'll have the minimum number of cubic feet per minute, or cfm, the air cleaner needs to pull through it's filters. Use the "Average CFM" number from the chart to see if the collector you're looking at is right for your shop space.

For example, if your shop measures 15 ft. x 20 ft. x 8 ft., it contains 2,400 cubic feet of air. Divide by 6 to get the minimum cfm required, in this case 400.

Features

Pre-filters

Air cleaner pre-filters are either disposable or washable (Photo 1). The choice is yours. A disposable pre-filter will be replaced many times before the pocket filter behind it needs replacement. You may be tempted to vacuum off a disposable pre-filter, but don't. This can damage the fabric and reduce the filter's efficiency.

Washable pre-filters, on the other hand, offer convenience and long-term cost savings. When they get dirty, you simply rinse them out, let them dry and put them back into service. The money you save using a washable filter may get spent in more frequent pocket filter changes, however, because the

washables let more dust through.

Remote Control

A remote control may be important if your machine is going to be out of reach (Photo 3). On some machines the remote control is the only way to adjust speed or set the timer (a bad deal if you run out of batteries or lose your remote).

Timer and Variable Speeds

A timer and/or variable speeds are available on some machines (Photo 4). Timers are great and allow the machine to keep cleaning your shop air when you're not there. Variable speeds allow you to run your machine at a lower cfm. This reduces the noise you have to put up with, but the lower cfm also reduces the effectiveness of your cleaner.

Noise

These machines are running for long periods of time, so noise can be an issue. All the machines were relatively quiet (we're talking about a woodshop here). The trade-off for a quiet machine is lower cfm. You just can't have your cake and eat it, too.



3 Remote controls let you operate your machine when it's out of reach. We liked radio-controlled remotes the best. They don't require you to aim the remote or have a clear shot at the control panel. They even come with key slots in the back so they can be hung on the wall.



4 Timers allow you to clean the air when you're not around. Just set the air cleaner to run a few hours after you're done and you'll return to a clean shop. Variable speeds are of less value. The machine is quieter on a low setting, but for best performance, it needs to be circulating as much air as possible.

CFM numbers provided by manufacturers are often unrealistic. They're based on running the blower without the filters!

AIR CLEANER TIPS



Telltale Filter Monitor

Ribbons on the exhaust port are a visible cue that it's time to change your filters. With a clean filter installed, tie a few long ribbon "telldales" onto the exhaust grate. Then, turn on the machine and shorten them until they flutter horizontally. They'll begin to droop at about a 45-degree angle when it's time to change the filters.

Where to Locate Your Air Cleaner

Locate your machine as centrally as possible but cheat it toward areas where the dust is created. For example, a good location is over an assembly table where you do hand sanding.

For best results, especially in larger shops, buy two smaller units rather than one big one. That's because your air cleaner tends to pull hardest on the air around it leaving the far corners of your shop virtually untouched. Two cleaners can be set up to create a current around the shop to maximize the circulation of air through the machines.



Prevent Leaks

Add a gasket on the filter flange to prevent air from bypassing the filters. Some models come with a gasket on the filter flanges, but all the ones we saw were poorly installed, leaving large gaps. You can apply your own gaskets using self-stick weather strip available at hardware stores.

Recommendations

Our picks represent the optimal combination of cfm and filtration. Units that allowed more than a gram of dust through were excluded from consideration. At first glance, this may seem overly restrictive, but a small difference in efficiency can make a huge difference in effectively capturing small, health-damaging dust particles.

Runners Up

A couple of models would have made Best Buy and Editors' Choice had filtering or cfm performance been better.

The Delta 50-875 was a top Editors' Choice contender. It has great filtration

but about 11-percent less cfm than the Editors' Choice, the JDS 750-ER.

Jet put up some strong cfm numbers, but both Jet machines let more than twice as much dust through as the JDS 750-ER.

The General Int'l 10-550 comes with a remote and good cfm, all at a great price. It would have been a strong Best Buy candidate if it hadn't let through four times more dust than the Delta AP-200, our Best Buy. The same thing can be said for the Shop Fox: great cfm and good features, but it fell down on filtration. The Lee Valley 03J05.20 took top honors in filtration, but was weak on the cfm side. **AW**

Note:

An air cleaner from Harbor Freight (800-423-2567), model #46361, arrived too late to include in the laboratory testing. At \$170, it is the lowest priced machine in the group. It's quiet, and includes a radio remote control and hanging hardware. However, the filters are only capable of filtering to 20 microns.

Craftsman and Grizzly declined to participate in this tool test.

Brand & Model	Contact Phone Number	Street Price	Clean Filter CFM / Dirty Filter CFM	Average CFM	Blow Through (in grams)	Washable (W) / Disposable (D)	Remote Control	Variable Speeds *Remote Only
Delta AP-200	(800) 438-2486	\$230	582/402	498	0.2	D	none	N
Delta 50-875	(800) 438-2486	\$270	594/437	523	0.3	W	infrared	Y
General Int'l 10-600 M1	(514) 326-1161	\$320	402/242	331	3.8	D	radio (†)	Y
General Int'l 10-550 M1	(514) 326-1161	\$220	641/383	523	1.2	D	infrared	N
JDS 750-ER	(800) 480-7269	\$289	664/514	589	0.3	W	infrared	Y
Jet AFS-1000B	(800) 274-6848	\$240	674/383	528	0.8	D	infrared	Y*
Jet AFS-1500	(800) 274-6848	\$325	899/737	823	0.65	D	infrared	Y*
Lee Valley #03J05.01 AB 500	(800) 871-8158	\$195	271/242	257	0.3	W	none	N
Lee Valley #03J05.20 AB 760	(800) 871-8158	\$279	402/297	351	0.1	W and D	none	Y
Penn State AC620	(800) 377-7297	\$240	242/45	139	2.05	W	radio (†)	Y*
Shop Fox W1690	(800) 840-8420	\$265	685/484	596	1.8	D	infrared	Y*
Woodtek 923-838	(800) 645-9292	\$200	171/99	146	3.6	W	none	N
Woodtek 923-859	(800) 645-9292	\$250	271/223	241	6.8	W	radio (†)	N

(†) manual switch to select remote or manual operation.



JDS 750-ER

This is a great all-around air cleaner. The JDS has the two basic requirements sewn up: excellent cfm and great filter performance. Plus, the 750-ER adds an infrared remote, timer and variable speed. We wish it had a radio remote, but that's our only complaint.



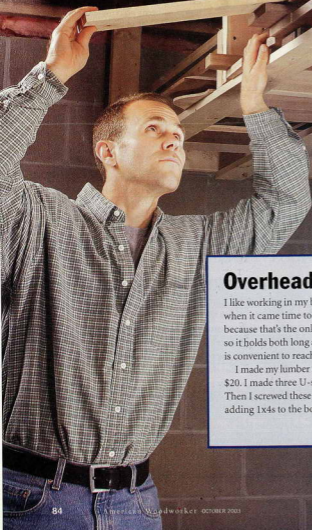
Delta AP-200

The Delta AP-200 has all the basic requirements at a low price: excellent filtering performance and high cfm. There's no remote control if you're thinking of hanging your machine up out of reach, but the switch is located on the power cord for easy access.



Timer (R)	Remote only	Ceiling Mounting Hardware Included	Size H x W x L (in")	Decibels (dB)	Comments and Features
N	Y	Y	12 x 24 x 28	65	Built-in switch in power cord. Electrostatic or charcoal pre-filter available.
Y	Y	Y	12 x 24 x 28	68	3-speed motor. Timer settings at 1/2 to 7-1/2 hour settings in 1/2 hour increments. Built-in dirty-filter indicator. Gaps in filter-flange gasket. Switch on power cord.
Y/R	Y	Y	14 x 24 x 30	64	Timer settings at 2, 4, 6 and 8 hours. 3-speed fan.
Y	Y	Y	12 x 24 x 28	65	Single speed. Timer settings at 2, 4 and 8 hours. Gaps in filter-flange gasket.
Y	Y	Y	12 x 24 x 34	65	3 speeds. Timer settings at 1, 2, 3 and 4 hours. Electrostatic or charcoal pre-filter available.
Y/R	Y	Y	12 x 24 x 30	66	Timer settings at 2, 4 or 8 hours. 3-speed fan. Electrostatic or charcoal pre-filter available. Gasket around pocket filter frame.
Y/R	Y	Y	16 x 20 x 32	68	2" thick pre-filter. Timer settings at 2, 4 or 8 hours. 3-speed fan. Comes with two filters, but has the capacity for three. Electrostatic or charcoal pre-filter available.
N	Y	Y	11 x 20 x 32	60	Filter change not tool-free. Small opening makes changing pocket filters difficult. Loose screws for filter access panel are easy to lose.
N	Y	Y	11 x 20 x 32	61	2 pre-filters. 2 speeds. Small opening makes changing pocket filters difficult. Loose screws for filter access panel are easy to lose.
Y/R	Y	Y	12 x 24 x 30	57	5 speeds. Gaps in filter-flange gasket. Higher efficiency pocket-filter upgrade available. Timer settings at 2, 4, 6 and 8 hours.
Y/R	Y	Y	12 x 24 x 30	66	3-speed fan. Gasket around pocket filter frame. Timer settings at 1, 2 and 4 hours.
N	N	Y	12 x 12 x 30	57	Polyester pocket filter is washable. Switch on power cord.
N	N	Y	12 x 24 x 30	57	Polyester pocket filter is washable. No pull chain or cord switch for manual operation. 1-micron upgrade filter available.

Small Shop Tips



Overhead Lumber Rack

I like working in my basement shop, but the floor space is limited. So when it came time to put up a lumber rack, I screwed it to the ceiling because that's the only space that was wide open. I designed the rack so it holds both long and short boards and installed it at a height that is convenient to reach but high enough so I don't bean my head.

I made my lumber rack out of 1x4s, 2x4s and 2x6s for a cost of about \$20. I made three U-shaped frames by screwing the 2x4s to the 2x6s. Then I screwed these frames to the ceiling joists. I finished the rack by adding 1x4s to the bottom edge of the frames.

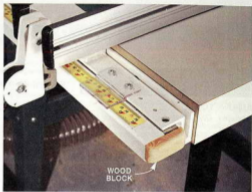
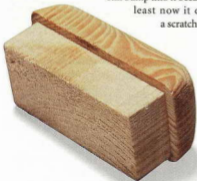
Michael Mass

No More Bruises

My shop is so small that I often bump into my tools while navigating between them. Recently, I got a nasty scrape and bruise on my thigh from the end of the fence rail on my tablesaw. To prevent further injury, I plugged the end of the rail with a rounded-over block of wood. I still bump into it occasionally, but at least now it doesn't leave a scratch.

James Hall

AW



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 your tip 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.