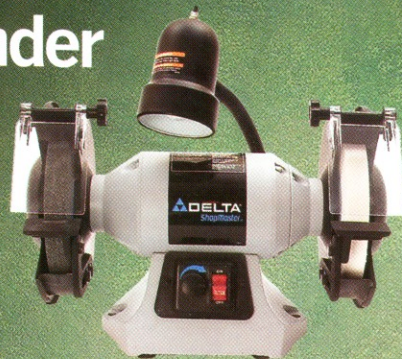


Choose the Right Slow-Speed Grinder
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Make your
Tablesaw
more accurate
to eliminate
burning
and binding



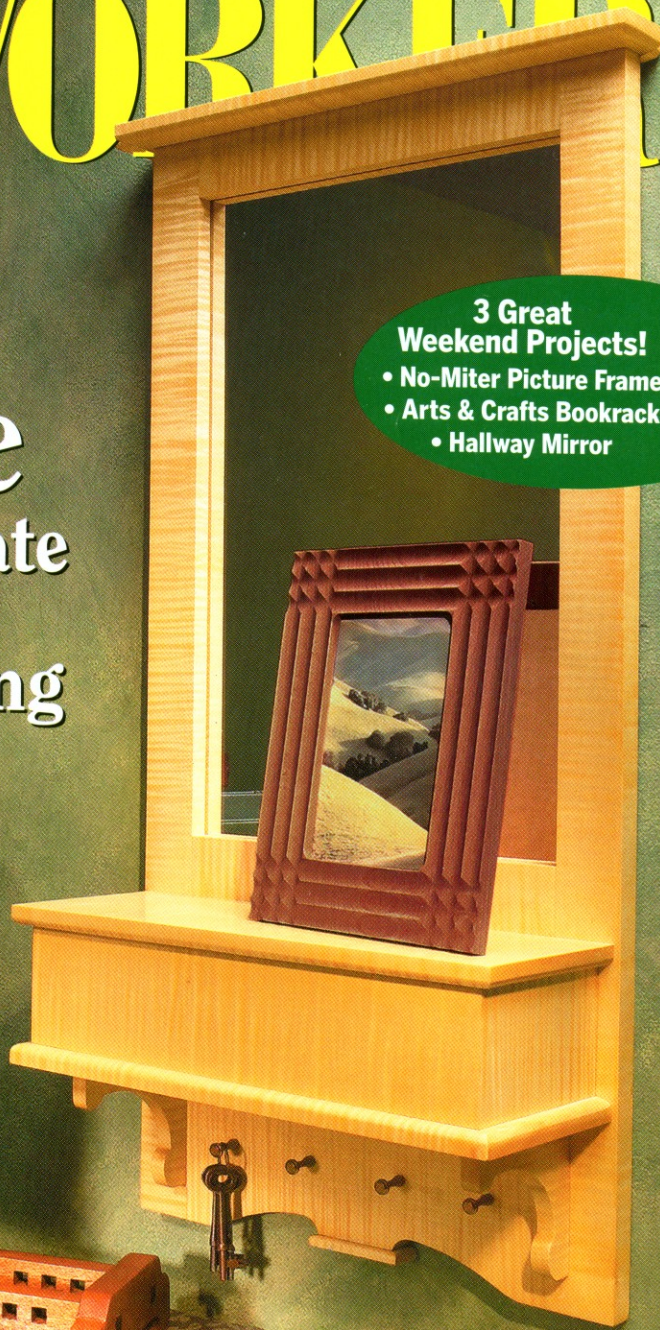
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- Arts & Crafts Bookrack
- Hallway Mirror

Tips for better
face-frame cabinets

Create gorgeous
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Solar kiln for
cheap, easy lumber

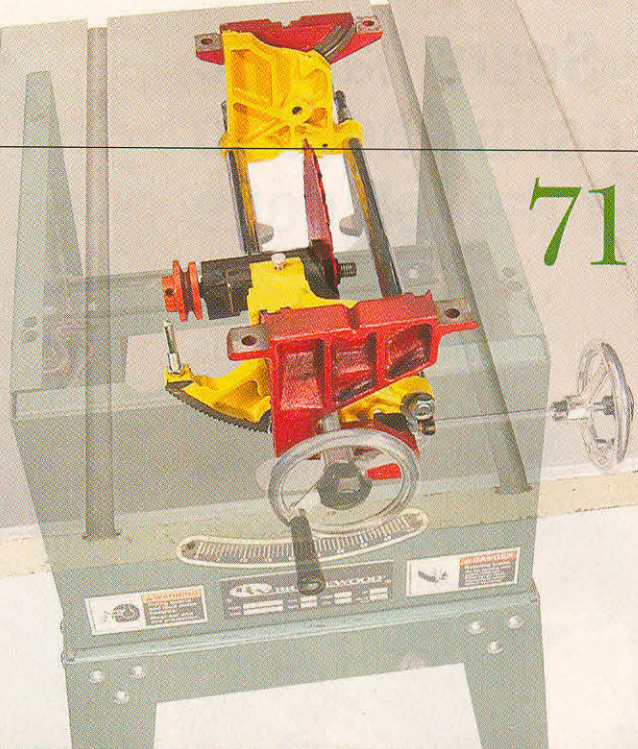


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(we counted 'em!)

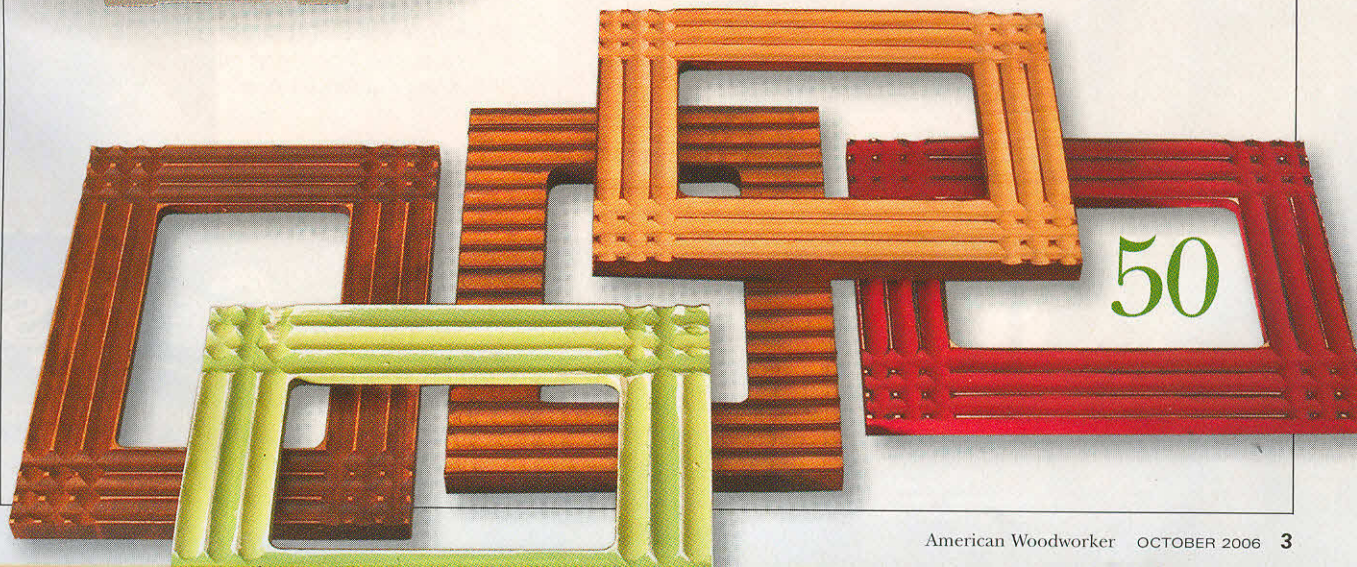
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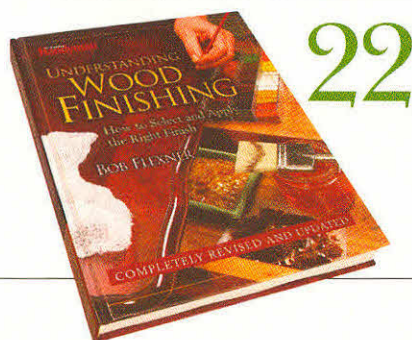
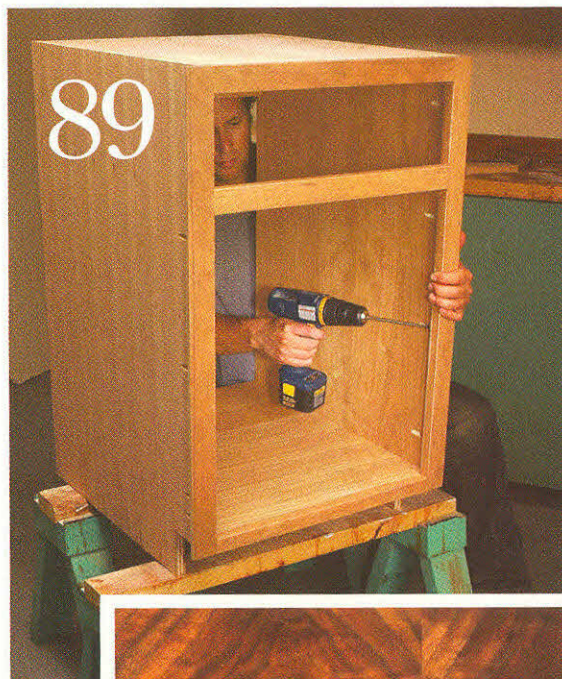
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EDITOR'S LETTER

Hiding in the Woodpile

One of my favorite games as a kid was playing hide-and-seek, and some of my favorite places to hide were behind the many woodpiles my dad had around our place. He was always on the lookout for a good deal. If a neighbor was getting rid of a pile of lumber, my dad would make a deal and add it to his collection. As an avid woodworker, he has made use of much of that acquired wood. The rest he says will be part of my inheritance. Not a bad deal, considering that hiding in those woodpiles are some very nice walnut and cherry boards. (Shhh, don't tell my brothers!)

Of course, woodpiles can hide more than boys and boards, as Luke Hartle, our editorial intern, found out while assisting Dave Munkittrick with his "Solar Kiln" story (see page 55). While they were setting up to shoot some photos, Dave asked Luke to move a pile of boards. Now Luke is avid outdoorsman, fisherman, and hunter, so he no softy. But, we'll be calling him Luke *Sky-walker* for a while because that's what he did when he pulled up the last couple of boards and exposed a nest of "giant" 6-in.-long baby bull snakes. Dave reported that Luke not only writes fast, but runs pretty fast, too.

There are certainly more relaxing ways to discover what's hiding in a woodpile. For instance, have you every tried making book-matched panels? It's a great way to use boards with unusual grain to make fascinating door panels or jewelry box lids (see "Tips for Making Book-Matched Panels," page 82). If you have a few chunks of hardwood and a lathe, check out Turning Wood on page 28 for a nifty four-in-one screwdriver project. The three other projects in this issue also take very little wood to build and, with the holiday season not far off, would make great gifts.

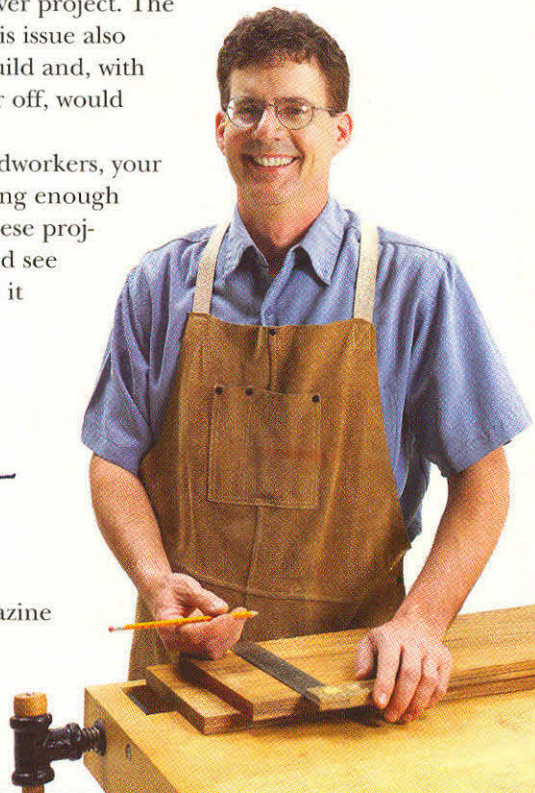
If you're like most woodworkers, your woodpile is probably hiding enough materials for several of these projects. So go dig around and see what you find—and hope it doesn't move.

Until next time,



Randy Johnson
Editor

American Woodworker magazine
randy_johnson@rd.com



The Last Plate Joiner You'll Ever Need!

Lamello



Lamello Top 20S
Biscuit Joiner

Your first plate joiner may not be a Lamello, but we're certain your last one will. It makes sense that the people who invented the technique of biscuit joining would build the world's finest plate joiner. These Swiss made, precision crafted tools are the most accurate, repeatable, rugged, reliable machines on the planet.

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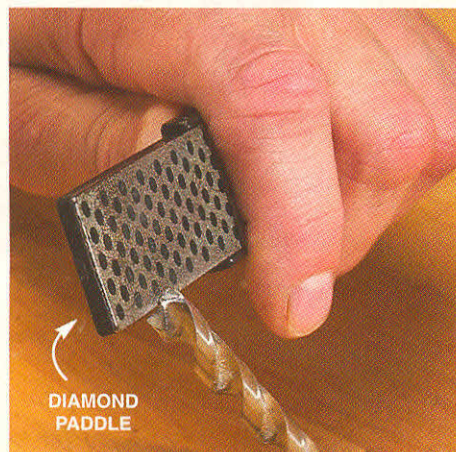
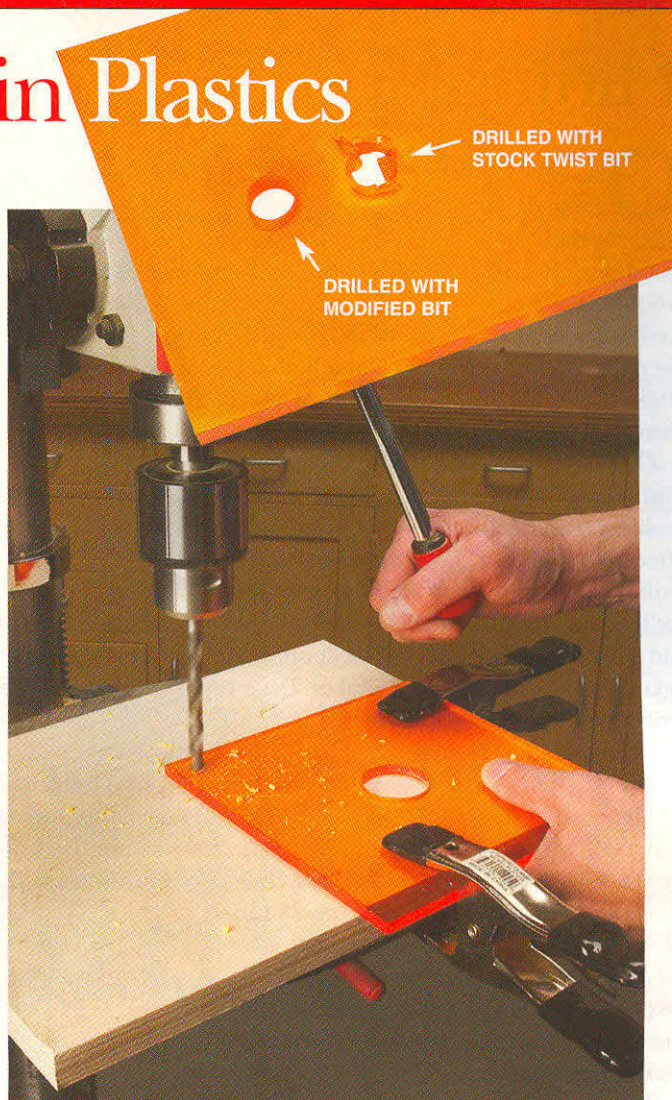
Q I make my own guards and router bases from plastic. How can I drill clean holes without the bit grabbing the plastic?

A A simple solution is to file a flat edge on a regular twist bit's cutting edges (see photos, below left and center). Use a small diamond paddle or ceramic stone to file its cutting edges flat.

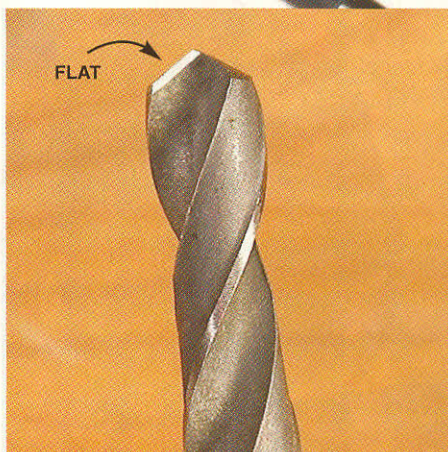
It is also best to drill at a higher speed, reducing the time the bit is drilling and causing heat to build up. Even then, a burr of melted plastic may form, which can be easily removed with a deburring tool or a bit of sandpaper.

As you've discovered, a standard twist bit is too aggressive for plastic, so it tends to grab and sometimes crack the work as it comes through the bottom. Also, plastic easily melts when drilled, causing molten plastic to adhere to the bit and make a gooey mess that quickly hardens.

Specialized plastic-cutting drill bits are available. They are ground to a sharp point and have a flattened cutting edge that scrapes rather than cuts the plastic. This design serves to reduce grabbing (see photo, below right). These bits work great but can be difficult to find in your local hardware store and cost twice as much as your typical twist bit.



File a flat on the face of the cutting edge using a diamond paddle or a ceramic stone. The flat should be in the same plane as the bit shank.



The modified edge produces a scraping cut that results in smooth cuts in plastic without the grabbing and cracking common when using regular twist bits.



Source
RPlastics, (800) 406-1672,
www.rplastics.com
1/4-in. plastic drill bit, \$6.

PROPER VARNISH STORAGE

Q Does varnish go bad sitting on the shelf?

A Unopened varnish should last for years on the shelf when kept away from excessive heat. When a can is opened and the finish exposed to oxygen, curing can begin. If the finish skins over, remove the skin and add mineral spirits to restore the original consistency. Water-based finishes have less tendency to skin over. If they do, add a bit of water to restore the original consistency. It's always best to test old varnish on a piece of scrap to make sure it's drying properly before you apply it to a project.

To maximize your varnish's shelf life after it has been opened, transfer any remaining finish to a smaller container. This will minimize the amount of oxygen in the container and preserve the varnish (see photo, right). Be sure to date and label the container. If you're using a glass jar to store the old varnish, be sure to keep it out of direct sunlight to prevent damage from UV radiation.

You can also try Bloxygen, a product that is sprayed into a partially used can and forms a gaseous barrier



to protect the varnish. It also protects other solvent-based products, such as wood filler and paint, although it will not protect lacquer or water-based finishes. One can is good for approximately 75 applications.

Source Woodcraft, (800) 225-1153, www.woodcraft.com
Bloxygen, #127965, \$12.

BANDSAWS FOR CUTTING METAL AND WOOD

Q I plan to buy a bandsaw, and I'd like one that can cut metal as well as wood. I've seen some two-speed bandsaws advertised. How well do they work to cut metal?

A The slow speed on most two-speed bandsaws is only slightly reduced from the normal 3,000 feet per minute (fpm) to around 2,500 fpm. The slower speed is designed to provide more power for resawing wide stock, not to slow the blade enough for cutting metal. Dedicated metal cutting bandsaws cut at speeds between 25 and 200 fpm, depending on the metal and thickness of the stock. In a pinch, you can cut soft, nonferrous metals like brass or aluminum on a woodworking bandsaw using a metal cutting blade, but the blade speed is far too fast for cutting steel or iron.

There are a few variable-speed bandsaws specifically designed to cut both wood and metal (see Sources, below).

Sources Woodworker's Supply, (800) 645-9292, www.woodworker.com Woodtek 15-in. wood/metal bandsaw, #130-367, \$900. 18-in. wood/metal bandsaw, #130-370, \$1,100. • Southern Tool, (800) 458-3687, www.Southern-Tool.com Wilton 14-in. Wilton vertical wood and metal Tradesman bandsaw, #WMH8201K, \$1,100. • Seven Corners Hardware, (800) 328-0457, www.7corners.com Delta 14-in. metal/wood-cutting bandsaw, #28-348, \$1,900.

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.



Stowable Outfeed Table

edited by Tim Johnson
and Brad Holden

I share my shop with my car, so everything has to be portable. My outfeed table installs in a minute and folds up flat for storage. It bolts onto the back of my saw and has adjustable feet (see Source, below), so it sits flat anywhere on my uneven garage floor.

The table is 3/4-in. melamine with hardwood edging. It measures 3 ft. wide by 4 ft deep, so it's big enough to support full sheets of plywood or 8-ft. boards, yet small enough for one person to maneuver. I built it in less than a day for less than \$50.

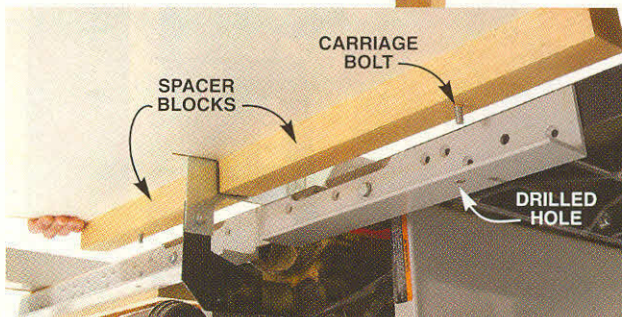
I routed dadoes for the miter gauge bar in the top and cut a slot for the blade-guard assembly. Then I attached the legs (see photo, below left). To mount the outfeed table flush with my saw table, I milled spacer blocks to the correct thickness and fastened them on each side of the blade-guard slot (see photo,

below right). Then I drilled holes for the 1/4-in. carriage bolts that connect the table to the saw. First I drilled stopped holes in the top to recess the bolt heads. Then I clamped the table in position behind the saw and drilled the shank holes through the spacer blocks and the L-bracket. Washers and wing nuts lock the table in place.

Dave Olson

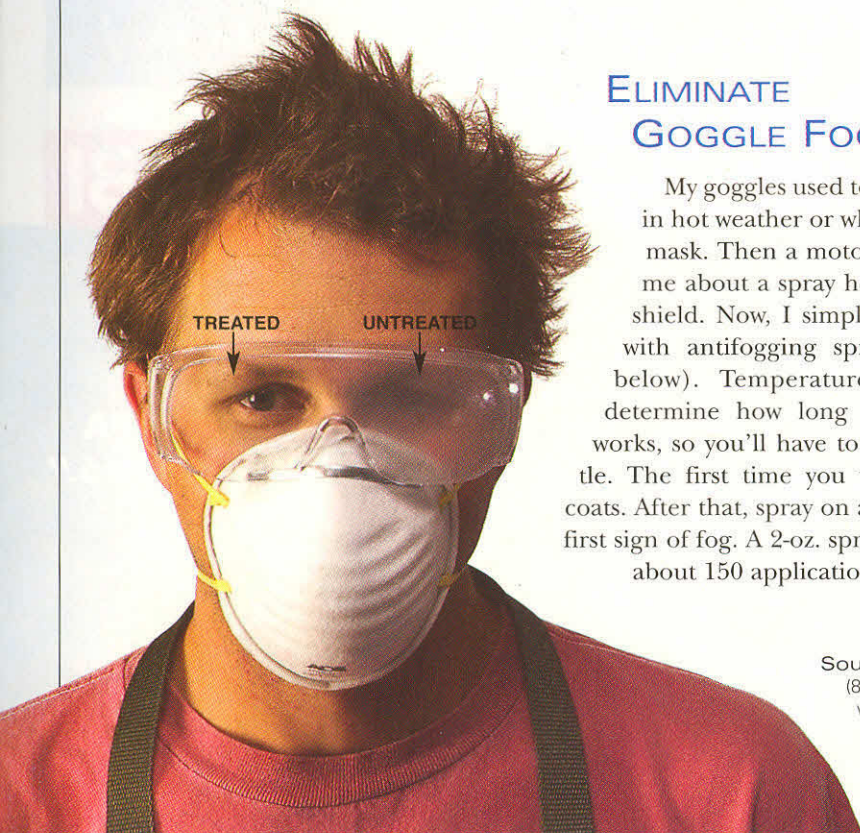


Folding leg brackets fasten the legs (see Source, right). A spring-loaded lever locks the legs open and closed.



Carriage bolts connect the table to the saw's L-bracket.

Source Rockler, (800) 279-4441, www.rockler.com Folding leg bracket, #32754, \$8. Leg equalizer with glide, #24315, four for \$10.



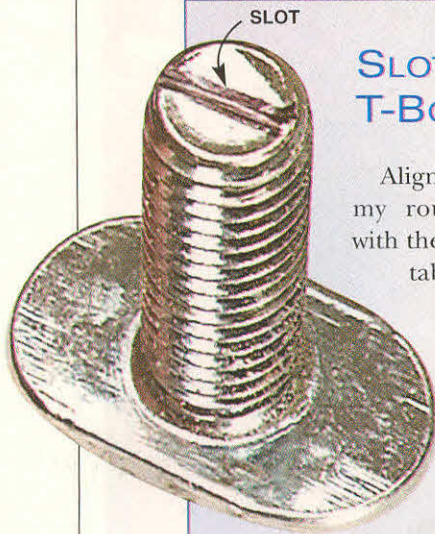
ELIMINATE GOGGLE FOGGING

My goggles used to completely fog over in hot weather or whenever I wore a dust mask. Then a motorcyclist friend told me about a spray he uses on his face shield. Now, I simply treat my lenses with antifogging spray (see Source, below). Temperature and humidity determine how long each application works, so you'll have to experiment a little. The first time you use it, apply two coats. After that, spray on a fresh coat at the first sign of fog. A 2-oz. spray bottle contains about 150 applications.

Alan Lacer

Source - KleerVu,
(877) 329-6450,
www.kleervu.com
KleerVu 2-oz. spray
cleaner, \$7 including
shipping.

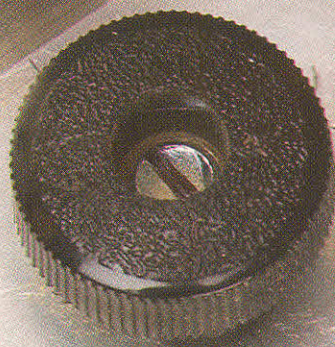




SLOT ORIENTS T-BOLT

Aligning the T-bolts on my router table's fence with the T-track slots in the table was a hassle. I could never tell which way the T-bolt heads were facing, because they were hidden beneath the fence. To eliminate the guesswork, I sawed a slot in the visible end of each T-bolt to indicate the head's orientation.

Richard Tendick



American Woodworker OCTOBER 2006 17

Calling all Tool Nuts!

I really don't need five cordless drills, seven routers or 24 antique hand planes, but I can't help it. I'm a tool nut. **Are you?**

Have you ever bought an old woodworking machine just because it looked cool? Tried a new tool and said, "Wow! This just changed my life!" Used a big, industrial machine and wondered how in the world you could sneak it into your shop?

We'd like to hear your stories. So e-mail or send us a letter about a tool or machine that really gets you excited. We'll pay you \$150 if we publish your story. Please include a photograph, too. We'd prefer a digital image, but a slide or print is OK. Visit our Web site, www.americanwoodworker.com/toolnut for some examples of what we've got in mind.

E-mail your entry to thetoolnut@readersdigest.com or write to us at The Tool Nut, American Woodworker magazine, 2915 Commers Dr., Suite 700, Eagan, MN 55121.

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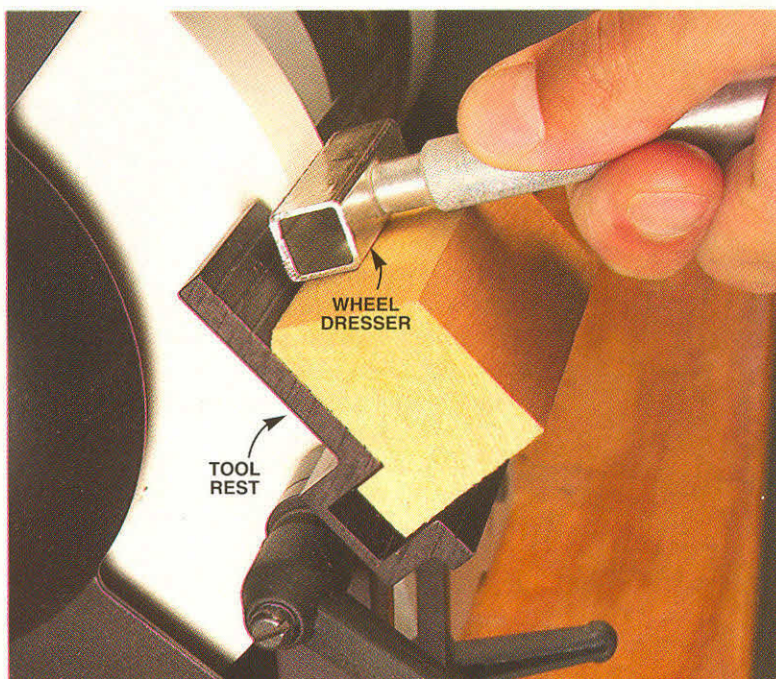
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WORKSHOP TIPS



INSTANT WHEEL-DRESSER SUPPORT

I use my grinder almost exclusively for beveling my chisels, so I like to keep the tool rest set to produce the 25-degree bevel I prefer. Having to reset the angle after using my diamond wheel dresser to clean and flatten the wheel bothered me until I made this wedge-shaped support.

Like many of my friends, I've upgraded my grinder by installing a top-quality tool rest (see Source, below). The wedge-shaped support I made fits snugly in the tool rest and instantly positions my diamond dresser correctly, perpendicular to the wheel's face.

After drawing the support's profile on the end of a 12-in.-long, 1-1/4-in. x 1-3/4-in. blank, I headed to my tablesaw. First, I cut a rabbet on the back of the blank to create the tongue. Rather than going for a precise fit, I cut the tongue a bit narrow and planned to install adjustment screws later.

Next, I cut the bevel. Its angle depends on your preferred bevel angle, the size of your grinding wheel and the location of your tool rest relative to the wheel.

After checking to make sure the bevel's angle was correct, I cut the support from the blank and installed the adjustment screws. Now, switching from grinding to dressing is effortless.

Tom Caspar

Source Lee Valley Tools, (800) 871-8158, www.leevalley.com
Veritas tool rest, #05M23.01, \$40.



We'll give you \$150, a great-looking shirt and a durable shop apron for your Workshop Tip!

Send your original tip to us with a sketch or photo. If we print it, you'll be woodworking in style. E-mail your tip to workshoptips@readersdigest.com or send it to Workshop Tips, American Woodworker, 2915 Commers Drive, Suite 700, Eagan, MN 55121. 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.

*Shirt and apron offer good only while supplies last.



One Man's Tree House

"I think of mine as a tree house for guys," Charles Beckman of Walker, Minn., says of his workshop. He has built his 20-ft. by 30-ft. shop from salvaged material, including wood from bowling alleys, discarded cabinets and old storm windows. It's equipped with a full range of power tools, all connected to a dust collector in the adjacent garage, "so as not to interfere with the deliberations which often take place in the shop."

It's the friendly, homely aspect of Charles' shop that captured our imagination: the memorabilia, including

hunting photos and a blown-up shotgun barrel, the treasures of model trucks and planes, the dog bed, and the assembly table that clearly does double duty as a bar, dining table and strategic planning center. As Charles puts it, "My shop is a sanctuary and I spend most of my days there, planning, building and dodging from jobs I should be doing. It also has become something of a social center for my buddies and others who stop by."



Tell us about your shop!

Readers whose shops are featured will receive \$150. Send us photos of your shop and a description of what makes it interesting. What do you make in it, and what makes your shop important to you?

Write to **My Shop, American Woodworker**, 2915 Commers Dr. Suite 700, Eagan, MN 55121, or e-mail to myshop@rd.com. Please send prints or digital photos on a disc. Submissions cannot be returned, and become our property on acceptance and payment. We may edit submissions and use them in all print and electronic media.

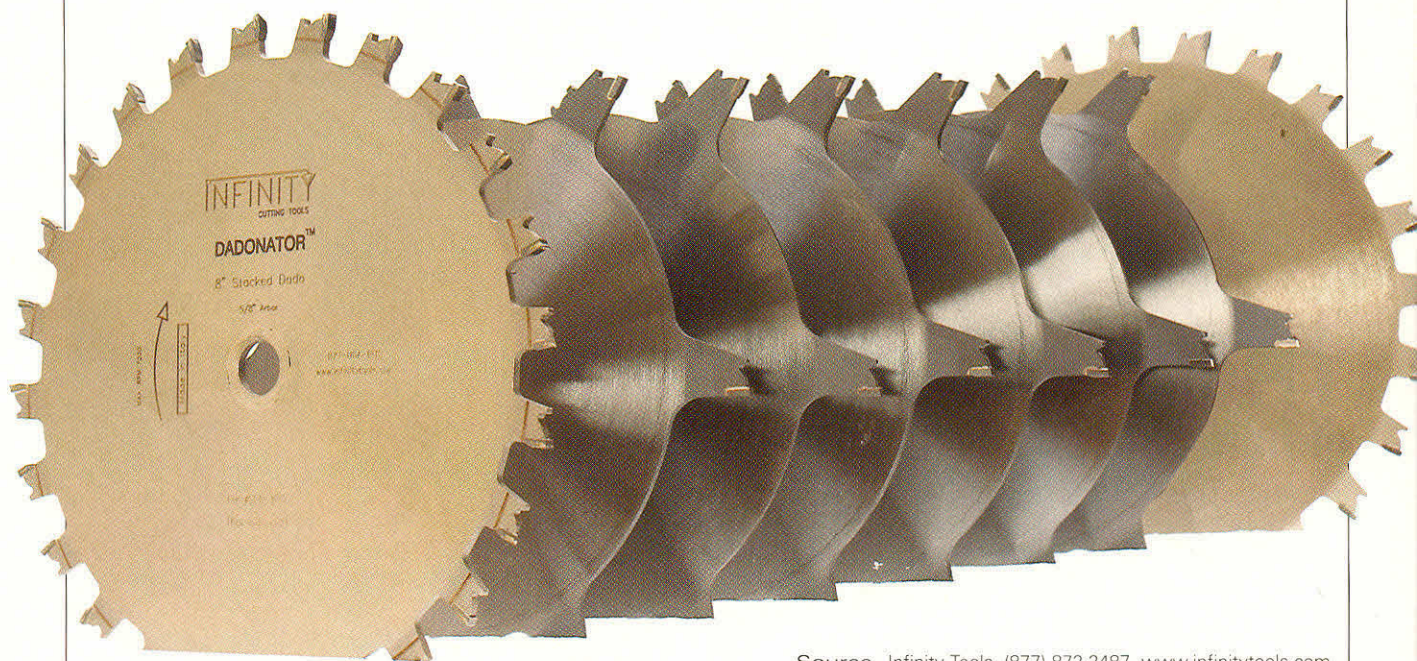
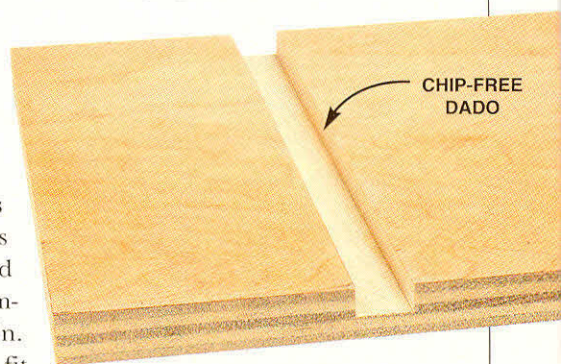
by George Vondriska

Great Dado-Head Performance

After you've lugged an expensive piece of plywood into the shop and started cutting dados and rabbets, the last thing you want to see is your dado head destroying the face veneer by leaving a trail of chips alongside the cut. In my tests, the Dadonator from Infinity Tools, \$180, did an excellent job of producing chip-free dados in both plywood and melamine. Equally important, the dados' bottoms were absolutely flat without a single high or low spot—such spots can occur when a dado head is not precisely machined.

The Dadonator is an 8-in. stackable dado head that includes two 24-tooth rim blades and six six-tooth chippers. The rim blades are nickel-coated, which Infinity claims will prevent corrosion and stop pitch buildup on the plates. The chippers are four of the common 1/8-in. size, one 1/16-in. size and one less common 3/32-in. size. The 3/32-in. chipper is handy for sneaking up on a perfect fit for undersized plywood. If you can't hit the size you need with the chippers, you can add dado shims, which are included with the set. Six-tooth chippers, compared with the more common four- and two-tooth chippers, should stay sharp longer, because the cutting workload is spread across more teeth.

The Dadonator comes in a cardboard shipping box that's robust enough to get the dado head to you unharmed but may not be the long-term storage solution you want to use in your shop. So you may want to make your own dado-head storage device.



Source: Infinity Tools, (877) 872-2487, www.infinitytools.com
Dadonator, #SDB-800, \$180.



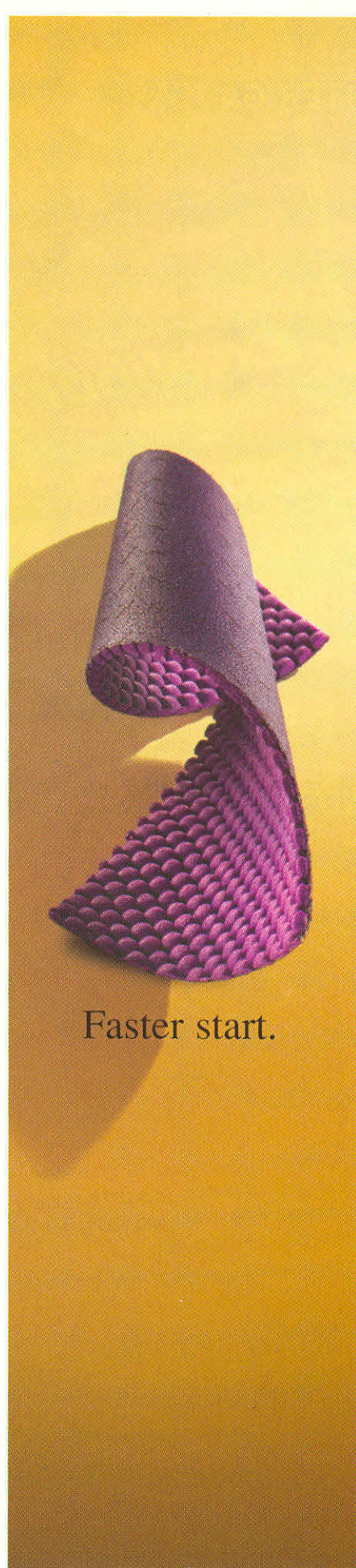
HANDY CORDLESS DRILL

The new PS20 Litheon drill/driver from Bosch, \$129, is the perfect driver for the typically small fasteners used on hinges, drawer slides, and other furniture and case parts. This drill not only fits your hand well but is also compact enough to drop into the pocket of most shop aprons.

With two lithium-ion batteries in the kit, you've got plenty of run time on this tool. Lithium-ion batteries don't trickle-drain the way nickel-cadmium batteries do, so even if this drill sits idle for a long period, it'll be ready to work when you are. According to Bosch, the PS20 will drive 100 3-in. screws on one charge. When you're out of juice, drop the battery into the 30-minute charger.

The PS20 has a 10-position clutch, plus one position intended to be used for drilling. Instead of a chuck, the PS20 has a 1/4-in. hex quick-change collar. This is great for the drivers used to run in fasteners, but unless you've got drill bits with 1/4-in. hex shafts, it may leave you stranded when you're trying to drill holes. With a top speed of 400 rpm, this machine is better for driving than drilling anyway.

Source Bosch Tools, (877) 267-2499, www.boschtools.com
Litheon drill/driver, #PS20, \$129.



Faster start.



NICELY BALANCED BELT SANDER

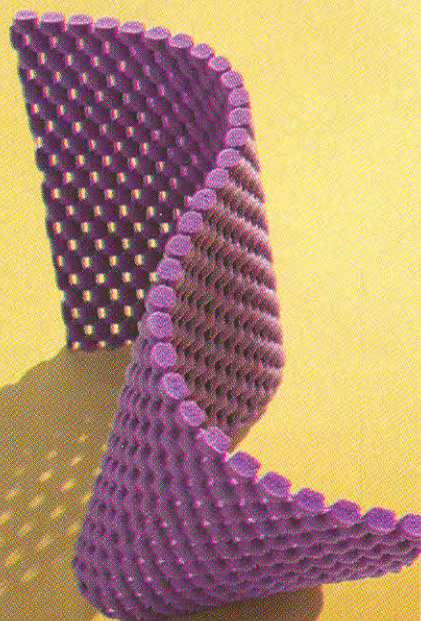
I've uttered a few choice words in my woodworking career over projects that went bad under a belt sander. A belt sander can easily undo a lot of good work, especially if the machine is poorly balanced. The Ridgid brand did a great job in developing its new 3-in. x 21-in. R2720 belt sander, \$179. It's a well-balanced machine that is pleasant to use.

The R2720 sports a 10-amp motor, which is a couple of amps larger than motors found on other 3-in. x 21-in. machines. The motor's electronic variable speed provides soft start, so there's a gentle take off instead of a missile launch when you power up. The belt speed can be varied from 800 to 1,500 feet per minute. Variable speed is a great feature on a belt sander, giving you more control over the amount of material you're removing.

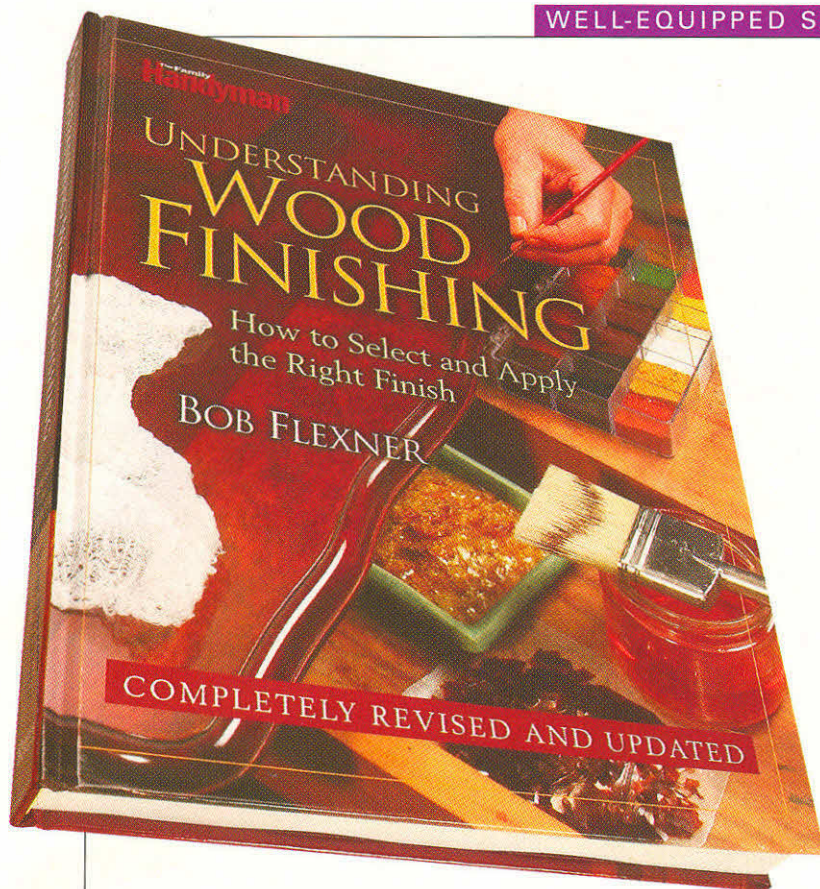
The generous 12-ft.-long cord on this sander may mean never using an extension cord with this tool. Dust collection with the included dust bag is good. Popping the dust bag off reveals a 1-1/4-in. round port that could connect to a vacuum.

The handle at the front of the sander can be set into three positions. Unfortunately, an Allen wrench is required to make this change. The good news is that the wrench is stored onboard.

Source Ridge Tool Co., (800) 474-3443, www.ridgid.com
3-in. x 21-in. Ridgid belt sander, #R2720, \$179.



Finer finish.



GREAT BOOK MADE BETTER

Does the prospect of applying finish to your projects make you nervous? Are you afraid of spoiling all those days of hard shop work with the wrong stain or varnish? If so, we've got help for you. Bob Flexner's finishing book, *Understanding Wood Finishing*, \$19.95, is now printed in its second edition. As good as the first book was, this edition is even better.

To call this book comprehensive is an understatement. It has rock-solid information on shellac, varnish, water- and oil-based finishes, waxes and stains. Looking for instructions for old-fashioned types of finishes, like French polish? This book has you covered. Want to know more about new ways of applying finish, such as spraying? Still got you covered.

Considering the time and energy that goes into building projects, the \$20 investment in this book is small potatoes. The photos—more than 300 of them—and the illustrations are great, and the information is extremely helpful.

Source Fox Chapel Publishing, (800) 457-9112, www.foxchapelpublishing.com
Understanding Wood Finishing, 2nd ed., 2005, paperback, \$19.95.

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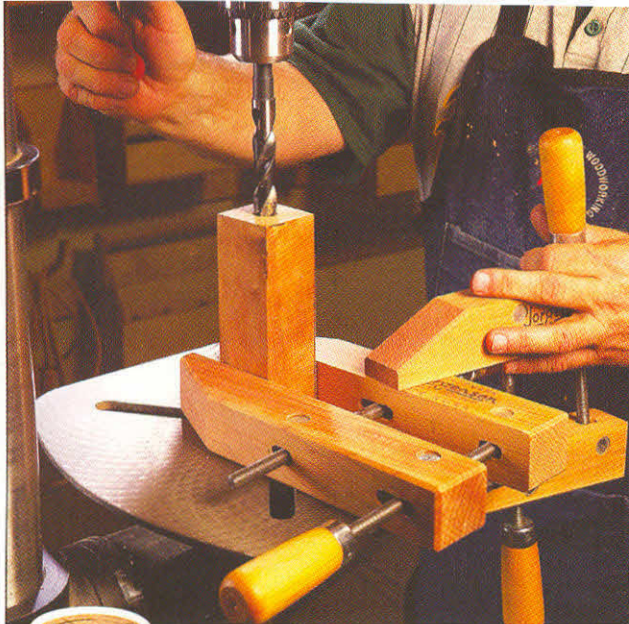
4-in-1 Screwdriver

Buy the parts;
turn the handle.



You just can't beat the look and feel of a beautifully turned handle. I love commercially made multiple-tip screwdrivers because they cut down on the clutter in my tool drawers. I don't care for their plastic handles, though, so I make my own from wood.

It's easy to crank out these screwdrivers in any shape or size. They make great gifts. All you need is a chunk of your favorite wood, a drill chuck for your lathe's headstock and a \$5 to \$7 hardware kit that contains two double-ended bits. This is a terrific project for a larger mini-lathe and takes less than an hour to complete.



PLUG

STEP 1

Drill a 5/8-in.-dia. starter hole in a square blank. Make the hole 1 in. deep.

STEP 2

Turn a tapered plug to fit in the hole. Put the plug in the hole and mount the blank on your lathe. The plug's center bears against the point of the live center in the tailstock. You may use a metal cone-type center as well.



STEP 3

Turn the blank into a cylinder using a spindle-roughing gouge.

PROJECT REQUIREMENTS

Materials

One 1-3/4 x 1-3/4 x 6-in. hardwood blank
One hardware kit (see Sources, page 34)

Tools

Drill press
5/8-in. and 7/16-in. twist drill bits
Spindle-roughing gouge
3/8-in. or 1/2-in. detail or spindle gouge
3/16-in. or 1/4-in. parting tool
Jacobs chuck with Morse taper to fit your lathe's headstock

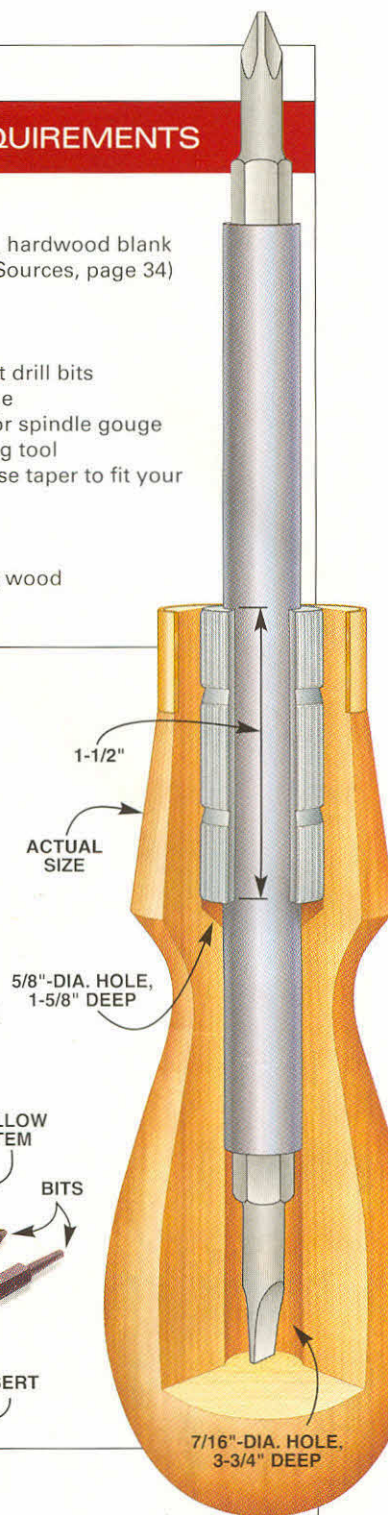
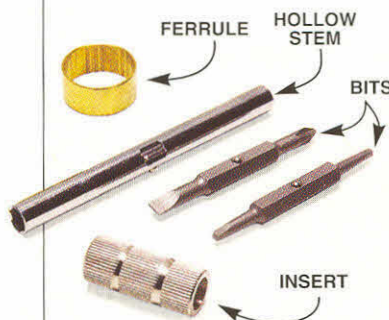
Cost

About \$7, not including wood

FIGURE A CUTAWAY VIEW

Hardware

The hardware kit contains a brass ferrule, a knurled insert, a hollow stem and two double-ended bits. Two different kits are available (see Sources, page 34). Rockler's kit is used and shown here. Check instructions with other kits for specific dimensions.



Select a Dense, Tough Wood



Pick a wood that's beautiful and durable. Hard maple, white oak, hickory, cherry, apple or Osage-orange are good domestic options. Purpleheart, cocobolo, tulipwood, goncalo alves, ipe, olive, black palm and Brazilian cherry are imports I also like.

Avoid softer woods, such as poplar, pine, cedar and basswood. They scratch easily and won't stand up to the daily rigors of driving screws or any of those jobs you're not supposed to do with screwdrivers.

**STEP 4**

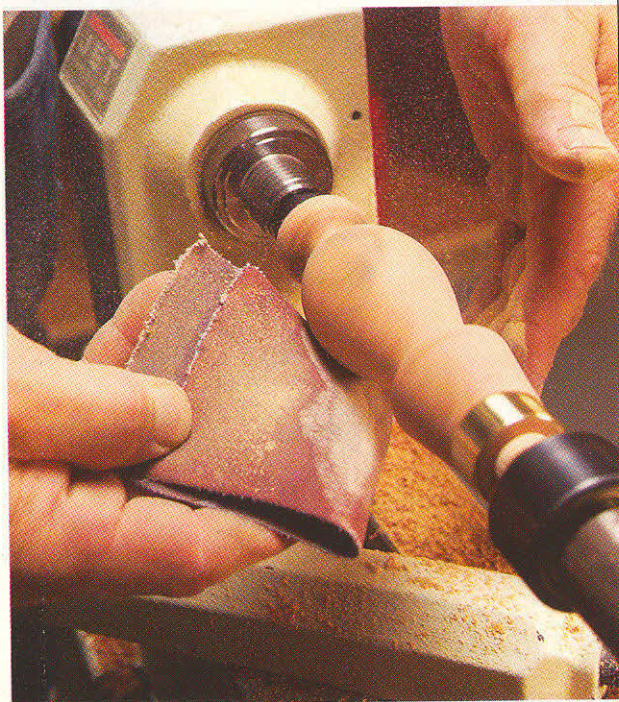
Cut a tenon using a parting tool. Set calipers to the ferrule's outside diameter. When the tenon matches this diameter, continue to remove small amounts of wood. Turn off the lathe and remove the handle often to check the ferrule's fit. Smooth caliper edges before using.

**STEP 5**

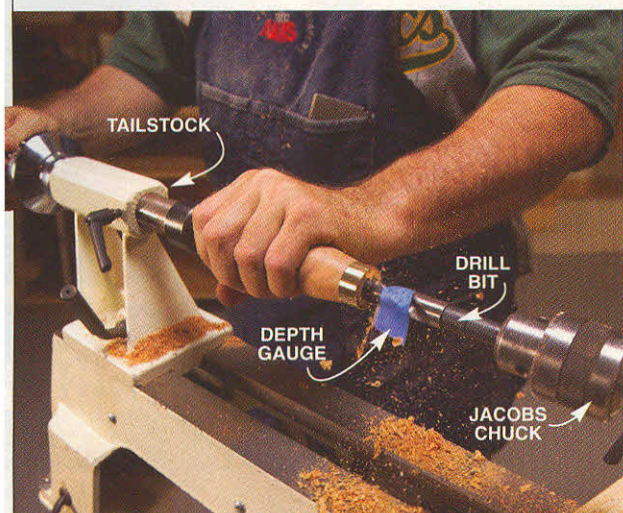
Use a soft mallet to tap the ferrule onto the tenon. Insert the plug and mount the blank back on your lathe with the ferrule in place.

**STEP 6**

Shape the handle using a spindle or detail gouge (Fig. A, page 30). Sneak up to the ferrule using very light pressure. Avoid cutting it with the gouge. Turn off the lathe to test the handle's fit in your hand. Remove the tool rest when you're done.

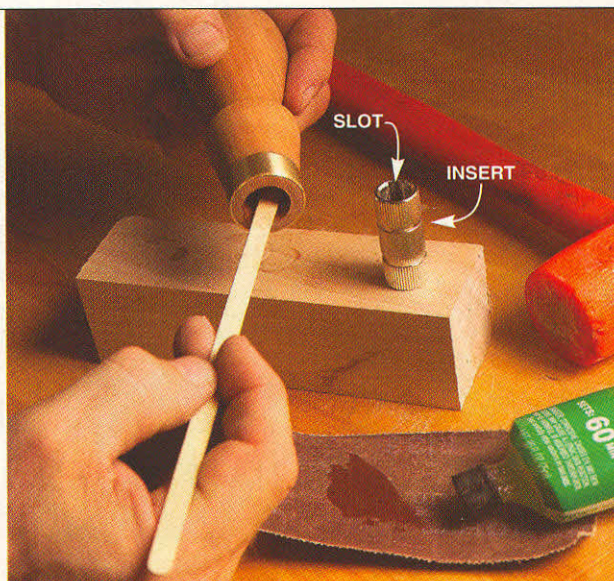
**STEP 7**

Sand the handle and ferrule. Make a smooth transition between them. Start with 120-grit sandpaper; continue with 150-, 180- and 220-grit paper. When you're done, remove the handle and insert a Jacobs chuck in your lathe's headstock.



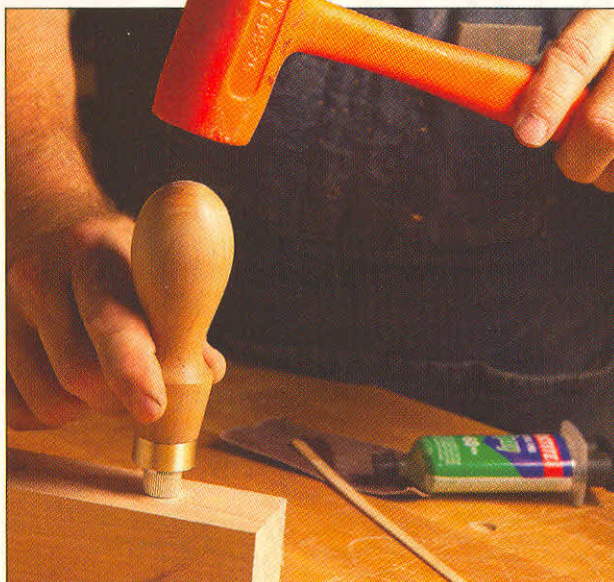
STEP 8

Deepen the handle's hole. Put a 5/8-in. bit in the chuck and set the lathe at a slow to medium speed. Mount the handle with the bit inserted into the handle's shallow hole. Simultaneously grip the handle and turn the handwheel to make a 1-5/8-in.-deep, perfectly centered hole (Fig. A). Next, insert a 7/16-in. bit and drill a hole 3-3/4 in. deep. Turn off the lathe, remove the handle and use a small handsaw to remove the waste material from the handle's end.



STEP 9

Glue the knurled metal insert into the handle using 30- to 60-minute slow-set epoxy. Spread epoxy inside the hole, but not on the insert. The insert has two slots on one end. Put the opposite end in the hole first.



STEP 10

Tap the insert into the hole. To seat the insert, turn the handle over, set it on a wood block and strike the handle. Remove any glue drips from inside the handle. Sand the saw marks on the handle's end.



STEP 11

Apply two coats of finish. I like to use an oil or an oil and varnish mixture. Assemble the shaft and bits. Your screwdriver is ready to go to work!

Sources Rockler, (800) 279-4441, www.rockler.com 4-in-1 kit, including insert, ferrule, hollow stem, No. 2 Phillips, standard slot and two square drive bits, #37707, \$7. • Penn State Industries (800) 377-7297, www.pennstateind.com 4-in-1 screwdriver kit, including two reversible bits, brass ferrule and endcap, and a reversible steel bit holder, #PKSDK4, \$6. • Packard Woodworks, (800) 683-8876, www.packardwoodwork.com No. 1 and No. 2 Morse taper arbor key chucks, \$37.

Hallway MIRROR

This weekend project features beautiful wood, invisible hinges and simple joinery.

My front hallway is the most heavily traveled, and usually the most cluttered, space in my home. Keys are tossed here and there, notes are scattered and the mail keeps getting lost. Tired of misplacing small but important items, I found a decorative way to keep everything together and organized. No more misplaced bills and no more lost keys.

This hallway mirror presented me with the perfect opportunity to display some highly figured English sycamore I had recently acquired. The design is simple yet elegant, allowing the wood to shine. It is the first thing people see when they enter my home.



by Luke Hartle



PROJECT REQUIREMENTS

Materials

4 bd. ft. of 5/4 figured English sycamore, about \$120, but a minimum order calls for 7 bd. ft. enough to build two hallway mirrors, about \$210

Tools

Tablesaw
Planer
Jointer
Biscuit joiner
Drill press
Router

Hardware

No. 7 x 1-in. trim-head screws
Two barrel hinges
Two mounting brackets
Six glazier points
Four brass pegs
Felt pads
Mirror

Cost about \$160 for one

Materials

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Biscuit joiner
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Hardware

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- Two barrel hinges
- Two mounting brackets
- Six glazier points
- Four brass pegs
- Felt pads
- Mirror

Cost about \$160 for one

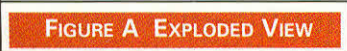


FIGURE B BRACKETS

$\square = 1/2$ in.

Use a photocopier to enlarge Figure B and Figure C images 400 percent and then 115 percent to make a 1/2-in. grid.

FIGURE C BOTTOM RAIL CUTOUT

A diagram showing a yellow rectangular area representing a bottom rail cutout. The area is set against a blue grid background. A semi-circular cutout is shown at the bottom center of the yellow area. A dashed horizontal line indicates the depth of the cutout. A legend at the bottom left shows a blue square followed by the text "= 1/2 in."



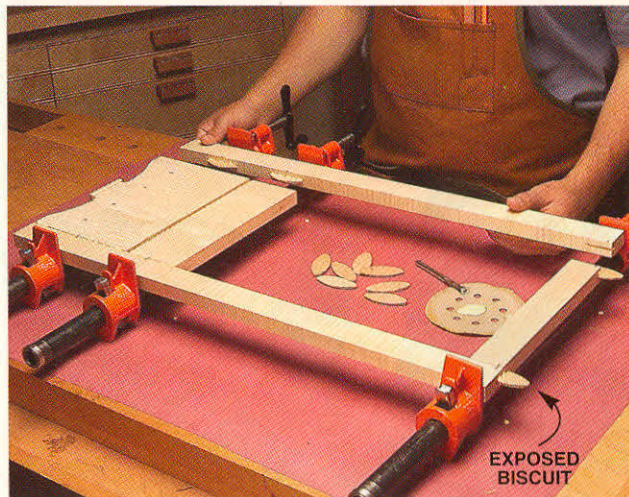
1 Before making any cuts, lay out the pieces to maximize the wood yield. Build visual harmony into the project by laying out the box sides end to end so the grain flows around the box when it is assembled.

MATERIALS AND CONSTRUCTION

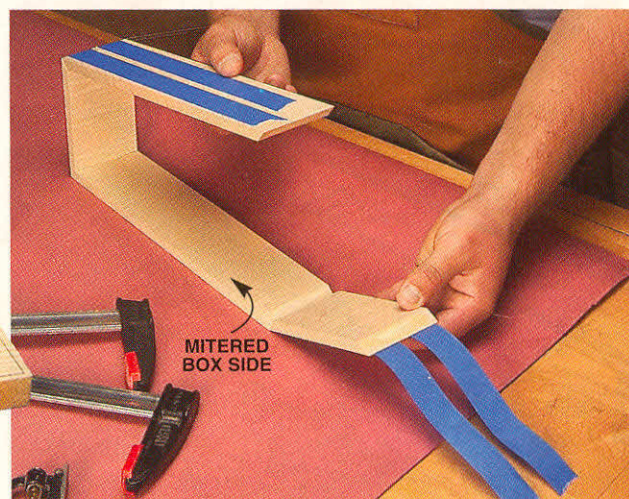
The frame is constructed with quick, easy biscuit joinery. Trim-head screws are used to attach the brackets, the lidded box and the cap piece on the frame. I chose these screws because their tiny heads are less visible and less prone to splitting thin parts, such as the brackets. Screws also allow the entire project to be disassembled for easier finishing.

Hidden barrel hinges give the box a clean, seamless appearance and allow the lid to double as a shelf. Solid brass pegs add beauty to the mirror and are perfect for hanging keys. The large mirror stands ready for a last-second glance before I walk out the door.

This project would also look great built with some straight-grained oak or pine, but I went all out and used figured English sycamore. The supplier requires a minimum purchase of \$200 (roughly 7 bd. ft.). This is double the amount of lum-



2 Join the frame parts using biscuits. On the narrow top rail, offset the slot so the biscuit protrudes out the top of the frame. It can be trimmed off later and completely covered by the top.



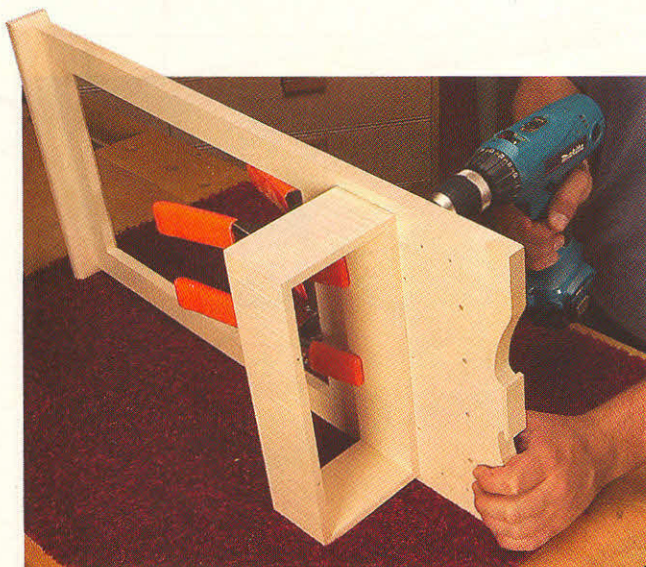
3 Position the box parts on two strips of masking tape. Spread glue and fold the pieces together. Use the overhanging tape to strap the last miter together. Square the box and snug the miters together with clamps.

ber needed to build one project, so I simply decided to build two and give one as a gift. You can also combine your order for this project with other wood to reach the \$200 threshold (see Sources, page 43).

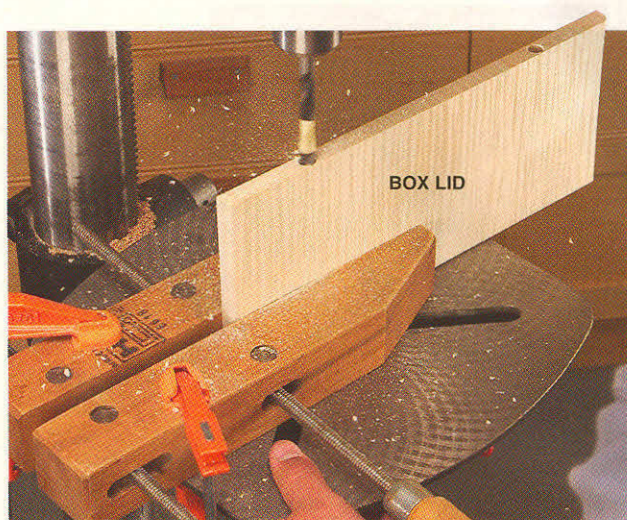
BUILD THE FRAME

1. Lay out the project parts on rough lumber (Photo 1). The wood gets resawn so you only need to lay out pieces for one mirror to make two. Planning before cutting allows you to match color and grain patterns and maximize the yield, which is especially important on precious wood. Lay out the brackets together on a piece of wood large enough to be planed and jointed before you cut them out.

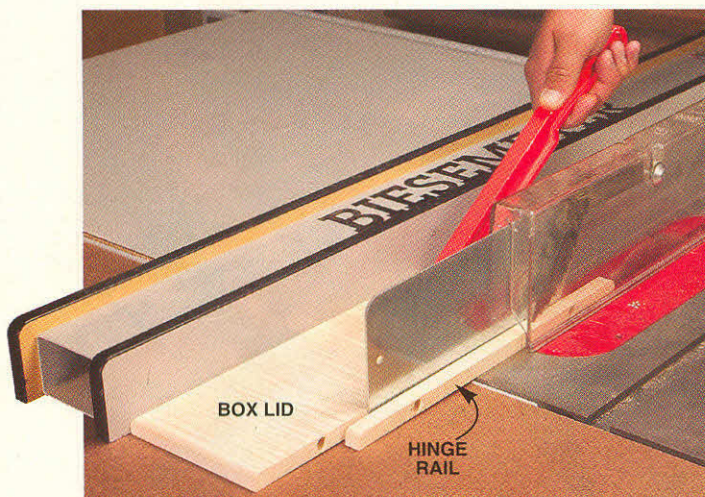
2. Cut and mill all the parts. I opted to use 5/4 stock because it minimizes waste and can be resawn into thinner pieces.



4 Screw the assembled box sides to the frame and build the rest of the box on the frame. Using this approach, it's easier to get the box lid and bottom to fit tightly against the mirror frame.



5 Drill holes in the box lid for the barrel hinges. Barrel hinges can be fussy to install. In this case, predrilling the hinge holes in the box lid and then ripping the hinge rail guarantees perfect alignment.



6 Rip the hinge rail from the box lid. Because the hinge rail will be cut from the box lid (see Step 13), the holes must be 1/8 in. deeper than the length of the hinge to account for the stock the tablesaw blade removed.



7 Place the hinges in the holes of the hinge rail. Tighten the screws just enough so the hinges can move in and out with pressure but do not slide freely.

3. Enlarge the pattern (Fig. C, page 40) to full size and trace it onto the bottom rail (D). Rough-cut the pattern on a bandsaw and then smooth the final shape on a sanding drum or a spindle sander. Trim off the waste piece.

4. Mark and drill the holes for the brass pegs on the bottom rail using a drill press (Fig. A, page 40).

5. Make the decorative cap (L). Ease the cap's edges and glue the cap to the bottom rail.

6. Join the frame pieces (Fig. A) using biscuits. Leave a 1/8-in. gap between the middle and bottom rails for cross-grain expansion. Offset the top rail slot so the biscuits hang out the top edge (Photo 2). Trim the biscuits flush after the glue has set.

7. Route a rabbet for the mirror around the back side of the frame. Square the corners using a chisel.

8. Attach the top (E) to the frame. Shape the front and side edges with a 1/4-in. round-over bit, and screw the top in place (Fig. A).

BUILD THE BOX

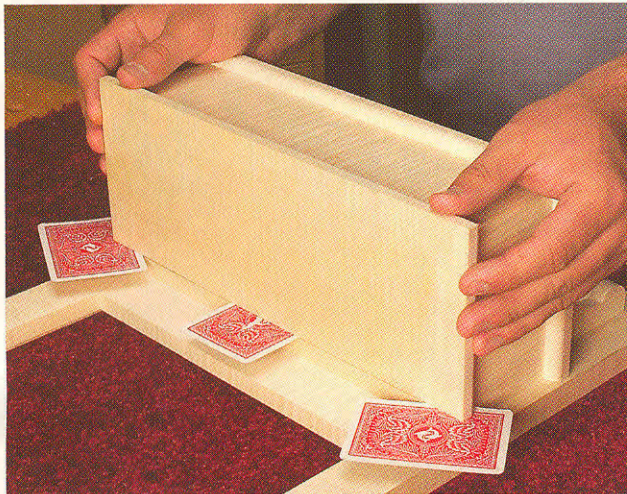
9. Miter the box sides (J, K) on a sliding miter saw or with a miter gauge on the tablesaw.

10. Glue up the box (Photo 3). As long as the miters have been cut correctly, the box will fold up easily and the tape will hold the pieces together. Place the box in a framing square to nudge the box square and use a clamp to tighten the joints, if necessary.

11. Attach the box to the frame (Photo 4, Fig. A).

12. Drill holes for the hinges in the box lid (Photo 5). Secure the lid in a hand-screw clamp to make sure the holes are drilled straight, and clamp everything to the table so nothing moves.

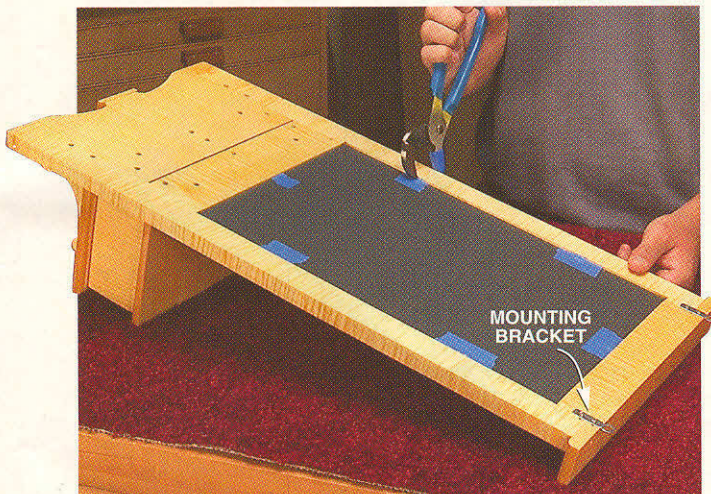




8 Use playing cards to set the gap between the lid and hinge rail. The perfect fit has a nominal gap between the lid and hinge spacer but allows the lid to close completely. If the lid does not close completely, double up the cards.



9 Disassemble the project's parts—except for the frame—to sand and finish. Every other piece can easily be sanded and finished individually, nearly eliminating the need to work in tight corners.



10 Secure the mirror with glazier points. Place tape below each point and on the pliers' jaws to prevent scratches. Stick a few felt pads on the back of the frame to keep the frame from rubbing against the wall.

13. Cut the hinge rail from the box lid (Photo 6) by ripping a strip, through the holes, 1/2 in. from the back edge of the box lid.

14. Screw the hinge rail to the frame and the box bottom to the box sides and frame (Fig. A).

15. Shape the brackets (H) from the pattern (Fig. B, page 40). Rough-cut the design on the bandsaw and sand each bracket smooth. Screw the brackets to the frame and to the box bottom (Fig. A).

INSTALL THE BARREL HINGES

16. Install the barrel hinges in the lid first and then place

the hinges in the holes of the hinge rail (Photo 7).

17. Set the hinges using thin spacers, such as playing cards (Photo 8). Place the cards between the lid and the hinge rail and lightly push down on the lid. Gently open the lid and tighten the setscrews. The lid should close tightly with only a slight gap between the lid and hinge rail.

ADD THE FINISHING TOUCHES

18. Disassemble the project and finish (Photo 9). After everything is finished, reassemble the project.

19. Add the mounting brackets and pegs and install the mirror (Photo 10). Hang and enjoy.



BARREL HINGE

Sources Lee Valley, (800) 871-8158, www.leevalley.com 10-mm concealed barrel hinge, #00H35.10, \$4.20 ea. No. 7 glazier points, #86K08.02, \$2.25 for 50. Rigid zinc-plated steel hanger, #00S06.10, \$1.60 for 10. Brass necklace hanger, #01B12.01, \$3.25. • Talarico Hardwoods, (610) 775-0400, www.talaricohardwoods.com 5/4 figured English sycamore, about \$30 per bd. ft., minimum order of \$200 (7 bd. ft.). • McFeely's (800) 443-7937, www.mcfeelys.com No. 7 x 1-in. finish-head screws, #0710-TSO-C, 100 for \$3.40. • Home center or hardware store Mirror, about \$8. Tube of silicon, about \$6. Antiscratch felt pads, 50 for about \$4.

Sliding Bookrack

by Seth Keller



Arts & Crafts details
add sophistication
to a simple project

I've always admired the work of Greene & Greene, two architects who designed Arts & Crafts homes and furnishings in the early 20th century. Their detailing is exquisite. I love the softened edges, pegged joinery, square motifs and overall lightness of their work. When I needed bookends to hold some special volumes, I

turned to these gifted artists for inspiration.

This bookrack works on a very simple principle: friction. The bookends are adjustable, sliding on two rails to hold any set of books. But when you push the ends up to the books, they tilt slightly and bind against the rails. They're locked in place. When you pull a book out, the ends are released and free to slide again.

PROJECT REQUIREMENTS AT A GLANCE

FIGURE A EXPLODED VIEW

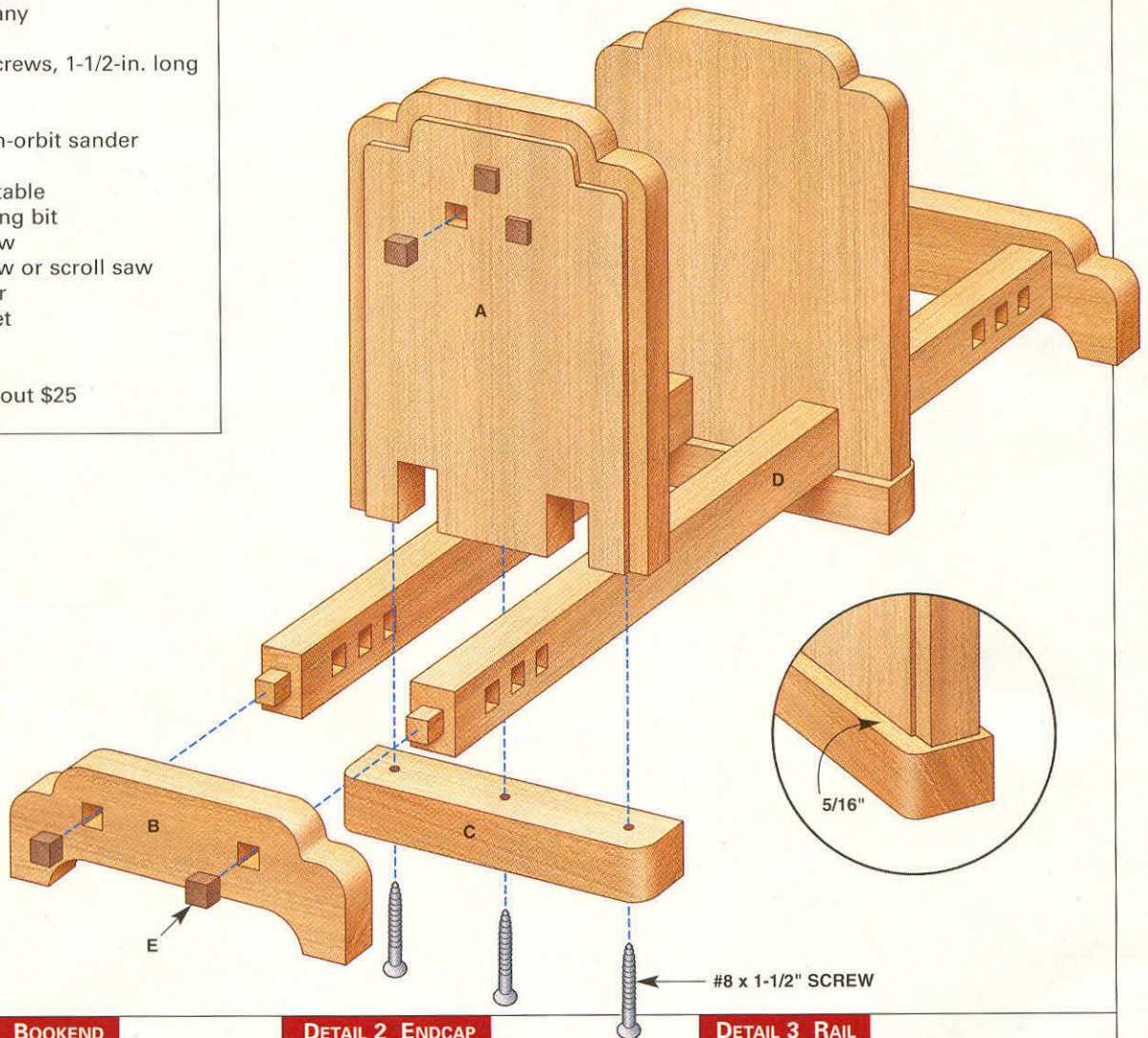
Materials

Mahogany
Walnut
No. 8 screws, 1-1/2-in. long

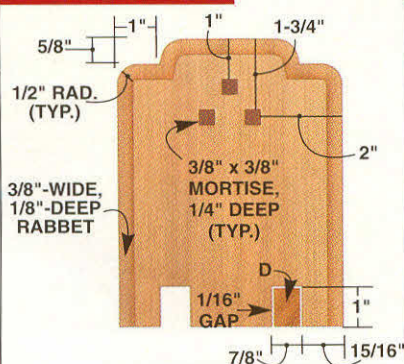
Tools

Random-orbit sander
Router
Router table
Rabbeting bit
Tablesaw
Bandsaw or scroll saw
Mortiser
Dado set
Planer

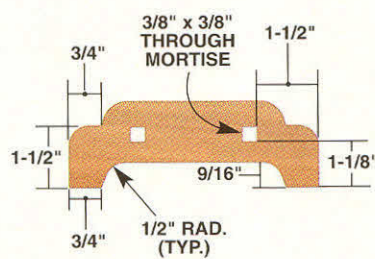
Cost about \$25



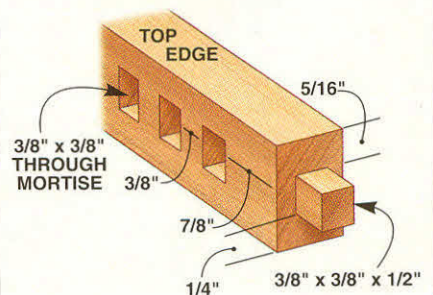
DETAIL 1 BOOKEND



DETAIL 2 ENDCAP



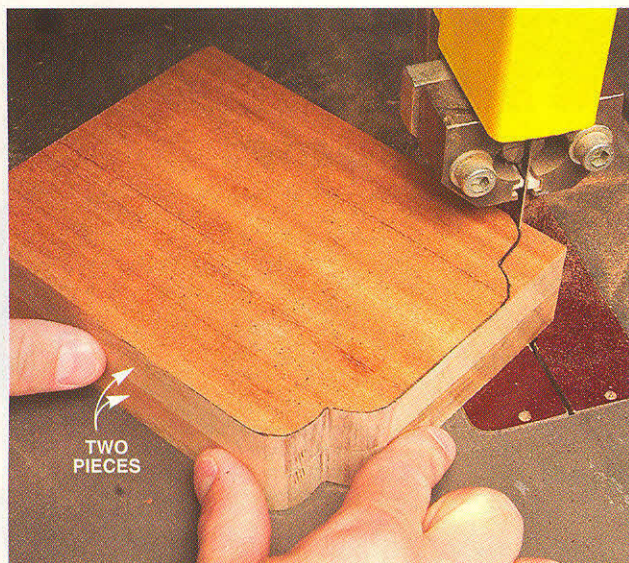
DETAIL 3 RAIL



CUTTING LIST

OVERALL DIMENSIONS: 7-13/16"H x 6-1/8"W x 23-1/2"L

Part	Name	Qty.	Material	TH x W x L
A	Bookend	2	Mahogany	3/4" x 5-1/2" x 7"
B	Endcap	2	Mahogany	3/4" x 2-1/8" x 6-1/8"
C	Base	2	Mahogany	3/4" x 5-3/4" x 1-1/4"
D	Rail	2	Mahogany	3/4" x 15/16" x 23"
E	Pegs	10	Walnut	3/8" x 3/8" x 1/4"



1 Begin by sawing the sliding bookends and other curved pieces. You can cut two at the same time. Hold the pieces together with double-stick tape.



2 Rout a stepped profile on the bookends using a rabbeting bit. To safely begin the cut, pivot the workpiece against a starting pin. Once started, you can ride on the bit's bearing.

MAKE THE PARTS

1. Mill the bookends (A), endcaps (B) and bases (C) to final size. Mill the rails (D) an extra 1/8 in. thick.

2. Cut the bookends, endcaps and bases on the bandsaw (Photo 1; Fig. A, page 46). Sand the sawn edges. Use 100-, 120- and 150-grit sandpaper.

3. Rout the bookend profile with a 3/8-in. rabbeting bit (Photo 2; Fig. A, Detail 1). Raise the bit in 1/16-in. increments to avoid tear-out. Use a chisel to square the rabbet's inside corners.

4. Cut shallow mortises into the bookends (Fig. A, Detail 1). Cut through mortises in the endcaps and rails (Photo 3; Fig. A, Details 2 and 3).

5. Plane the rails to final thickness (Photo 4).

6. Cut tenons on the rails using a dado set (Fig. A, Detail 3).

7. Make pegs (E) from 3/8-in.-thick square blank. Cut the pegs to length with a Japanese pull saw, dovetail saw or bandsaw.

ASSEMBLE THE BOOKRACK

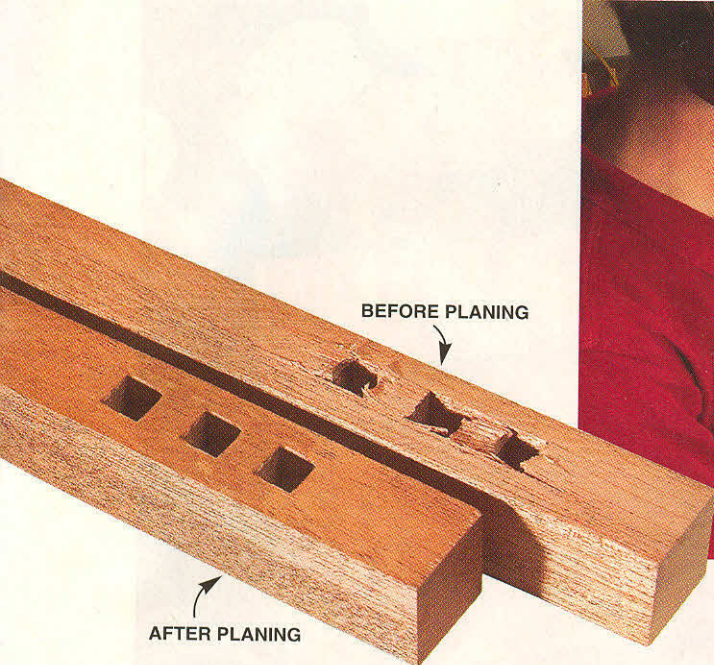
8. Glue and clamp the rails and endcaps. Work on a flat surface. Check the assembly for wobble before you set it aside to dry.



3 Cut square holes through the rails using a mortising machine. Some tear-out on the back is inevitable, even with a sacrificial board under the rail, but you'll remove it in the next step.

9. Glue pegs (E) into the bookends and endcaps (Photo 5). Leave the pegs proud by at least 1/16 in. Scrape excess glue from around the pegs before the glue dries.

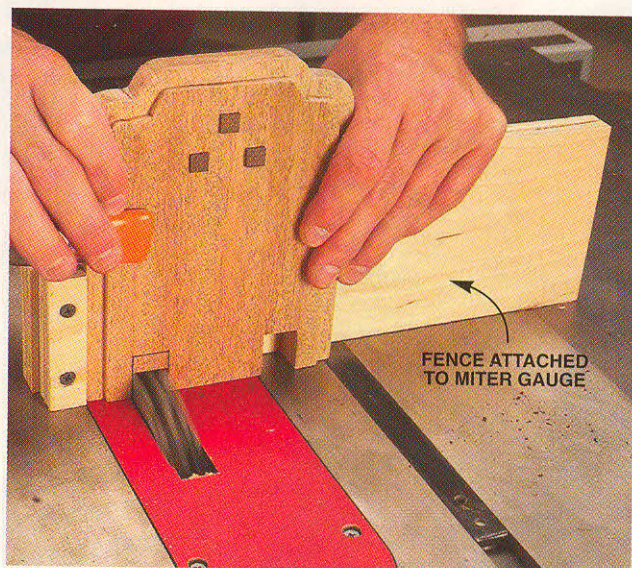
For small projects,
the beauty is in the details.



4 Plane the rails to final thickness. Place the torn-out sides facing up. They'll come out perfectly smooth.



5 Glue walnut pegs into the square holes. The heads of the pegs should be slightly proud of the surface. Round over their sharp corners with sandpaper after the glue is dry.



6 Cut slots in the bookends. Their spacing is critical for the bookends to slide smoothly on the rails. Assemble the base first; then mark each slot's position directly from the rails.

10. Use 180-grit sandpaper in a random-orbit sander to round the edges of the pegs.

11. Mark the positions of the bookend slots directly from the rail and endcap assembly. Cut the slots using your miter gauge and a tall auxiliary fence (Photo 6). Make multiple passes, raising the blade 1/4 in. with each cut.

12. Predrill the bases and bookends. Screw these parts together on the rail and endcap assembly and test their fit. There should be a little play so the bookends will slide. Disassemble the bases and bookends for finishing.

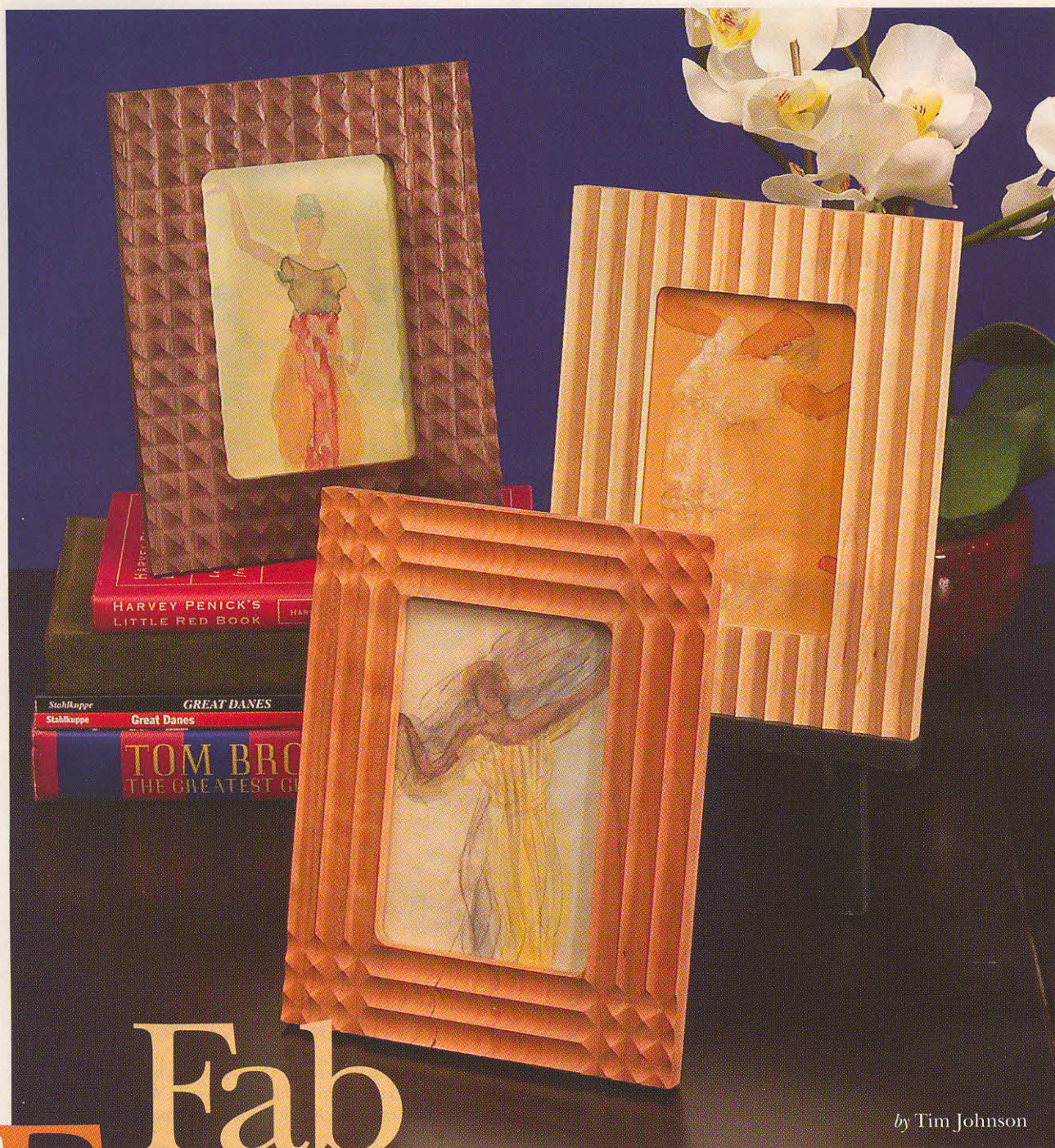
13. Sand with 180- and 220-grit sandpaper to gently

round the edges of the bookends, endcaps, rails and bases. Don't sand the bookends' bottom edges.

14. Apply the finish. I used a mixture of cherry and medium-walnut Danish oil to achieve a beautiful warm tone, and wiped on two coats.

15. After the finish is dry, apply a coat of paste wax over every surface and rub out with #0000 steel wool to an even sheen. This is an essential step. The wax lubricates the rails, allowing the bookends to slide smoothly.

16. Screw the bases to the bookends and load the rack with books.



by Tim Johnson

Fab Frames

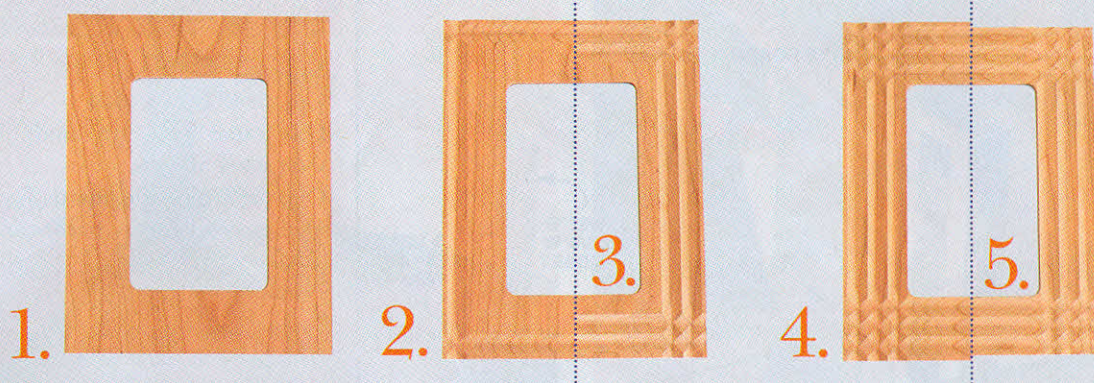
No miters and no fuss!
Multiples and cool variations are easy.

Forget about cutting and fitting miter joints the next time you make a picture frame. Scrap wood, a saber saw, a fence-equipped router table and three common router bits are all you need to make this one.

The process couldn't be simpler: Saw and rout an opening for a 4 x 6-in. image in the center of a board; then rout flutes around the face (Fig. A, page 52). This procedure is

ideal for making multiple frames, and changing the pattern is so easy that you can rout several different-looking frames at the same time (see "Amazing Variations," page 51).

Those large offcuts you've been saving are perfect for this project, but you can also make frame blanks by gluing up narrow stock. Hardwoods such as birch, maple, cherry, beech, walnut and poplar are good choices.



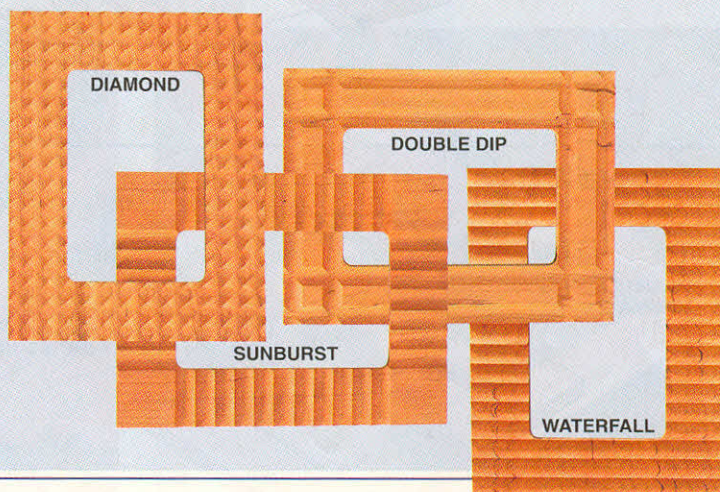
Five Easy Steps

Step 1: Rout a rectangular picture opening in the center of a piece of wood. **Steps 2–4:** Rout flutes around the face. **Step 5:** trim the edges.

Amazing Variations

The setup used to create the basic fab frame, shown above, lends itself to a surprising number of interesting variations. For example, rout a single middle flute on each side. Or rout outside and inside flutes only (see the double dip frame, right). You can rout only vertical flutes on the stiles, or only horizontal flutes on the rails.

Creating the diamond, sunburst and waterfall frames requires routing additional rows of flutes. Simply install as many 1/2-in.-wide spacers as you need before routing the first flute.



SHAPE THE BLANK

1. Glue together a template sized precisely, as shown in Fig. B (page 52). Drill shank holes for the screws that will hold this template to the frame blank.

2. Plane wood for the blank to 1/2-in. thickness. This piece must be at least 12 in. long to safely pass through your planer. You can skip this step and use thicker stock, of course—your finished frame will just look heftier.

3. Cut the frame blank to size, 1/8 in. wider and longer than your template.

4. Center the template on the blank and attach it with one screw. With a pencil, trace the picture opening onto the blank. Mark the template so you'll use the same screw hole when you remount it in Step 6.

5. After you've removed the template, drill access holes for the saber-saw blade in the blank, near the corners of the picture opening. Then rough-saw the opening 1/8 in. or less away from the traced line.

6. Remount the template using all four screws.

7. Using a flush-trim bit (see Sources, page 54), rout the blank to match the template (Photo 1). Feed the blank clockwise to rout the inside and counterclockwise to rout the outside. Tear-out may occur at the corners when you rout the

blank's outside edges, but it's OK, because the routed blank is still oversize. It will be trimmed to its final size later.

8. Complete the picture opening by installing a rabbeting bit and routing a 9/32-in.-deep x 3/8-in.-wide rabbet for the glass, matte board, image and back. Square the rabbet's corners with a chisel.

ROUT THE FLUTES

I'll explain how to rout the basic frame, but you can use the same steps to create several variations.

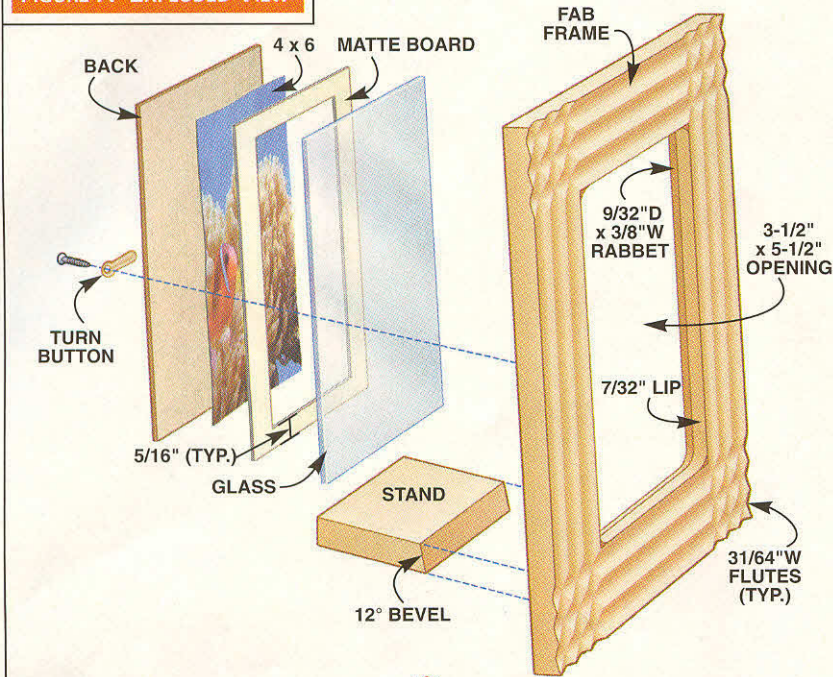
The frame's 1/2-in.-wide flutes are routed with a 3/4-in.-dia. round-nose bit that's partially recessed in the router table.

Instant Frame Stand

The EaselMate frame stand screws on in a minute. This pro-quality stand makes it easy to change the frame's display from vertical to horizontal or convert it for wall mounting (see Sources, page 54).



FIGURE A EXPLODED VIEW



PROJECT REQUIREMENTS

Materials

1 sq. ft. of 1/2-in. MDF
 One frame blank and stand
 One sheet of glass
 One piece of matte board
 One piece of 1/8-in. hardboard

Tools

Planer
 Tablesaw
 Drill press or hand drill
 1/2-in. drill bit
 Saber saw
 Router table with router and fence
 Flush-trim bit
 Rabbeting bit
 3/4-in.-dia round-nose bit (also called a core-box bit)
 Chisel
 Two 8-in.-capacity clamps

Hardware

Four No. 6 screws
 Four turn buttons
 One EaselMate frame stand (optional)

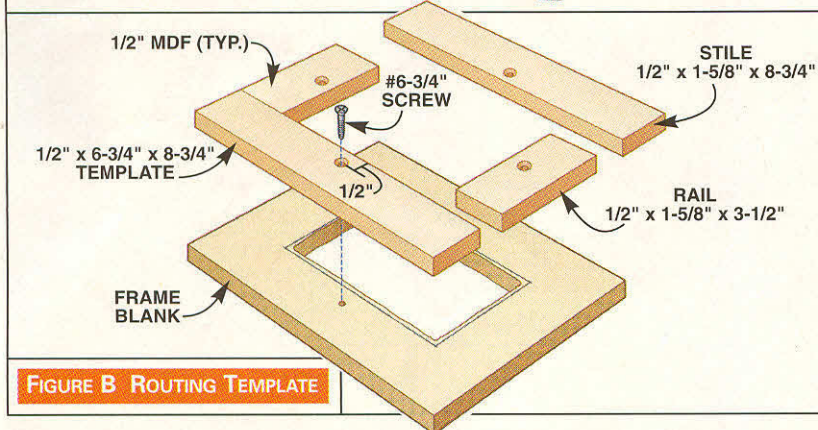


FIGURE B ROUTING TEMPLATE

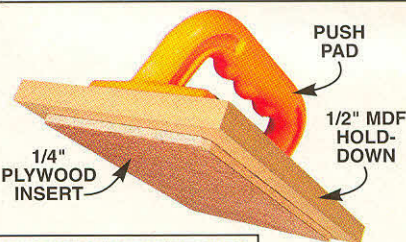
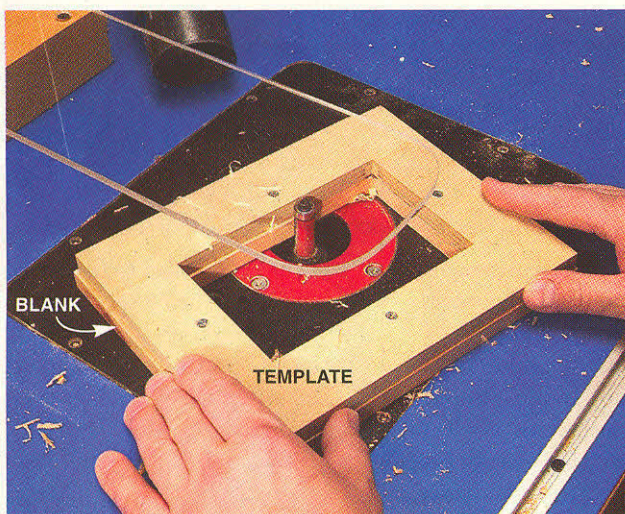
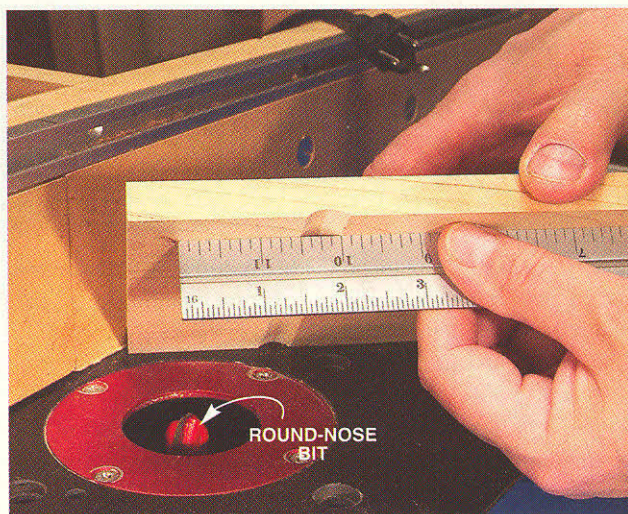


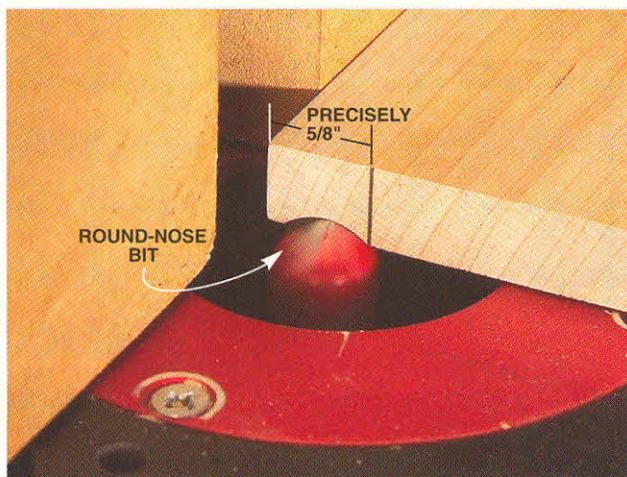
FIGURE C PUSH BLOCK



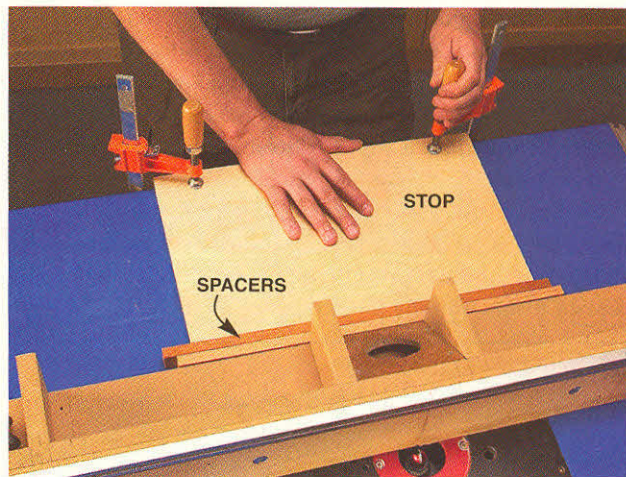
1 This picture frame is just a piece of wood with a rectangular hole cut in it. After rough-cutting the picture opening in an oversize frame blank, use the routing template (Fig. B, above) and a flush-trim bit to cleanly rout both the inside and outside edges.



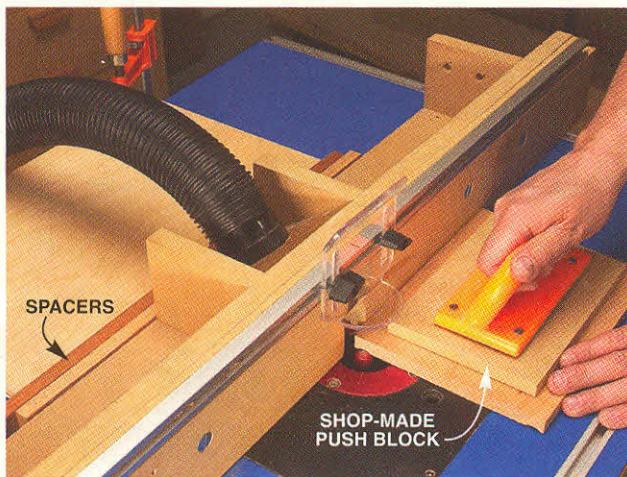
2 Dial in the flute's width by adjusting the bit's height. Make test cuts in a scrap piece until the flute measures slightly less than 1/2 in. wide. It's easy to eyeball this measurement on a coarse scale: Just sight along both graduations' inside edges.



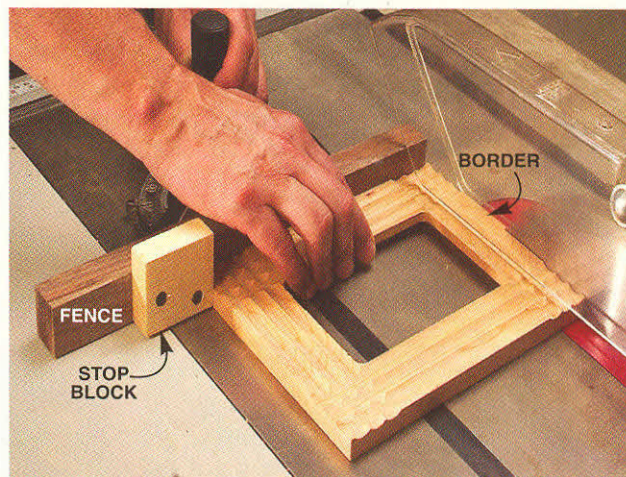
3 Set the router table's fence to rout the outside flutes. Draw a line on your test piece exactly 5/8 in. from the edge. Then make test cuts until the flute's inner edge precisely aligns with the line.



4 Install a pair of 1/2-in.-wide spacers and a stop behind the fence. This setup makes it easy to accurately reposition the fence for routing the middle and inside flutes.



5 Rout the flutes, starting at the outside edge. To rout the middle flutes, simply remove one spacer and reposition the fence. Remove both spacers to rout the inside flutes.



6 Trim the frame to its final size by sawing off the borders. Trimming the frame after routing the flutes eliminates the possibility of router tear-out on the outside edges.

This setup creates shallow flutes that look much better than the deep flutes a 1/2-in.-dia. bit would create.

9. Raise the bit to set the flute's width (Photo 2). The flutes should measure about 1/64 in. less than 1/2-in. wide. Flutes wider than 1/2 in. won't work.

10. Lock the fence in position to rout the outside flutes (Photo 3). When properly located, these flutes leave 1 in. for the two remaining flutes.

11. Mill a pair of long spacers exactly 1/2 in. wide and install them behind the router table's fence. A clamped-on stop holds them in place (Photo 4).

12. Rout the outside flutes all around the frame blank (Photo 5). A shop-made push block with an insert that fits into the rabbeted picture opening makes routing super-easy and safe. (Fig. C, page 52).

13. Loosen the fence and remove one spacer. Firmly push the fence against the remaining spacer and clamp it in place. This adjustment moves the fence exactly 1/2 in. so you can rout the middle flutes. As you rout across the grain, use a slow

feed rate to minimize tear-out between the two flutes.

14. To rout the inner flutes, simply remove the remaining spacer and reposition the fence against the stop.

FINISHING TOUCHES

15. Trim the frame's sides on the tablesaw (Photo 6).

16. Sand the flutes to eliminate ridges and blend uneven spacing. Sanding also gets rid of tear-out between the flutes. I use Tadpole contour sanders to help with this job (see Sources, page 54), but a detail sander or sandpaper wrapped around a dowel will also do the trick.

17. To make a stand for the frame, saw a 12-degree bevel on one edge of a long blank. Then cut the stand to size.

18. Glue the stand to the back of the frame. You don't have to use clamps. Just brush a coat of glue on the stand's beveled edge. With the frame lying on its face, press the stand onto the frame, flush with the bottom edge. Rub the stand back and forth to set the glue; then let the assembly dry. As an alternative, the EaselMate frame stand doesn't

require gluing and it's removable (see page 51).

19. Apply your favorite finish to both sides of the frame. I prefer aerosol-spray finishes for small jobs like this, because they're fast, but you won't have to worry about drips if you choose a wipe-on finish. Or you could be adventurous (see "Great Fun To Finish," right).

20. Install the glass, matte board, image and the back. Then screw on the turn buttons (see Sources, right). You should be able to use the screw holes that remain from fastening the template.

Cutting List

Overall Dimensions: 1/2" x 6-1/2" x 8-1/2"
Picture Opening: 3-1/2" x 5-1/2"

Part	Qty.	Dimensions
Frame blank	1	1/2" x 6-7/8" x 8-7/8"
Stand	1	1/2" x 2" x 2-1/2"
Glass	1	3/32" x 4-3/16" x 6-3/16"
Matte board	1	1/16" x 4-1/4" x 6-1/4"
Back	1	1/8"*** 4-1/4" x 6-1/4"
Frame template	1	1/2" x 6-3/4" x 8-3/4"
Template stile	2	1/2" x 1-5/8" x 8-3/4"
Template rail	2	1/2" x 1-5/8" x 3-1/2"
Push-block hold-down	1	1/2" x 5-1/4" x 7-1/4"
Push-block insert	1	1/4"*** x 4-1/4" x 6-1/4"

* one edge beveled 12 degrees ** hardboard *** plywood



Great Fun To Finish

My children had a blast painting and staining these frames. They quickly discovered how easy it was to highlight the flutes by sanding the finish or by adding additional colors.

Sources Freud Inc., (800) 334-4107, www.freudtools.com 1/2-in.-dia. flush-trim bit with three cutting flutes, #44-104, \$20. Rabbeting bit with bearing, #32-102, \$26. 3/4-in.-dia. round-nose bit, #18-112, \$26. • Rockler, (800) 279-4441, www.rockler.com 7/8-in. brass-plated turn buttons, #27912, \$2 for a pack of eight. • Klingspor's Woodworking Shop, (800) 228-0000, www.woodworkingshop.com Tadpole contour sanders, convex set, #KL20000, \$5. • Albin Products Inc., (800) 225-6821, www.albinproducts.com EaselMate frame stand, pack of two, \$6; pack of six, \$16; pack of 12, \$30.

SOLAR KILN

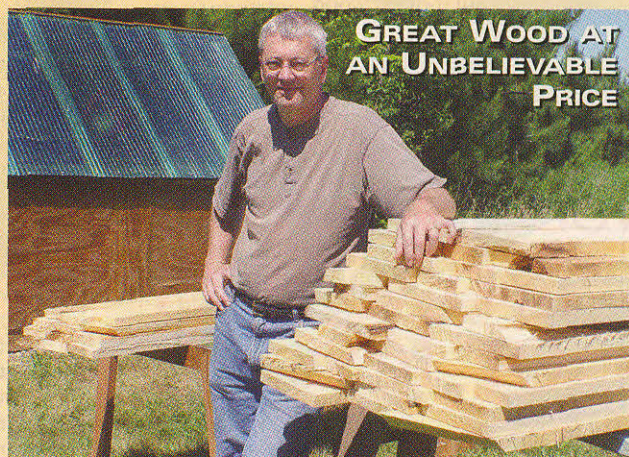
DRY YOUR OWN WOOD FAST AND HASSLE-FREE

by Dave Munkittrick



DRY ANYTHING

With care, a solar kiln can dry wood pieces that are just about any shape or size. You can often dry mixed species and thicknesses in the same load. A solar kiln makes it easy.



GREAT WOOD AT AN UNBELIEVABLE PRICE

Buying wood green and drying it yourself saves a lot of money. The big pile of green wood in front cost the same as the tiny pile of kiln-dried wood behind me.

Wood is expensive. And extra-wide or figured wood is practically beyond reach.

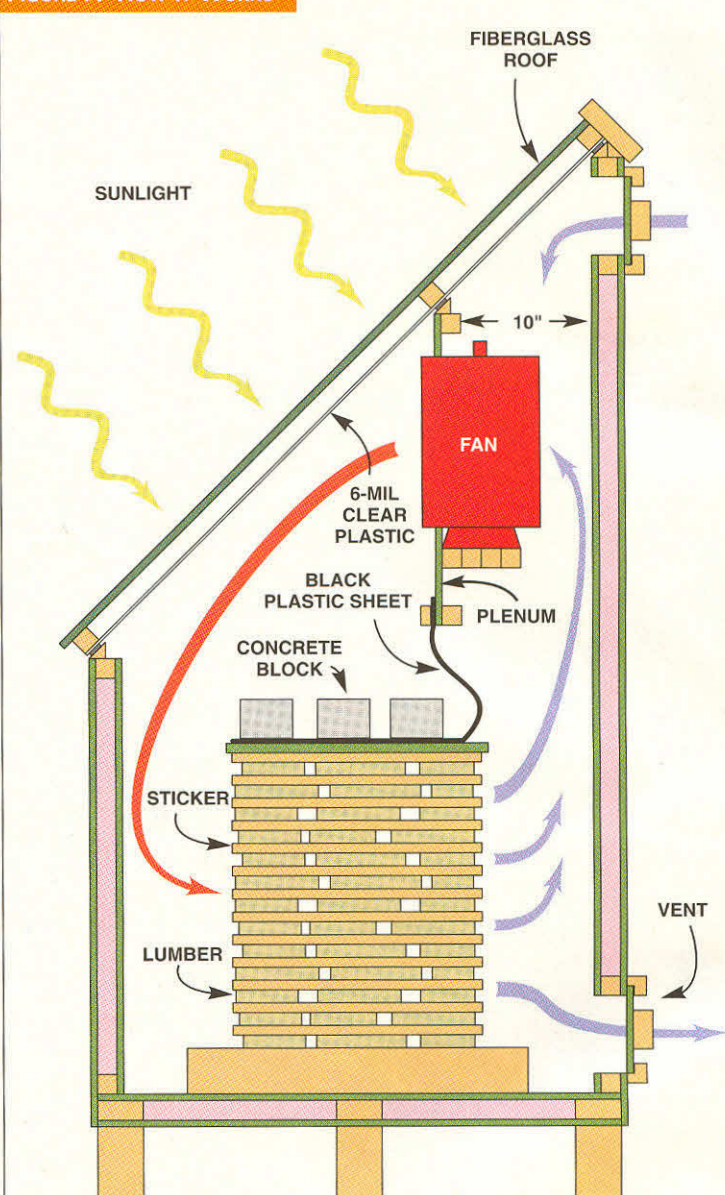
Over the 25-plus years I've been a professional woodworker, wood seems to have taken a cue from oil: The price keeps going up. There are ways to use less oil, but when a project requires 100 bd. ft. of walnut, you gotta buy 100 bd. ft. of walnut. That's why I was so thrilled to discover a simple solar kiln developed by Dr. Eugene Wengert, an extension forest products specialist at the University of Wisconsin-Madison.

Wood is relatively inexpensive before it's dry. I have managed to obtain green wood at a lumberyard at a fraction of the price of dry wood. Granted, there is a fair amount of sweat equity involved in stacking and transporting larger amounts of wood, but the savings are well worth the effort.

A solar kiln is the simplest and safest way to dry green wood quickly. Because the wood is protected from the elements, this solar kiln offers more control with much less chance of defects than air-drying provides. Unlike air-drying, it'll dry wood to the moisture level needed for interior use. And unlike other kilns, it is designed so that it's nearly impossible to dry 4/4 wood too fast. It's as close as you can get to a "set it and forget it" system. After the kiln is loaded, all that's required is some minimal vent adjusting while the wood dries. No sweating over daily drying rates and continual monitoring of the drying process.

I talked with a number of solar-kiln owners for this article. I discovered they all share one problem: where to store all their wonderful solar-dried wood.

FIGURE A How It Works



Here's how this solar kiln works: Solar energy enters the kiln through the fiberglass roof. The sun's radiant energy hits the dark interior and heats the kiln. A timer is set to run the fan from about one hour after sunrise to one hour after sunset. As the kiln heats up during the day, the fan circulates warm air through the lumber stack. A plastic sheet forms a baffle that forces air only through the stack. The moving air picks up moisture from the wet wood and is vented out the back.

Note: Opening the vents allows you to release moist air more rapidly. The kiln is not airtight, so moisture-laden air can escape even with the vents closed. At night, the fan shuts down, the kiln cools and the moisture from the air condenses, wetting the boards. This conditions the wood and eases any drying stresses built up during the day. This process practically guarantees good results without daily monitoring. I dried 4/4 red oak in six weeks with virtually no checking.

**Dry most
wood species
in 6 weeks
or less.**

PROJECT REQUIREMENTS AT A GLANCE

Materials

28 2x2 x 8' treated
10 2x4 x 10' treated
One 2x6 x 10' treated
Three 4x6 x 10' treated
Seven 1-1/2" x 4' x 8' sheathing foam
14 1/2" x 48" x 96" treated plywood
One 12" ventilation fan
One multiple-outlet timer
Five 25-1/2" x 120" corrugated fiberglass panels

Hardware

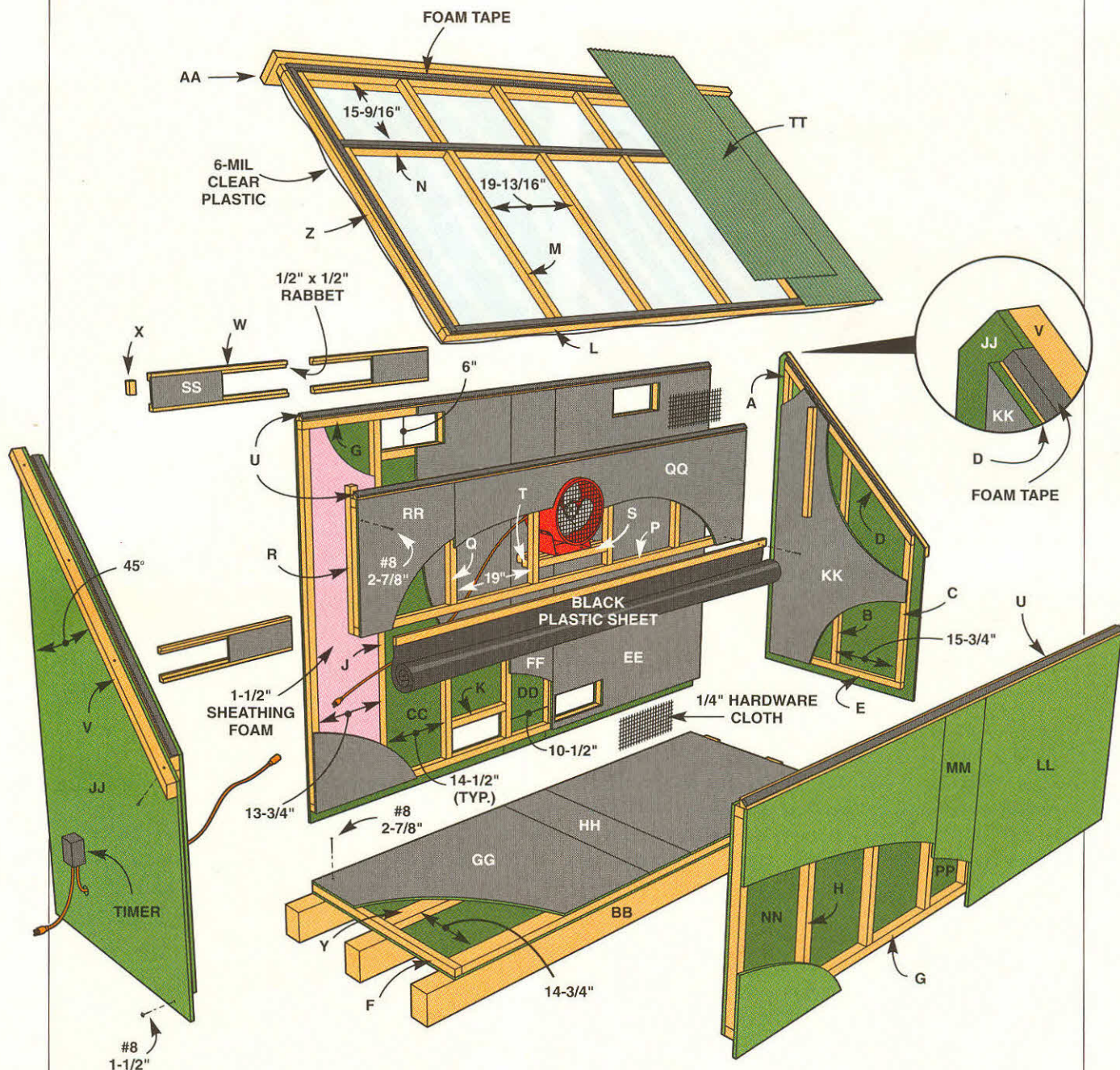
Eight 7/16" x 1-1/4" x 10' black foam tape
No. 8 x 2-7/8" corrosion-resistant screws
No. 8 x 1-1/2" corrosion-resistant screws
Sealing washers
One fan timer
One 1,000-cfm fan
1-gal. flat black oil-based paint

Tools

Tablesaw and/or circular saw
Miter saw
Drill
Framing square
4-ft. level

Cost \$850

FIGURE B EXPLODED VIEW



SET IT AND FORGET IT

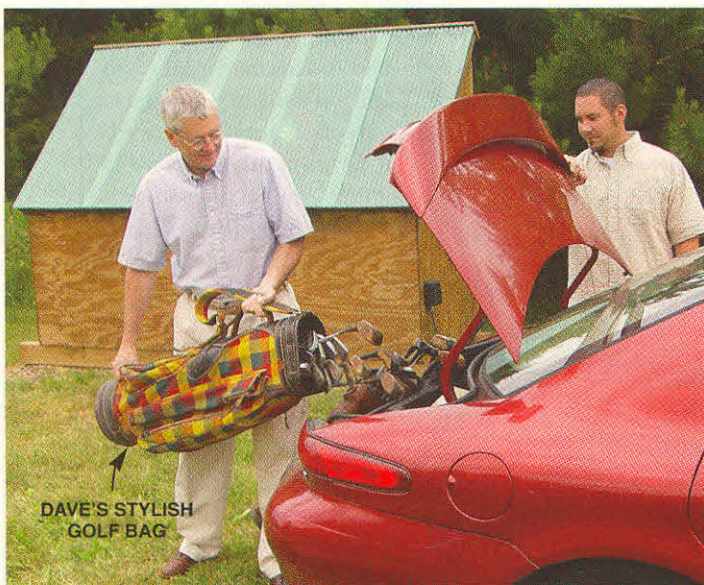
The beauty of this solar kiln design is that it's almost impossible to dry 4/4 wood too quickly. Even so, most hardwoods can be dried in six weeks during the peak summer months. Our load of basswood took only four weeks. A conventional kiln dries the wood continuously and has to be monitored closely to prevent exceeding the safe drying rate for that species (see "Safe Drying Rates," page 61). A solar kiln is cyclical (Fig. A, page 56). During the day, the kiln heats up and the fan comes on to circulate hot air through the stack. Moisture is drawn from the wood into the air and is vented outside

through the vents or leaks out naturally through the kiln's joints and seams. At night, the cooling cycle begins. The temperature drops, the fan shuts down and the moist air condenses. The surface of the wood gets wet and cool, relieving any drying stresses that built up during the day. It's like having an automatic conditioning cycle built in.

For most 4/4 stock, it's OK to start with the vents open an inch or two (Photo 8). This helps remove the moist air quickly. At the same time, however, you're also letting out heat, so there is a trade-off. After the majority of the moisture is out of the wood, which usually takes a week or two, go ahead and shut the vents to maximize the temperature. Moisture can still escape the kiln because it's not airtight.

For figured, thick, prized or check-prone wood, it's best to start the drying process with the vents closed. This keeps the humidity in the kiln from dropping too quickly and slows the drying process. This is especially necessary with stock thicker than 4/4. (For fast-drying or white woods, leave the vents wide open until the wood reaches 20 percent moisture content.) After a few weeks with the vents closed, most of the moisture will be out of the wood. Open the vents a few inches to help expel the remaining moisture. Shut the vents for the last week or so. You may find it's easiest to simply leave the vents closed all the time for thick or hard-to-dry wood.

Drying thicker wood does require some monitoring of the drying rate. For safe drying rates, see "Safe Drying Rates." To slow the drying process for thick wood or when the kiln is less than full, you can block off parts of the roof with an opaque covering or tarp. You can learn all there is to know about solar kilns and wood drying at www.woodweb.com. Click on The Wood Doctor.



With this kiln, you really can "set it and forget it." While your wood dries, you can get back to your shop or other interests.

Kiln Design

I downsized Dr. Wengert's kiln design to dry about 300 bd. ft. of 4/4 wood at a time. I changed the construction a bit so it could be disassembled and stored in a garage or shed when not in use. The smaller size allows me to remove the roof and front panel for easy loading. If you wish to alter the size of your kiln, there is an important ratio to remember: For every 10 bd. ft. of capacity, you need 1 sq. ft. of solar-panel or roof area. Too much solar-panel area and you'll run the risk of drying the wood too fast; not enough and you'll never get the wood to dry below 15 percent moisture content (MC). Since my kiln is designed to hold about 300 bd. ft., that dictates a roof area of about 30 sq. ft., not including overhangs and framing that will block solar gain.

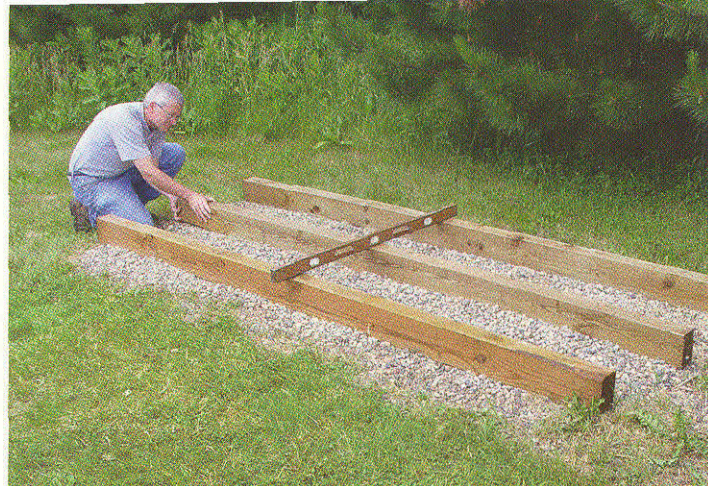
I installed a single fan rated at 1,000 cubic feet per minute (cfm) to circulate air through the stack of wood. A

larger kiln will require two such fans for optimum airflow. Shoot for approximately 150 feet per minute (fpm) air velocity through the stack. To calculate the size of fan needed (in cfm), multiply the number of sticker layers by the length in feet of the wood stack times the thickness in feet of the stickers (3/4 in. equals 1/16 ft.) times 150 fpm. A typical load of 4/4 wood in my kiln has 14 layers x 8.5 ft. x 1/16 ft. x 150 fpm, which equals approximately 1,100 cfm. The fan is mounted high where it can push the hot air down through the stack (Fig. A, page 56).

Roof angle is important. Determine your latitude; then use that latitude number, plus or minus 5 degrees, for the kiln roof's pitch. In Minnesota, for example, our latitude is about 45 degrees north, so I mounted the solar panel at a 45-degree angle.



1 I built the kiln's panels in my shop using deck screws. Foam insulation board helps hold the heat in when the sun is down. Treated wood and plywood resist decay in the high moisture environment of a kiln.



2 To prepare a base for the kiln, I leveled treated landscape timbers on a bed of river rock in my backyard. A sheet of plastic under the river rock discourages weed growth.



3 The panels go together easily. I painted the kiln's interior surfaces black to protect the wooden walls against moisture penetration and to help absorb more heat from the sun.

BUILD THE KILN

Building the kiln is straightforward. All the materials are readily available at home centers or lumberyards. The total cost, including a fan and timer, should run about \$850. Be sure to use corrosion-resistant fasteners throughout the kiln (see Sources, page 60).

The kiln is made up of six panels (Fig. B, page 57)—floor, roof, front, back and sides—that can be built in the comfort of your shop (Photo 1). Insulation in the walls and floor helps the kiln retain heat, which helps speed the drying process. All of the interior surfaces are coated with a flat black oil-based paint. The oil base prevents moisture from penetrating into the wood, and the flat black color absorbs heat from the solar energy.

The solar-panel roof is made with translucent corrugated-fiberglass roofing material. It offers the best combination of low cost and durability. The corrugated roof must be sealed against the roof frame at the top and bottom edges. Corrugated roofing manufacturers offer various solutions

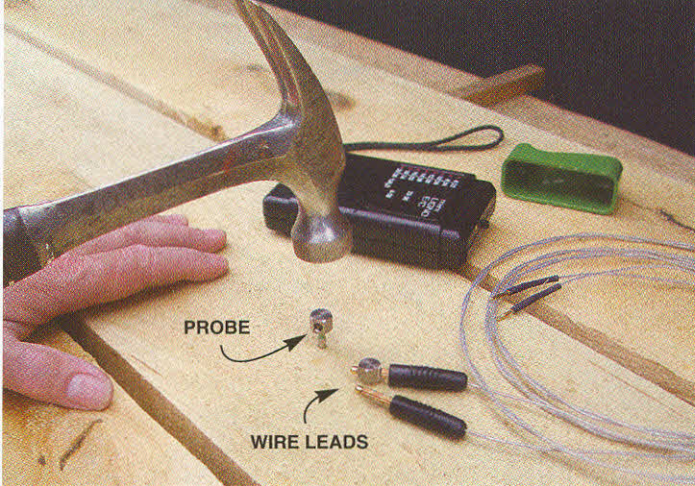


4 I started the stack with timbers to keep the drying wood up off the wet floor. I stacked the green wood to within about 6 in. of the bottom of the fan plenum. Stickers create a gap between each layer so hot air can be driven through the stack by the fan.

to this problem, such as wood strips cut to match the undulating roofline or strips of foam that conform to the corrugations. To increase the insulating value of the roof, I also stapled clear 6-mil-thick plastic sheeting on the underside of the roof frame. This added layer greatly improves the kiln's performance.

ASSEMBLE THE KILN

It's important to locate the kiln with a south-facing exposure that's free of shadows. I set down treated landscape timbers to hold the kiln up off the ground (Photo 2). The timbers provide a level platform for the kiln to rest on. I started by securing the floor to the timbers, then added the back and sides (Photo 3). After attaching the fan plenum (Fig. B) to cleats mounted on the side panels, I drilled a hole for the fan cord. Finally, the kiln was ready for loading. All I needed was some green wood to dry.



5 Two probes are hammered into a board in the middle of the stack. Wire leads are run out of the kiln, where a moisture meter can take readings. Sensors allow you to monitor the wood without having to open the kiln.



6 I topped the stack with cement blocks painted black for heat absorption. The weight from the blocks reduces warping in the drying wood. A plastic sheet attached to the plenum and draped over the top of the stack forces air through the stack.



7 With the help of a friend, I set the roof on the kiln. The removable roof hooks over the peak and is secured with screws through a cleat on the side.



8 Vents allow moisture to escape during drying. They are closed toward the end of the drying process to help maximize heat and get the wood down to the target 8 percent MC.

LOAD THE KILN

Loading the kiln is a breeze with the roof and front panel removed (Photo 4). If you're drying check-prone wood, such as oak, use an end sealer (see Sources, below) on the wood before it's stacked. **Note:** Be sure to stack the wood to leave at least a 6-in. airspace in front and back and under the fan plenum.

I added a couple of remote sensors in the middle of the stack so I could tell when the wood was dry without having to open the kiln (Photo 5). I used a commercial kit (see Sources). You can substitute two nails for the sensors; set them about an inch apart and driven to one-quarter depth of a board. Attach a wire to each nail with alligator clips and run them out a hole in the side of the kiln. To take a reading, simply clip the wires onto the prongs on your moisture meter.

When you're done stacking your green wood, attach a plastic sheet to the bottom of the fan plenum and drape it over the

stack (Fig. B). The plastic directs the air so it circulates through the stack. Weight the stack down with cement blocks (Photo 6).

Run an extension cord from the outdoor timer to the fan through a hole drilled in a side panel (Fig. B). Attach the front panel and the roof (Photo 7) and set the vents (Photo 8). Your green wood is on its way to being kiln-dried.

Sources McFeely's, (800) 443-7937, www.mcfeelys.com No-Co-Rode Drivers, #2 x 2"L, #HX-0222, \$1 ea. ProMax No-Co-Rode Dekkers, #8 x 2-7/8" self-drilling, flat-head screw, #0827-FPX, package of 100, \$8. Promaster No-Co-Rode Saw Tooth Screws, #8 x 1-1/2", #0814-FAX, package of 100, \$4. Sealing Washers, #0800-GSW, package of 25, \$1. • Charley's Greenhouse & Garden, (800) 322-4707, www.charleysgreenhouse.com Multiple-outlet timer, #3360, \$30. • Nasco, (800) 558-9595, www.eNasco.com 12-in. ventilation fan, #C13098N, \$120. • Lignomat, (800) 227-2105, www.lignomat.com Kiln Package: 1-mini-Ligno E/C, pair of PKB-Probes, 6 ft. PK-mini cable, # E-11, \$165. • Woodcraft, (800) 225-1153, www.woodcraft.com Green wood end sealer, #125305, 1 gal., \$20. • Home Centers Fiberglass roofing panels, treated lumber, treated plywood and insulation.

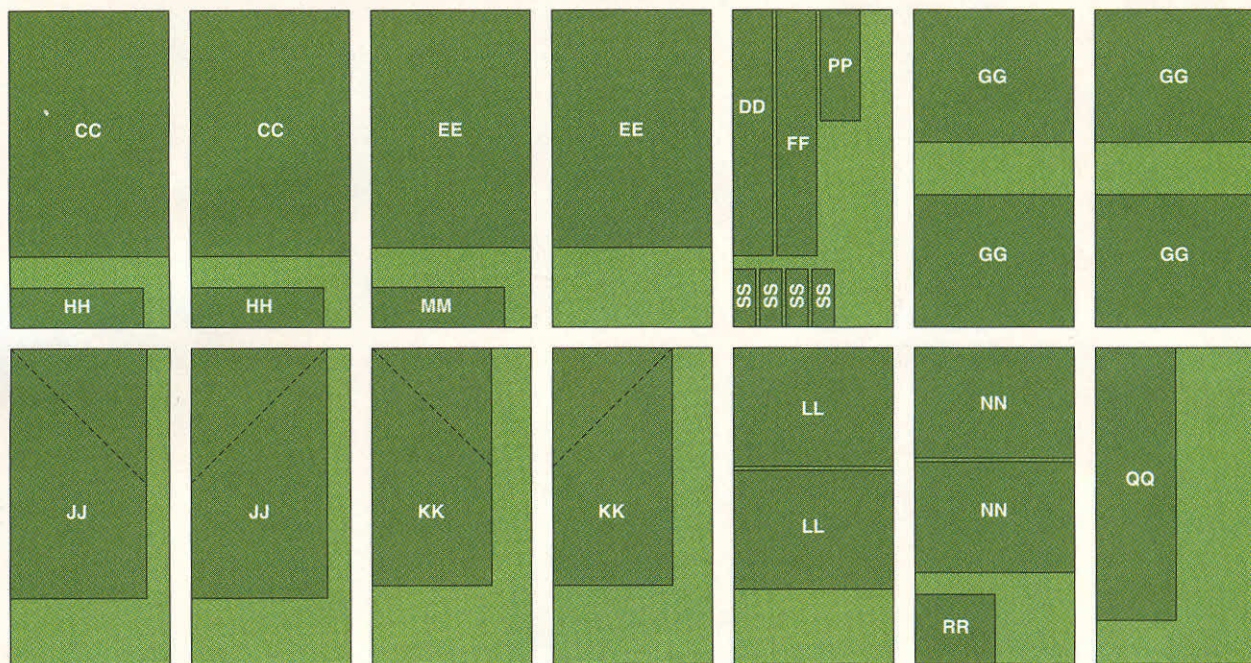
CUTTING LIST OVERALL DIMENSIONS: 109"W x 78-3/4"T x 41"D

Material	Part	Name	Qty.	Dimensions
2x2 treated	A	Side stud	2	68-3/8" *
	B	Side stud	2	51-1/8"
	C	Side stud	2	33-7/8"
	D	Side top plate	2	50-15/16" **
	E	Side bottom plate	2	36"
	F	Floor plate	2	40"
	G	Front and back wall plate	4	108"
	H	Front wall stud	8	30-1/2"
	J	Back wall stud	8	69"
	K	Back wall blocking	4	14-1/2"
	L	Roof plate	2	112"
	M	Roof rafter	4	53-1/2"
	N	Roof blocking	5	19-13/16"
	P	Plenum plate	2	104"
	Q	Plenum stud	6	21"
	R	Plenum cleat	2	25-15/16"
	S	Fan shelf	3	19"
	T	Fan shelf mount	1	22" ***
	U	Wall cap	4	1-1/4" x 1-1/4" x 108"
	V	Roof-attachment cleat	2	57-11/16"
	W	Door track	8	35"
	X	Door handle	4	3"

Material	Part	Name	Qty.	Dimensions
2x4 treated	Y	Floor stud	3	105"
	Z	Roof end rafter	2	53-1/2"
2x6 treated	AA	Roof rear lip	1	114"
4x6 treated	BB	Platform	3	120"
1/2" treated plywood				
	CC	Back (exterior)	2	48" x 74-1/2"
	DD	Back strip (exterior)	1	12" x 74-1/2"
	EE	Back (interior)	2	48" x 72"
	FF	Back strip (interior)	1	12" x 72"
	GG	Floor	4	48" x 40"
	HH	Floor strip	2	40" x 12"
	JJ	Side (exterior)	2	41" x 75-3/4"
	KK	Side (interior)	2	36" x 72"
	LL	Front (exterior)	2	48" x 36"
	MM	Front strip (exterior)	1	36" x 12"
	NN	Front (interior)	2	48" x 33-1/2"
	PP	Front strip (interior)	1	12" x 33-1/2"
	QQ	Fan plenum	1	24" x 82-3/4"
	RR	Fan plenum strip	1	24" x 21-1/4"
	SS	Door	4	6-3/4" x 17-1/2"
	TT	Roof panel	5	25-1/2" x 57"

* Measure to long point of 45-degree cut on the end. ** Measure from long point on one 45-degree end to short point on other 45-degree end. *** Rip 2x2 stock at 45 degrees.

PLYWOOD CUTTING DIAGRAM 14 SHEETS OF 1/2" x 48" x 96" TREATED PLYWOOD



Safe Drying Rates above 30% Moisture Content (MC)

Species	Maximum Rate of MC Loss Per Day
Beech	4.5%
Birch	6.1%
Hard Maple	6.5%
Soft Maple	13.8%
Red Oak	3.8%
White Oak	2.5%
Walnut	8.2%

The maximum "safe rate" for 2-in. hardwood lumber can be obtained by dividing the 1-in. safe rate by 2.5. Thus, the 2-in. safe rate for beech is 1.8 percent moisture content (MC) loss per day ($4.5 \div 2.5 = 1.8$).

Excerpted from "Processing Trees to Lumber—for the Hobbyist and Small Business" by Eugene M. Wengert and Dan A. Meyer, www.woodweb.com. Click on The Wood Doctor, Kiln Operation, Processing Trees to Lumber.

TOOL TEST

Slow-Speed Grinders

These 10 machines are designed to save your tools from overheating: Do they measure up?

*by Tom Caspar
and Jason McNellis*



ART DIRECTION AND PHOTOGRAPHY: VERN JOHNSON

If you love hand tools, chances are you'll need a grinder. When a blade becomes very dull, chipped or nicked, grinding is the fastest way to renew its bevel.

But have you ever seen a tool that has been overheated by a grinder? When an edge becomes too hot, it loses its temper and turns bright blue. The only solution is to grind off the softened section and start again.

Slow-speed grinders are designed to prevent this problem. They run approximately 50 percent slower than high-speed machines, which are built for general-purpose metalworking. You can successfully grind woodworking tools with a high-speed grinder if you're extremely careful, but we much prefer slow-speed machines. Many have variable speed for quick stock removal as well.

We examined 10 slow-speed grinders priced from \$80 to \$300. Before you buy, you should know four things about a grinder: how slow it is, whether it has good tool rests, whether it has at least one soft-bond wheel and whether it comes with a wheel dresser.



Slow Speed Has a Wide Range

Slow is slow, right? Not exactly. The wheel's surface travels much faster on some machines than on others, and that makes quite a difference in heat buildup. Higher surface speeds create more friction and more heat. A wheel's surface speed, measured in surface feet per minute (sfpm), depends on two factors: the motor's revolutions per minute (rpm) and the wheel's circumference.

You might think all slow-speed grinders spin at the same speed, but they don't. At their slowest settings, they range from 1,120 to 2,000 rpm (see Profiles, pages 68 and 69). Most are in the range of 1,725 to 2,000 rpm.

Slow-speed grinders have 6- or 8-in.-dia. wheels. The distance around a 6-in. wheel is about 1.5 ft.; the distance around an 8-in. wheel is about 2 ft. A 6-in. wheel's surface travels 33 percent slower than an 8-in. wheel's surface, if both wheels rotate at the same speed.

Combine both factors, speed and circumference, and you get the sfpm number, the one number that tells you the most about heat buildup on any particular grinder. It's easy to figure out: Speed (rpm) multiplied by a wheel's circumference equals surface speed (sfpm). We've done the math for each machine.

It's no surprise that 6-in. machines grind at cooler temperatures than 8-in. machines do. The minimum sfpm rate for 6-in. grinders varies from 1,760 to 3,140 sfpm, for 8-in. grinders, from 3,610 to 3,770 sfpm. Both work well, but you must exercise a lighter touch and quench more often when using an 8-in. grinder.

Have a Good Rest

Tool rests on most slow-speed grinders don't offer the precision, adjustability and convenience we want for woodworking tools. Only one machine, the Palmgren 82064, has tool rests that we like.

We recommend adding at least one aftermarket tool rest on any other grinder (see photos, left). This adds about \$40 to a grinder's cost and requires mounting the grinder

on a plywood base or bench-top. Two excellent tool rests are available (see Sources, below). We prefer the Veritas for its larger locking levers and smoother operation. A single aftermarket rest will do, because you'll primarily work on a 60-grit wheel when grinding chisels and plane irons. Two aftermarket rests aren't absolutely necessary but are a nice luxury.

An aftermarket tool rest offers multiple benefits:

- **Tool-free adjustability.** No wrenches are necessary to adjust the rest's angle. In contrast, manufacturer-supplied tool rests require one or two wrenches to adjust and typically are balky.

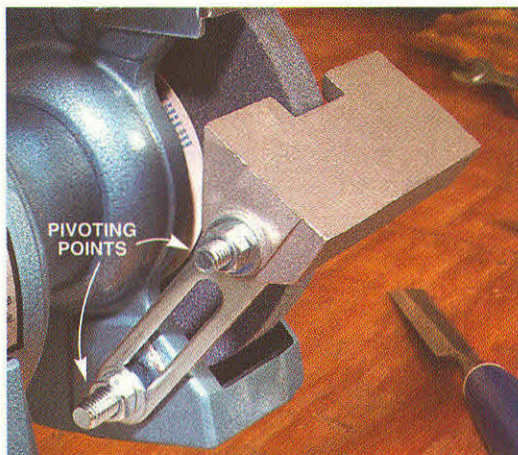
- **Continuous positioning.** You can raise or tilt the rest to grind any bevel between 15 and 90 degrees. With two pivoting points, fine-tuning an angle is quite easy.

Manufacturer-supplied tool rests often have detents, limiting your choice of angles.

- **Comfortable grinding position.** When grinding at 25 degrees, which is one of the most commonly used bevel angles, we prefer to adjust an aftermarket rest to sit high and at a shallow angle to the grinder's base. This puts your wrists at a comfortable angle. To grind the same bevel, most rests that ship with the grinders must be positioned at a steep angle to the grinder's base, where it's awkward to grind a straight edge because your wrists are uncomfortably bent. These rests simply slide in and out; they can't be raised to a more comfortable angle.

- **Minimum gap.** You can easily set the rest 1/8 in. or less from the wheel at any angle. That's important for safety. When grinding 25- to 30-degree bevels on many manufacturer-supplied rests, the smallest gap you can set is much greater than 1/8 in.

- **Broad support.** The platform is deep and wide. Extra depth helps support long-handled tools. Extra width helps your fingers guide a plane blade, so you get a straight edge. Most manufacturer-supplied tool rests are too small.



We like the tool rest on the Palmgren 82064. With two pivoting points, it can be raised for a more comfortable working angle. All other manufacturer-supplied tool rests have only one pivoting point and can't be raised.

Sources Lee Valley, (800) 871-8158, www.leevalley.com Veritas grinder tool rest, #05M23.01, \$40. • Hartville Tool, (800) 345-2396, www.hartvilletool.com Versa-Rest, #12321, \$37.



White Wheels Produce Less Heat

Many grinders come with one or two grey hard-bond wheels. We prefer white soft-bond wheels because they provide more insurance against overheating your tools.

We recommend installing a medium 60-grit white wheel on every grinder. Some machines come with this wheel, but many don't. It's easy to replace a grey wheel with a white one, but it does add \$20 to \$31 to the machine's cost.

Hard- and soft-bond wheels have very different properties. Bond refers to the strength with which abrasive particles are bound together. Grey hard-bond wheels wear very slowly. They retain their shape well but, when grinding tool steel, can quickly load and become glazed with metal particles, increasing the friction on a tool. They work better with softer steel. White soft-bond wheels are preferable for chisels and plane irons. Soft-bond wheels come in other colors, too, but white is the most common. Soft-bond wheels are

more friable, meaning they wear faster, but that helps prevent them from loading.

The grinders we tested come equipped with coarse 36-grit and medium 60-grit wheels or medium 60-grit and fine 120-grit wheels. We prefer the medium and fine combination, as long as both are soft-bond wheels. The finer the grit, the slower and hotter a wheel cuts. We recommend a medium-grit white wheel for grinding chisels and plane irons. It removes material fast without too much heat buildup. Coarse wheels are good for major reshaping. Fine wheels are good for shaping delicate tools, such as carving gouges, and for putting a final edge on some tools, such as a scrub plane iron.

Source Woodcraft Supply, (800) 225-1153, www.woodcraft.com
6-in., 60-grit, white wheel, #01W44, \$20. 8-in., 60-grit, white wheel, #01W48, \$31.



A Wheel Dresser Is a Must

Dressing your wheels keeps them clean and round. It also creates a flat face. Clean wheels create less heat, round wheels minimize vibration and a flat face creates a straight edge.

Dressing is routine maintenance.

For the best results, you should dress the wheels each session if you grind more than a few minutes.

We prefer a T-style diamond dresser for white wheels. It costs about \$15. This dresser works fast and doesn't require finesse. Some grinders come with one. If a grinder doesn't include this dresser, we recommend getting one when you buy your grinder. New wheels must often be trued round after they're mounted, so your machine will run with the least vibration.

Source Woodcraft Supply, (800) 225-1153, www.woodcraft.com
Diamond-tip wheel dresser, #124670, \$15.



Wide Wheels Make Grinding Easier

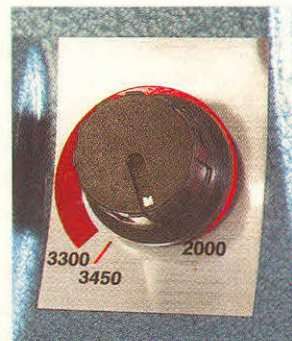
Slow-speed grinding wheels come in two widths: 3/4 and 1 in. Among the machines we tested, all the 6-in. grinders come with 3/4-in. wheels and all the 8-in. machines have 1-in. wheels. Most woodworkers find it easier to grind a straight edge when using a 1-in. wheel. A 3/4-in. wheel requires more finesse.

We recommend getting an 8-in. machine if you will do lots of grinding, such as sharpening turning tools. Wheels that are 1 in. wide with an 8 in. diameter have much more material than narrower and smaller wheels, so they'll last longer.

High-Speed Option Is Handy

Many slow-speed grinders have dials that allow you to increase the motor's speed. At the top end, these variable-speed motors spin about as fast as a high-speed grinder (3,450 rpm). One model, the Woodcraft 144291, has two separate speeds, low and high.

High speed is a very handy feature, particularly if you also use your grinder for general metalworking. You can remove a lot of metal much faster at high speed, and some grinding jobs do require hogging off lots of material.



Lightweights Are Easy To Store

Many woodworkers store their grinders on a shelf or under a bench when not in use. A lightweight machine is easier to lift and maneuver into cramped quarters than a heavier one.

Lightweight 6-in. slow-speed grinders generally weigh about 27 lbs. Moderately heavy 6-in. models and most 8-in. models weigh about 45 lbs. One very heavy 8-in. model, the Delta 23-725, tips the scales at 86 lbs. Moderately heavy machines can be difficult to lift above or below your waistline. The Delta 23-725 requires a permanent home.

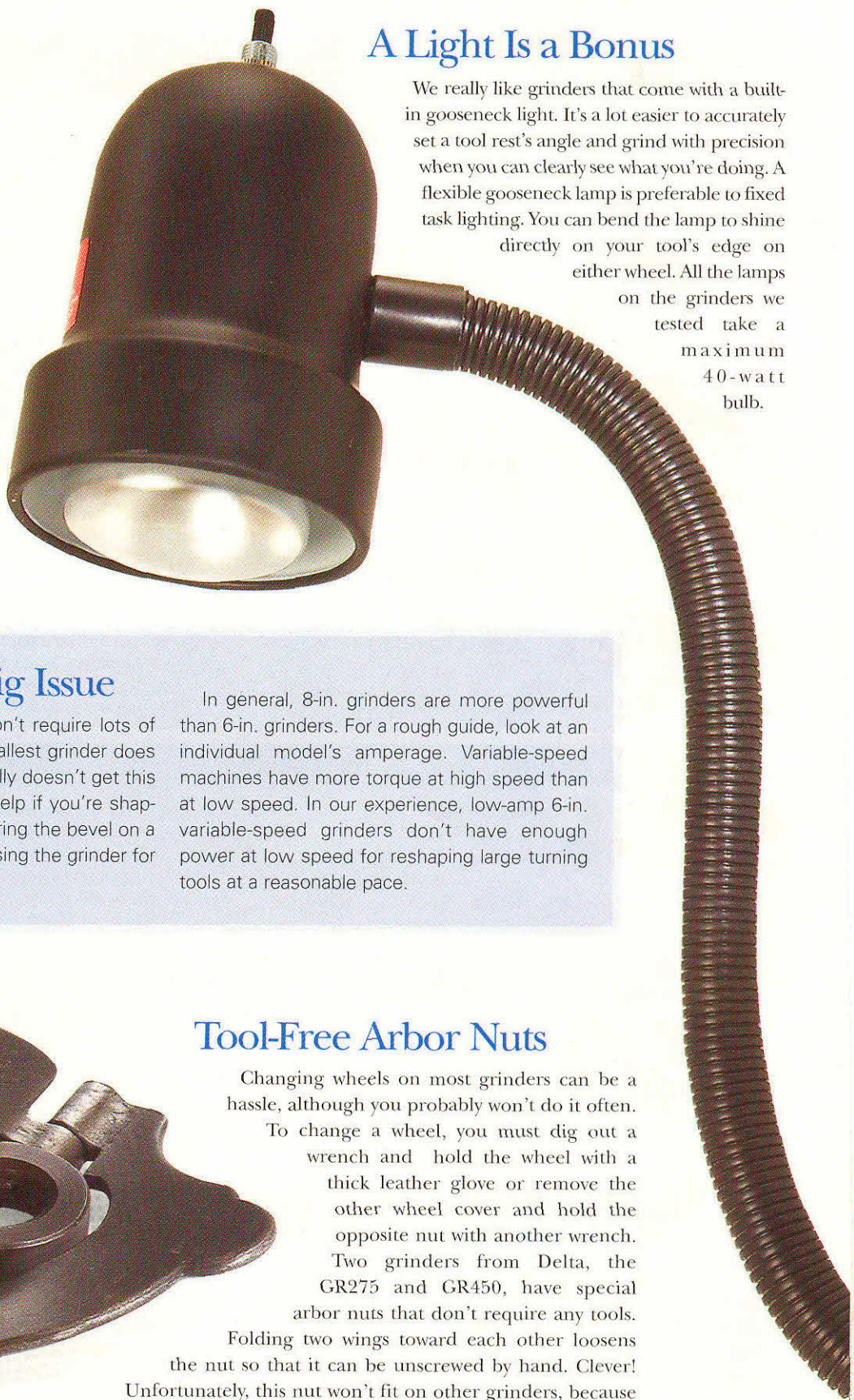


Tip

To eliminate annoying vibration from your grinder, draw pencil lines all the way around the surface of both wheels. Dress the wheels until the lines are completely gone. Sometimes you must remove quite a lot of material to make the wheels perfectly round and balanced. New wheels often require this, too.

A Light Is a Bonus

We really like grinders that come with a built-in gooseneck light. It's a lot easier to accurately set a tool rest's angle and grind with precision when you can clearly see what you're doing. A flexible gooseneck lamp is preferable to fixed task lighting. You can bend the lamp to shine directly on your tool's edge on either wheel. All the lamps on the grinders we tested take a maximum 40-watt bulb.



Power Isn't a Big Issue

Chisels and plane irons don't require lots of power to grind. Even the smallest grinder does a good job. Extra power usually doesn't get this job done faster, but it does help if you're shaping large turning gouges, altering the bevel on a large chisel or plane iron or using the grinder for metalworking.

In general, 8-in. grinders are more powerful than 6-in. grinders. For a rough guide, look at an individual model's amperage. Variable-speed machines have more torque at high speed than at low speed. In our experience, low-amp 6-in. variable-speed grinders don't have enough power at low speed for reshaping large turning tools at a reasonable pace.



Tool-Free Arbor Nuts

Changing wheels on most grinders can be a hassle, although you probably won't do it often.

To change a wheel, you must dig out a wrench and hold the wheel with a thick leather glove or remove the other wheel cover and hold the opposite nut with another wrench.

Two grinders from Delta, the GR275 and GR450, have special arbor nuts that don't require any tools.

Folding two wings toward each other loosens the nut so that it can be unscrewed by hand. Clever! Unfortunately, this nut won't fit on other grinders, because their wheel covers don't have sufficient clearance.

6-in. Grinder Profiles



BALDOR 632E

\$295

Motor speed _____ 1,800 rpm
Surface speed _____ 2,810 sfpm
Medium white wheel _____ No
Diamond dresser _____ No
Source Baldor, (479) 646-4711, www.baldor.com

This single-speed grinder is designed for prolonged, everyday use, perfect for a woodworking club, a school or a shop with a large staff. It comes with 36- and 60-grit grey wheels. Its 2.8-amp motor provides plenty of power. It's moderately heavy at 41 lbs.



CRAFTSMAN OR15104

\$80

Motor speed _____ 2,000 to 3,450 rpm
Surface speed _____ 3,120 to 5,420 sfpm
Medium white wheel _____ No
Diamond dresser _____ No
Source Craftsman, (800) 383-4814, www.sears.com

This compact variable-speed grinder weighs only 27 lbs., so is easy to move around the shop. It comes with a 60-grit grey wheel, a wire wheel and a light. At slow speed, its 2-amp motor bogs down under a heavy load. Its base is too wide for the Hartville Tool aftermarket tool rest.

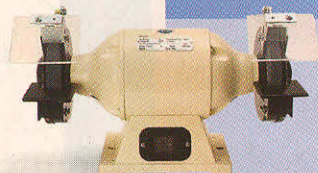


DELTA GR275

\$90

Motor speed _____ 2,000 to 3,450 rpm
Surface speed _____ 3,120 to 5,420 sfpm
Medium white wheel _____ Yes
Diamond dresser _____ Yes
Source Delta, (800) 223-7278, www.deltamachinery.com

This machine is similar in size, weight (27 lbs.) and power (2 amps) to the Craftsman OR15104. The Delta GR275 comes with two upgrades we recommend: a 60-grit white wheel and a diamond dresser. Its second wheel is a 36-grit grey. This grinder has quick-change wheel covers and arbor nuts and a light.

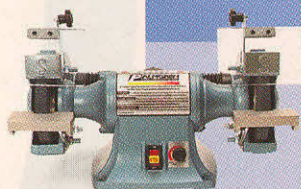


GARRETT WADE 98N20.06

\$166

Motor speed _____ 1,120 rpm
Surface speed _____ 1,750 sfpm
Medium white wheel _____ No
Diamond dresser _____ No
Source Garrett Wade, (800) 221-2942, www.garrettwade.com

This is a super-slow-speed grinder. It's almost impossible to burn a tool on this model if you upgrade to white wheels (it comes with 36-grit and 60-grit grey wheels). Its surface speed is about 33 percent slower than that of any other grinder we tested. The 2.9-amp motor has lots of power. This machine is moderately heavy at 43 lbs.



PALMGREN 82064

\$170

Motor speed _____ 2,000 to 3,450 rpm
Surface speed _____ 3,120 to 5,420 sfpm
Medium white wheel _____ No
Diamond dresser _____ No
Source Palmgren, (800) 621-6145, www.palmgren.com

This variable-speed grinder has good tool rests. They're easy to adjust at a comfortable working angle but require two wrenches. This lightweight 27-lb. machine has a powerful 3.5-amp motor that rarely bogs down under a heavy load at slow speed. It comes with 36- and 60-grit grey wheels.

Recommendations

The ideal slow-speed grinder package includes an easy-to-adjust tool rest, a medium-grit white wheel and a T-style diamond wheel dresser. No grinder comes with all three, but any machine can be upgraded. As you're comparing prices, add \$40 for an aftermarket tool rest, \$20 to \$31 for the wheel and \$15 for the dresser.

For most woodworkers, we recommend an 8-in. variable-speed or two-speed grinder. The wheels are wider and last

longer than those on 6-in. machines, although the wheels' surface speed is faster, so you must exercise more caution when grinding. These machines are versatile enough for woodworking tools and metalworking. You've got three good choices: the Delta GR450 (\$120), Steel City Tool Works 15420 (\$139) or Woodcraft 144291 (\$120). The Delta is the most complete package, including both a medium white wheel and a T-style diamond dresser.

8-in. Grinder Profiles



DELTA 23-725

\$175

Motor speed _____ 1,800 rpm
Surface speed _____ 3,770 sfpm
Medium white wheel _____ No
Diamond dresser _____ No
Source Delta, (800) 223-7278,
www.deltamachinery.com

If you're a serious woodturner, this is the machine for you. Its 8-amp motor is extremely powerful and, weighing 86 lbs, this Delta model is very sturdy. It comes with a 60-grit grey wheel, a 120-grit white wheel, a star-wheel-style dresser (which is fine for grey wheels but too aggressive for white wheels) and a light.



DELTA GR450

\$120

Motor speed _____ 1,725 to 3,450 rpm
Surface speed _____ 3,610 to 7,230 sfpm
Medium white wheel _____ Yes
Diamond dresser _____ Yes
Source Delta, (800) 223-7278,
www.deltamachinery.com

This variable-speed grinder has just about everything we want, except woodworker's tool rests. It has a 5-amp motor that's very hard to bog down at slow speed. It comes with 60-grit white and 36-grit grey wheels, quick-release wheel covers and arbor nuts, and a light. At 47 lbs., it's moderately heavy.



STEEL CITY TOOL WORKS 15420

\$139

Motor speed _____ 1,725 to 3,450 rpm
Surface speed _____ 3,610 to 7,230 sfpm
Medium white wheel _____ No
Diamond dresser _____ Yes
Source Steel City Tool Works, (615) 225-9001,
www.steelcitytoolworks.com

This variable-speed grinder comes with a 60-grit grey wheel and a 120-grit white wheel. This grit combination is our favorite, but we would upgrade the 60-grit wheel to a white one. The 15420 model has a 5-amp motor, plenty of power for turning tools. This grinder has a light and is moderately heavy at 44 lbs.



WOODCRAFT 144290

\$95

Motor speed _____ 1,725 rpm
Surface speed _____ 3,610 sfpm
Medium white wheel _____ Yes
Diamond dresser _____ No
Source Woodcraft, (800) 225-1153,
www.woodcraft.com

This single-speed, no-frills machine comes with two white wheels, 60 and 120 grit. That's an ideal set for grinding a wide variety of woodworking tools. It has plenty of power with 4.5 amps and is moderately heavy, weighing 40 lbs.



WOODCRAFT 144291

\$120

Motor speed _____ 1,725, 3,450 rpm
Surface speed _____ 3,610, 7,230 sfpm
Medium white wheel _____ No
Diamond dresser _____ No
Source Woodcraft, (800) 225-1153,
www.woodcraft.com

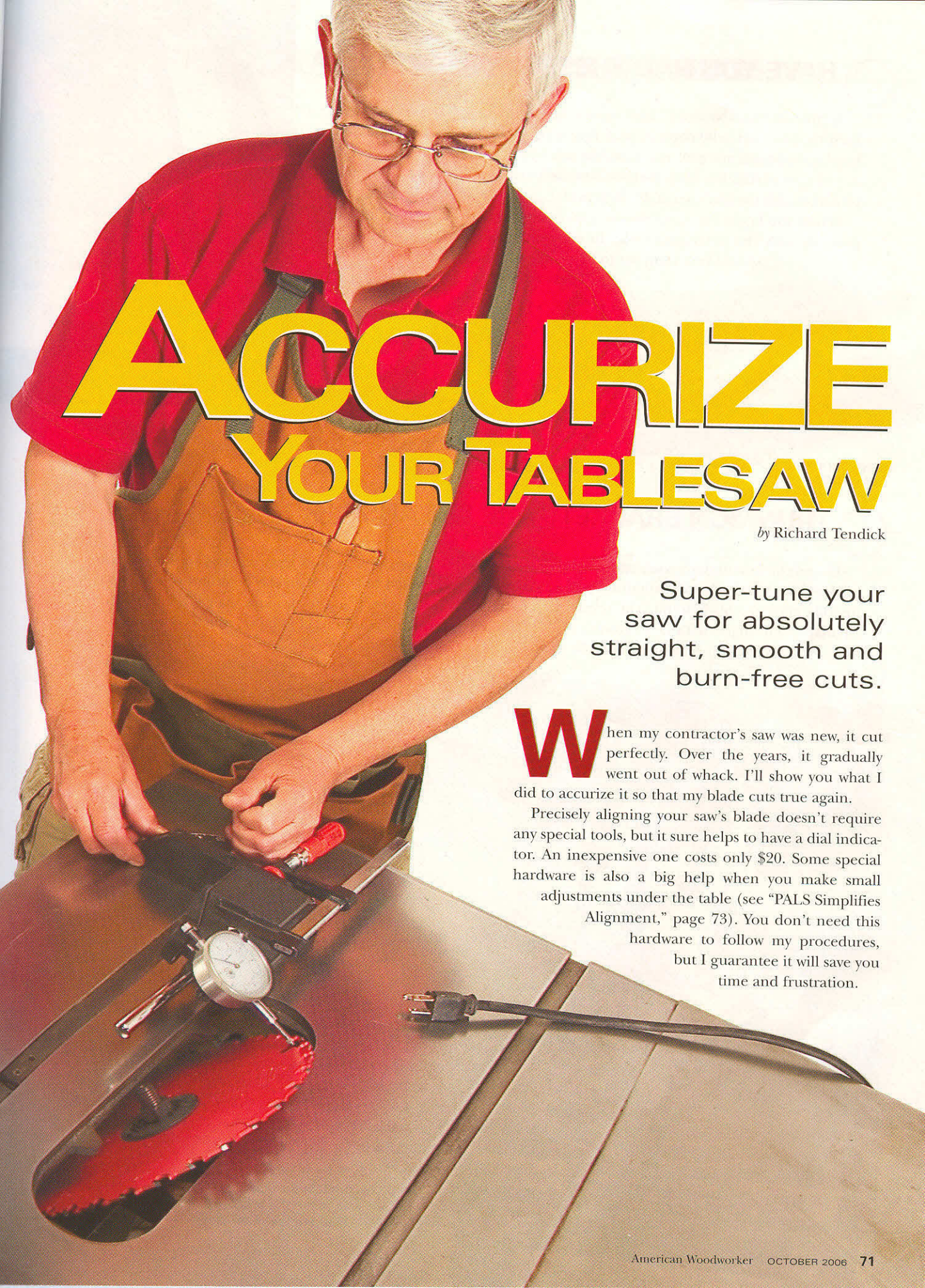
Instead of variable speed, this machine has two speeds. At low speed, it has more torque than variable-speed grinders do. It draws 4.5 amps, weighs 41 lbs. and comes with 60-grit grey and 120-grit white wheels.

If you're totally spooked by bluing your tools and want the most insurance possible, we recommend the 6-in. single-speed Garrett Wade 98N20.06 (\$166). Its surface speed is one-third slower than that of any other machine. You don't get the option of a higher speed, however.

If you need a lightweight machine to tuck away in your shop or want an extra-slow machine without the additional cost of the Garrett Wade, we recommend two other 6-in. mod-

els: the Delta GR275 (\$90) or Palmgren 82064 (\$170). The Delta is an excellent value, coming with a medium white wheel, T-style diamond dresser, variable speed and a light. The Palmgren also offers variable speed, but has much more power. It has tool rests that don't require upgrading.

If you grind a lot of turning tools and have a permanent spot for an 8-in. grinder, we recommend the Delta 23-725 (\$175) for its extra power and stability.

A man with white hair and glasses, wearing a red polo shirt and a brown leather apron, is leaning over a table saw. He is using a red-handled tool to adjust the blade. A dial indicator is mounted on the table saw's surface, pointing to the blade. The background is a plain, light-colored wall.

ACCURIZE YOUR TABLESAW

by Richard Tendick

Super-tune your saw for absolutely straight, smooth and burn-free cuts.

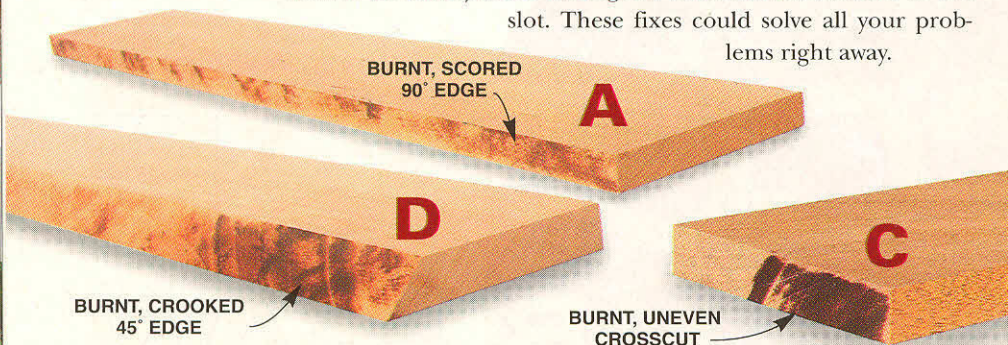
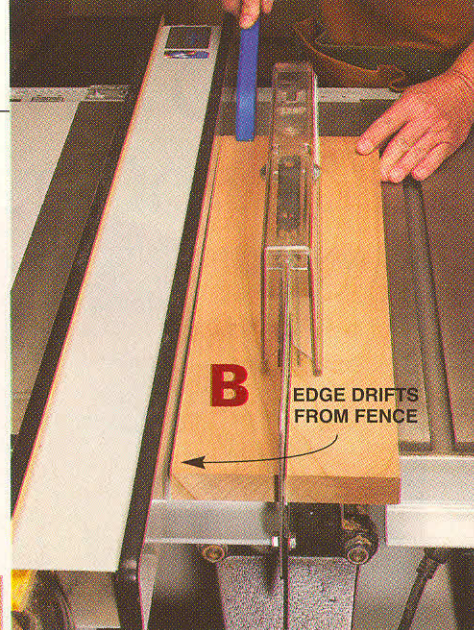
When my contractor's saw was new, it cut perfectly. Over the years, it gradually went out of whack. I'll show you what I did to accurize it so that my blade cuts true again.

Precisely aligning your saw's blade doesn't require any special tools, but it sure helps to have a dial indicator. An inexpensive one costs only \$20. Some special hardware is also a big help when you make small adjustments under the table (see "PALS Simplifies Alignment," page 73). You don't need this hardware to follow my procedures, but I guarantee it will save you time and frustration.

HAVE YOU HAD THESE PROBLEMS?

Accurizing your saw should solve one or more of these aggravating problems. With the blade set at 90 degrees, your rip cuts may be burnt (A). On the other hand, your boards may pull away from the fence (B). Wide crosscuts may tail off, out of square (C). But even if those cuts are perfect, you might have similar problems with the blade set at 45 degrees (D).

Before you begin the accurizing procedures, make sure your fence lines up perfectly with the miter-gauge slot. In addition, check your miter gauge. It should be exactly set to 90 degrees and shouldn't wobble in the slot. These fixes could solve all your problems right away.



TRUNNION BRACKETS ARE THE ANSWER

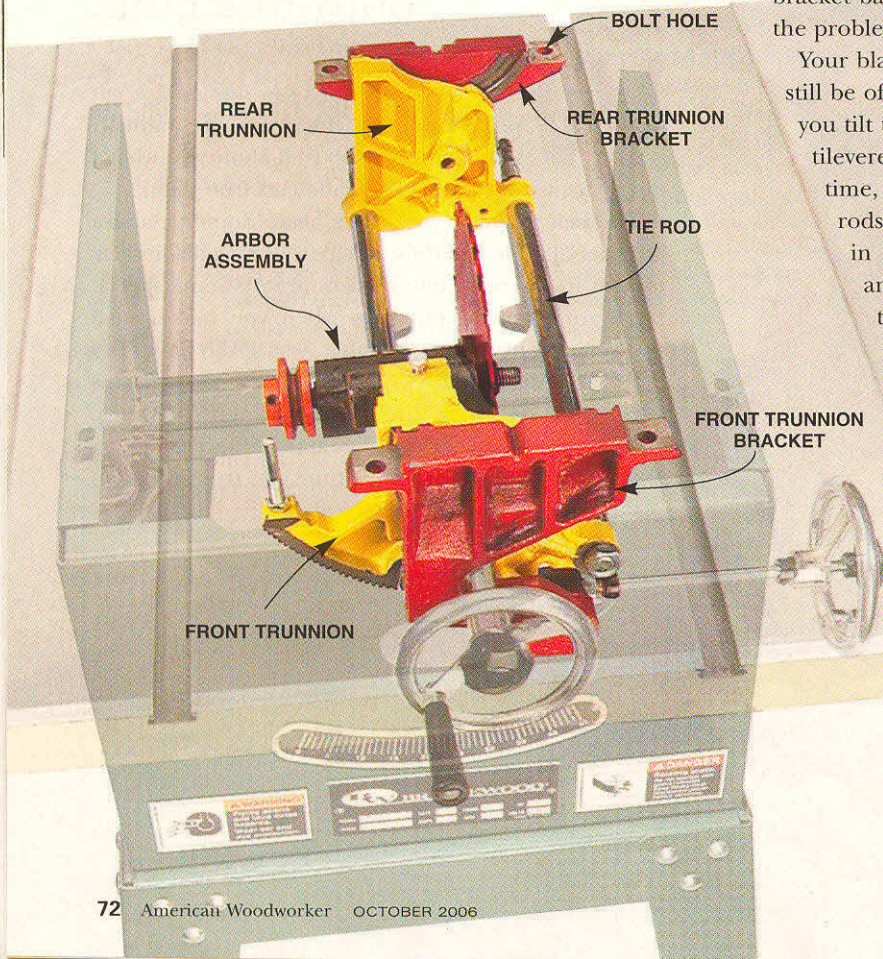
The mechanism under a contractor saw is relatively simple (see photo, below). Two trunnions, connected by long tie rods, allow the blade to tilt. The trunnions have semi-circular raised ridges that ride in grooves in the trunnion brackets. This mechanism allows the blade to tilt.

The trunnion brackets are bolted to the table through oversized holes. Loosen the bolts and you can move the brackets back and forth more than 1/8 in. Vibration can cause the rear bracket to move, which skews the blade out of alignment. The solution to this problem is to move the bracket back to its proper position. That only solves half the problem, however.

Your blade can be perfectly aligned at 90 degrees and still be off at 45 degrees. How does that happen? When you tilt the blade, you also tilt the motor, which is cantilevered off the back of the trunnion tie rods. Over time, vibration and the motor's weight may cause the rods to twist in relation to each other, so they're not in the same plane. This shifts the rear trunnion and skews the blade. Moving or lifting the saw by the motor may have the same effect.

You can solve the 45-degree alignment problem in two ways. I prefer to lower one or both trunnion brackets with shims. It's slow-going, but controlled and precise. You can also untwist the rods. To do this, you loosen the tie-rod nuts at the motor end, insert a lever between the rods and pry. I've tried this method, but I found it too awkward and hard to control the results.

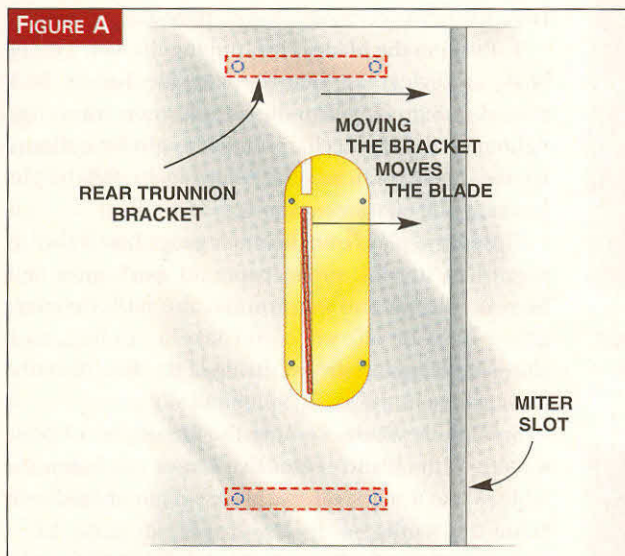
If you could look through the table of a contractor's saw, here's what you would find. The trunnion brackets are bolted to the underside. Loosening these bolts allows you to move the brackets, which realigns the blade to the miter slot.



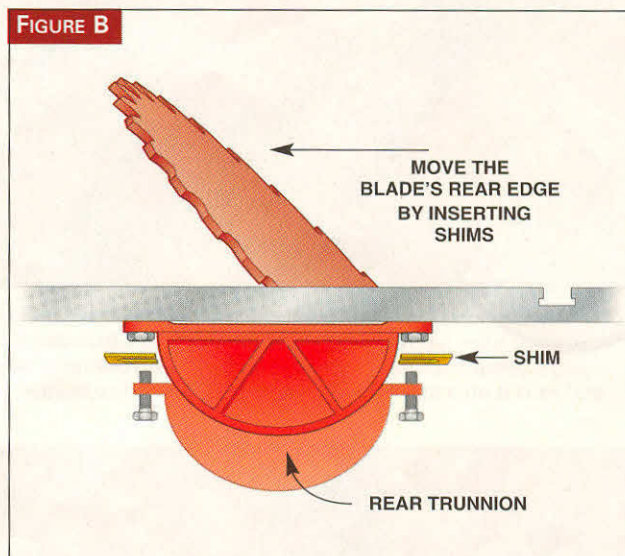
ALIGN THE BLADE AT 90 DEGREES, THEN 45 DEGREES

Aligning your blade is a two-step process. First, you set the blade at 90 degrees and align it parallel to the saw's miter slot (Fig. A). Second, you tilt the blade to 45 degrees and check its alignment again (Fig. B). Each alignment pro-

cedure requires shifting the trunnion brackets in a different way. You can't reverse the order; you must perform the 90-degree alignment before moving on to the 45-degree alignment (see pages 74 and 75).



To align the blade at 90 degrees, shift the rear trunnion bracket left or right until the blade is perfectly parallel to the saw's miter slot.



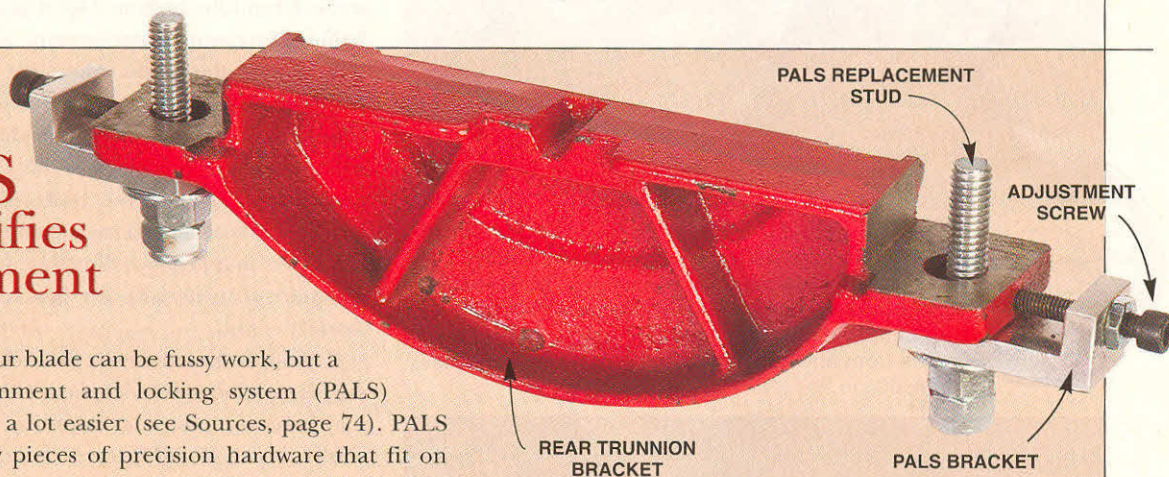
To align the blade at 45 degrees, lower one or both trunnion brackets by inserting shims under the table. This brings the blade back into alignment.

PALS Simplifies Alignment

Aligning your blade can be fussy work, but a precision alignment and locking system (PALS) makes the job a lot easier (see Sources, page 74). PALS includes a few pieces of precision hardware that fit on your saw's rear trunnion bracket. Believe me, it's the best \$20 you can spend on your contractor's saw. After your saw is trued, PALS prevents it from creeping out of alignment again.

When your tablesaw blade needs aligning, you have to shift the saw's rear trunnion bracket side to side to put things right. The low-tech way to do this is to tap the bracket back and forth (see "90-Degree Alignment," page 74, Photo 3). Inevitably, you smack too hard and overshoot the mark. The PALS method is more sophisticated and much quicker. To move the bracket, you turn a pair of opposing screws. In effect, you dial in the adjustment.

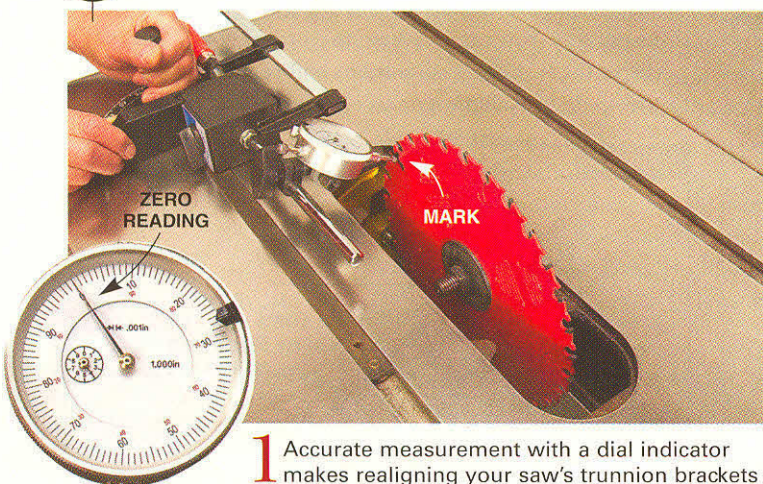
Installing PALS is easy and doesn't require special tools. It fits most contractor's saws. First, you replace the



rear trunnion bracket's bolts with studs. (You don't have to remove the bracket to do this.) Then you install an L-shaped bracket with an adjusting screw on each stud. The PALS hole precisely fits the stud, unlike the oversized holes in the bracket. The adjusting screws bear against the bracket's ends. Turn the screws and you precisely move the bracket. When the screws bear against both sides of the bracket and their nuts are tight, the bracket isn't going anywhere.

The PALS adjusting screws also make the complicated 45-degree alignment procedure much easier (see page 75). With PALS, you can loosen and lower the rear bracket without losing its correct position.

90-DEGREE ALIGNMENT



1 Accurate measurement with a dial indicator makes realigning your saw's trunnion brackets much easier. Clamp the indicator to your miter gauge and zero it on a spot you've marked at the blade's front.

I use a dial indicator to measure the blade's alignment (see Sources, below), but you can also use a combination square. I installed the PALS system before beginning the alignment procedure, but it isn't absolutely necessary (see "PALS Simplifies Alignment," page 73).

1. Position the blade. First, unplug the saw. Tilt the blade to 5 degrees. Gently rotate the handle back toward 0 degrees. This relieves any strain from over-tightening the tilt mechanism that might have distorted the readings. Raise the blade to its full height. Lower it one-quarter turn to remove strain.

2. Remove play from the miter-gauge bar. If the bar wiggles in its slot, insert paper or packaging tape between the bar and slot. You can also push the miter gauge right or left when you take a reading, so it always butts against the same side of the slot. Place the miter gauge in the saw's right-hand slot.

3. Mark the blade. Remove the throat plate. Locate a tooth at the blade's front that's at or just below the table. Make a mark on the blade's plate immediately below this tooth.

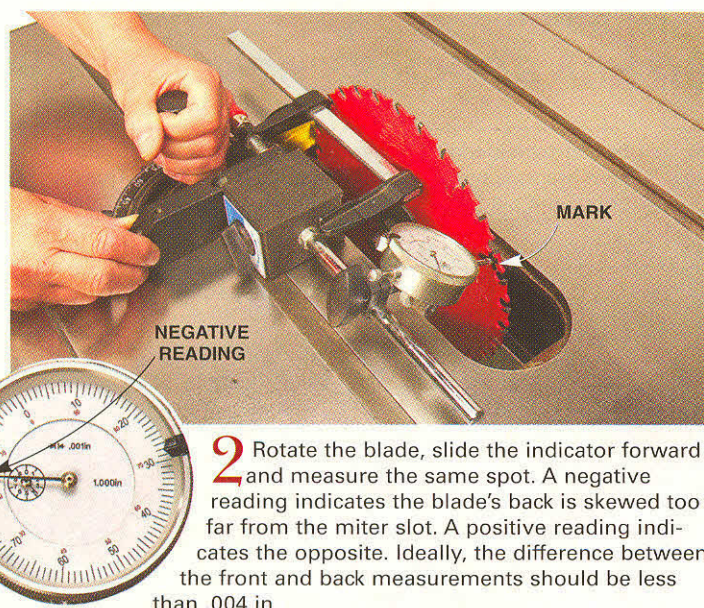
4. Zero the indicator at the blade's front. Clamp the indicator's base to the miter gauge (Photo 1). Adjust the indicator so its spring-loaded ball foot touches the mark. Clamp the indicator so its plunger is depressed halfway. Set the indicator to zero.

5. Rotate the blade. Move the indicator to the blade's back and relocate the ball foot on the mark (Photo 2). If you get a positive reading more than .004 in., the back of the blade is too close to the miter-gauge slot. To align the blade, the rear trunnion bracket must be moved *away* from the slot. If the needle moves in a negative direction and you get a reading more than .004 in., the bracket must be moved *toward* the slot.

6. Shift the rear trunnion bracket. From behind the saw, slightly loosen the bracket's bolts (Photo 3). (You may have to remove the saw's rear rail for access.) If you've installed PALS, turn its adjusting screws to move the bracket left or right. If you don't have PALS, drive the bracket left or right using a hammer and a pointed stick or dowel. A small tap will make a big difference, so take it easy.

7. Measure again. Repeat Steps 4 and 5 to see where you are. When the two readings are .004 in. or less apart, you should be good to go. Tighten the brackets' bolts and measure one last time. On the PALS system, tighten both adjusting screws against the bracket to lock it in place.

Sources In-Line Industries, (800) 533-6709, www.in-lineindustries.com Contractor saw precision alignment and locking system (PALS), \$20. • Little Machine Shop, (800) 981-9663, www.littlemachineshop.com Dial indicator set, #1782, \$20. • Lee Valley, (800) 871-8158, www.leevalley.com Brass shim stock sampler pack, #27K07.50, six sheets for \$7.

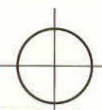


2 Rotate the blade, slide the indicator forward and measure the same spot. A negative reading indicates the blade's back is skewed too far from the miter slot. A positive reading indicates the opposite. Ideally, the difference between the front and back measurements should be less than .004 in.



3 Shift the rear trunnion bracket by slightly loosening its bolts and gently tapping left or right with a hammer and a pointed stick. The blade moves with the bracket. This crude method works OK, but you'll find installing a PALS system makes this adjustment much easier (see "PALS Simplifies Alignment," page 73).

45-DEGREE ALIGNMENT



Before starting this procedure, make sure your blade is aligned at 90 degrees.

8. Measure the alignment. Repeat Steps 1 through 5 with the blade tilted away from the indicator (Photo 4). Adjust the blade to 44 degrees to remove strain.

9. Identify which bracket to lower. See the chart below. To shim the front bracket, go to Step 10. To shim the rear bracket only, skip to Step 12.

10. Shim the front trunnion bracket, if needed. Remove the motor and turn the saw over. Install two 5/16-in. washers under each bolt (Photo 5). Tighten the bolts. Turn the saw back on its feet and install the motor. You shouldn't have to turn the saw over again.

11. Check 90- and 45-degree alignments again. Repeat Steps 1 through 8. You should get a positive reading in Step 8, which means the rear bracket must now be lowered. Move on to Step 12 to fine-tune the 45-degree alignment.

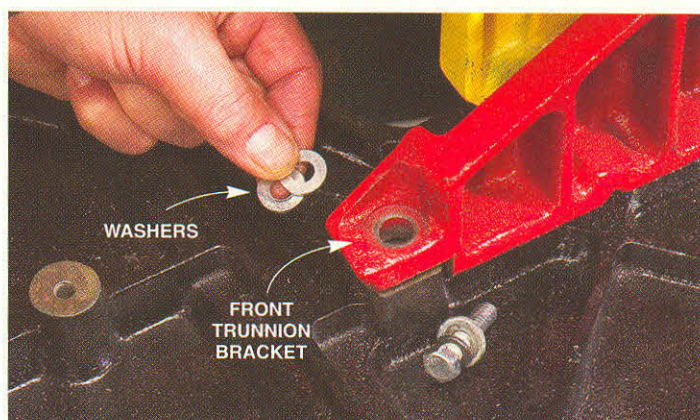
12. Shim the rear bracket. Use scissors to cut U-shaped shims of various thicknesses. Brass shim stock works best (see Sources, page 74). The shims' correct thickness can only be determined by trial and error. Start with .006-in. shims. Slightly loosen the bracket's bolts and insert one shim around each bolt (Photo 6).

13. Repeat the 90-degree alignment procedure (Steps 1 through 7). It's no fun, but you must correct for any side-to-side movement in the bracket whenever you've loosened it. If you have installed the PALS system, chances are the rear bracket will not have moved, but it's still worth checking.

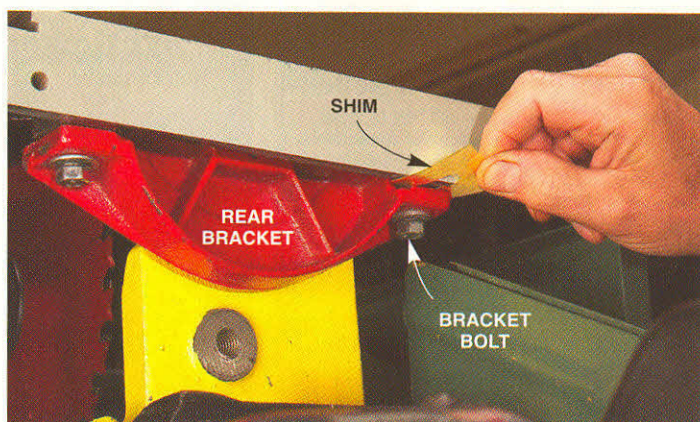
14. Check the blade's alignment at 45 degrees. Repeat Step 8. If the readings are within .004 in., you're done. If the reading is positive and more than .004 in., use thicker shims. If it's negative by more than .004 in., use thinner shims. Then measure again.



4 Measure the blade's alignment at 45 degrees. Repeat the same front-and-back measuring procedure you used to align the blade at 90 degrees. This time, the blade is tilted away from the dial indicator.



5 Place two washers under each side of the front trunnion bracket if it must be lowered. This requires turning the saw over. Washers will overcompensate, so you don't have to turn the saw over a second time. Fine-tune the alignment by shimming the rear bracket, with the saw upright (Photo 6). This bracket is easily accessible.



6 Place thin metal shims under each side of the rear bracket to align the blade. You'll have to experiment with different thicknesses to make the alignment spot-on. It may seem odd, but a paper-thin shim can shift the blade quite a lot.

45-DEGREE ALIGNMENT FOR LEFT- OR RIGHT-TILT SAWS

From this miter-gauge slot	if the back of the blade is...	take this action
Right slot on Left-Tilt saw	too close (positive reading) too far (negative reading)	shim rear bracket shim front and rear brackets
Left slot on Right-Tilt saw	too close (positive reading) too far (negative reading)	shim rear bracket shim front and rear brackets

Tips for Making Book-Matched Panels

SUCCEED WITH A TOUCH OF ARTISTRY AND SKILL.

The longer I've worked with wood, the more I've appreciated that no two boards are alike. I like variety! But when I make a door panel or a cabinet side, I often want perfectly symmetrical boards: a book-matched pair in which the two boards mirror each other.

I make book-matched panels by sawing through the

middle of a thick board, splitting it in two. It's just like opening a book—you never know exactly what you'll find inside! With the perfect board, the effect is stunning. Here are some tips to help you find those boards, to make the most of those that are seemingly too thin or too narrow and to glue them into striking patterns.



MAKE MAGIC WITH A MIRROR

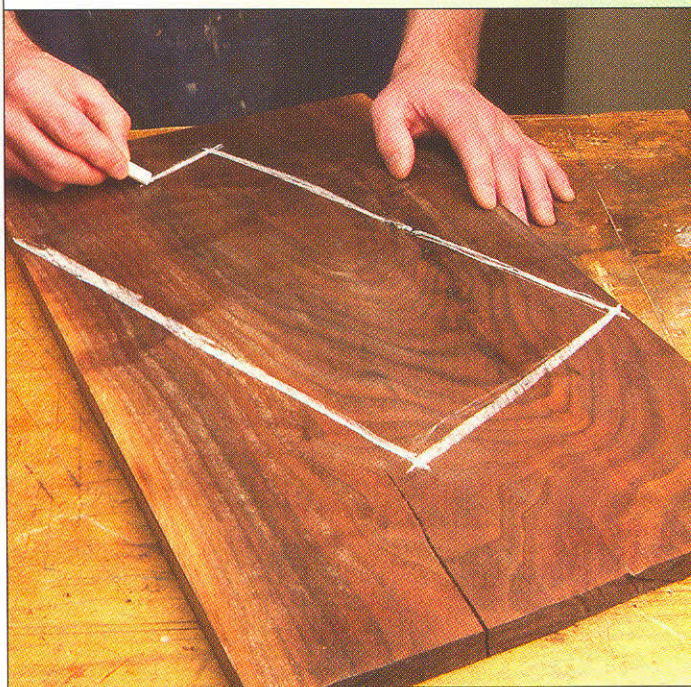
My friends laugh about resawing magic, but I really do use a mirror before crosscutting and resawing a board into book-matched panels. By shifting the mirror, I can gain a fairly good idea how the finished panel might look. Angle the edge this way or that way? Crosscut here, or maybe down there? Just like a magic act, this mirror trick is really a lot of fun. I only wish the mirror could tell me what the *inside* of the board looks like. The outside is just a hint.



ALIGN WITH CAULS

It's hard to clamp thin resawn boards together. The clamps won't stay on the edges. The joint pops apart. The seam won't stay even. Any of these situations can become a calamity if you've got glue on the boards, but cauls can save the day. Cauls are straight, stout boards that hold the panel rigid. Tape prevents the cauls from adhering to the panel.

Here's the gluing order: First, put tape on the cauls. Next, apply glue to the two book-matched panels and butt them together. Clamp the cauls to the panel in opposing pairs. Finally, place clamps across the panels and squeeze the joint tight.



THINK INSIDE THE BOARD

Ignore the straight edges the sawmill gave you. If you can imagine new edges running at skewed angles to the factory ones, you can create spectacular mirror images.

This poor walnut board was cracked, had sapwood running down one side and featured an ugly bull's-eye figure. But it was crotch-wood, cut near a branch, with curly grain and dramatic colors. After I sawed new edges and split it open, look how splendidly it turned out (see photo, above). Wow!



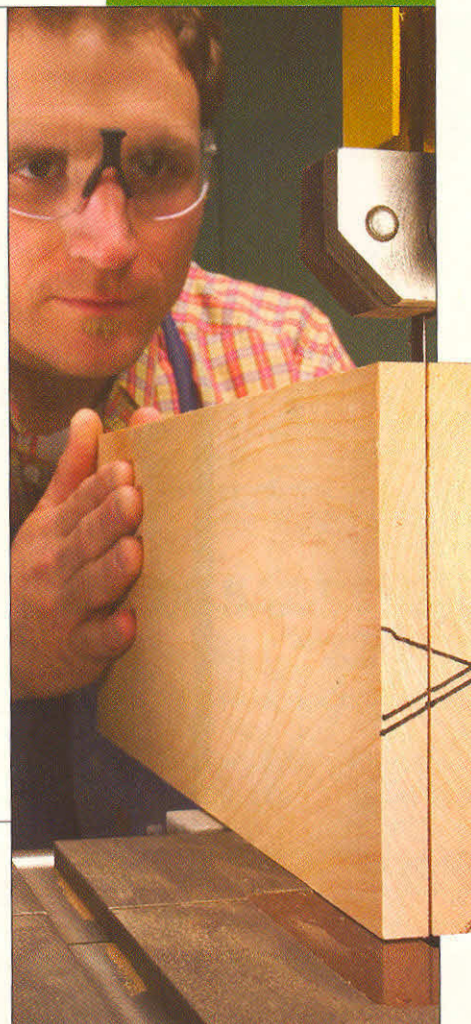


MAKE PANELS EXTRA LONG

Extra length makes it easier to align grain patterns by sliding one board past another. If you could cut a board with a knife, the way veneer is made, the grain on both boards would line up perfectly. But in the real world, sawing and jointing remove at least 1/8 in. between the boards. This lost wood means the boards' figure won't be identical.

Look at the edge of the board you'll resaw: The greater the angle at which the grain leans, the more offset the grain patterns will be. To be on the safe side, I usually roughcut the boards I'll resaw at least 2 in. longer than the panel's finished length.

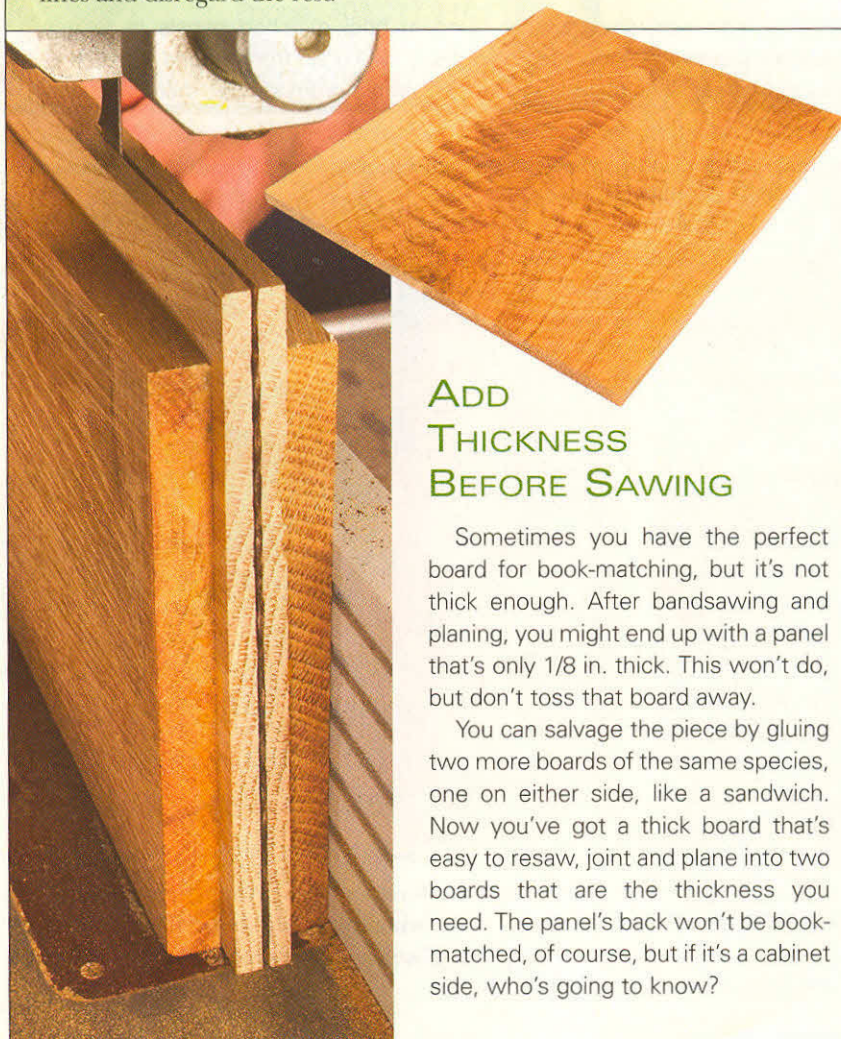
After sliding one board past another, I look for good balance but don't expect all the figure to be perfectly aligned. I match the most prominent lines and disregard the rest.



MARK THE ENDS

Do you ever get confused about what goes where? After machining a pile of resawn boards, I've had trouble identifying exactly which boards go together and which faces are the inside ones, the perfect matches. Sometimes an outside face can look suspiciously like an inside face.

To prevent this predicament, I now mark my boards with a cabinetmaker's triangle *before* I saw. This mark positively identifies the inner faces, because the triangle's halves can go back together only one way. I use different line patterns or colors to distinguish one board from another.



ADD THICKNESS BEFORE SAWING

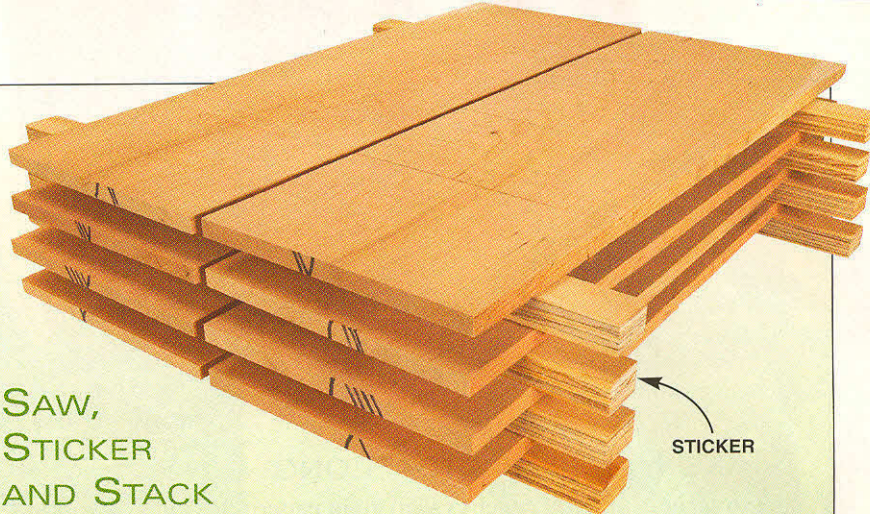
Sometimes you have the perfect board for book-matching, but it's not thick enough. After bandsawing and planing, you might end up with a panel that's only 1/8 in. thick. This won't do, but don't toss that board away.

You can salvage the piece by gluing two more boards of the same species, one on either side, like a sandwich. Now you've got a thick board that's easy to resaw, joint and plane into two boards that are the thickness you need. The panel's back won't be book-matched, of course, but if it's a cabinet side, who's going to know?



ADD WIDTH, THEN SAW

What do you do if an ideal board isn't wide enough? Get out the board stretcher? I wish. No, the best solution is to edge-glue an additional piece before you resaw. This works best when you're working with wood that has straight-grained figure. Straight grain glued next to straight grain can make a nearly invisible joint, particularly if the panels and the additional pieces come from the same parent board.



SAW, STICKER AND STACK

Patience pays off when making book-matched panels, whether they're large or small. After you saw, stack your boards in a pile. Separate each layer with stickers, so air circulates freely. Wait a few days before jointing and planing. This gives each board a chance to twist or cup if it wants to. These forces are virtually unstoppable, so it's better to give in than fight. Here's your consolation: This approach improves the chance that your book-matched panels will stay flat when installed in your project.

SAND AFTER GLUING

The high-tech way to level glued-up book-matched panels is to use a drum sander. If your boards have really wild grain from around a crotch or a knot, this is definitely the way to go. With a drum sander, there's no way you'll get tear-out.

SEEK UNUSUAL FIGURE

Look twice at this panel—can you see an elephant's head? I didn't see this one at first, but boards with weird figure are often good candidates for resawing into book-matched panels.

Keep your eyes open for boards with swirly grain or knots near an edge or those whose figure runs out along an edge. When they're book-matched, the two mirror images make something new and entirely different, just like a folded ink blot. I prefer abstract patterns to elephants' heads, but children sure like this one.

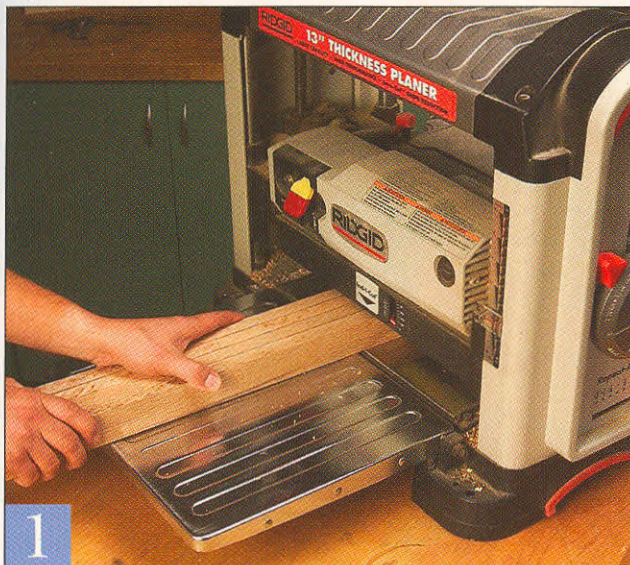


8 Tips for Building with Face Frames

FACE FRAMES ARE A HALLMARK OF TRADITIONAL CABINETRY, ADDING RIGIDITY AND STRENGTH TO CABINET BOXES.

Face frames provide a solid-wood surface for attaching hinges and a built-in scribing edge when fit to a finished wall. There are probably as many ways to make face-frame cabinets as there are woodworkers. Here are eight of my favorite tips for building cabinets with face frames.





1

PLANE FACE-FRAME PARTS TOGETHER

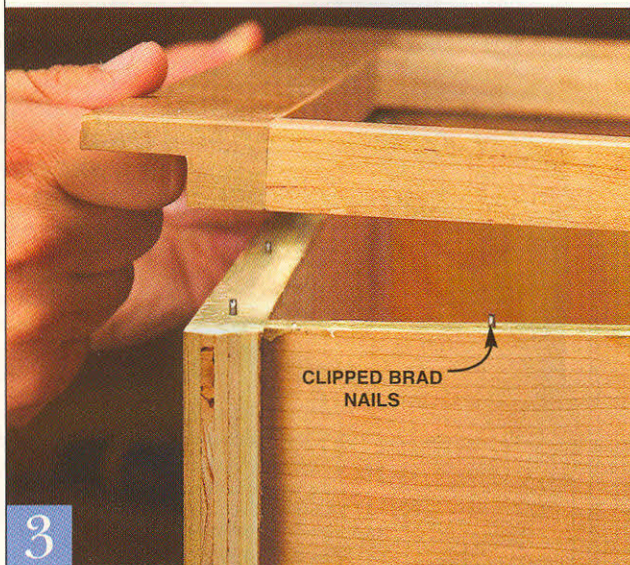
You'll have many face-frame parts that are the same width. Running them through the planer in a group is quicker than running each piece individually. Hold the pieces together as you feed them, so they stay square to the table. After planing, cut them to their finished lengths.



2

USE POCKET SCREWS FOR FAST ASSEMBLY

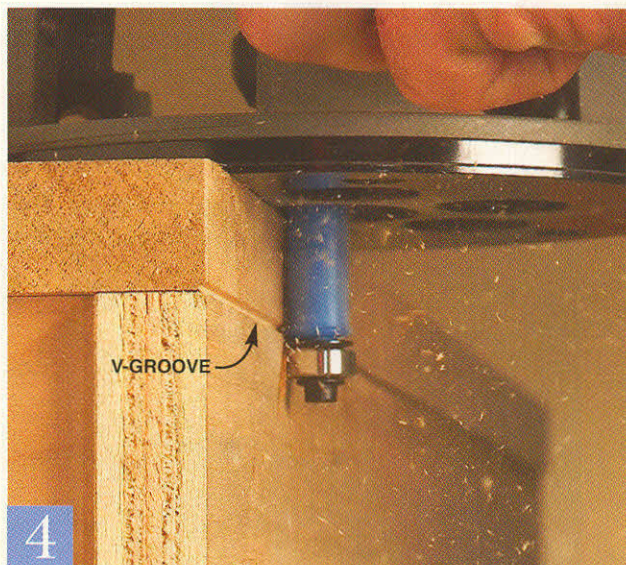
Pocket-hole joinery is hands-down the fastest way to assemble face frames. Because the holes are on the face frame's back side, they don't show on the finished cabinet. The clamping jig shown here, attached to flat work surface, keeps the parts flush as you drive the screws (see Sources, page 94).



3

SMALL BRADS KEEP FRAMES FROM SLIDING

Glued face frames can slide out of alignment when you apply clamp pressure. If you don't have access to a pocket-hole jig or biscuit joiner, space brad nails every 8 to 10 in. and clip off their heads so that about 1/8 in. remains exposed. Apply glue, align the frame and clamp it in place.



4

USE A V-GROOVE ROUTER BIT

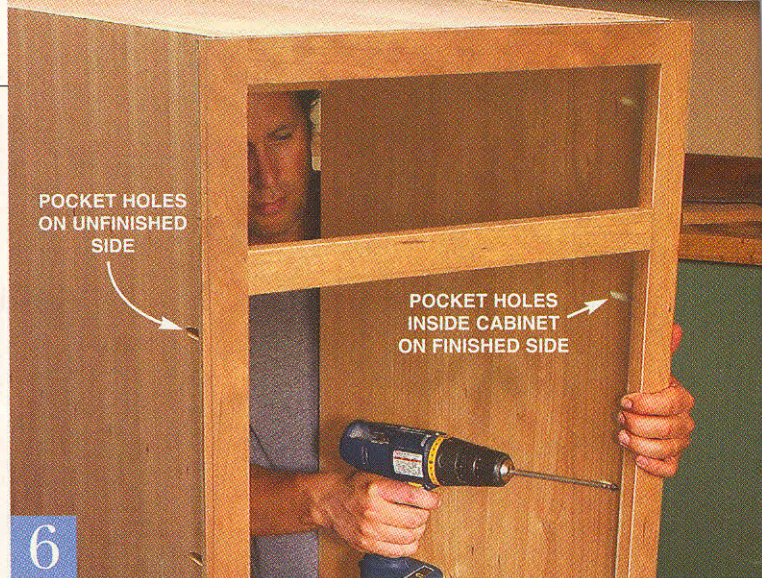
The V-groove router bit simultaneously trims the face frames flush and adds a decorative reveal. Start with the face frame about 1/16 in. wider than the case. Line up the V-groove's point on the bit with the joint line where the face frame meets the cabinet and trim the face frame flush. The V-groove visually minimizes the glue line (see Sources, page 94).



5

USE BISCUITS TO ALIGN FACE FRAMES

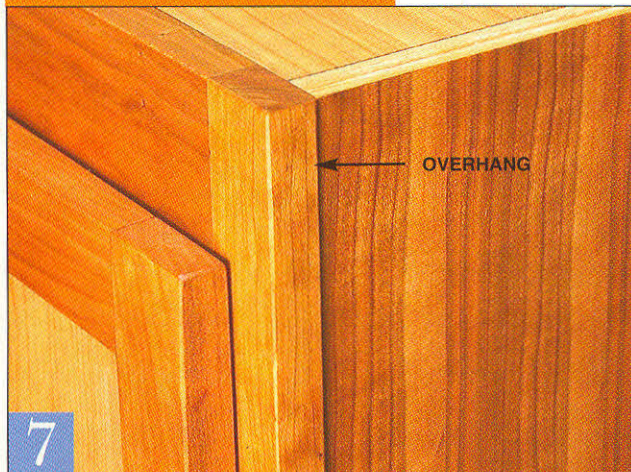
For precise alignment, particularly on long sides, use biscuits. You can use them along the whole frame or just the critical edges. This even works with sides on which you want the face frame to overhang the case. Adjust the depth of the biscuit joiner's fence to accommodate the overhang.



6

USE POCKET SCREWS TO ATTACH THE FACE FRAME

Simply glue and clamp the frame in position and drive in the screws. The screws hold the frame in position while the glue dries, so you can remove the clamps immediately and continue working on the cabinet without waiting. Locate pocket holes where they'll be least seen, such as inside drawer openings, on the outside of unfinished ends or on the inside of finished ends.



OVERHANG THE STILE ON FINISHED ENDS

This adds a decorative touch and eliminates the step of trimming the face frame flush. I round the face frame's back corner slightly before attaching it to the cabinet. It's easier than doing it after attachment and it gives the face frame a smoother feel and look.

Sources Rockler, (800) 279-4441, www.rockler.com V-groove router bit, #21074, \$18. • Kreg Tools, (800) 447-8638, www.kregtool.com Pocket-hole jigs, various kits available, \$55 to \$150.



RABBET THE SCRIBE EDGE

It's rare to find a wall that is perfectly straight, so overhang the stile on the wall side and trim it to fit. Rabbeting the stile's back edge makes scribing easier because you have less material to remove. I like to make the rabbet about 1/2 in. deep, leaving the scribe lip about 1/4 in. thick. Then I use a block plane or belt sander to trim the edge.

edited by Tim Johnson



STEEL WOOL WOES

I was grinding aggressively while restoring the bevel on an old chisel, so the sparks were really flying. When I noticed an eerie orange glow at my feet, I stopped grinding to take a closer look.

What I saw was astonishing! Earlier, I had dropped the steel wool pad that I'd used to remove surface rust from the chisel. Now the pad was alight with tiny glowing embers that shot across its surface and deep inside—as though the pad were overrun by a zigzagging horde of miniature lightning bugs.

I was shocked: I had no idea steel wool could burn, and now it looked like it might sear my toes. Yikes! Fortunately, I was able to quickly extinguish the pad without any damage.

When I recounted my story to a friend, he explained that most steel wool contains an oil residue from the manufacturing process and, given the chance, the oil burns along with the steel fibers, like tiny fuses. Evidently, the shower of sparks from the grinder had presented the opportunity.

Dennis Liechty

TACKED TAMBOUR

I needed a flat surface to glue together the tambour I was making, so I laid the canvas backing on my workbench. I used a roller to evenly spread glue on the canvas. I also rolled a thin layer of glue on each slat before carefully positioning it. When all the slats were in place, I laid a sheet of 3/4-in. plywood over the whole assembly and weighed it down with four 5-gal. buckets of sand.

The next morning, I eagerly took off the buckets and the sheet of plywood. But when I tried to lift the tambour, it wouldn't budge. You guessed it—the tambour was firmly glued to the workbench. Rats! I'd forgotten to put a sheet of waxed paper between the canvas and the benchtop.

Disheartened, I arduously chipped off the tambour with a chisel. Most of the canvas remained attached to the benchtop, so I soaked it with water to soften the glue and then scraped it off with a putty knife. My benchtop survived, and now it carries a painted-on reminder: "Remember the waxed paper!"

Randall Nelson



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