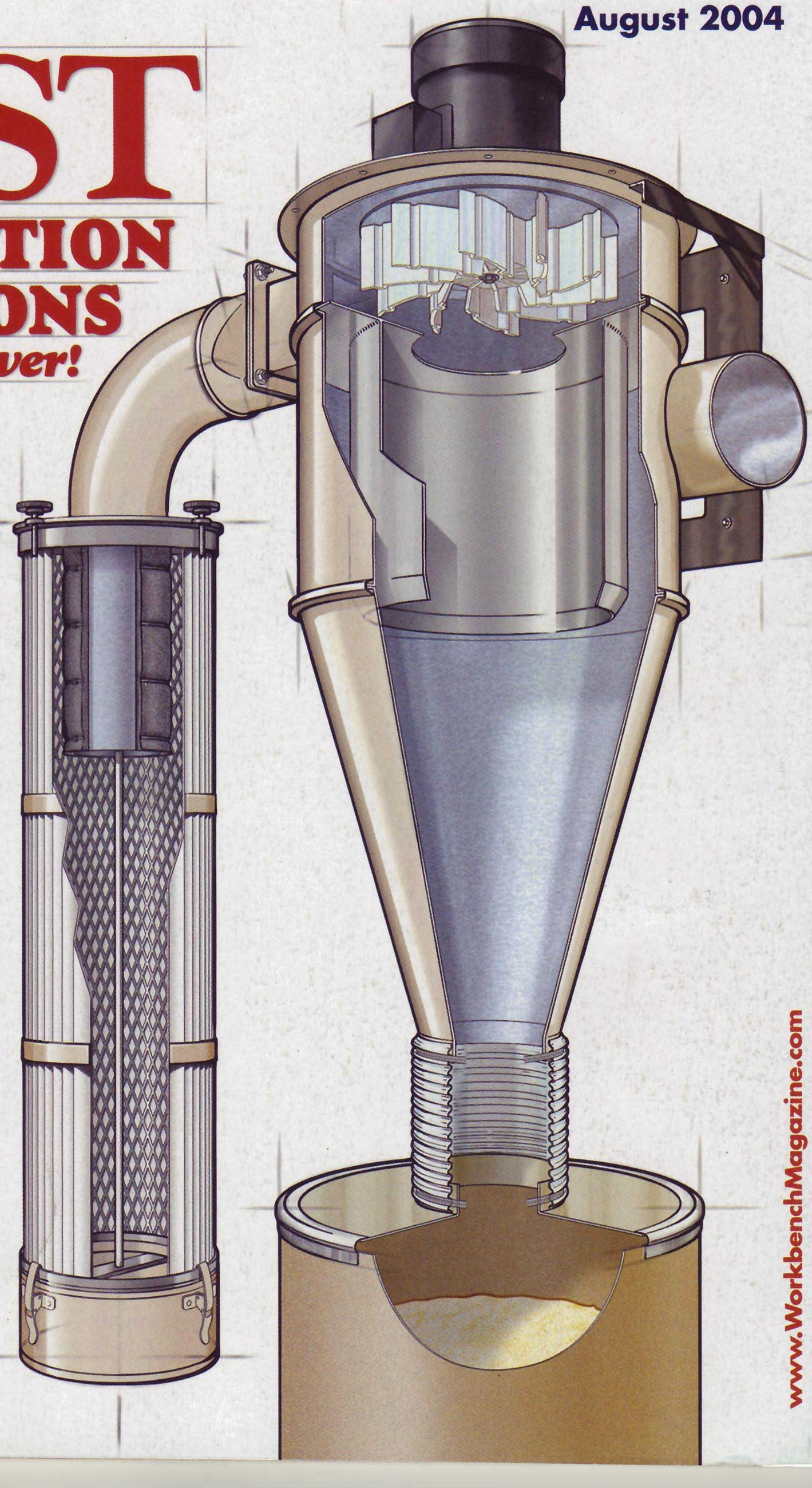
ROUTER WORKSHOP: How to Build Arched Raised-Panel Doors

WORKBENCH®

WOODWORKING TO IMPROVE YOUR HOME®

August 2004

4 DUST COLLECTION SOLUTIONS *that deliver!*



Home Storage

3 GREAT PROJECTS!

- **OUTDOOR STORAGE BENCH**
- **MOBILE GARAGE ORGANIZERS**
- **SPACE-SAVING KITCHEN PANTRY**

www.WorkbenchMagazine.com

ROUTER WORKSHOP: RAISED-PANEL DOORS • AUGUST 2004

EDITOR'S NOTES

As any woodworker will tell you, it isn't the tools that determine the quality of a project — it's the skillful use of those tools. That said, let's not underestimate the importance of tools. After all, they're what make the "working" in woodworking possible.

And speaking of tools, who could have foreseen the spectacular developments that have occurred in the tool industry recently? We're seeing more high-quality tools with more innovative new features than ever before. And to top it off, many of these tools are actually *less* expensive than similar models a few years ago.

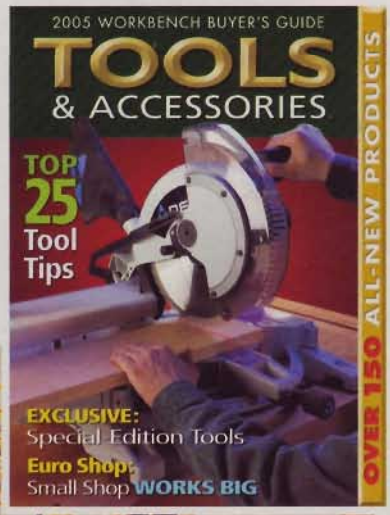
Of course, bringing you in-depth tool information has long been a primary mission of *Workbench*. It's just that with the exploding growth of the tool industry, there aren't enough pages in the magazine to always do it justice.

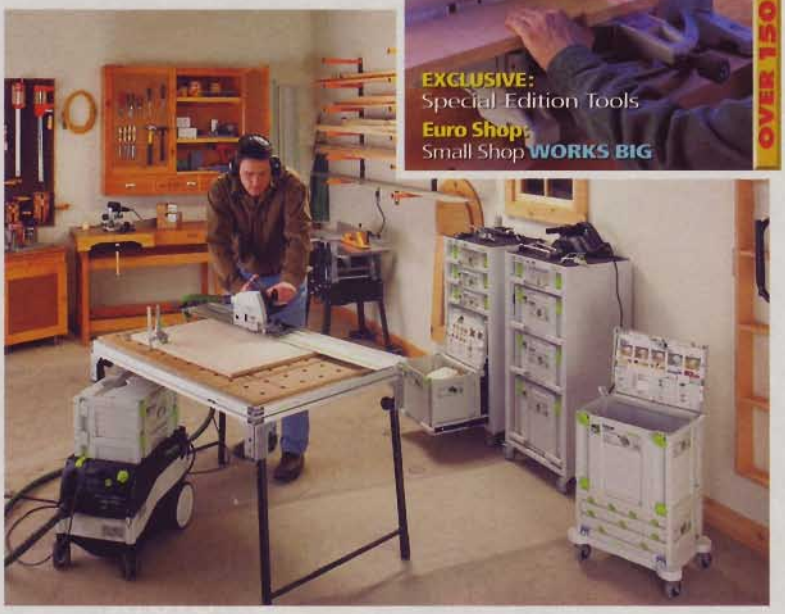
Tools & Accessories — All that's about to change though — our premiere issue of *Tools & Accessories* is just a few months away. This *2005 Workbench Buyer's Guide* is packed with all sorts of exciting tool information. Among other things, it includes the best new tools, must-have tool accessories, practical tool tips and techniques, tool selections that make a small shop work "big," and last but not least, a behind-the-scenes look at how tools are designed, built, and tested.

Well, I could go on and on about *Tools & Accessories*, but before I run out of room, I want to tell you how to go about getting it.

One way is to pick it up at the newsstand near the end of September. Or, you can reserve a copy, and have it mailed to you along with your next issue of *Workbench*. (For more details and information about *Tools & Accessories*, please turn to page 32.)

Tim





WORKBENCH
VOLUME 60 NO. 4

President & Publisher
Donald B. Peschke

Editor	Tim Robertson
Senior Design Editor	James R. Downing
Senior Editor	Bill Link
Associate Editor	Joe Hawkins
Assistant Editors	Wyatt Myers
	Kate Busenbarrick
Project Builder	Mike Donovan
Associate Art Director	Kim Downing
Sr. Graphic Designer	Kurt Schultz
Senior Illustrators	Erich Lage
	Matt Scott
Contributing Illustrators	Nathan Robertson
	John Hartman
Creative Director	Ted Kralicek
Sr. Project Designers	Ken Munkel
	Kent Welsh
	Chris Fitch
	Ryan Mimick
Shop Craftsmen	Steve Curtis
	Steve Johnson
Senior Photographer	Crayola England
Associate Style Director	Rebecca Cunningham
Pre-Press Image Spec.	Troy Clark
Group Director Marketing and Sales	J. Fritz Craiger
Adv. Sales Managers	George A. Clark
	Mary K. Day
Marketing Associate	Nicolle Scott 515-875-7135

Audit Bureau of Circulations

WORKBENCH (ISSN 0043-8057) is published bimonthly (Feb., April, June, Aug., Oct., Dec.) by August Home Publishing Company, 2200 Grand Ave., Des Moines, IA 50312.
Workbench is a trademark of August Home Publishing.

Subscription rates: Single copy, $4.99. One-year subscription (6 issues), $22; two-year sub., $33; three-year sub., $44. Canadian/Intl., add $10 per year. Periodicals postage paid at Des Moines, Iowa, and at additional offices.
"USPS/Perry-Judd's Heartland Division automatable poly."
Postmaster: Send address changes to *Workbench*, PO Box 37272, Boone, IA 50037-0272.
Canadian Subscriptions: Canada Post Agreement No. 40038201. Send change of address information to: PO Box 881, Station Main, Markham, ON L3P 8M6.
Printed in U.S.A.

AUGUST HOME PUBLISHING COMPANY

Corporate Services: *Corporate Vice Presidents:* Douglas L. Hicks, Mary R. Scheve, *Controller:* Craig Stille, *Sr. Accountant:* Laura J. Thomas, *Accounts Payable:* Mary J. Schultz, *Accounts Receivable:* Margo Petrus, *Elect. Pub. Dir.:* Douglas M. Lidster, *Prod. Dir.:* George Chmielarz, Pre-Press Image Specialist: Minniette Johnson, *System Admin.:* Cris Schwanebeck, *PC Maintenance Tech.:* Robert D. Cook, *New Media Mgr.:* Gordon C. Gaippe, *Web Site Art Dir.:* Eugene Pedersen, *Multimedia Designer:* Kara Blessing, *Web Server Admin.:* Carol Schoeppler, *Web Site Content Mgrs.:* David Briggs, *Web Producer:* Terry Walker, *Research Coordinator:* Nicholas A. Jaeger, *Prof. Development Dir.:* Michal Sigel, *Human Resources Asst.:* Kirsten Koele, *Office Mgr.:* Natalie Lonsdale, *Admin. Asst./Receptionist:* Jeanne Johnson, *Admin. Ass't.:* Brandi Hammond, *Mail/Delivery Clerk:* Lou Webber, *Facilities Mgr.:* Kurt Johnson • **Circulation:** *Circ. Ops. Dir.:* Sandy Baum, *Circ. Marketing Dir.:* Wayde J. Klingbeil, *Renewal Mgr.:* Paige Rogers, *Circ. Strategic Business Analyst:* Kris Schlemmer, Paula M. DeMatteo, *Circ. Marketing Analyst:* Patrick A. Walsh, *Circ. Marketing Assoc.:* Christine Forret, *Fulfillment Mgr.:* Steph Forinash • **Creative Resources:** *Sr. Editor:* Craig Ruegsegger, *Assoc. Editor:* Joel Hess, *Art Dir.:* Douglas A. Flint, *Sr. Graphic Designers:* Chris Glowacki, Mark A. Hayes, Jr., Robin Friend, *Sr. Graphic Designer:* Randy Shebek, *Graphic Designer:* Katie Beckman • **Products Group:** *Operations Dir.:* Bob Baker, *Customer Service Mgr:* Jennie Enos, *Warehouse Supervisor:* Nancy Johnson, *Buyer:* Linda Jones, *Asst. Buyer:* Nancy Downey, *Sr. Cust. Service Reps.:* Tammy Truckenbrod, Anna Cox, April Revell, Deborah Rich, Valerie Jo Riley, *Cust. Service Reps.:* Melissa Clark, Kim Harlan, Cheryl Jordan, *Warehouse Staff:* Sylvia Carey, Kim Freauff, Neil Nardini • **Woodsmith Store:** *Mgr.:* Dave Larson, *Asst. Mgr.:* Tim Thelen, *Merchandise Marketing Mgr.:* John Siberell, *Paint Dept. Mgr.:* James Hockins, *Lumber Sales Mgr.:* Mark Mattiussi, *Office Mgrs.:* Vicki Edwards, Tami Kessler, *Store Shipping/Receiving:* Larry Morrison, *Sales Staff:* Wendell Stone, Mark Johnson, Gregory Kauzlarich, John Warren, Dave Fremming, Stephen Duncan, Brian Simmons, Sherrie Simmons, Georgia Klimek, Dan LeBeau, Mike McCauley

Customer Service
Phone: 800-311-3991

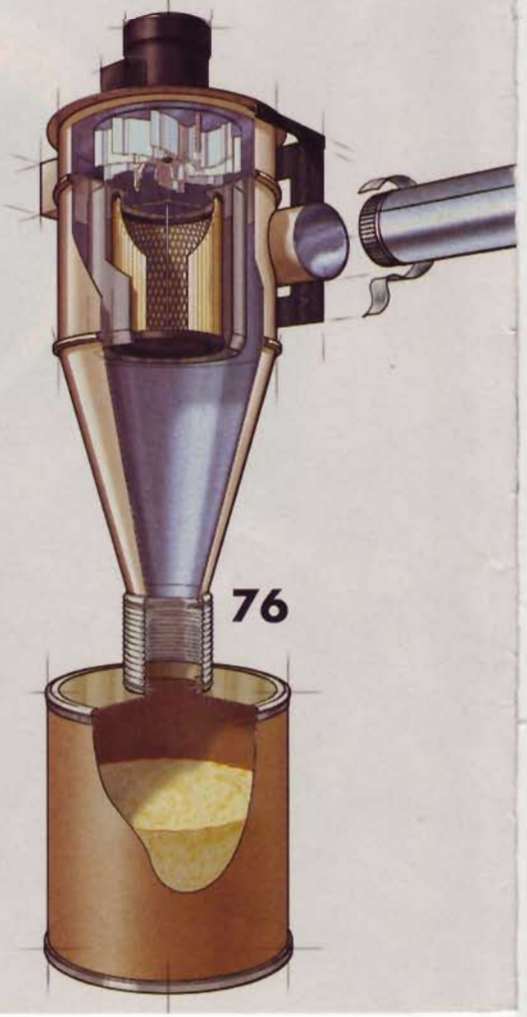
Subscriptions
Workbench Customer Service
P.O. Box 842,
Des Moines, IA 50304-9961
Online:
www.WorkbenchMagazine.com

Editorial
Workbench Magazine
2200 Grand Ave.
Des Moines, IA 50312
email: Editor@Workbenchmag.com

Contents

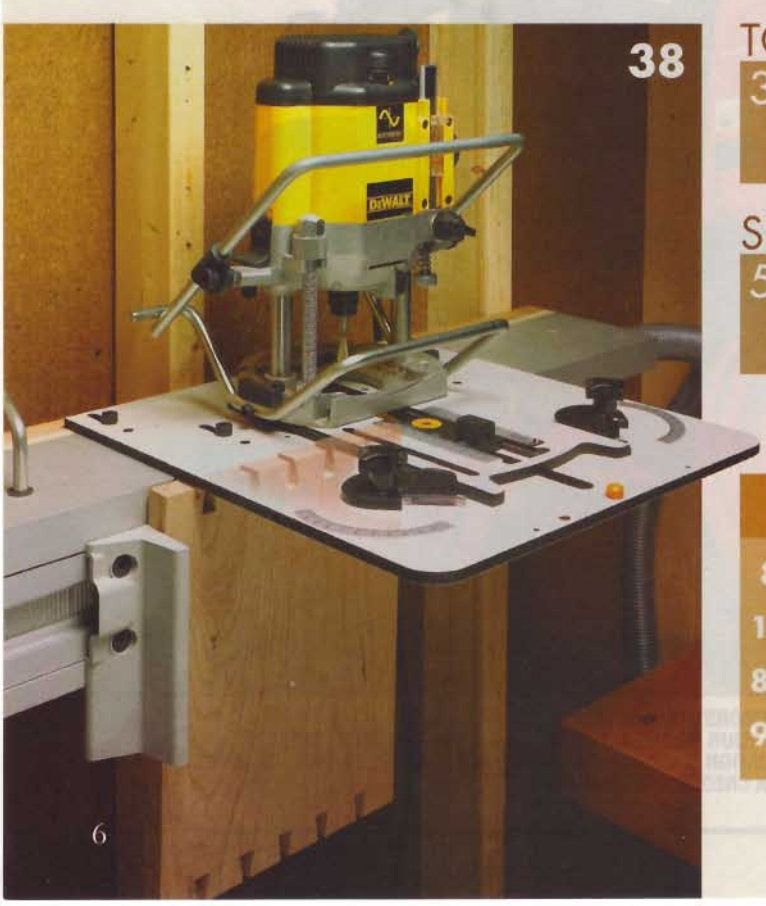
WORKBENCH® August 2004

FEATURES



IN EVERY ISSUE

CONTENTS



Questions & ANSWERS

tips for TOOL BATTERIES

Q I heard that I was supposed to run my tool batteries all the way down before recharging them. But ever since starting this practice, I feel like I'm actually getting less life from my batteries. What can I do to get more run-time from my batteries?

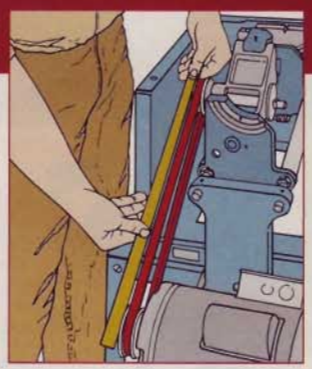
Cory Taliaferro
Concord, NH

A First of all, *do not* run your batteries all the way down before recharging them. It's actually one of the worst things you can do. It creates damaging heat, which diminishes the battery's ability to produce an electrical charge.

Instead, when the tool can no longer adequately perform the function you need it to do, allow it to cool down to room temperature, and then place it on the charger. Here are a few other tips to increase battery life.

- **Leave your batteries on a charger overnight once a week to "top off."**
- **Always charge a battery fully before using it for the first time.**
- **Keep in mind that it will take a few cycles for a battery to reach capacity.**
- **Don't leave batteries on the charger if power interruptions are common.**
- **Don't "help" a battery cool down or heat up – this could damage it.**
- **Store batteries in a cool, dry, dust-free location to prevent corrosion.**

Tool Motor Tune-Up



Q In regard to your "Tool Motor Tune-Up" (October 2003 Workbench, page 8), I think there might be another solution to the problem. Since the table saw motor was replaced, wouldn't the motor pulley need to be realigned with the arbor pulley in order to run straight?

Ed Stadler
Via email

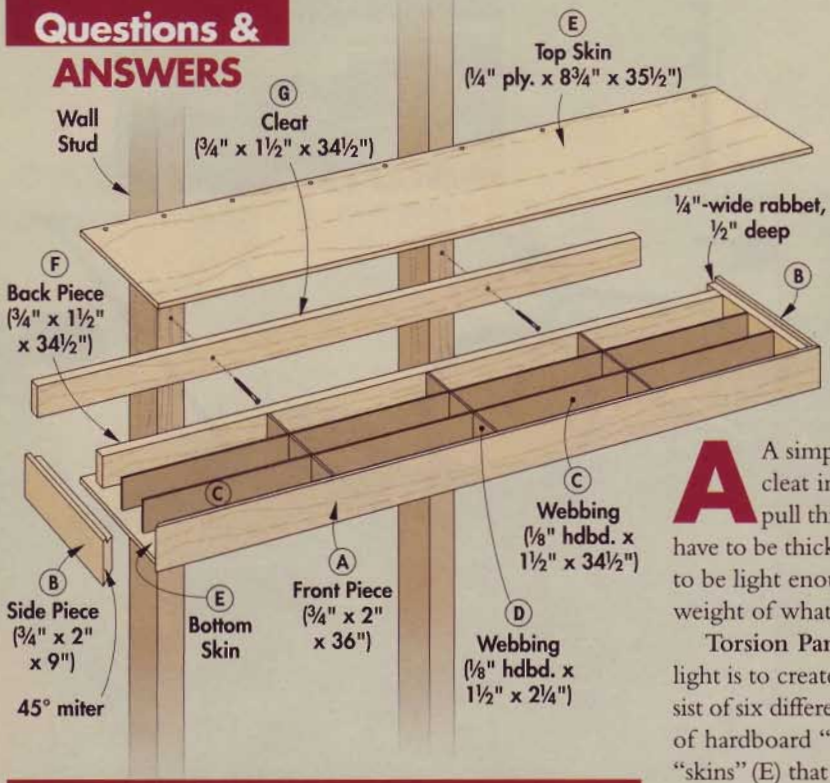
A To get the straight scoop on this table saw problem, we called Ron Boes at Delta. Ron confirmed that adding new key stock and pulleys as we recommended in our reply is critical to preventing a pulley from coming loose from the motor shaft. As you mentioned, though, keeping the motor and arbor pulleys aligned is important if a wobbling belt happens to be an issue.

To check the alignment of the motor and arbor pulleys on the table saw, hold a straightedge against both pulleys *(see Illustration)*. If it touches the outside edge of both pulleys, they're aligned properly. If not, reposition the pulleys on the arbors so the straightedge fits against each one without a gap.

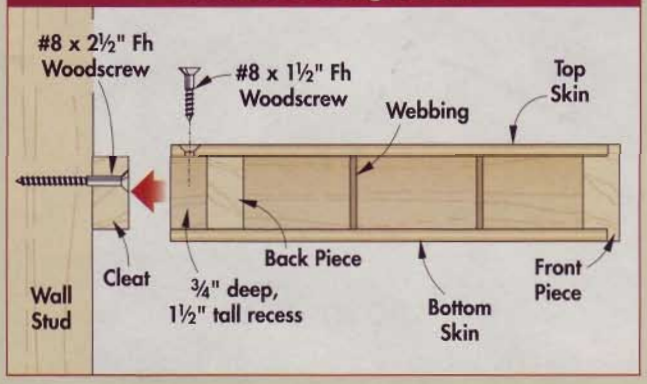
how to make a FLOATING SHELF

Q I'm seeing more and more of these shelves that appear to "float" on the wall with no brackets holding them in place. How would I go about making shelves like this without expensive hardware?

Joseph B. Gallagher
Lewes, DE



Shelf Mounting Detail



A A simple way to make your own floating shelf is to screw a cleat into wall studs, and screw the shelf onto the cleat. To pull this off successfully, though, both the shelf and the cleat have to be thick enough to support a lot of weight. And the shelf has to be light enough that it won't sag under its own weight — or the weight of whatever you put on it.

Torsion Panel — A good way to make the shelf both thick and light is to create a torsion panel. In this instance, the panel will consist of six different parts: rabbeted front (A) and side pieces (B), pieces of hardboard "webbing" (C, D) for added support, two plywood "skins" (E) that cover the top and bottom of the panel, and a recessed back piece (F) for rigidity. When assembled, the "skins" are enclosed in rabbets on the front and side pieces, hiding their edges from view.

Making the Panel — To make the panel, cut all the pieces to size on the table saw. Then rabbet the top and bottom edges of the front and side pieces, and miter the corners. A good way to assemble the panel is to set the bottom skin on a workbench. Then properly position the front, sides, and back, and glue these parts in place. Next, fit and glue the webbing pieces in place. When the glue has set up enough that these pieces are fixed in position, glue the top skin in place.

Wall Mounting — To install the shelf on the wall, cut a cleat (G) to size to fill the recess in the back of the torsion panel, and screw it into the wall studs. Then, slip the torsion panel over the cleat, and drive screws down through the top skin and into the cleat *(Mounting Detail)*.

The Great Table Saw Debate

Q I'm ready to buy my first table saw, but I'm not sure if I should get a contractor's saw or a cabinet saw. Which type of saw do you recommend?

Donald Frame
Rosemount, MN

A If you want a permanent fixture in your woodshop and money is no object, choose a cabinet saw. The cabinet saw's biggest advantages are weight and power. If you're shopping on a budget or want something a little more mobile, however, a contractor's saw is a suitable choice. You sacrifice some power and smoothness while cutting, but the bottom line is it still can handle most jobs. For a head-to-head comparison of these two types of table saws, see the *Chart* at right.

TABLE SAW COMPARISON

	Contractor's Saw	Cabinet Saw
Average Weight	250 lbs.	500 lbs.
Typical Horsepower	1.5 - 2	3 - 5
Base Type	Open	Closed
Motor Mounting	In Back of Saw	In Base
Dust Collection	Difficult	Efficient
Vibration	Some	Minimal
Mobility	Needs Mobile Base	Needs Mobile Base
Average Price	$500 - $900	$1,100 - $2,500

Finishing Fundamentals

apply polyurethane LIKE A PRO

Q *I sprayed my kitchen cabinets with a clear lacquer finish, but it recently started peeling and flecking because of all the moisture in my kitchen. Can you recommend a good, clear finish that can tolerate the rigors of a kitchen environment?*

Peter Najar
Via email

A Lacquer is a high-quality finish, but it dries extremely fast. Because of this, lacquer doesn't form a strong bond with wood and occasionally chips or peels in high moisture areas like kitchens or bathrooms.

Polyurethane — A better moisture-resistant finish is polyurethane. Helmsman Spar Urethane is particularly good for interior or exterior wood that is exposed to sunlight, water, or temperature changes.

Brush on the First Coat — To apply the finish, select a quality, natural bristle brush. Dip just the tips of the bristles into the can *(Fig. 1)*, and then use the bristles to work the clear finish into the pores of the wood.

Tipping Off — The action of your brush will create bubbles and brush marks in the wet finish. You can "erase" these before the finish dries by using a technique called "tipping off." After applying finish to one door or drawer, hold the brush at a 45° angle and gently pull it in the direction of the grain the entire length of each piece *(Fig. 2)*. The tips of the bristles will pop bubbles, level out runs or drips, and distribute finish evenly. Then, clean the brush and let the first coat dry.

Sand Lightly — The following day, you likely will feel some dust particles caught in the dried finish. Using a sanding block with 220-grit sandpaper, lightly sand the top of the finish. The action of the sandpaper will remove dust particles and — just as importantly — create tiny scratches for the second coat of polyurethane to grip.

Wet-Sanding — Your second coat should be applied just as the first. But rather than sanding the dust particles after the finish has dried, apply mineral oil to 600-grit sandpaper and "wet-sand" the finish to a smoothness you thought only professionals could achieve *(Fig. 3)*.

While sanding, keep both the finish and sandpaper well lubricated with mineral oil to prevent the sandpaper from leaving scratches in the finish. Afterward, wipe off the lubricant with a clean cloth.

▲ To ensure that only a thin coat of polyurethane is applied to a piece, dip just the tips of the bristles into the can.

▲ To remove bubbles and brush marks, "tip off" the surface, that is, hold the handle at 45° and brush with the grain.

▲ When the second coat dries, use 600-grit sandpaper lubricated with mineral oil to "wet-sand" to a smooth finish.

Workbench and **Bruce Johnson**, Minwax finishing expert, are teaming up to answer your questions about finishing.

Send your finishing questions to:

Mail: Workbench Q&A
2200 Grand Avenue
Des Moines, IA 50312

Email: editor@workbenchmag.com

Winners receive a **FREE** Minwax Finishing Kit!

Finishing Fundamentals

best finish for a CEDAR FENCE

▲ Olympic Water Repellent Oil Stain is one of many penetrating, oil-based, and water-resistant products that protect the natural color of cedar.

Q *I built your cedar fence from the May 1999 issue of Workbench. What would be the best way to finish the fence to prevent graying and maintain the beauty of the wood? I'd like some sort of finish that I do not have to reapply every three to four years.*

Ron Krager
Via email

A Two categories of exterior finishes do a good job protecting cedar while maintaining the rich color of the wood — water-repellent preservatives and oils, and semi-transparent stains. And regardless of which of these two you choose, the three key phrases you'll want to look for on the product's label are *penetrating*, *oil-based*, and *water-resistant*.

Products with these three traits often last longer than three or four years without fading, even in the most severe outdoor conditions, says Tony Bonura of the Western Red Cedar Lumber Association. And they complement the color of cedar with a lush, colorful finish. Most exterior finishes also protect against mildew and sun damage.

On another note, you'll want to opt for a toned or tinted finish rather than a clear one. The transparent finishes just don't last as long.

Among the water-repellent preservatives, Tony recommends Cabot's Australian Timber Oil and Penofin Red Label Wood Finish. Olympic Water Repellent Oil Stain *(Photo, left)* is also a good choice for a semi-transparent stain. Of course, any penetrating, oil-based, and water-resistant product is a safe bet.

Foolproof Method for Cleaning Dirty Brushes

Q *What's the best way to clean brushes for later use? I've tried several techniques, but my brushes always end up stiff, dirty, and unusable.*

Ralph Alvarez, Jr.
Columbus, OH

A I've known woodworkers who have used the same brush for years. Their secret is taking a few extra minutes to clean it. Here's a surefire four-step approach to getting almost any brush completely clean.

▲ After wiping off excess finish, rinse the brush in thinner several times. Then wrap the brush in a towel.

▲ Remove the towel, and squirt some dish soap onto the brush. Rub it in your hand to work up a lather.

▲ When the brush no longer feels slimy, rinse it in water, then spin it between your hands to dry it out.

▲ Finally, straighten out the bristles with a comb, and wrap the brush in a paper towel until it finishes drying.

Tips & techniques

build your own BENCH HOOKS

Usually a hold-down is used to clamp a workpiece flat against a benchtop. That's okay for some work. But if you're sawing, drilling, or routing, it often requires clamping the piece so it overhangs the edge of the bench. As a result, it's not fully supported, which makes for a rough, less-than-accurate cut.

A more versatile solution is to make a set of bench hooks that hold the workpiece securely *above* the bench *(Photo, right)*. This provides clearance underneath for bits and blades, letting you work directly over the bench.

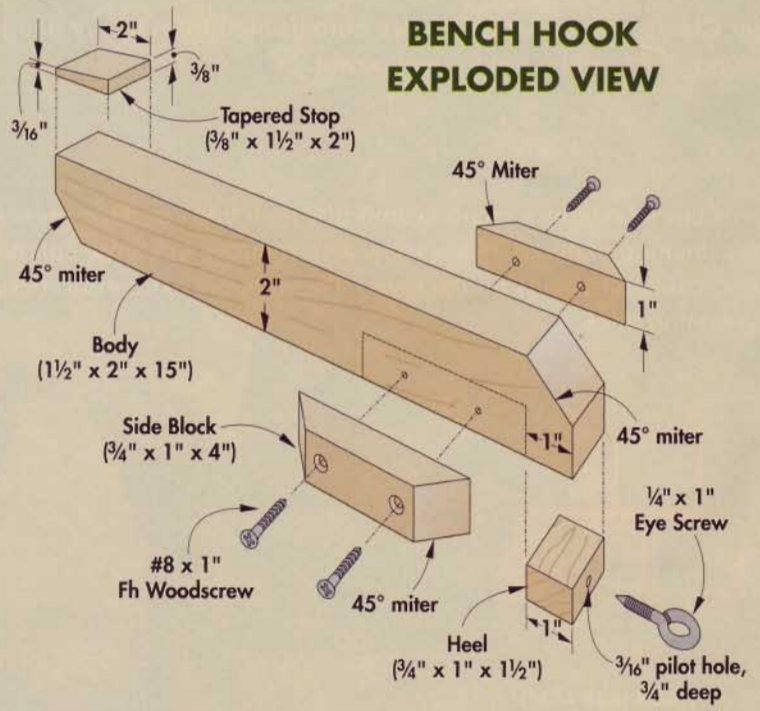
As useful as they are, I'd have to say that these bench hooks are a bit unusual looking. So it's not immediately apparent how they work — until you put them to use.

To do that, simply set a bench hook on the bench and push it forward until the heel "catches" the edge of the bench. Then place the workpiece on top, and butt it against the wedge-shaped stop at the end.

To make the piece stay put as you work, just continue pressing it against the stop. A light touch is all that's needed. And since the heel is engaged on the bench, this pressure keeps the bench hook from shifting forward. Small blocks attached to the body of the bench hook keep it from tipping from side to side.

Dennis Satriano
Center Moriches, NY

▲ These bench hooks hold boards securely *above* the bench, letting you cut or drill without damaging the worksurface. When you're done, just hang them up for storage *(right)*.



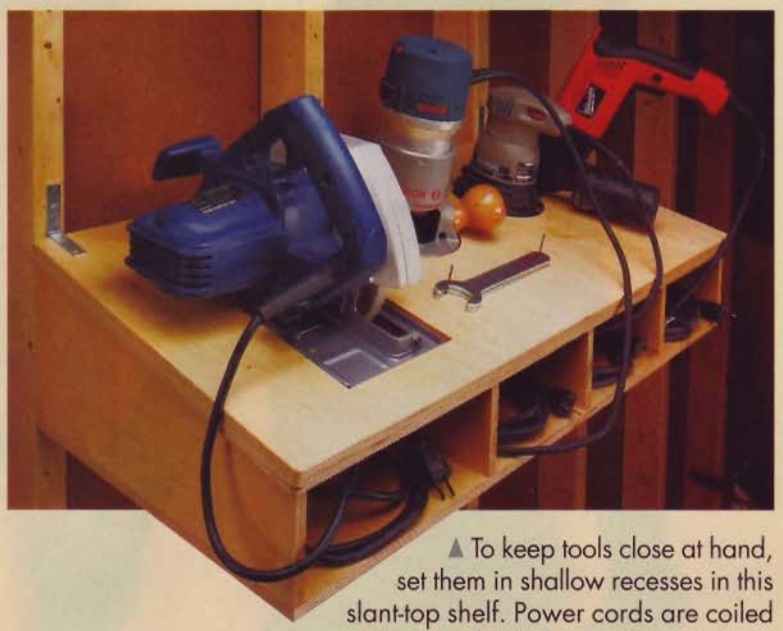
BEST TIP!

For sending us his tip, Dennis Satriano wins a Bosch 1590 Jig Saw Kit. Congratulations, Dennis!

Mail Tips to:
Workbench Tips
& Techniques
2200 Grand Ave.
Des Moines, IA 50312

Email: editor@workbenchmag.com

slant-top TOOL SHELF



▲ To keep tools close at hand, set them in shallow recesses in this slant-top shelf. Power cords are coiled neatly in cubbyholes underneath.

The first rule of an efficient shop is to have the tools you use most often at arm's reach. And of course, it helps if the power cords aren't tangled up like spaghetti.

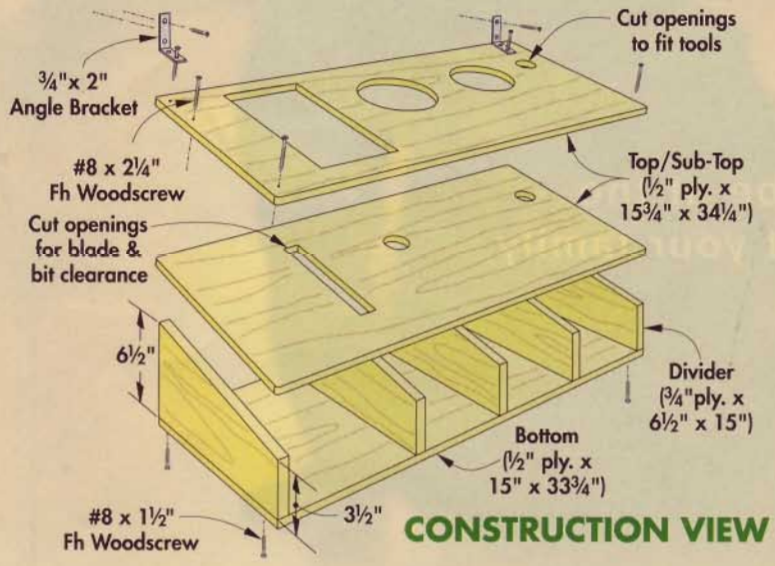
This slant-top tool shelf excels on both counts. Power tools nest conveniently in shallow recesses in the shelf. And cords are coiled neatly in cubbyholes underneath.

These cord compartments are formed by angled dividers that are sandwiched between a two-part shelf (a top and a sub-top) and a bottom piece *(Construction View)*.

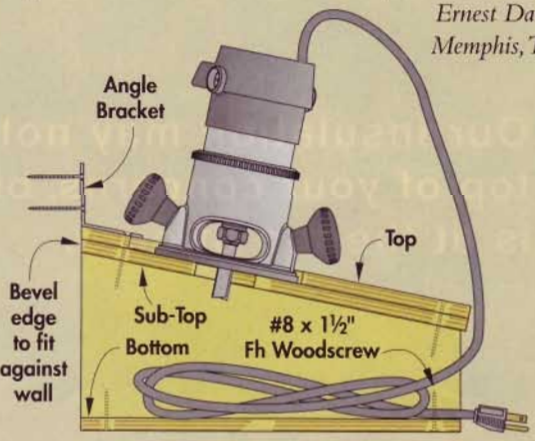
To create the recesses in the shelf, openings are cut in the top to match the "footprints" of the tool bases. Similarly, holes (or slots) in the sub-top provide clearance for bits and blades.

After cutting all the openings, glue the two pieces together to make the shelf. Then glue and screw the shelf and bottom piece to the dividers. A couple of L-shaped brackets hold the unit securely on the wall.

Ernest Danes
Memphis, TN



CONSTRUCTION VIEW



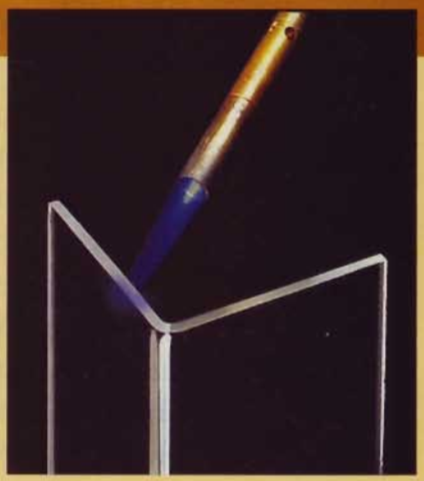
SECTION VIEW

flame-polished Plexiglas A "HOT" SHOP TIP

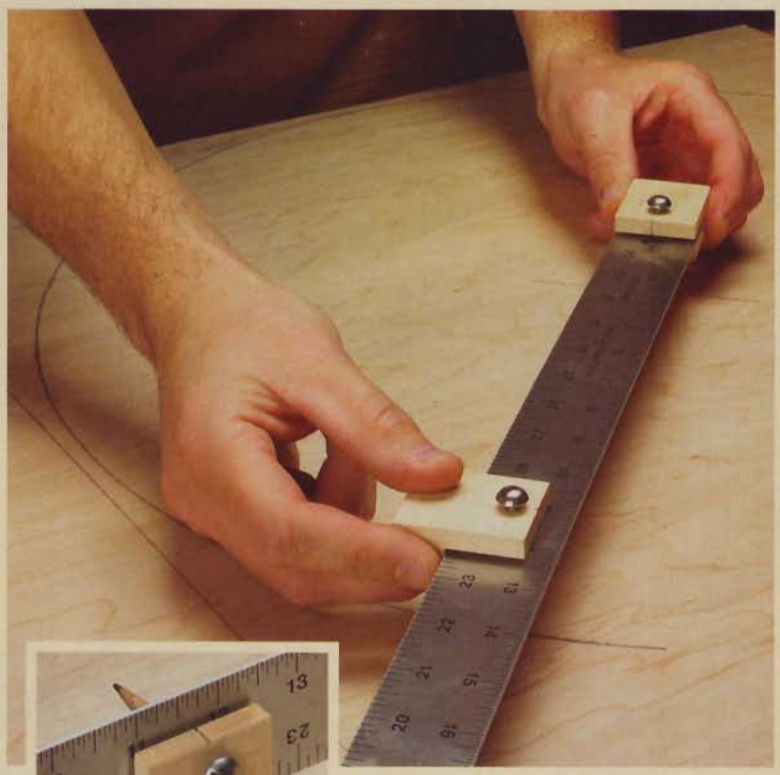
Occasionally, I use Plexiglas in my woodworking projects. Although it cuts easily on the table saw, the blade leaves a rough, unfinished edge, not clear like Plexiglas ought to be.

To restore it to its original transparency, I sand the edge smooth and "polish" it with a plumber's torch. The idea is to "brush" the flame quickly across the edge for a few seconds. As it heats, the plastic regains its glass-like appearance. Be careful, though — too much heat will cause it to bubble.

Clay Lovelace
Boston, MA



super-sized BEAM COMPASS



▲ A 36" steel rule and two wood blocks combine to make a simple beam compass. An adjustable marking block *(left)* lets you draw circles up to six feet in diameter.

In the past, when I had to lay out a large circle or arc, I usually resorted to making a compass specifically for that application. Recently, however, when faced with the prospect of making yet *another* single-use compass, I decided to build this adjustable beam compass instead.

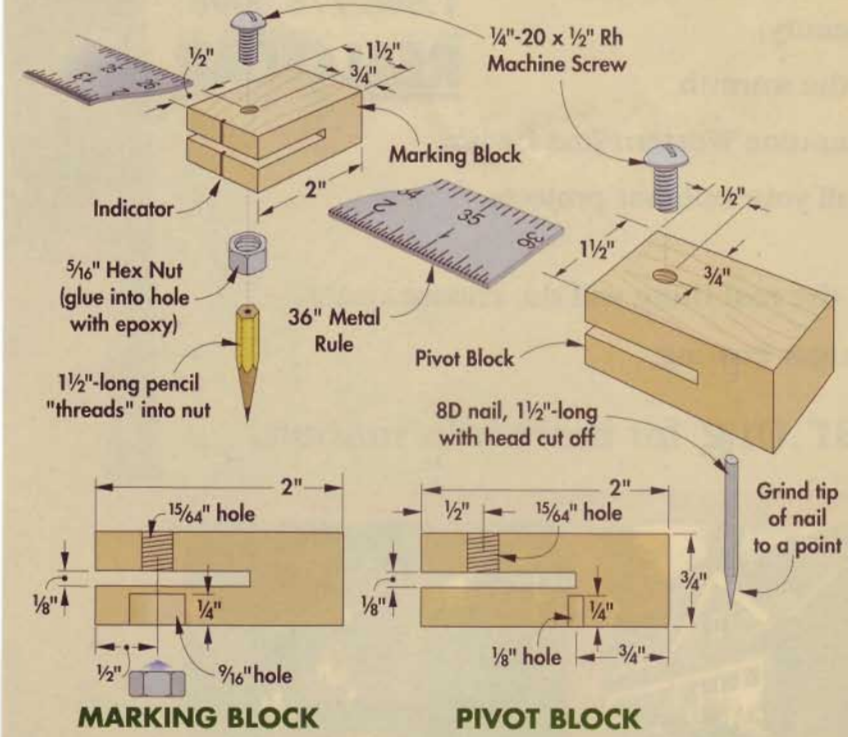
The compass consists of a 36" steel rule and two hardwood blocks *(Photo, left)*. A pivot block, which holds a steel pin (nail), fits over the end of the rule *(Illustration, below)*. And an adjustable marking block with a pencil slips over the edge of the rule. Machine screws, threaded into tapped holes in the wood, secure the blocks to the rule.

For safety, the blocks are cut from a single large blank *(see Box below)*. Rip the blank to width to match the rule ($1\frac{1}{2}$" in my case). Then, using the table saw, cut a kerf in one edge to allow the blocks to fit over the rule. The depth of this kerf is sized so when the rule is bottomed out in the marking block, you can still see the increments *(Inset Photo)*. Note how the indicator (a kerf made with a handsaw) is used to align the marking block on the rule.

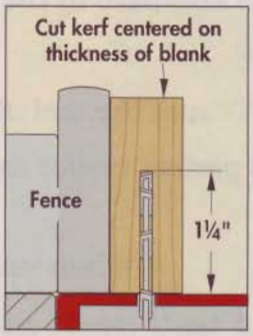
Before cutting the blocks from the blank, drill holes for the pivot pin and a nut that holds a pencil stub. For accuracy, make sure the holes are aligned along the same centerline. Then cut the blocks, glue in the pivot pin and nut with epoxy, and "thread" the pencil into the nut.

Paul Muszynski
Harrison, ME

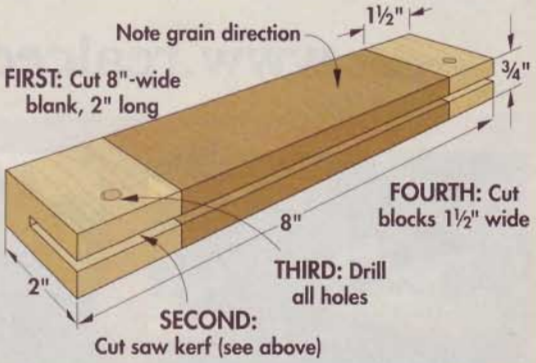
TRAMMEL ASSEMBLY



Working with Small Parts



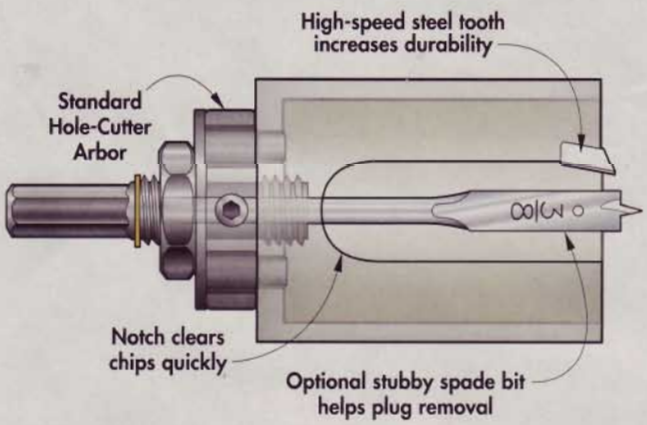
The blocks on this beam compass are too small to work with safely on the table saw. So they're cut from a large blank. Note that the blank is wider than it is long, which orients the grain for maximum strength.



One-Tooth CUTTER

When it comes to drilling large holes in lumber, the first tool you probably think of is a hole saw. But hole saws have three drawbacks — they cut slowly, bind easily, and it's tough to get the wood plug out of the saw.

A Better Cutter — Well, Lenox has a new hole cutter that will change the way you think about cutting large holes. It may look like a hole saw with one large tooth *(Photo, left)*, but the Lenox cuts three times faster than a hole saw and can bore through $2^1/_2$"-thick stock.



▲ This Lenox cutter quickly chews through dimensional lumber, and the plug is easily removed.

One Tooth — The secret to the Lenox cutter's design is its tooth, which is high-speed steel that stays sharp even after cutting as many as 300 holes. The tooth has an aggressive 15° rake angle — perfect for powering through holes in a hurry.

No Binding — Binding is also a non-issue with the Lenox. This is because the tooth sticks out past the body of the cutter, so it cuts a wide swath through the wood. The large notch in the cutter also helps by removing chips as you cut *(Art, left)*.

Easy Plug Ejection — This large notch serves another purpose — it lets you pull the wood plug out of the cutter with minimal effort. A $^3/_8$" stubby spade bit (sold separately) makes it even easier to remove plugs.

Lenox cutters come in 12 sizes ($2^1/_8$" to $6^1/_4$" in diameter) in prices ranging from $40 to $150. The arbor to which all the cutters mount sells for $30, and the optional short spade bit sells for $5. For more information, call 800-628-8810 or visit www.LenoxSaw.com

3X Paper for Power Sanders

In the December 2003 issue of *Workbench*, we reviewed 3X sheet sandpaper from Norton that claimed to cut three times faster and last three times longer than standard sandpaper. It tested so well that we were thrilled when Norton released 3X paper for disc, belt, and spindle sanders.

These sanding tools feature the same technology that made the sheet paper so great. Durable compounds are heat-treated, coated with zinc stearate to prevent dust clogging, and then bonded strongly to tough backing material.

When I sanded rough hardwood for 15 minutes with a 120-grit Norton 3X disc, it was hard to tell I had even used it. The same job with a standard disc left it smooth, with almost no grit remaining.

Prices for Norton 3X range from $3 for a 3-pack of spindles to $12 for a 5-pack of belts. For more information, call Norton at 800-551-4415.

▲ Norton 3X for Sanders: Norton 3X paper for power sanders claims to cut faster and longer than standard sandpaper. The paper did just that throughout our testing.

Porter-Cable's PROGRESSIVE TOOTH SAW BLADES

Until recently, I never felt cordless reciprocating saws had enough power. But that was before I discovered Porter-Cable's new line of progressive-tooth reciprocating saw blades.

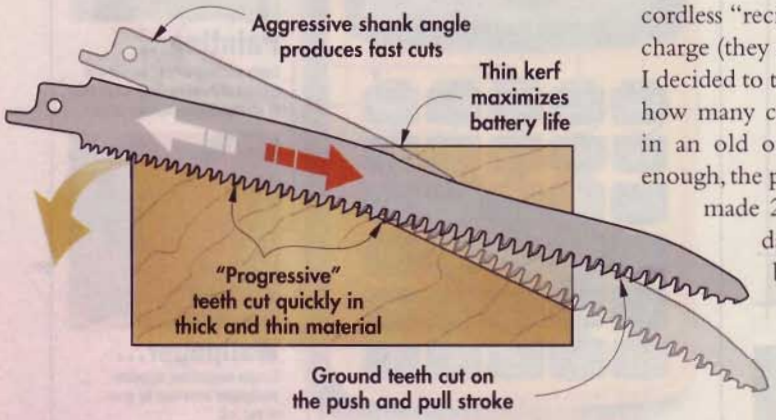
More Cuts — These blades actually increase the number of cuts a cordless "recip" saw can make per charge (they claim 50% more cuts). I decided to test this claim by seeing how many crosscuts I could make in an old oak 4x4 *(Photo)*. Sure enough, the progressive-tooth blade made 24 crosscuts to a standard reciprocating saw blade's 16 — exactly 50% more cuts.

Teeth — This blade makes batteries last longer for three reasons. First is the progressive-tooth design. This means that the teeth are set close together near the shank (for thin material) and further apart at the end (for thicker pieces). The result is a blade that cuts quickly through any thickness of stock *(Art, left)*.

Thin Kerf — Also important is the thinner body of the blade. It cuts a thinner kerf, displaces less wood, and uses less of the saw's power per cut.

Shank Angle — Finally, the shank angle of this blade is more aggressive than a standard blade, further adding to its ability to make quick cuts.

Porter-Cable has three types of the blades (wood-cutting, metal-cutting, and general purpose) for $12 per 3-pack. For more info, call 800-487-8665 or visit www.Porter-Cable.com



A Smoother Way to Flush Trim

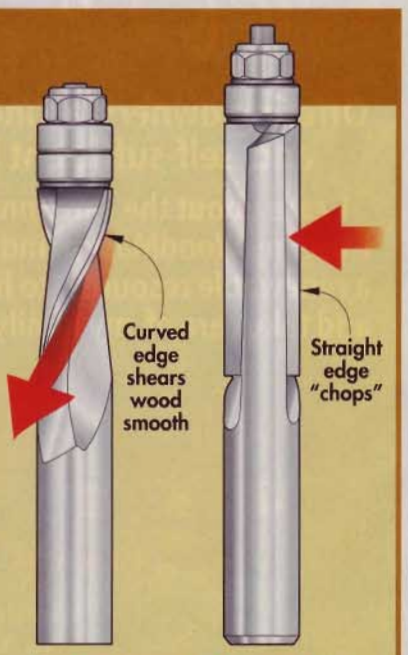
▲ Template routing is just one of several flush-trimming tasks that a spiral flush-trim bit handles more smoothly than a standard flush-trim bit.

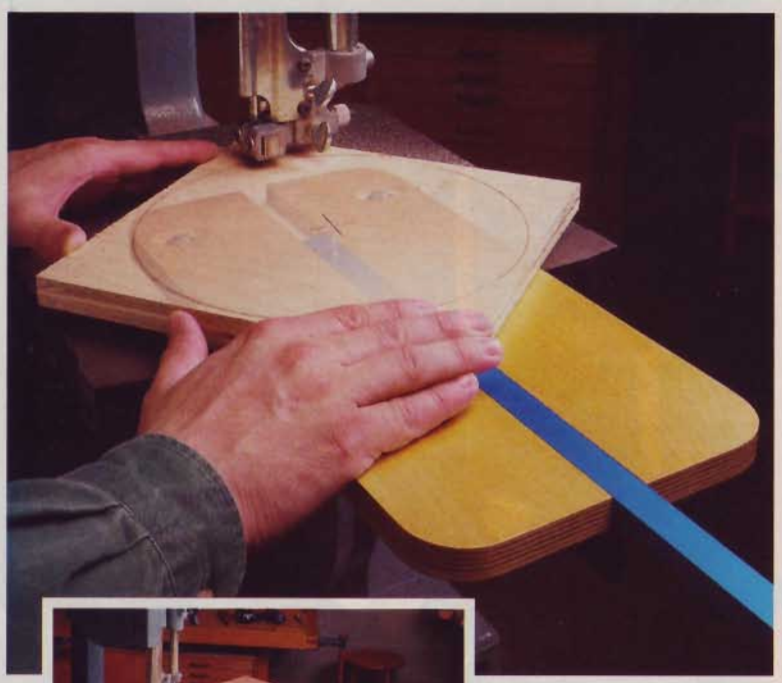
A flush-trim bit gets a lot of use around my shop for edge trimming and template routing. That's not to say it's my favorite bit, though. It has a tendency to chip-out, and routing end grain without burning the surface is darn near impossible.

But then I tried this new solid-carbide spiral flush-trim bit. It left a smooth surface on both edge *and* end grain with no chipout.

The secret to the spiral flush-trim bit's performance is the cutting action of the bit itself. While a standard flush-trim bit cuts perpendicular with the surface of the wood in a chopping motion, the spiral bit shears wood at an angle, creating a smoother surface.

Spiral flush-trim bits are available in both upcut and downcut varieties from Amana (800-445-0077, AmanaTool.com) and MLCS (800-533-9298, MLCSWoodworking.com).





▲ A pivot pin on a sliding rail makes it easy to cut a circle on a band saw. With the rail inserted one way, you can cut smaller circles. Flip it end for end for larger circles *(Inset)*.

band saw CIRCLE JIG

One of the easiest ways to make a perfect circle is to cut it on a band saw. Simply spin the workpiece on a nail (pivot pin) that's installed in a piece of plywood.

Taking that concept a step further, Robert DeGraw of Kirkland, Washington, made an adjustable circle jig that attaches to the table of his band saw *(Photos, left)*. On this jig, the pivot pin is installed in a sliding metal rail, which makes it easy to cut different-size circles.

Sliding Rail — The rail is a length of aluminum T-track that fits upside down in a groove cut in the base of the jig *(Construction View)*. To connect the rail to the base, it fits over two T-bolts that pass through holes in the base. Tightening knobs on the T-bolts "locks" the rail.

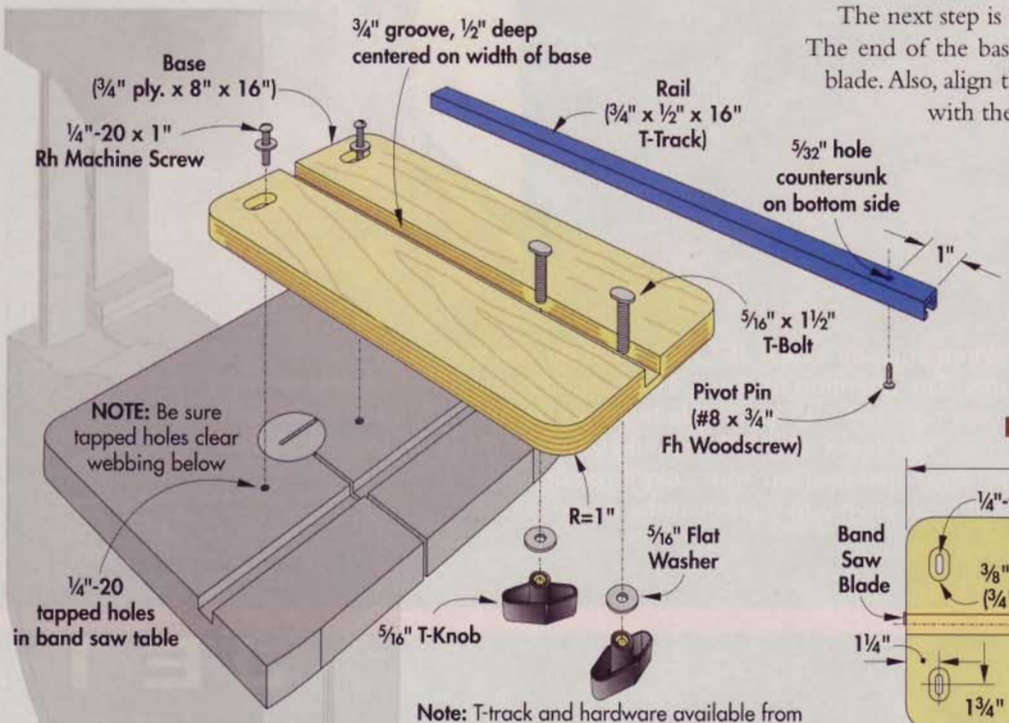
Pivot Pin — Before installing the rail, you'll need to drill a hole near one end for the pivot pin. (A woodscrew serves as the pin.) Note that this hole is countersunk on the inside face of the T-track, which allows the piece to spin freely as you cut the circle.

Mounting the Jig — The jig is held in place with two machine screws that pass through adjustment slots in the base and then thread into tapped holes in the band saw table. These slots are recessed to hold the screw heads. To form the recess, drill shallow, overlapping counterbores with a Forstner bit. Then drill through-holes to complete the slots.

The next step is to position the jig on the saw table. The end of the base should just "kiss" the side of the blade. Also, align the center of the groove in the base with the leading edge of the blade.

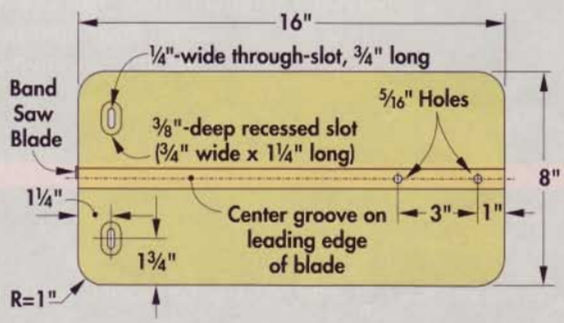
Once the jig is in position, use the adjustment slots to locate mounting holes on the band saw table. Check that they won't interfere with the webbing underneath the table. Then remove the table, drill the holes on a drill press, and tap the threads.

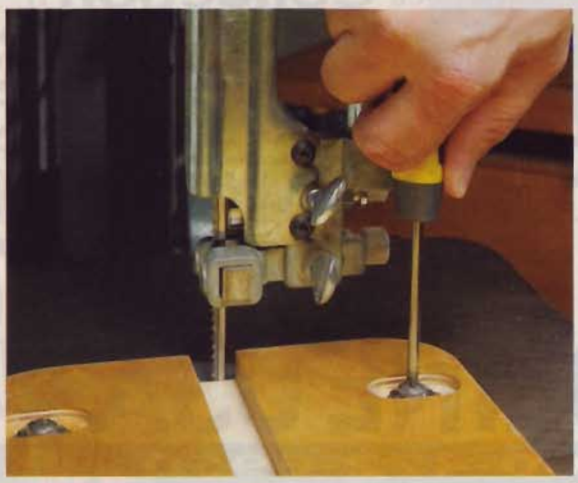
CONSTRUCTION VIEW



Note: T-track and hardware available from Rockler, 800-279-4441, or www.Rockler.com

BASE PARTS VIEW





▲ To ensure accurate circle cutting, align the leading edge of the blade with the center of the groove. Then, simply tighten the mounting screws.

circle-jig setup

It only takes a minute to set up the circle jig. For accurate results, the idea is to position it on the band saw table so the leading edge of the blade aligns with the center of the groove that holds the rail *(Photo, left)*.

Of course, the alignment will vary slightly depending on the width of blade you're using. That's not a problem though. Thanks to the adjustment slots in the base, you can move the jig back and forth until it's properly aligned. Then simply tighten the machine screws, as shown.

Once the jig is secured to the table, it's just a matter of attaching the sliding rail to the bottom of the workpiece with the pivot pin *(see Figures 1 through 3 below)*. Then slide the rail over the T-bolts *(Fig. 4)* and cut the circle, as shown in *Figures 5 and 6*.

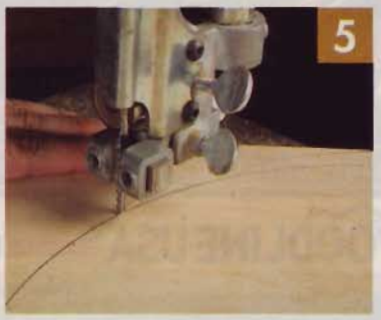
step-by-step
CUTTING PERFECT CIRCLES

▲ Start by drawing diagonal lines to find the centerpoint on *each* side of the workpiece.

▲ Using a compass made from a scrap of wood, draw the circle on the *top face* of the workpiece.

▲ Attach the rail to the *bottom* of the piece by installing the pivot pin (screw) at the centerpoint.

▲ Now slide the rail over the heads of the T-bolts. Note: Don't tighten the lock knobs just yet.



▲ Start the cut at the edge. Then cut toward the circle by rotating the work and sliding the rail in.

▲ When the blade begins to cut along the circle *(Fig. 5)*, tighten the knobs and complete the cut.

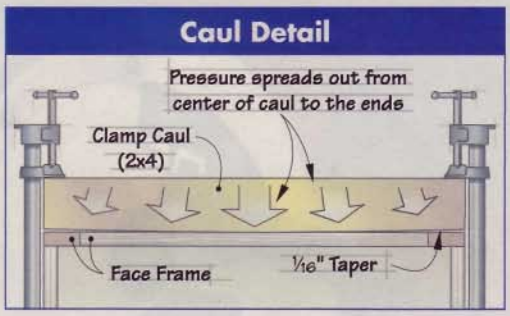
TIPS FROM THE WORKBENCH SHOP

close-up on CLAMP CAULS

Gluing face frames to a cabinet — such as on the garage organizers on page 60 — almost always presents the challenge of how to apply pressure evenly along the entire gluing surface. Clamping the ends isn't a problem, but there's no easy way to clamp the center of the frame.

The solution is to use cauls to distribute the clamping pressure across the full length of the gluing surface. A caul is just a board with a slightly curved edge. If you look closely at the *Caul Detail*, you can see that this edge has a "hump" in the middle, and then it tapers toward both ends of the board. The tapers are quite small (about 1/16"), and they're easily made with a hand plane.

When you clamp the caul across a project, pressure is applied at the center of the caul first. Then, as the clamps squeeze the tapered ends flat against the project, it exerts pressure along the entire length of the caul.



▲ A clamp caul, made from a scrap 2x4, distributes pressure evenly along its entire length. The key is a curved edge that exerts pressure first at the center, then at the tapered ends.

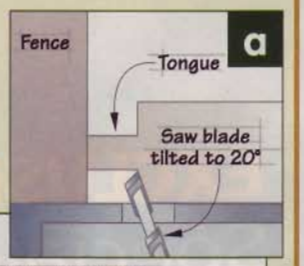
Table Saw Technique — Tongue & Groove

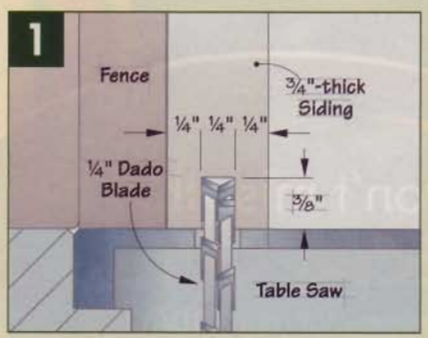
The siding of the storage bench is assembled with tongue-and-groove joints. These joints, as well as chamfers along the joint lines, can be cut easily on the table saw.

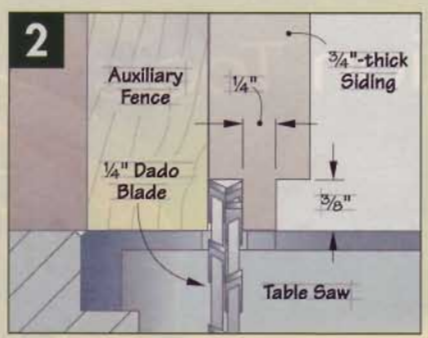
Grooves — The first step is to cut the grooves. A 1/4" dado blade makes quick work of this. Position the fence so the blade is centered on the siding thickness *(Fig. 1)*. Then make a single pass to cut each groove.

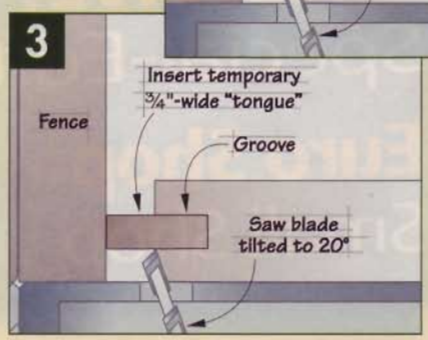
Tongues — Now you can focus on the tongues that fit into the grooves. The tongues are formed by cutting two rabbets *(Fig. 2)*. You can use the same dado blade setup here. Only this time, the blade should just "kiss" the side of an auxiliary fence attached to the rip fence.

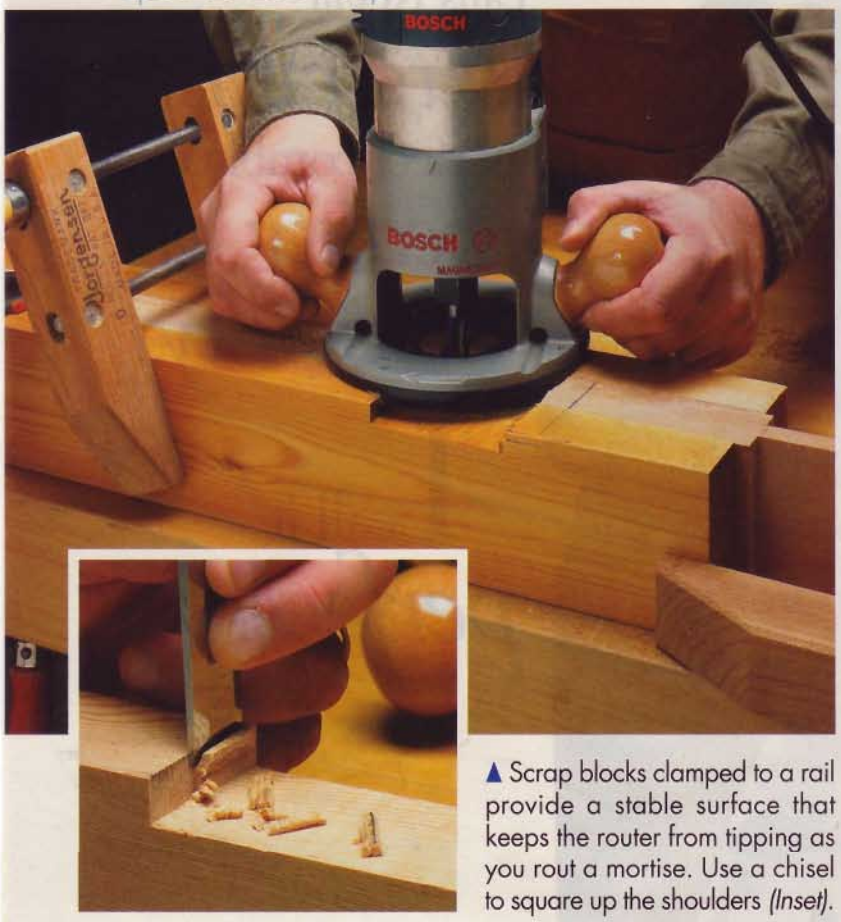
Chamfers — Finally, tilt the saw blade to 20° to cut the chamfers *(Figs. 3 and 3a)*. Note the temporary "tongue" inserted in the grooved edge. It allows you to use the same setup as when cutting chamfers in the tongued edge.











▲ Scrap blocks clamped to a rail provide a stable surface that keeps the router from tipping as you rout a mortise. Use a chisel to square up the shoulders *(Inset)*.

hinge-mortise SHORTCUT

When you see a plan that calls for cutting a deep hinge mortise (like in the rail of the storage bench on page 66), you might think "lots of work with a chisel." But think again. You can save a lot of time by removing the bulk of the waste with a hand-held router and a 1/2" straight bit.

Before you get started though, you'll need to lay out the location of the mortise. This is just a matter of marking the ends of the mortise. As for the depth of the mortise, it's determined by the hinge, so adjust the depth of cut accordingly (1/2" for the mortises in the bench).

To provide plenty of support for the base of the router, I clamp a couple of scrap blocks to the workpiece, flush with the edge *(Photo, left)*. These blocks keep the router from tipping. And as an added benefit, they prevent chipout where the bit exits the cut.

To cut the mortise, turn on the router, plow through one of the blocks, and begin routing up close to the layout lines (within 1/8" or so). You'll cut into the scrap blocks as you rout back and forth, but that's okay. They've accomplished their sacrificial job.

Once you've removed most of the waste material, unclamp the blocks and square up the shoulders of the mortise with a chisel *(Inset Photo)*.

panel-raising ROUTER TABLE

Not all router tables have big enough openings to accommodate the large router bits used to build raised-panel doors *(page 52)*. In that case, I'd suggest making a simple router table and clamping it to a pair of sawhorses *(Photo, right)*.

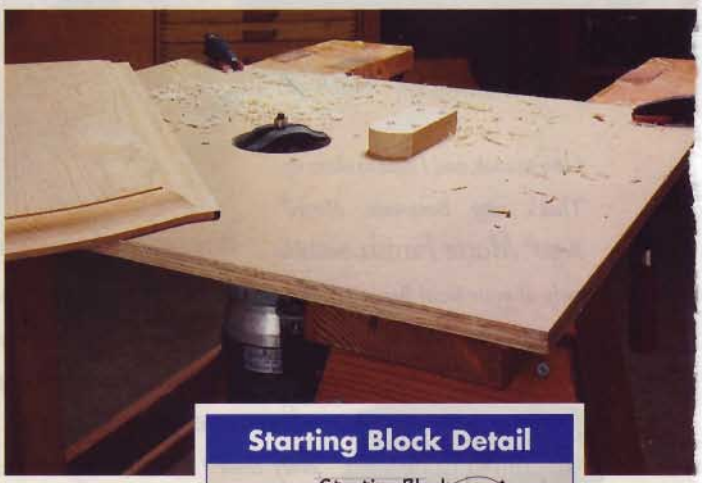
The router table doesn't have to be fancy. A 24"x 24" piece of 1/2"-plywood works fine, as long as it's flat. Plus it's thin enough that you can adjust the bit height to rout the full profile the bit is designed to cut.

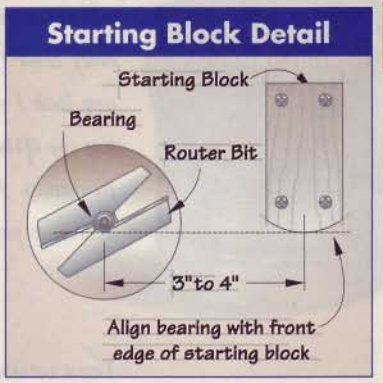
To mount the router, use the holes in the plastic base to locate mounting holes in the table. Now drill the holes and, if possible, use the same mounting screws to secure the router. (You may have to get longer screws.)

Once you've mounted the router to the table, you'll need to locate the centerpoint of the opening for the bit. To do that, chuck a 1/4" straight bit in the router, and then raise the spinning bit up through the table.

Now remove the router and cut an opening that's about 1/8" larger than the panel-raising bit. After reinstalling the router, you're almost ready to rout — after one more simple, but useful, addition.

Particularly in the case of panel-raising operations, a starting pin is a valuable accessory *(see page 56 for more about this)*. A starting block made from a scrap piece of wood — like the one in the *Illustration* at right — provides the same safety and convenience.





▲ Router tables don't get any simpler than this — a 1/2" plywood table with a large bit opening and a starting block made of scrap.

TOOL Close-Up

Wood Rat PRECISION JOINERY MACHINE

A sales brochure for the WoodRat describes the tool as a "Precision Joinery Machine," which is as fitting a definition for this oddly named tool as can be found.

When coupled with a plunge router, "the rat" can do many of the same things a router table does, but it clearly isn't a router table. Likewise, dovetails and box joints are standard fare for the rat, but the system is not like any joinery jig we've ever seen.

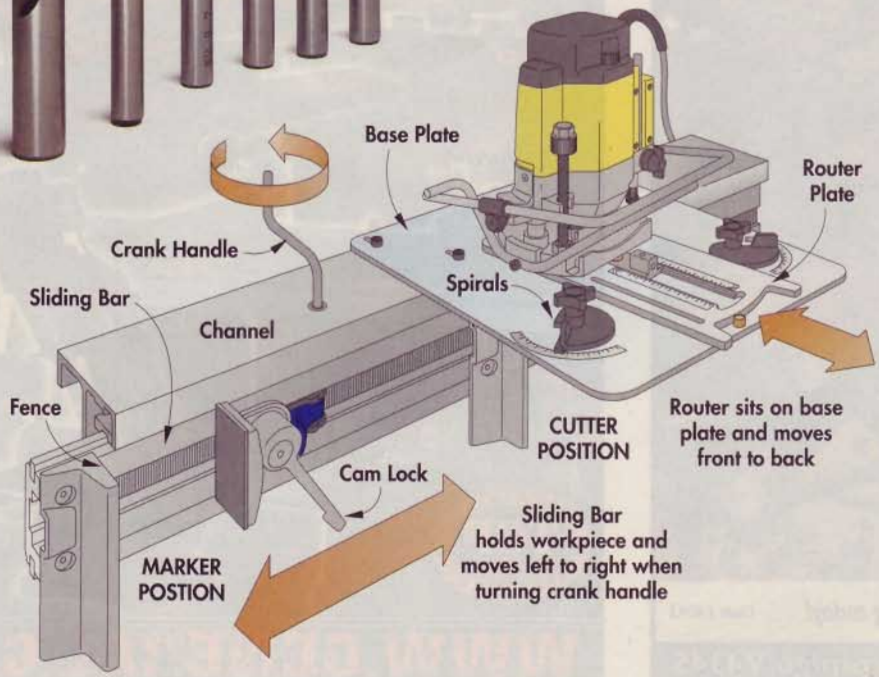
The key difference between this and conventional dovetail or box joint jigs is that the WoodRat doesn't use templates, guide bushings, or bearing-guided bits to create the joinery pattern. Rather, this system relies on the accuracy of the operator to create precise joints.

By foregoing the virtually automatic accuracy of templates and guided bits, you can be as creative as you want when designing joinery. An example of cutting custom dovetails is shown on page 40. But first, take a look at the *Illustration* at left for a quick overview of the machine.

WoodRat Anatomy — The "body" of the WoodRat is a channel that affixes to a wall and also supports the base plate. A plunge router connects to this base plate and, depending on the operation, may be stationary or slide front to back.

The other major component is a sliding bar that aligns and holds the workpieces in either the cutter position or the marker position. Turning a crank moves the sliding bar and the workpieces between cuts.

▲ The WoodRat is a unique jointing system in many aspects, including the use of high-speed steel bits, *left*. *Below* is a diagram to familiarize you with you the WoodRat components.



cutting custom DOVETAILS

Although the WoodRat is much more than a dovetailing machine, it's this classic joint that most clearly demonstrates the unique appeal of this tool.

The joint shown at left is a good example of the design flexibility that distinguishes this joinery system from others. Where a more conventional dovetail jig often results in a number of uniformly spaced dovetails, here we were able to customize both the size and spacing of the pins and tails. The result is a joint that is as elegant as it is strong.

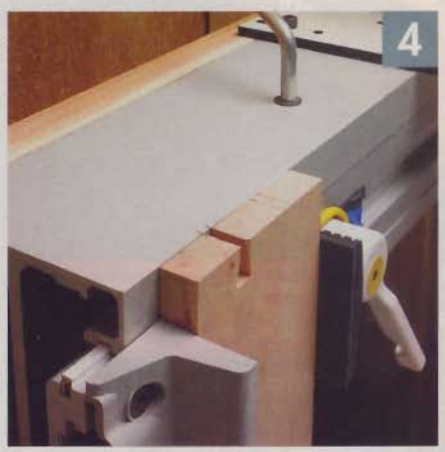
Another important element of these stylized dovetails is the *length* of the pins and tails. This comes from using high-speed steel bits, which typically have longer cutting flutes than carbide-tipped bits. The WoodRat instruction manual makes a strong argument for high-speed steel bits, and we agree that they do create an elegant joint.

Below is an overview of how to rout dovetails using the WoodRat. For a more detailed look at the system, including pricing information, visit their website at www.WoodRat.com or call 877-966-3728.

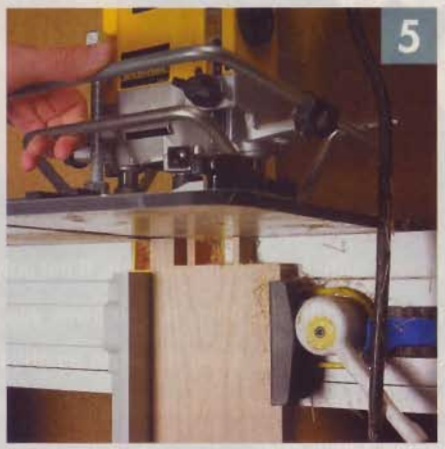
▲ Make two test boards. Zero the dovetail cutter on one board while using the other board to set the depth stop.

▲ Cut a socket in one test board. Move this board to the "Marker" position and trace the socket onto the channel.

▲ Use the parallelogram to mark tail locations on a workpiece. The parallelogram adjusts for custom layouts.



▲ Cut the tails on one workpiece and then place it in the "Marker" position for use as a guide to cut remaining pieces.



▲ A look underneath the WoodRat shows how it cuts away material to create matching pins.

▲ WoodRat's optional plunge bar makes plunging the router to depth a one-handed operation.

swing-out kitchen pantry

▲ Every kitchen deserves to have a spacious pantry. Now, every kitchen *can* with this unique countertop unit. It has storage space like a floor pantry, and the shelves *swing out* for easy access to the back.

When I imagine the perfect kitchen, the first thing that comes to mind is a large pantry with lots of storage space.

But in the real world, a lot of folks don't have the space for a floor pantry — let alone a large one. So storage space is often at a premium.

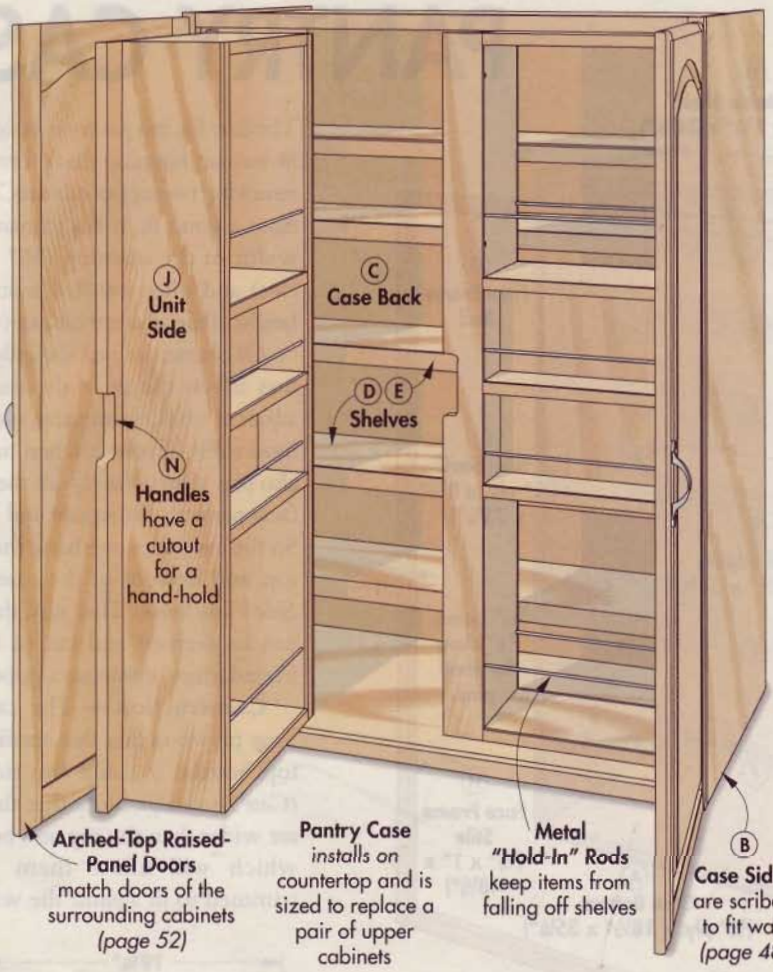
The design of this pantry makes it a perfect storage solution for any kitchen, regardless of its size. By removing two upper cabinets and installing this pantry in their place, the result is a huge increase in the storage capacity of your kitchen *(Photos, page 43)*.

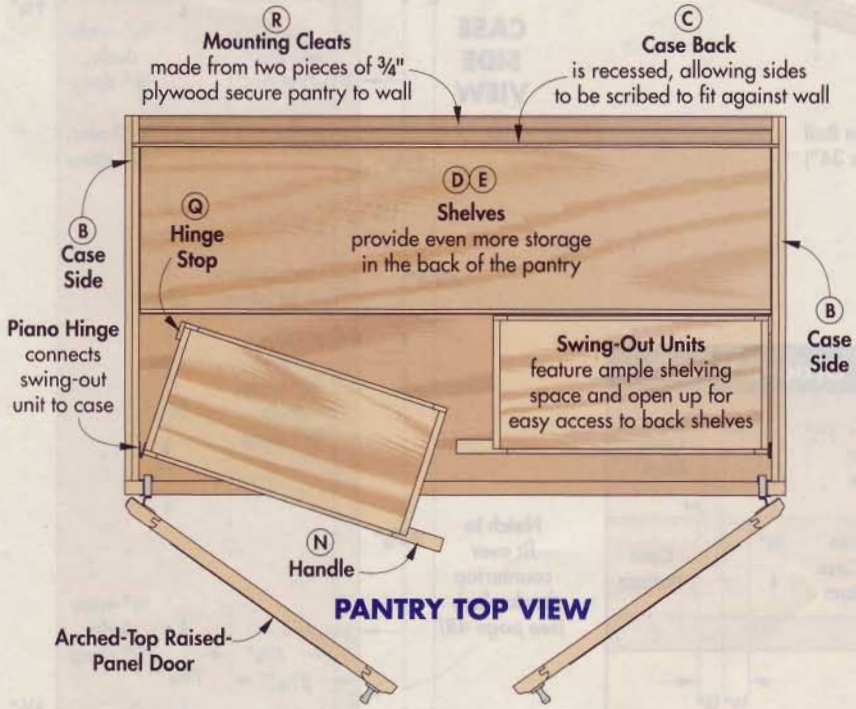
Another unique aspect of this design is the pair of swing-out units in the front of the pantry. By opening up these units, you have easy access to items on the back shelves.

But the most interesting part of this project was building the arched-top raised-panel doors to match the existing cabinets *(see page 52)*.

Construction Details

Overall Dimensions: 36" W x 21¼" D x 48½" H





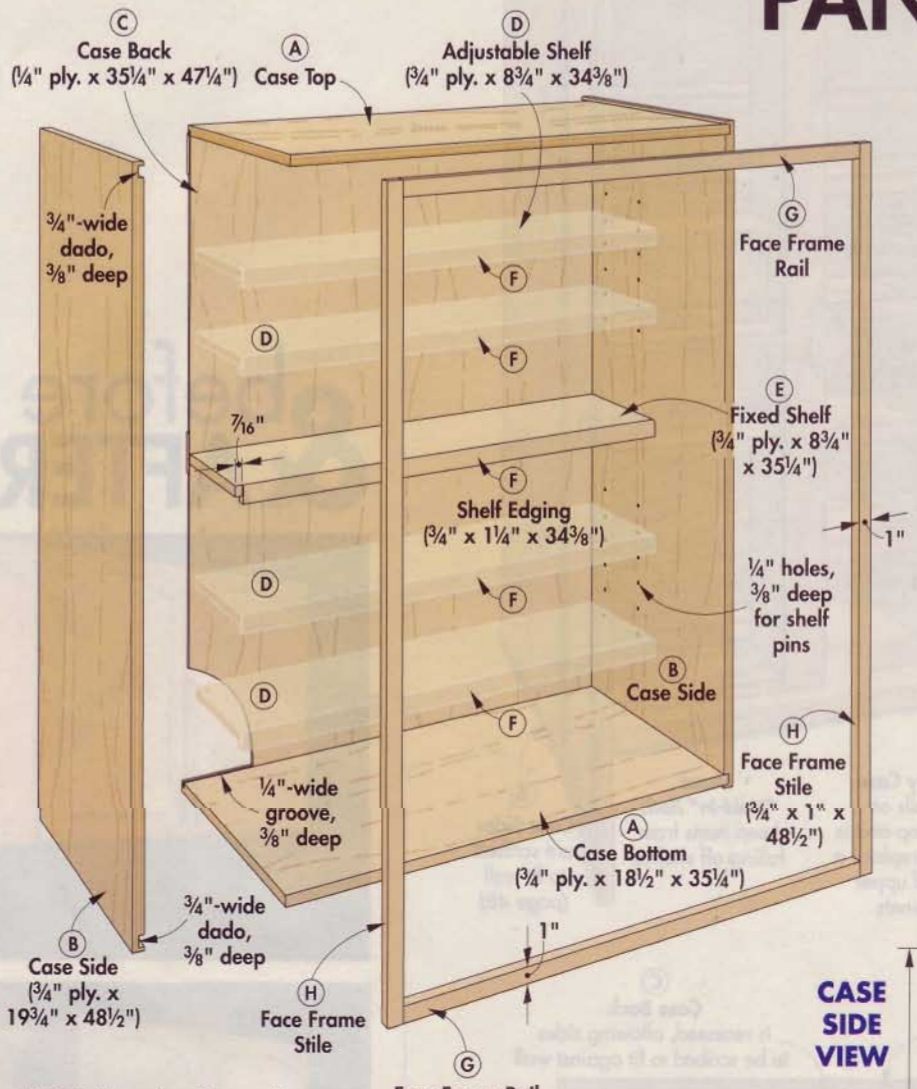
PANTRY TOP VIEW

before & AFTER

▲ By removing a pair of upper cabinets, this pantry can slide right into their place. It's a simple solution that adds a lot of storage, especially in homes that have a small kitchen.

built-to-fit PANTRY CASE

CASE ASSEMBLY



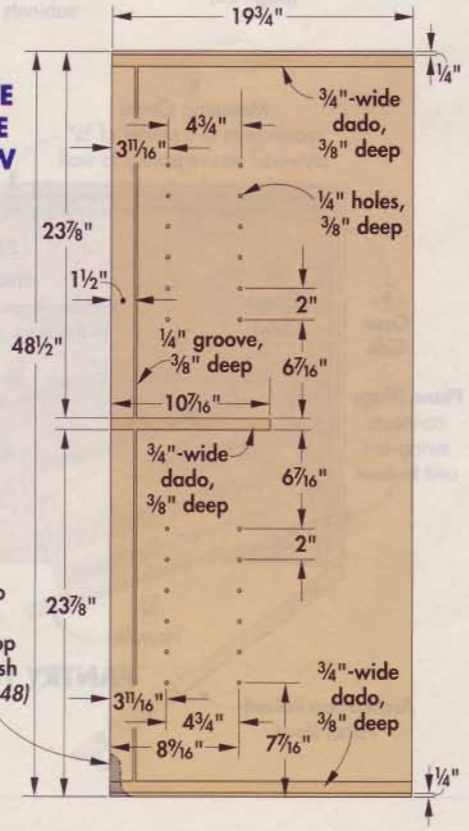
NOTE: Mount face frame stiles flush with *outside* face of case sides, and face frame rails flush with *inside* face of top and bottom

The case for this pantry is designed to fit into an opening that's formed by removing two upper cabinets. To produce a good fit, it has to match the width of the opening (36" in our case), and when installed, it sits at the height of the adjacent cabinet (48½").

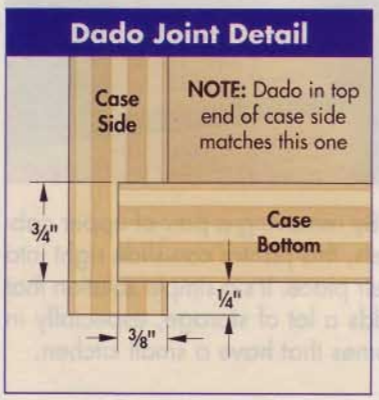
Of course, size isn't the only factor that affects the fit of the case. The adjacent walls, countertop, and overhead soffit (if your kitchen has one) also play a part. Rarely are these surfaces perfectly flat, square, and plumb. So the case sides overhang the back, top, and bottom of the case *(Case Side View, below)*. That way, the sides can be scribed and cut to fit any irregularities, ensuring a good fit.

Construction — The case is a large plywood box that consists of a top, bottom (A), and two sides (B) *(Case Assembly)*. Note that the sides are wider than the top and bottom, which will allow them to be trimmed to fit against the walls.

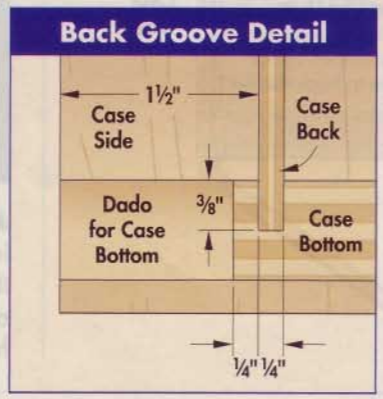
CASE SIDE VIEW



Dado Joint Detail



Back Groove Detail



Dado Joints — After sizing the pieces, the next step is to cut dadoes in each side to hold the top and bottom *(Dado Joint Detail)*. To achieve snug-fitting joints, I used a hand-held router with a straight bit that's specially manufactured to cut dadoes for 3/4" plywood (which is slightly thinner than 3/4"). **Note:** See page 63 for more information about these bits.

For straight, accurate cuts, it's also important to use a cutting guide with the router. (Free plans for a shop-made cutting guide are available at www.WorkbenchMagazine.com).

Stopped Dadoes — In addition to the dadoes for the top and bottom, you'll also need to cut a dado for a fixed shelf that's added later. This shelf (along with a set of adjustable shelves) occupies the back half of the cabinet, so it fits into a "stopped" dado, which is cut as shown in the *Photos* at right.

Grooves for Back — Once that's accomplished, the last bit of joinery to attend to is to cut grooves in the top, bottom, and sides to hold the back (C) of the case. The back is made from 1/4" plywood, which is slightly thinner than 1/4". To get a good fit here, I made two passes on the table saw, nudging the fence between passes. **Note:** Since the top and bottom are narrower than the sides, reference all cuts from the *front* edges of the pieces.

Add the Shelves — At this point, you can turn your attention to the shelves. The four adjustable shelves (D) and the fixed shelf (E) are all made from 3/4" plywood. The fixed shelf is longer than the others because it fits into the stopped dadoes. After the case is assembled, the adjustable shelves will sit on shelf supports inserted into holes you drill in the sides *(Case Side View)*.

To prevent the shelves from sagging, I added thick, wraparound edging (F) to the front edge of each shelf *(see Box below)*. Be sure to set this edging in from the end of the fixed shelf, so it will fit into the dado.

Face Frame — After gluing and clamping the case together, I added a 3/4" hardwood face frame to the front. The rails (G) and stiles (H) of the face frame are glued and clamped to the case. The face frame stiles align flush with the *outside* of the case, while the face frame rails fit flush with the *inside* face of the top and bottom.

◀ To ensure accuracy, I used a shop-made guide when cutting the stopped dado. Carefully rout up to the end of the dado *(above)*. Then square the corners with a chisel *(Inset Photo)*.

Shelf-Strengthening Hardwood Edging

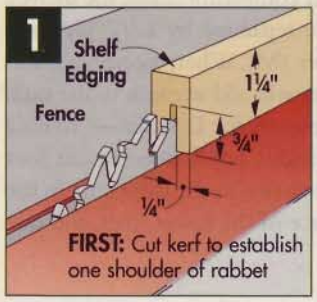
To prevent the pantry shelves from sagging with the weight of canned items, the edging has a thick lip that wraps underneath the shelf *(Photo, right)*. In addition, a decorative roundover creates a seamless transition from plywood to edging.

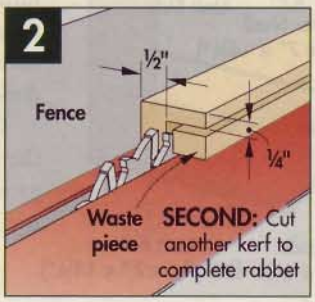
Form the Lip — A simple rabbet in a 3/4"-thick hardwood blank forms the wraparound lip. Two passes on the table saw — one for each shoulder of the rabbet — makes quick work of that *(Figs. 1 and 2)*.

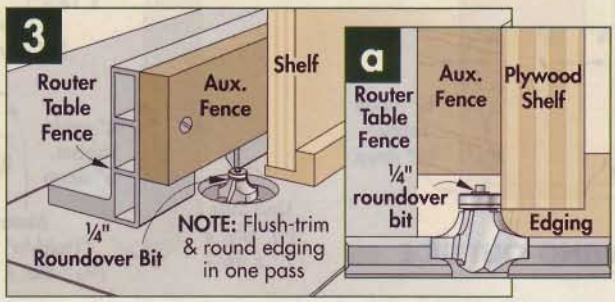
Rout the Roundover — As for the roundover, it can be routed *after* the edging has been glued to the shelf. In fact, you can rout the roundover *and* trim the edging flush with the surface of the plywood in one operation.

To do that, mount an auxiliary fence to the router table fence so there's clearance underneath for the edging strip *(Figs. 3 and 3a)*. Then align the fence with the bearing, and rout the edging as shown.

▲ This rabbeted block of hardwood adds strength to a load-bearing shelf.







making swing-out STORAGE UNITS

With the case complete, it's time to build the two tall swing-out units that fit inside. Shelves divide these units into several compartments, providing easy access to items on either side.

Metal Hold-Ins — One unique aspect of these shelves is a set of metal "hold-in" rods that span the openings between the sides of the unit. These rods keep items from sliding off the shelves when you open and close the unit.

Unit Construction — The construction of the swing-out units is similar to the case. The top and bottom (I) fit into rabbets in the sides (J), and dadoes hold the shelves *(see Swing-Out Unit Assembly below)*.

For a trouble-free assembly, it's important that the rabbet and dado joints align with each other. An easy way to accomplish that is to cut the joints in an extra-wide workpiece. (A hand-held router and a cutting guide make quick work of that.) Then use the table saw to rip the two sides from this wide workpiece.

Hold-Ins — Once the joinery is complete, it's time to turn your attention to the metal hold-in rods.

Installing these hold-ins presents a couple of challenges. First, the holes in both side pieces need to align perfectly with one another. Second, the hold-ins have to be easy to install *after* the unit is assembled.

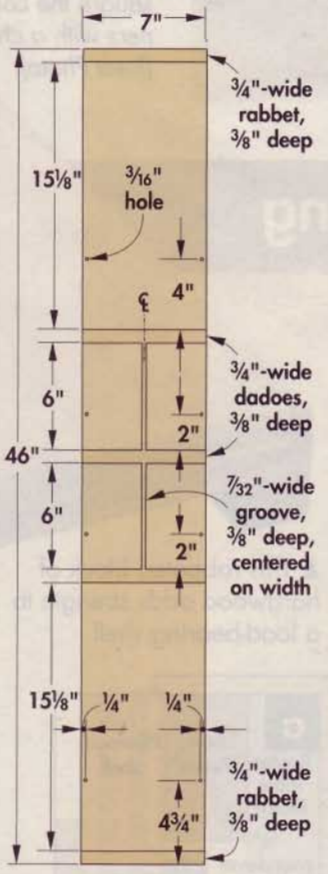
To align the sides for drilling the holes, I fit scrap blocks into the dadoes already cut in the side pieces. Inserting these blocks in the dadoes in one side and then fitting the dadoes in the other side over the blocks results in perfectly aligned side pieces *(Photo, page 47)*.

Now it's just a matter of laying out and drilling the holes. You'll want to drill all the way through the top piece, but only halfway through the bottom *(Drilling Detail)*. This way, once the unit is assembled, you'll be able to slip the rod into the side with the through-hole (from the outside) and then slide it into the stopped hole, capturing the rods between the sides. Later, a hinge and a wood stop will cover the through-holes.

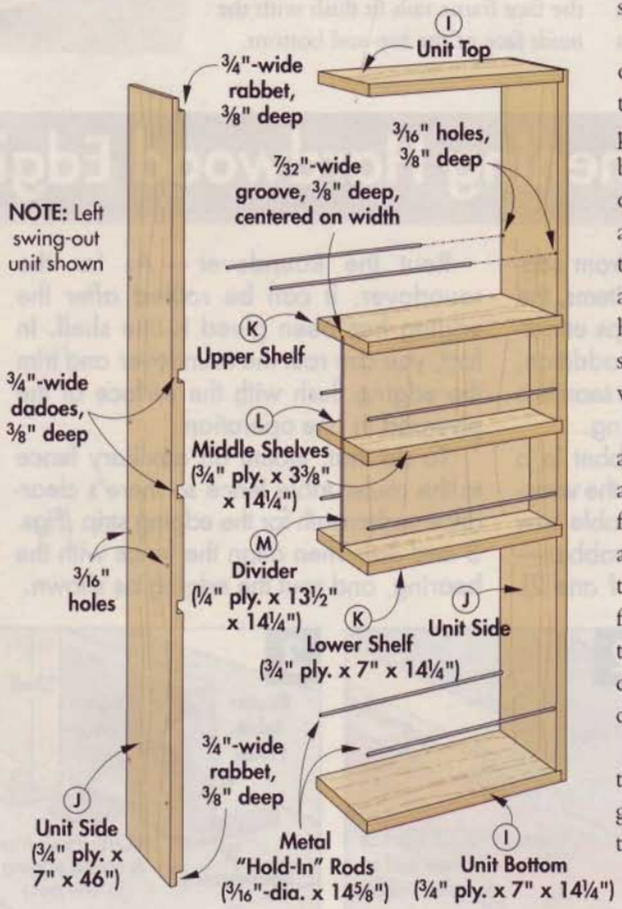
Shelves & Divider — Before assembling the units, you'll need to add shelves and a divider. There are four 3/4" plywood shelves in each unit: a wide upper and lower shelf (K) and two narrow middle shelves (L). To further compartmentalize the shelves, they're separated by a 1/4" plywood divider (M). When assembled, this divider will add strength to the unit.

Grooves for Divider — To hold the divider, you'll need to cut four grooves: two in the sides, one in the top face of the lower shelf, and one

SWING-OUT UNIT ASSEMBLY



SWING-OUT SIDE



in the bottom face of the upper shelf. This is easy to accomplish by using a straight bit that's sized to cut dadoes for 1/4" plywood *(see Box on page 63)* in a table-mounted router.

Start by positioning the router table fence so the bit is centered on the width of the workpiece, and rout the grooves in the shelves from end to end. For the grooves in the sides, begin routing the groove in the dado for the lower shelf, and stop routing when you reach the upper shelf dado *(see Swing-Out Side, page 46)*.

Unit Assembly — The swing-out units now can be assembled with glue and clamps. Once the units are assembled, you can slide the metal hold-in rods into place by inserting them into the through-holes and pushing them into the holes on the other side.

Handle — Each unit has a tall, vertical handle (N) made of 3/4"-thick hardwood. One edge of this handle is rabbeted to form a lip that covers the front edge of the side piece *(Handle Top View)*. The other edge has a cutout that forms a handhold *(Handle Cutout Detail)*. This is easy to cut to shape with a jig saw. Then, sand a slight roundover on the handle to soften the edge.

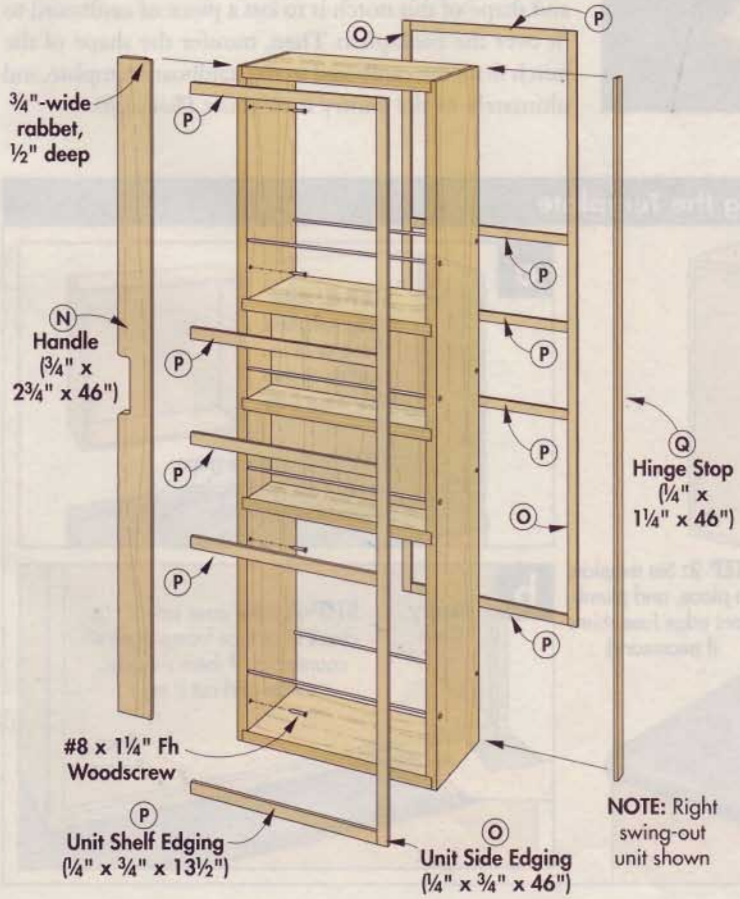
To install the handle, glue and clamp it in place. Then drive screws through the side and into the handle.

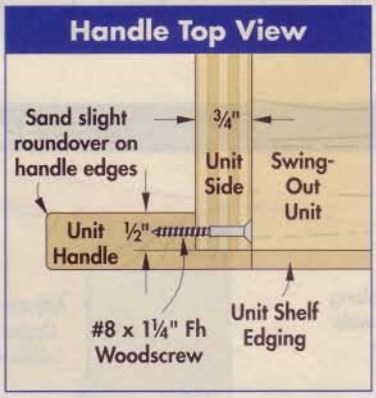
Add Edging — The handle covers one of the exposed edges on the front of the swing-out units. To hide the remaining edges, I added thin strips of solid-wood edging (O, P). These strips are simply cut to fit and then glued in place.

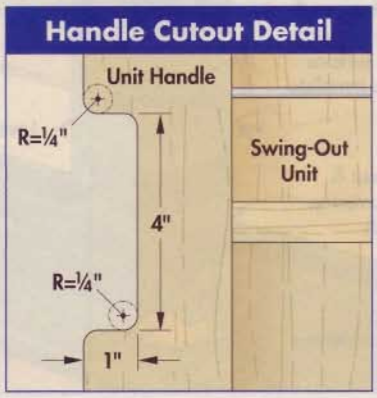
Hinge Stop — While you're adding the edging, go ahead and add a hinge stop (Q) that's the same thickness as the edging near the back of the unit side. The hinge stop is the same thickness as a closed piano hinge, so it prevents the hinge from overextending when you close the unit. It also keeps the unit from marring the case side when closed.

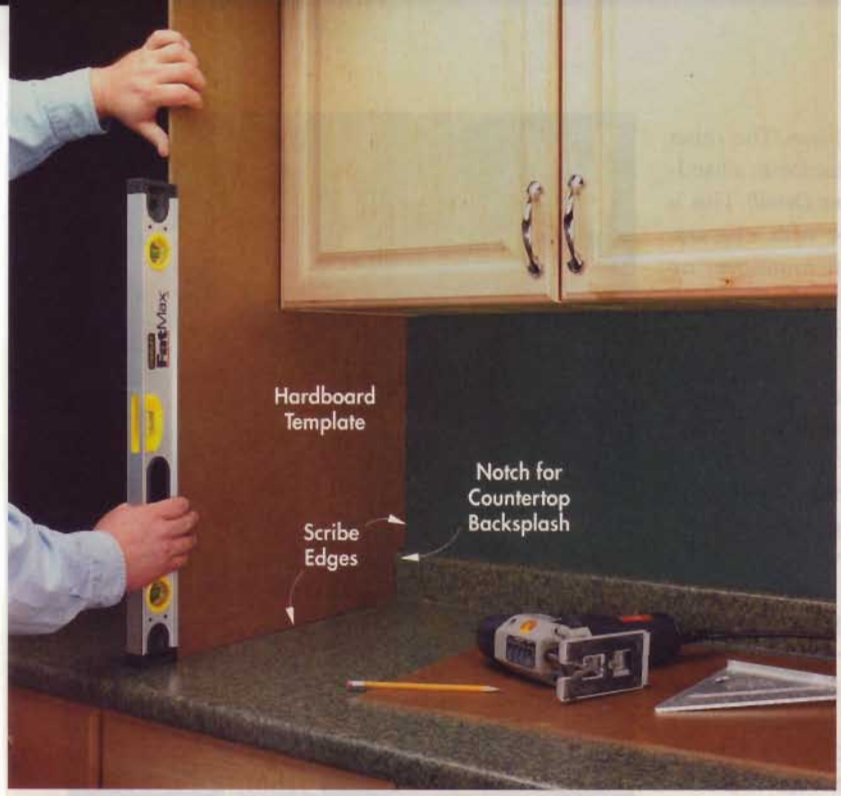
▲ Scrap blocks cut to fit the dadoes in the sides of the swing-out unit keep the pieces aligned while drilling holes for the metal "hold-in" rods.

SWING-OUT UNIT EDGING & HANDLE









storage pantry INSTALLATION

The case is lighter and easier to move around before the swing-out units and doors are installed. So it makes sense to fit the case into its opening and attach it to the wall before adding these elements.

Making It Fit

One of the things you're likely to run up against while installing the pantry is typical of most built-in cabinets. Chances are slim that the countertop, wall, and adjacent cabinets will be perfectly level and plumb — so the chances are also slim that the pantry will fit tightly against these surfaces.

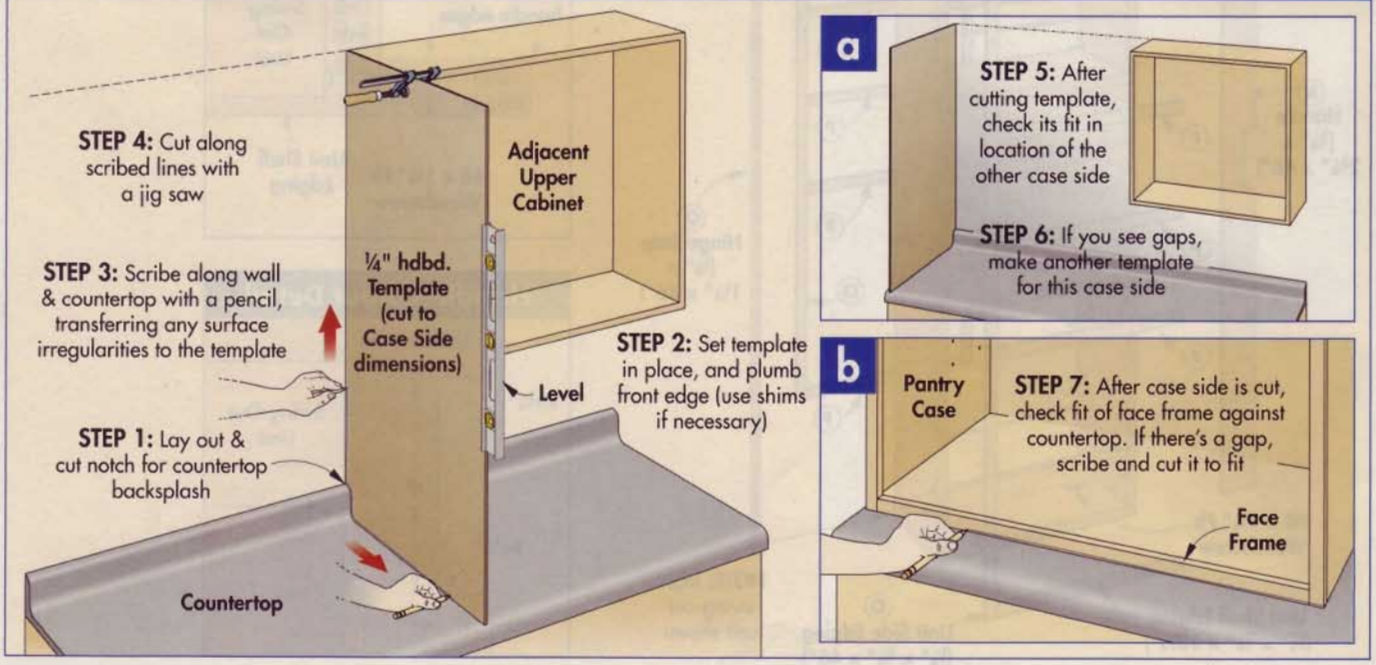
That's why the sides of the pantry extend beyond the back, bottom, and top of the cabinet. If you find that the pantry won't sit flat on the countertop or against the wall, you can scribe it to match any irregularities in those surfaces, and then cut the sides to fit just right.

Create A Template — An easy way to do this is to make a hardboard template that's the same size as the side of the case and scribe it to fit the opening *(Photo, left)*.

Before doing any scribing, though, you'll probably need to notch the template to fit around the backsplash on the countertop. A good way to determine the size and shape of this notch is to cut a piece of cardboard to fit over the backsplash. Then, transfer the shape of the notch from the cardboard to the hardboard template, and ultimately to the pantry itself *(Inset Photo, left)*.

▲Use a hardboard template to fit the case into its opening. After notching it to fit over the backsplash *(Inset)*, plumb the template *(above)*. Then scribe along the wall and counter, and cut the template to fit.

Scribing the Template



Now set the template in place in the opening, and plumb the front edge *(Photo, page 48)*. You may have to shim the template to accomplish this. Then scribe by sliding a pencil along the wall and countertop, marking a line on the template *(Scribing the Template)*.

After scribing the template, cut along the layout lines with a jig saw. Next, use the template to check the fit of the other side of the case *(Fig. a)*. If you see gaps, make a second template for this side as well.

Once the template (or templates) are complete, set it on the side of the case (flush with the front edge) and trace around it. Then use a jig saw to cut along the lines, and sand the edges smooth.

Finally, set the case into place and check the fit between the face frame and countertop *(Fig. b)*. If there's a slight gap, scribe the face frame, and then cut it to fit.

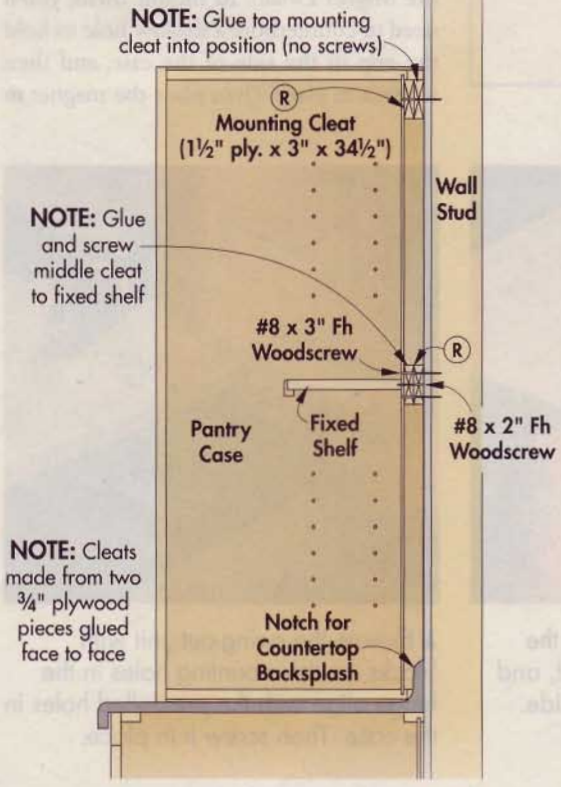
Installing the Case

Once you're satisfied with how the case fits into the opening, it can be mounted to the wall. This is accomplished with two mounting cleats (R) that fit into the recess behind the back of the case. I glued two scrap plywood pieces face to face to make the cleats.

Mount the Case — To mount the cabinet, first attach the cleats to the back of the case *(Photo, right)*. Then set the case on the countertop. Pre-drill pilot holes, and run long woodscrews through the back of the case, cleats, and into the wall studs *(Case Installation)*.

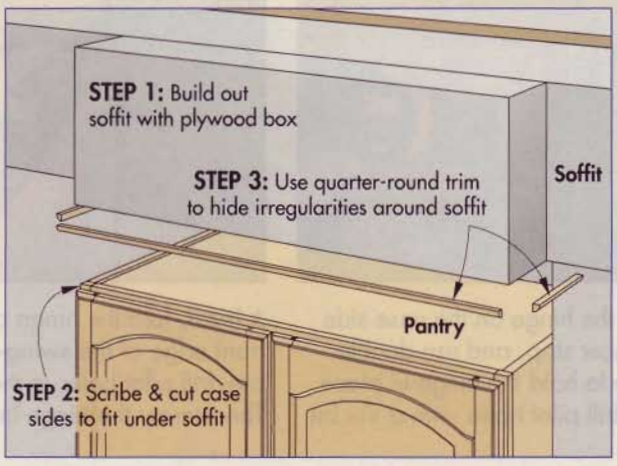
▲ Two cleats attached to the case back make it possible to install the pantry. The middle cleat *(shown)* is screwed to the fixed shelf, while the top cleat is glued in place.

CASE INSTALLATION



Soffit Options

If your cabinets are mounted under a soffit, it might take some extra steps to get the pantry to fit just right. First, the pantry will protrude beyond most soffits, but you can build the soffit out by making a plywood box. Once this box is built, you can use a template and scribe around the soffit just as for the countertop and wall. Finally, some strips of quarter-round trim will hide any imperfections around the top edge of the pantry.



add swing-out units & DOORS

Once the case is installed, you can turn your attention to installing the swing-out units and the raised-panel doors.

Install Swing-Out Units

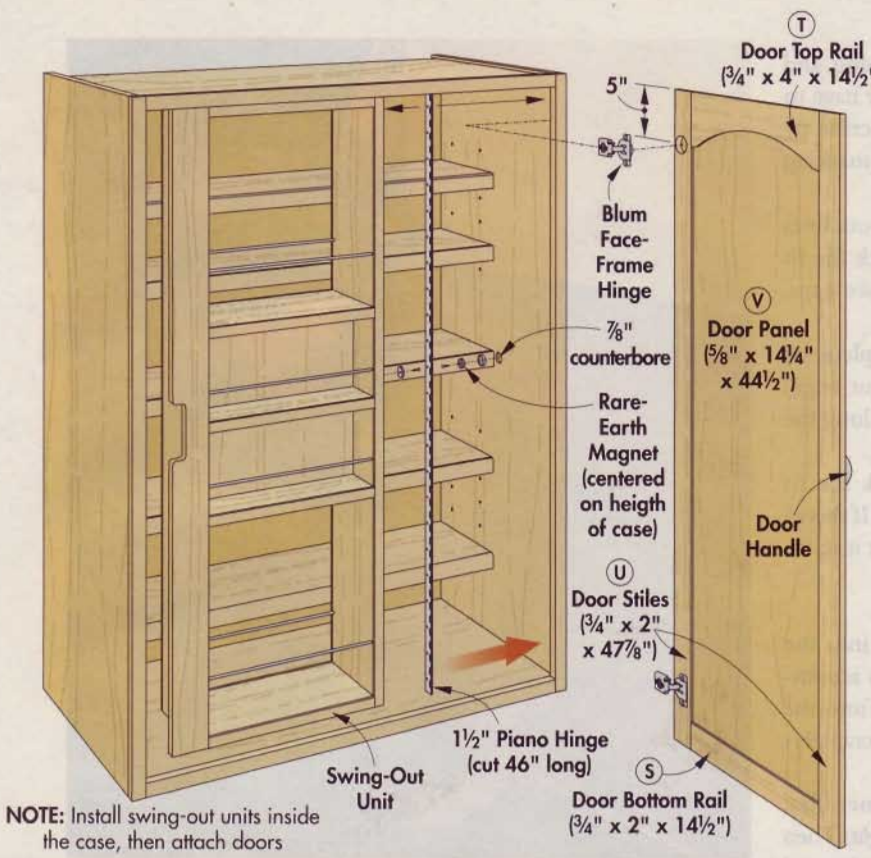
Each swing-out unit is mounted inside the case with a long continuous hinge that's screwed to both the side of the case and the swing-out unit. You'll want to cut these hinges to the proper length using a hacksaw.

When mounted, the hinge is centered on the length of the case side, top to bottom. The positioning of this hinge from *front to back*, however, is most crucial, as it has to be set back far enough that the swing-out units don't contact the face frame of the case.

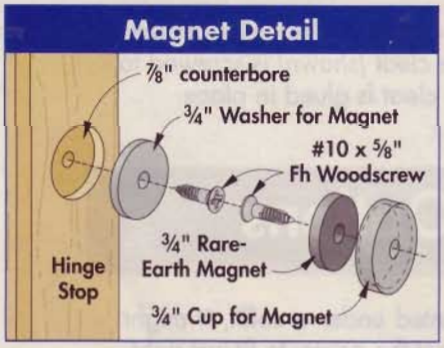
To position the hinge accurately and then install the swing-out unit, I followed the sequence shown in the *Photos* below.

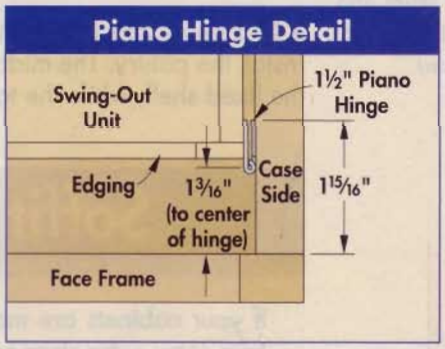
Add Magnetic Catches — To prevent the swing-out units from opening up when not in use, I installed Rare-Earth Magnets.

These magnets consist of a cup that accepts a magnet on one side, and a washer that sticks to the magnet on the other side *(see Magnet Detail)*. To mount them, you'll need to counterbore a shallow hole to hold the cup in the side of the case, and then screw it in place. Then place the magnet in



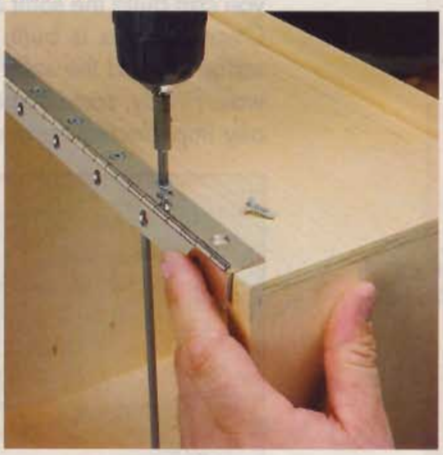
NOTE: Install swing-out units inside the case, then attach doors





SWING-OUT UNIT INSTALLATION

▲ Position the hinge on the case side with a spacer strip, and use double-sided tape to hold the hinge in place. Then pre-drill pilot holes with a Vix bit.



▲ Next, fold the hinge around the front edge of the swing-out unit, and pre-drill pilot holes in the unit side. Then screw the hinge in place.

▲ Elevate the swing-out unit with blocks, so the mounting holes in the hinge align with the pre-drilled holes in the case. Then screw it in place.

the cup. Next, counterbore a hole to accept the washer in the hinge stop on the swing-out unit, and screw the washer in place. Make sure the two holes align precisely for the magnets to work their best.

Mount Raised-Panel Doors

To match the existing cabinets, I made arched-top raised-panel doors for the pantry. The doors consist of a frame constructed of maple rails (S,T) and stiles (U) that surrounds an arched, raised, solid-wood panel (V). For an in-depth look at how I made the doors, see the article on page 52.

Face Frame Hinges — After building the doors, I found some special face frame hinges that made mounting them a cinch. These hinges have a cup on one side that attaches to the door, and a mounting plate on the other side that screws to the edge of the face frame on the case.

The first step in attaching the doors is to bore holes in a stile on each door to accept the cup side of the hinge. Then attach the hinge to the door with screws.

Attach Hinge to Face Frame — One of the nice things about these hinges is that you can easily adjust the height of the doors after the hinges are attached. This is because of a slot in the mounting plate. Thanks to this slot, you can hold the open door against the face frame on the case side, mark and pre-drill pilot holes, and screw the hinges in place. It helps to elevate the door slightly with a scrap block to get it positioned the way you want it *(see Photo and Inset, right)*.

Then, back off the screws just a hair, and adjust the door until it is positioned in the opening just right. Tighten the screws, and your door should be set.

A Nice Finish — One last consideration with this pantry — you'll want to finish it to match the surrounding cabinets. (I used a glossy polyacrylic blend from General Finishes.) One way to do this is to take a door off a cabinet next to the pantry to a local paint store and have them prepare a finish that matches.

▲ After attaching these face frame hinges to the door, installing the door is as easy as marking the location of the screws and then driving screws into the face frame. A scrap block elevates the door to the desired height.

Reinforcing Piano Hinges

The piano hinges in this pantry support a lot of weight. And most hinges come with 1/2" screws, which are too small to get a good "bite." To add strength to the hinges, use #8 x 5/8" screws instead. So the larger screw heads will rest flush with the surface of the hinge, countersink the mounting holes before installation.

MATERIALS & HARDWARE

	Part	Qty	T	W	L	Material
A	Case Top & Bottom	2	3/4"	18 1/2"	35 1/4"	Maple Plywood
B	Case Sides	2	3/4"	19 3/4"	48 1/2"	Maple Plywood
C	Case Back	1	1/4"	35 1/4"	47 1/4"	Maple Plywood
D	Adjustable Shelves	4	3/4"	8 3/4"	34 3/8"	Maple Plywood
E	Fixed Shelf	1	3/4"	8 3/4"	35 1/4"	Maple Plywood
F	Shelf Edging	5	3/4"	1 1/4"	34 3/8"	Maple
G	Face Frame Rails	2	3/4"	1"	34"	Maple
H	Face Frame Stiles	2	3/4"	1"	48 1/2"	Maple
I	Unit Tops & Bottoms	4	3/4"	7"	14 1/4"	Maple Plywood
J	Unit Sides	4	3/4"	7"	46"	Maple Plywood
K	Upper/Lower Shelves	4	3/4"	7"	14 1/4"	Maple Plywood
L	Middle Shelves	4	3/4"	3 3/8"	14 1/4"	Maple Plywood
M	Dividers	2	1/4"	13 1/2"	14 1/4"	Maple Plywood
N	Unit Handles	2	3/4"	2 3/4"	46"	Maple
O	Unit Side Edging	6	1/4"	3/4"	46"	Maple
P	Unit Shelf Edging	20	1/4"	3/4"	13 1/2"	Maple
Q	Hinge Stops	2	1/4"	1 1/4"	46"	Maple
R	Mounting Cleats	2	1 1/2"	3"	34 1/2"	Maple Plywood
S	Door Bottom Rails	2	3/4"	2"	14 1/2"	Maple
T	Door Top Rails	2	3/4"	4"	14 1/2"	Maple
U	Door Stiles	4	3/4"	2"	47 7/8"	Maple
V	Door Panels	2	5/8"	14 1/4"	44 1/2"	Maple

- (4) Blum Face-Frame Hinges*
- (2) Door Pulls (to match cabinets)*
- (2) 1 1/2" Piano Hinges (48" long)
- (16) 1/4" Shelf Supports
- (2) 3/4" Rare-Earth Magnets, Cups, and Washers**
- (16) 3/16"-dia. x 14 5/8" Metal Rods
- (10) #8 x 1 1/4" Fh Woodscrews
- (4) #8 x 2" Fh Woodscrews
- (96) #8 x 5/8" Fh Woodscrews
- (6) #8 x 3" Panhead Screws

ONLINE Extras
Cutting Diagram
WorkbenchMagazine.com

*Blum Hinges (55918) and Door Pulls (10338) are from Rockler (800-279-4441, Rockler.com).

**Rare-Earth Magnets (99K32.11), Cups (99K32.54), and Washers (99K32.64) are from Lee Valley (800-871-8158, LeeValley.com).

WORKBENCH KITCHEN PANTRY

Issue 284 Volume 60 Number 4 July/August 2004

MATERIALS LIST

MATERIALS & HARDWARE

	Part	Qty.	T	W	L	Material
A	Case Top & Bottom	2	¾"	13½"	38¼"	Maple Plywood
B	Case Sides	2	¾"	19¾"	48½"	Maple Plywood
C	Case Back	1	¼"	38¼"	47¼"	Maple Plywood
D	Adjustable Shelves	4	¾"	6¾"	34½"	Maple Plywood
E	Fixed Shelf	1	¾"	6¾"	38¼"	Maple Plywood
F	Shelf Edging	5	¾"	¾"	34½"	Maple
G	Face Frame Rails	2	¾"	1"	34"	Maple
H	Face Frame Stiles	2	¾"	1"	48½"	Maple
I	Wall Tops & Bottoms	4	¾"	7"	14¼"	Maple Plywood
J	Wall Sides	4	¾"	7"	46"	Maple Plywood
K	Upper/Lower Shelves	4	¾"	7"	14¼"	Maple Plywood
L	Middle Shelves	4	¾"	3½"	14¼"	Maple Plywood
M	Dividers	2	¾"	13½"	14¼"	Maple Plywood
N	Wall Nailers	2	¾"	2½"	46"	Maple
O	Wall Side Edging	6	¾"	¾"	46"	Maple
P	Wall Shelf Edging	20	¾"	¾"	13½"	Maple
Q	Hinge Stops	2	¾"	7¾"	46"	Maple
R	Mounting Cleats	2	1½"	3"	34½"	Maple Plywood
S	Door Bottom Rails	2	¾"	2"	14½"	Maple
T	Door Top Rails	2	¾"	4"	14½"	Maple
U	Door Stiles	4	¾"	2"	47¾"	Maple
V	Door Panels	2	¼"	14¼"	44½"	Maple

- (4) 16mm Face-Frame Hinges*
- (2) Door Pulls (to match cabinets)*
- (2) 11½" Piano Hinges (48" long)
- (16) ¼" Shelf Supports
- (2) ¾" Rare-Earth Magnets, Cups, and Washers**
- (16) ¾"-dia. x 14½" Metal Rods
- (10) #8 x ¾" Fh Woodscrews
- (4) #8 x 2" Fh Woodscrews
- (96) #8 x ¾" Fh Woodscrews
- (6) #8 x 3" Panhead Screws

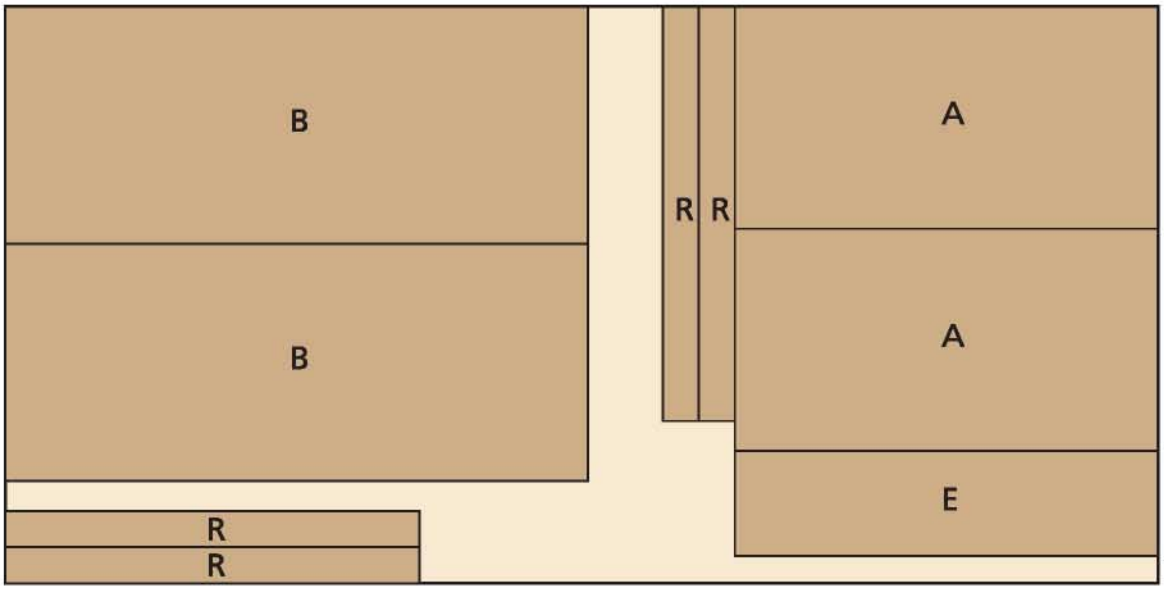
Cutting Diagram

WorkbenchMagazine.com

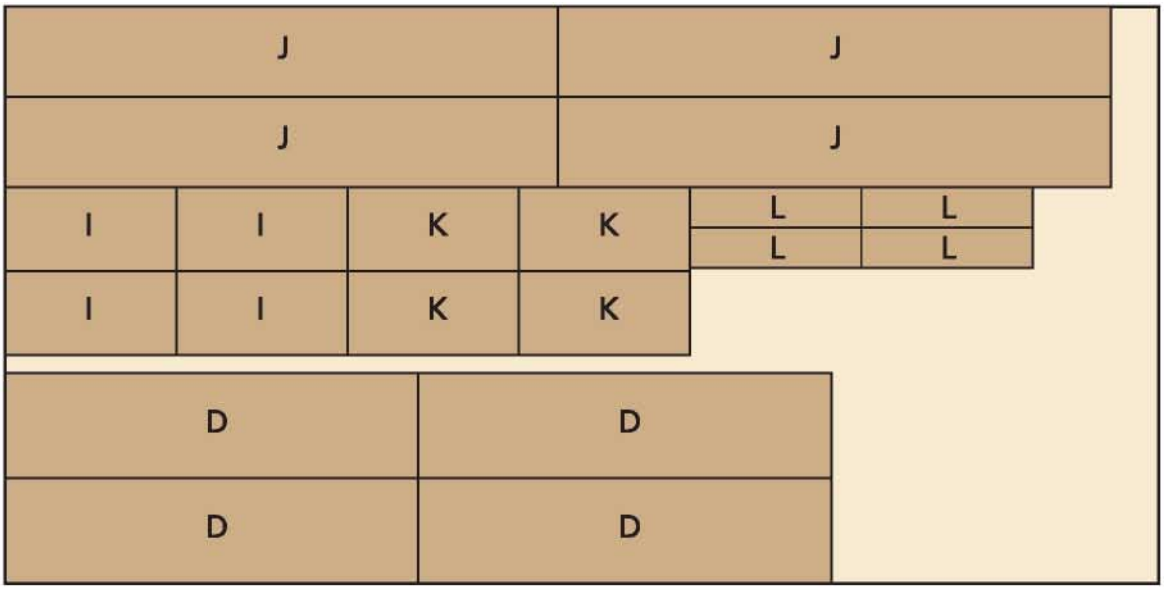
*Blum Hinges (50T0) and Door Pulls (105SS) are from Rockler (800-279-4441, Rockler.com).

**Rare-Earth Magnets (MEDS.11), Cups (MEDS.64), and Washers (MEDS.64) are from Lee Valley (800-871-8158, leevalley.com).

CUTTING DIAGRAM

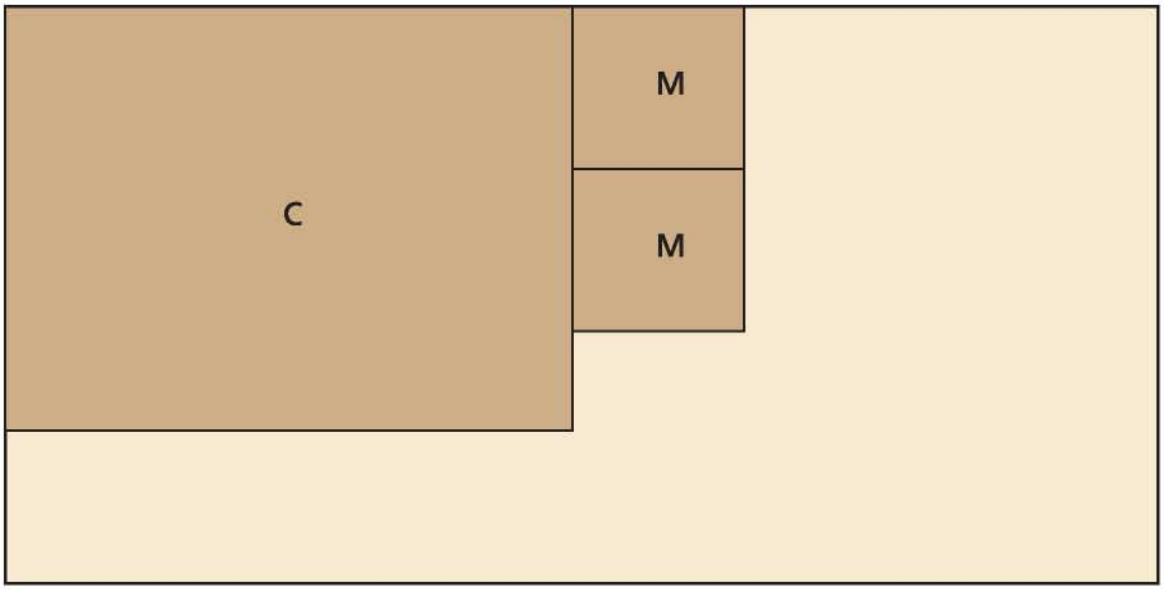


¾" X 48" X 96" (MAPLE PLYWOOD)

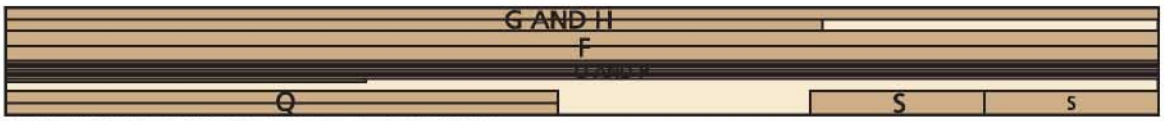


¾" X 48" X 96" (MAPLE PLYWOOD)

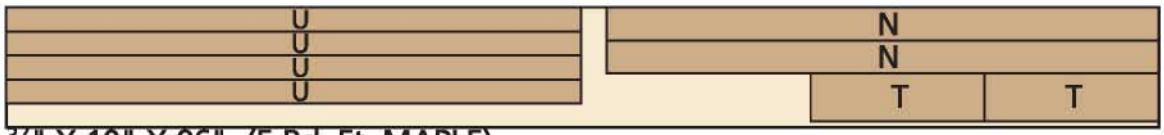
CUTTING DIAGRAM



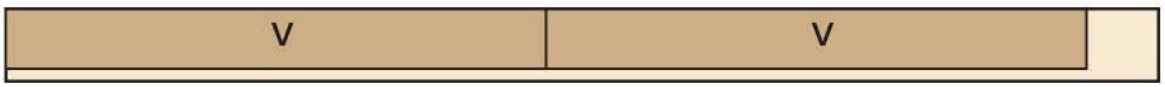
¼" X 48" X 96" (MAPLE PLYWOOD)



¾" X 9" X 96" (4.5 Bd. Ft. MAPLE)



¾" X 10" X 96" (5 Bd. Ft. MAPLE)



3 BOARDS- ¾" X 6" X 96" (12 Bd. Ft. TOTAL MAPLE)

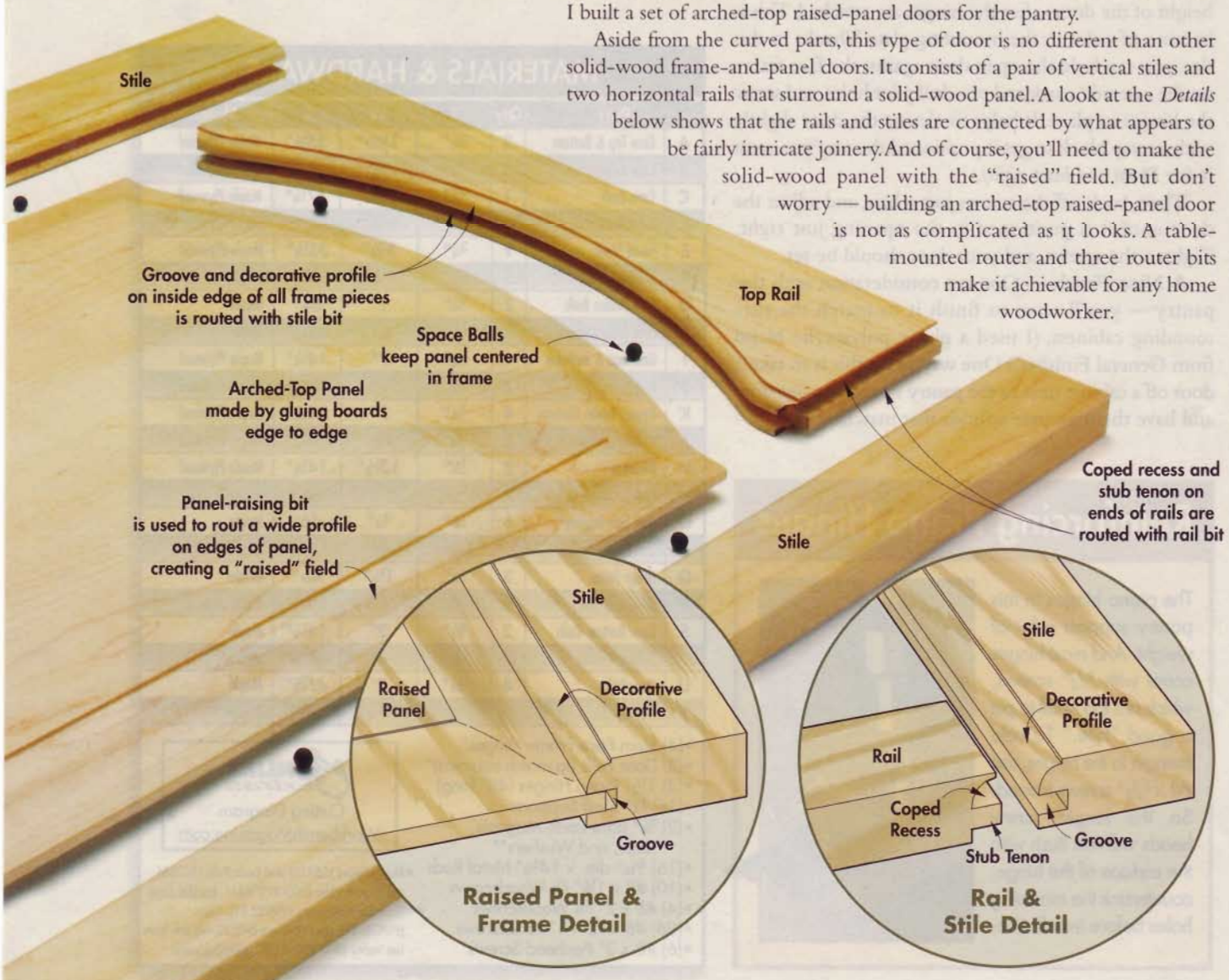
building arched-top RAISED-PANEL DOORS

These shop-tested routing techniques will have you building arched-top raised-panel doors like a pro in no time.

I've always been impressed by the arched-top raised-panel doors that are built in commercial cabinet shops. The wood frame on these doors features a gracefully curved top rail, which is echoed by a curved solid-wood panel *(see Photo below)*.

This is the type of door that was on the cabinets in the kitchen where we installed the countertop pantry *(page 42)*. So, in order to match those doors, I built a set of arched-top raised-panel doors for the pantry.

Aside from the curved parts, this type of door is no different than other solid-wood frame-and-panel doors. It consists of a pair of vertical stiles and two horizontal rails that surround a solid-wood panel. A look at the *Details* below shows that the rails and stiles are connected by what appears to be fairly intricate joinery. And of course, you'll need to make the solid-wood panel with the "raised" field. But don't worry — building an arched-top raised-panel door is not as complicated as it looks. A table-mounted router and three router bits make it achievable for any home woodworker.



A BIT ABOUT BITS

Before you get down to serious door-building, you'll need to round up three router bits: a matched pair of bits called stile and rail bits and a panel-raising bit *(Photos, right)*.

Stile & Rails Bits — The matched router bits are known as a stile and rail set. The stile bit is used to cut a groove in *each* of the frame pieces — rails *and* stiles — to hold the panel. At the same time, it creates a decorative profile on the edge of the frame pieces. Bits with several decorative profiles, including bead, bevel, and ogee, are available.

The rail bit is used exclusively on the ends of the rails to produce the stub tenons that fit into the grooves. It also forms a coped recess that fits over the decorative profile on the stiles. (I used the Amana Timberline Series stile and rail bit set #440-14. Go to www.amanatool.com for availability information.)

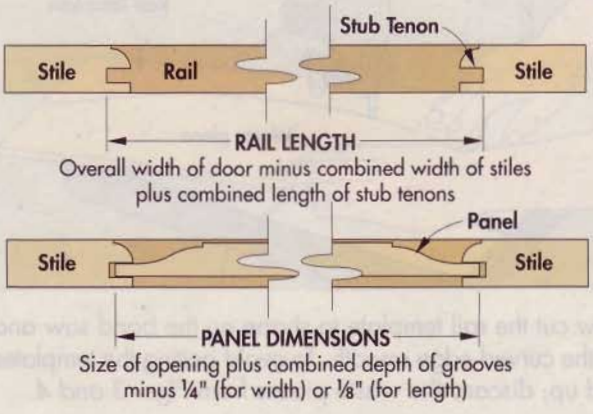
Panel-Raising Bit — In addition to the stile and rail bits, you'll need a panel-raising bit. This large bit is used to create a wide profile on all four edges of the panel, which "raises" the field in the center. (Here, I used the Timberline #420-22).

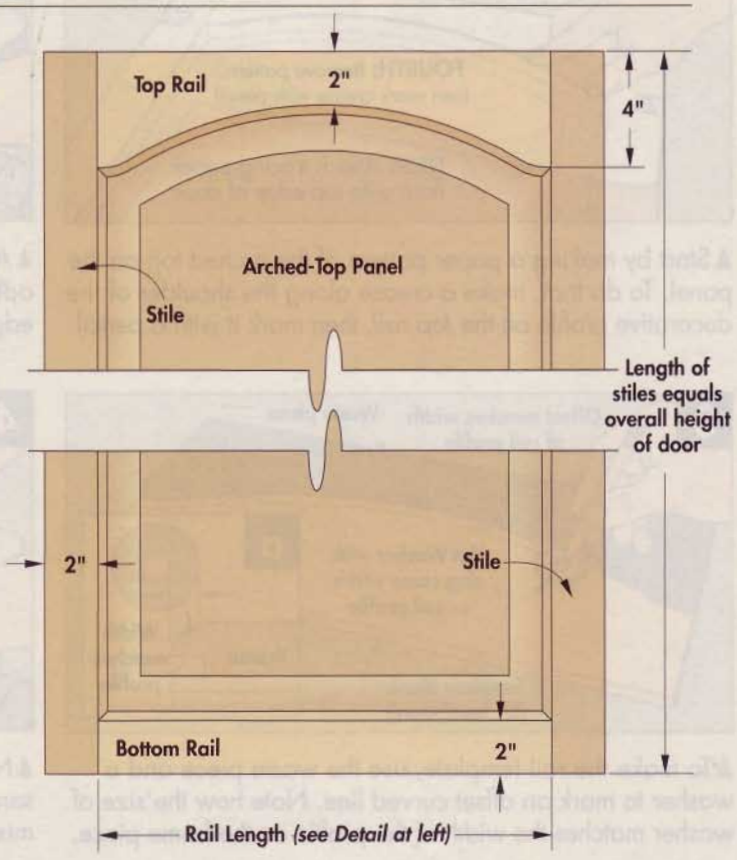
One more note. All of these router bits have $\frac{1}{2}$" shanks, so you'll need a router with a $\frac{1}{2}$" collet.

SIZING THE DOOR

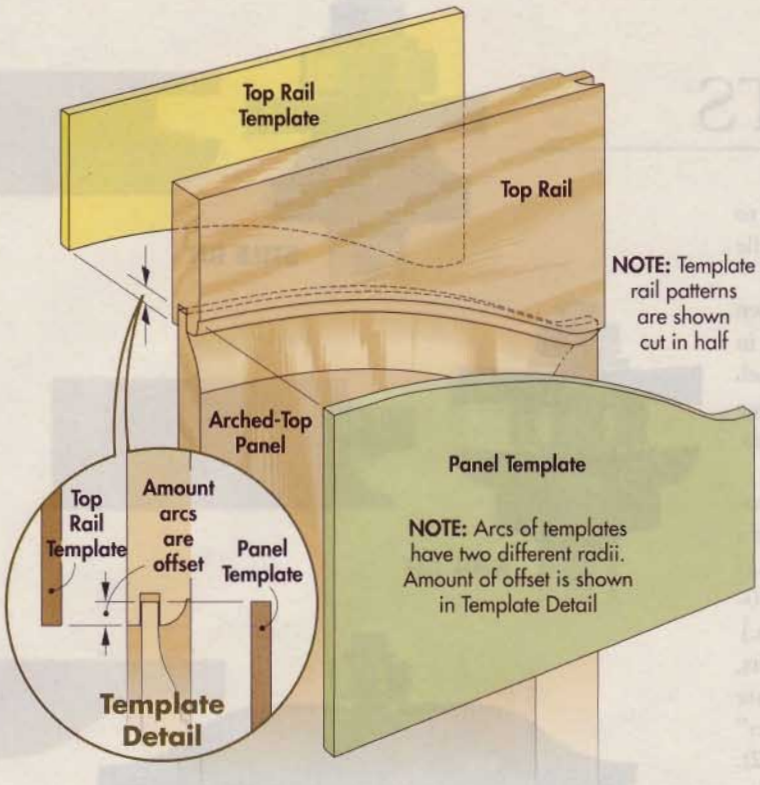
Another thing to take into consideration is the size of the door. For the kitchen pantry, dimensions are shown on pages 50-51. If you're building new doors for your kitchen cabinets, just make the doors the same size as the old ones.

As for the size of the individual door components, it's helpful to keep a few basic guidelines in mind. Generally, frame pieces are made from $\frac{3}{4}$"-thick hardwood. (I'll explain about panel thickness later.) As for the width, I made my frame pieces 2" wide, which is typical for cabinet doors. (Note: The arched top rail is 4" wide, but it will be 2" wide at its narrowest point.) The length of the frame pieces is determined as shown in the *Illustrations* at right and below.





making curved TEMPLATES



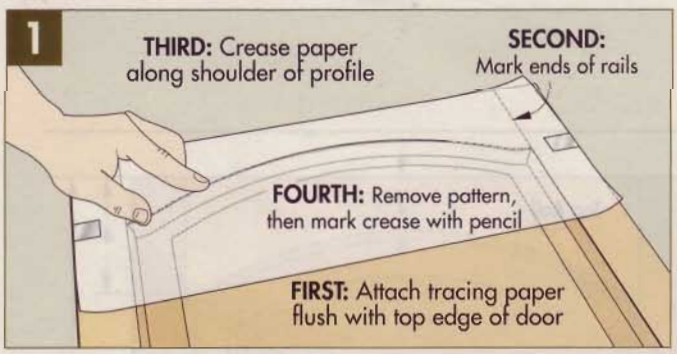
Making the curved top rail and arched-top panel might seem a little intimidating at first. But actually, there's an easy way to go about it. The trick is to make two curved templates — one for the panel and another for the rail — and then use them as guides when shaping the parts.

But wait a minute, the two curves are identical aren't they? So why not make one template and use it for both pieces? Well, as is often the case, looks are deceiving. The two curves are *parallel*, but *not* identical. To produce a good fit, the arch on the rail has a slightly smaller radius than the corresponding arch of the panel *(Illustration, left)*. Which is why you need two templates.

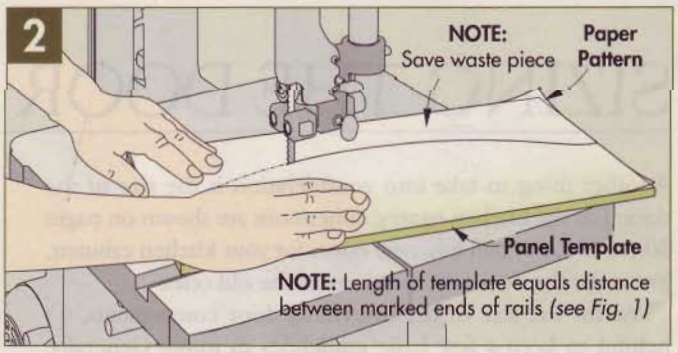
The *Illustrations* below explain how to make templates to match an existing door. To create a custom arch for a new door, refer to the *Box* on page 55.

Panel Template — The first step is to make the template for the arched panel, which fits up inside the groove in the top rail. If you could look through this rail, you'd see that the curved edge of the panel roughly aligns with the shoulder of the decorative profile. So in order to dupli-

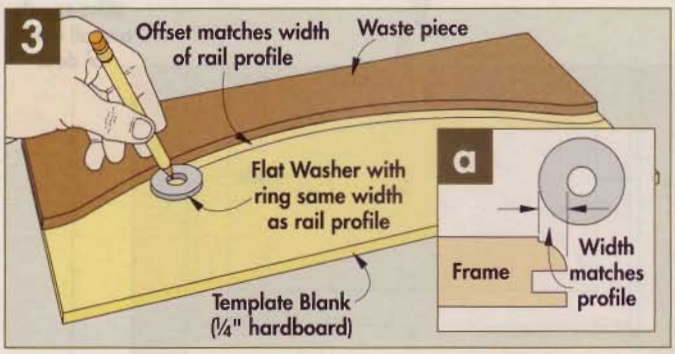
FOUR EASY STEPS TO MAKING TEMPLATES



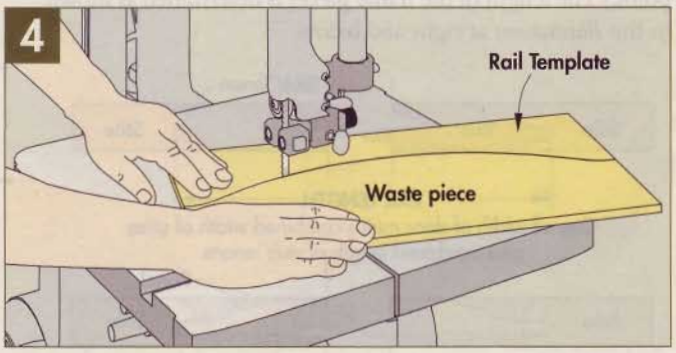
▲Start by making a paper pattern of the arched top on the panel. To do that, make a crease along the shoulder of the decorative profile on the *top rail*, then mark it with a pencil.



▲Attach the pattern to a piece of 1/4" hardboard with spray adhesive, then cut the panel template to shape. Sand the edges of the template, as well as the waste piece smooth.



▲To make the rail template, use the waste piece and a washer to mark an offset curved line. Note how the size of washer matches the width of the profile on the frame piece.



▲Now cut the rail template to shape on the band saw and sand the curved edge smooth. To avoid getting the templates mixed up, discard the waste pieces from *Figs. 3 and 4*.

cate the shape of the panel, all you need to do is make a paper pattern of the shoulder of this profile *(Fig. 1)*.

Once that's accomplished, you can use the pattern to lay out the shape of the template. (I use 1/4" hardboard for a template.) Then just cut the template to shape *(Fig. 2)*. By the way, don't throw away the waste piece. It's used as a guide when making the template for the top rail.

Of course, the curved edge of this waste piece isn't an exact duplicate of the curve on the top rail. Remember, it matches the shoulder — not the bottom edge — of the decorative profile on the rail.

Rail Template — To lay out the rail template, you'll have to offset the curve on the waste piece by an amount that's equal to the width of the profile. An easy way to accomplish that is to use an ordinary flat washer with a ring that's the same width as the offset *(Fig. 3)*. After marking the curve as shown, cut the rail template to shape *(Fig. 4)*.

Shaping the Top Rail — Once the templates are completed, set aside the template for the arched panel for now. You won't use it until after you build the frame and glue up the panel. In the meantime, cut the frame components to size *(see page 53)* and then use the rail template to mark the curve on the top rail. Cut the top rail to rough shape *(Photo, upper right)*. Then attach the template with double-sided tape and flush-trim the piece *(Photo, lower right)*.

Skill Builder

◄ Carefully cut the curved shape of the top rail on the band saw, staying about 1/8" on the waste side of the line.

◄ Use a flush-trim bit in a table-mounted router to trim off the waste. Adjust the bit height so the template rides against the bearing.

Laying Out A Custom Arch

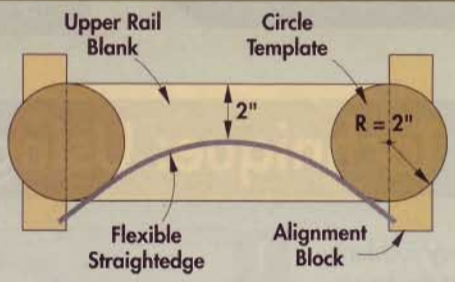
It's not a problem if you don't have an existing door to use as a pattern — laying out your own custom arch is easy.

One complicating factor, however, is that the radius of the center arc varies depending on the width of the door.

That said, the radius of the arc near the end of the rail remains constant — regardless of door width. As a rule, a 2" radius forms a nicely proportionate curve.

Another constant here is the height of the center arc. In order to create a uniform look, the peak of this arc has to be the same distance from the top edge of the rail as it is on the doors of the adjacent cabinets (2" in the example shown here).

To lay out an arch then, I use two 4" circle templates made of 1/4" hardboard. Each template is attached to a wood block that aligns with the template's centerline.



To use these circle templates, simply butt the alignment block on each one against the end of the rail and clamp it in place. Mark around the circles to form part of the arch *(Inset Photo)*. To draw the main arc, trace along a flexible straightedge positioned 2" from the top edge of the rail and bent against the templates *(Photo, above right)*.

Once the rail is machined to shape, use the procedure in *Figures 1 and 2* on page 54 to create a pattern and a template for the arched panel.

▲ To lay out the arch, mark around the circle templates *(Inset)* and a flexible straightedge *(above)*. Then "blend" the lines together.

▲ For safety, use a starting pin and guard when routing the curved top rail *(above)*, and a fence and push block for the straight frame pieces *(right)*.

tips on using the STILE BIT

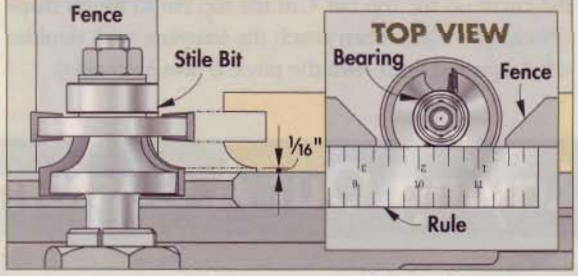
The stile bit is the one used to rout a groove and a decorative profile on the inside edge of each of the frame pieces (both stiles and rails).

Adjust Bit Height — The first step is to set the stile bit to the correct height. As a rule, I adjust the height so the bit leaves a $^1/_{16}$" shoulder in a test piece *(see Stile Bit Setup below)*.

"Stile" Cuts — Now you're ready to make the "stile" cuts. Each frame piece is routed with its "show" side face-down against the router table. Since the top rail is curved, you can't use a fence. So you'll have to use the bearing on top of the bit to guide the workpiece instead. A starting pin provides a safe way to ease the rail into the bit *(see Box below)*.

As for the straight frame pieces, set up a fence on the router table and use a rule to check that the bearing is flush with the face of the fence *(see Stile Bit Setup)*. Use a featherboard to keep the stock firmly against the fence, and a push block to safely guide the workpiece past the bit.

Stile Bit Setup

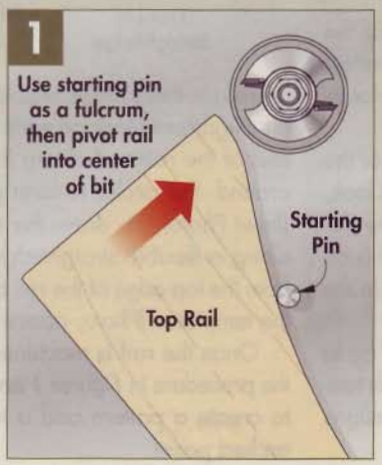


Router Table Technique: Using a Starting Pin

When routing without a fence, the bit may suddenly "grab" a workpiece out of your hands at the beginning of a cut, creating an unsafe situation. To prevent that, I use a starting pin threaded into the router table insert. It's simply a metal pin that allows you to "ease" the workpiece into the spinning bit.

To make an initial cut with a starting pin, hold the workpiece firmly against the pin. Using the pin as a fulcrum, carefully pivot the corner of the piece into the center of the bit as shown in *Fig 1*.

Once the workpiece has engaged the bit and is riding against the bearing, there's no further need to use the starting pin. Just continue feeding the workpiece from right to left as shown in *Fig 2*.



coping with the RAIL BIT

Skill Builder

To produce a snug, square-shouldered joint, you'll need to rout the ends of the rails with the rail bit. As I mentioned, this bit forms a coped recess that fits over the decorative profile on the "stile-cut" pieces, as well as a short stub tenon that's inserted into the groove.

Adjust Bit Height — Here again, the first order of business is to adjust the height of the bit. An easy way to do that is to use one of the pieces you've already routed with the stile bit, set it face-down next to the bit, and use it as a gauge. Align the opening in the bit with the groove in the piece *(see Rail Bit Setup below)*. This should make the faces of the mating pieces fit flush.

Set Fence Opening — Since you'll be routing the square ends of the rails, you can use the fence for all these cuts. Align the fence as before, and close the opening around the bit *(see Detail)*. This will prevent the narrow ends of the rails from accidentally catching in the opening.

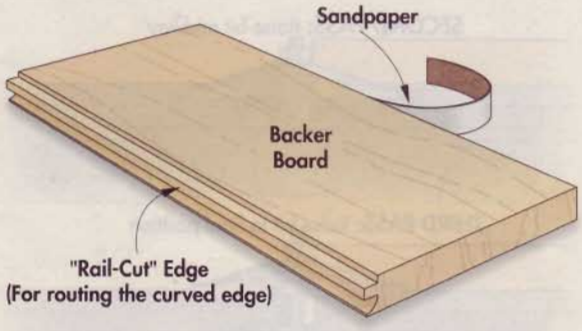
Using a Backer Board — To ensure a square cut (and to prevent chipout on the back edge of the workpiece), it's best to use a squared-up backer board to push the rail through the bit. It's also a good idea to attach sandpaper to the edge of the backer board to keep the rail from slipping during the cut *(see Illustration, below)*.

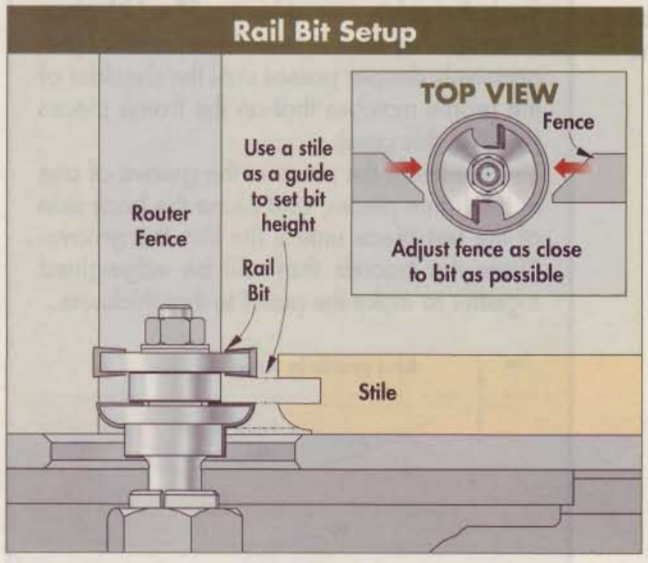
This works fine when you cut with the straight edge of the top rail against the backer board *(Inset Photo)*. But when you turn the rail around to rout the opposite end (again, face-down), there's a problem. Because of the profile on the curved edge, the rail won't fit tightly against the backer board, which will cause the wood fibers to chip out. To prevent that, rout one edge of the backer board with the rail bit. Then fit the "stile-cut" edge of the rail into the backer board and rout the end *(Photo, above)*.

Rout Bottom Rail — To rout the bottom rail, the process is the same. Only here, the entire "stile-cut" edge of the rail will fit into the recess in the backer board.

▲ To prevent chipout, fit the "stile-cut" edge of the curved top rail into a "rail-cut" edge on a backer board. When you turn the rail end for end, sandpaper on the uncut edge of the backer board keeps the rail from slipping *(Inset)*.

BACKER BOARD





routing a RAISED PANEL

▲ A large panel-raising bit creates a "raised" field on the panel. It also thins the edge of the panel, so it fits into the grooves in the frame.

Once the joinery for the frame is completed, you can concentrate on the centerpiece of the door — a solid-wood panel with a "raised" field. This field is formed by routing a wide profile along all four edges of the panel with a panel-raising bit *(Photo, left)*.

In addition to creating the raised field, this bit also "thins" the edge of the panel so it will fit into the grooves in the frame pieces.

Making a Solid-Wood Panel

The panel is made by edge-gluing several narrow boards together. As for the thickness of these boards, that depends on the panel-raising bit you're using. To determine the proper panel thickness, check out the *Panel Thickness Box* below.

Another consideration is the size of the panel. An easy way to determine this size is to dry-assemble the frame. After measuring the opening in the frame, add the combined depth of the grooves. But don't cut the panel to that size. You still need to take into account the expansion and contraction of the wood with changes in humidity.

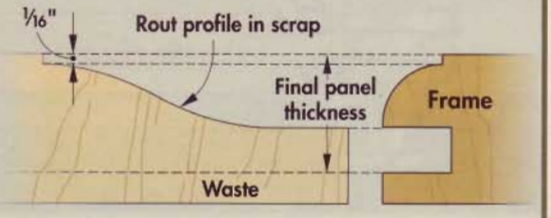
Most of this movement occurs across the width of the panel (not the length). So I allow for $\frac{1}{8}$" gap between the panel and the bottom of the groove on each side ($\frac{1}{4}$" overall). At the top and bottom, $\frac{1}{16}$" clearance ($\frac{1}{8}$" overall) is plenty.

Lay Out Arch — After cutting the panel to size, you're ready to lay out the arch. This is where the panel template you made earlier comes into play. Just like the template for the rail, it's used to first lay out the arch. Then, after rough-cutting the panel to shape, attach the template with double-sided tape, and use a flush-trim bit to rout the panel to shape.

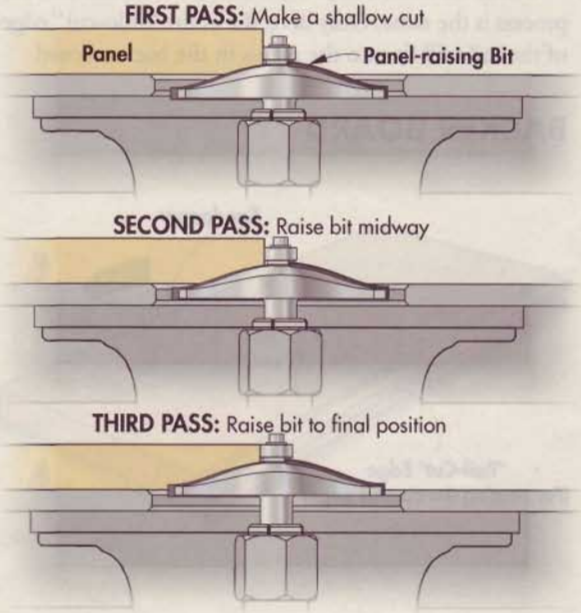
Panel Thickness

To determine the proper thickness of the boards that make up the panel, I use the panel-raising bit to rout a profile in a test piece of $\frac{3}{4}$"-thick stock. For safety, use at least a 5" x 12" piece of scrap. The idea is to make a series of progressively deeper passes until the shoulder of the profile matches that on the frame pieces ($\frac{1}{16}$" in this case).

Then test-fit the piece in the groove of one of the frame pieces, and plane the back side of the test piece until it fits into the groove. Plane the boards that will be edge-glued together to make the panel to that thickness.



A RAISED PANEL IN 3 PASSES



"Raising" the Field

As soon as the panel has been cut to shape, it takes on that classic, elegant look that you typically associate with arched-top doors. Routing the wide, decorative profiles to "raise" the field completes the transformation.

As I mentioned, this is accomplished with the third of the specialized bits — the panel-raising bit. To produce such a wide profile, this type of bit is quite large. (They range from $2^3/_4$" to $3^1/_2$" in diameter.)

Slow Speed — Because of its size, this bit requires special consideration. You'll want to reduce the speed of the router to a safe operating speed of around 12,000 rpm.

Light Cuts — For similar reasons, adjust the height of the bit to make a very light cut. The purpose is to make a series of successively deeper cuts *(Illustrations, page 58)*. Each pass will widen the profile as it thins the edge of the panel.

End Grain First, Then Edge Grain — To avoid tearout, it's best to rout the ends of the panel first. This way, any chipout on the end grain will be cleaned up when you rout the edges. Generally, I start with the arched top of the panel. Set the panel face down on the router table and hold it firmly against a starting pin. Then slowly pivot the edge of the panel into the spinning bit. When the edge of the panel contacts the bearing, feed it smoothly from right to left.

The process is identical for the other three sides of the panel. Once you've completed one pass on all four sides, raise the bit and make another series of passes. Continue like this until the tongue of the panel fits snugly (not tightly) into the grooves in the frame pieces.

Assembling a Frame & Panel Door

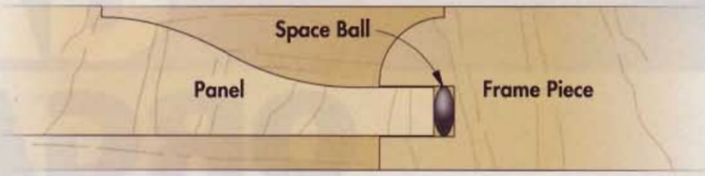
When it comes to assembling a frame and panel door, the most important thing to remember is the panel isn't glued into the frame. Instead, it "floats" inside the frame, allowing the panel to expand and contract.

Space Balls — Since the panel isn't secured, it could shift inside the frame. So to keep it centered, I use a product called Space Balls *(Photo, right)*. These are small rubber balls that you insert into the grooves in the frame *(Illustration, right)*. The balls compress when the panel expands, and they return to their original shape when it contracts, holding the panel in place.

Finish Panel — Before assembling the door, it's a good idea to apply a stain (if you're planning to stain the wood, that is) and a finish. That way, if the wood shrinks, it won't expose unfinished surfaces.

Final Assembly — To assemble the door, brush glue onto the ends of the rails, and fit the frame pieces around the panel *(Inset Photo)*. Then clamp across the frame, checking to make sure it's flat *(Photo, above)*.

◄ After gluing and clamping the door, sight along the clamps to check that the assembly is flat. If it isn't, gently wrench the clamps to correct for any twist in the frame.



► Space Balls fit inside the grooves in the frame to help compensate for fluctuations in panel size. They're available in three sizes ($^3/_{16}$", $^7/_{32}$", and $^1/_4$") at www.SpaceBalls.com

storage on a roll

GARAGE ORGANIZERS

It takes all sorts of stuff to keep a modern household running smoothly — lawn and garden supplies, car care products, and recreational gear, to name a few. And most of it ends up in the garage, often squeezing the car out of its rightful place.

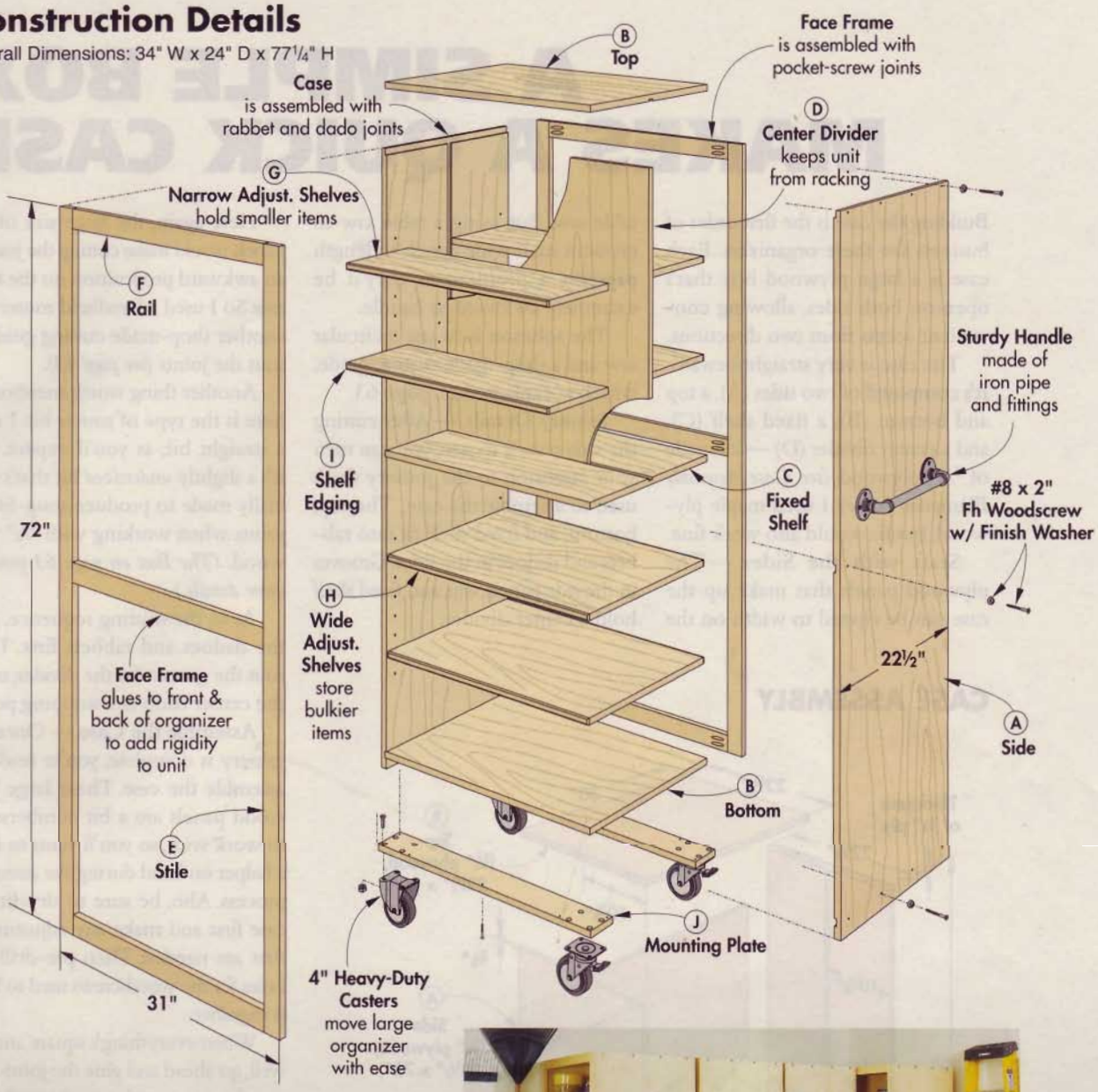
Now, finding a place to put all these household necessities is one thing. (There's always room for one more shelf, right?) The real trick is making that storage easily accessible, so you can actually find what you're looking for.

One of the best ways I've seen for getting a handle on garage storage is an idea that was sent in by Robert DeGraw of Kirkland, Washington. It's a bank of tall, mobile organizers that line the garage wall like giant filing cabinets *(see Photo, above)*. You simply pull out one of the units, grab what you need, and then roll it back in place.

To provide easy access, these versatile units are open on both sides. Smaller items are stored in the upper part of the case, which is divided into front and back

Construction Details

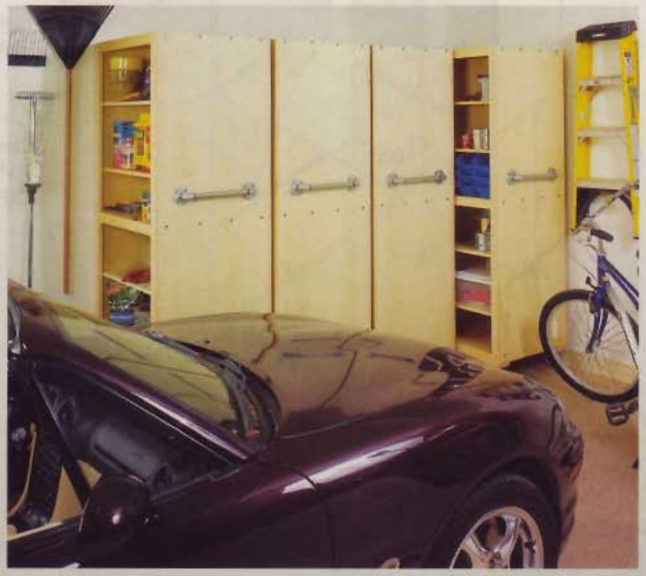
Overall Dimensions: 34" W x 24" D x 77¼" H



compartments, each with a set of narrow shelves *(see Construction Details above)*. The lower part contains wide shelves to accommodate bulkier items.

Because these organizers have such a large capacity, they're bound to get loaded down — so they have to be sturdy enough to support the weight. Also, since they're open on each side (there is no back), they presented an interesting design challenge — how to keep the units from "racking."

The answer to this challenge is in the construction details. A large center divider provides substantial structural stability, and a hardwood face frame on each side contributes additional rigidity.



▲ These space-efficient garage organizers give you the best of both worlds by making your stored items easily accessible while still leaving plenty of room to park your car.

A SIMPLE BOX MAKES A QUICK CASE

Building the case is the first order of business for these organizers. Each case is a large plywood box that's open on both sides, allowing convenient access from two directions.

The case is very straightforward. It's composed of two sides (A), a top and bottom (B), a fixed shelf (C), and a center divider (D) — all made of 3/4" plywood *(see Case Assembly Illustration below)*. I used maple plywood, but fir would also work fine.

Start with the Sides — The plywood panels that make up the case can be ripped to width on the table saw. But using a table saw to crosscut such wide panels to length presents a problem as they'd be extremely awkward to handle.

The solution is to use a circular saw and a shop-made cutting guide, which is explained on page 63.

Joinery Details — After cutting the side panels to size, you can turn your attention to the joinery that's used to assemble the case. The top, bottom, and fixed shelf fit into rabbets and dadoes in the sides. Grooves in the side panels, top, and fixed shelf hold a center divider.

Here again, the large size of the panels would make cutting the joinery an awkward proposition on the table saw. So I used a handheld router and another shop-made cutting guide to rout the joints *(see page 63)*.

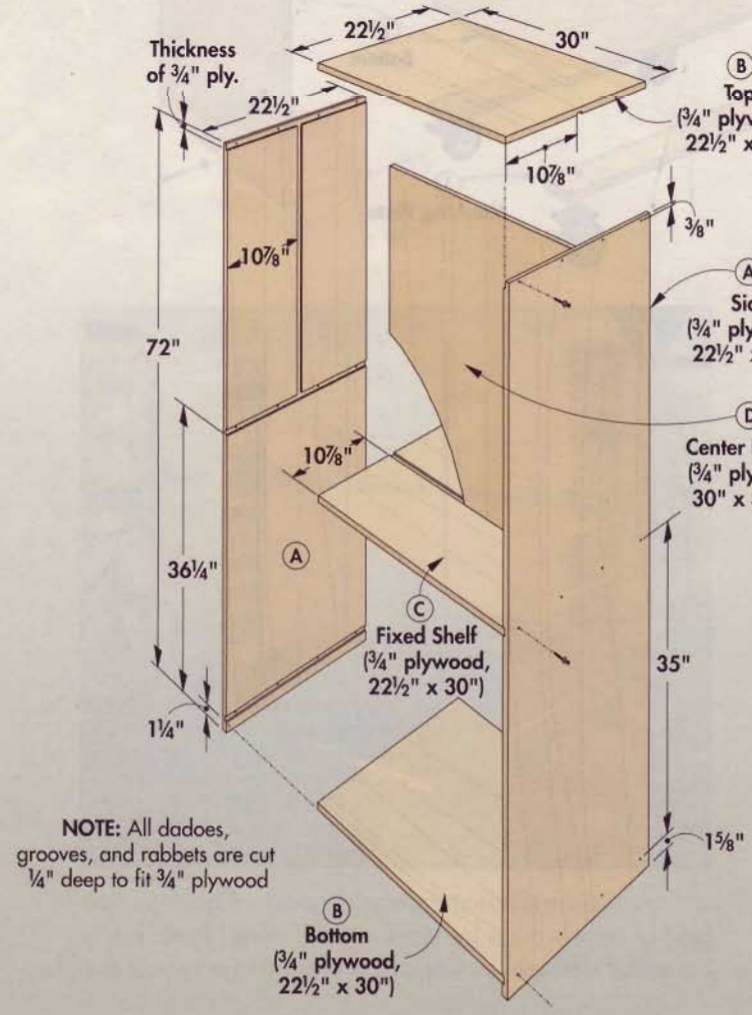
Another thing worth mentioning here is the type of router bit. I used a straight bit, as you'd expect. But it's a slightly *undersized* bit that's specially made to produce snug-fitting joints when working with 3/4" plywood. *(The Box on page 63 provides more details.)*

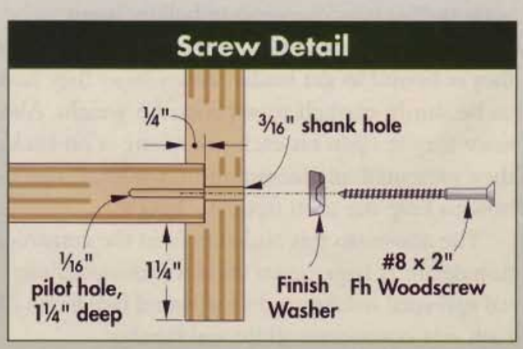
As to the routing sequence, rout the dadoes and rabbets first. Then rout the groove for the divider, using the center dado as a stopping point.

Assemble the Case — Once the joinery is complete, you're ready to assemble the case. These large plywood panels are a bit cumbersome to work with, so you'll want to have a helper on hand during the assembly process. Also, be sure to dry-fit the case first and make any adjustments that are needed. Then pre-drill the holes for the woodscrews used to hold it together.

When everything's square and fits well, go ahead and glue the joints and put the case together in this order: fit the bottom and fixed shelf to the sides, slide the center divider into place, and cap it with the top. The screws — together with decorative finish-washers — act as "clamps."

CASE ASSEMBLY





plywood TIPS & TRICKS

When working with plywood, there's more to getting accurate cuts and routing perfect-fitting joints than meets the eye. These two tips will help.

Cutting Guide — One of the simplest and most effective things you can do is to make a cutting guide for your router and circular saw *(Photos, below)*. Like its name implies, it guides the base of the tool, producing a straight, accurate cut.

There's nothing complicated about a cutting guide. It consists of a plywood (or hardboard) base for the tool to ride on and a wood fence to guide the tool during the cut.

The edge of the base indicates the path of the blade (or bit). You simply align this edge with a layout line, clamp the guide in place, and run the tool against the fence. Note: For more information about cutting guides, review the June 2004 issue of *Workbench* or you can go to www.WorkbenchMagazine.com.

Routing Perfect-Fitting Joints — Many plywood case projects (like these organizers) require routing dadoes and grooves. For strength and appearance, the width of these cuts must match the thickness of the piece that's going to fit into the joint.

The only problem is plywood is *thinner* than its nominal size. For example, 3/4" plywood is really 23/32" thick. That's why it fits loosely in a dado cut with a 3/4" straight bit.

One way to get a snug-fitting joint is to use a special undersized (23/32") straight bit *(above)*. A dado cut with this type of bit results in a perfect fit and a strong, attractive joint. Note: Undersized straight bits are also available for 1/4" and 1/2" plywood.

A TALE OF TWO STRAIGHT BITS

▲ These two straight bits look identical, but the dadoes they cut tell a different story. The 23/32" bit on the left creates a tight-fitting joint that matches the *actual* thickness of 3/4" plywood. The 3/4" bit on the right produces a sloppy fit.

▲ With a cutting guide clamped to the plywood and a 40-tooth plywood-cutting blade installed in a circular saw, crosscutting this wide panel results in a clean, accurate cut.

◄ This long cutting guide is ideal for routing grooves in a large sheet of plywood. Here again, the edge of the guide indicates the path of the bit. To use the guide, lay out one edge of the groove, align the edge of the guide with the line, then make the cut.

READY TO ROLL

▲ Heavy-duty casters and handles make it easy to pull the storage units out from the wall.

With the case complete, converting it into a sturdy storage unit is just a matter of adding a couple of face frames, the adjustable shelves, some casters, and a handle.

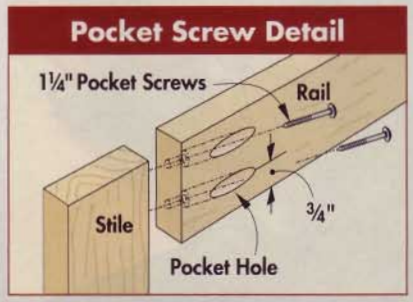
Face Frames First

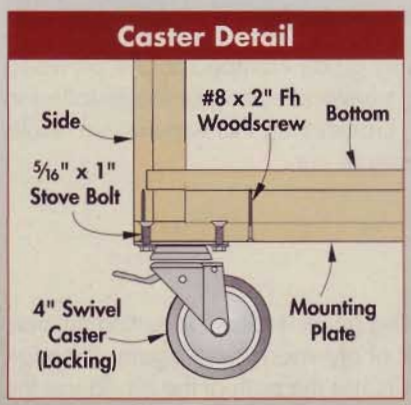
As you can see in the *Illustration* below, a face frame is attached to each side of the case. These frames cover the exposed plywood edges, but they're more than just a pretty facade. They provide additional rigidity that will help prevent the storage unit from racking.

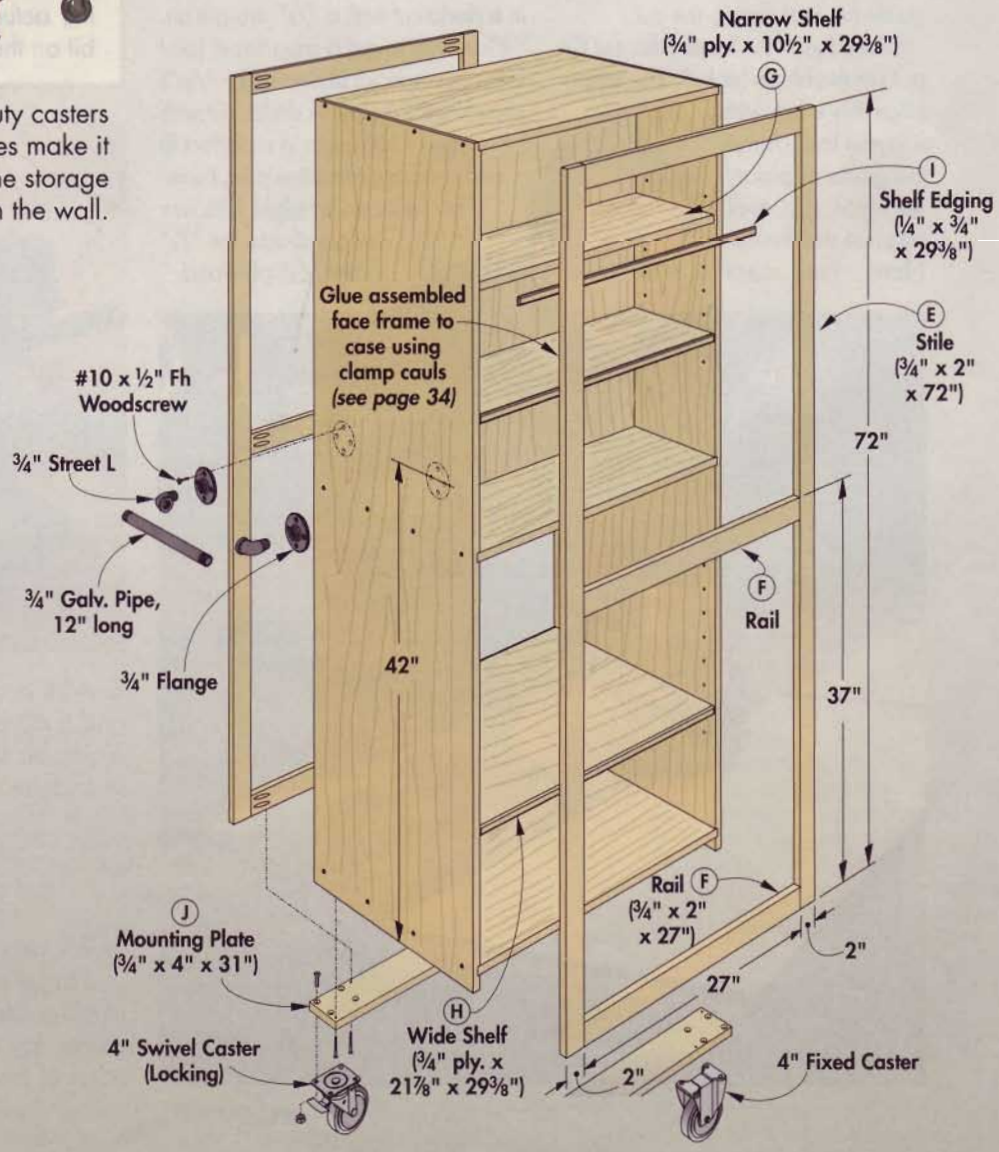
Since the face frames are such an integral structural element, it's best to assemble the frames *before* mounting them to the case. This ensures a strong, solid cabinet.

The face frames are made from ¾"-thick hardwood. (I used maple.) Each frame consists of two vertical stiles (E) and three horizontal rails (F) that are assembled using butt joints and pocket screws *(see Pocket Screw Detail)*.

The face frame is sized to fit flush with the sides and top of the cabinet. Another important thing to note is the position of the lower and middle rails. The goal is to make the *top* edge of these rails flush with the surface of the bottom and fixed shelf. This way, you'll be able to slide items in and out of the finished storage







unit without having them "catch" on the face frame.

After assembling the face frames, the next step is to attach them to the case. To avoid having any visible fasteners, I glued the frames to the case. Also, to reduce the number of clamps and to exert uniform pressure across the rails, I made some tapered clamp cauls *(see Photo, above right)*.

Adjustable Shelves

To accommodate a wide range of storage items, the case has a number of adjustable-height plywood shelves. Narrow shelves (G) occupy both sides of the upper compartment, and the lower part contains full-width shelves (H). Solid-wood edging (I) covers the exposed edges of the plywood and keeps them from chipping. You'll only need to apply edging to one edge of the narrow shelves. Conversely, *both* edges of the wide shelves require edging.

The shelves rest on shelf supports that fit into holes drilled in the sides of the case. To keep the shelves from rocking, it's important that these holes line up precisely. To ensure proper alignment, I devised a hardboard template that made this task quick and accurate *(see Shelf-Hole Template below)*. A strip of masking tape around the drill bit acts as a depth gauge *(see Photo, lower right)*.

Add the Casters

To make each organizer mobile, they're fitted with a set of four casters: two fixed casters in back, and two swivel locking casters in front.

The casters aren't attached directly to the case. Instead, they're bolted to two hardwood mounting plates (J), which are in turn secured to the assembled unit *(see Caster Detail)*. This takes a bit more time and material, but ensures the casters won't tear out when rolling over uneven surfaces. The mounting plates are screwed to the face frames and the sides of the case.

Heavy-Duty Handle

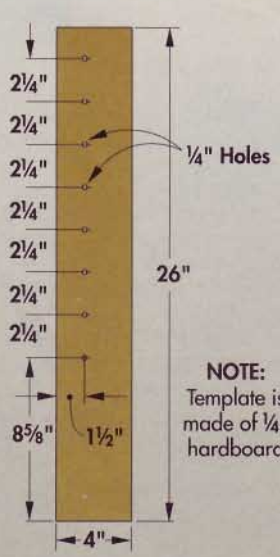
The storage unit is equipped with a sturdy shop-made handle that makes it easy to pull out.

This handle is a 12"-long piece of $^3/_4$" iron pipe that's threaded on both ends. (Pipe is generally available already cut and threaded to these specifications. Or your hardware store can do it on-site for a small cost.) The pipe is held in place by fittings called "street L's" that screw into flanges. The entire pipe assembly is then screwed to the side of the case.

▲ Using a slightly tapered caul while gluing on the face frames ensures even distribution of clamping pressure. *(For more on this, see page 34.)*

▲ For accurate results, butt the same edge of the hole template against the face frame *(shown)* and the divider when drilling the shelf support holes.

SHELF-HOLE TEMPLATE



MATERIALS & HARDWARE

	Part	Qty.	T	W	L	Material
A	Sides	2	¾"	22½"	72"	Maple Plywood
B	Top & Bottom	2	¾"	22½"	30"	Maple Plywood
C	Fixed Shelf	1	¾"	22½"	30"	Maple Plywood
D	Center Divider	1	¾"	30"	34¾"	Maple Plywood
E	Face Frame Stiles	4	¾"	2"	72"	Maple Hardwood
F	Face Frame Rails	6	¾"	2"	27"	Maple Hardwood
G	Narrow Shelves	4	¾"	10½"	29⅜"	Maple Plywood
H	Wide Shelves	2	¾"	21⅞"	29⅜"	Maple Plywood
I	Shelf Edging	8	¼"	¾"	29⅜"	Maple Hardwood
J	Mounting Plates	2	¾"	4"	31"	Maple Hardwood

- (34) #8 x 2" Fh Woodscrews
- (16) $^5/_{16}$" x 1" Stove Bolts
- (4) 4" Casters (two fixed, two swivel locking)
- (24) 1¼" Pocket Screws
- (24) ¼" Shelf Supports
- (8) #10 x ½" Fh Woodscrews
- (1) ¾" Galv. Pipe, 12" long (threaded both ends)
- (2) ¾" Street L's
- (2) ¾" Flanges
- (24) Finish Washers

ONLINE Extras
WorkbenchMagazine.com
- Cutting Diagram
- Free Cutting Guide Plans

WORKBENCH

GARAGE ORGANIZERS

Issue 284 Volume 60 Number 4 July/August 2004

MATERIALS LIST

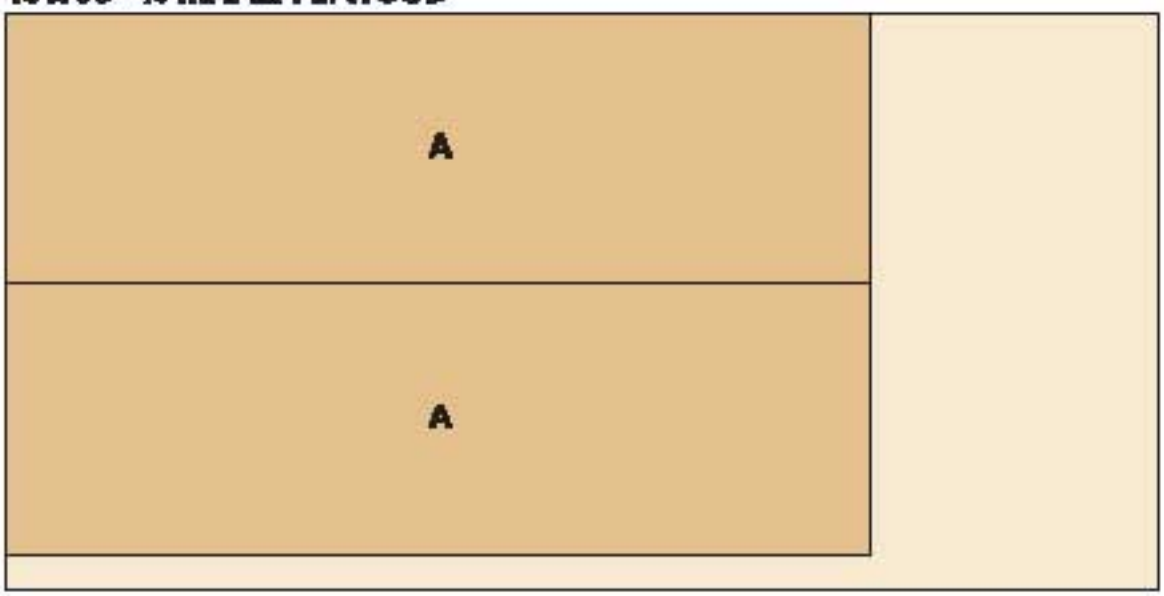
MATERIALS & HARDWARE

	Part	Qty.	T	W	L	Material
A	Side	2	¾"	22½"	72"	Maple plywood
B	Top & Bottom	2	¾"	22½"	30"	Maple plywood
C	Floor Shelf	1	¾"	22½"	30"	Maple plywood
D	Center Divider	1	¾"	30"	34½"	Maple plywood
E	Face Frame Stile	4	¾"	2"	72"	Maple hardwood
F	Face Frame Rail	6	¾"	2"	27"	Maple hardwood
G	Runner Shelves	4	¾"	14½"	29½"	Maple plywood
H	Slide Shelves	2	¾"	21⅞"	29½"	Maple plywood
I	Shelf Edging	3	¾"	¾"	29½"	Maple hardwood
J	Mounting Plate	2	¾"	4"	31"	Maple hardwood

- [24] #8 x 2" Fh Woodscrews
- [16] 5/16" x 1" Stove Bolts
- [4] 4" Casters (two rigid, two steel locking)
- [24] 1¼" Pocket Screws
- [24] ¼" Shelf Supports
- [8] #10 x ½" Fh Woodscrews
- [1] ¾" Galv. Pipe, 12" long
- [2] ¾" Street Ell
- [2] ¾" Flanges
- [24] Finish Washers

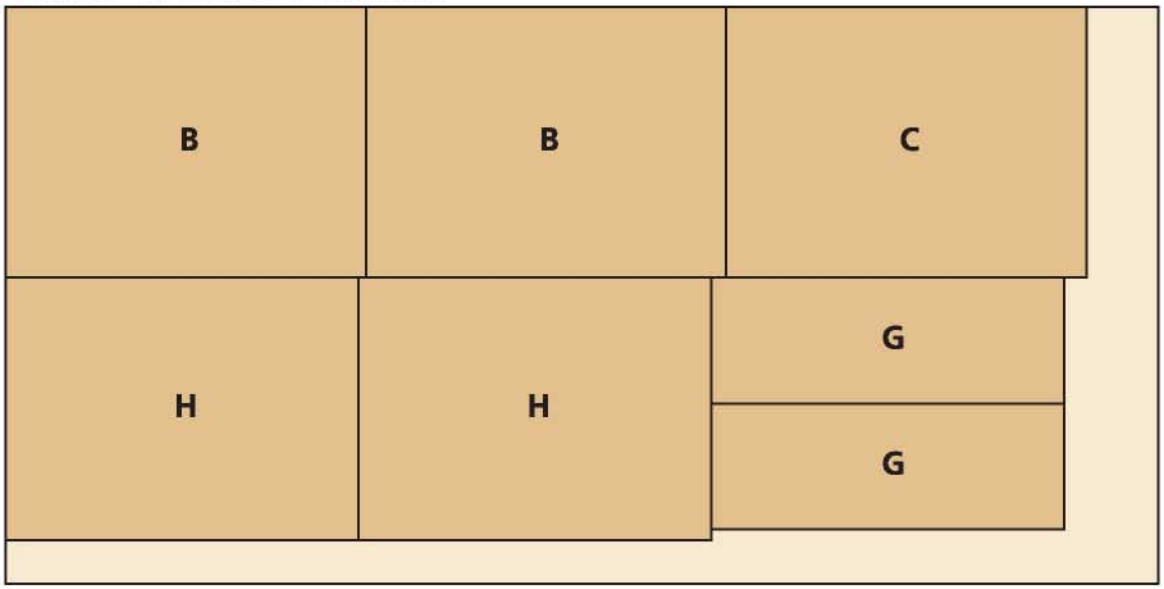
CUTTING DIAGRAM

48 x 96 – ¾ MAPLE PLYWOOD

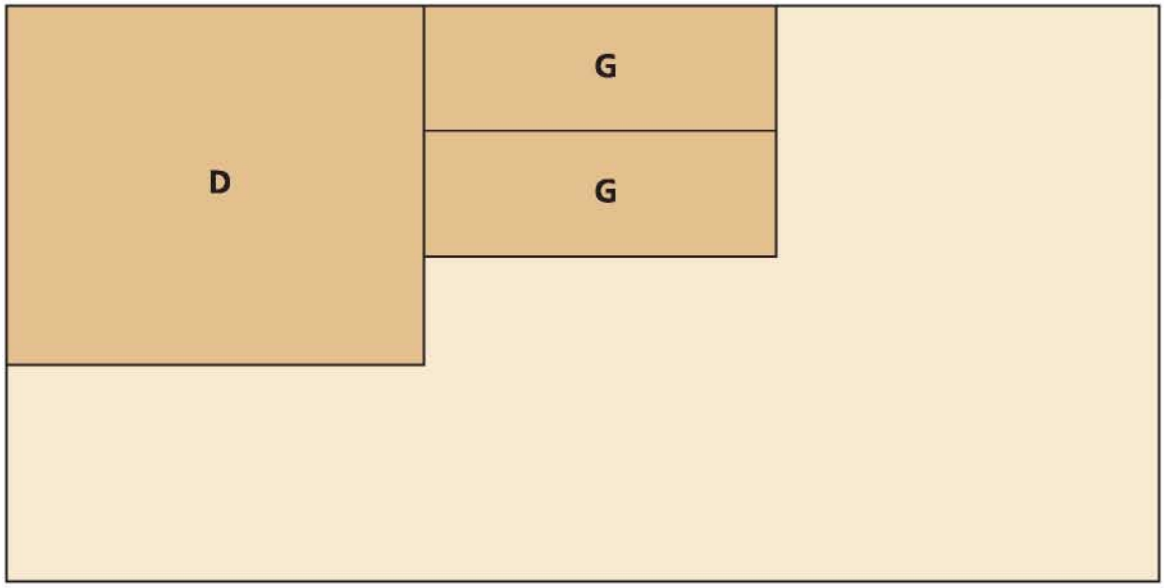


CUTTING DIAGRAM

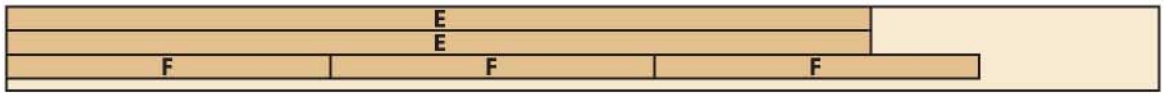
48 x 96 - ¾ MAPLE PLYWOOD



48 x 96 - ¾ MAPLE PLYWOOD



¾ x 7 x 96 HARD MAPLE (2) BOARDS @4.66 BD. FT. EA.



¾ x 4½ x 96 HARD MAPLE @4.66 BD. FT.

storage with style
GARDEN BENCH

stow gardening gear out of sight . . . then sit and relax on this stylish, solid-wood bench

A beautiful yard and garden require a little bit of inspiration, a lot of hard work, and of course, the proverbial green thumb. That's not to overlook the basic necessities, though. You know, the small hand tools, hoses, and supplies you're always dragging back and forth across the yard.

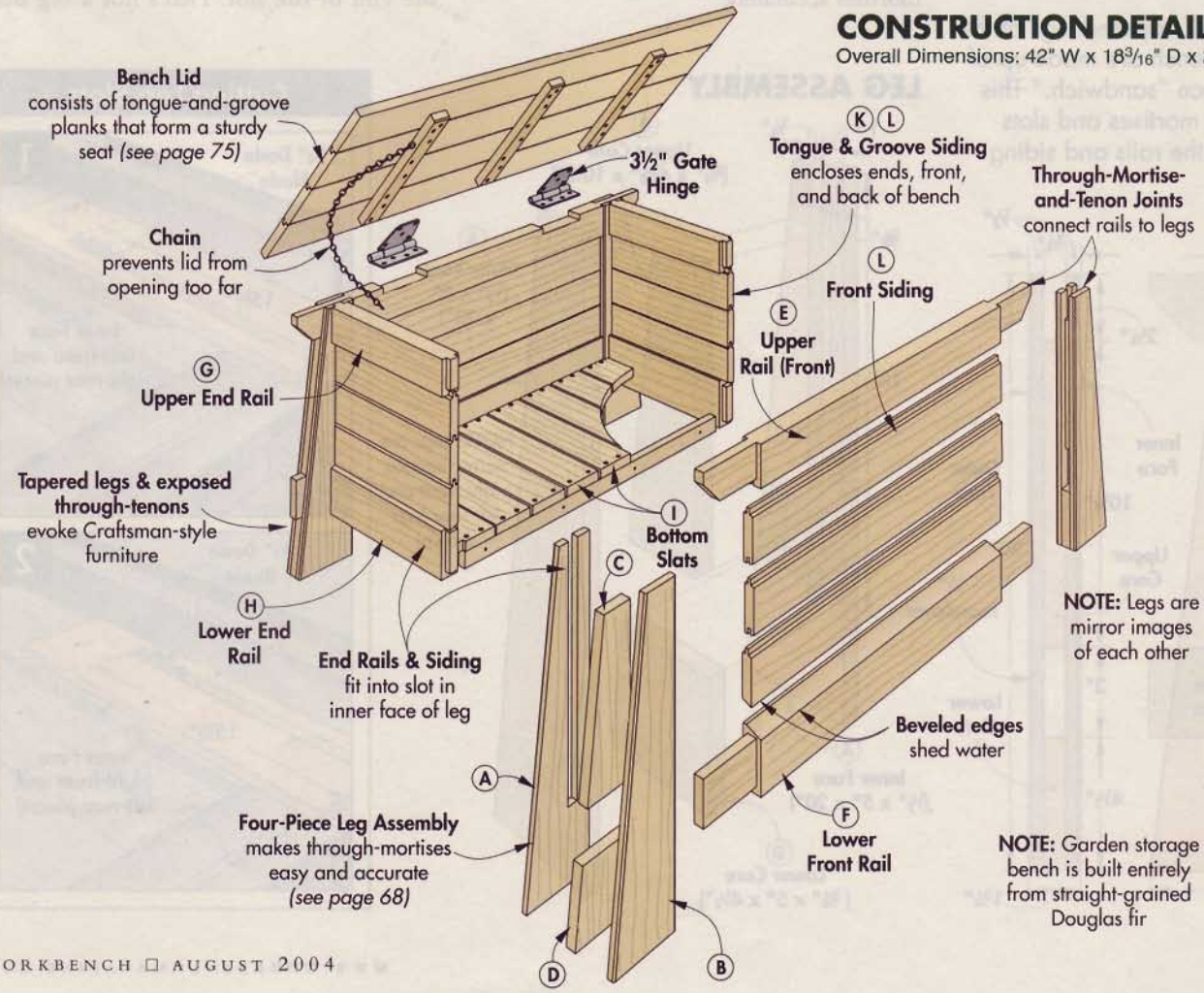
Providing a place to stow that stuff is one of the main purposes of this bench. It's a spacious chest that keeps gardening gear handy, out of sight, *and* protected from the elements. In addition, it offers a place to sit and enjoy the garden *(Photo, right)*.

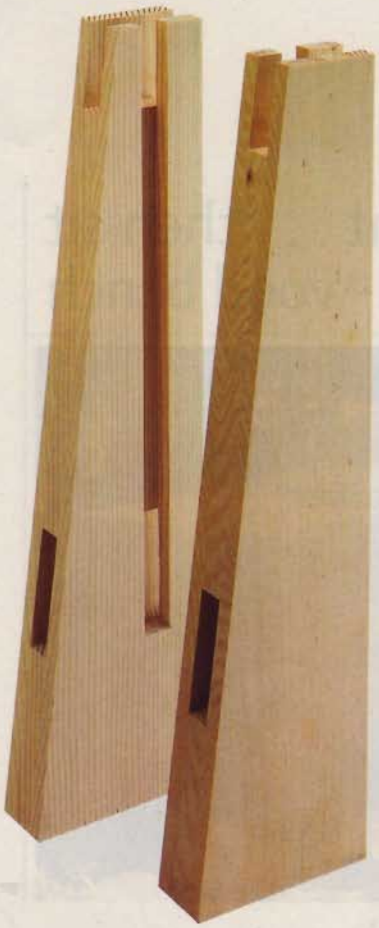
Since this bench sits in plain view, it has to be as attractive as it is functional. Tapered legs and through-tenons give it a distinctive look that accomplishes that. And to complement the clean, simple lines, the bench is built entirely with straight-grained Douglas fir.

But there's more to this bench than good looks. With its solid-wood construction, through-mortise-and-tenon joints, and tongue-and-groove planking, this project is definitely built to last. A penetrating oil finish, renewed every year or two, is bound to make the bench a garden perennial.

CONSTRUCTION DETAILS

Overall Dimensions: 42" W x 18 3/16" D x 20 13/16" H





sturdy & stylish TAPERED LEGS

One of the distinctive elements of this bench is its tapered legs. Narrow at the top, the legs flare out toward the bottom, giving the bench a wide, stable footprint.

Besides adding visual interest, the legs — together with two long rails — frame the front and back panels of the bench *(see Construction Details on page 67)*. The upper rails fit into through-mortises in the top ends of the legs, and a large through-mortise near the bottom accepts the lower rails *(Photo, left)*.

In addition to these mortises, each leg has a long, vertical slot in the *inner face*. This slot holds the shorter rails and siding that make up the end panels of the bench. Finally, a slot in the *inner (untapered) edge* of each leg accepts the rails and siding that form the front and back panels.

Now, I know it probably sounds like it would be a pretty time-consuming task to cut all these mortises and slots. Not to mention the difficulty of cutting the large through-mortises accurately.

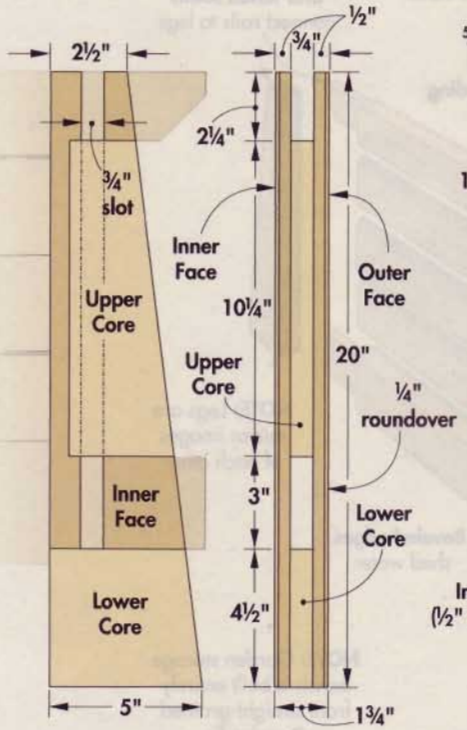
Four-Piece "Sandwich" — So to simplify things, the legs are built up as a four-piece "sandwich." As you can see in the *Leg Assembly Illustration* below, it consists of a $^1/_2$"-thick inner (A) and an outer face (B) with a $^3/_4$"-thick upper (C) and lower core piece (D) in between. This layered design not only provides an easy way to make the joints — it ensures accuracy as well.

Mirror Images — Although the leg pieces are identical, the legs themselves are mirror images of each other *(Photo, left)*. That's important to keep in mind, so all the joints end up in their proper locations.

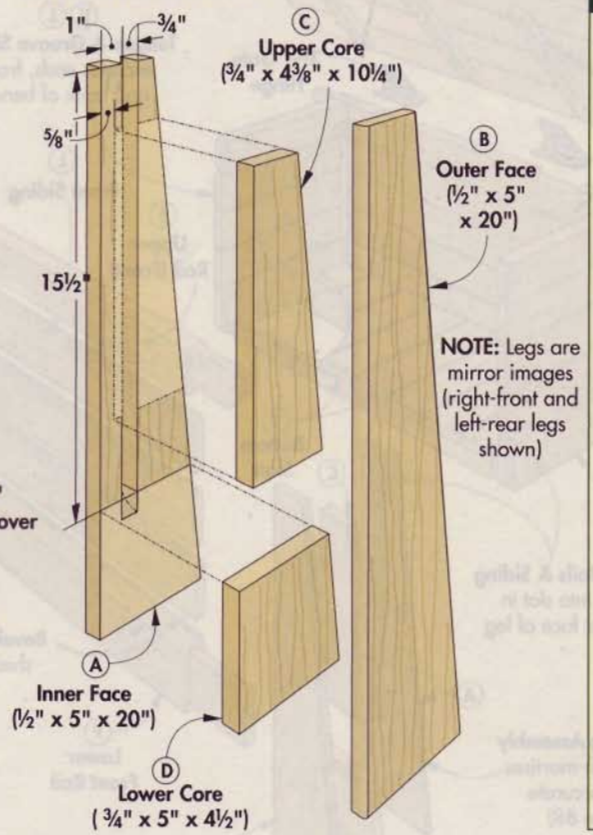
Stopped Slots — After cutting all the leg pieces to size, the first step is to cut a long "stopped" slot in each inner face. This is the slot that holds the rails and siding that make up the end panels of the bench.

A table saw and a $^3/_4$" dado blade make quick work of cutting the slot. But since it's a stopped cut, the blade will leave a radius at the end of the slot. That's not a big deal

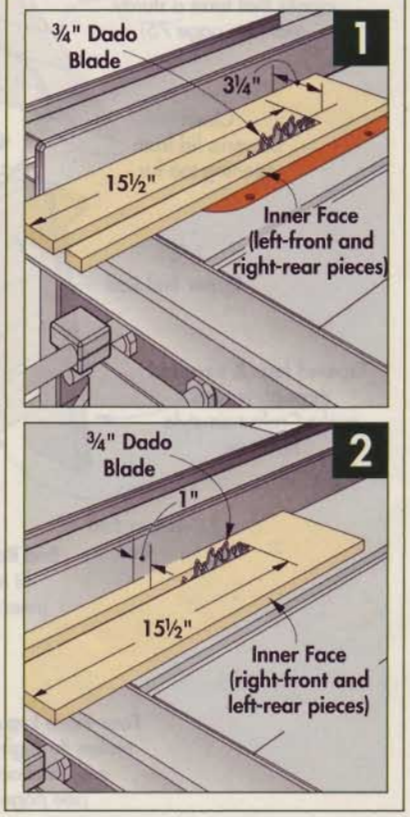
▲ The thick, tapered legs of the storage bench are made up of a four-piece "sandwich." This forms the mortises and slots that hold the rails and siding.



LEG ASSEMBLY



Cutting Leg Slots



though — it will be covered by the lower core piece when the legs are glued together. Of course, the curved end of the slot has to face inward. And since the legs are mirror images, you'll need to make two separate table saw setups *(see Figures 1 and 2)*.

Glue-Up — Now you're ready to glue the pieces together to make the legs. Since this is how the joints are created, proper alignment of the pieces is crucial.

To that end, I used a couple of scrap pieces as temporary spacers *(Leg Assembly Sequence)*. One spacer forms the lower through-mortise. The other maintains the width of the slot in the inner face. Just be sure to apply wax to the spacers to avoid gluing them permanently.

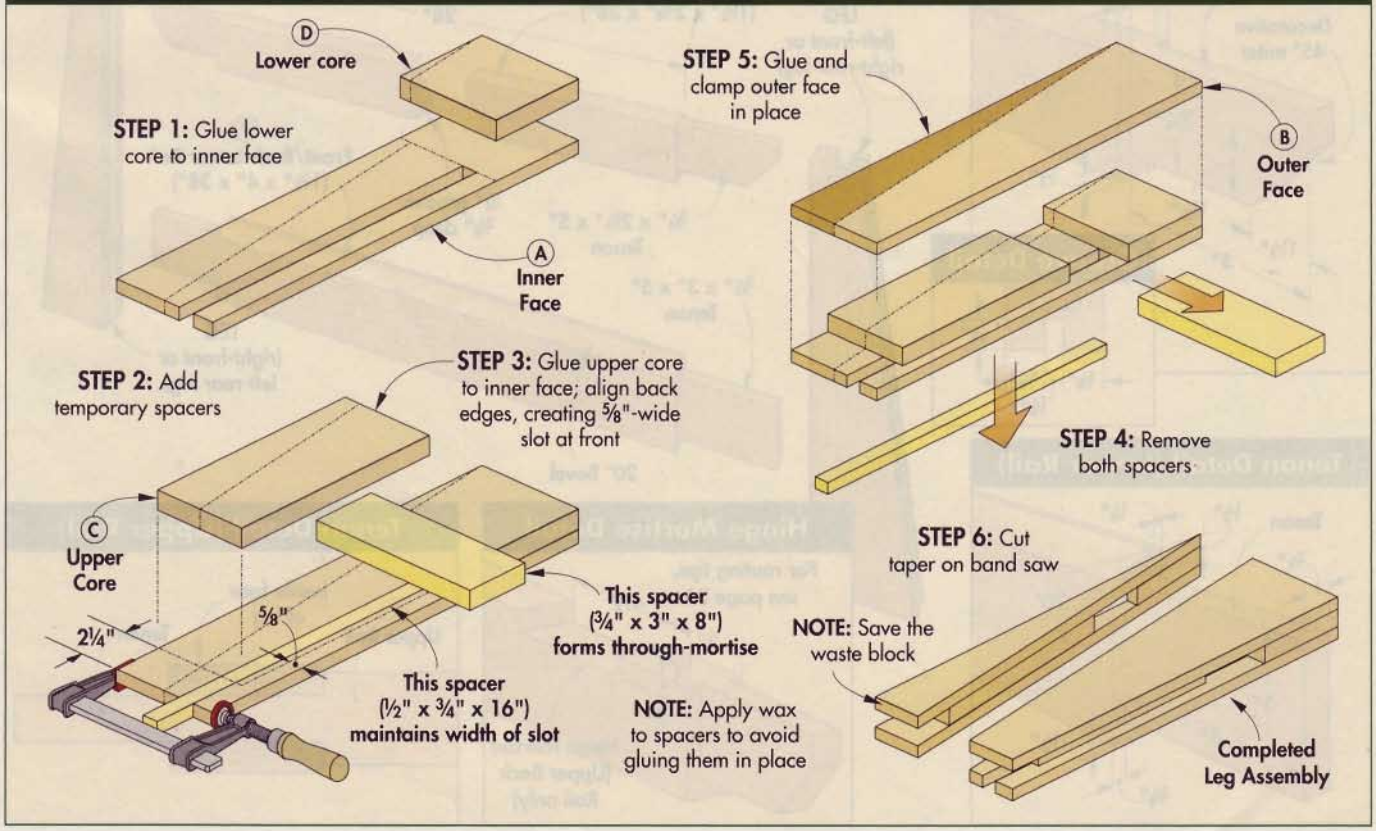
Speaking of glue, don't get carried away and apply too much. If glue squeezes into the lower mortise, it will be difficult to clean up. A thin film of glue is all that's needed.

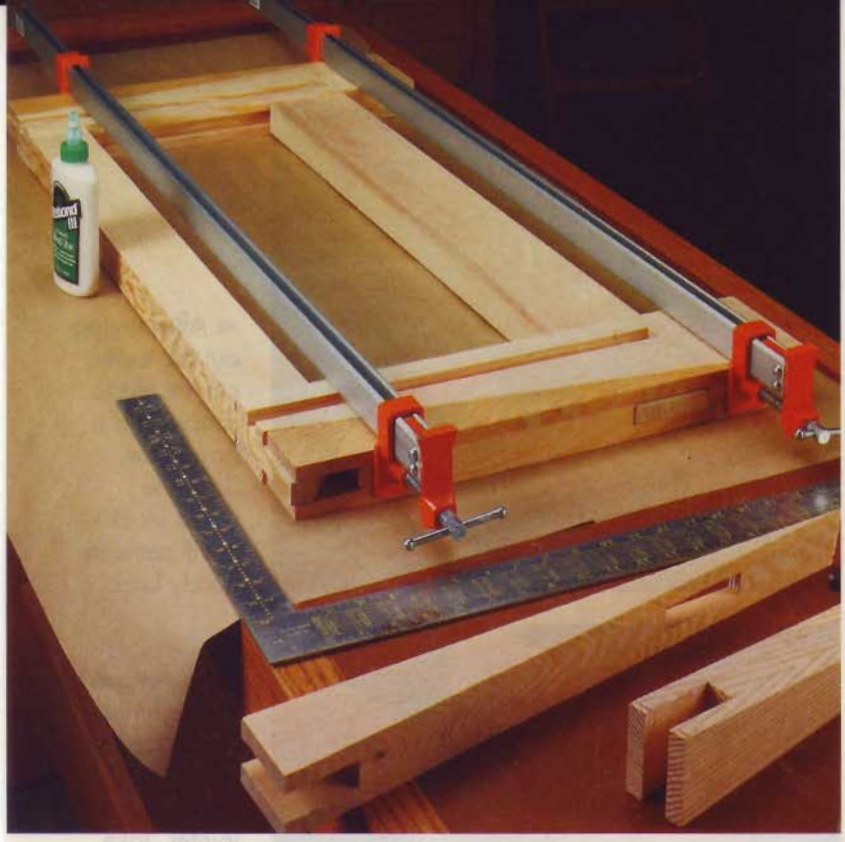
Cut Legs to Shape — When the glue dries, simply lay out the tapers on the legs and cut them to shape on the band saw *(Upper Photo, right)*. Don't throw the waste block away. It comes in handy later on when gluing the legs to the lower rails. Finally, cleaning up the saw marks on a jointer completes the legs *(Photo, right)*.

◄ After laying out the taper, cut the leg to shape with a band saw. Save the waste block — it will come in handy later.

◄ To remove the saw marks on the tapered edge, run the leg across a jointer. Take several light passes to create a clean, crisp edge.

Leg Assembly Sequence





▲ To create parallel clamping surfaces, slip the angled waste blocks from the legs over the protruding tenons of the rails. Note: Glue the lower rail only (not the upper rail) into the legs at this point.

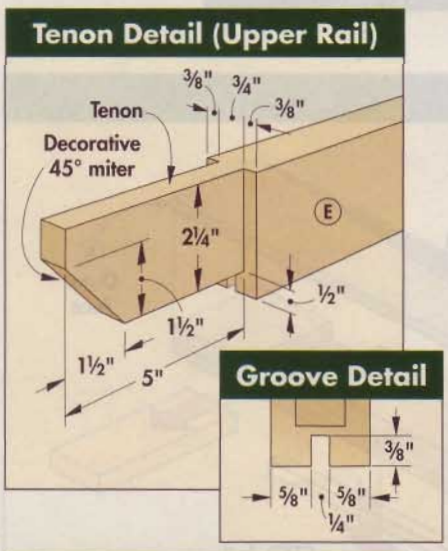
rails form rigid FRAMEWORK

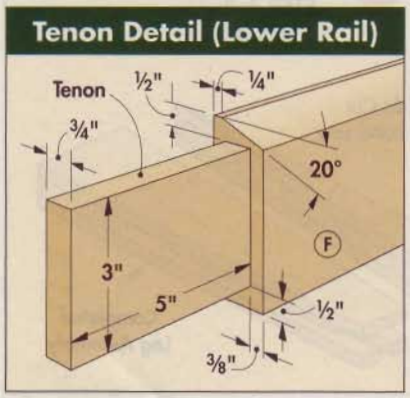
As I mentioned earlier, the long rails of this bench form a strong interlocking connection with the legs. This creates a rigid framework for the front and back panels of the bench *(Photo, left)*. The long through-tenons on the rails also help to give the bench its distinctive look.

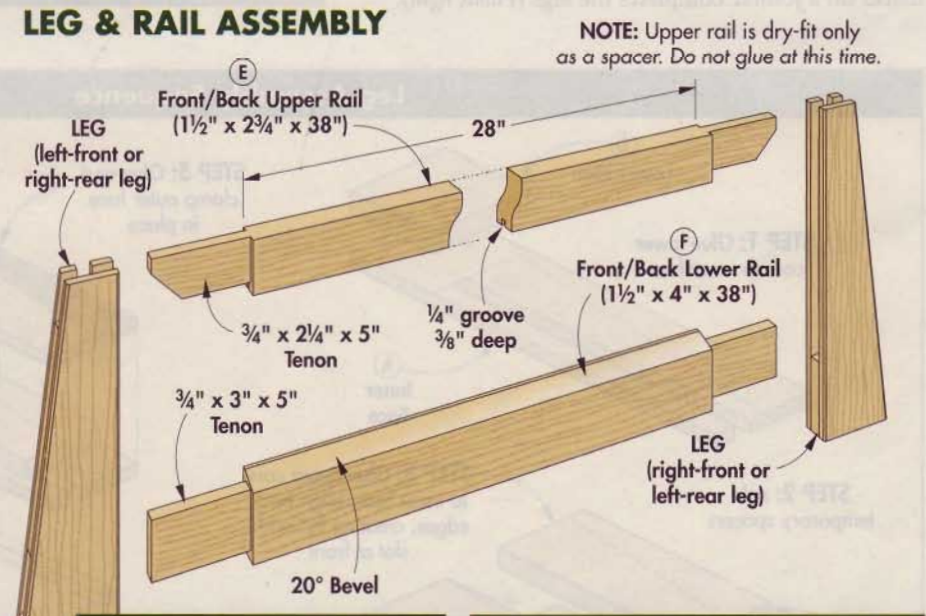
The upper and lower rails are cut from 2x stock. To prevent them from warping after the project is assembled, be sure to select straight-grained boards. Often, searching through a stack of 2x10s or 2x12s will turn up a board with a wide section of straight grain near the edges that will yield rails of the proper width.

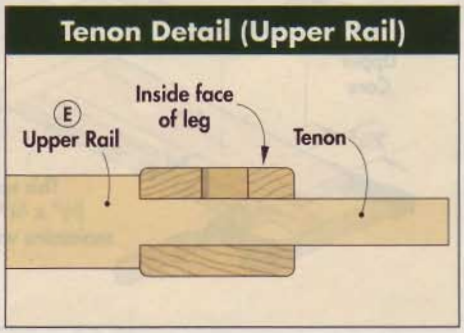
Sizing the Rails — Speaking of that, note that the rails are two different widths. To achieve a pleasing proportion, the upper rails (E) are narrower than the lower rails (F). As for length, the rails are identical (38" long). I know, the upper rail appears to be longer, but that's only because it extends farther past the tapered sides of the legs than the lower rail.

Time for Tenons — The next step is to cut the through-tenons to fit the mortises in the legs *(Tenon*









Details, page 70). Notice that the tenon on the upper rail has three shoulders compared to four on the lower tenon. This way, it will fit flush with the top of the legs.

There are two main goals when cutting these tenons. For a strong joint, the shoulders of the tenon must seat squarely against the leg. And second, the tenon should fit into its mortise with a "friction" fit. To accomplish those things, I used the tool setups shown in the *Box* below.

Upper Rail Details — After completing the tenons, you'll need to cut a groove in the bottom edge of the upper rails *(Groove Detail, page 70).* This groove accepts a tongue on the siding that will be installed below it.

Next, to create a decorative accent, miter the lower outside corner of each tenon *(Tenon Detail, Upper Rail).*

It's also a good time to rout the hinge mortises in the back rail only (see *Hinge Detail and tip on page 36).*

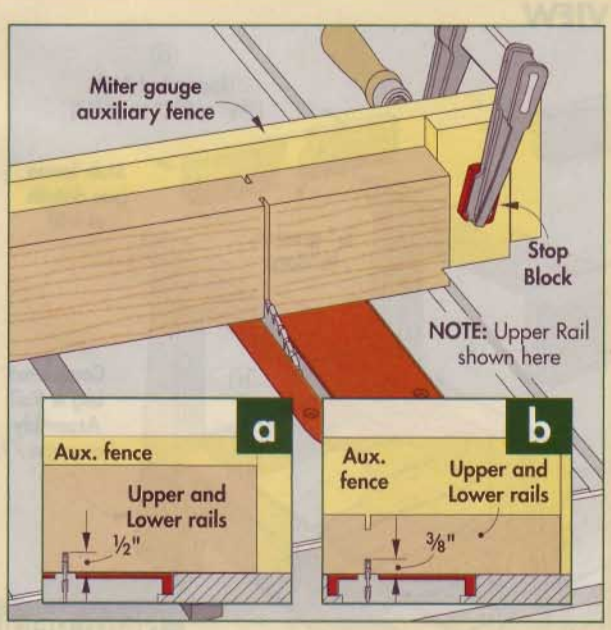
Bevel Lower Rail — The lower rail also needs attention. To help shed water, there's a wide bevel cut on the top edge of this rail *(Photo, right).*

Assembly — At this point, you're ready to begin assembling the bench. I say "begin" because only the lower rail is glued to the legs at this time. The upper rail will be glued in place *after* all the panel slats are added. Still, to prevent racking, it's important to dry-fit this rail into the assembly.

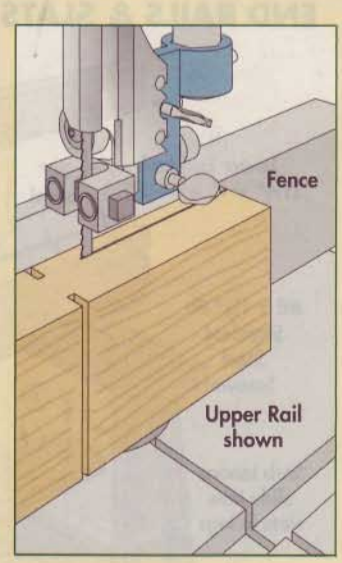
As for glue, be sure to use a waterproof glue like Titebond III or Gorilla Glue. To avoid a messy clean-up, spread the glue only on the part of the tenon housed in the mortise. Slide the rails into their respective mortises. Then clamp the assembly together *(Photo, page 70).* Note how the waste blocks cut earlier from the legs create parallel surfaces that keep the clamps from slipping off the angled legs.

▲ After tilting the saw blade to 20°, rip a wide bevel on the top edge of the lower rail. This bevel will help shed water once the project is assembled.

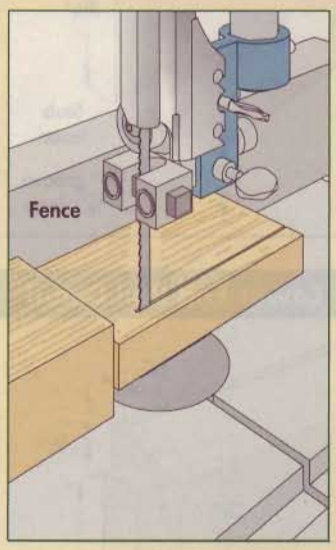
Technique: Cutting Long Tenons



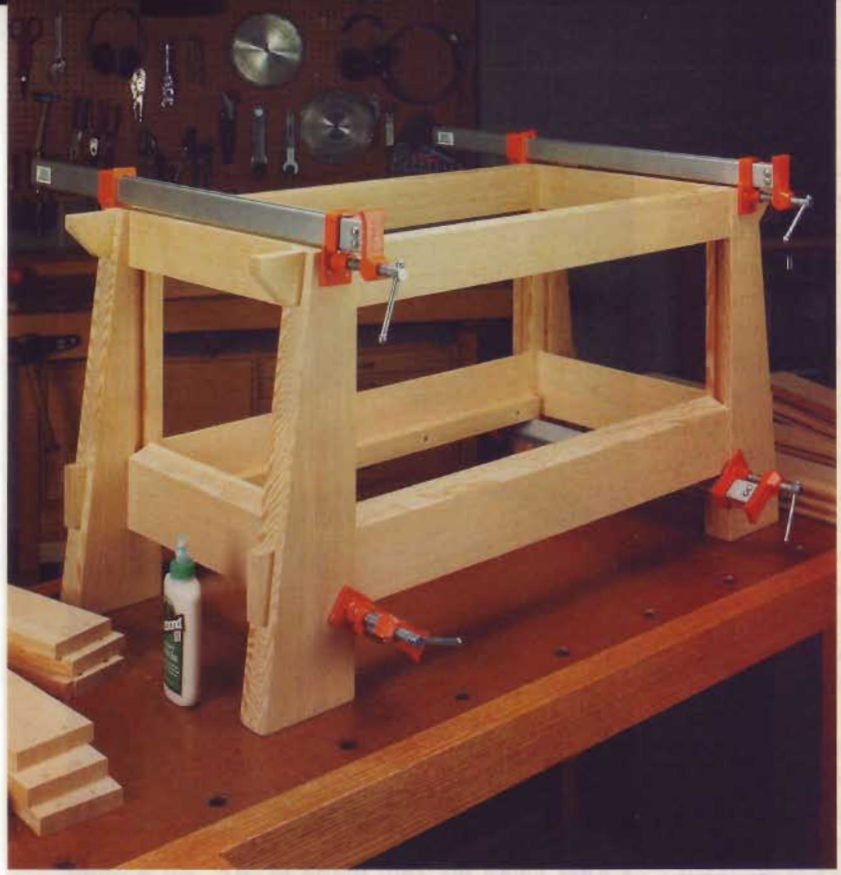
▲ DEFINE SHOULDERS OF THE TENON
A table saw makes it easy to produce square-shouldered tenons. Clamp a block to a fence on the miter gauge to ensure accuracy when cutting shoulders in the edge *(Fig. a)* and then the face *(Fig. b)* of the rail.



▲ CUT TENON CHEEKS
With the rail sitting on edge, cut the cheeks of the tenon on a band saw. A fence guides the rail as you cut the cheeks, establishing the thickness of the tenon.



▲ TRIM TENON TO WIDTH
With the rail face down on the band saw, trim the tenon to width to fit into the mortise. Here again, a fence ensures straight, accurate cuts.



▲ Gluing the lower end rails to the legs completes the second phase of the bench assembly. To ensure a square assembly, all four upper rails are *dry-fit* into place.

a simple structure TAKES SHAPE

There's a point in every project where it really begins to take shape. For this outdoor storage bench, that point is when the frames for the front and back panels are connected by the end rails *(Photo, left)*.

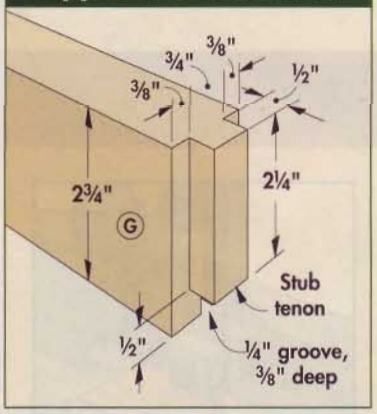
End Rails — The upper (G) and lower end rails (H) share a number of similarities with the front and back rails *(see Illustration below)*. Here again, they're made from 2x Douglas fir. And as before, two different rail widths make for pleasing proportions. (They match the corresponding widths of the front and back rails.) Finally, a groove in the upper end rail and a wide bevel in the lower end rail continues this close resemblance *(see Details below)*.

Stub Tenons — That, however, is where the similarity ends. Instead of through-tenons, the rails are joined to the legs with stub (short) tenons. These tenons fit into the vertical slots in the inner faces of the legs.

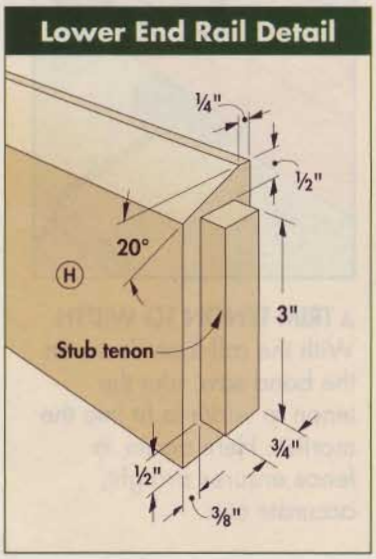
A quick way to cut the stub tenons is to use a dado blade mounted in the table saw. *(For more on this, see the Box on page 73.)* Here again, the upper end rail gets a three-shouldered tenon, while the tenon on the lower end rail has shoulders all the way around.

Assembly — Once the stub tenons are completed, you're ready to begin the second phase of the assembly,

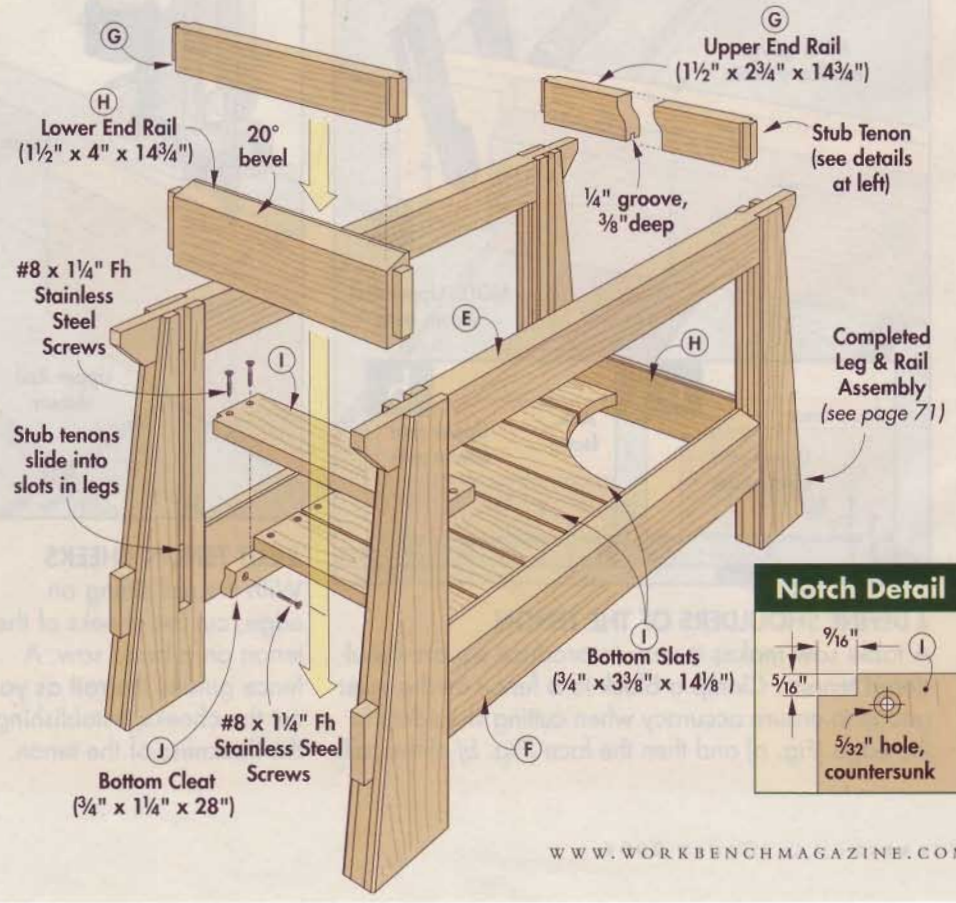
Upper End Rail Detail



Lower End Rail Detail



END RAILS & SLATS VIEW



Notch Detail

that is, connecting the front and back frame assemblies with the end rails. Like the first phase, the idea is to glue the lower end rails only to the legs. Once again, the upper rails on the sides, front, and back are *dry-fit* (not glued) to ensure a square assembly *(Photo, page 72)*.

Add Bottom Slats

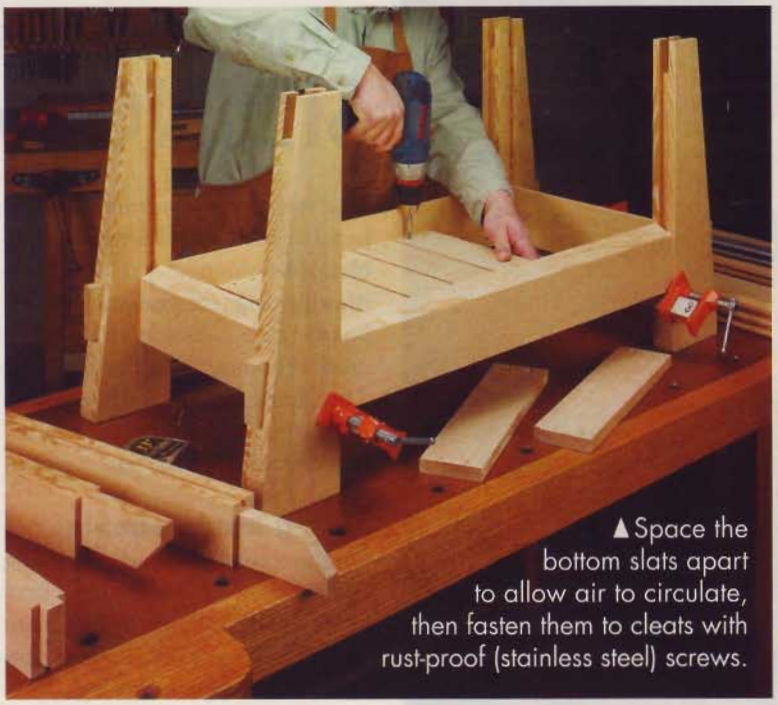
After removing the clamps and the upper rails, the next step is to add the slats that form the bottom of the storage compartment.

Slat Construction — The slats (I) are made from 3/4"-thick stock. They're simply ripped to width and then crosscut to length to fit between the lower front and back rails.

In order to fit around the legs, you'll need to notch the outer corner of each end slat *(Notch Detail)*. A jig saw makes quick work of that.

Before installing the slats, it's easiest to pre-drill the mounting holes in them. These holes will be used when attaching the slats to the cleats, which are added next.

Support Cleats — The slats are supported by 3/4"-thick cleats (J) that are attached to the lower front and back rails. Align the cleats flush with the bottom edge of the lower rails, and fasten them with screws. I used stainless steel screws here (and also for the slats) to prevent rust from staining the wood.



▲ Space the bottom slats apart to allow air to circulate, then fasten them to cleats with rust-proof (stainless steel) screws.

Install Slats — Now it's just a matter of installing the slats. For ventilation, leave a small gap between each slat. Working from the ends of the compartment, space the slats evenly, and fasten them to the cleats with stainless steel screws.

Table Saw Technique: Stub Tenons

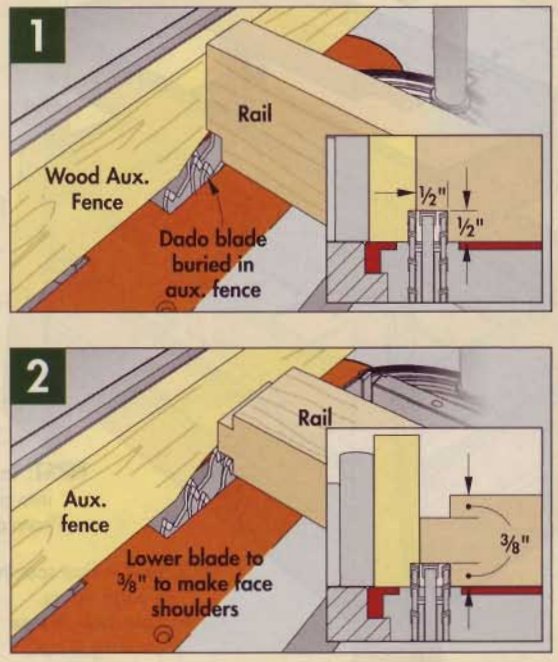
One of the quickest and easiest ways to cut a stub tenon is with a dado blade mounted in a table saw. This requires a two-part setup.

First, the dado blade is "buried" in an auxiliary fence, which is attached to the rip fence of the saw. The portion of the blade that's exposed equals the length of the tenon.

The second part of the setup is to adjust the blade height to cut the shoulders of the tenon. Here again, the upper end rail (shown at right) has three shoulders, and the lower rail has four.

In either case though, you'll need to make two height adjustments — one for the shoulder cut in the edges of the rail *(Fig. 1)* and another for the shoulder cuts in the faces *(Fig. 2)*.

For a square cut, the workpiece is guided by a miter gauge. Butt the end of the piece against the auxiliary fence and hold it firmly against the miter gauge as you make a cut.



▲ Stub (short) tenons on the end rails are cut to fit snugly into slots in the legs.

▲ Interlocking tongue-and-groove boards create the old-fashioned "siding" that encloses the storage compartment of the bench. Slip the siding pieces into the slots in the legs, and then tap them into position.

tongue-and-groove SIDING & SEATING

The storage compartment of this bench is enclosed with what resembles old-fashioned "car" siding — interlocking tongue-and-groove boards with a decorative V-shaped groove running along the joint line. This siding can be made easily in the shop. First, however, a quick overview of how it all goes together.

Siding Made Simple

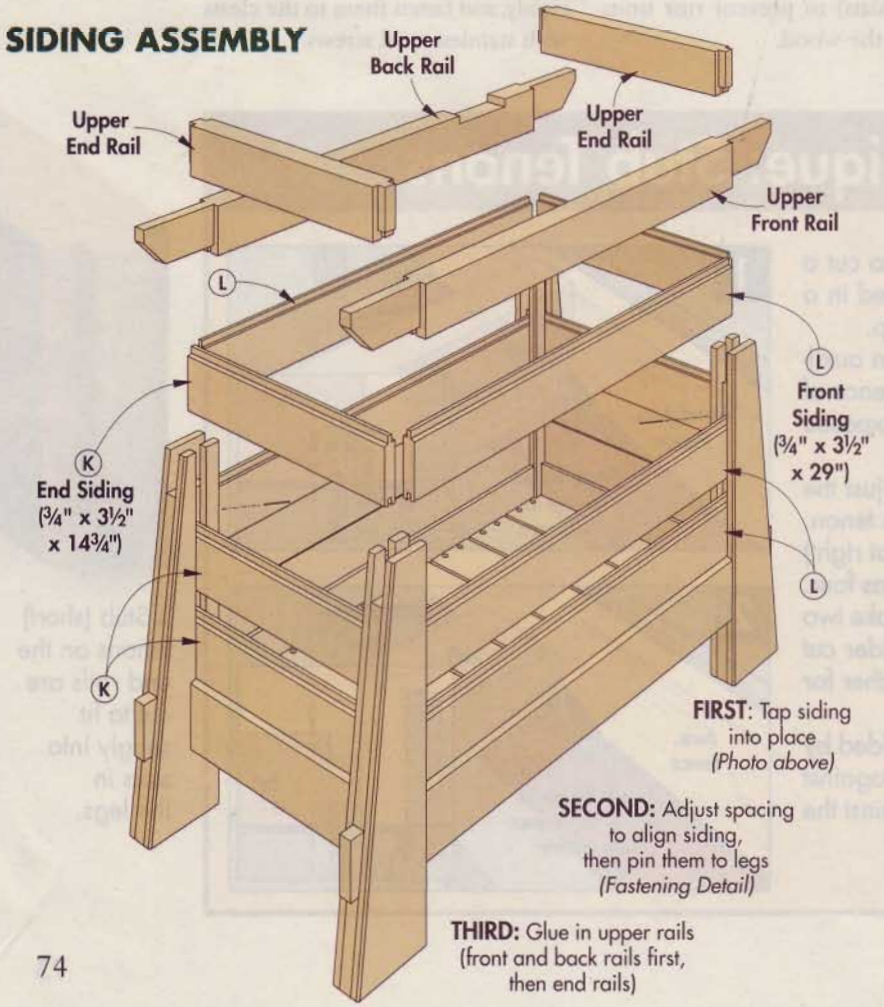
On the ends of the bench, the siding (K) fits into the slots in the inner faces of the legs *(Siding Assembly)*. The front and back siding (L) fits into the slots in the inside edges of the legs.

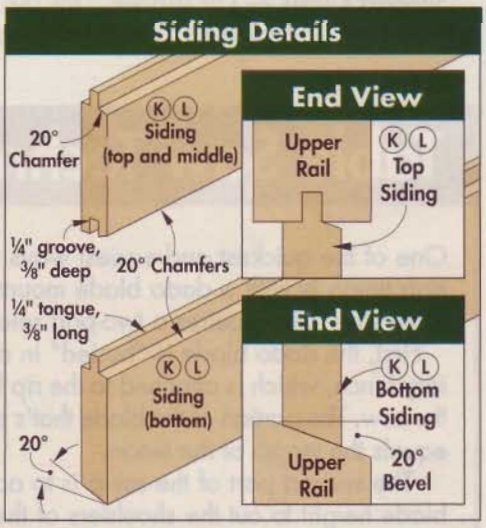
There's no need to cut any additional joinery on the ends of the siding. Simply cut the siding from ¾"-thick stock (the width of the slots), and it should fit nice and snug.

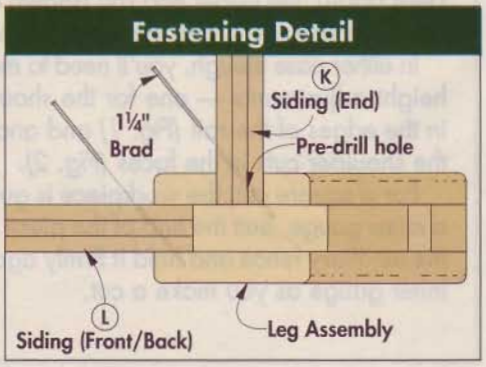
Tongue & Groove Joints — After ripping the siding to width and cutting it to length, you can turn your attention to the tongue-and-groove joints. Note that the top edge of each piece gets a tongue. And, with one exception, the bottom edge is grooved to fit over the tongue. That exception is the bottom piece of siding on all four sides of the bench. It's beveled to fit against the corresponding bevel on the lower rails.

The tongue-and-groove joints can be cut quickly and easily on a table saw, a technique that's detailed on page 34. Also included is an explanation of cutting the chamfers.

Install Siding — Once the siding is completed, installing it goes quickly — just slip the pieces down into their respective slots and tap







them into position. You may have to adjust the vertical spacing of the siding a bit. The whole idea is to align the pieces all the way around the bench. Then use brads to "pin" the siding pieces in that position *(Fastening Detail)*.

Attach Upper Rails — Once that's accomplished, it's time to permanently attach the upper rails to the legs. Like the lower rails, they're glued in place *(Siding Assembly)*.

Lid Doubles as a Sturdy Seat

The top of this storage bench is enclosed with a lid that serves as a seat when it's closed.

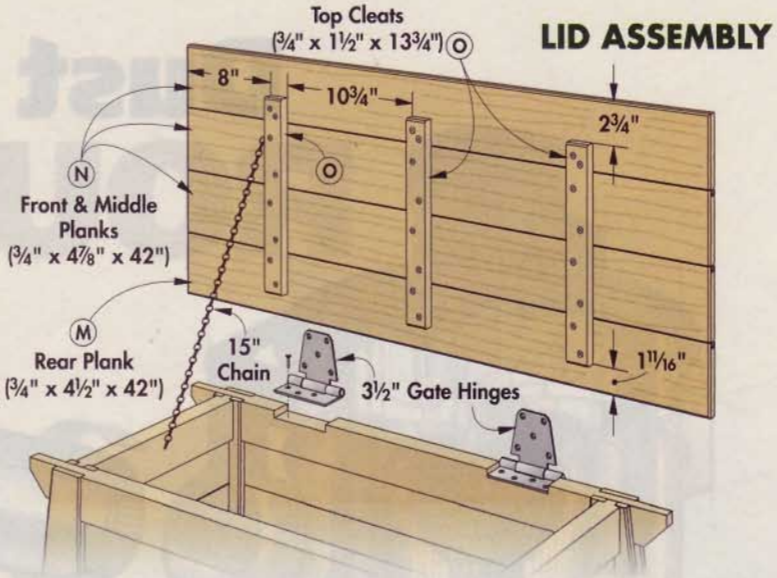
Tongue-and-Groove Planks — The lid is comprised of four 3/4"-thick tongue-and-groove planks that are held together with wood cleats *(Lid Assembly)*.

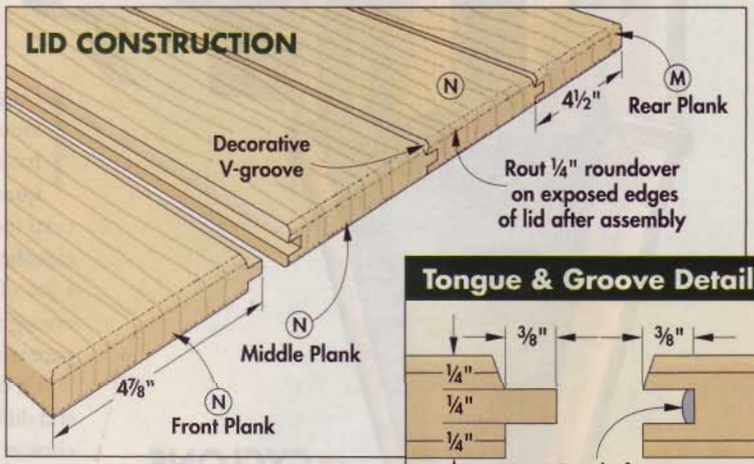
Note that there are two different widths of planks. The rear plank (M) is 3/8" narrower than the other three planks (N). That's because it doesn't have a tongue like all the other planks. For that same reason, the exposed edge of the rear plank, as well as the front plank, is left square *(Lid Construction)*.

As for the tongue-and-groove joints, they're identical to the siding, including the chamfered edges that form the V-shaped grooves *(Tongue and Groove Detail)*.

Assemble the Lid — Once the joinery is completed, you can assemble the lid. To prevent moisture from working its way through the joints, apply a bead of silicone sealer in the grooves of the planks before you fit them together. Then clamp up the lid and attach the three wood cleats (O) with screws *(Top Cleat)*.

Finishing Touches — To protect the wood, I applied two coats of a penetrating oil finish. When it dries, hinge the lid to the bench and add a chain.



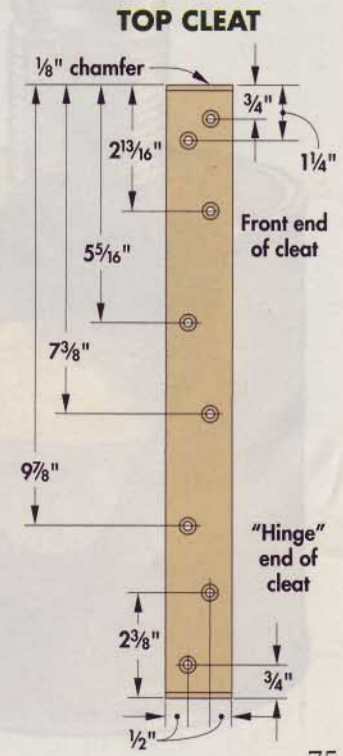


MATERIALS & HARDWARE

	Part	Qty.	T	W	L	Material
A	Inner Leg Face	4	1/2"	5"	20"	Douglas Fir
B	Outer Leg Face	4	1/2"	5"	20"	Douglas Fir
C	Upper Leg Core	4	3/4"	4 3/8"	10 1/4"	Douglas Fir
D	Lower Leg Core	4	3/4"	5"	4 1/2"	Douglas Fir
E	Upper Rail (Front/Back)	2	1 1/2"	2 3/4"	38"	Douglas Fir
F	Lower Rail (Front/Back)	2	1 1/2"	4"	38"	Douglas Fir
G	Upper Rail (Ends)	2	1 1/2"	2 3/4"	14 3/4"	Douglas Fir
H	Lower Rail (Ends)	2	1 1/2"	4"	14 3/4"	Douglas Fir
I	Bottom Slat	8	3/4"	3 3/8"	14 1/8"	Douglas Fir
J	Bottom Cleat	2	3/4"	1 1/4"	28"	Douglas Fir
K	Siding (Ends)	6	3/4"	3 1/2"	14 3/4"	Douglas Fir
L	Siding (Front/Back)	6	3/4"	3 1/2"	29"	Douglas Fir
M	Plank (Rear)	3	3/4"	4 1/2"	42"	Douglas Fir
N	Plank (Front/Middle)	1	3/4"	4 7/8"	42"	Douglas Fir
O	Top Cleat	3	3/4"	1 1/2"	13 3/4"	Douglas Fir

- Titebond III Wood Glue
- (82) #8 x 1 1/4" Stainless Steel Fh Woodscrews
- (2) 3 1/2" Gate Hinges
- (32) 1 1/4" Brads
- (1) Tube OSI Silicone Sealer
- (1) 15" Chain for Lid
- Watco Penetrating Oil Finish

ONLINE Extras
WorkbenchMagazine.com
Garden Bench Cutting Diagram



WORKBENCH

GARDEN BENCH

Issue 284 Volume 60 Number 4 July/August 2004

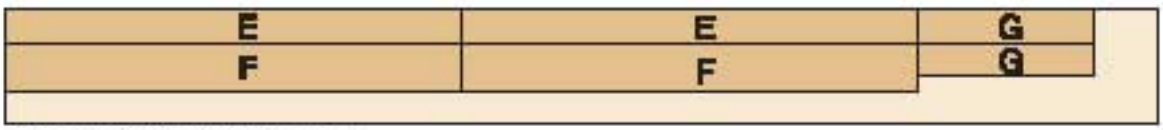
MATERIALS LIST

MATERIALS & HARDWARE

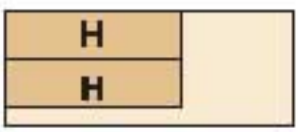
	Part	Qty.	T	W	L	Material
A	Inner Leg Front	4	½"	3"	28"	Douglas fir
B	Outer Leg Front	4	½"	3"	28"	Douglas fir
C	Upper Leg Side	4	¾"	4½"	10½"	Douglas fir
D	Lower Leg Side	4	¾"	3"	4½"	Douglas fir
E	Upper Rail (Front/Back)	2	1½"	2½"	36"	Douglas fir
F	Lower Rail (Front/Back)	2	1½"	4"	36"	Douglas fir
G	Upper Rail (Ends)	2	1½"	2½"	14½"	Douglas fir
H	Lower Rail (Ends)	2	1½"	4"	14½"	Douglas fir
I	Bottom Slat	8	¾"	3½"	14½"	Douglas fir
J	Bottom Cleat	2	¾"	1½"	28"	Douglas fir
K	Siding (Ends)	6	¾"	3½"	14½"	Douglas fir
L	Siding (Front/Back)	6	¾"	3½"	29"	Douglas fir
M	Back Short	1	¾"	4½"	42"	Douglas fir
N	Back (Front/Middle)	3	¾"	4½"	42"	Douglas fir
O	Top Cleat	3	¾"	1½"	13½"	Douglas fir

- Titebond II Wood Glue
- (32) #8 x 1¼" Stainless Steel Fh Woodscrews
- (2) 3½" Gate Hinges
- (32) 1¼" Brads
- (1) Tube OSI Silicone Sealer
- (1) 15" Chain for Lid
- Watco Penetrating Oil Finish

CUTTING DIAGRAM

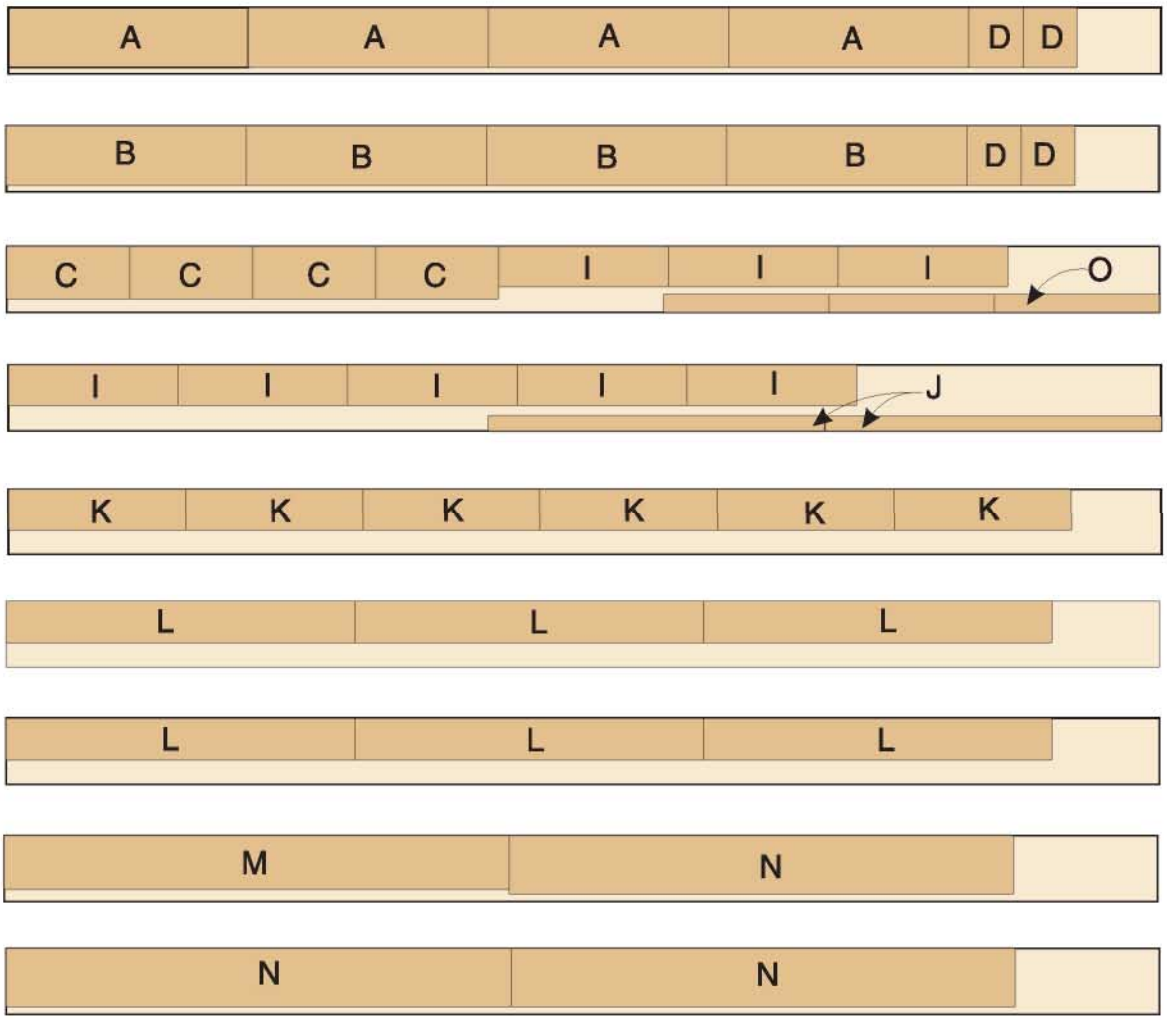


2 x 10 - 96", Douglas Fir



2 x 10 - 24", Douglas Fir

CUTTING DIAGRAM



1 x 6 - 96, Douglas Fir

Dust Collection ROUND-UP

◄CYCLONE
Cyclones are the best option, but not the only option, for dust control. Details of four dust collection systems begin on page 78.

If the letters, emails, and phone calls I've been receiving of late are any indication, then concerns over dust in the woodshop have become paramount to many woodworkers. There's little question these days that wood dust is a very real health concern for woodworkers. (At least three public health agencies have classified wood dust as a carcinogen.) And along these lines, I get a lot of inquiries about how much or how little dust control is enough. There seems to be a lot of confusion over how to compare one dust collector to another.

Of course, there's no "one size fits all" dust collector. Different shops and different budgets require a variety of solutions. I've divided those choices into four categories, which are described in detail on the following pages. In considering each of these options, it's important to weigh their costs relative to their capabilities and limitations.

As to side-by-side comparisons of dust collectors, the most telling information can be found in their performance curves.

WOODWORKING TOOLS AND REQUIRED AIRFLOW

POWER TOOL	CFM
10" Table Saw	550
Surface Planer	550
Belt/Disk/Drum Sander	550
Compound Miter Saw	475
Router Table/Shaper	450
Band Saw	375
Scroll Saw	375
Jointer	375
Drill Press	375

These simple graphs show how the volume of air moved by a dust collector (indicated in Cubic Feet per Minute or CFM) is affected by an increase in pressure, as when drawing air through a system of ductwork. (This is measured in Inches of Static Pressure, abbreviated as SP.)

The sample curves *(below)* show how two systems with similar CFM ratings fare quite differently as static pressure increases. (Performance curves for most dust collectors are available by request from manufacturers.) The table on page 76 shows the airflow required to effectively collect dust from the most popular woodworking tools.

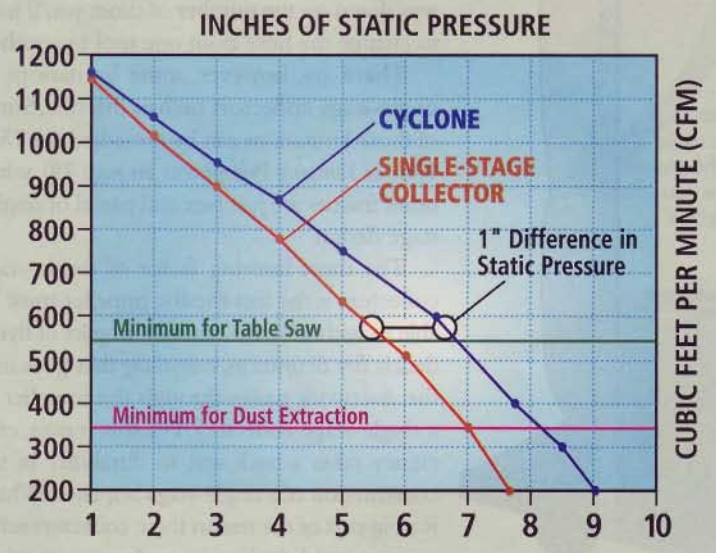
Keep in mind that every foot of ductwork and every fitting increases the pressure that the dust collector must overcome in order to maintain adequate airflow. So it's crucial that ductwork be constructed as efficiently as possible.

In that vein, the *Sidebar at right* provides some basic guidelines for getting the best performance from your dust collector. While these guidelines are most pertinent to central systems, the principles remain the same for collectors of all size.

SAMPLE PERFORMANCE CURVES

This graph shows representative performance curves for two popular types of dust collectors. Notice that both collectors have a maximum airflow of approximately 1,150 CFM. As pressure increases, the CFM of each tool declines correspondingly. Also note the steeper decline of the curve for the single-stage collector.

At first glance, the difference in the curves seems negligible. However, if you consider at what point the collectors fall below 550 CFM (the airflow typically considered minimal for collecting dust at a table saw) the difference in the machines becomes more meaningful. The single-stage collector falls below this threshold at approximately $5\frac{1}{2}$" of static pressure. The cyclone reaches the same point at about $6\frac{1}{2}$" of SP. Again, an apparently insignificant difference. But consider that a mere 1" of SP difference represents almost 15 feet of 4" duct, and the cyclone's advantage is clear.



5 FUNDAMENTALS FOR DEFEATING DUST

1 SHORT & STRAIGHT

The duct between tool and collector should be in the straightest possible line and as short as as you can make it. When making turns, try to use 45° fittings instead of 90° fittings.

2 USE DUST-WORTHY DUCT

PVC pipe and HVAC duct do *not* make good dust collection duct. PVC creates far too much additional pressure and HVAC duct is too thin to withstand the pressure of a dust collector.

3 SEAL ALL THE JOINTS

A small leak in the ductwork can have a huge impact on the efficiency of your system. All connections should be sealed using either metal duct tape (good) or silicone sealant (best).

4 USE BLAST GATES

Blast gates ensure that you're only drawing air through the tool in use. Install blast gates at every tool branch and then *use* them.

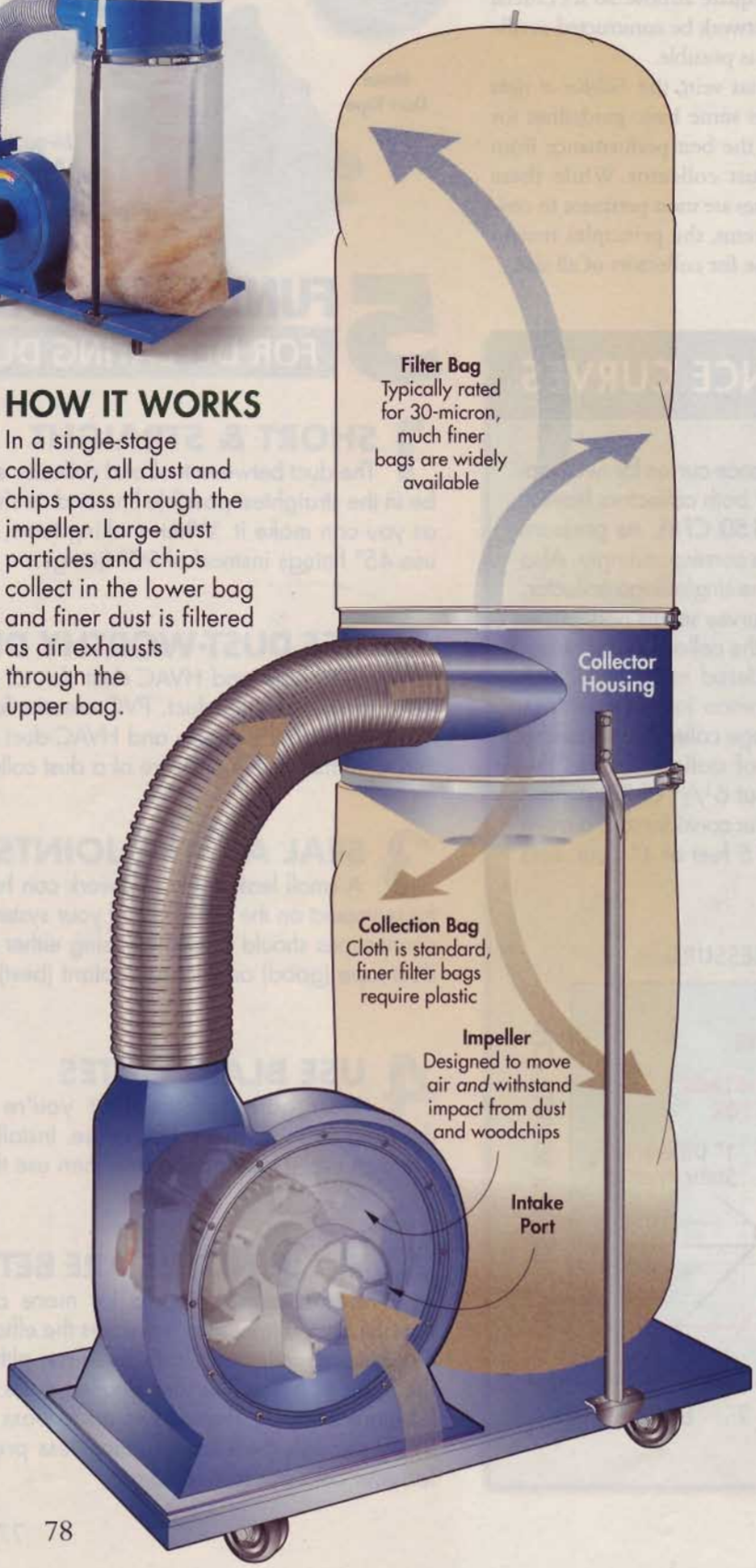
5 FINER FILTERS ARE BETTER

Besides capturing a lot more of the harmful dust, a finer filter increases the efficiency of your dust collector. That's because, although the holes in a fine filter are smaller, there are a lot more of them. That allows air to pass more freely through the filter, creating less pressure for your collector to overcome.

SINGLE-STAGE COLLECTOR

HOW IT WORKS

In a single-stage collector, all dust and chips pass through the impeller. Large dust particles and chips collect in the lower bag and finer dust is filtered as air exhausts through the upper bag.



Single-stage dust collectors like the one represented here continue to be the most popular choice for the home woodshop. There are a number of reasons for this.

First is the relatively low cost. The JDS Dust-Force shown on these pages sells for $299 plus shipping. That's about one-half to one-third the cost of similarly sized cyclone units.

Second are the very satisfactory performance characteristics. This 1 1/2-hp unit boasts 1,250 CFM (before factoring in any static pressure — remember the performance curve) and 42 pounds of dust collection capacity. This is more than adequate on both counts for most home woodshops.

A couple more reasons for the popularity of single-stage systems are their ease of setup and versatility. Whether your shop consists of a couple of stationary tools or an entire garage full of dust-raising woodworking machines, a single-stage collector can be configured to manage the dust effectively in short order.

Right out of the box, most of these collectors have casters on their bases. So it isn't necessary to run an elaborate system of ductwork in order to put the collector to work. You can simply roll the collector from tool to tool.

As an alternative, most single-stage collectors come standard with a Y-connector so you can connect more than one tool at a time. By using blast gates and a couple lengths of flex hose (typically not included) this can cut way down on the number of times you'll have to change the hose from one tool to another.

There are, however, some limitations to single-stage collectors such as this one. Some of those limitations can be remedied *(see Three Ways to Enhance Performance on page 79)*, while other frailties are just part and parcel of single-stage design.

The most limiting factor of single-stage collectors is the fact the the impeller must be able to withstand the constant impact of flying debris (by definition, *everything* that goes into the ductwork passes through the impeller of a single-stage collector). For this reason, efficiency takes a back seat to durability in the construction of a single-stage impeller. Which is a big part of the reason these collectors suffer a more rapid decline in performance when compared to two-stage cyclone collectors.

THREE WAYS TO ENHANCE PERFORMANCE

1 FILTRATION

Several options are available to improve on the 30-micron filter bag that's standard fare on single-stage collectors. *Below* is a 1-micron filter bag with a plastic lower bag (this forces all the air through the filter bag). *At right* is a canister filter rated to trap particles as small as .5 microns.

2 CONNECT IT DIRECTLY

By removing the Y-fitting *(Photo, below)* and connecting the ductwork directly to the collector, you eliminate an unnecessary restriction and are able to start with a larger diameter of duct. (Each branch of the Y is 3" in diameter. The trunk has a 4" diameter.)

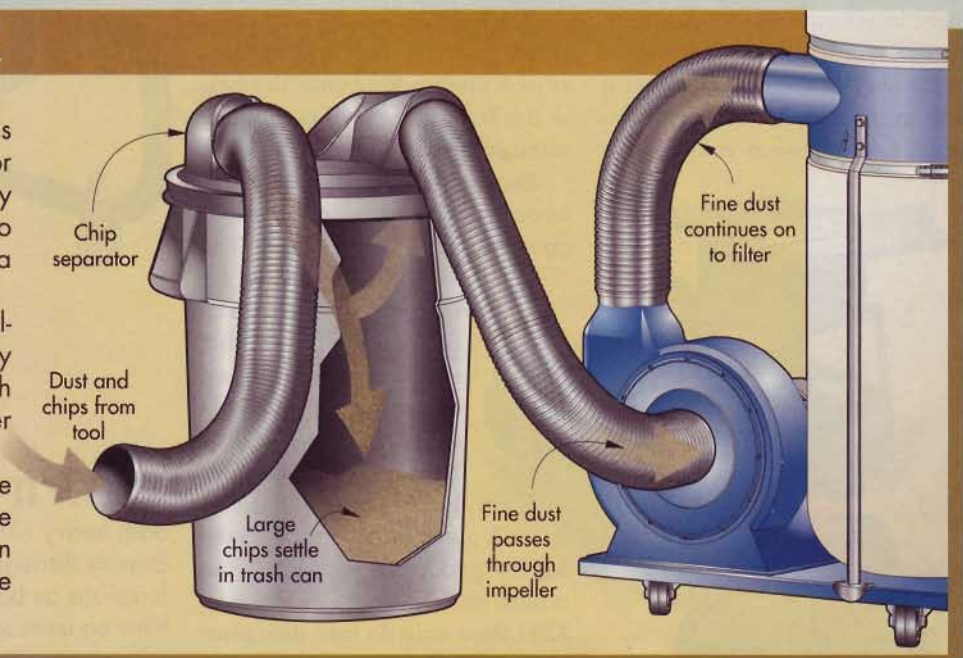
The canister filter not only captures smaller particles than a bag, but also increases filter area almost 600%.

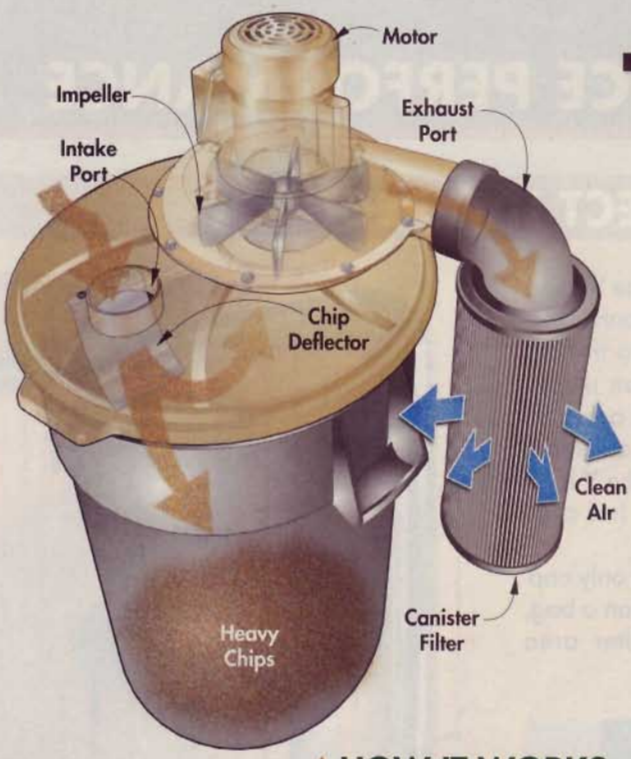
3 SEPARATOR

Centrally located systems should also include a separator *(Illustration, right)*. This effectively turns a single-stage collector into a two-stage collector, which has a couple advantages.

First, the large chips are collected in the separator before they can impact the impeller, which lessens damage to the impeller and extends its useful life.

Secondly, emptying the garbage can that serves as the chip collector is much easier than removing the lower bag from the collector itself.





TWO-STAGE COLLECTOR

▲HOW IT WORKS

Dust is drawn directly into the garbage can, where heavy particles settle. Fine dust is captured in the canister filter.

This two-stage collector combines space-saving portability (provided you use a trash can with casters on it) with the performance of two-stage dust collection *(Photo, right)*. The collector fits 20-gallon steel garbage cans or 32- or 40-gallon plastic cans. The weight of the collector is enough to hold it firmly in place and create a tight seal.

Large chips are collected in the trash can (not included), and fine dust is captured in the cartridge filter before the air is recirculated into the shop *(see How it Works, at left)*.

You might think that the small filter will require constant cleaning, but that isn't the case. The efficiency of two-stage dust collection, and the surprisingly large filter area inside the cartridge mean you'll only need to clean the filter after every third or fourth time you empty the trash can.

The one drawback to this unit is having to lift the heavy, awkward collector off of the trash can each time you empty it.

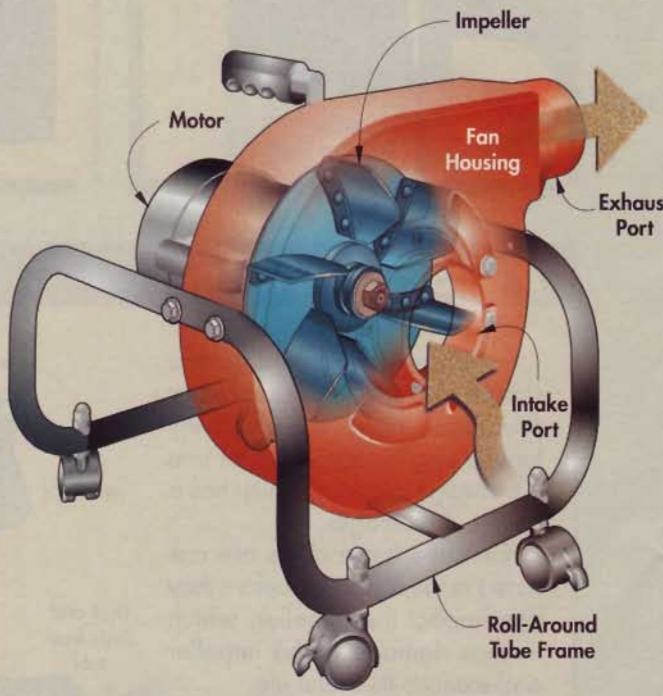
COMPACT PORTABLE

This is the most affordable type of dust collector available. Not surprisingly, its effectiveness is limited. In fact, this type of collector offers more in the way of convenience than it does in effective dust collection. You won't have to sweep your shop as often, but don't count on this unit to maintain a safe level of air quality.

The bag shown here is rated for 1-micron, which is finer than the bags of most similarly sized units. But even at this level, airborne dust escaping through the bag is a real concern.

Because these units are designed to be compact, impeller size is restricted compared to the larger models. The result is a steeper decline in the performance curve as pressure is increased. For that reason, these collectors are intended to be connected directly to a single tool.

The size of the bag also limits the usefulness of this collector. A planer or jointer will fill the bag too quickly to make the unit particularly useful. Nonetheless, for under $200, these units do have their place in the small shop.



▲HOW IT WORKS

Both heavy chips and fine dust are drawn directly through the impeller. A single bag functions as both chip collector and dust filter on units such as this.

▲ Although often configured as a central system, as shown here, cyclones can be used as portable systems.

CYCLONE

TWO-STAGE WITH A TWIST

Cyclone dust collectors are inarguably the best dust collection system you can install in your shop. Their superior performance and their name come from the cyclonic action illustrated in *How it Works* on page 83.

The efficient separation of dust from air means the impeller in a cyclone collector can be designed to generate maximum airflow without consideration for sustaining impact from flying wood chips. This gives cyclones a much better performance curve and makes them highly effective even when connected to an elaborate system of ductwork.

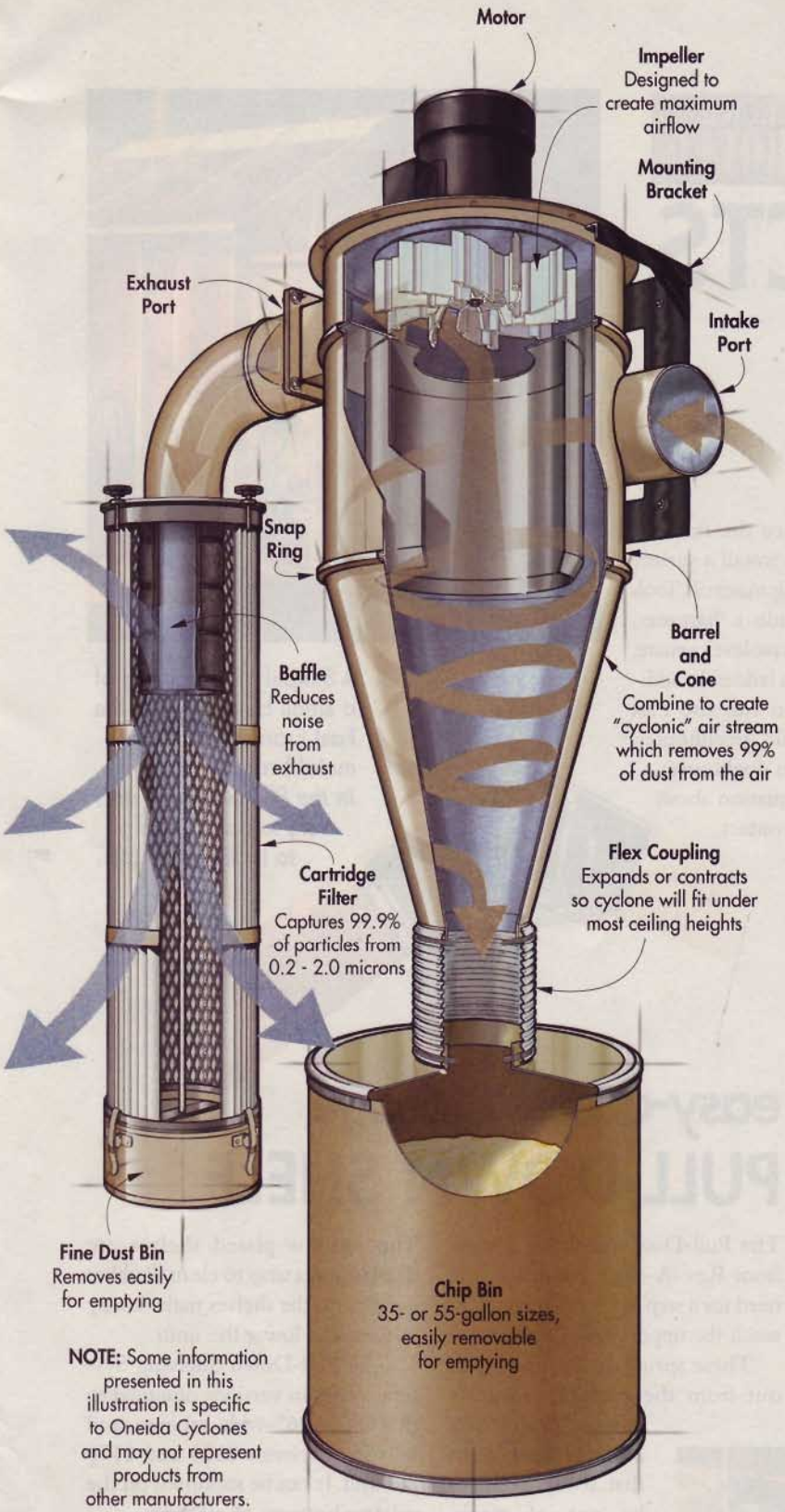
Filtration can vary between manufacturers. The Oneida we purchased uses a pleated cartridge filter that captures 99.9% of dust particles down to .2 microns.

Clearly there is no need and no means to improve the performance of a cyclone collector with add-ons. You can, however, choose between an internal filter *(Illustration, page 76)* or an external filter *(Photo above and Illustration on page 83)*.

There is little in the way of performance difference between these two options. The real differences are space utilization (the external filter takes up a lot of room) and convenience (cleaning the internal filter means taking the cyclone apart — see Oneida's tip for easy reassembly in the box on page 83). Cleaning the external filter calls for blowing the pleats clean with an air hose and emptying the dust pan.

The cost of a cyclone, and the misperception that they must be used with a fully-plumbed system of ductwork, often lead home shop users to consider less costly (and less effective) means of dust control.

Contrary to popular belief, cyclone collectors do *not* have to be connected to a complete system of ductwork to be useful. An economical way to get started with a cyclone is to mount the unit on a mobile stand (available from Oneida) and use it just as you would a portable single-stage collector. As budget allows, you can add ductwork and blast gates a little at a time.



▲HOW IT WORKS

Debris enters the barrel and is separated in a "cyclonic" stream of air. Large dust particles and chips fall into the bin and finer dust is trapped in the cartridge filter.

CLEANING AND REPLACING INTERNAL CYCLONE FILTERS

To save space, Oneida cyclones can be configured with an internal filter. The trade-off is that you must remove the metal cone of the cyclone to access and clean the filter. The real trick, though, is getting the cone back on. Oneida offers this advice.

◄INTERNAL FILTER REMOVAL

Disconnect the cone and move it aside while you remove the internal filter for cleaning *(Fig. 1)*. Once removed, blow the pleated filter clean with compressed air.

▲USING SUCTION TO CONNECT

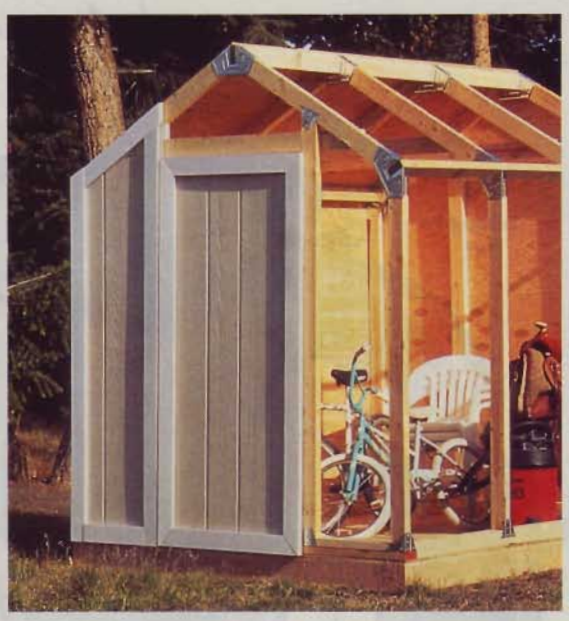
To reattach the cone after installing the clean filter, first make sure all of the blast gates are closed.

Then turn the cyclone on and let the suction draw the cone tight against the barrel *(Fig. 2)*. The suction will hold the cone tight against the bottom of the barrel and allow you to use both hands to reattach the snap ring *(Fig. 3)*.

Tools & PRODUCTS

WORKBENCH APPROVED

build-a-shed
FAST FRAMER KIT



Building even a simple structure like a backyard shed can be discouraging if you can't figure out how to put together sections like the roof framing. In fact, it might stop you from building it at all.

A solution to this dilemma is the Fast Framer Kit, which simplifies the process of framing a small building. Metal brackets hold dimensional lumber (not included) at the correct angle, eliminating the need for making tricky miter cuts.

One kit ($50) includes the directions to frame a 7-ft. x 8-ft. shed, as well as 24 angle brackets and 12 stud brackets. Once the frame is complete, you can install a variety of roofing and siding materials. Tools you'll need include a hammer, screwdriver/drill, saw, level, square, tape measure, and a ladder. In addition to sheds, you can use Fast Framer Kits to build greenhouses, playhouses, or even doghouses.

For more information about Fast Framer Kits, contact G&T Sales at 406-849-5138, or visit them at www.ProFrameKits.com

▲ Simplify the framing of a small building with the Fast Framer Kit. It uses metal brackets *(shown in the Photos above and left)* to put an end to tricky miter cuts.

easy-access storage
PULL-DOWN SHELF

▲ The Pull-Down Shelving System from Rev-A-Shelf brings hard-to-reach items in the upper part of a cabinet down to a more accessible height.

The Pull-Down Shelving System from Rev-A-Shelf eliminates the need for a step stool when trying to reach the upper part of a cabinet.

These spring-loaded units pull out from the cabinet and glide down to provide easy access to those items that always seem to be out of reach. Assisted by gas-filled struts, the shelves operate smoothly throughout their full range of movement ($14\frac{3}{4}$" out from the cabinet, 10" down). The chrome-plated shelves are durable and a snap to clean. Rubber handles on the shelves make it easy to raise and lower the units.

The Pull-Down Shelving System comes in versions designed to fit 24"- or 36"-wide cabinets, and sells for between $160 and $170 per unit. It can be mounted on the sides or bottoms of cabinets.

Rev-A-Shelf products are available at home centers, but you may have to special-order these units from a store's kitchen department. For more information, visit www.Rev-A-Shelf.com, or call 800-626-1126.

WORKBENCH APPROVED

no foolin'
NO-TOOL BLADE CHANGE

▲ Porter-Cable's new circular saw simplifies blade changes. Just push the arbor-lock button on top, and rotate the blade clamp to loosen or tighten by hand.

Changing a blade on a circular saw can be a hassle. That's not the case, however, with the 7¼" Quik-Change Mag-Saw from Porter-Cable ($129). The process takes just seconds, and no blade wrench is needed.

Just push the arbor-lock button on the top of the saw, flip out the lever on the blade clamp, and rotate the clamp counterclockwise by hand. Remove the clamp, along with the flange that goes between the clamp and the blade. With a new blade in place, simply replace the flange and rotate the clamp by hand in a clockwise motion until it's tight.

Other highlights of the saw include a body and base made of magnesium, a powerful 15-amp motor, and a built-in dust-exhaust port. It comes equipped with one of the company's new carbide-tipped Razor blades.

For more information, visit www.Porter-Cable.com

▲ Two nice features of the Mag-Saw are a base that tilts for miter cuts up to 50°, and a swivel port for dust collection.

a different kind of cordless
BRING YOUR OWN PLUG

▲ A hook on top swings out and locks in place, allowing you to hang the saw on a rafter or other framing member between cuts. A lever on the base locks in miter angles.

I'll admit it. I've done some pretty bone-headed things — like accidentally cutting off the power cord of my circular saw. Normally, that would render the saw unusable until the cord is replaced.

If this happens with the CS20 Circular Saw from Bosch, however, you can keep on working. You see, the saw doesn't have its own power cord. Instead, just plug an extension cord into the saw's handle, and you're in business. Not having an attached cord also means it's easier to store the saw.

The CS20 ($140) has a 15-amp motor and a composite base that's designed to stay flat. A convenient rafter hook lets you hang the saw on a framing member between cuts.

Also, an onboard blower disperses dust, making it easy to see layout lines as you cut. For more information, visit www.BoschTools.com

▲ The CS20 circular saw from Bosch Tools is "cordless" only in that you attach your own extension cord to the plug on the handle of the saw.

small but powerful
COMPACT CORDLESS DRILLS

Milwaukee Electric Tool products are synonymous with heavy-duty. So that means the company's new "compact" drills have a reputation to uphold.

Yes, the cordless drills in the Compact Series (a 12-volt, 3/8" model and a 14.4-volt, 1/2" model) are smaller, which means they will work well even in tight spaces. But their two-speed motors still have plenty of power.

Also, because of their smaller size, these drills can easily travel with you, thanks to an included locking belt clip *(Photos left and right)*.

For further convenience in tight drilling situations, the battery can be reversed, locking to the bottom of the drill in either direction.

Both drills feature a five-year limited warranty, with prices from $135 to $228. For more information, call 800-729-3878, or visit www.MilwaukeeTool.com

▲ With the aid of a clip that attaches to a work belt, drills in Milwaukee's Compact Series travel with you on the job. The rechargeable battery slides on the drill from either direction.

easy, accurate way to
INSTALL JOIST HANGERS

Joist-Loc from Bench Dog eliminates one of the biggest hassles of installing joists.

Normally, it's back-breaking work to lift joists with one hand while trying to nail joist brackets in place with the other. Now, just tap Joist-Loc into place on the rim joist at the location where you want to install a hanger. (It has teeth that will dig right into the wood.).

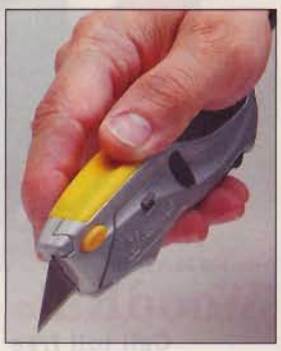
Set the Joist-Loc's sliding gauge to the correct depth for the joists you are hanging. Next, slip the hanger under the bottom of the tool and nail the hanger in place *(Photo)*.

Then, just detach Joist-Loc and move it to the location of the next joist. The correct depth is already locked in. Joist-Loc ($22.99) works with single, double and angled hanger brackets. Go to www.BenchDog.com for more information.

retractable
UTILITY KNIFE

Just give this new utility knife a squeeze, and the blade pops out, locked in place for use. Push the black button on the side of the Squeeze Knife, and the blade automatically retracts.

Its best feature, however, may be how easy it is to change blades. The manufacturer, Alltrade, touts it as the world's fastest quick-change utility knife. Push the yellow button, pull out the old blade, and then insert the new blade.



It's available at most home centers and hardware stores for under $10 (www.AlltradeTools.com).

WORKBENCH APPROVED

more than a BOOM BOX

The Power Box that Bosch recently introduced redefines the idea of a jobsite radio/CD player. All four sides of the Power Box offer helpful functions for woodworking and home improvement projects, and a tubular aluminum cage protects the unit from damage.

Side 1 — Controls and speakers for the sound system are on this side. An optional CD player employs anti-skip technology and can even play MP3 CDs.

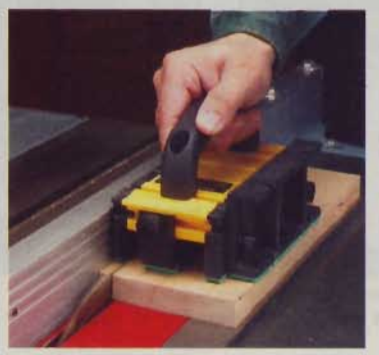
Side 2 — Four GFCI outlets mean that when the Power Box is plugged into an electrical source, it becomes a hub for plugging in other tools.

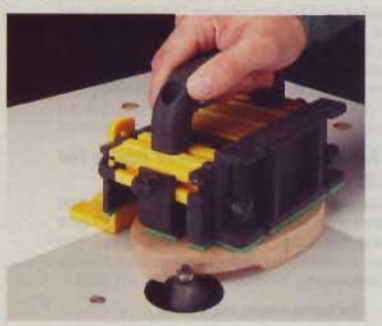
Side 3 — A freshly charged battery for cordless tools is on hand in the charger bay. With a battery in the bay, it provides power for the radio/CD.

Side 4 — A 12-volt outlet is perfect for cell phone chargers, and you can plug devices like MP3 players into an audio-input jack located here.

The Power Box sells for about $150 ($180 for a unit with a CD player). See it at www.BoschTools.com

► All four sides of the Power Box offer functionality: a radio/CD player, a bay for charging batteries, four AC power outlets, a 12-volt outlet, and an audio-input jack for MP3 players.





▲ Cutting thin strips *(top)* or routing irregular-shaped pieces *(bottom)* is easier and safer with the Grr-Ripper.

save your fingers GET A Grr-Ripper

At first I thought $60 was a lot to pay for what looks like just a fancy push block. After using the Grr-Ripper, however, I realized that it's much more than that.

It's a highly adjustable safety tool that can save time, materials, and most importantly, your fingers. Non-slip pads on the bottom surfaces of the tool grip onto workpieces as you make a cut. The Grr-Ripper comes in especially handy when you are cutting thin strips on a table saw or routing an irregularly shaped piece.

In many situations where cuts seem too difficult or dangerous to make, the Grr-Ripper's stable pushing advantage can help.

The optional outrigger also is adjustable and adds even more stability during difficult cuts. Additionally, the large, ergonomic handle makes the Grr-Ripper easy to control.

To buy the Grr-Ripper, or for more information, visit www.MicroJig.com or www.ForrestBlades.com

◄ Grooved, non-slip pads adjust up and down and left and right, allowing the Grr-Ripper to, well, grip workpieces for all types of cuts.

the love of building IN MINIATURE

In the woodworking world, there are models, and there are *models*. Tom Whalley's miniature creations are precise to the last detail — and even the lug nuts are made of wood.

Tom Whalley's most important woodworking tool is a micrometer. This is a testament to the precision and patience with which this Iowa native builds his wood re-creations.

Starting Small — A woodworker for over 30 years, Tom first decided to build small after attending the Iowa State Fair in 2002. The wood models on display that year motivated him to create his own — but to more exacting standards. The result was the Peterbilt truck and Cottrell car carrier shown on page 96.

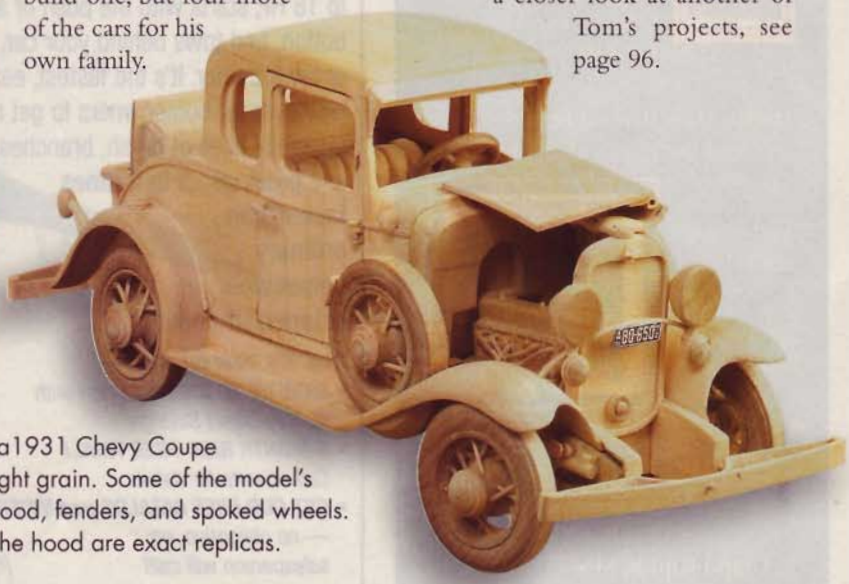
'31 Chevy — A friend of Tom's father-in-law was so impressed by the model that he issued Tom his second challenge — to make his vintage 1931 Chevrolet Coupe from wood. Tom decided not only to build one, but four more of the cars for his own family.

Maple Models — Tom builds his miniature replicas from maple hardwood because of its tight grain. He leaves the wood unfinished, so the parts will move properly. Not a single wire makes its way into the models — they're made entirely from wood.

Tiny Tools — Many of the parts of Tom's models are so small, in fact, that he has to invent his own tools in order to shape them. One example of this is the homemade lathe tool Tom used to turn the inside of the Chevy's wheels *(Photos, left)*.

Other challenges of the Chevy include the hood and fenders, which were cut incredibly thin and then steamed and bent to shape. Even the wheel spokes are individual wood dowels (that Tom made himself) mounted at just the right angle. For a closer look at another of Tom's projects, see page 96.

► Every part of Tom Whalley's models — from the hinge pins to the wheel spokes to the spark plug wires — are constructed entirely of wood. Some of the pieces are so small that Tom has to make his own tools in order to duplicate the parts. Such was the case with the wheels of this 1931 Chevrolet Coupe, which are too small to turn with a standard lathe tool. To solve the problem, Tom ground down an Allen wrench and attached it to a wood block to make his own lathe tool.



► Tom constructed this model of a1931 Chevy Coupe from maple because he likes its tight grain. Some of the model's highlights include its steam-bent hood, fenders, and spoked wheels. Even the spark plug wires under the hood are exact replicas.

an eighteen-wheel MASTERPIECE

Tom Whalley is not a trucker, and neither is anyone in his family. But ever since he was a young man, Tom has always wanted to build a car carrier — those trailers that you see behind semi trucks hauling eight or nine cars down the road.

Keep on Truckin' — A trip to the Iowa State Fair inspired Tom to begin work on this model. Before long, he was spending more time at truck stops than at home. After 400 photographs and 1,200 hours in the shop, Tom's model Peterbilt 379 truck and Cottrell Model C-14 trailer were ready to hit the road.

Precision in Wood — As with the 1931 Chevy Coupes Tom constructed, each and every detail of this car carrier is built precisely to scale — 1" on Tom's truck equals 18" on the real truck. And every part is made exclusively from maple hardwood.

Design Details — Perhaps as interesting as the precision of Tom's model is how well all the parts work. The doors open, the mirrors adjust, and the front wheels turn *(Photos, right)*. The hydraulic cylinders that enable the loading of multiple vehicles all function on Tom's trailer as well *(Photo, left)*. Tom drilled holes in dowels to accept smaller dowels in order to duplicate the sliding action of the cylinders.

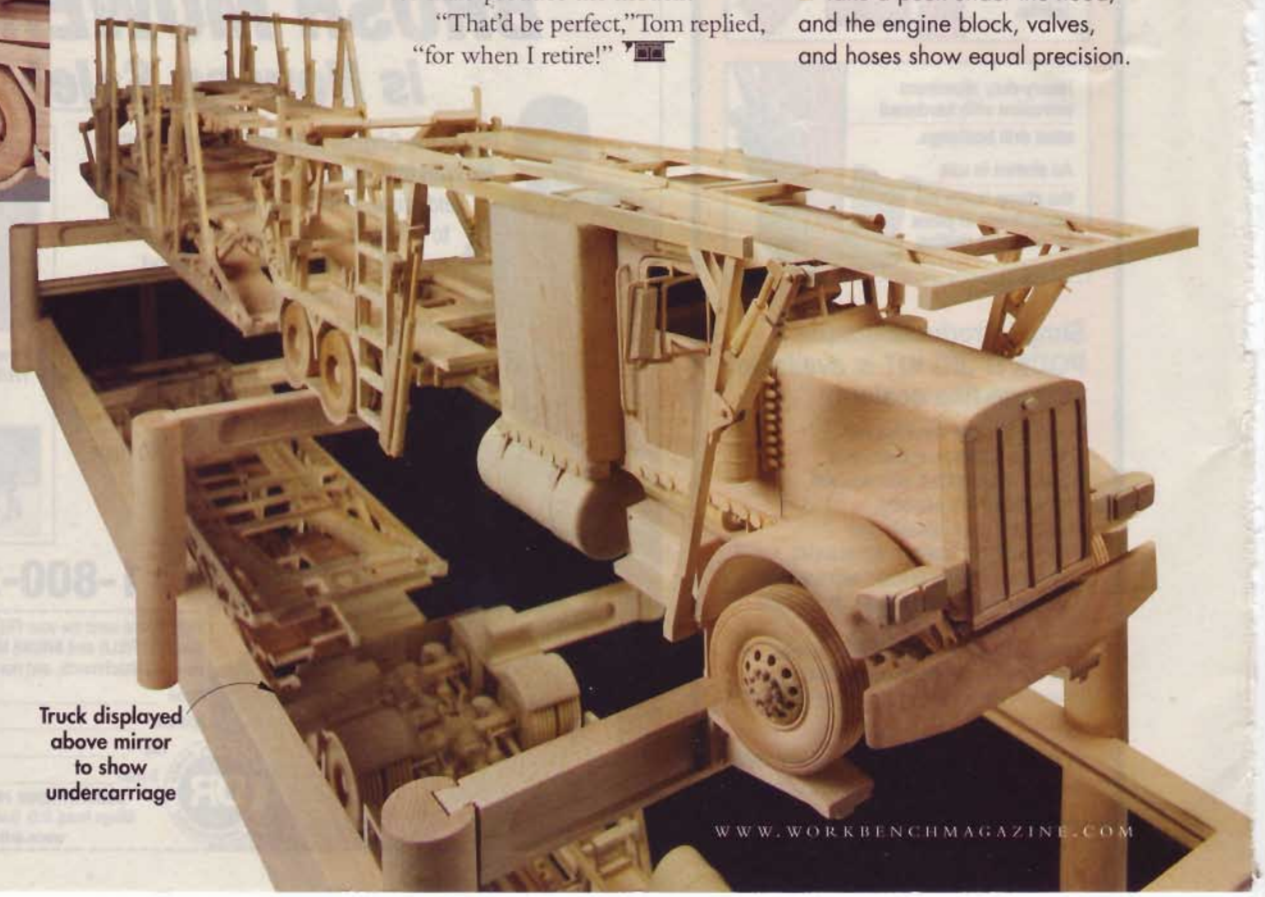
Tom displayed his model at the Trucker's Jamboree in Walcott, Iowa. Soon afterward, he received a call from the national sales manager of Cottrell, Inc., asking him if he'd like to mass-produce the models.

"That'd be perfect," Tom replied, "for when I retire!"

▲ A look inside the cab shows the devotion to detail. Note the pedals and turned steering wheel.

▲ Take a peek under the hood, and the engine block, valves, and hoses show equal precision.

▲ On a real car carrier, hydraulic cylinders move racks up and down so cars can be loaded on both levels. Tom re-created this action by inserting dowels that slide within other dowels. Wood locks also snap into holes to hold the racks in place.



Truck displayed above mirror to show undercarriage