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**SPACE-SAVING MURPHY BED & DISPLAY CABINETS**

# WORKBENCH®

WOODWORKING TO IMPROVE YOUR HOME®

June 2005

# Outdoor Kitchen

**5 Easy-To-Build Projects!**

WORKBENCH VOL 61 NO 3 ISSUE #398

• OUTDOOR KITCHEN: 5 EASY-TO-BUILD PROJECTS • 10" SLIDING COMPOUND MITER SAWS • MURPHY BED & DISPLAY CABINETS • DOWNDRAFT SANDING TABLE • BUYING LUMBER

JUNE 2005

# EDITOR'S NOTES

WORKBENCH
VOLUME 61 NO. 3 ISSUE #289

Build it, and they will come. Those were the mysterious whisperings that drove a farmer in a popular movie to build a baseball diamond in the middle of his cornfield. And sure enough, the ghosts of baseball greats actually emerged from the cornfield on opening day.

I've got a hunch that building the outdoor kitchen featured in this issue will have a similar effect. Now, don't count on Shoeless Joe Jackson making an appearance. But you can bet it will be a magnet for friends and neighbors. With a gourmet grilling center, a food prep and serving bar, and a tall cafe table and chairs, it's ideal for entertaining outside.

More importantly, this outdoor kitchen has all the conveniences you're accustomed to when cooking inside — a built-in gas grill, a refrigerator, and yes, even the kitchen sink. In short, it has all the amenities you need so you can attend to the cooking without missing the party.

**Online Shop Planner** — In the April 2005 issue of *Workbench*, we ran an article that provided practical tips for selecting tools and arranging them in your shop. To simplify that process, we've added a new interactive Shop Planner to our website. You simply size the floor plan of this virtual shop to match your own space. Then "drag" tools from the tool library over to the shop. Once you get the tools positioned right where you want them, print the plan and take it to your shop. It's quick and easy, and it sure beats dragging heavy tools across the floor. I'm sure you'll find our latest "tool" helpful in setting up shop.


*Try out our new Shop Planner at*
*WorkbenchMagazine.com*

Tim



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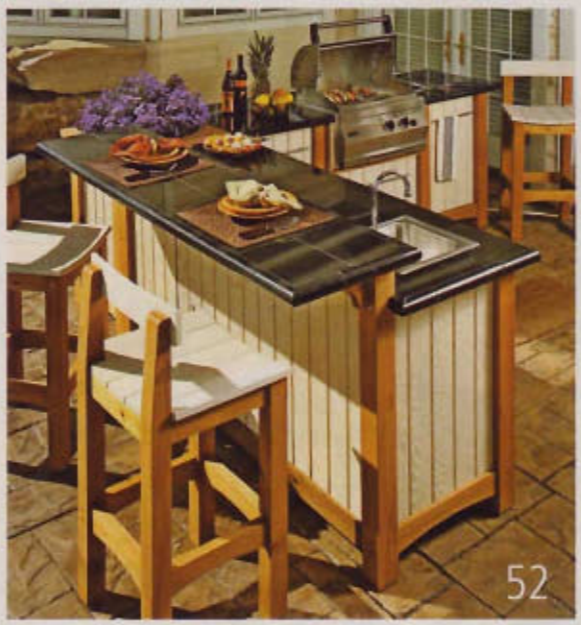
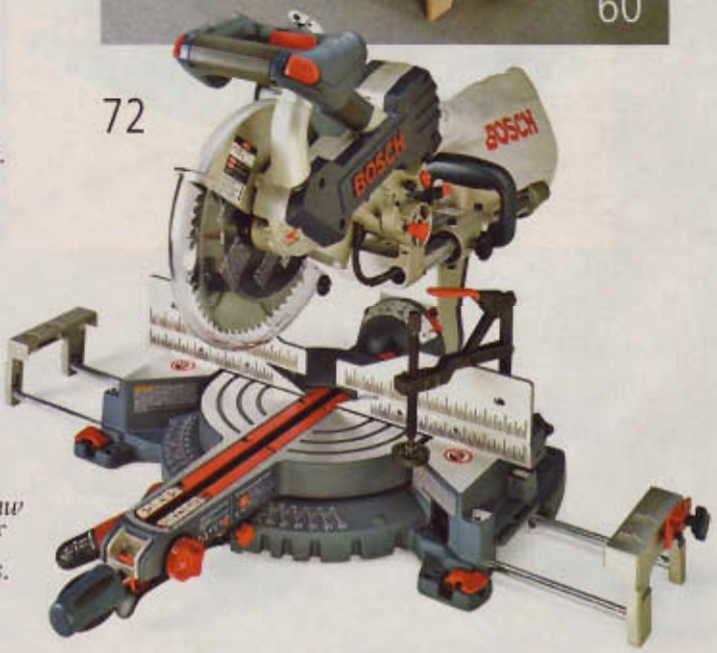
# CONTENTS

WORKBENCH® June 2005

## FEATURES









CONTENTS



# IN EVERY ISSUE







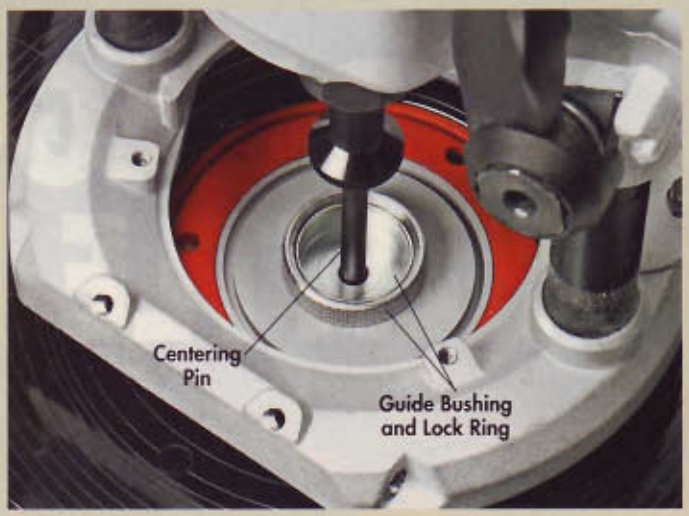

DEPARTMENTS

# Questions & ANSWERS

## fast, easy, & accurate ROUTER TABLE SETUP

**Q** *I'm setting up a router table, and I've been told to mount the router so the bit is exactly centered on the opening in the table insert plate. Is there an easy way?*

*Tim Rogers*
*San Diego, CA*




▲ A centering pin and guide bushing are all you need to accurately mount your router to a table insert plate. Both are available from woodworking suppliers like Rockler.com.

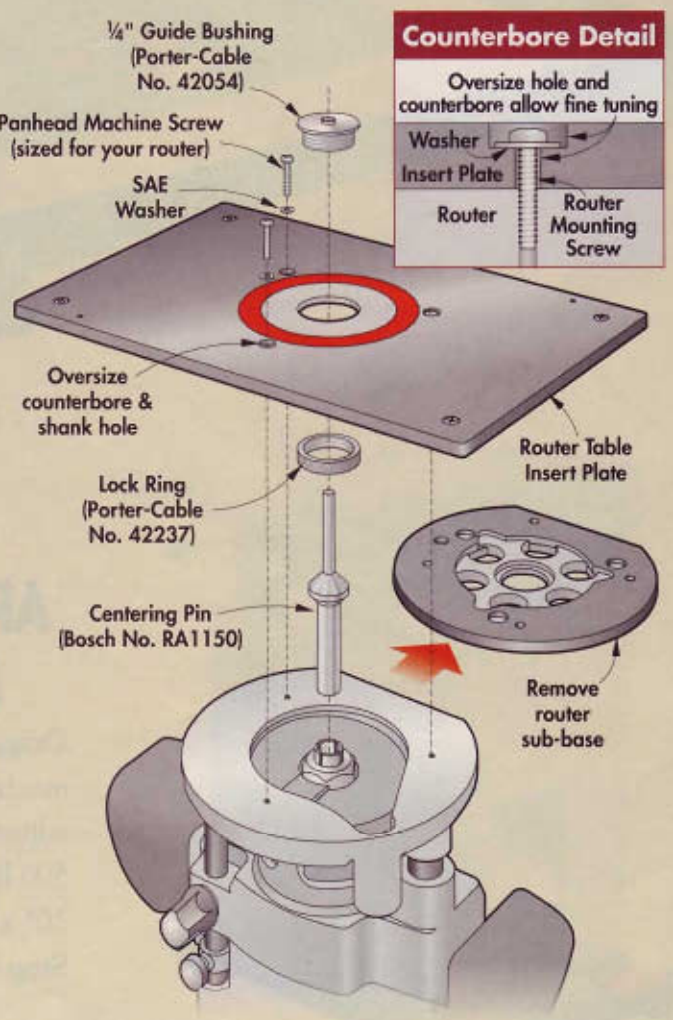
**A** The main reason to center the router exactly is to ensure consistent results when you use a guide bushing, which many insert plates are designed to accept. If your router table insert plate didn't come pre-drilled, here's a simple way to do it accurately using a $^1/_4$" guide bushing with a lock ring and a centering pin *(Photo and Illustration, right)*.

Start by removing the sub-base from your router. Then chuck the centering pin in the collet, and install the guide bushing in the plate. Now place the router on the underside of the plate, as shown, so the centering pin protrudes through the guide bushing. Carefully trace around the router base. (Put tape on the insert plate if markings are difficult to see.) Next, align the router sub-base on the plate (bottom face against the plate), so it's aligned with the traced outline. Then transfer the mounting hole locations to the plate.

This mounting technique, by the way, may require new mounting screws for your router. You need *panhead* screws long enough to reach through the plate, and matching SAE washers.

**Drill & Counterbore** — Using the marked locations as a guide, drill $^1/_{16}$" pilot holes through the insert plate at the marked locations. Make sure these are centered in the mounting-hole openings. Then flip the plate over and bore shallow, oversize counterbores in the top face, using the pilot holes to guide the bit. With that done, you can enlarge the pilot holes to create oversize shank holes for the router mounting screws *(Detail Illustration)*. These allow you to fine-tune the router position.

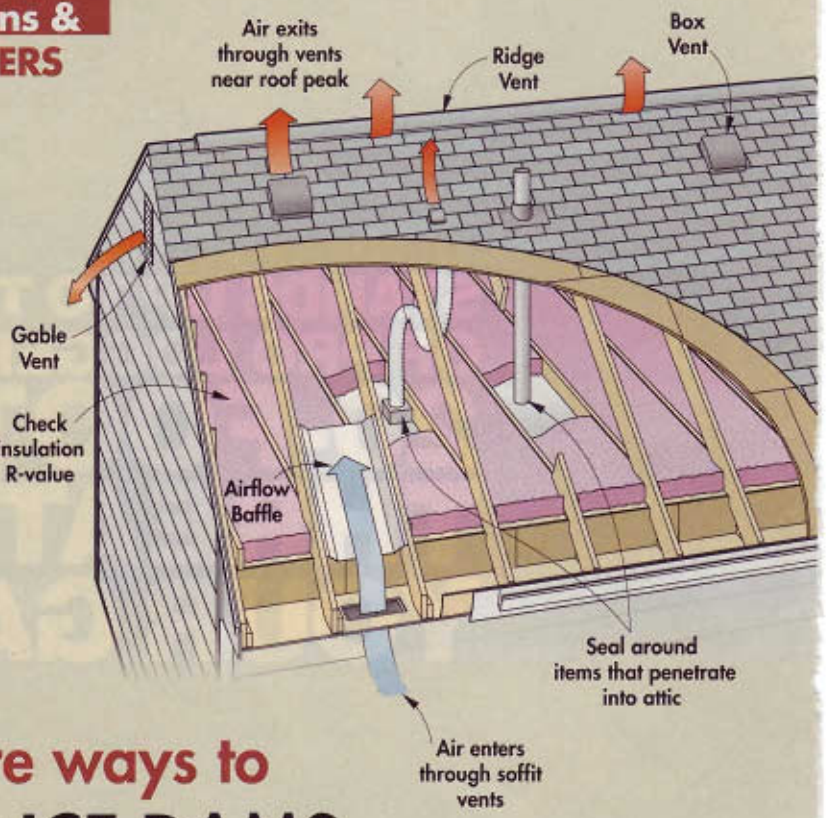
**Mount the Router** — After you drill all the holes, you can mount the router, again using the pin and bushing as guides. First, loosely thread in the mounting screws. Position the router exactly where you want it, and then fully tighten the screws.




## GOT QUESTIONS? WE HAVE ANSWERS!

*Include full name, address, and daytime phone number. You'll receive one of our handsome* ***Workbench*** *caps if we publish your question.*

**HOW TO SEND YOUR QUESTIONS:**
**Email:** Q&A @workbenchmag.com
**Forums:** forums.woodnet.net
**Mail:** Workbench Q&A, 2200 Grand Ave., Des Moines, IA 50312




# surefire ways to STOP ICE DAMS

**Q** *Last winter, large ice dams formed on my roof. What can I do to prevent them from forming again next winter?*

*Steve Asher*
*Rapid City, SD*

**A** Usually, ice dams are caused by warm, moist air heating up the underside of the roof. This causes the snow to melt, run down to the edge of the roof, and freeze. As water backs up behind the ice dam, it can get under the shingles, leak into the home, and cause damage to walls and ceilings.

To prevent ice dams, you need to keep the underside of the roof cool by stopping warm air from getting to it. And you need adequate insulation and ventilation.

**Seal Interior Gaps** — The first thing to look for is any areas where warm air from inside the house can escape into the attic. The *Illustration* above shows common sources for warm-air leaks, such as bathroom and kitchen fans, plumbing vent stacks, and recessed "can" lights. Seal around these items to stop air leakage.

By the way, always duct bath and kitchen fans to the outside. Exhausting them into the attic allows warm, moist air to get in.

**Insulate the Attic** — Next, check to see there's enough insulation. To find the R-value for your area, check with a home center or an insulation manufacturer, such as Johns-Manville (jm.com/insulation). You can add batt insulation or blow it in.

**Establish Airflow** — The final step involves making sure you have adequate ventilation. This will keep the underside of the roof cool, but it won't affect living spaces if you've sealed and insulated well.

When installing vents, place half at the bottom of the roof in the soffits or the eaves and the other half near the top. Several types of vents exist *(Illustration)*.

**Note:** Building codes dictate how many vents you'll need. And standards are different in areas prone to forest fires. Check with your building inspector to determine the standards in your area.

Regardless of the type or number of vents, make sure they aren't blocked by insulation. Install baffles to prevent obstructions to airflow.

# pros & cons of PUCK LIGHTS

**Q** *I've seen under-cabinet "puck" lights in both 12-volt and 120-volt versions. What are the differences, and which should I choose?*

*Jim Burke*
*Nashua, NH*

**A** Low- and full-voltage puck lights are similar and can be used in the same applications. The main difference between the two types lies in how they're wired.

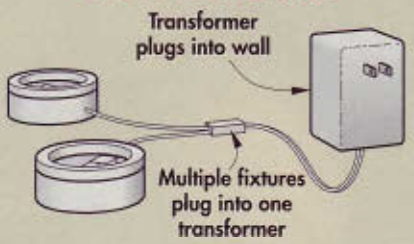
Low-voltage pucks are connected to a transformer that plugs into an outlet and steps the power down to 12 volts. One transformer can power several lights (usually about three) that simply plug into the transformer. This makes low-voltage lights easy to hook up, even if you don't have wiring experience.

On the downside, the only easy way to turn low-voltage pucks on and off is to use an in-line switch. To control the lights using a standard wall switch, you'd have to wire in a switched outlet for the transformer.

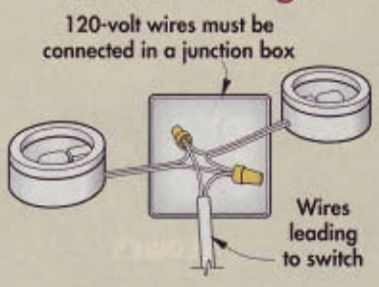
Full-voltage pucks run on standard household power, meaning they can be plugged directly into an outlet. But the downside here is that each has to be plugged in individually. And, if you're using multiple lights, each will need its own in-line switch.

To avoid this, you can also wire full-voltage pucks to one another like any other built-in fixture. That lets you control them all using a wall-mounted switch. But it means the wiring gets more complicated. You'll have to run wires through the walls or cabinets and connect everything together inside junction boxes *(Illustration)*.

**12-volt Puck Light**




**120-volt Puck Light**



# Tips & techniques

## replaceable inserts SAVE SAWHORSES

▲ These stackable sawhorses don't require a big stable for storage *(left)*. And when they get chewed up, don't put them out to pasture — just replace the insert instead.

In one regard, these sawhorses are like any others — they get chewed up with use. What's different about them is they have a replaceable insert made from 2x stock. Once this insert gets riddled with saw kerfs, you simply replace it with a new one *(Photo, left)*.

These sawhorses aren't just one-trick ponies, either. In order to save floor space, they stack together when it's time to "stable" the horses *(Inset Photo)*.

To form an opening for the insert, the top of each sawhorse consists of two rails made of $^3/_4$"-thick stock with a 2x spacer sandwiched between. The rails are notched to make a socket for the legs to fit into. After cutting these notches, glue and clamp the rails and spacer together.

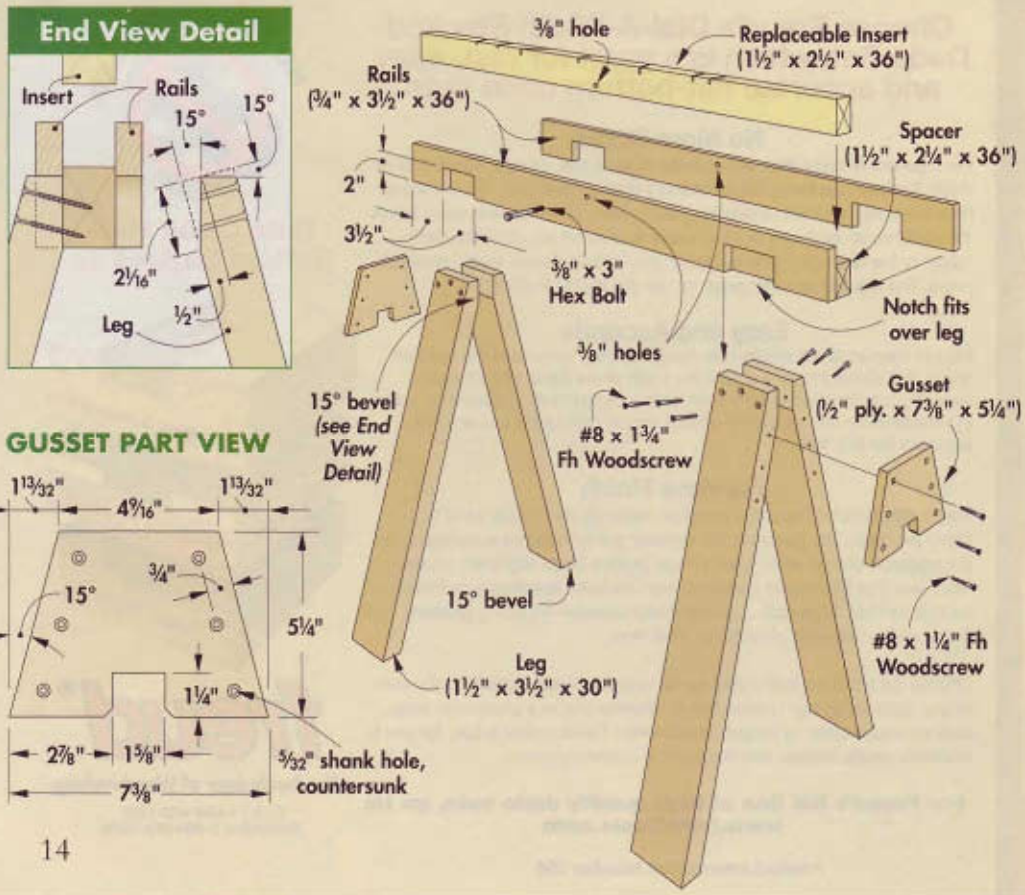
As for the insert, just cut it to size from 2x stock. It's held in place by a bolt that passes through a hole drilled in the rails and insert.

The sawhorses are supported by splayed 2x4 legs that nest in the sockets in the rails. To make them sit flat, you'll need to cut a long bevel at the top end of each leg *(End View)*. An easy way to do this is to use a hand saw (or band saw) and then sand the surface smooth.

Before attaching the legs, there's one more thing to do. That's to cut a bevel on both ends of each leg so the sawhorses will sit flat on the floor. After making the bevel cuts with a circular saw or miter saw, glue and screw the legs in place.

To prevent the sawhorses from racking, I attached a $^1/_2$" plywood gusset to each end. Notch the bottom edge of this gusset to allow the sawhorses to stack together. Then glue and screw the gussets to the legs.

*Robert Wirges*
*Benton, AR*




## WIN $300

*For sending us this feature tip, Robert Wirges wins a case of caulk from Polyseamseal and $300!*


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

**Email:** Tips@workbenchmag.com

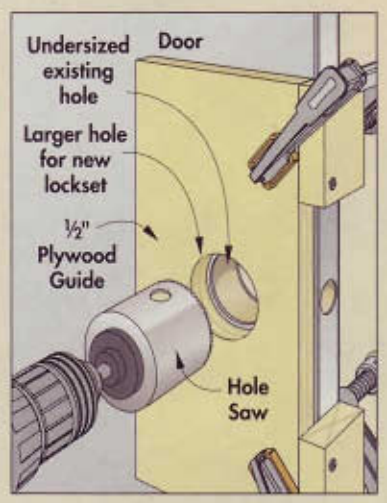
# use a simple guide to ENLARGE LOCKSET HOLE

When I need to enlarge a hole in a door for a new lockset (say, from $2^{1}/_{8}$" to $2^{3}/_{8}$"), I use a shop-made guide and a standard hole saw.

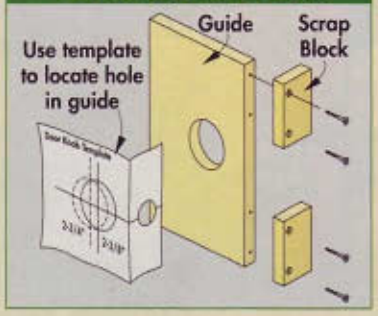
The guide is a scrap piece of $^{1}/_{2}$" plywood with a hole that's sized to accommodate the lockset. Use the paper template that comes with the lockset to locate the hole in the guide *(Guide Layout Detail)*.

After cutting the hole with a hole saw, align the guide on the door. (I attach scrap blocks to the guide to register it flush with the edge.) Now clamp the guide in place, and use the same hole saw to enlarge the opening in the door. The guide keeps the hole saw straight, ensuring an accurate cut.

*Glenn MacRill*
*Houston, TX*




**Guide Layout Detail**




CLASSIC TIP

# build an I-beam for DRILLING SMALL PIECES

Drilling holes in small pieces on a drill press can be tricky. They're difficult to clamp, and they often spin around when you hold them with your hand.

This shop-made "I-beam" solves that problem. The top of the beam provides a handy clamping surface for small pieces *(Photo, left)*. And the bottom is used to secure the beam to the drill press table with carriage bolts and wing nuts.

The I-beam is a scrap 2x4 that fits into grooves in a plywood top and bottom. Drill holes in the bottom for the bolts, then glue the beam together.

*Ryan Johnson*
*Costa Mesa, CA*

# Quick Tips

## Staining Small Parts: A Dab of Hot Glue Will Do

Staining small parts like these mushroom-shaped screw hole buttons is a pain. They're hard to hold, and they usually get knocked over before the stain dries. To hold them in place, use a dab of hot glue to stick them onto a protective paper. Then just brush on the stain, let it dry, and remove the buttons.

*Richard Wegner*
*Joliet, IL*


## "Fixing" Your Roller Stand

To make my roller stand do double duty as a stock support, I use a threaded knob to stop the roller from spinning. The knob threads into a tapped hole in the support bracket and into a clearance hole in the roller.

*Yaniv Matza*
*Tamarac, FL*

## Scraper Beats Router When Trimming Edgebanding Flush

The heat-sensitive glue on iron-on edgebanding gums up router bearings and bits when trimming it flush. So I use a cabinet scraper instead to quickly remove excess glue and pare the edgebanding flush.

*John Havel*
*Wadsworth, OH*

# Finishing Fundamentals

## a weatherproof
# OUTDOOR FINISH

*Q I finished my solid oak front door with a couple coats of spar varnish, but the finish began to peel and fade in less than a year. How can I remove this failed finish? And what finish would you recommend to prevent this from happening again?*

*Tim Browning*
*Pella, IA*


▲ To get the longest-lasting exterior finish, I chose a high-solids alkyd finish from Sikkens. It can withstand three to four years of exposure to harsh weather without needing another coat.

A One of the most durable finishes you can use for an exterior door is a high-solids alkyd finish. This type of finish is more flexible than spar varnish, so it moves with the wood as it expands and contracts rather than flaking or chipping off. To learn more about applying an alkyd finish, see page 20.

**Surface Preparation** — Although it's extremely durable, an alkyd finish won't last without proper surface preparation. That starts with scraping as much of the old finish from the door as possible. Carbide-tipped scrapers do an effective job of removing finish without gouging the wood *(Fig. 1)*. A detail scraper works good for corners.

Once you've scraped off as much of the finish as possible, the next step is to sand with 60-grit sandpaper. Most of the sanding can be handled with a random-orbit sander *(Fig. 2)*, but a sanding block helps in the edges and corners.

**Weather Marks** — Even after sanding, the door may have gray streaks from weathering. What I found worked best for removing these was a two-part Teak Cleaner and Brightener system that I purchased from a marine supply company.

Before you use Teak Cleaner, you'll want to take a few precautions. First, test the cleaner on an inconspicuous area to make sure it will be effective without doing damage to the wood. Also, the cleaner is okay to use on a tight-grained hardwood like your oak door, but you wouldn't want to use it on a softwood such as cedar, as it could damage the fibers. For cedar and other softwoods, try a different wood cleaner, such as oxalic acid (also known as wood bleach) or Trisodium Phosphate (TSP) *(see Product Guide, page 20)*.

With these precautions in mind, brush the cleaner on with a foam brush, and scrub it into the pores with a plastic bristle brush *(Fig. 3)*. Then use a sponge and several water rinses to remove the cleaner. The Teak Cleaner darkens the wood, so follow up with the Teak Brightener to bring it back to its original color. Here again, brush the brightener on, scrub it in *(Fig. 4)*, and then rinse it off several times with water.

After allowing the wood to dry for three days, follow up with another round of sanding with 100-grit and then 150-grit sandpaper to smooth the wood. Then you're ready to apply the finish *(page 20)*.


▲ For quick removal, use carbide scrapers to remove as much of the finish as possible *(see Sources, page 20)*.


▲ After scraping, remove the rest of the finish from the wood by using 60-grit sandpaper on a random-orbit sander.


▲ To remove the gray weather marks, scrub on a 20-percent solution of Teak Cleaner and water, and then rinse.


▲ This Teak Cleaner darkens the wood, so I also scrubbed Teak Brightener into the wood to restore the natural color.

# Finishing Fundamentals

## tips for applying
# AN ALKYD FINISH

Outdoor projects have a lot of enemies, like extremes of temperature and changing humidity levels. As a result, wood expands and contracts more outdoors than indoors, causing the finish to lose its bond. And sunlight further contributes to finish losing its grip on wood, as well as causing it to fade.

**The Sikkens Solution** — One finish that's specially formulated to handle all these challenges is Cetol Door & Window, which is manufactured by the Sikkens Company. It's available in four colors, along with satin and gloss clear finishes, for around $20 a quart.

As I mentioned earlier, this finish is a high-solids alkyd resin finish. This formulation is flexible, so it moves with wood as it expands and contracts. And the finish also has iron oxide pigments that block UV rays. (These rays make a finish lose its bond with wood.) The result is a durable finish that can last three to four years without any need of refinishing.

These iron oxide pigments make the finish look a good deal darker than spar varnish *(Photo, below left)*. Even so, you'll find that the clear alkyd finish has the appearance of a standard clear coat once applied.

On the other hand, each subsequent coat of colored finish will darken the wood more than the coat before. As a result, a combination of colored coats followed by clear coats is the best approach to getting the look you want from three coats of finish (the required number of coats). To make sure you get it right, try some test pieces first *(Photo, below right)*.

**Applying Finish** — As you start to apply this finish, you'll notice it's heavy-bodied, almost like a paint. This makes proper brushing technique very important. Put on an even coat with a natural-bristle brush, and hold your brush at a 45° angle to "tip off" the surface as you apply it *(Photo, above)*. Then, once you're satisfied with the look of the first coat, wait 24 hours between subsequent coats.

◀ Iron oxide pigments make an alkyd finish *(left)* darker than spar varnish *(right)*.

▲ Since Sikkens goes on thicker in some areas than others, use wide strokes at a 45° angle to "tip off" the finish.

### PRODUCTS WE USED

**SCRAPERS**
Bahco Carbide Scrapers
Rockler
800-279-4441; www.Rockler.com

**WOOD CLEANERS**
Teak Cleaner & Brightener
800-783-7507; www.NauticalEase.com

DAP Wood Bleach (Oxalic Acid)
888-327-8477; www.DAP.com

Savogran TSP & TSP-PF (Trisodium Phosphate & Phosphate-Free)
800-225-9872; www.Savogran.com

**SIKKENS FINISH**
Cetol Door & Window ("Natural" first coat & two "Clear Satin" top coats)
866-745-5367; www.Nam.Sikkens.com


▲ Three coats of alkyd finish are needed, and each coat of colored finish darkens wood more than the coat before. It's best to use a colored finish first, followed with clear finish on top. Use test pieces to achieve a color combination you like.

▲ This sanding table houses a blower and pleated filters that "scrub" the dust from the air as you sand. And the table doubles as a shop air cleaner.

▼ The table also makes a handy tool platform. Here short "feet" on the tool base extend only into the mat, providing a vibration-free mount.

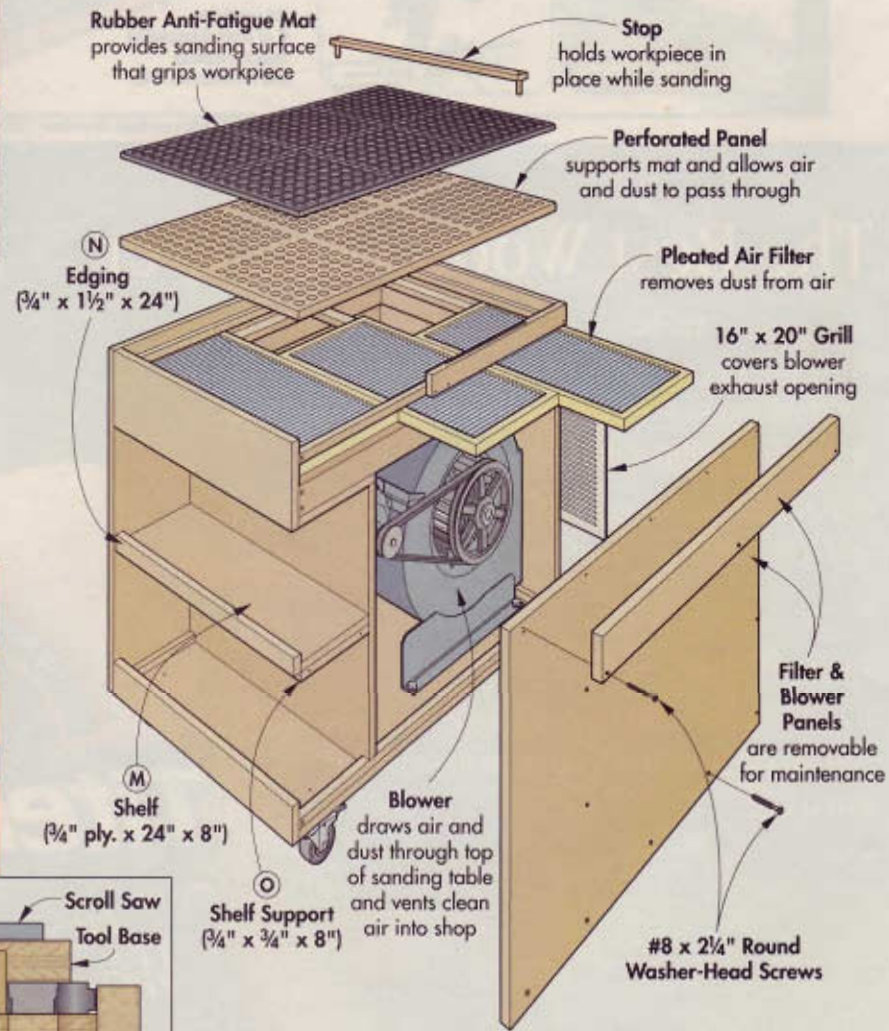

# dust-free downdraft SANDING TABLE

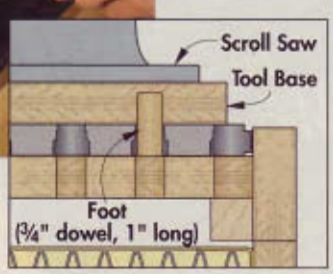
One of the best solutions I've seen to controlling dust in a shop is this downdraft sanding table. Based on a project idea sent to us by Peter Dulak of Red Wing, Minnesota, it captures the fine dust produced by a sander. Plus, it's a great air cleaner — even when you're not sanding a project.

The table houses a blower that draws air through a system of pleated filters *(see Illustration below)*. These filters remove the dust from the air, which is then exhausted to the shop.

For this particular downdraft table, we purchased a new blower. However, a blower salvaged from an old furnace would also work well. As for the sanding surface, a rubber anti-fatigue mat (used as under-foot padding on concrete floors) provides a surface that grips the workpiece and keeps it from slipping. The mat is supported by a perforated sheet of plywood that allows air to pass through.

**Case Construction** — The case of this sanding table is contructed of ¾" plywood panels. The dimensions of the panels shown here are for our blower and 12" x 24" filters. You'll want to have your blower and filters



on hand before building the case, and adjust dimensions accordingly.

Begin construction by cutting the bottom panel (A) and the large end panel (B) to size *(see Case Assembly, below)*. To allow air to exhaust from the case, this end panel has an opening that's sized to match the blower outlet. It's best to mount your blower to accurately mark this opening, as shown at right. Then drill a clearance hole in each corner of the opening, and cut it with a jig saw.

The end of the case opposite the blower outlet serves as a storage area for sanders and sanding supplies. So instead of a large end panel, it has two narrower rails (C, D) that tie the sides of the case together at this end.

After cutting the end rails to size, you can focus on the sides of the case. One side is enclosed with a large fixed panel (E). On the opposite side, a removable blower panel (F) and filter panel (G) provide access for maintenance. A small upper panel (H) completes the enclosure on this side.

There's one more thing to do before assembly. To create a solid mounting surface for the panels, screw four wood cleats (I, J) around the perimeter of the bottom. Then just screw the case together. **Note:** Use washer-head screws to install the two removable panels to make it easy to access the blower and filters.

At this point, the outer shell of the case is complete, with one exception — the "shelf" end is still open. This end is enclosed with two dividers (K, L) that are screwed together in an L-shaped assembly.

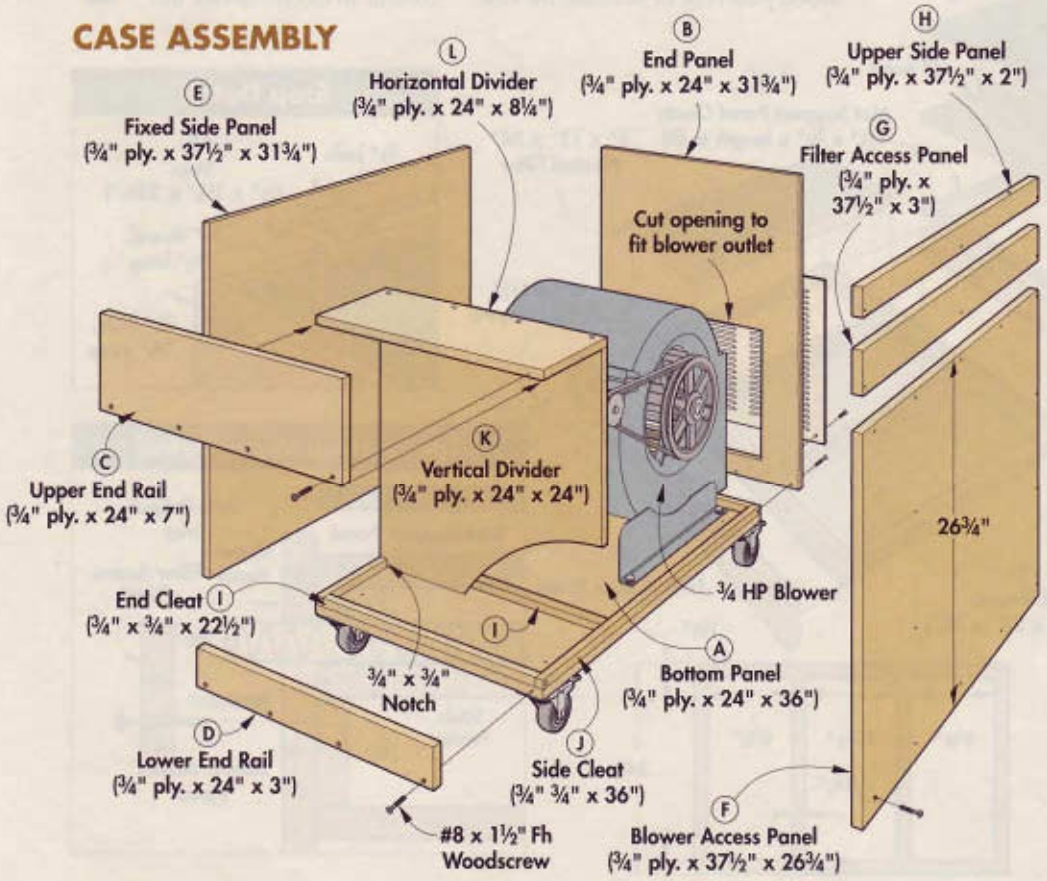
Before installing this assembly, you'll need to notch the lower corners of the vertical divider to fit over the cleats on the bottom panel. Then screw another cleat (I) to the bottom to create a mounting surface for the divider. Now slip the L-shaped assembly into place, and screw it to the inner cleat, fixed side panel, blower access panel, and upper end rail.

**Add a Shelf** — All that's needed to turn the end of the case into a handy storage area is to add a plywood shelf (M). A strip of hardwood edging (N) keeps items from falling off when you roll the sanding table around. After gluing on the edging, screw a pair of wood supports (O) to the side panel and blower access panel. Then fasten the shelf to the supports with screws.

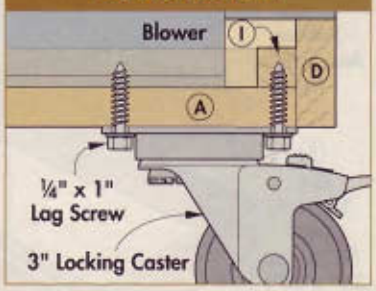
**Mount the Casters** — A set of four locking swivel casters make this sanding table mobile. Mount the casters with lag screws, as shown in the *Caster Detail*.

▲ With the blower bolted to the bottom panel, set the end panel in place and then mark around the blower outlet.

## CASE ASSEMBLY




### Caster Detail




### SOURCES

**GRAINGER**
800-323-0620
www.Grainger.com
¾ HP Blower (No. 70576)

**ROCKLER**
800-279-4441
www.Rockler.com
3" Locking Casters (No. 31870)

**LOWE'S**
www.Lowes.com
Goodacre 3' x 3' Anti-Fatigue Industrial Mat (No. 155419)

▲ A stop holds work in place when using a belt sander *(top)*. Remove the mat and panel to vacuum the filters *(left)*.

## A MULTI-LAYER TOP

The top of this table has to provide a sturdy platform for sanding, yet it also must allow a large quantity of air to pass through. To accomplish that, it's built up in layers. Notice in the *Top Assembly Illustration* that a rubber mat sits on a perforated plywood panel, which is supported by four cleats. The filters rest on a web frame, which also sits on cleats.

**Web Frame** — The first step is to make the web frame that supports the filters (P). It's a ¾" plywood panel with large openings cut in it for air to pass through *(Web Frame Part View)*. This forms "ribs" between the openings that keep the filters from sagging.

With the filter support panel complete, cut the cleats (Q, R) to size from ¾"-thick stock. Assemble the cleats as a frame, screw the frame to the case from inside, and then install the web frame.

**Mat Support** — The mat support panel (S) underlying the rubber pad is next. Here again, it's a ¾" plywood panel cut to fit inside the case. To allow air to flow through, you'll need to drill a bunch of holes that turn the panel into what looks like a giant piece of Swiss cheese.

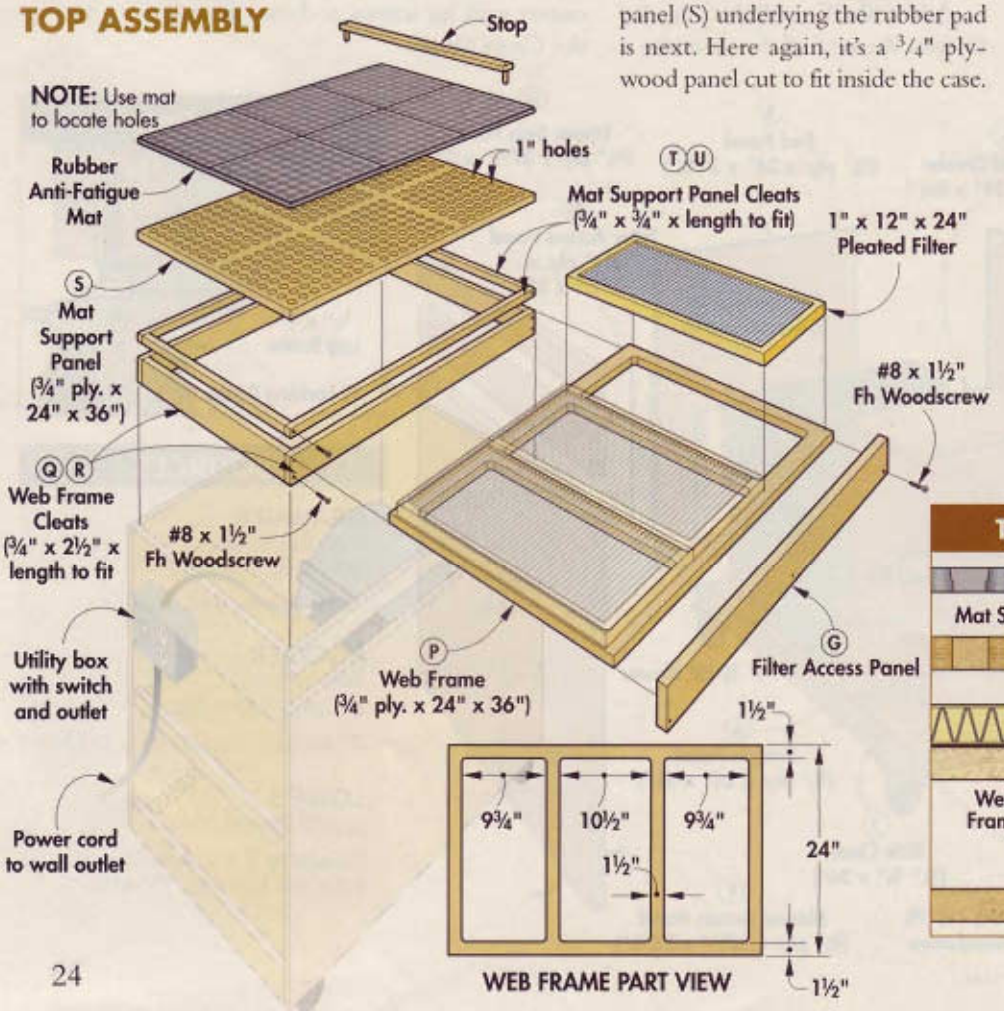
To do that, cut the mat to size, lay it on top of the panel, and mark the hole locations. (We bought a 36"-square mat and cut it to fit the case.) Drill the holes a bit larger than the holes in the mat. (A 1" spade bit works fine.) Also, use a backerboard to avoid splintering the back of the panel.

That done, cut the cleats (T, U) to size, screw them in place, and insert the perforated panel and mat.

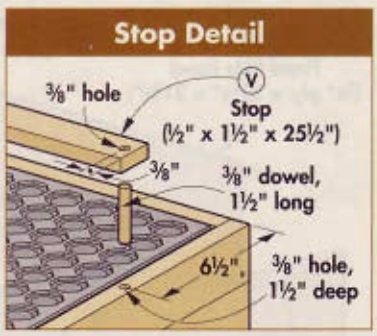
**Sanding Stop** — Next, to hold workpieces in place when using a belt sander, you'll want to add a stop (V) *(Stop Detail, below)*. It's a piece of ½"-thick stock with a couple of dowels that fit into holes drilled in the case.

**Install Switch** — Now all that's left is to install a switch. A utility box with both a switch and an outlet lets you plug in sanders, which makes for a handy setup. Depending on your experience, you may want to consult an electrician for this.

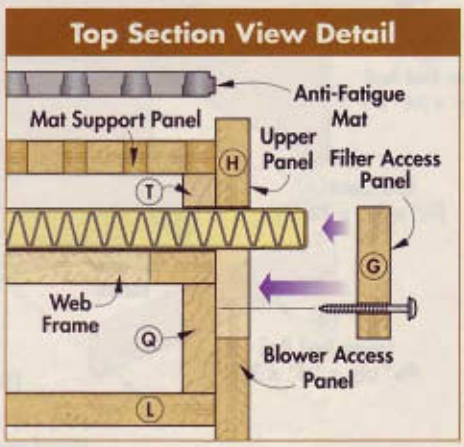
## TOP ASSEMBLY




### Stop Detail




### Top Section View Detail



▲ Machining thick stock (like this cedar post) to proper width and thickness is easy. Start by creating two flat faces on the jointer, and then plane it with the jointed face facing down.

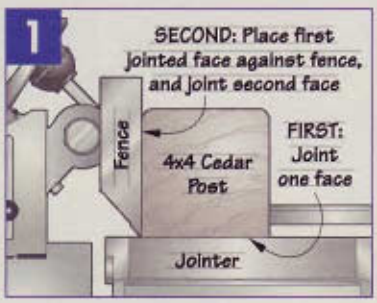
# flat, straight, & square — STOCK PREP SECRETS

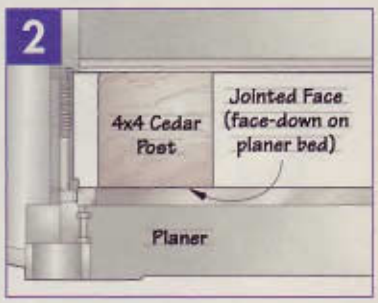
Jointing and planing stock before you build is always a good idea, even on already "square" pieces like the 4x4 cedar posts used in the outdoor kitchen projects *(page 40)*.

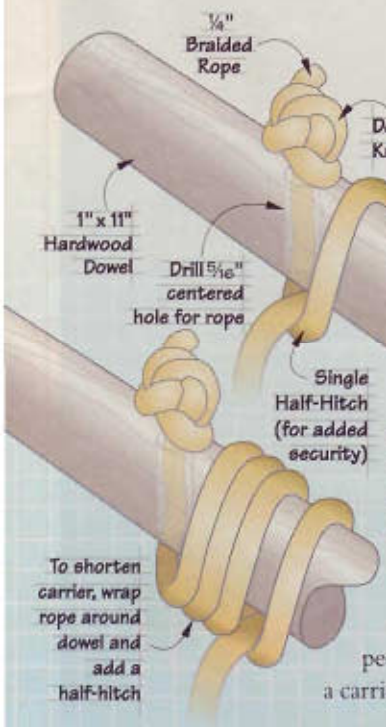
Not only do these tools produce straight faces that are square to each other, but they also clean up dings and scuffs and crisp up the corners of the dimensional cedar.

When machining these cedar posts, the first step is to create two flat, adjoining faces. In order to do this, start by making one face flat on the jointer. Then, simply turn the post 90°, set the jointed face against the fence, and joint the adjoining face *(Fig. 1)*.

Now you're ready to move to the planer. Place one of the jointed faces down on the planer bed, and make a pass. Then flip the piece 90° again to plane the adjoining face. Continue making passes through the planer this way until the pieces reach the desired width and thickness *(Fig. 2)*.




# heavy project CARRIERS

The outdoor kitchen projects *(page 40)* are heavy, and it's tempting to pick them up by the top to move them around. But lifting the projects this way could break the tile.

These carriers make moving the projects easy. Each one is a 2x4 connected to two dowel handles with ropes. For clearance, cut the 2x4 at least 12" longer than the project is wide, and secure the rope through holes in the 2x4 and dowels with double knots, as shown at left.

With the carrier under a project, two people can pick up an end *(Photo)*. And with a carrier under each end, four people can move it.

▲ These carriers make it easy to lift the outdoor kitchen projects *(page 40)*. The rope lengths are adjustable, so you can lift with a straight back.

TIPS FROM THE WORKBENCH SHOP

# working with BACKERBOARD

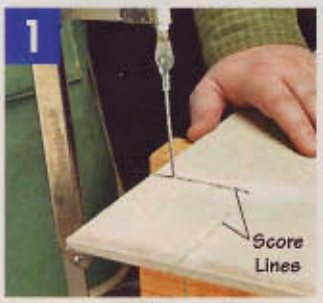

▲ To cut backerboard, first score it several times using a scoring blade guided by a straightedge. Then, snap it up toward the score line.

I used ¼"-thick backerboard (Hardibacker) as the underlayment for the tile countertops on the outdoor kitchen projects *(page 48)*. This fiber-cement sheet material is denser, cuts cleaner, and lays flatter than cementboard.

One thing to be aware of is that you don't want to use standard tools to machine backerboard, as it dulls blades incredibly fast. For a few dollars, you can pick up all the tools you'll need at your local hardware store.

To make a long, straight cut, the main tool that's required is a scoring blade. This is a hooked utility knife blade that fits in a fixed-blade utility knife. It's less likely to snap or dull than a standard blade. Use it to score the cutline, and then snap the backerboard as shown at left.

For smaller notches, a carbide-grit hacksaw blade comes in handy (I use a Stanley 15-410). Pliers and a file also help with this task *(Figs. 1-3)*. And for mounting backerboard, special backerboard screws are available that countersink flush with the surface *(Box, below)*.




▲ For a small notch, score both lines. Cut one line with a carbide-grit hacksaw blade.


▲ Pliers provide leverage as you snap the waste piece free to form the notch.


▲ A rasp makes quick work of smoothing the broken edge of the backerboard.

## FASTENERS


**For mounting backerboard, these backerboard screws (sometimes called fiber-cementboard screws) give you several advantages over standard screws. The screws have spurs that drill a pilot hole, and they also drill their own countersink so the head is flush with the surface. They are available at most home centers.**

## POWER TOOL CUTTING OPTIONS

**If you'd prefer to machine backerboard with power tools, there are several blades designed for the task.**

**For straight cuts, a diamond-grit circular saw blade fills the bill *(right)*. This Hitachi model costs about $50. For curved cuts and notches, you can get carbide-grit blades for a jig saw in several shapes and sizes *(below)*. Be aware that this material kicks up a lot of dust, so machine it outside, and wear a respirator.**


▲ For fast, straight cuts in backerboard, this diamond-grit circular saw blade has only four carbide teeth that produce minimal dust.

These carbide-grit ► jig saw blades stay sharper longer while making curved cuts in backerboard.

BENCH BASICS
FUNDAMENTAL SKILLS FOR BETTER WOODWORKING

# A GUIDE TO SELECTING & BUYING LUMBER

Learn the tips and tricks for buying hardwood to ensure that you'll get the best lumber possible for all of your projects.

To build great-looking projects, you need good wood. That seems simple enough. So when I was a beginning woodworker, I would purchase premium-priced boards from the lumberyard. But my projects would never look like the ones in the magazine, even though I'd built them carefully.

Eventually, I realized the difference was in the wood. That meant good-quality lumber alone wasn't enough. To get *great* results, I needed to find the absolute *best boards* for the specific project at hand.

Here, we'll help you understand how to evaluate boards based on their type, grain, color, and defects. Be prepared to spend some time sorting through stacks of lumber to do this.

And be aware that lumber is an inconsistent material. As a result, you'll need to buy about 25 percent extra to allow for defects, waste, and the occasional "oops."

Of course, buying extra lumber adds cost, and good wood can be expensive. But we have some great tips on page 38 that will help you save money when you buy boards.

## SOFTWOODS & HARDWOODS — KNOW THE DIFFERENCES

**SOFTWOOD LUMBER**

Softwood boards are usually milled to standard sizes (such as 2x4 or 1x6), so all boards of the same species and size are priced equally.

**HARDWOOD LUMBER**

Hardwood boards are milled in random widths and lengths, so boards of the same species often have different prices.

The first thing you need to understand about wood is that there are two distinct types: softwood and hardwood. Surprisingly, this distinction doesn't mean that all softwoods are soft and hardwoods hard.

For woodworkers, the most important difference between softwoods and hardwoods lies in how each type is milled and sold.

Most of the time, softwoods are cut into boards with standard sizes and sold as "dimensional" lumber *(Photo, left)*. This produces waste as the boards are trimmed to size. But softwoods grow relatively quickly and yield an abundant supply of wood.

Hardwood trees take longer to reach harvestable size. Because of this, hardwood logs are milled to produce the maximum number of boards with minimal waste. That explains why hardwoods are sold in random widths and lengths *(Photo, below left)*.

As for thickness, softwoods are standardized and expressed in inches. Hardwoods are milled to standard thicknesses, but even this measurement is expressed differently.

Hardwood measurements are expressed in quarters of an inch, or just "quarters." So, a 1"-thick board is said to be "four quarters," shown as "4/4." A $1\frac{1}{2}$" board is "6/4," and so on. This measurement refers to the rough-milled thickness. When planed smooth, as most boards are, the board is $\frac{1}{8}$" to $\frac{3}{16}$" thinner.

## APPEARANCE DEPENDS ON
# HOW YOU SLICE IT

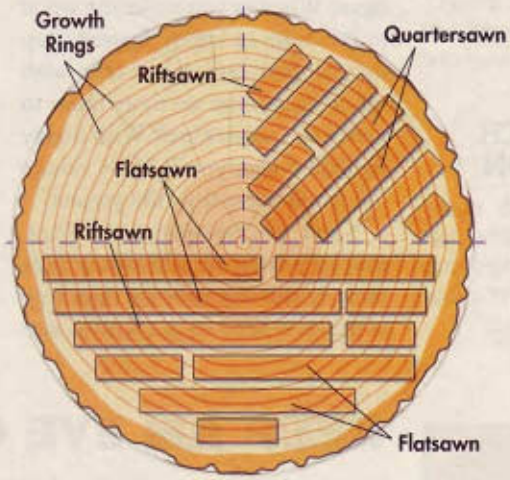
When a log gets milled into boards, the blade cuts through the growth rings *(Art, below right)*. The angle at which these rings are cut determines the appearance of the grain on the face of the board *(Photos, right)*.

The top board was "flatsawn" one slice after another. Look closely at this board's end grain, and you'll see that the growth rings run almost parallel to the face of the board. On the face, you see the telltale wavy grain that results.

The middle board was "quartersawn," meaning the log first gets cut into quarters and then sliced so that the end grain runs perpendicular to the board's face. This results in straight face grain. In some woods, such as oak, quartersawing produces "ray fleck" figure.

Quartersawn wood is almost always sold separately from flatsawn and priced higher. But some flatsawn boards will have quartered grain, depending on where in the log the board came from.

The bottom board is "riftsawn." Here, the end grain runs not parallel or perpendicular to the face, but between. The face grain is still straight but lacks the flecks. Riftsawn stock may be sold separately or, more typically, mixed in with flatsawn.





# HOW TO MEASURE HARDWOODS

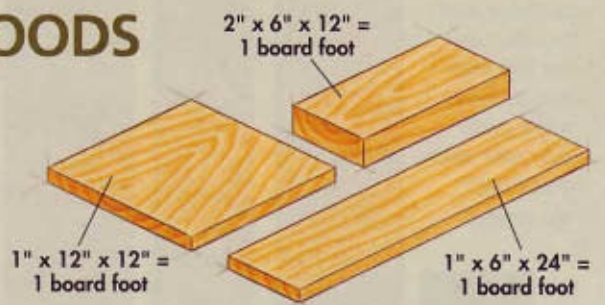
When you purchase dimensional lumber, every board is the same size and, accordingly, priced the same. But hardwoods can't be priced "by the board" because they're sawn to random widths and lengths. That's why hardwoods have their own measurement system, called a *board foot* (bf).

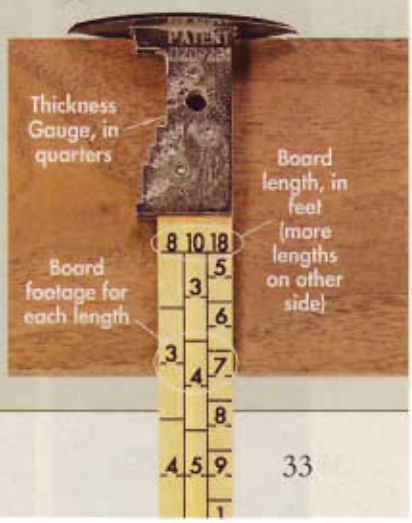
One board foot is equal to a board 1" thick, 12" wide, and 12" long. But boards of different dimensions can also measure one board foot, as the *Illustrations* at right show. Since hardwoods are priced per board foot, you need to understand board footage.

To calculate the board footage of any board, multiply its thickness, width, and length (all in inches), and then divide by 144. For example, a board 1" thick, 6" wide, and 96" long measures 4 bf (1×6×96=576÷144=4). If that board were 2" thick, it would be 8 bf (2×6×96=1152÷144=8).

To save you from having to measure every board, lumber dealers will have a grading stick, shown at right. It's like a "cheat sheet" for measuring board feet. Just lay it across the board, and it shows you the board footage.

$$\text{Board Footage} = \frac{T \times W \times L}{144}$$




► A grading stick shows the board footage of 4/4 stock. Read the number that's closest to the edge under the "length" number. If the board is 8-feet long, it measures 3 bf. Multiply by the thickness if the board is thicker.

# SIMPLE TIPS FOR LUMBER SELECTION

**GOOD MATCHES**

All three of these boards have straight grain with similar spacing between the lines. When used in a project, they'll match well and create a consistent look throughout.

**POOR MATCH & VARIATION**

These two boards match poorly with each other and the three above. They should be rejected or used in unseen parts of the projects.

## WATCH YOUR FIGURE

When selecting boards, grain figure is the first thing you should examine. That's because it will have the single biggest influence on the appearance of the project.

Because of this, make sure to have a good idea of what kind of figure you want before you shop. There's no right or wrong when it comes to figure. Whether you prefer the wood to be subtle or highly figured is up to you. Just remember that with subtle figure, you are more likely to notice the project itself. With highly figured wood, you'll likely notice the wood more than the project.

Once you know what you want, start by pulling out and setting aside those boards that have the right type of figure. When I shop, I'll often start by pulling twice as many boards as I really need. Boards that don't have the right kind of figure get neatly restacked on the pile.

Once you have a batch of good boards, line them up side by side. Keep the best grain matches, and return the rejects to the stack.

At the same time, you need to think about what project parts may be cut from each board. You'll want the most-visible parts of the project to come from the best boards.

This grain-matching process will probably cull some boards from your batch of contenders. Ideally, you'll still have about 50 percent more wood at this point in the process than your project calls for. If so, you're ready to move on.

**CONSISTENT COLOR**

Color matching is important for project consistency. Subtle differences probably won't be noticeable, but big ones may become more visible over time, even if you stain the project.

## KEEP AN EYE ON COLOR

Now you can start to match color. Again, your goal is consistency.

Don't be too quick to decide one board is "just the color you want." I've been frustrated before by doing this and then being unable to find more boards that match. You'll have better luck if you look instead for the color that most of your contenders have in common. You can always tweak the color with a stain or finish to get the exact color you desire.

Even in the best batch of boards, you're bound to find some color inconsistency. That's because trees absorb different minerals depending on where they grow. And chances are slim that you'll find a batch of boards together in the stack that were cut from a single tree.

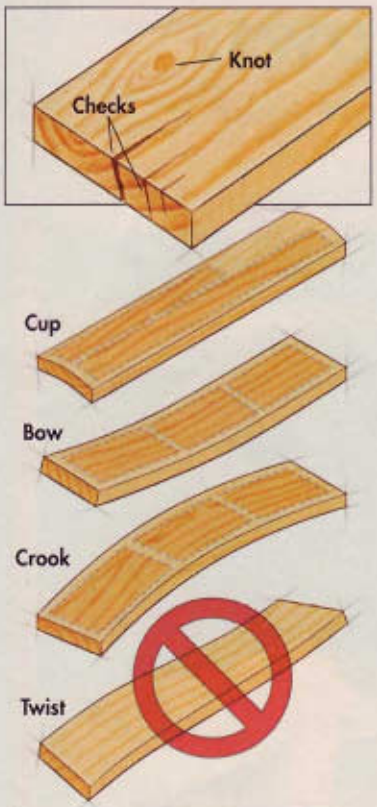
So, just as you did when matching grain, keep your project parts in mind so that you can reserve the best color for the most visible parts. Again, restack the rejects as you sort through your contenders.

When matching color, just like when matching grain, you're likely to have to make some compromises. But if you've selected carefully, you should have options. If the color and/or grain figure are mismatched on some boards, use those for internal parts, or at least those parts that are the least visible.

After color matching, you want to be left with about 25 percent more wood than you need to complete your project. You can quickly check your quantity using the grading stick, as shown on page 33.

**COLOR CHANGE**

All woods can vary in color. But some, such as this cherry, are particularly prone to variation. Reject boards that differ widely whenever possible. But if you just can't find enough matching boards, use the off-color ones for parts that won't be seen.




# DON'T GET DONE IN BY DEFECTS

Now check for defects. Hardwood is graded on how few knots and checks (splits) it has *(Illustration, left)*.

The highest-grade boards, called "Firsts and Seconds" (FAS), have to be at least 8-ft. long, 6" wide, and yield at least 80 percent clear cuttings on the best face. "Selects," the second-highest grade, can be shorter. "No. 1 Common" boards follow, and are 66-percent clear on the best face.

**Work Around Defects**— Splits at the end of a board aren't a big deal. Just crosscut these sections off, or rip around them. You also can cut around knots. If the knots are small and tightly attached, use those sections to make parts that aren't seen.

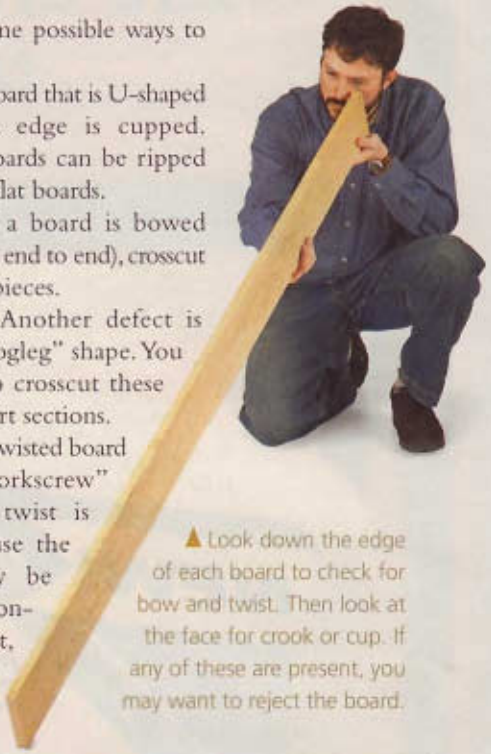
**Check For Flatness** — Grades tell you about defects, but give no indication of lumber flatness. The *Illustrations* at left show warped boards, and some possible ways to salvage them:

**Cup** — A board that is U-shaped from edge to edge is cupped. Often, these boards can be ripped into narrower, flat boards.

**Bow** — If a board is bowed (U-shaped from end to end), crosscut it into shorter pieces.

**Crook** — Another defect is crook, or a "dogleg" shape. You may be able to crosscut these boards into short sections.

**Twist** — A twisted board has a mild "corkscrew" shape. If the twist is severe, don't use the board. It may be unstable and continue to twist, even if cut into smaller pieces.



▲ Look down the edge of each board to check for bow and twist. Then look at the face for crook or cup. If any of these are present, you may want to reject the board.

## SIMPLE STRATEGIES FOR
# SAVING MONEY ON WOOD

Good lumber doesn't come cheap. But here are a few ways to make your lumber dollar go further:

**Go Short** — Dealers sometimes have to cut long boards down. Remnants of these boards measuring four to five feet long will get sold as "shorts" at a lower price.

**Go Big** — Handling costs drive up lumber prices, so dealers like to sell in volume. Most offer discounts if you buy a minimum number of board feet. Discounts can start at 25 board feet and are common at 100 and 250 board feet. Many times, you can mix species and still get a break.

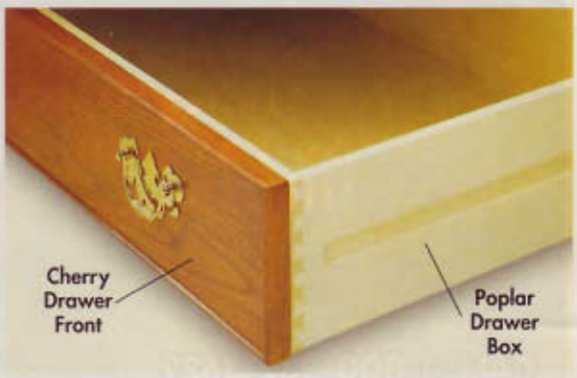
**Downgrade** — If your dealer carries No. 1 Common, consider buying that instead of FAS or Select. Common boards yield less wood, but often sell for 30 percent less. You'll have more waste, but if your project doesn't require a lot of large parts, you can still be money ahead.

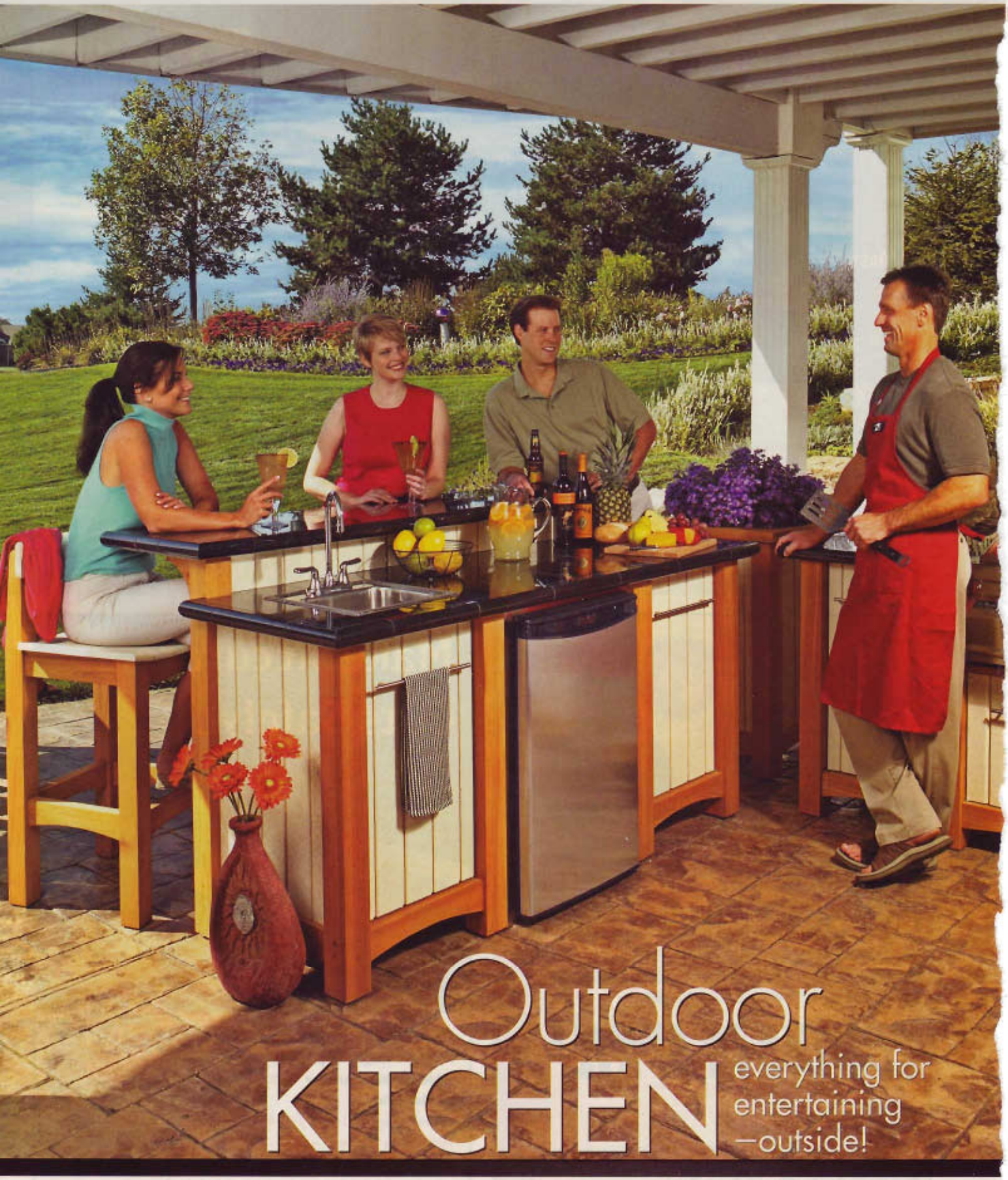
**Create Quartersawn** — If you look again at the *Illustration* on page 33, you can see that many flatsawn boards will contain sections along one or both edges that have straight grain figure. So rather than pay a premium for quartersawn or riftsawn stock, you can select wide flatsawn boards and rip off these straight sections. Use the remnants for unseen parts where the grain figure doesn't matter.

**Use Low-Cost Wood** — In many projects, there are a number of parts that will be seldom or never seen. You can build these from a less expensive hardwood to save money. Drawers are a great example.

As you can see in the *Photo* below, the drawer sides, front, and back are made from poplar. It costs about half as much as the higher-priced cherry and performs just as well.

▼ Poplar works great for internal parts, such as drawer sides. The wood is stable, easy to work with, and inexpensive.





# Outdoor KITCHEN

everything for entertaining —outside!

Time was when "cooking out" meant one brave soul alone in the backyard with a charcoal grill, a plate full of steaks, and a lawn chair. The rest of the meal was being prepared in the house, and that's where the dinner guests were gathered, as well. But today's philosophy of converting yard space into outdoor living space means bringing indoor amenities, and your dinner guests, to the great outdoors. And this outdoor kitchen does precisely that.

**Kitchen Components** — The kitchen consists of a gourmet grilling center with a built-in gas grill, a two-tiered serving bar with a stainless steel refrigerator and sink, a corner planter box for adding a splash of color, and a tall cafe table with a set of four chairs for enjoying your open-air feast *(Photo, below)*.

In this issue, we'll take you through the construction of the grilling center, serving bar, and planter. In the next issue, we'll build the cafe table and matching chairs.

**Construction Overview** — Of course, this is an *outdoor* kitchen, so we did take special care to choose materials, joinery, and finishes that will look good and withstand the elements.

To that end, cedar lumber is the key ingredient in all these projects, along with some cedar siding and exterior plywood.

The most striking element, though, has to be the black polished granite countertops on the grilling center and serving bar. And of course, we'll show you how to create these beautiful and durable surfaces, one tile at a time.

But first, we'll take you step-by-step through building the bases for the kitchen centers. You'll see how we created simple but sturdy connections using butt joints, some special screws, and a bit of epoxy.

Finally, we'll tell you a little about the stains we used to give the kitchen an attractive and durable two-tone finish.

The best seat *out* of the house is this cafe table with matching chairs, which we'll build in the next issue of *Workbench*. This time, we construct the gourmet grilling center, serving bar, and planter box.

# gourmet GRILLING CENTER

No outdoor kitchen is complete without a grill. With its cedar cabinet, granite tile countertop, and stainless steel gas grill, this center is a cut above the average backyard barbecue pit.

Of all the furniture in our outdoor kitchen, this grill is truly the centerpiece. It simplifies outdoor cooking and provides storage and countertop space, all in one great-looking project.

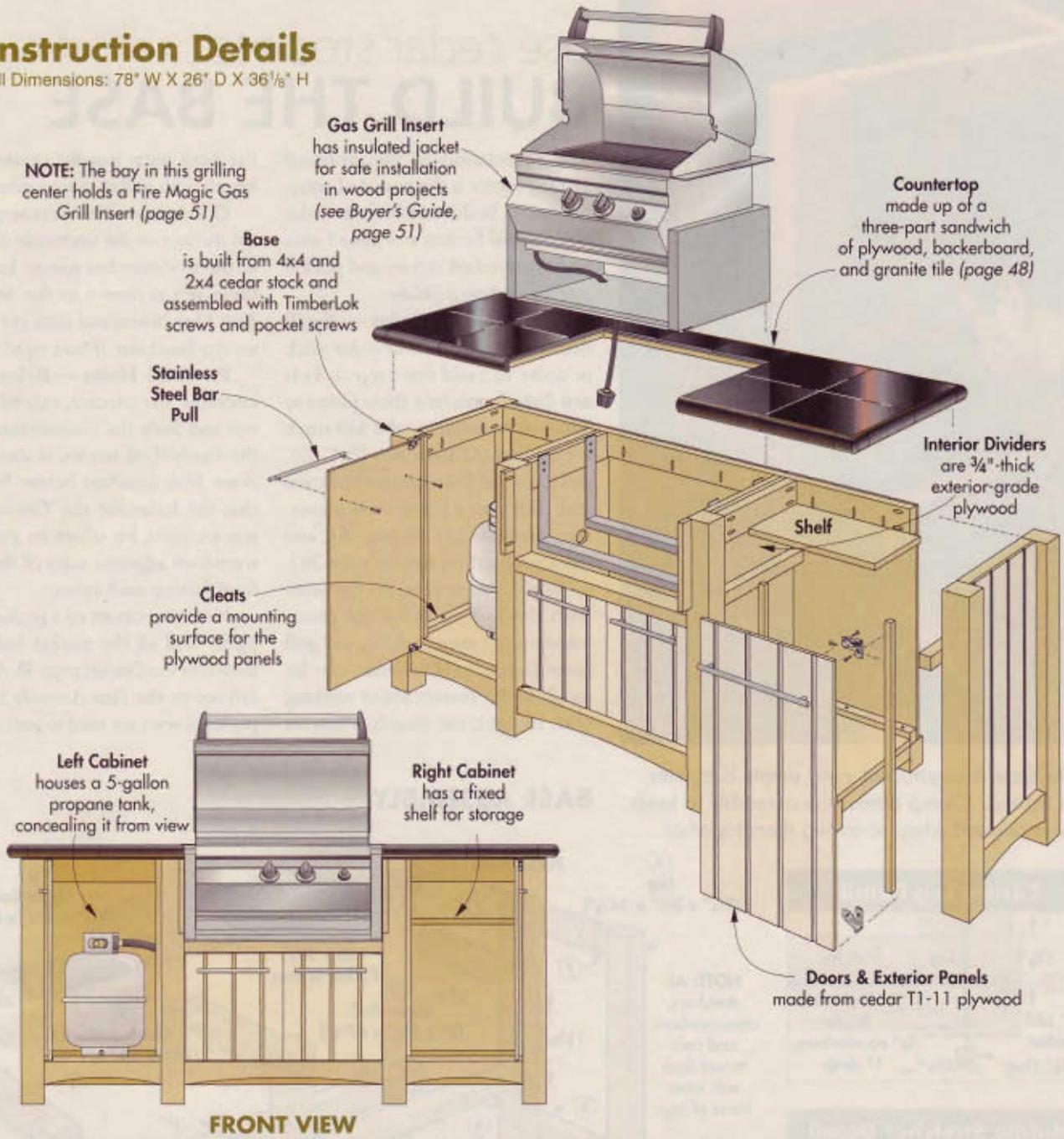
The center is designed to hold a stainless steel gas grill. Look closely at the *Construction Details* on page 43, and you'll see that this grill has an insulated jacket specifically designed for use in a wood surround *(Buyer's Guide, page 51)*.

But it's the cabinet *around* the grill that makes this project unique. It offers plenty of storage for kitchen accessories and the propane tank. To top it off, it has a granite countertop that's used to prepare meals for cooking. This countertop is actually made from granite *tiles*, so you can easily install it by yourself. (Installation tips begin on page 48.)

This grilling center may be big, but it's easier to build than you might think. The base is made out of dimensional cedar lumber, and it's enclosed with cedar T1-11 plywood that's stained white for contrast. As for joinery, it's the easiest part of all. This project is assembled using simple butt joints and special outdoor screws *(page 43)*.

# Construction Details

Overall Dimensions: 78" W X 26" D X 36⅛" H

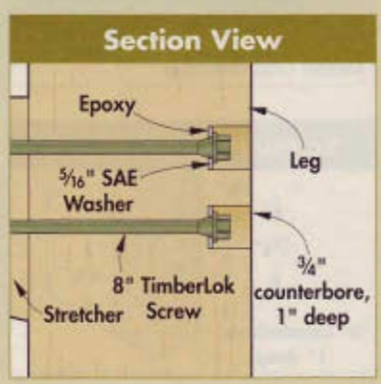



FRONT VIEW

## TIMBERLOK SCREWS

**For these projects, "TimberLok" screws provide a strong, easy-to-install joinery solution. Their long shanks and deep threads draw thick parts tightly together and prevent splitting, so no pilot or shank holes are needed. Counterbores let you hide the screw heads below the wood's surface *(Art, right)*.**

**When you drive a screw into soft cedar, the head can bury itself in the wood. To prevent that, I slipped a washer around the screw head before installing it. I also brushed epoxy into the counterbore as added insurance to keep the screw from loosening *(see Photo, right)*.**



▲ The base is constructed using simple butt joints and screws. Clamp across the assembly to keep pieces aligned when screwing them together.

## use cedar stock to
# BUILD THE BASE

The foundation of this outdoor grilling center is the base. As I mentioned, it's built entirely from cedar dimensional lumber and joined with both TimberLok screws and pocket screws, as shown below.

**Two Sizes of Cedar** — You'll need to buy two sizes of cedar stock in order to build this project: 4x4s and 2x4s. To machine these pieces to size, start by reducing the 4x4 stock for the legs (A), stretchers (B, C, D), and lower rail (E) to proper thickness and width on a jointer and planer. (See *Materials List* on page 51, and stock preparation tips on page 26.)

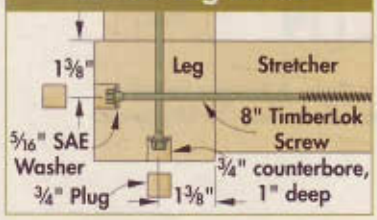
While you're at it, do the same with the 2x4 stock for the crossmembers (F), upper rail (G), and grill front support (H). Cedar can be rough, so this ensures you're working with straight, flat boards. Then all the base parts can be crosscut to length with a table saw or miter saw.

**Cut Arcs** — The next step is to cut the arcs on the underside of each of the five stretcher pieces. Lay out these arcs as shown in the *Stretcher Parts View* below, and then cut them on the band saw *(Photo, right)*.

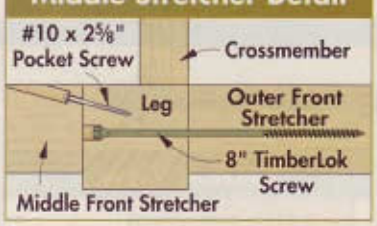
**Pre-Drill Holes** — Before you assemble the carcase, carefully lay out and bore the counterbores for the TimberLok screws, as shown in *Screw Hole Locations* below. Notice that the holes for the TimberLok screws must be offset to prevent screws on adjacent sides of the legs from hitting each other.

Next, you can set up a pocket hole jig to drill all the pocket holes, as shown in the *Box* on page 45. As you can see in the *Base Assembly* below, pocket screws are used to join all the

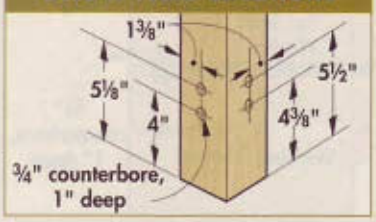
### Corner Leg Detail



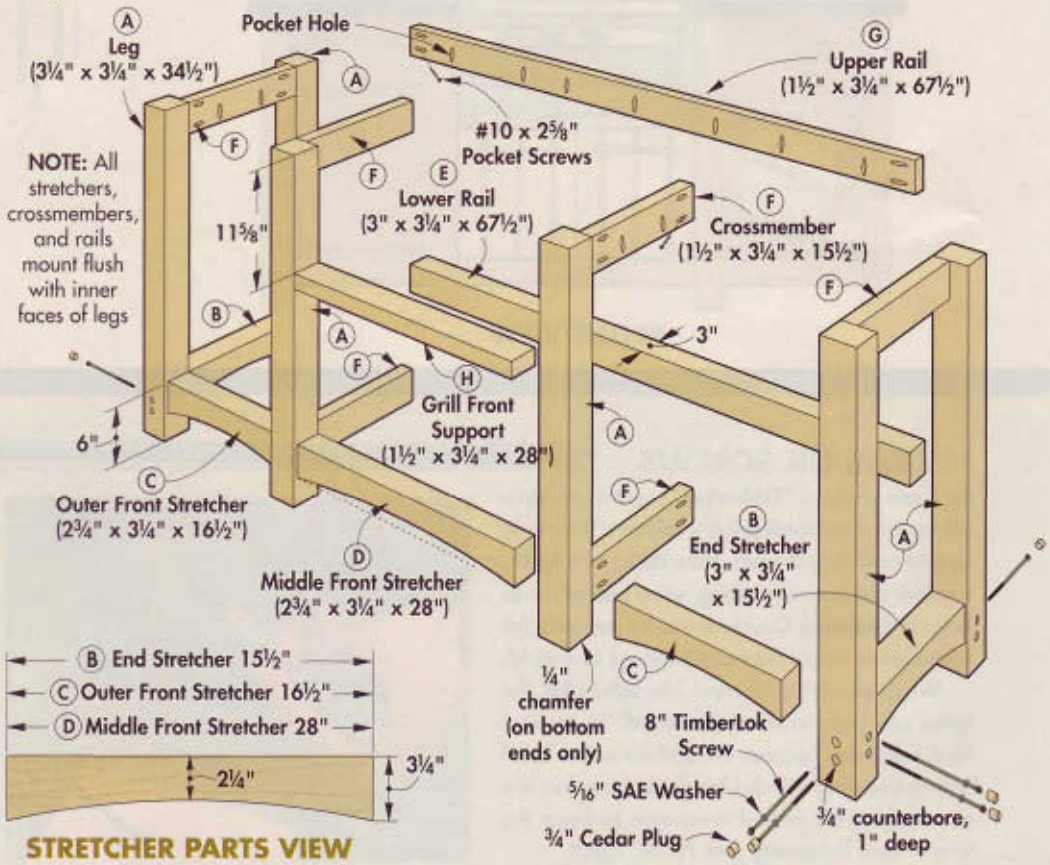

### Middle Stretcher Detail




### Screw Hole Locations




## BASE ASSEMBLY







**STRETCHER PARTS VIEW**

2x4 parts (and the middle front stretcher) to the base, and are later used to attach the top.

**Base Assembly Tips** — The biggest trick to making this base is assembling it in the right order. Following the sequence outlined in the *Box* below helps simplify the process. After assembling the end frames and joining them with the upper and lower rails, you'll have a structure that stands upright freely, which eases the assembly process.

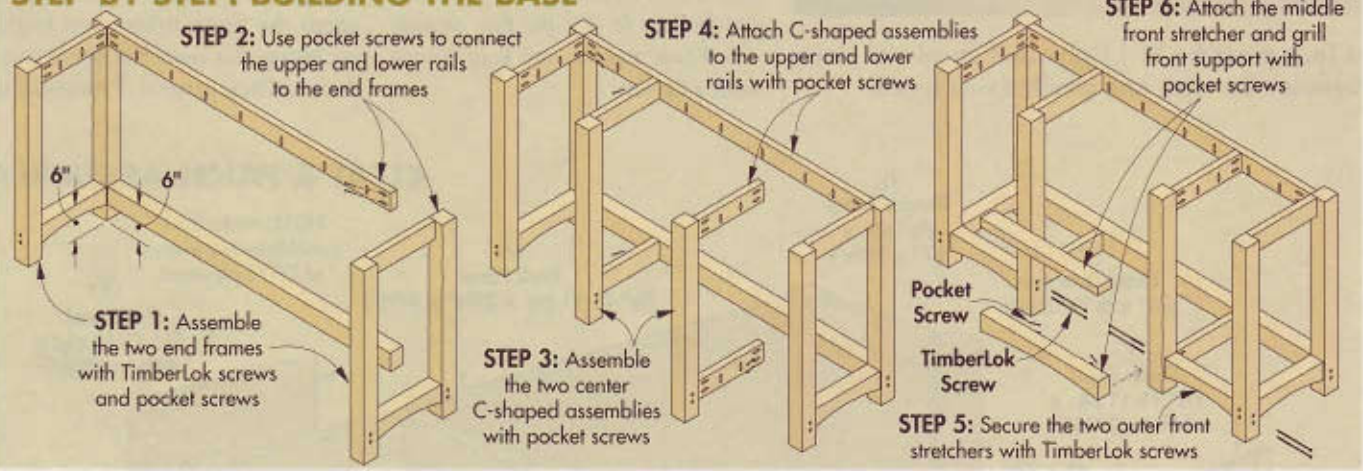
The next step is to put the two middle C-shaped assemblies together with pocket screws, and attach them to the upper and lower rails. I used an outer stretcher as a spacer to position these assemblies on the rails. Simply place the stretcher between the end frame and the lower crossmember on the C-shaped assembly. Then fasten the assembly with pocket screws.

The last step is to add the stretchers. The outer stretchers are installed using TimberLok screws *(Photo, left)*, and the middle stretcher is held in place with pocket screws *(Middle Stretcher Detail, page 44)*. Also, be sure to add the grill front support (also with pocket screws) to hold the grill insert later on.

With the base fully assembled, the last step is to glue wood plugs into the counterbores *(page 92)*.

▲ The arcs on the stretcher pieces can be cut freehand on the band saw. After laying out the arc, cut to the waste side of the line, and then sand the surface to remove saw marks.

## STEP-BY-STEP: BUILDING THE BASE

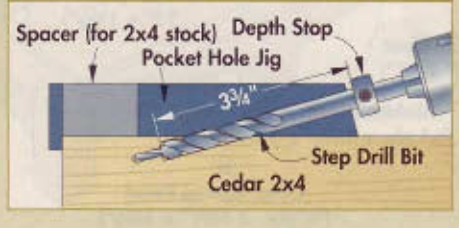



## DRILLING POCKET HOLES IN THICK STOCK

**TimberLok screws can split the narrow 2x4 parts of the base, so I decided to use pocket screws to attach these pieces to the project. This joinery method involves driving a screw through an angled pilot hole in one piece and into a mating piece to create a strong joint.**

**Pocket hole jigs are made to join 3/4" stock, but most come with a spacer that allows you to drill holes in thicker stock. *(Photo, right)*. This spacer locates the pocket hole so the pocket screw will exit at a point that's centered on the thickness of the workpiece *(see Detail)*.**

**Pocket Hole Detail**





▲ To install the end panels on the base, start by applying a bead of construction adhesive.

▲ Then press the T1-11 plywood panel into place between the legs, and attach it with brads.

## enclose the base with
# PLYWOOD PANELS

With the base complete, it's time to enclose it. To add a decorative touch on the outside, I used cedar T1-11 plywood, which has grooves running vertically along the length of the panels. The interior panels are made from ¾" exterior-grade plywood. All of these panels are attached to a system of cleats, which are attached to the base.

The first step is to cut all the cleats and panels to size on the table saw. The cleats (I, J, K, L) are simply ripped to width and crosscut to length out of cedar 2x4 stock. The bottom (M, N) and divider panels (O) can also be cut to size on the table saw. The only special considerations here are the divider panels and middle bottom panel, which are notched to fit *(see the Box on page 47)*. These notches are easy to cut with a jig saw.

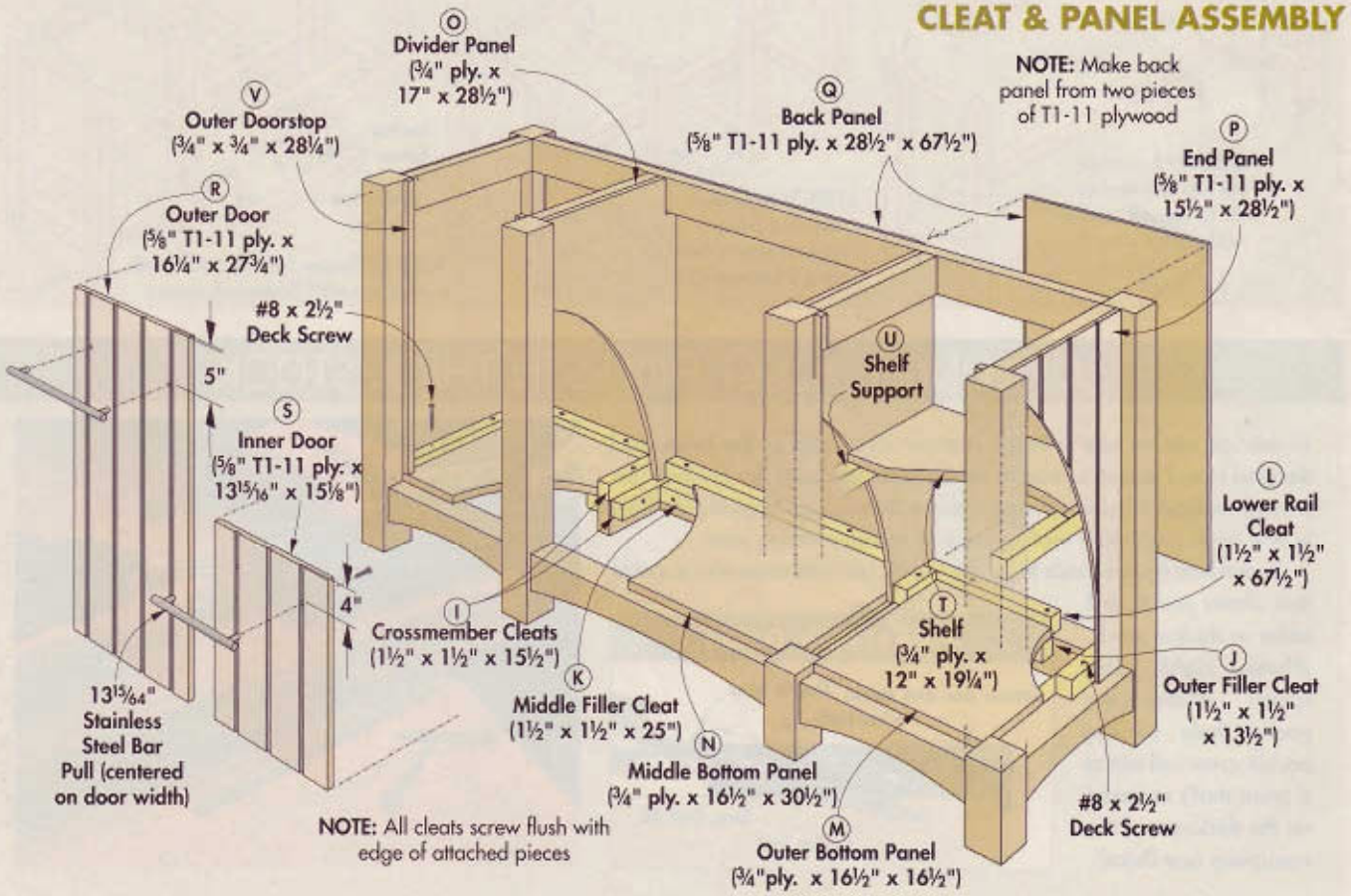
As for the end panels (P) and back panel (Q), the vertical grooves in the T1-11 plywood complicate things a bit. For the best appearance, the space between the edge of the panel and the nearest groove should be the same on each side. With this in mind, lay out the panels so the spacing is equal, and then cut them to size.

The back panel is extra-wide, so it's made up of two pieces of T1-11 plywood. For these, you'll need to pay attention to the spacing of the vertical grooves across both pieces.

**Install Cleats & Panels** — As with the base, the sequence in which you add the cleats and panels is important. The *Box* on page 47 provides a helpful guide here.

**Apply A Finish** — Just a note about the finish before you begin enclosing the base: For these outdoor kitchen projects, I wanted the

## CLEAT & PANEL ASSEMBLY



base to have a warm, amber-colored tone. As for the panels, I wanted them to be a light, contrasting color.

To accomplish that, I went ahead and applied a finish at this point, before the last panels were put in place. I stained the partially assembled base with a semi-transparent, water-repellent oil stain, and the back panel and end panels with a solid-color white oil stain. I used Olympic stains for both applications.

After the finish is dry, go ahead and attach the back and end panels around the base, as shown below.

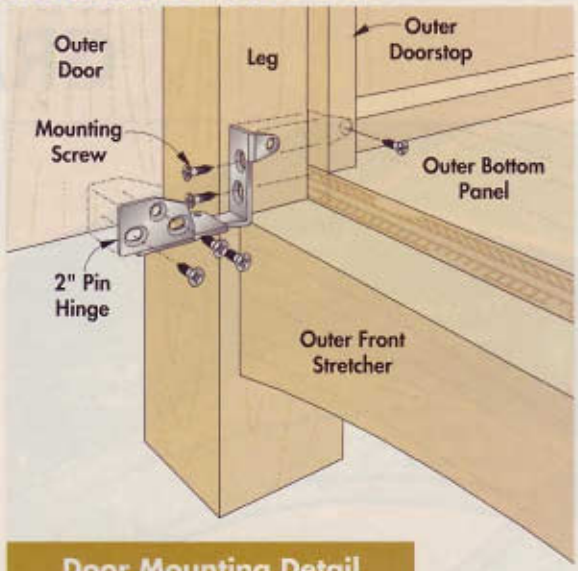
**Add A Shelf** — To make the most of the storage space inside the grilling center, I installed a shelf in the right-side cabinet. (The left side holds the propane tank.) This shelf is just a $^3/_4$" plywood panel (T) that's cut to size and mounted to a pair of shelf supports (U).

**Mount Doors** — The last step is adding the doors. To prevent the doors from swinging too far into their openings, I screwed a pair of doorstops (V,W) to the legs on both sides of each opening, flush with the front edge of each bottom panel *(see the Door Mounting Detail at right)*. The doors also contact the front edges of the bottom panels, which helps keep them aligned when closed.

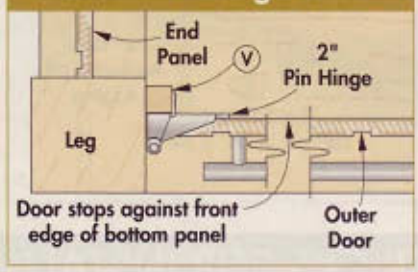
Before mounting the doors, note that the shelf, shelf supports, and doorstops receive the semi-transparent oil stain, while the doors get a coat of the solid-color white stain.

Once the stain dries, you can mount the doors with 2" pin hinges. The nice thing about these hinges is that no mortises are necessary to install them. They just screw right in place on the doors and the doorstops *(see the Illustrations at right)*.

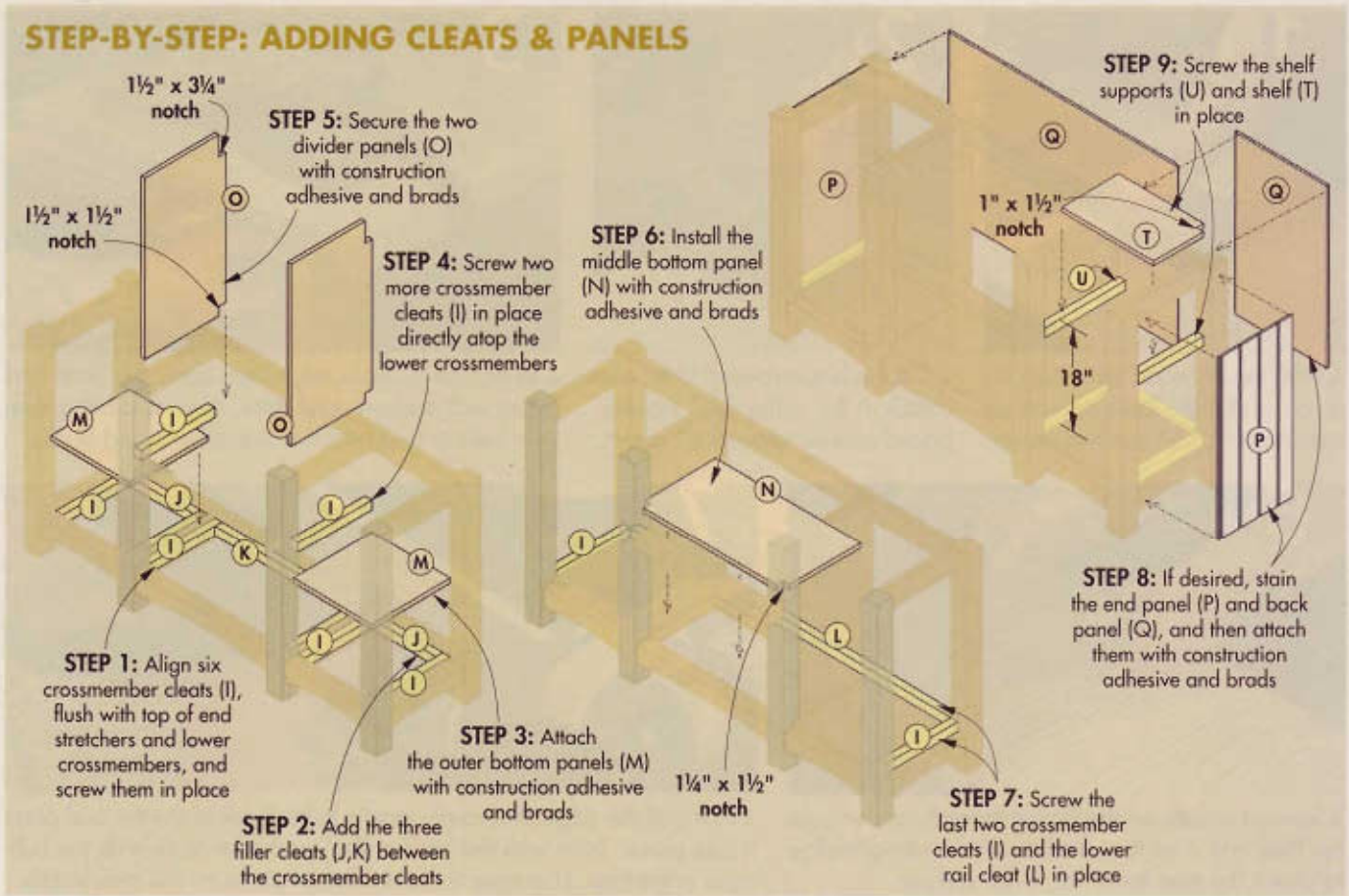
## MOUNTING THE DOOR



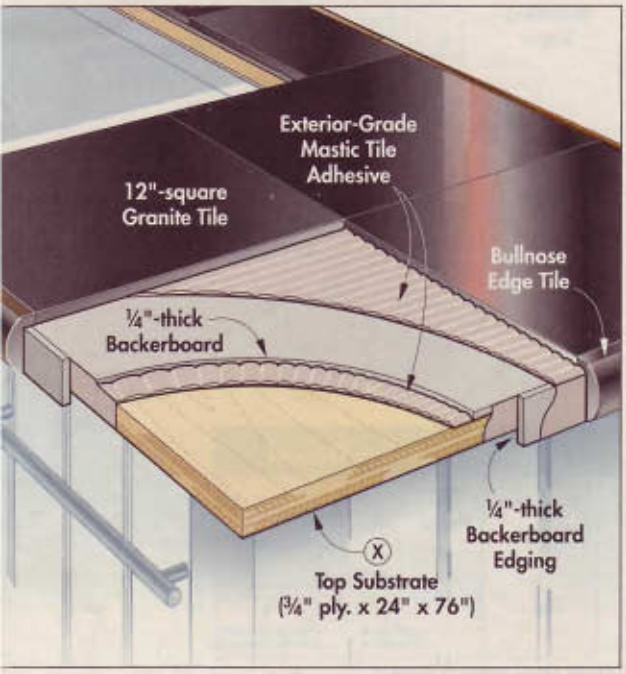

### Door Mounting Detail




## STEP-BY-STEP: ADDING CLEATS & PANELS



# top it off with GRANITE TILE




The crowning touch of this grilling center is a granite tile top. Take a look at the *Illustration* at left, and you can see that this top is actually a three-part sandwich of ¾" exterior plywood, ¼" backerboard (I used Hardibacker), and 12"-square granite tiles. Exterior-grade mastic tile adhesive holds these three layers together as you build the top.

This grilling center gets heavy with the top added, so I built the top separately on top of two 2x4s laid across a pair of sawhorses *(Top Assembly, page 49)*. It's very important to build on a *level* surface, so use the straightest 2x4s you can find. These 2x4s will also come in handy later when it's time to install the top on the grilling center, which you'll want to do out on the deck or patio.

The first step in building the top is to cut a plywood substrate (X) to size. Then, cut a large notch in the middle to accommodate the grill. (A jig saw makes quick work of this.) Rather than notch the backerboard, I simply cut three separate pieces. *(See tips for cutting backerboard on page 28)*. These are attached to the plywood with a layer of mastic and backerboard screws *(Photos, below)*.

With the backerboard in place, it's time to add the granite tile. The *Photos* below will walk you through this process.

Once the tile has set, recruit a friend to help you move the top. After setting it in place on the grilling center, carefully remove the 2x4s. Then center the top on the base, and attach it with pocket screws *(Detail, page 49)*.

## TIPS & TRICKS FOR INSTALLING THE TILE TOP

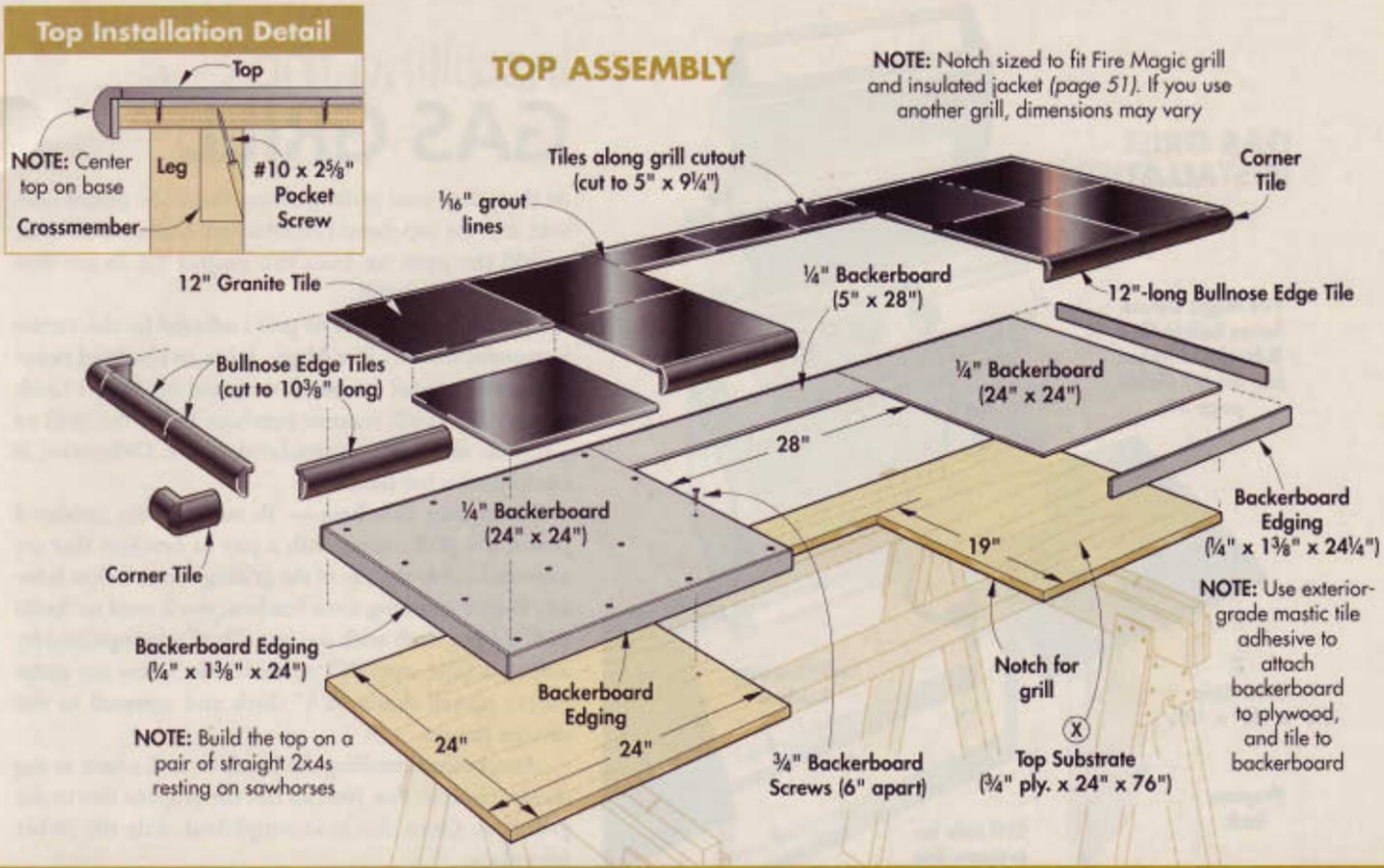

▲ With the plywood top sitting on a pair of straight 2x4s, spread on mastic with a ¼" notched trowel.


▲ Cut the backerboard to fit, and attach it by using ¾" backerboard screws spaced 6" apart.


▲ To accept bullnose edge tiles, cover the ends and edges with backerboard strips. Align each strip flush with the top and attach it with mastic and brads.


▲ Spread mastic on the backerboard, and wiggle the tiles into it so they lie flat. Use a straightedge to check the tiles for a flat, even surface.


▲ To install the edge tiles, apply mastic to the back of the tile and press it into place. Start with the corner tiles, and then fill in with the bullnose edge tiles. Use tape to hold them in place as the mastic sets.



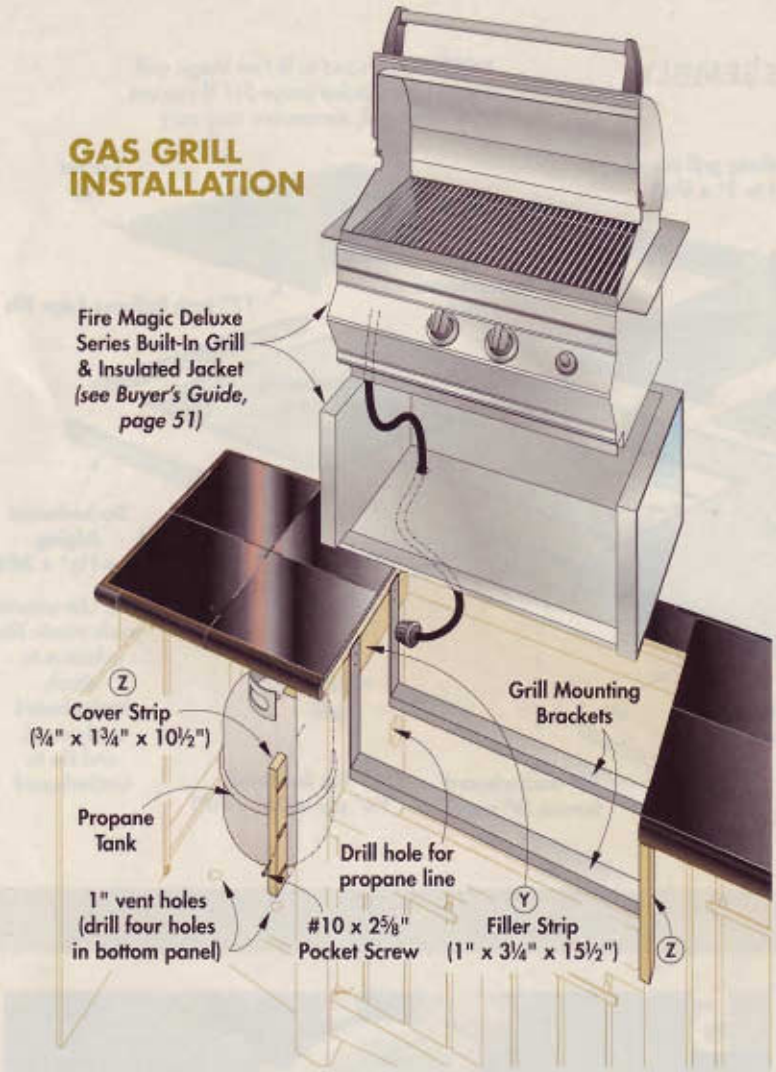


▲ Dry-assemble the tiles using 1/16" spacers to ensure consistent grout lines. For the bullnose tiles, determine the space needed and tape them in place.


▲ A few of the bullnose edge tiles, as well as the three tiles that fit behind the notch for the grill, need to be cut to size. *(Dimensions are in the Top Assembly above).* You'll need to rent a wet saw to do this.


▲ The last step is applying grout. (I used black grout that matched the tiles.) First mix the powdered grout with water to the consistency of peanut butter, and press it firmly into the joints with a rubber float.


▲ Finally, use a sponge and water to smooth the grout lines and clean the tiles. Move the sponge diagonally to avoid removing grout from the joints.





▲ The Fire Magic grill comes with two metal brackets that support the insulated jacket and gas grill. The brackets are screwed to the filler strips, which are attached to the divider panels.

# installing the GAS GRILL

At this point, your grilling center should be placed outside, and the top should be attached. And now it's time to add the item we built this project for in the first place — the gas grill.

**Insulated Grill** — The grill I selected for this center is manufactured by Fire Magic. It has an insulated jacket that's safe to install in a wood surround *(see Buyer's Guide on page 51)*. You'll want to purchase either this grill or a similar one with an insulated jacket. Otherwise, it could pose a fire hazard.

**Mounting Brackets** — To support the insulated jacket, the grill comes with a pair of brackets that are mounted inside the bay of the grilling center *(Photo, below left)*. Before attaching these brackets, you'll need to "build out" the bay flush with the legs. That's accomplished by adding a filler strip (Y) on each side. These are cedar pieces planed down to 1" thick and screwed to the divider panels.

Also, before installing the brackets, drill a hole in the divider panel so that you can run the propane line to the grill later. Once this is accomplished, slide the jacket into place.

**Cover Strips** — One thing to be aware of is that the jacket sticks out past the front of the base. To conceal the jacket, I added a couple cover strips (Z). These are just cedar blocks that are attached on either side of the jacket with pocket screws. You'll need to remove the jacket temporarily to screw the blocks in place *(Photo, below)*.

**Install Grill** — You're almost ready to install the grill. But before you set it in place, the last consideration is the propane tank. It sits in the left storage compartment of the base. You'll want to drill some holes in the bottom panel of this compartment to allow for ventilation in the event of a propane leak. Then, it's just a matter of fishing the line for the propane tank through the holes in the divider panel and insulated jacket, connecting it to the grill, and setting the grill in place.


▲ To conceal the exposed front of the insulated jacket, use pocket screws to attach a cedar cover strip to the leg on each side of the bay.

# choosing the right APPLIANCES

For both these outdoor kitchen projects (this grilling center and the serving bar on page 52), we made some special considerations when selecting the appliances. First, we wanted products designed for outdoor use. That's why we chose a stainless steel grill, refrigerator, and sink. This high-quality material will take years of harsh outdoor conditions without rusting.

Of course, we needed appliances that could also be *built in* to our wood projects. The grill and refrigerator fill the bill here. The insulated jacket makes the grill safe to install in a wood surround, and both products have accessories that allow them to be built seamlessly into the projects. For information on buying the appliances we used, see the *Buyer's Guide* at right.

Stainless Steel Refrigerator

Insulated Jacket

Mounting Brackets

Gas Grill

Grill Hood

## BUYER'S GUIDE

### GRILL
- Fire Magic Deluxe Series Built-In Grill (#11-S1S1N-A)
- Insulated Jacket (#3100-50)

This stainless steel gas grill comes with hood and mounting brackets for around $1,000. The insulated jacket sells for $300.

### REFRIGERATOR
- Fire Magic Compact Refrigerator (#3590)
- Trim Kit (#3809)

The refrigerator is also stainless steel and sells for $600. The trim kit sells separately for $100.

Gas Grills Now
877-669-4669
GasGrillsNow.com

### SINK
Elkay 15"x15" Celebrity Bar Sink Package (BCRA150C)

We chose this sink from Elkay for $200, but any 15" x 15" bar sink and faucet combination will do.

Elkay
630-572-3192
ElkayUSA.com

## MATERIALS & HARDWARE

| | Part | Qty | T | W | L | Material |
|---|---|---|---|---|---|---|
| A | Legs | 6 | 3¼" | 3¼" | 34½" | Cedar |
| B | End Stretchers | 2 | 3" | 3¼" | 15½" | Cedar |
| C | Outer Front Stretchers | 2 | 2¾" | 3¼" | 16½" | Cedar |
| D | Middle Front Stretcher | 1 | 2¾" | 3¼" | 28" | Cedar |
| E | Lower Rail | 1 | 3" | 3¼" | 67½" | Cedar |
| F | Crossmembers | 6 | 1½" | 3¼" | 15½" | Cedar |
| G | Upper Rail | 1 | 1½" | 3¼" | 67½" | Cedar |
| H | Grill Front Support | 1 | 1½" | 3¼" | 28" | Cedar |
| I | Crossmember Cleats | 10 | 1½" | 1½" | 15½" | Cedar |
| J | Outer Filler Cleats | 2 | 1½" | 1½" | 13½" | Cedar |
| K | Middle Filler Cleat | 1 | 1½" | 1½" | 25" | Cedar |
| L | Lower Rail Cleat | 1 | 1½" | 1½" | 67½" | Cedar |
| M | Outer Bottom Panels | 2 | ¾" | 16½" | 16½" | Exterior Plywood |
| N | Middle Bottom Panel | 1 | ¾" | 16½" | 30½" | Exterior Plywood |
| O | Divider Panels | 2 | ¾" | 17" | 28½" | Exterior Plywood |
| P | End Panels | 2 | ⅝" | 15½" | 28½" | T1-11 Plywood |
| Q | Back Panel | 1 | ⅝" | 28½" | 67½" | T1-11 Plywood |
| R | Outer Doors | 2 | ⅝" | 16¼" | 27¾" | T1-11 Plywood |
| S | Inner Doors | 2 | ⅝" | 13 15/16" | 15⅛" | T1-11 Plywood |

| | Part | Qty | T | W | L | Material |
|---|---|---|---|---|---|---|
| T | Shelf | 1 | ¾" | 12" | 19¼" | Exterior Plywood |
| U | Shelf Supports | 2 | 1½" | 1½" | 15½" | Cedar |
| V | Outer Doorstops | 4 | ¾" | ¾" | 28¼" | Cedar |
| W | Inner Doorstops | 2 | ¾" | ¾" | 15⅛" | Cedar |
| X | Top Substrate | 1 | ¾" | 24" | 76" | Exterior Plywood |
| Y | Filler Strips | 2 | 1" | 3¼" | 15½" | Cedar |
| Z | Cover Strips | 2 | ¾" | 1¾" | 10½" | Cedar |

**Grilling Center Hardware**
- (20) 8" TimberLok Screws (TLS-4080)*
- (20) 5/16" SAE Washers
- (20) ¾" Cedar Plugs
- (64) #10 x 2⅝" Pocket Screws
- (38) #8 x 2½" Deck Screws
- (100) 1½" Brads
- (8) 2" Pin Hinges (#26955)**
- (4) Stainless Steel Bar Pulls (#54720)**
- (2) Hardibacker Panels (¼" x 48" x 48")
- (30) ¾" Backerboard Screws
- (11) 12" Shanxi Black Prescott Tiles***
- (15) Shanxi Black Prescott Bullnose Tile***
- (4) Shanxi Black Prescott Corner Tile***
- Exterior-Grade Mastic Tile Adhesive
- Grout

* Item available at McFeelys.com or 800-443-7937
** Items available at Rockler.com or 800-279-4441
*** Items available from The Tile Shop at 800-433-2939.

# food prep & SERVING BAR

With a countertop, built-in refrigerator, cabinets, and a raised bar area, this project has everything you need for your next cookout — *including* the kitchen sink.

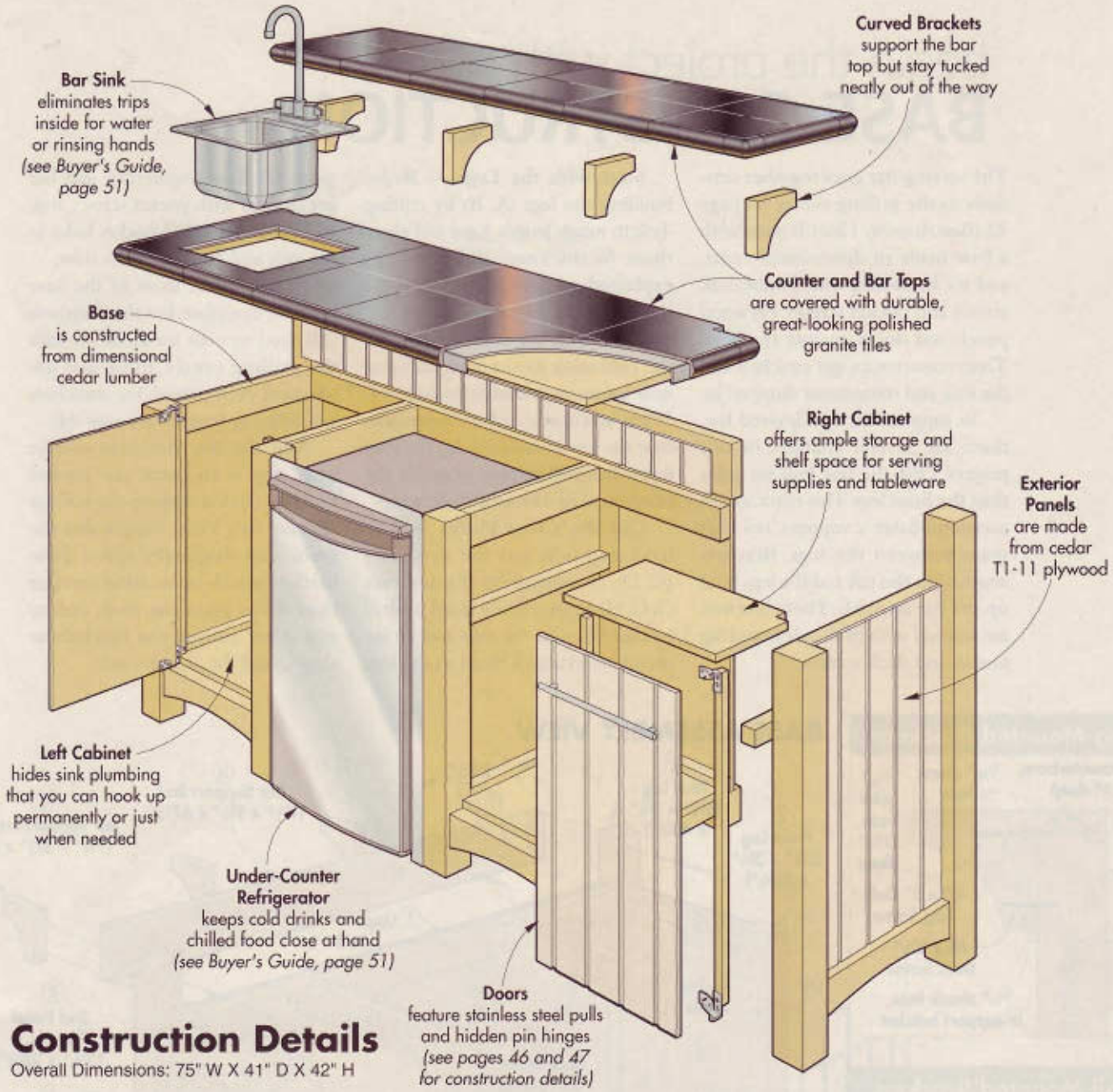
This food preparation and serving bar makes the perfect companion to the gourmet grilling center on page 42. It comes equipped with all the amenities you need to turn the grilling center into a true outdoor kitchen.

**A Full Serving of Features** — The bar starts off with a generously sized two-tier countertop clad in durable granite tile.

The main counter offers plenty of space where you can prepare your feast. And at one end, there's a small bar sink. This may seem like a complicated adventure in plumbing. But we'll show you how to hook it up easily to provide a convenient place where you can pour a cool glass of water, rinse your hands, or wash vegetables.

Above the main countertop is an elevated bar. It sits at just the right height to make a great serving station for your freshly prepared food. And you can use the bar as a dining counter or a place to chat with the cook.

Even more features rest below the countertop. For starters, there's a sturdy base cabinet that offers ample enclosed storage on one side and hides the sink plumbing on the other. Then there's the niche in the middle that's sized to hold an under-counter




## Construction Details

Overall Dimensions: 75" W X 41" D X 42" H

refrigerator. You can load it up with your favorite beverages, cold foods, and marinating meat. That means you'll never have to run back inside and miss out on the entertaining action outdoors.

The serving bar matches the grilling center, both in terms of functional style and straightforward construction. You can see the finer points of both in the *Construction Details* above.

The main differences are the tall back legs, additional rail, and curved brackets that support the bar. And instead of a grill and low cabinet, this serving center has a wide opening in the middle for the refrigerator.

# begin the project with
# BASE CONSTRUCTION

The serving bar goes together similarly to the grilling center on page 42 *(Base Assembly View)*. It starts with a base made of dimensional cedar, and it's assembled with TimberLok screws and pocket screws. Plywood panels and doors enclose the base. Then countertops get attached and the sink and refrigerator dropped in.

To support the cantilevered bar, there are several changes in this project. First, the rear legs are taller than the front legs. This extra length accommodates a support rail that spans between the legs. Brackets attached to this rail and the legs hold up the bar assembly. These brackets are secured with both galvanized lag screws and deck screws.

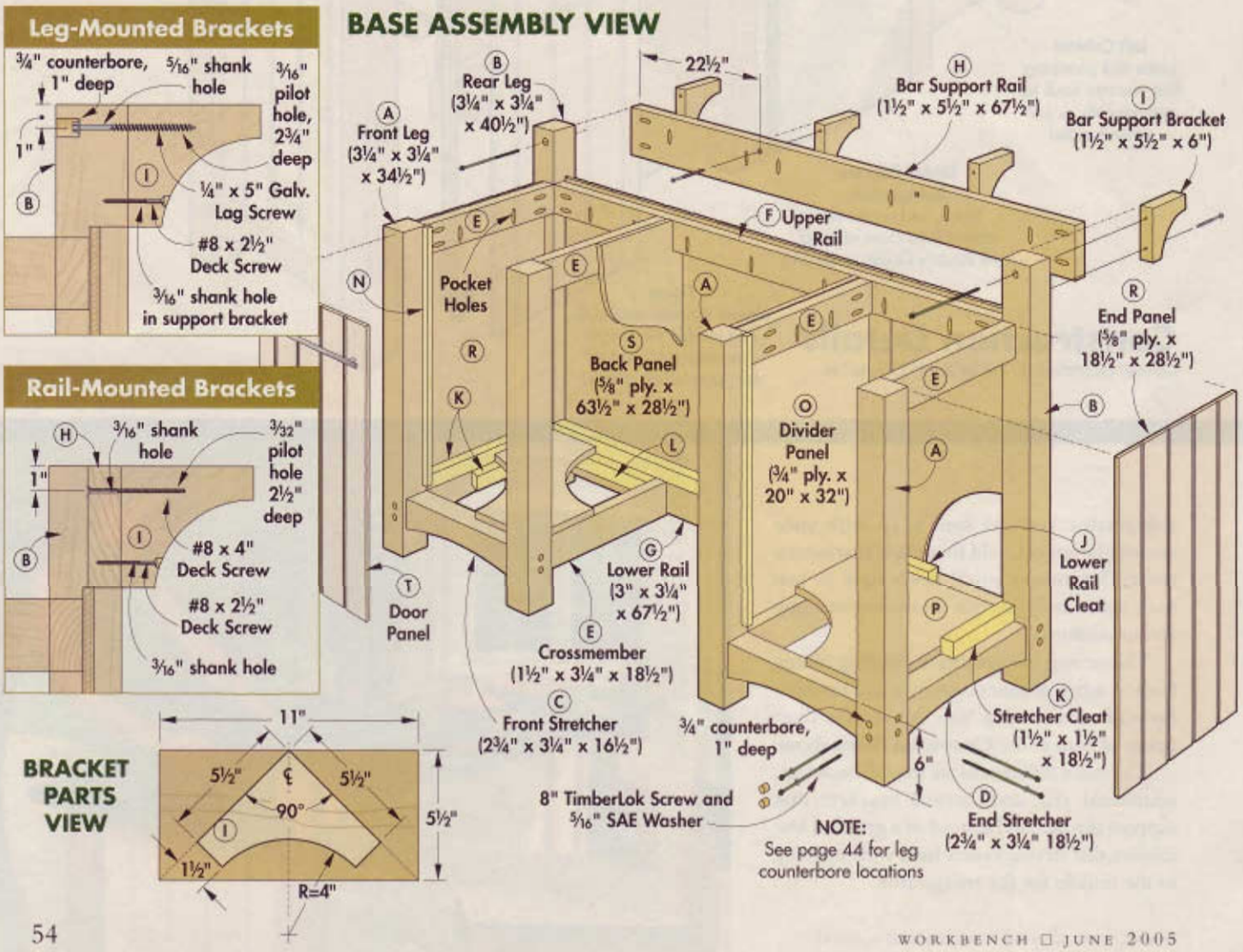
**Start with the Legs** — Begin building the legs (A, B) by cutting 4x4s to rough length. Joint and plane them to thickness and width, as explained on page 26, and then cut the legs to final length.

Next, drill the counterbores for the Timberlok screws using the same hole locations as shown on page 44. While you're at it, drill a counterbore near the top of each rear leg for a lag screw that will be used to secure the brackets *(Leg-Mounted Brackets)*.

**Cut the Cross Pieces** — The next step is to cut the stretchers (C, D), crossmembers (E), and rails (F, G, H) to size. You'll need to drill pocket holes in the rails and crossmembers to attach them to the legs *(page 45)*. The countertop and bar get secured with pocket screws, too, so go ahead and drill pocket holes in the rails and crossmembers now.

At this point, most of the base parts are complete, but the stretchers still need arcs cut on them. As with the grilling center, these arcs are identical, even though the stretchers are different lengths *(see page 44)*.

**Add the Bar Brackets** — The next step is to make the curved brackets (I) that support the bar top *(Bracket Parts View)*. Notice that the grain runs diagonally across these brackets, which makes them stronger than if the grain ran from end to end. After cutting the brackets to shape, sand the arcs smooth.



## CLEAT & PANEL ASSEMBLY

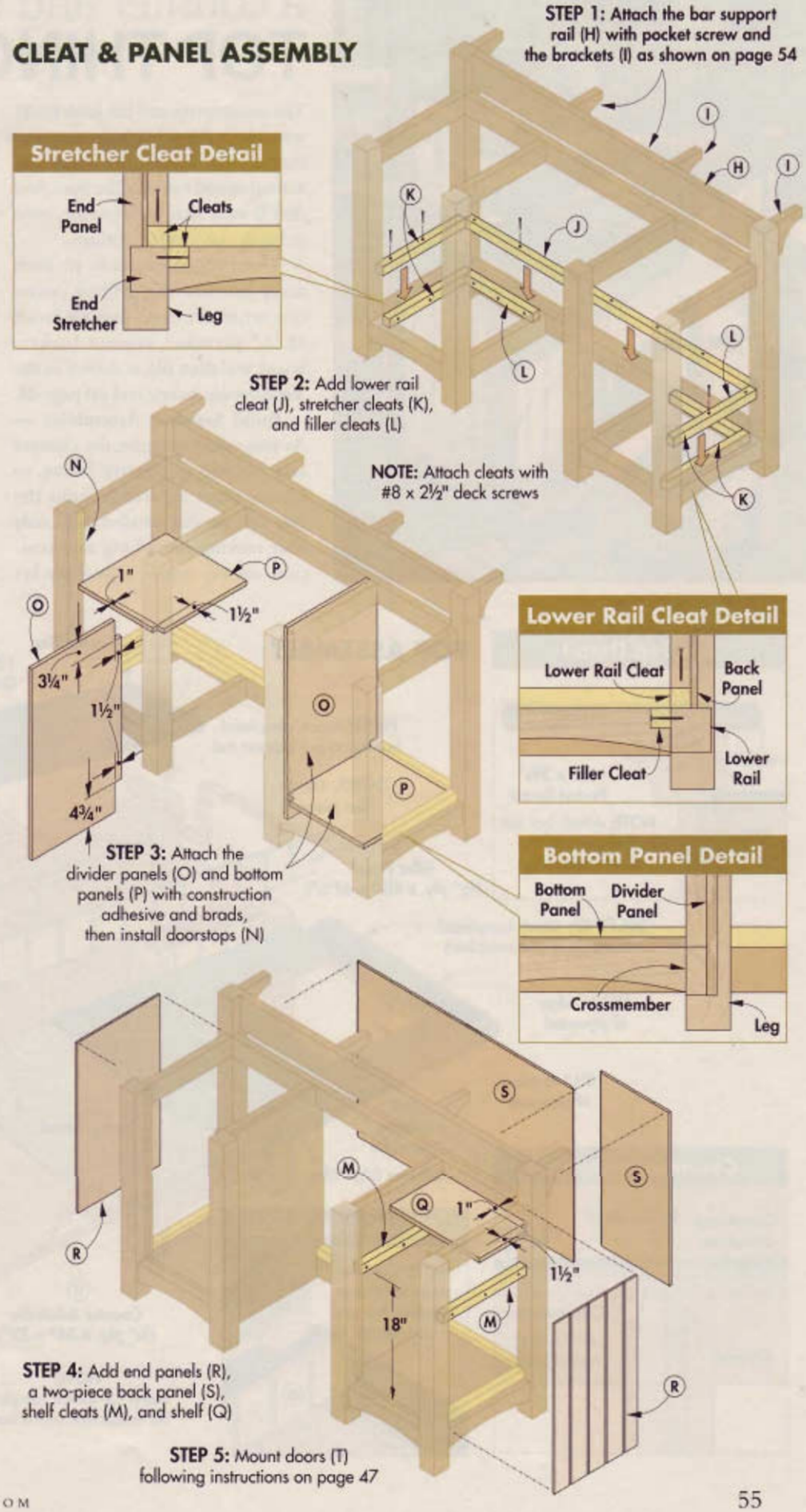
To bear the bar's weight, a strong mechanical connection is an absolute must for these brackets. The *Details* on page 54 show that the two brackets attached to the legs are secured with lag screws at the top. To avoid splitting the wood, I drilled a shank hole in each leg and a pilot hole in each bracket. To secure the lower part of the bracket, drill a pilot hole and drive in a deck screw.

The two middle brackets are mounted to the bar support rail *(Rail-Mounted Brackets)*. There's no thick, beefy leg to tie into here, so to make the bracket connections as strong as possible, I drilled pilot holes and drove long deck screws through the rail into the bracket at the top. Here again, fasten the bottom of each bracket with a deck screw.

**Bring It All Together** — Putting the base together involves juggling quite a few pieces. But it's essentially the same as the grilling center, so you can look at page 45 to see the correct assembly sequence for the main base. After assembling the base, plug all of the counterbores using the techniques shown on page 92.

**Enclose the Base** — Also like the grilling center, the base of this serving bar is enclosed with plywood panels. Here again, a system of cleats provides a mounting surface for the fixed panels. Follow the *Cleat & Panel Assembly* at right to make sure you get everything put together correctly. You'll also need to notch the dividers and bottom panels, and add a shelf, shelf cleats, and doorstops. See details of the stop installation on page 47

Before mounting the outer panels and doors, I stained the assembled base and the outer panels to match the grilling center. Then I attached the panels with construction adhesive and brads. Next, you can mount the doors on pin hinges, and install the door pulls. You'll find a detail of these installations on page 47.



## a counter and bar
# TOP THINGS OFF

The countertop and bar look great, with their shiny black granite tiles that contrast against the white and natural-wood tones of the base. And they'll wear like, well, granite, even in harsh outdoor conditions.

These counter surfaces are both made just like the grilling center counter, with a three-layer sandwich of 3/4" plywood, cement backerboard, and then tile, as shown in the *Top Assembly*, below, and on page 48.

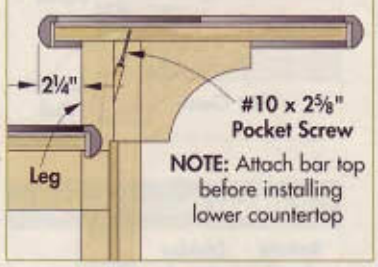
**Build Separate Assemblies —** As you might imagine, the counter and bar top get pretty heavy, so I built them separately from the base cabinet, and installed them only after moving everything into position on my patio. Using pocket screws to secure the tops makes this possible.

Start building the counter and bar top by cutting the plywood counter and bar substrates (U,V) to size. Next, lay out the sink opening. Note that our opening is sized for a 15"-square sink. Check the sink you buy. Then drill clearance holes in the corners, and cut the opening with a jig saw.

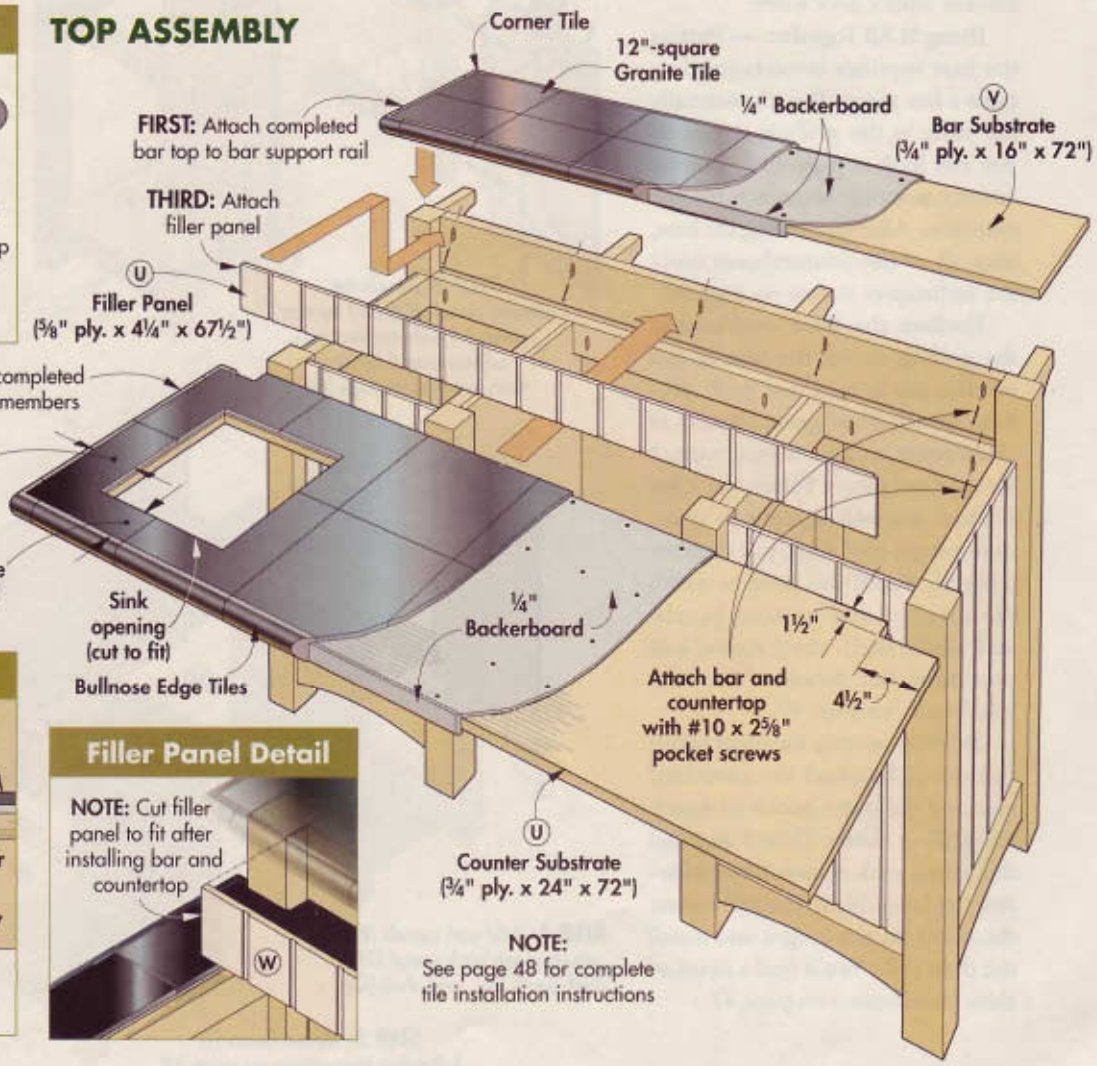
Now you can add the fiber-cement backerboard. The counter has one large main piece, with small splices around the sink cutout. The bar has two pieces. See pages 26 and 48 to learn more about this material.

After that, you can add the tile and grout to complete the countertop and bar *(page 48)*.

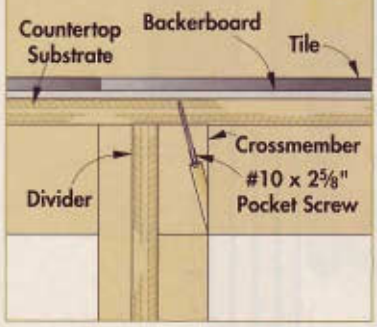
### Bar Top Detail




### TOP ASSEMBLY




### Countertop Detail




### Filler Panel Detail

**Anchor the Base** — Before adding the completed tops and installing the sink and refrigerator, you need to do two things. First, move the base cabinet into its final position on your patio or deck.

Second, anchor the base to eliminate any risk of it tipping when people lean on the bar. You can do this easily by mounting a couple of galvanized corner braces to the inner front legs *(see the Illustration and Detail, below right)*. Then drill holes in the concrete, and drive in a masonry screw at each leg.

**Bring On the Tops** — With the base secured, you can install the tops. Attach the bar top first so that you have space to drive the pocket screws that are located in the bar support rail. Once the bar is secure, screw the countertop into position below, again using pocket screws.

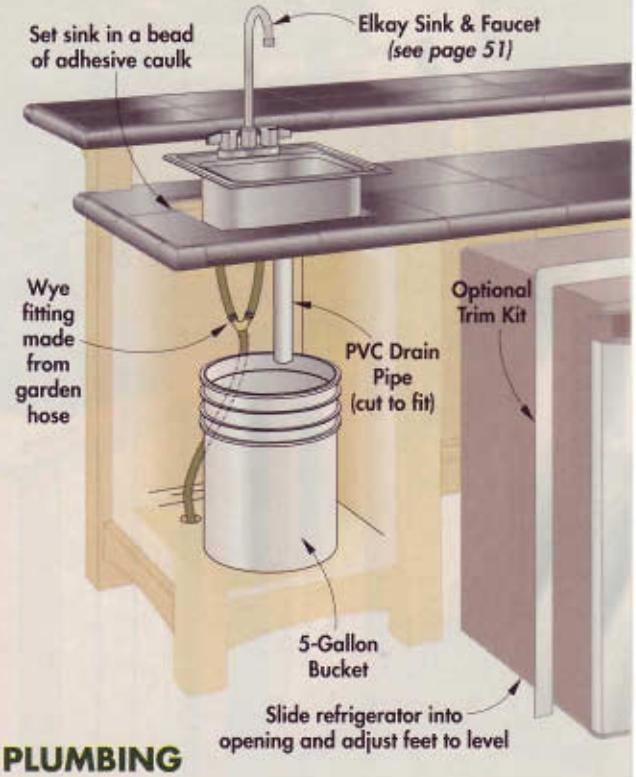
You'll see that there's a gap between the bar and counter where the back of the bar support rail is visible. I covered this with a filler panel (W) made from T1-11 plywood *(Filler Panel Detail)*. Like the back panel, the filler is made of two pieces. I stained the filler white, then secured it with adhesive and brads.

**Set the Sink** — Now you can install the sink, which means you'll have to decide whether to plumb it permanently, or use a temporary hookup. Permanent plumbing is great, but it can be costly and difficult to install. Plus, if you live in a cold climate, you'll have to drain the lines to prevent them from freezing.

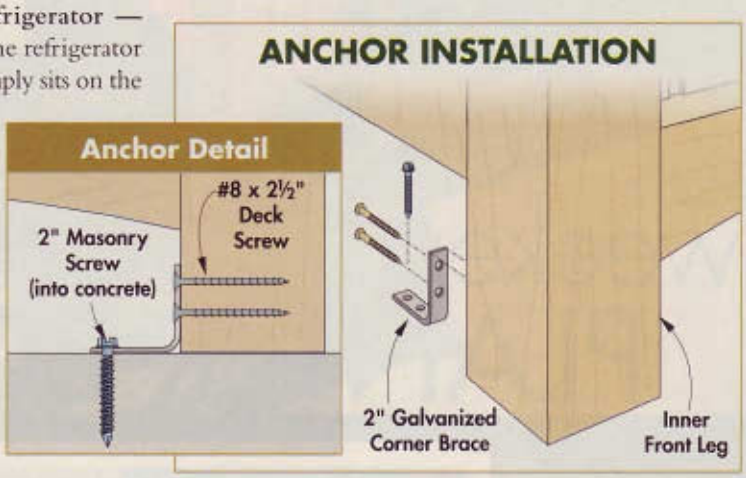
Because I mainly wanted to use the sink for a quick splash of water when I needed it, I went with a temporary hookup, as shown at right. I made a wye fitting from garden hose, and then connected it to the faucet with adapters from the hardware store. A 5-gallon bucket in the cabinet holds drain water.

**Slide In the Refrigerator** — Finally, you can slip the refrigerator into its opening. It simply sits on the ground and doesn't need to be secured to the base.

Also, make sure to use a heavy-duty extension cord, and plug the refrigerator into a Ground Fault Circuit Interrupter (GFCI) outlet for safety.




**PLUMBING**




## MATERIALS & HARDWARE

| | Part | Qty | T | W | L | Material |
|---|---|---|---|---|---|---|
| A | Front Legs | 4 | 3¼" | 3¼" | 34½" | Cedar |
| B | Rear Legs | 2 | 3¼" | 3¼" | 40½" | Cedar |
| C | Front Stretchers | 2 | 2¾" | 3¼" | 16½" | Cedar |
| D | End Stretchers | 2 | 2¾" | 3¼" | 18½" | Cedar |
| E | Crossmembers | 6 | 1½" | 3¼" | 18½" | Cedar |
| F | Upper Rail | 1 | 1½" | 3¼" | 67½" | Cedar |
| G | Lower Rail | 1 | 3" | 3¼" | 67½" | Cedar |
| H | Bar Support Rail | 1 | 1½" | 5½" | 67½" | Cedar |
| I | Bar Support Brackets | 4 | 1½" | 5½" | 6" | Cedar |
| J | Lower Rail Cleat | 1 | 1½" | 1½" | 67½" | Cedar |
| K | Stretcher Cleats | 4 | 1½" | 1½" | 18½" | Cedar |
| L | Filler Cleats | 2 | 1½" | 1½" | 13½" | Cedar |
| M | Shelf Cleats | 2 | 1½" | 1½" | 15" | Cedar |
| N | Doorstops | 4 | ¾" | ¾" | 28½" | Cedar |
| O | Divider Panels | 2 | ¾" | 20" | 32" | Exterior Plywood |
| P | Bottom Panels | 2 | ¾" | 18" | 19½" | Exterior Plywood |
| Q | Shelf | 2 | ¾" | 12" | 19¼" | Exterior Plywood |

| | Part | Qty | T | W | L | Material |
|---|---|---|---|---|---|---|
| R | End Panels | 2 | ⅝" | 18½" | 28½" | T1-11 Plywood |
| S | Back Panel | 1 | ⅝" | 28½" | 67½" | T1-11 Plywood |
| T | Doors | 2 | ⅝" | 16¼" | 27¾" | T1-11 Plywood |
| U | Counter Substrate | 1 | ¾" | 24" | 72" | Exterior Plywood |
| V | Bar Substrate | 2 | ¾" | 16" | 72" | Exterior Plywood |
| W | Filler Panel | 2 | ⅝" | 4¼" | 67½" | T1-11 Plywood |

**Serving Center Hardware**
- (20) 8" TimberLok Screws (TLS-4080)*
- (2) ¼" x 5" Galvanized Lag Screws
- (22) 5/16" SAE Washers
- (22) ¾" Cedar Plugs
- (55) #10 x 2⅝" Pocket Screws
- (28) #8 x 2½" Deck Screws
- (2) #8 x 4" Deck Screws
- (50) ¾" Cementboard Screws
- (100) 1½" Brads
- (4) 2" Pin Hinges (#26955)**
- (2) Stainless Steel Bar Pulls (#54720)**
- (2) Hardibacker Panels (¼" x 36" x 60")
- (2) 2" Galvanized Corner Braces
- (2) 3/16 x 2" Masonry Screws
- (24) 12" x 12" Granite Tiles***
- (30) Bullnose Edge Tiles***
- (8) Corner Tiles***
- Mastic Tile Adhesive
- Grout

* Item available at 800-443-7937 or McFeelys.com
** Items available at 800-279-4441 or Rockler.com
*** Shanxi Black Prescott tile available from The Tile Shop at 800-433-2939

# weekend PLANTER BOX

Place a potted plant on the adjustable shelf in this project to add a little color to the outdoor kitchen *(above)*. Or for "cooler" pursuits, just put an ice bucket on the shelf to transform it into a chest for keeping drinks cold.

For a nice complement to the other outdoor kitchen projects, you can build this planter box in a weekend or less. The box's main purpose is to add a little color to the kitchen by holding a potted plant *(Photo, left)*. Or if you prefer, use it as an ice chest for keeping drinks cold *(Photo, below)*.

**Planter Details** — Just like the grilling center and serving bar, this planter is made up of thick legs (A) and curved stretchers (B) made from 4x4 cedar posts, and 2x4 crossmembers (C) that connect the legs at the top. The legs are joined to the stretchers with TimberLok screws and the crossmembers with pocket screws. Note that when drilling the pocket holes in the crossmembers, you'll also want to drill pocket holes for attaching the top later *(Construction Details)*.

Here again, a set of cleats (D) are attached to the top of the stretchers to hold four cedar T1-11 plywood side panels (E) in place.

There are, however, a couple areas where the construction of this planter differs from the other projects.

**Shelf** — First, you'll need to drill a series of holes in the legs for shelf pins, which accept an adjustable shelf (F) *(Planter Side Detail)*. This shelf is a piece of $^3/_4$" plywood that's cut to size to fit inside the planter box.

**Top** — Also, the planter top is a square frame made from cedar 2x6 stock. The four frame pieces (G) are joined with half laps *(Half Lap Detail)*.

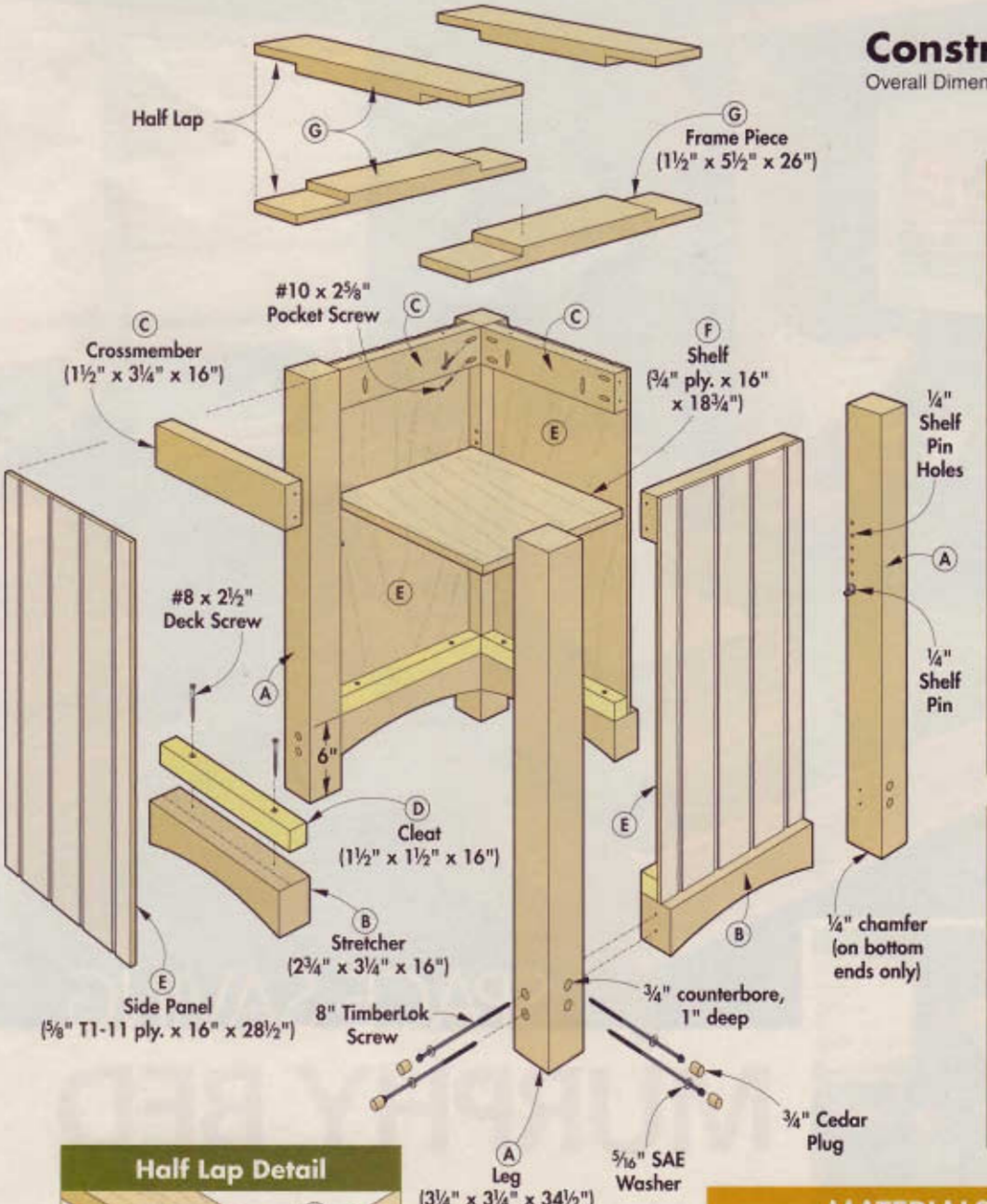
**Half Laps** — To make the half laps, set up a dado blade in the table saw at the height of half the thickness of the stock. Then set the rip fence to cut the shoulder of the joint. With the piece lying flat on the saw, make a series of passes on each end to form the half laps.

Now assemble the frame with polyurethane glue, and clamp it together. When the glue dries, set it on the planter box so it overhangs by an equal amount all around, and attach it with pocket screws *(Side Detail)*.

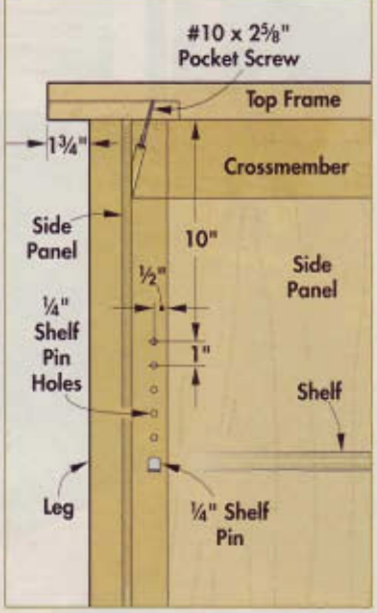
Last, secure the panels with construction adhesive and brads, set the shelf in place, and this planter box is ready for the patio.

# Construction Details

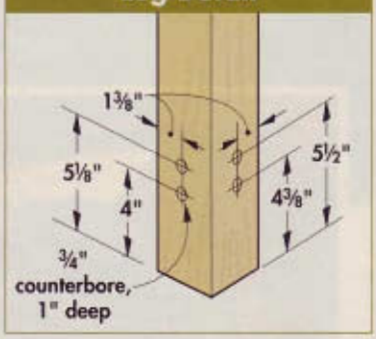
Overall Dimensions: 26" W X 26" D X 36" H



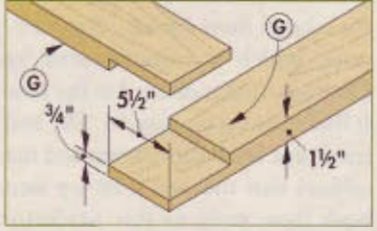

## Planter Side Detail



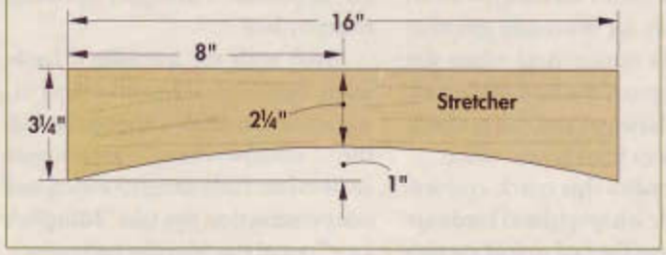

## Leg Detail




## Half Lap Detail




## Stretcher Parts View




## MATERIALS & HARDWARE

| | Part | Qty | T | W | L | Material |
|---|---|---|---|---|---|---|
| A | Legs | 4 | 3¼" | 3¼" | 34½" | Cedar |
| B | Stretchers | 4 | 2¾" | 3¼" | 16" | Cedar |
| C | Crossmembers | 4 | 1½" | 3¼" | 16" | Cedar |
| D | Cleats | 4 | 1½" | 1½" | 16" | Cedar |
| E | Side Panels | 4 | ⅝" | 16" | 28½" | T1-11 Plywood |
| F | Shelf | 1 | ¾" | 16" | 18¾" | Exterior Plywood |
| G | Frame Pieces | 4 | 1½" | 5½" | 26" | Cedar |

**Planter Box Hardware**

- (16) 8" TimberLok Screws (TLS-4080)*
- (16) 5/16" SAE Washers
- (16) ¾" Cedar Wood Plugs
- (24) #10 x 2⅝" Pocket Screws
- (12) #8 x 2½" Deck Screws
- (24) 1½" Brads
- (4) ¼" Shelf Pins

* Item available at 800-443-7937 or McFeelys.com

**▲ HOME OFFICE SUITE**
This easy-to-operate Murphy bed lets you convert your home office into a guest bedroom — and back again — in minutes.

# SPACE-SAVING MURPHY BED

In the April 2005 issue of *Workbench*, we built the furniture that constitutes the "office" part of our home office suite — specifically, a computer desk, a printer cabinet, and a file cabinet. In this issue, we turn our attention to the sleeping accommodations for guests.

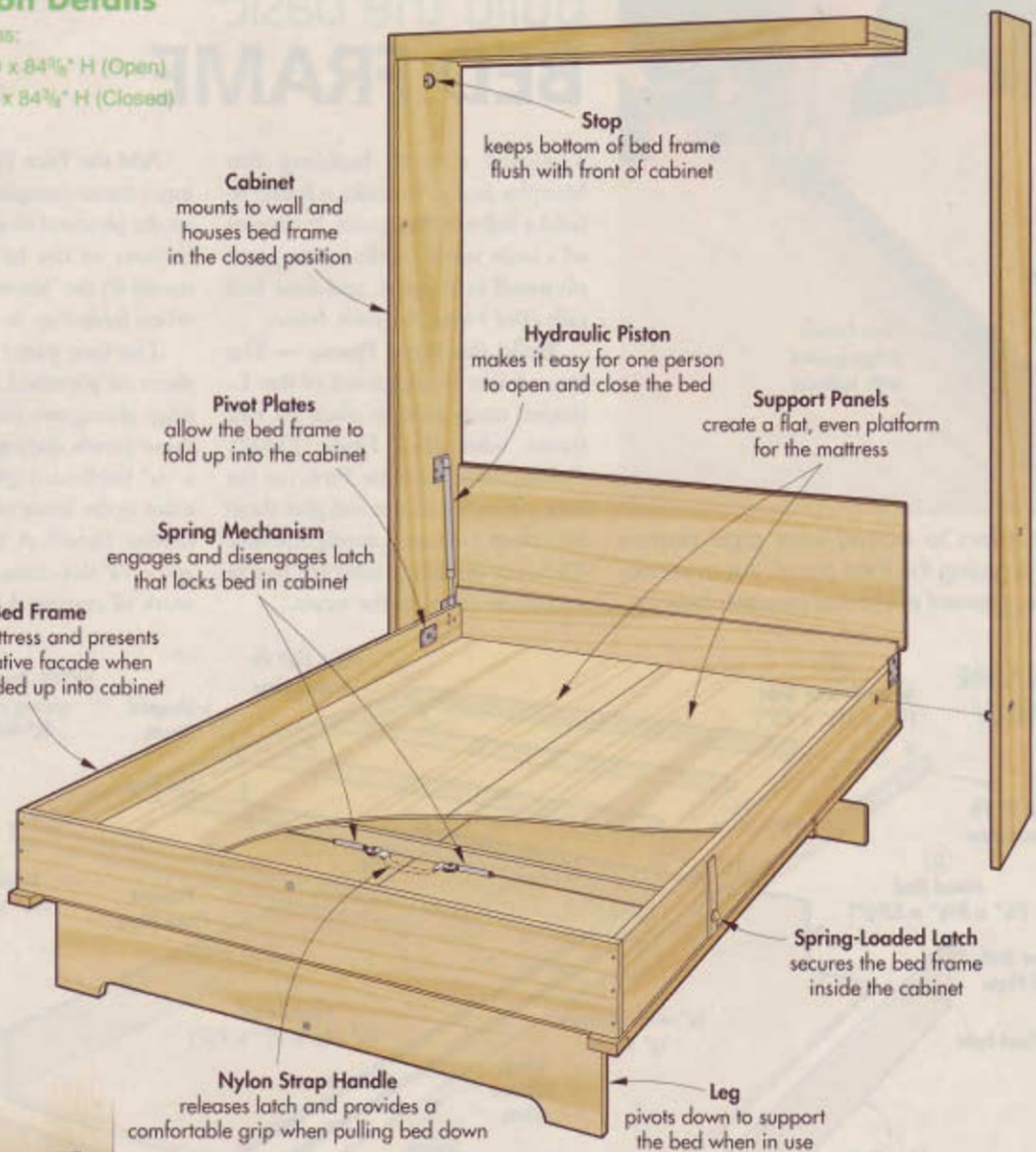
By building a Murphy bed that folds down from a cabinet, the room can be ready for overnight guests at a moment's notice. And when the guests are gone, the bed folds back into the cabinet, so you can get back to business in your home office.

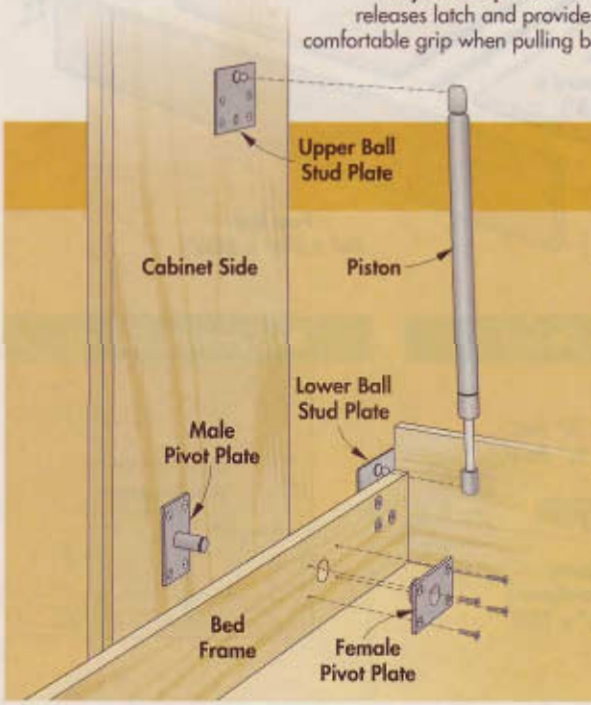
What makes this quick conversion possible is a specialized hardware kit that allows the bed to fold up into the cabinet *(Inset Photos)*. This hardware, which is manufactured by Create-A-Bed, is detailed in the *How It Works Sidebar* on page 61. The bed frame that holds the mattress and the cabinet that the bed folds up into both have parts of this hardware mounted on them. When assembled, these pieces of hardware act in concert to produce a smoothly operating Murphy bed.

Even with the specialized hardware, building a Murphy bed is, admittedly, no small undertaking. But the woodworking techniques involved are fairly straightforward, and our construction tips take "Murphy's Law" out of this Murphy bed project.

## Construction Details

Overall Dimensions:
57⅞" W x 78⅝" D x 84⅜" H (Open)
57⅞" W x15⅞" D x 84⅜" H (Closed)




## HOW IT WORKS

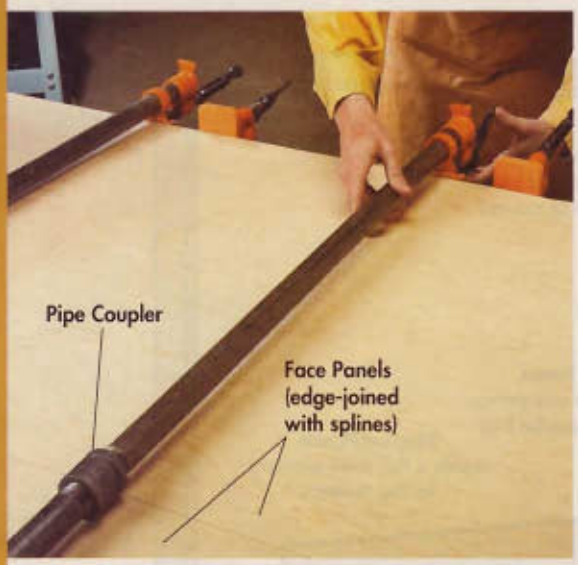
The key to this Murphy bed's operation is the specialized hardware. Keep in mind that the details of this design are specific to the Create-A-Bed hardware kit we purchased from Rockler (vertical installation for a full-sized mattress).

The main hardware pieces in the kit are the pivot plates, pistons, and ball stud plates *(see Illustration)*.

There are two pairs of pivot plates in the Murphy bed kit. Each pair includes a male and female pivot plate. These connect the bed frame to the cabinet and allow the bed to fold up and down.

Two hydraulic pistons help control the descent of the bed and also aid in lifting the bed back into the storage cabinet.

Each of the pistons snaps onto two ball stud plates, which are installed on the cabinet side and the bed frame.




▲ Use couplers to extend your pipe clamps when edge-gluing the face panel. An over-and-under arrangement of clamps prevents bowing.

## build the basic
# BED FRAME

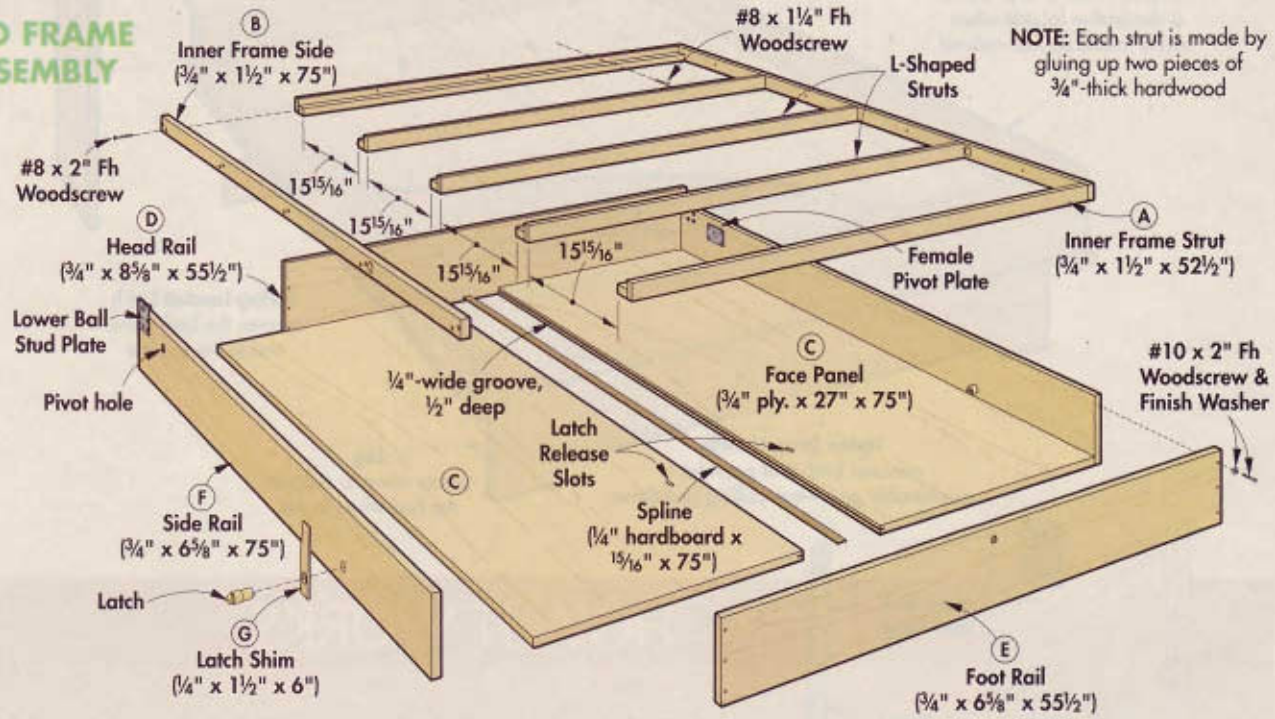
The first step to building this Murphy bed is to make a frame to hold a full-sized mattress. It consists of a large inner frame, a two-piece plywood face panel, and four bed rails *(Bed Frame Assembly, below)*.

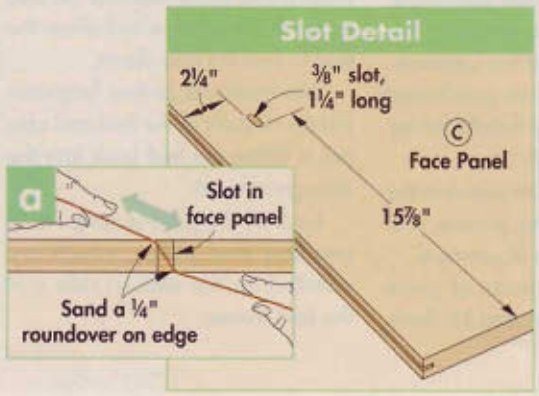
**Build the Inner Frame** — The inner frame is composed of five L-shaped struts held in place by two frame sides *(Bed Frame Detail)*. Construction is simple. First, cut ten strut pieces (A) to size and glue them into their L-shaped configurations. Then cut the frame sides (B) to size and screw them to the struts.

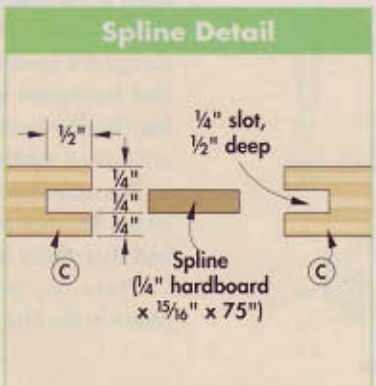
**Add the Face Panel** — With the inner frame complete, you can focus on the plywood face panel. This is the bottom of the bed frame, which means it's the "show" face of the bed when folded up in the cabinet.

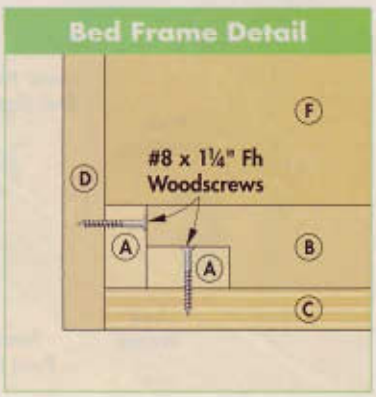
The face panel is wider than a sheet of plywood, so it's made by edge-gluing two panels (C). To align these panels during glue-up, I used a 1/4" hardboard spline that fits into a slot in the inner edge of each piece *(Spline Detail)*. A handheld router and a 1/4" slot-cutting bit make quick work of cutting this slot.

## BED FRAME ASSEMBLY



Before gluing up the face panel, there's one last detail to attend to. That's cutting a small slot in each panel for a nylon strap, which is part of the latch release mechanism *(Slot Detail)*. I used a plunge router with an edge guide, and then routed the slots with a $^3/_8$" spiral bit. Then I sanded the edges of the slots to keep the strap from fraying *(Detail a)*.

Now you're ready to glue the panels together — provided you have enough long clamps. If not, you can "stretch" your clamps by using the tip shown on page 62. Once you've rounded up the clamps, brush glue into the grooves, insert the spline, and clamp the face panel together.

**Attach Face Panel to Frame —** When the glue dries, it's time to attach the face panel to the inner frame. To do that, set the face panel on a flat surface with its "show" side down. Then attach the frame with glue and screws *(Bed Frame Detail)*.

**Make the Bed Frame Rails —** The next step is to surround the inner frame and face panel with four bed rails made from $^3/_4$"-thick maple. Start by cutting the head rail (D), foot rail (E), and side rails (F) to size.

**Add Latch Shims —** If you look at the *Side Rail Illustration* below, you'll see that there's a wood shim (G) attached to the outer face of each side rail. This shim ensures the proper spacing between the bed frame and the wall cabinet, which is required for the latch to operate.

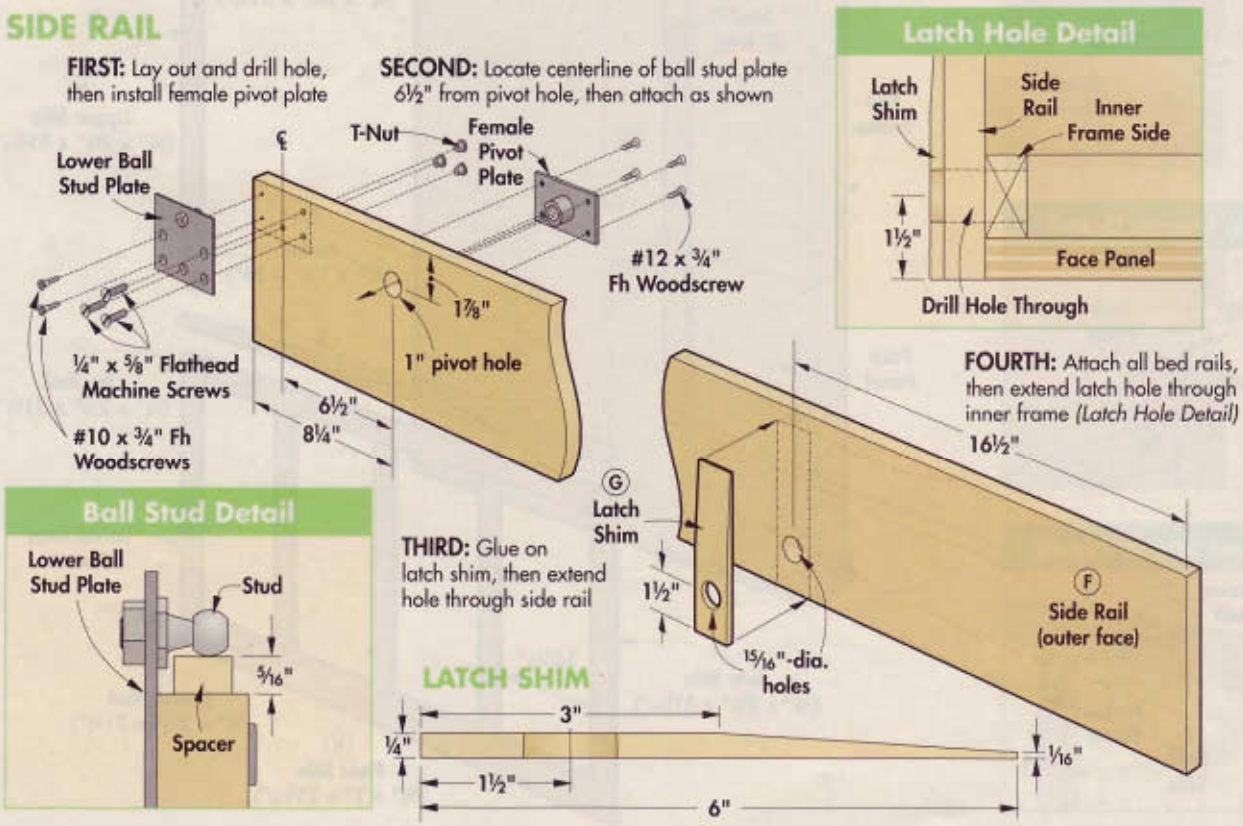
The latch shim is a thin strip of hardwood that tapers toward one end. Drill a hole in the shim to accept the latch. Then sand the taper using a belt/disk sander. The shim is simply glued to the side rail. Once the glue dries, take the side rail to the drill press and extend the hole in the shim through the rail.

At this point, you're ready to start mounting the hardware that makes this Murphy bed operate. In particular, you'll be mounting a female pivot plate and a lower ball stud plate to each side rail. One thing to be aware of here is that the side rails are *mirror* images of each other. So you'll want to label the inside and outside faces of each rail to make sure the hardware gets mounted on the correct side.

That done, follow the step-by-step installation process detailed in the *Illustration* below to mount the hardware. Note that you'll need to drill a hole to accept the female pivot plate. Also, it's important to install the ball stud plate so the stud is $^5/_{16}$" above the top of the rail *(Ball Stud Detail)*. Later, this will allow clearance for the piston to snap onto the stud. I made a spacer to ensure proper clearance.

**Attach the Bed Rails —** All that's needed to complete the bed frame is to attach the rails. The side rails go on first. Align these rails so they're flush with the inner frame on the ends. Then drive screws through the inner frame and into the side rails. Now attach the head and foot rails to the side rails using woodscrews and finish washers.

After completing the assembly, there's one final detail to take care of. You need to extend the latch hole that you drilled in the shim and side rail through the inner frame *(Latch Hole Detail)*. An easy way to do that is use the existing hole as a guide. Just chuck a Forstner bit in a portable drill and drill the hole.




▲ A leg assembly pivots down from the frame to support the bed during use.

## add a decorative face &
# FLIP-DOWN LEG

As I mentioned, the face panel of the bed frame is the "show" side of this Murphy bed. So to make it as attractive as possible, I applied decorative trim pieces to the face panel. One of these trim pieces is also functional. It's part of a leg assembly that sits flat on top of the bed frame when it's folded up, then swings down for support when you pull the bed out of the cabinet *(see Photo at left)*.

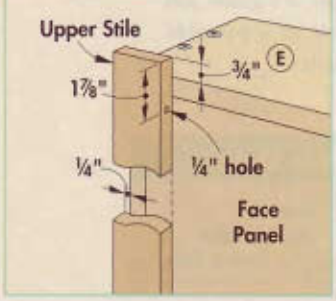
The trim pieces, including the leg assembly, are all made from ¾"-thick hardwood. They're attached in three phases. First, a lower face frame is applied as a single unit *(Trim & Leg Assembly)*. Then two upper stiles are added on. Finally, the pivoting leg assembly is connected to the stiles.

**Build the Lower Face Frame —** The lower face frame is sized to overhang the bed frame by ¼" on each side *(Face Frame Detail)*. With that in mind, start by cutting the top and bottom rails (H, I) and side stiles (J) of the face frame. Then drill pocket holes in the rails and assemble the frame *(Pocket Screw Detail)*. Now cut the field stiles (K) to fit between the rails and attach them with pocket screws.

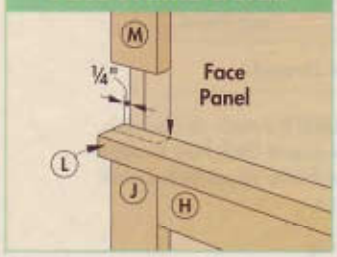
The final piece of the lower face frame is a hardwood ledge (L). Simply cut this ledge to size and then glue and clamp it to the top rail.

Now you're ready to attach the face frame. To do this, glue and clamp it in place, taking care to maintain that overhang I mentioned earlier.

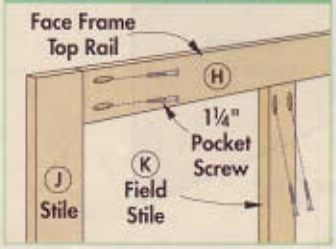
### Upper Stile Detail



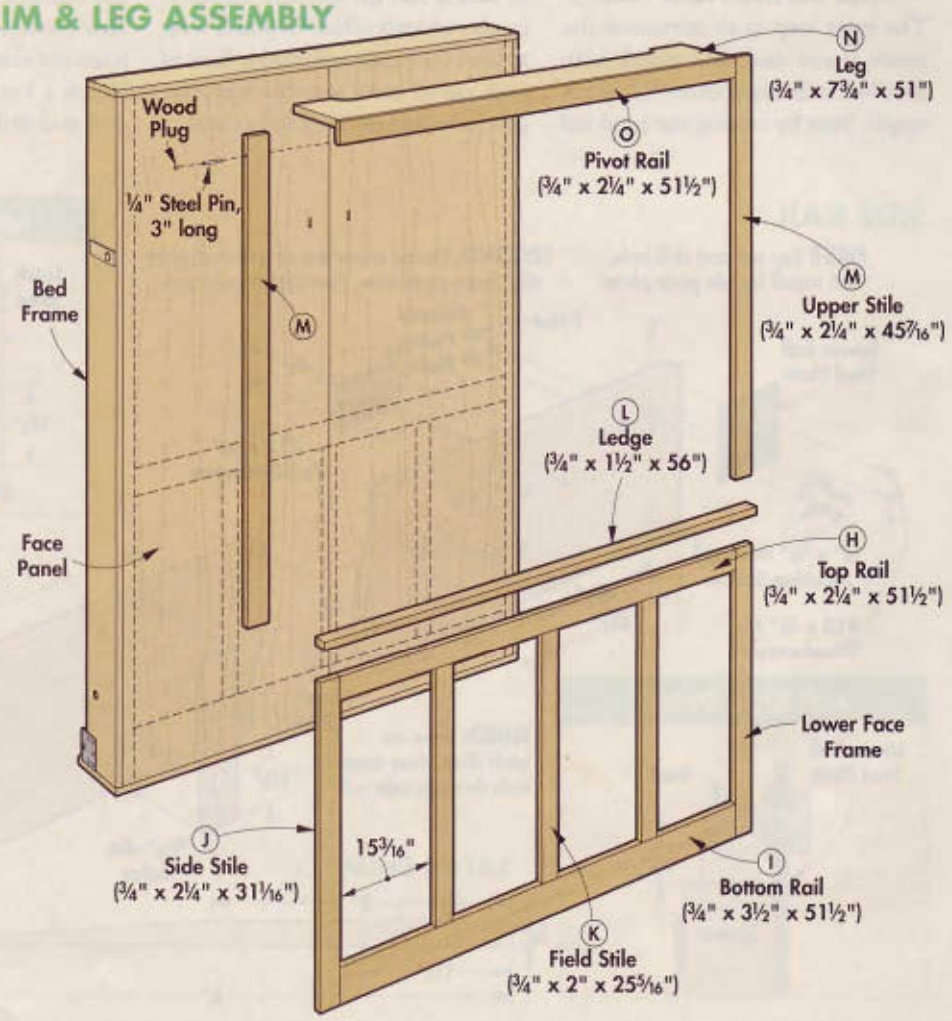

### Face Frame Detail




### Pocket Screw Detail




### TRIM & LEG ASSEMBLY



**The Upper Stiles** — The upper stiles (M) are next, and these pieces are about as simple as they get, except for one small detail. When the bed is complete, the support leg will pivot on steel pins that connect the leg assembly to the upper stiles. You'll install those pins later, but you need to make accommodations for them now.

To do that, you'll need to drill a 1/4" hole through each stile for the pin *(Upper Stile Detail)*. Carefully lay out the location of each hole and drill it at the drill press.

With that done, glue and clamp the stiles to the face panel. Pay attention to a couple things here. First, make sure that both stiles overhang the same amount (1/4") as the lower face frame. Then measure between the stiles at the top and bottom to be sure they're parallel.

**Support Leg** — Despite its "pivotal" role in supporting the bed, the leg assembly is still a simple build. It's comprised of two pieces: the leg itself and a pivot rail *(Support Leg Assembly)*.

Start by cutting the leg (N) to size. Then lay out and cut the curved "lift" with a jig saw.

The next step is to cut the pivot rail (O) to size. Note that it's 1/2" longer than the leg, which creates a 1/4" overhang on each side *(Pivot Rail Detail)*. This provides clearance to keep the leg from rubbing against the stiles.

For a similar reason, you'll need to rout a bullnose profile on one edge of the pivot rail *(Bullnose Detail)*. This profile allows the leg assembly to pivot freely without binding against the bed frame.

After shaping the edge of the pivot rail on the router table, simply glue and clamp it to the leg.

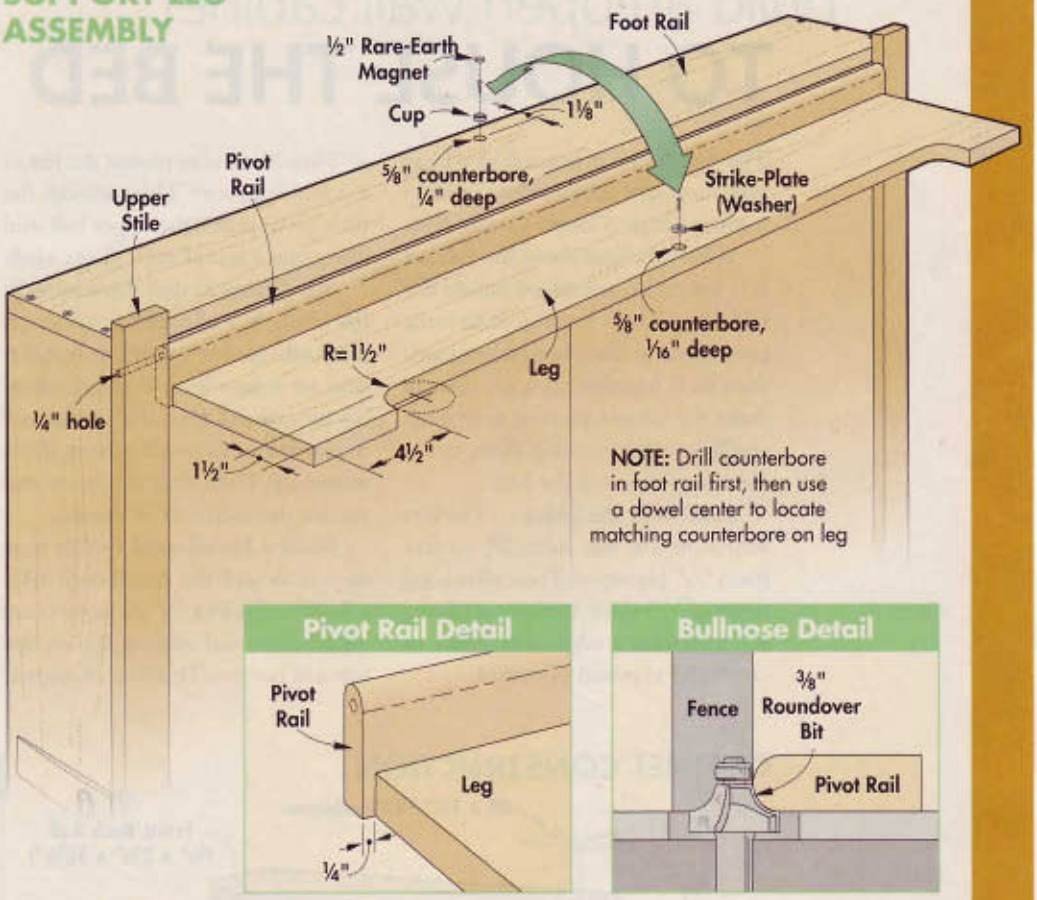
**Attach the Support Leg** — In order to mount the support leg assembly using the pivot pins mentioned earlier, you'll have to drill holes in the pivot rail that align with those in the upper stiles. To do this accurately, position the leg assembly between the stiles and temporarily clamp it to the bed frame in the closed position. Then, using the holes in the stiles as a guide, drill the holes in the pivot rail *(Fig. 1)*. Now tap the pins through the stiles and into the pivot rail *(Fig. 2)*. Once that's done, glue in wood plugs to conceal the holes.

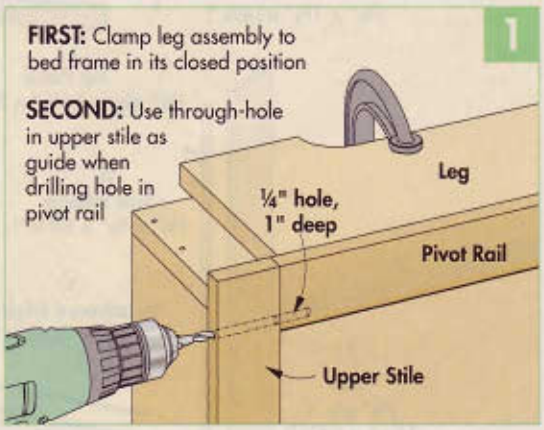
**Add a Magnetic Catch** — To keep the support leg from swinging out unexpectedly when lowering the bed, I added a magnetic catch. It's comprised of a rare-earth cup magnet and a strike plate (washer). These parts fit into shallow pockets that are formed by drilling counterbores in the foot rail and leg *(Support Leg Assembly)*.

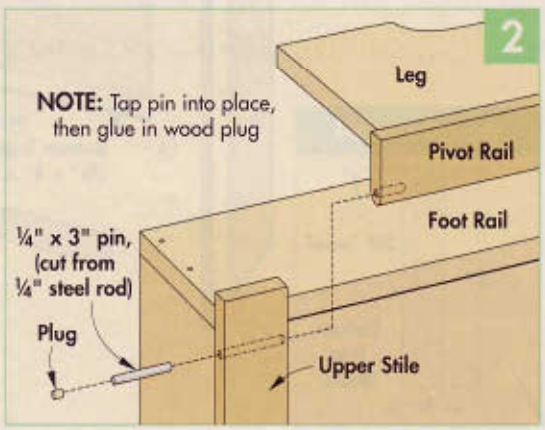
An easy way to align the counterbores is to use a dowel center. This is a metal pin that you insert into a dowel hole. It has a sharp spur which is used to locate the exact center in a mating piece.

To use the dowel center on the bed, drill a counterbore in the foot rail. Then insert the dowel center and close the leg against the foot rail to mark the location of the strike plate. Now drill the counterbore in the leg and install the catch.

## SUPPORT LEG ASSEMBLY



build an open wall cabinet

# TO HOUSE THE BED

The bed frame is housed in a large wall-mounted cabinet that's open in front and back *(Cabinet Construction)*.

What's unusual about this cabinet is it has to be assembled *around* the bed frame. That's because of how the pivot plates in the Murphy bed hardware kit fit together. So, while you can make the cabinet parts in your shop, you'll actually assemble them in the room as you install the bed.

**Start with the Sides** — The first step is to cut the sides (P) to size from $^3/_4$" plywood. Then glue long strips of $^3/_4$"-thick hardwood edging (Q) to the front edge of each side to cover the exposed plywood.

Now it's time to mount the rest of the bed hardware. This includes the male pivot plates, the upper ball stud plates, and a pair of stops *(Side Detail)*.

You'll need to drill three holes in the inside face of each side to accept this hardware. Here again, the cabinet sides are mirror images of each other. So be sure to label the inside and outside faces to avoid getting them mixed up. Then drill the holes and mount the hardware as shown.

**Build a Headboard** — The next step is to add the headboard (R). Like the sides, it's a $^3/_4$" plywood panel with hardwood edging (S) on the top and bottom. This time, however, I used $^1/_4$"-thick strips so the long, horizontal joint lines between the edging and the headboard would practically disappear.

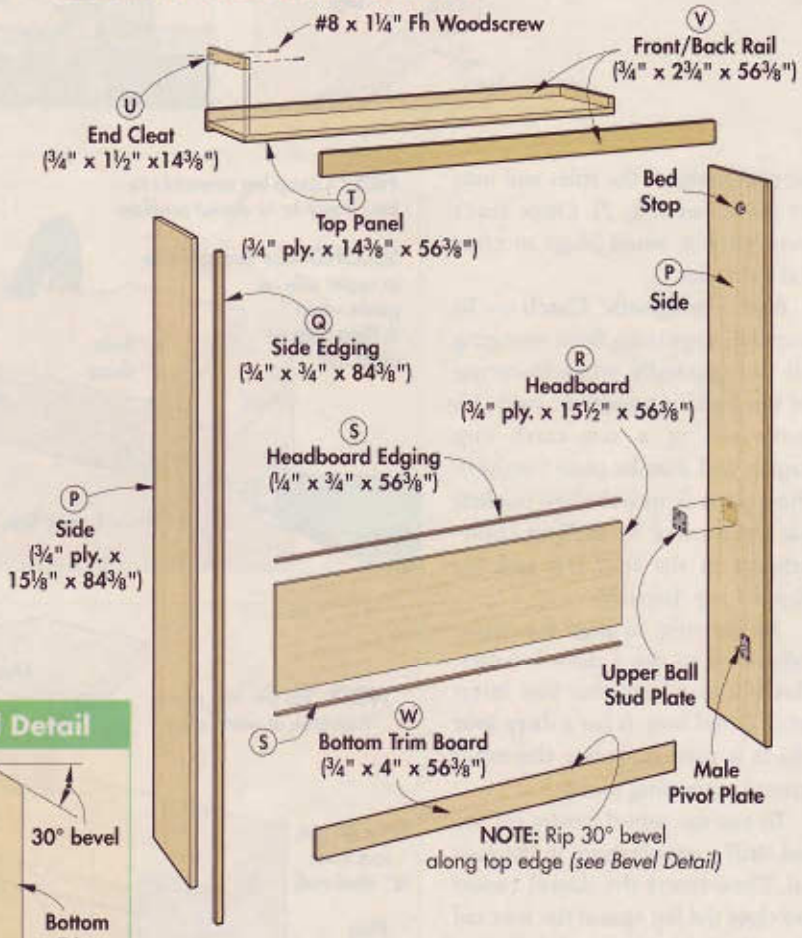
The headboard will be attached to the sides of the cabinets with pocket screws *(Headboard Detail, page 67)*. To simplify assembly later on, drill pocket holes for the screws now.

**Topping It Off** — Building the top of the cabinet is next. It consists of a $^3/_4$" plywood top panel with $^3/_4$"-thick hardwood end cleats (U) and rails (V). Note that the end cleats are narrower than the rails.

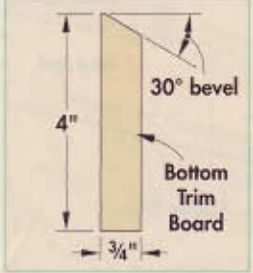
Start by gluing the end cleats to the top of the plywood top panel, flush with the front and back edges. Then glue on the rails so they're flush with the tops of the cleats.

**Bottom Trim Board** — The final piece of the cabinet is a bottom

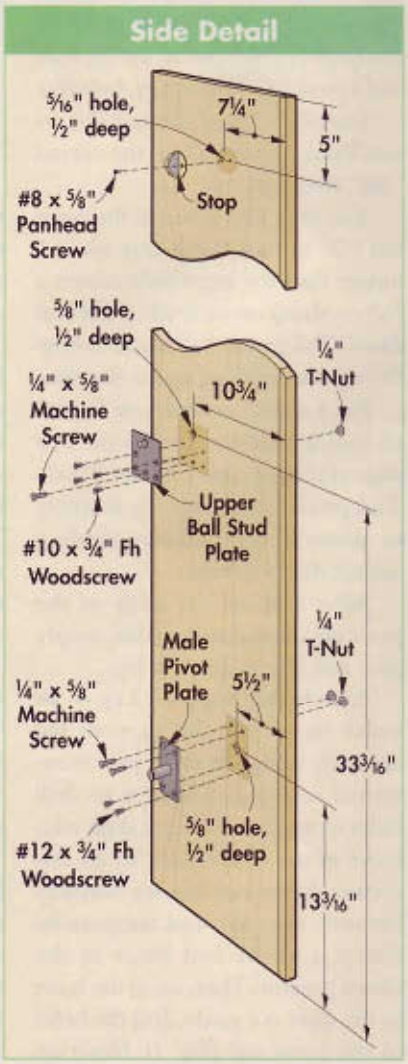
## CABINET CONSTRUCTION




### Bevel Detail




### Side Detail



trim board (W) made from ¾"-thick hardwood. Notice the bevel on the top inside edge of this piece *(Bevel Detail, page 66)*. It creates clearance for the bed frame to swing in and out. Rip this bevel on the table saw. Then once again, drill pocket holes that will be used to secure the trim board to the cabinet.

**Apply the Finish** — Before moving the bed from the shop to the room where it's going to be installed, you'll want to apply the finish. I used the same finish as on the office furniture, which is detailed in the April 2005 issue of *Workbench* and online at Workbenchmagazine.com

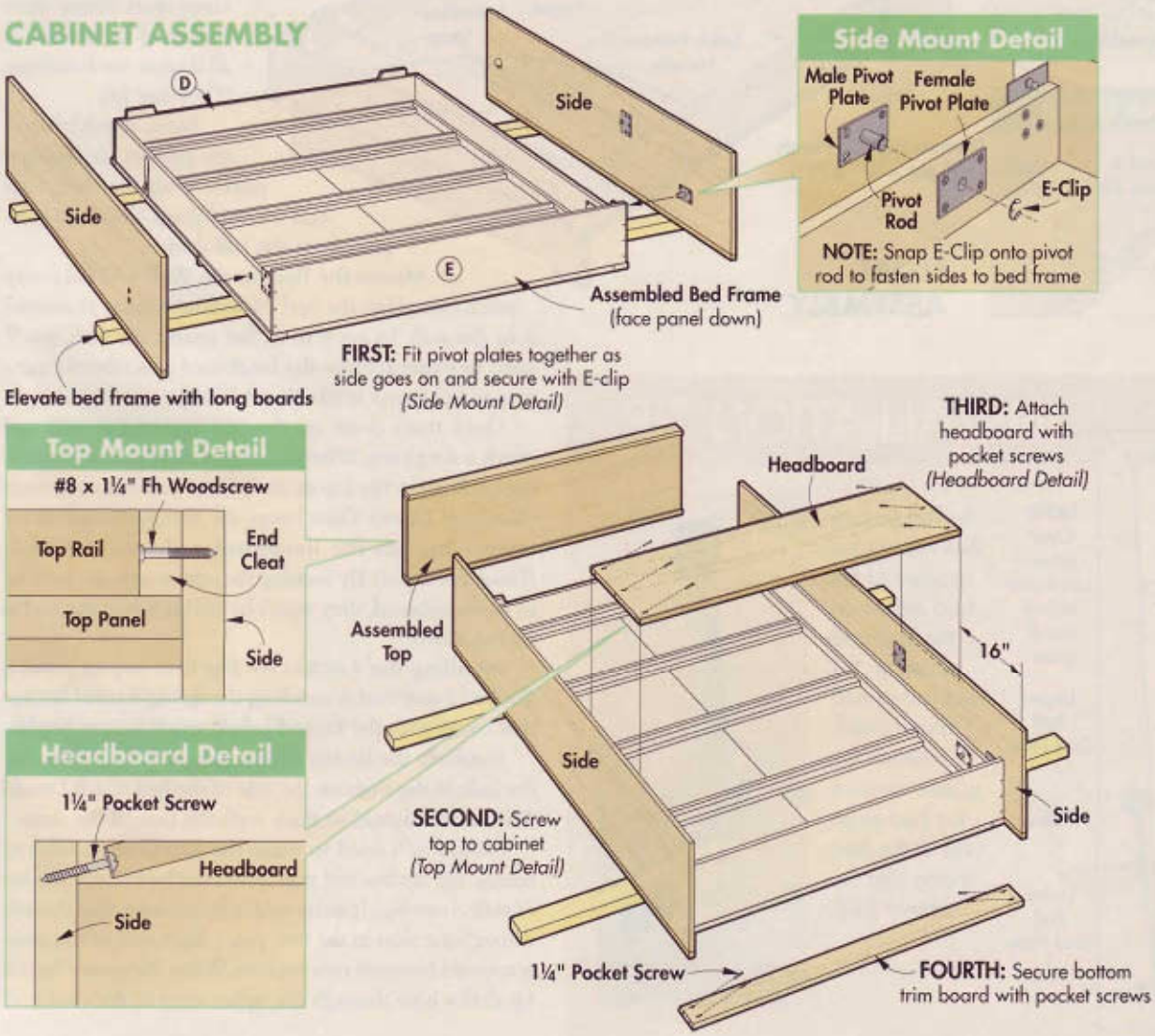
Just a note about the finish. Since the face panel of this bed is so large, you may want to use the finish to "break" it up a bit. To help disguise the bed, I used the clear finish on the lower part of the panel, the face frame, and the upper trim boards. Then I painted the upper part of the panel to match the walls.

**Preparing for Installation** — Once the finish is dry, you can move the bed pieces into the room. An extra set of hands will be useful for much of the installation process, so round up a helper, too. Position the bed frame with the face panel down and the head rail facing the wall. Prop the frame off the floor with boards to keep it from teetering on the ledge of the face frame *(Cabinet Assembly)*.

**Assemble the Cabinet** — Now you're ready to assemble the Murphy bed. The cabinet sides mount to the bed frame first. To accomplish this, fit the rod in the pivot plate on each side into the pivot plate in the bed frame *(Side Mount Detail)*. Then snap the E-clip included in the kit over the rod to secure the connection.

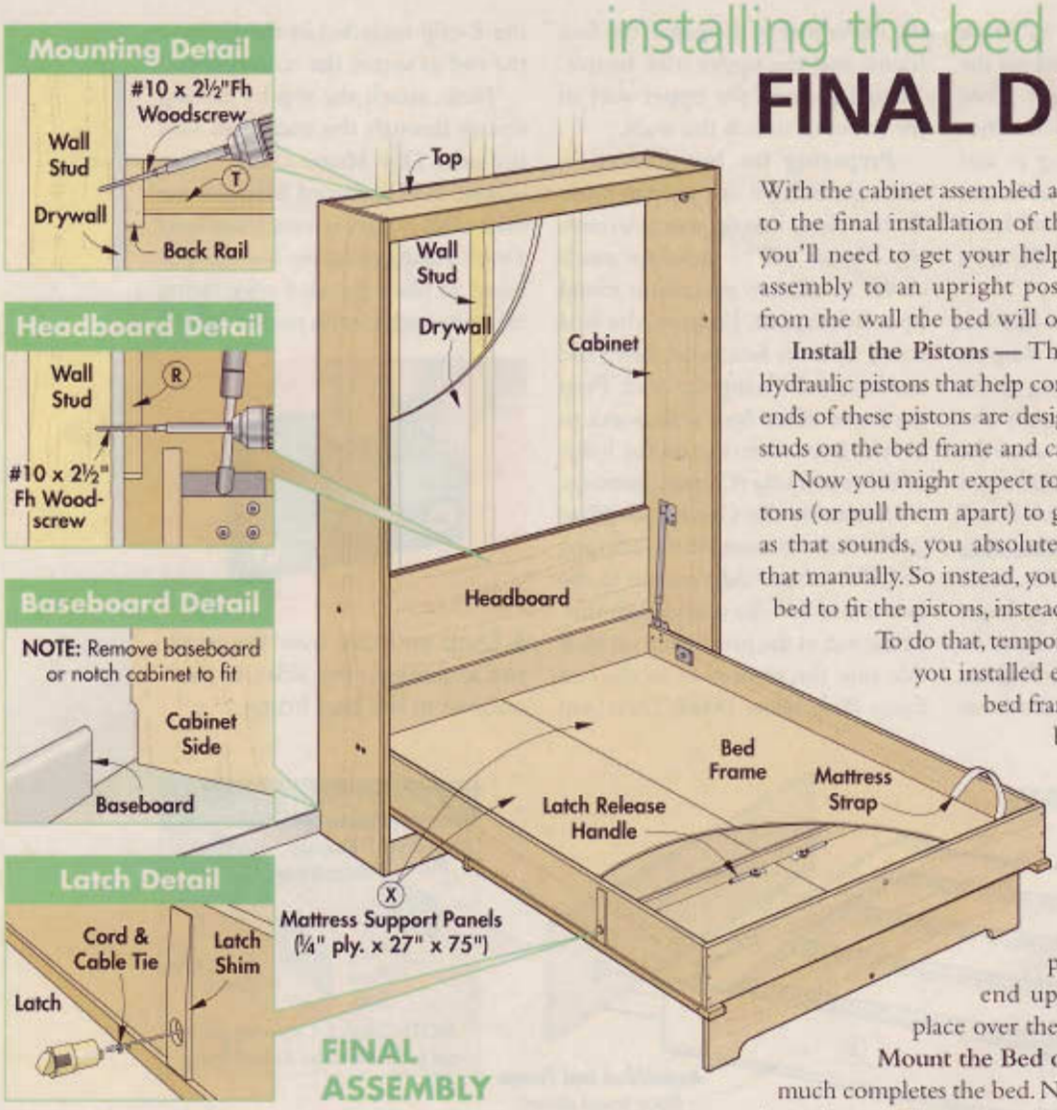
Next, attach the top by driving screws through the end cleats into the sides *(Top Mount Detail)*. Then mount the headboard between the sides with pocket screws *(Headboard Detail)*. Finally, clamp the bottom trim board in place (beveled edge facing in), and attach it with pocket screws.

▲ Snap an E-clip over the pivot rod to connect the sides of the cabinet to the bed frame.



## installing the bed &

# FINAL DETAILS




With the cabinet assembled around the frame, we come to the final installation of the Murphy bed. For this, you'll need to get your helper to assist in raising the assembly to an upright position a couple feet away from the wall the bed will occupy.

**Install the Pistons** — The first step is to install the hydraulic pistons that help control the bed's descent. The ends of these pistons are designed to snap onto the ball studs on the bed frame and cabinet sides.

Now you might expect to have to compress the pistons (or pull them apart) to get them to fit. But as easy as that sounds, you absolutely will not be able to do that manually. So instead, you'll have to manipulate the bed to fit the pistons, instead of the other way around. To do that, temporarily remove the bed stops you installed earlier. This lets you tilt the bed frame into the cabinet so the ball studs are the right distance apart. About three inches of inward tilt is all it takes *(see Installation Tip, below left)*.

Now, stand behind the cabinet, orient each piston with the indicated end up, and snap the ends into place over the ball studs.

**Mount the Bed on the Wall** — That pretty much completes the bed. Now you're ready to mount it to the wall. To get it to sit flat against the wall, you'll need to either remove the baseboard or scribe the cabinet to fit around it *(Baseboard Detail)*.

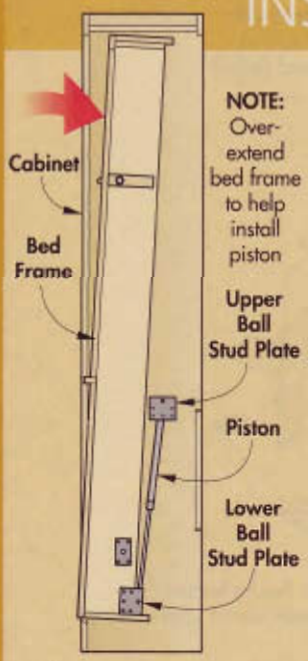
Once that's done, set the bed against the wall and check it for plumb. When it's plumb, drive screws through the back rail in the top of the cabinet and into wall studs *(Mounting Detail)*. Then lower the bed frame and drive screws through the headboard and into the studs *(Headboard Detail)*. By locating the screws near the bottom of the headboard, they won't be visible when the bed is folded down.

**Installing the Latches** — The final step in making this bed functional is installing the spring-loaded latches that come with the kit and a shop-made release handle.

Installing the latches is easy. Just push each one into the hole in the shim on the side of the bed *(Latch Detail)*. The latches should sit flush with the face of the shim.

Now, you'll need to make the handle that's used to release the latches and pull down the bed *(Latch Release Handle Assembly)*. It starts with a nylon strap that threads through the slots in the face panel. Each end of this strap is epoxied between two washers. When the epoxy has set up, drill a hole through the nylon strap in the center of

## INSTALLATION TIP




► The pistons that control the descent of the bed mount on the ball stud plates on the bed frame and cabinet sides. To attach the piston, remove the bed stops and tilt the bed frame into the cabinet *(left)*.

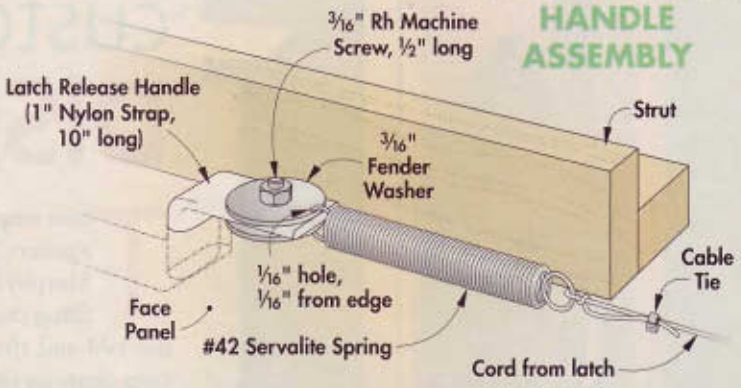
the washers for a machine screw and nut that hold the handle together. Then drill a smaller hole to connect the spring that provides tension for the latch system.

To complete the handle assembly, install a machine screw and nut into the center of each pair of washers, and hook the spring into the smaller hole. Then tie the cord from the latch through the end of the spring. Adjust the length of cord so that the spring just starts to pull, and reinforce the knot with a cable tie.

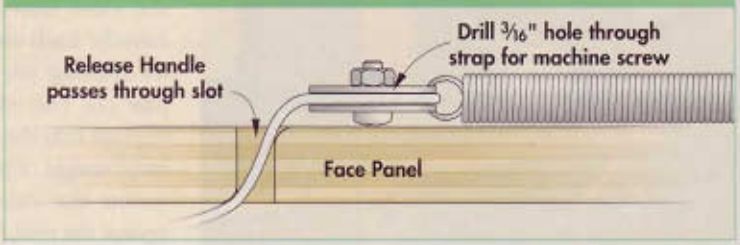
**Drill Latch Catches** — The latches rest in "catches" in the cabinet sides to provide a secure hold on the bed when it's folded up. These catches are nothing more than counterbores that are easy to locate accurately by following the sequence shown in *Figures 1 through 3*, below.

**Final Details** — Only a couple minor details remain. First, cut 1/4" plywood support panels (X) for the mattress to rest on and set them in the bed frame *(Final Assembly, page 68)*. Next, attach the mattress straps included in the kit. Take care to position them so they don't interfere with the latches. Finally, set the mattress in place.

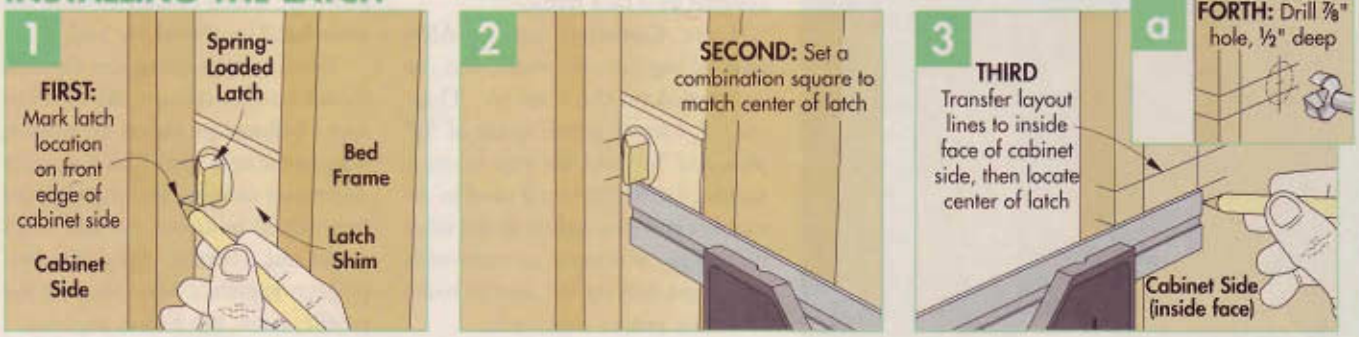
## LATCH RELEASE HANDLE ASSEMBLY




### Release Handle Detail




## INSTALLING THE LATCH




## MATERIALS & HARDWARE

| | Part | Qty | T | W | L | Material |
|---|---|---|---|---|---|---|
| | **Bed Frame** | | | | | |
| A | Inner Frame Struts | 10 | 3/4" | 1 1/2" | 52 1/2" | Maple |
| B | Inner Frame Sides | 2 | 3/4" | 1 1/2" | 75" | Maple |
| C | Face Panels | 2 | 3/4" | 27" | 75" | Maple Plywood |
| D | Head Rail | 1 | 3/4" | 8 5/8" | 55 1/2" | Maple |
| E | Foot Rail | 1 | 3/4" | 6 5/8" | 55 1/2" | Maple |
| F | Side Rails | 2 | 3/4" | 6 5/8" | 75" | Maple |
| G | Shims | 2 | 1/4" | 1 1/2" | 6" | Maple |
| H | Top Rail | 1 | 3/4" | 2 1/4" | 51 1/2" | Maple |
| I | Bottom Rail | 1 | 3/4" | 3 1/2" | 51 1/2" | Maple |
| J | Side Stiles | 2 | 3/4" | 2 1/4" | 31 1/16" | Maple |
| K | Field Stiles | 3 | 3/4" | 2" | 25 5/16" | Maple |
| L | Face Frame Ledge | 1 | 3/4" | 1 1/2" | 56" | Maple |
| M | Upper Trim Stiles | 2 | 3/4" | 2 1/4" | 45 7/16" | Maple |
| N | Leg | 1 | 3/4" | 7 3/4" | 51" | Maple |
| O | Pivot Rail | 1 | 3/4" | 2 1/4" | 51 1/2" | Maple |
| | **Cabinet** | | | | | |
| P | Sides | 2 | 3/4" | 15 1/8" | 84 3/8" | Maple Plywood |
| Q | Side Edging | 2 | 3/4" | 3/4" | 84 3/8" | Maple |
| R | Headboard | 1 | 3/4" | 15 1/2" | 56 3/8" | Maple Plywood |

| | Part | Qty | T | W | L | Material |
|---|---|---|---|---|---|---|
| S | Headboard Edging | 2 | 1/4" | 3/4" | 56 3/8" | Maple |
| T | Top Panel | 1 | 3/4" | 14 3/8" | 56 3/8" | Maple Plywood |
| U | End Cleats | 2 | 3/4" | 1 1/2" | 14 3/8" | Maple |
| V | Front/Back Rails | 2 | 3/4" | 2 3/4" | 56 3/8" | Maple |
| W | Bottom Trim Boards | 1 | 3/4" | 4" | 56 3/8" | Maple |
| X | Mattress Support Panels | 2 | 1/4" | 27" | 75" | Maple Plywood |

- (1) Create-A-Bed Hardware Kit for full bed, vertical installation (#89624)*
- (12) #10 x 2" Fh Woodscrews & Finish Washers
- (1) 1/2" Rare-Earth Magnet, Cup & Washer
- (2) 1/4" Steel Pin, 3" long
- (4) 3/16" Fender Washers (1 1/4" O.D.)
- (2) 3/16" Roundhead Metal Screws
- (2) 3/16" Nuts
- (2) #42 Servalite Springs
- (1) 1"-wide Nylon Strap, 10" long
- (20) #8 x 2" Fh Woodscrews
- (18) #8 x 1 1/4" Fh Woodscrews
- (30) 1 1/4" Pocket Screws
- (6) #10 x 2 1/2" Fh Woodscrews

*Item available at 800-279-4441, www.Rockler.com

ONLINE Extras — WorkbenchMagazine.com — Murpy Bed Cutting Diagram

# custom-fit DISPLAY CASES

These maple display cases are a perfect "side project" to the Murphy bed on page 60. By filling the openings between the bed and the wall, the display cases create an elegant built-in look.

**Sizing the Cases** — Actually, the cases don't fill the openings entirely. Each case is 1" *narrower* than its opening *(see Sizing the Case on page 71)*. This will make it easy to fit the case into the opening if the walls aren't straight or plumb. Of course, this means the case won't fit tightly against the wall, but any gaps will get covered by a face frame.

**Case Construction** — After establishing the case width, you can get started on the sides (A). These are tall, narrow panels made of 3/4" plywood. To hold the top, bottom, and fixed shelf (B), you'll need to cut a rabbet and two dadoes in the sides. It's best to cut these in an extra-wide panel, and then rip the sides to width to ensure proper alignment.

Now it's just a matter of dry-assembling the case to check the fit. This is also a good time to cut a 1/4" plywood back (C). Glue and screw the case together, and nail the back in place to help square up the case. Don't worry about the exposed screws. They'll be covered by the bed.

The next step is to add two mounting cleats (D) which are used to attach the cases to the wall. These cleats are installed inside the cabinet — one below the top and the other below the fixed shelf. Mount the cleats by driving screws through the sides.

To complete the case, drill holes for the pins that hold the glass shelves.

**Face Frames** — The next step is to add two face frames to the front of the case. These frames will be scribed to fit against the wall. That means they have to start out a bit wider than the opening for the case. I made mine 1/4" wider than the opening, as shown in *Sizing the Case*.

To simplify construction, the face frames are assembled with pocket screws. The lower frame consists of two stiles (E), a bottom rail (F), and a ledge (G). The upper frame has two stiles (H) and an upper rail (I). Note that this frame is topped with a fascia board (J), which visually extends the wide band on top of the bed.

Before assembling the frames, there's one last thing to do. That's to rout a bullnose profile on the bottom edge of the upper rail. This is a purely decorative element that matches the functional bullnose on the bed's pivot rail, visually tying the two projects together. After routing the profile, screw the frames together.

Another visual link between the display cases and the bed is a "shadow line" between the upper face frame and the fascia board *(Upper Frame Detail)*. This line imitates the gap between the top of the bed cabinet and the pivot rail. All that's needed to form this shadow line is to rout a small rabbet in the top edge of the upper face frame.

Once that's done, attach the fascia board with pocket screws. Then glue and clamp the frames to the case.

**Build the Door** — The frame and glass-panel door on each display case matches those on the computer desk and printer stand. It's an inset door sized to fit the opening in the lower face frame with a 1/16" gap all around. The door is assembled with mortise and loose tenon joints *(Mortise & Tenon Detail)*. For a review of this type of joint, go to the "Online Extras" at WorkbenchMagazine.com

## MATERIALS & HARDWARE

| | Part | Qty | T | W | L | Material |
|---|---|---|---|---|---|---|
| A | Cabinet Sides | 2 | 3/4" | 11 1/4" | 84 3/8" | Maple Plywood |
| B | Top, Btm., Fixed Shelf | 3 | 3/4" | 11 1/4" | 19 1/2" | Maple Plywood |
| C | Back | 1 | 1/4" | 20 1/2" | 84 3/8" | Maple Plywood |
| D | Mounting Cleats | 2 | 3/4" | 2" | 19" | Maple |
| E | Lower Stiles | 2 | 3/4" | 2 1/4" | 31 1/4" | Maple |
| F | Bottom Rail | 1 | 3/4" | 4" | 21 1/2" | Maple |
| G | Ledge | 1 | 3/4" | 1 1/2" | 21 1/2" | Maple |
| H | Upper Stiles | 2 | 3/4" | 2 1/4" | 45 5/8" | Maple |
| I | Upper Rail | 1 | 3/4" | 2 7/16" | 17" | Maple |
| J | Fascia Board | 1 | 3/4" | 2 3/4" | 21 1/2" | Maple |
| K | Upper Door Rail | 1 | 3/4" | 2 1/4" | 12 7/8" | Maple |
| L | Lower Door Rail | 1 | 3/4" | 3 7/16" | 12 7/8" | Maple |
| M | Door Stiles | 2 | 3/4" | 2" | 31 1/8" | Maple |
| N | Doorstop | 1 | 3/4" | 3/4" | 19" | Maple |
| O | Upper Loose Tenon | 2 | 3/8" | 1 3/8" | 2" | Maple |
| P | Lower Loose Tenon | 2 | 3/8" | 2 3/8" | 2" | Maple |

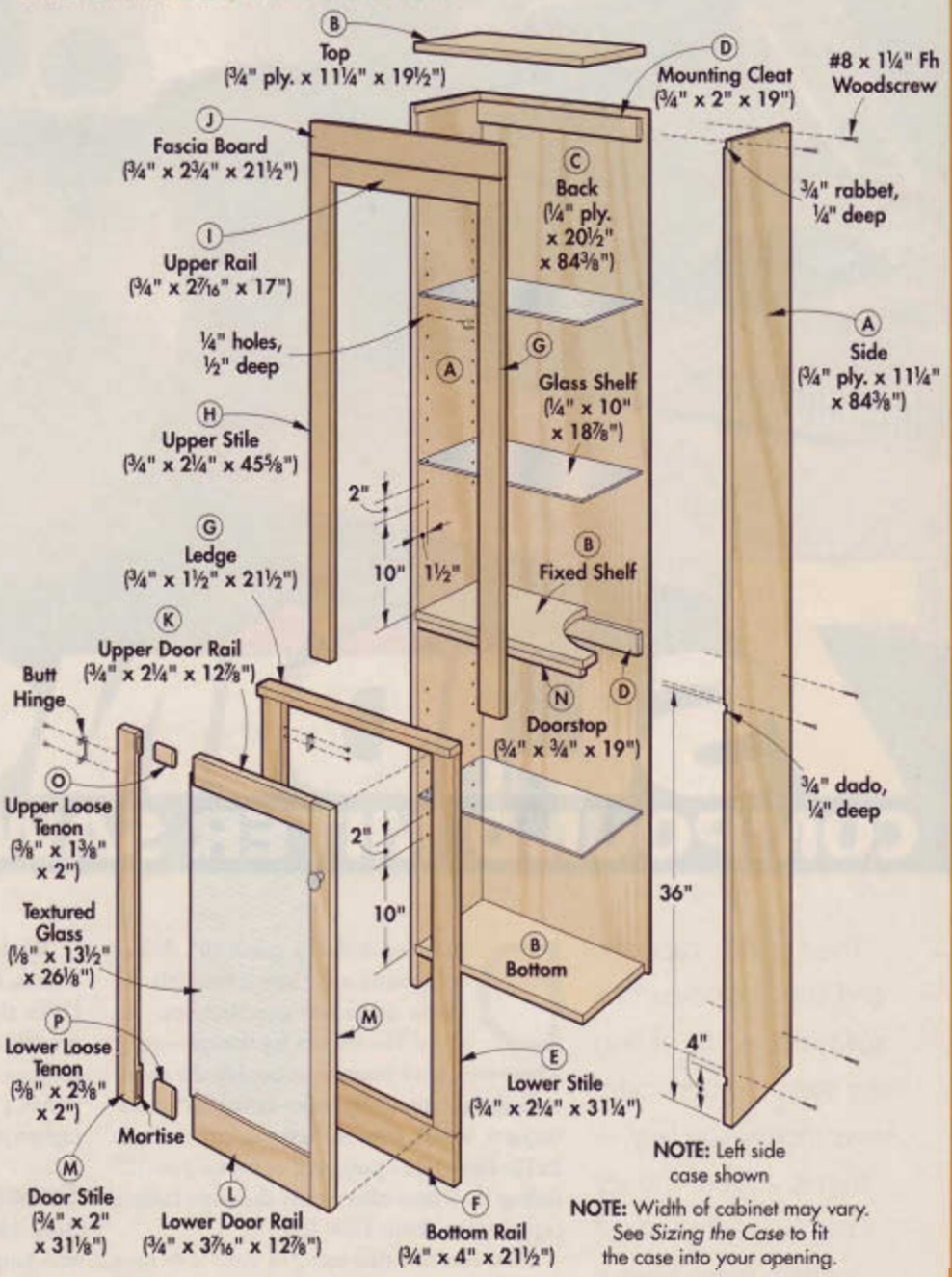
After constructing the door frame, rout a rabbet in the back to accept the glass panel. Square up the corners of the rabbet with a chisel, and install the glass with silicone adhesive. While the silicone dries, attach a doorstop (N) inside the case, underneath the front edge of the fixed shelf. This piece is simply glued and clamped in place.

**Scribe Case to Fit** — With the cases complete, it's time to scribe them to fit against the wall. To do this, place the case against the wall, check it for plumb, and locate the widest gap between the face frame and the wall. Cut a scribing block that's at least as thick as this gap, and slide the block along the wall, holding a pencil against it *(Scribing Detail)*. Then sand, plane, or cut to the scribe line.

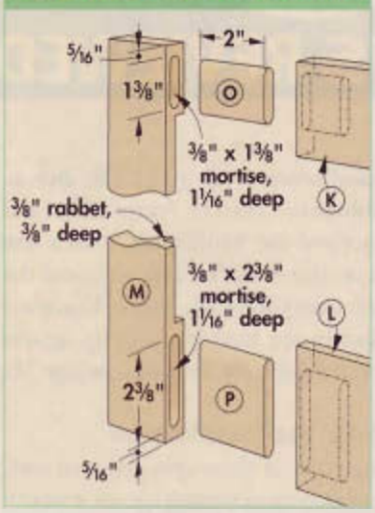
Finally, set the cases in place, and drive screws through the mounting cleats into the walls.

## Construction Details

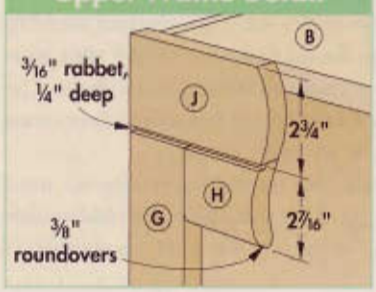
Overall Dimension: 20½" W x 11¼" D x 84⅜" H



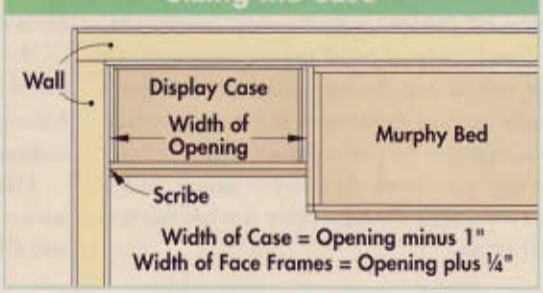

### Mortise & Tenon Detail



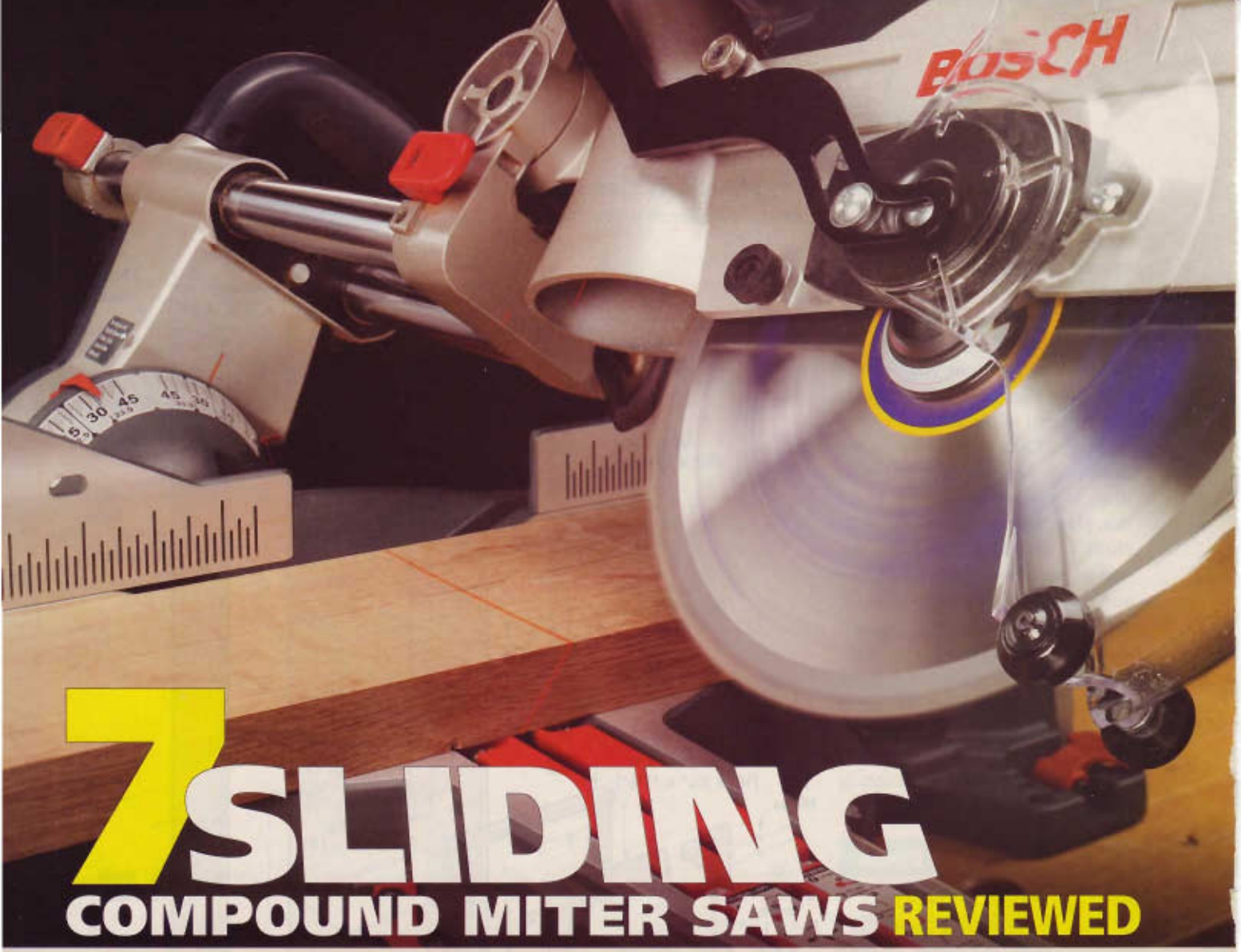

### Upper Frame Detail




### Sizing the Case




### Scribing Detail




# 7 SLIDING COMPOUND MITER SAWS REVIEWED

Their power, capacity, and compound-cutting ability make 10" sliding miter saws the best miter saws money can buy — that is, a *lot* of money can buy. So which of these seven saws is worth the investment? We found a few.

Dollar for dollar, a good 10" sliding compound miter saw is probably the wisest miter saw purchase you can make. The reasons for this are simple: These saws have more than double the cross-cutting capacity of their non-sliding 10" counterparts, which means they can cut through 2x12s like child's play. And compared to 12" sliding saws, they offer nearly the same cutting capacity for about $200 less.

Also consider that many of these saws have some genuinely valuable features that aren't available on lesser models, and it becomes clear why a 10" "slider" is such a solid investment.

Nonetheless, a good sliding miter saw is a *large* investment. So you want to make sure you're buying the best saw for the money, both in terms of performance and matching the way you work. And determining which saws are worth the high price is what this test is all about.

We tested seven tools in all. The Bosch, Makita, Milwaukee, Hitachi, Porter-Cable, and Delta all topped the $400 mark, with a few models at or near $500. We also evaluated the $200 model from Global Machinery Company (GMC) just to see how it stacks up against higher-priced models *(see the Sidebar on page 78).*

## Setup & Adjustment

Assembling most of these saws required only attaching a knob or mounting a stock support. But the Bosch required us to replace the standard blade bushing with a laser bushing. And the Delta comes with a stand that requires assembly.

We also found that most of the saws were tuned for accurate miter and bevel angles. The Milwaukee needed some minor adjustments to fine-tune its angle settings.

Likewise, the fences and tables on most saws were dead flat and square. The Milwaukee and GMC saws were the only exceptions.

# BOSCH
**4410L**

## Virtues

- The up-front controls are very convenient.
- Microadjustable miter settings make accurate setups easy.
- Tables and fences are dead flat and square to each other.
- Excellent stock support with a built-in stop.
- Super-fine laser makes cut alignment foolproof.
- Cuts at all angles are dead-on accurate.
- Above-average cut quality.
- Very powerful saw.
- Adjustable handle accommodates all users.
- The stock hold-down is effective and simple to use.
- Tools for blade-changing and tune-up store onboard.
- Dual bevel capabilities.

## Vices

- Blade changing is unnecessarily awkward.

## Verdict

This saw has it all — power, accuracy, and a lot of extras that make it incredibly easy to use. There is a slight learning curve to the unique up-front controls, but being able to adjust the saw quickly and accurately from one location is worth it. Changing blades is a bit of a nuisance, but for a saw this good, we can live with it.

**For more information:**
**www.BoschTools.com or call 877-267-2499**


## SPECIFICATIONS

| | | | |
|---|---|---|---|
| **Price** | $550 | **Fence Height** | 4½" |
| **Motor** | 15 amps | **Detent Override** | Yes |
| **RPM** | 4,800 | **Laser** | Yes |
| **Blade** | 60T Carbide | **Spindle Lock** | Yes |
| **Max. Crosscut** | 3⅝" x 12" | **Soft Start** | Yes |
| **Max. Miter** | 52°L/60°R | **Electric Brake** | Yes |
| **Max. Bevel** | 47°L/46°R | **Warranty** | 1 year |

## How We Tested

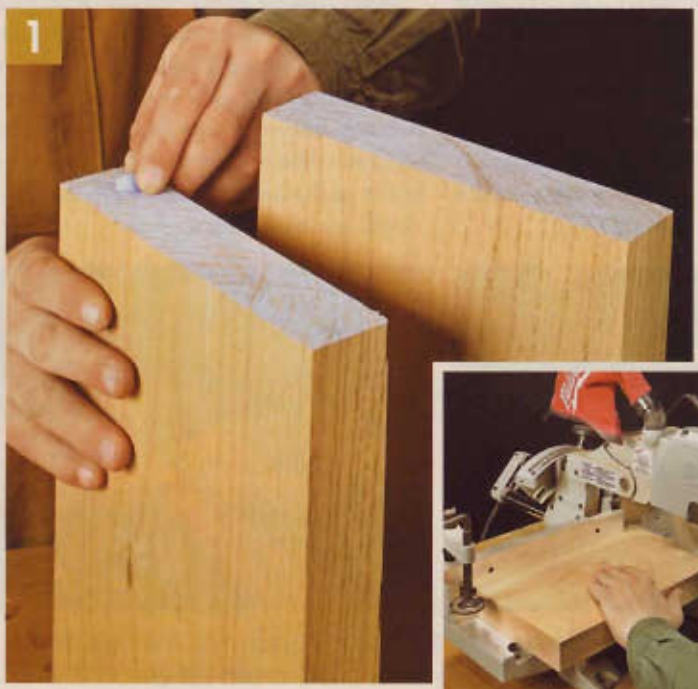
Miter saws are purely crosscutting machines. But that still encompasses a wide variety of cuts. Cutting through a 12"-wide slab of 8/4 hardwood, for instance, is quite different than a precise compound cut in crown molding.

The former demands pure power, while the latter requires dead-on miter and bevel settings. So we made a variety of straight, miter, and bevel cuts, using both thick and thin lumber, to see how the saws performed in different applications.

What we found is that any of these saws can make accurate cuts, provided you take the time to ensure a precise setup.

One caveat is that some saws are easier to set up than others because of their controls and detents (those spring-operated catches that hold the saw at preset angles).

*(continued on page 74)*




**CUT QUALITY**
By chalking the ends of the boards after they are crosscut, we can clearly see how smoothly the saw cuts.

# MAKITA
LS1013

## Virtues

- Very powerful saw.
- Incredibly smooth plunging and sliding action.
- Accuracy at all angles is flawless.
- The 60-tooth blade provides excellent cut quality.
- Tables and fences are dead flat and square to each other.
- Large and effective bar-type stock supports.
- Dual bevel capabilities.
- Dust collection is better than on most other saws.
- Stock hold-down can be used in five different locations.
- Up-front slide lock is a convenient feature.
- Has a two-position "flip fence" on the left.

## Vices

- No detent override.
- Miter scales get hidden by the workpiece.
- The blade guard interferes slightly with blade changing.

## Verdict

We were very impressed with the smooth operation, accuracy, and cut quality of this saw. It has all the performance of the Bosch, but a few less features. At this price, though, it's easily the best buy in this group.

**For more information:**
**www.Makita.com or call 800-462-5482**

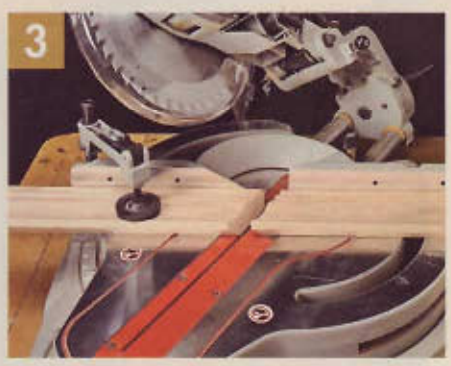
## SPECIFICATIONS

| | | | |
|---|---|---|---|
| **Price** | $480 | **Fence Height** | 3⅜" |
| **Motor** | 13 amps | **Detent Override** | No |
| **RPM** | 3,700 | **Laser** | No |
| **Blade** | 64T Carbide | **Spindle Lock** | Yes |
| **Max. Crosscut** | 3⅝" x 12" | **Soft Start** | Yes |
| **Max. Miter** | 47°L/52°R | **Electric Brake** | Yes |
| **Max. Bevel** | 45°L/45°R | **Warranty** | 1 year |

We'll cover those under *Distinguishing Details*, but for now let's focus on performance issues.

The performance issues that came to the forefront during our testing were power and quality of cut. If a saw is underpowered or has a mediocre blade, it tends to make rough cuts *(see Fig. 1 on page 73)*.

After making several test cuts with each saw using the blade that came with the tool, we mounted a high-quality Irwin crosscut blade on each saw to see if there was any improvement in the saws' performance. You can see how the saws fared in this and other comparisons in the individual saw write-ups.


**COMPOUND MITER CUTS** Tall fences like those on the Bosch *(Fig. 2)* are perfect for the "old school" method of cutting crown molding at the spring angle. Short fences like the Porter-Cable *(Fig. 3)* use the saw's compound settings to cut crown lying flat.

## Distinguishing Details

Performance notwithstanding, there are a number of features that differentiate these saws from one another. We spent a lot of time comparing those features and debating their relative strengths and weaknesses.

**Fences** — The fences on these miter saws differ widely, from the very large, highly adjustable fences of the Bosch, to the smaller, fixed fences of the Porter-Cable. There are arguments for and against both types.

For instance, tall fences are nice for cutting crown molding at its spring angle *(Fig. 2)*. On the downside, these fences have to be adjusted each time you change the bevel angle, so they don't interfere with the operation of the saw, or worse, end up in the path of the blade.

On the other hand, if you'd rather cut crown molding when it's lying flat (which is probably the most useful function of a compound miter saw), then the short fixed

# MILWAUKEE
6497

## Virtues

- Very powerful saw.
- The 80-tooth blade is the best among these saws.
- Large "flip fence" on the left side of the saw.
- Outstanding detent design.
- Does have a detent override.
- Excellent blade changing.
- Smooth plunge and slide action.
- Best warranty in the business.

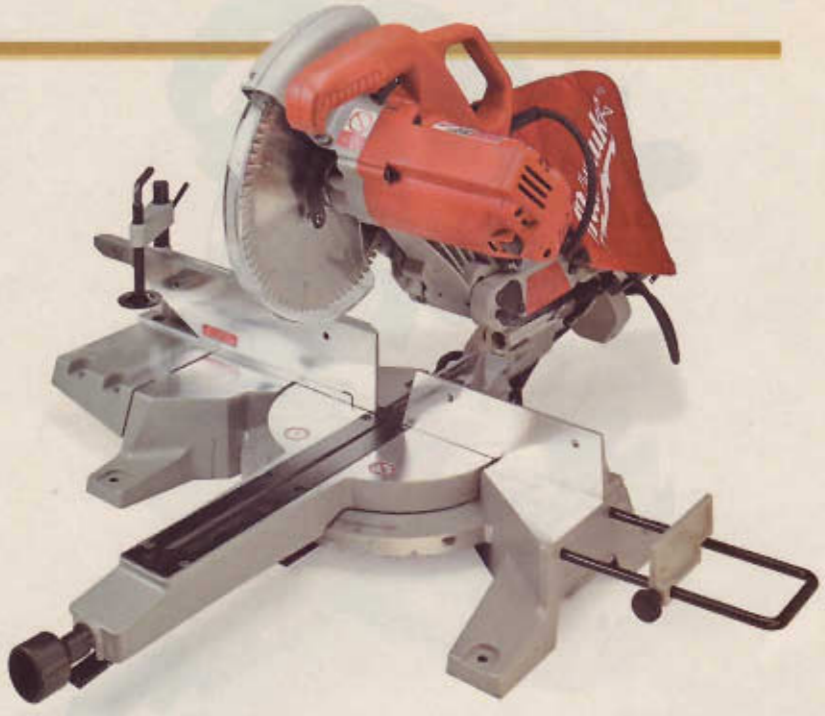
## Vices

- Bevel and miter required adjustment out of the box.
- The left fence has a slight dip at the center.
- Both fences were tipped back slightly.
- Has only one stock support.
- The saw tends to tip backwards when the cutterhead is positioned at the back of the slides.
- Limited right bevel capability.

## Verdict

This is a no-nonsense, hardworking miter saw that delivers excellent accuracy and cut quality after an initial tune-up.

**For more information:**
www.MilwaukeeTool.com **or call 800-729-3878**



## SPECIFICATIONS

| | | | |
|---|---|---|---|
| **Price** | $475 | **Fence Height** | 3½" |
| **Motor** | 15 amps | **Detent Override** | Yes |
| **RPM** | 4,800 | **Laser** | No |
| **Blade** | 80T Carbide | **Spindle Lock** | Yes |
| **Max. Crosscut** | 3½" x 12" | **Soft Start** | Yes |
| **Max. Miter** | 51°L/59°R | **Electric Brake** | Yes |
| **Max. Bevel** | 48°L/3°R | **Warranty** | 5 years |

fences on the Porter-Cable and Delta saws will work fine *(Fig. 3)*.

Other saws offer a compromise with an adjustable fence on the left side of the blade and a smaller fixed fence on the right side.

Considering all the ways a miter saw can be used, we don't feel that any particular design is superior to another, but you may want to think about how a particular fence matches your method of work.

**Stock Support** — More often than not, you're working with long boards when you use a miter saw. So adequate stock support is important.

The stock supports on these saws range from excellent on the Bosch to non-existent on the Porter-Cable. One interesting twist is the Delta saw. The saw itself has no stock support, but the stand that comes with it does. It's a nice compromise, as long as you never plan to remove the saw from the stand.

**Controls** — Bosch's controls continue to be the gold standard among miter saws. Not only can you unlock the miter and bevel controls from the front of the saw, but the Bosch also has a detent override and a microadjusting knob for the miter angle. The detent override should be standard on every saw, but strangely isn't, so we applaud Bosch for having it. The microadjusting knob, though, is another Bosch exclusive that makes fine-tuning miter cuts so much easier.

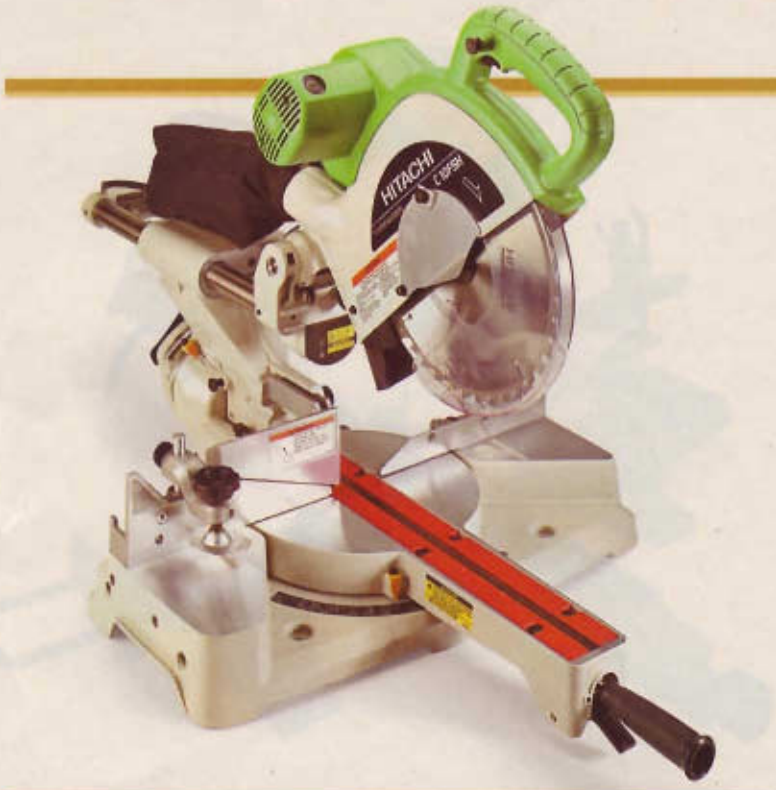
The controls on the other saws are largely what we've become accustomed to — miter angle controls at the front, bevel angle controls at the back. A detent override on the Milwaukee and a front-mounted slide lock on the Makita earned those saws extra points.

**Detents** — If detents are to be valuable, they need to provide a positive hold at the desired angle, and they have to be durable.

One of the the best examples of good detents is found on the Milwaukee *(Fig. 4)*. This system uses a steel ball bearing that locks into a tapered notch. The notch forces the bearing to self-center at the detent angle. And should the bearing ever wear down (which isn't likely), it will simply

*(continued on page 76)*


**DETENTS** A steel ball bearing that locks into a tapered notch doesn't allow any slop in the Milwaukee's detents.



## HITACHI
C10FSH

### Virtues
- Tables and fences are flat and square.
- Large "flip fence" on the left side of the saw.
- Accurate cuts at all angles.
- Excellent blade changing.
- Smooth plunging and sliding action.
- The laser cutline indicator is a helpful feature.
- A guard behind the blade helps prevent kickback.
- Dust collection is above average and gets even better when connected to a vacuum.
- Dual bevel capabilities.

### Vices
- Side tables were slightly lower than center table.
- No stock support extensions.
- No detent override.
- Would benefit from a blade with a higher tooth count.

### Verdict
This is a very capable miter saw in terms of power and accuracy, but it lacks many of the refinements of the three previous saws. That makes the price seem slightly high by comparison.

**For more information:**
www.HitachiPowerTools.com **or call 800-829-4752**

### SPECIFICATIONS

| | | | |
|---|---|---|---|
| **Price** | $500 | **Fence Height** | 3½" |
| **Motor** | 12 amps | **Detent Override** | No |
| **RPM** | 3,800 | **Laser** | Yes |
| **Blade** | 40T Carbide | **Spindle Lock** | Yes |
| **Max. Crosscut** | 3 9/16" x 11" | **Soft Start** | Yes |
| **Max. Miter** | 45°L/57°R | **Electric Brake** | Yes |
| **Max. Bevel** | 45°L/45°R | **Warranty** | 1 year |

ride further up in the tapered notch and still provide a positive hold.

We were most disappointed with the Delta and GMC detents. The Delta's detents were difficult to engage because of stiff table movement, and they failed to hold the saw securely once they were engaged. The GMC detents were sloppy, and the plastic pin showed wear after only a few uses.

**Blade Changing** — Changing blades isn't something you do frequently with a miter saw, but there will come a time when your regular-duty blade needs to be sharpened, replaced, or just changed for cutting a different material. When that time comes, it should be relatively easy to switch blades. And on most of these saws, it is.

The Milwaukee made it especially easy to change blades since there's only a small plate that has to be moved to get to the arbor bolt *(Fig. 5)*.

Changing the blade on the Bosch gave us fits. It's almost a three-handed operation on this saw because of a small, poorly-placed spindle lock and a blade guard that won't stay up on its own *(Fig. 6)*. Ironically, removing the blade is one of the first things you'll have to do after unpacking your Bosch saw so you can replace the standard blade washer with a laser-generating washer, which is a new feature on the Bosch.

**Dust Control** — Miter saws are notoriously dusty tools. And although every one of these saws includes a dust bag, we didn't find any that did a remarkable job of collecting dust. The good news is that a few of the saws showed some improve-



**BLADE CHANGE** Milwaukee makes blade changing easy with a small cover plate and well-designed spindle lock *(Fig. 5)*. The Bosch complicates the operation with a pesky blade guard and a spindle lock that's too small and too stiff *(Fig. 6)*.

# PORTER-CABLE
3807

## Virtues
- Tables and fences are flat and square.
- Accurate cuts at all angles.
- Wide base makes the saw very stable.
- Very solid miter detents.
- Smooth plunge and slide action.

## Vices
- No stock support whatsoever.
- Labored to cut through thick stock.
- Very poor dust control.
- Poor cut quality due to inferior blade.
- No detent override.
- No right bevel capability.
- The power trigger felt very loose and sloppy.

## Verdict
This is a disappointing effort from Porter-Cable. We wouldn't exactly call it a *bad* saw, but we can't really call it a good saw either. It can be turned into an adequate tool as long as you're willing to pay for a better blade and add some stock support.

**For more information:**
**www.Porter-Cable.com or call 800-223-7278**

## SPECIFICATIONS

| | | | |
|---|---|---|---|
| **Price** | $470 | **Fence Height** | 1¾" |
| **Motor** | 15 amps | **Detent Override** | No |
| **RPM** | 5,000 | **Laser** | No |
| **Blade** | 40T Carbide | **Spindle Lock** | Yes |
| **Max. Crosscut** | 3⅝" x 11½" | **Soft Start** | Yes |
| **Max. Miter** | 46°L/57°R | **Electric Brake** | Yes |
| **Max. Bevel** | 45°L | **Warranty** | 1 year |

ment when we connected a shop vacuum to their dust port. The Bosch, Milwaukee, and Hitachi saws were the most improved. The Porter-Cable showed nominal improvement, but the others remained largely unchanged.

**Lasers** — A laser cutline indicator isn't a necessity on any tool, but it can be a nice feature if it's executed well. Three of the saws in this group sport lasers, so this feature bears some comparison.

Once again, the Bosch set the standard. The laser line is extremely fine and lies directly to the left of the saw kerf. And because the laser is built into the blade washer, it projects the line on the face *and* edge of the workpiece, so you can see both the miter and bevel angle of the cut *(Fig. 7)*. This laser is powered by two watch batteries that come with the saw.

Hitachi's laser, which doesn't require batteries, isn't quite as thin as the Bosch's, but it's still helpful. It also has the added benefit of being easily adjustable, so you can set it to show the left, right, or center of the cut. One quirk with this laser is that a dust boot mounted directly behind the blade blocks the laser line when the cutterhead is plunged down, so just as you start making a cut, the line disappears.

The GMC's laser seems more like a gimmicky add-on than any attempt to build a useful feature into the saw. The line it projects is too weak to be seen in bright light, and it tapers dramatically from back to front *(Fig. 8)*. That makes it difficult to accurately align a cut mark with the laser.



**LASER GUIDES** Bosch's laser is in the blade washer, which allows it to project a super-fine line on both the face and edge of the board *(Fig. 7)*. The laser on the GMC is weak and tapers dramatically from back to front *(Fig. 8)*.

## SPECIFICATIONS

| | | | |
|---|---|---|---|
| **Price** | $440 | **Fence Height** | 1¾" |
| **Motor** | 15 amps | **Detent Override** | No |
| **RPM** | 5,000 | **Laser** | No |
| **Blade** | 40T Carbide | **Spindle Lock** | Yes |
| **Max. Crosscut** | 3⅝" x 11½" | **Soft Start** | Yes |
| **Max. Miter** | 46°L/57°R | **Electric Brake** | Yes |
| **Max. Bevel** | 45°L | **Warranty** | 2 years |

# DELTA
36-250

## Virtues

- Tables and fences are flat and square.
- Accurate cuts at all angles.
- Wide base makes the saw very stable.
- Comes with a collapsible stand.

## Vices

- No stock support built into the saw, but the stand has adjustable extensions.
- Labored to cut through thick stock.
- Miter and bevel adjustments were very stiff.
- Miter scale is built into the table and gets covered by the workpiece.
- Very poor dust control.
- Poor cut quality due to inferior blade.
- No detent override.
- No right bevel capability.

## Verdict

Considering the similarity of this saw to the Porter-Cable, it's no surprise that is suffers from all the same problems. Unfortunately, this model brings a few of its own troubles, like incredibly stiff movement, into the mix. We can't recommend this saw at this price.

**For more information:**
www.DeltaWoodworking.com **or call 800-223-7278**

# FINAL RECOMMENDATIONS

There are four saws in this group we'd be thrilled to have in our shops. Those are the Bosch, Makita, Milwaukee, and Hitachi. The Bosch is our first choice because it combines power and performance with several innovative and genuinely useful features. The up-front controls, expanding side tables, adjustable handle, and super-fine laser set this saw apart from the others. Our only complaint is that changing the blade on this saw is unnecessarily awkward.

Running a very close second is the Makita. There aren't a lot of bells and whistles to this saw, but the power, cut quality, and its overall smoothness of operation make it an excellent choice for any shop or jobsite.

The Milwaukee saw epitomizes no-nonsense performance. Power to spare, a fantastic blade, simple controls, and Milwaukee's trademark sturdy construction mean this saw is up to any crosscutting task and likely will be for years to come. It is edged out of the top spot by Bosch and Makita only because of the "extras" built into those saws.

The Hitachi lacks nothing in terms of power or accuracy, although it could be improved with features like an ambidextrous trigger lock and a detent override. But if you can learn to work without those, you'll be completely satisfied with this saw.

The Porter-Cable and Delta saws miss on too many basic points for us to feel good about recommending either saw.

## Global Machinery Company

We included the GMC saw in this test because we wanted to know how a $200 saw competes with saws that cost more than twice as much. Not surprisingly, it can't. In fact, we didn't find enough good about this saw to justify even its ridiculously low price. Cut quality is poor, the detents are sloppy, you can't lock the saw between detent angles, the laser is useless, and the stock supports are too narrow.

This saw *might* be worthwhile if you need to cut a lot of wide boards and cut quality doesn't matter. And even then, you'd still be better off with a standard 10" or 12" miter saw from any of the other manufacturers in this test for about the same price.

On a positive note, GMC will soon replace this saw with a new version. We'll be anxious to see if there is any improvement.

# TOOL Close-Up


## CMT 3D ROUTER CARVER SYSTEM

Nothing can personalize a woodworking project better than carved details. Unfortunately, carving is a skill that can take years to master.

The good news is that CMT's new 3D Router Carver System makes it easy to add carved details to projects without the learning curve. All you need is a plunge router with a $1/2$" collet and a few minutes to learn the process.

It really is as simple as clamping a holding frame to the workpiece and then placing a template in the frame. After that, simply chuck the special carving bit in your router, and let the cone-shaped guide do its thing *(see How it Works, below)*. For most designs, the same template is routed several times *(see Photo, left)*.

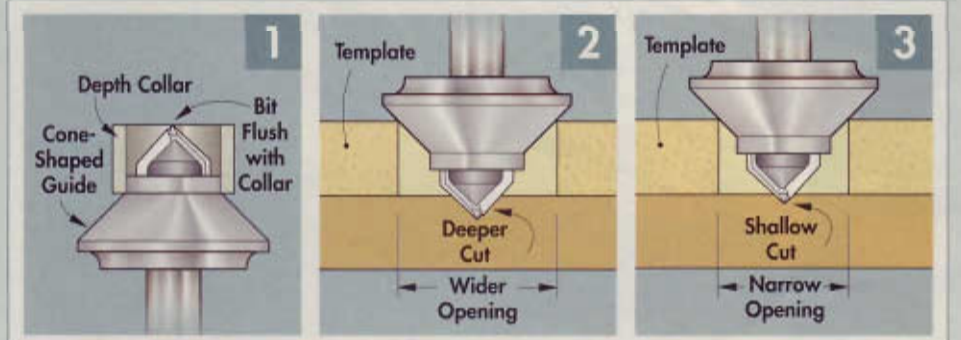
A starter set includes the carving bit, templates, holding frames, and an instructional video for about $330. The templates included in this kit produce the "classical" carving shown in the *Photo* at left. For other templates and more information on the router carver system, visit CMTUSA.com or call 888-268-2487.

▲Most door and drawer patterns require at least two templates. Each template is routed as many as four times in different orientations.

## HOW IT WORKS

**The secret of the CMT Router Carver System is a special V-Groove bit enclosed in a cone-shaped guide. And the only critical setup consideration is ensuring that the bit is properly positioned in the guide, which is easy to do using a depth collar that comes with the set *(Fig. 1)*.**

**Then, with the carving bit chucked in your plunge router and the plunge mechanism unlocked, simply let the guide trace the openings in the template. The width of the openings determines the depth of cut by limiting how far the bit can descend into the workpiece *(Figs. 2 & 3)*.**

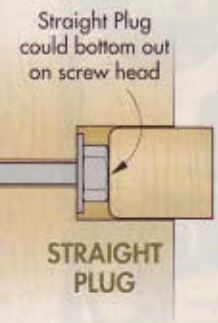
# perfect WOOD PLUGS

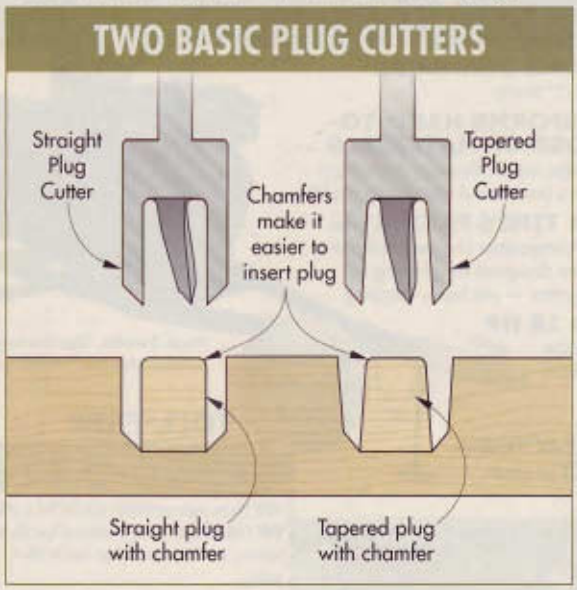
Learn the best tricks for cutting and installing wood plugs that will make screw holes virtually disappear.



When assembling a project with screws, as we did with the outdoor kitchen projects *(page 40)*, the best way to hide the screws is to bury the heads in deep counterbores and then fill the holes with wood plugs *(see the Illustrations at left)*. You can buy pre-cut plugs, but I prefer to make my own for a couple of reasons.

**A Look At Pre-Cut Plugs** — First, pre-cut plugs are usually available in a limited selection of sizes and wood species. Most suppliers carry $^3/_8$"- and $^1/_2$"-diameter plugs made of oak, maple, birch, walnut, and cherry. These will take care of many projects, but didn't help us with ours that required $^3/_4$"-diameter cedar plugs.




▲A straight plug cutter *(left)* creates a cylindrical plug. A tapered version *(right)* cuts a conical plug. Both types chamfer the end to ease plug insertion.

Second, the grain in pre-cut plugs often doesn't match up well with the grain in your project. That's because most plugs are simply crosscut from long dowels, which leaves end grain on the exposed surface.

You may be able to find face-grain plugs that will look much better, but the grain match is still usually far from perfect. And face-grain plugs still aren't available in a wide variety of species.

**Advantages of Shop-Made Plugs** —Making your own plugs allows you to get around all these problems. For starters, you can buy plug cutters in sizes from $^1/_4$" through $^3/_4$" (in $^1/_8$" increments). And you can cut plugs from any wood species and in any surface — face, edge, or end grain.

**Types of Cutters** — To produce your own plugs, you'll need a plug cutter. There are two basic types, shown at left. They appear almost identical, but the plugs they cut are different.

A traditional straight cutter uses four cutting flutes to produce a plug with straight sides. A tapered plug cutter looks like the straight version, but cuts a plug with a slightly conical shape. As the *Illustration* in the margin shows, a tapered plug can be tapped in for a very snug fit. (I prefer a tapered cutter, but I couldn't find one in the $^3/_4$" size needed for the outdoor kitchen projects.)

To learn how to cut plugs that fit great and match the grain of the workpiece they'll fit into, just follow the step-by-step guide on page 94.

## Produce Perfect Plugs

The single biggest trick to making matching plugs is to cut them from scraps of the same workpiece you'll be plugging. If you don't have scrap from the actual piece, look for a board with color and grain that closely match your workpiece.

By the way, be sure to cut plugs from the appropriate surface of the scrap. The legs of the outdoor kitchen projects received plugs in both face and edge grain, so I cut plugs from both of these surfaces.

And, of course, even the best-made plugs won't fit snugly into a poorly drilled counterbore. So I use a Forstner bit at the drill press whenever possible. That way, I know the bit won't wander and create an oval-shaped hole.

**Start by Drilling** — To get started making plugs, chuck the plug cutter into your drill press, as shown in *Fig. 1*. To prevent burning and chipout, set the drill press at a slow speed — about 500 to 600 RPM — and plunge the cutter in slowly.

**Slice the Plugs Free** — You can pry small-diameter plugs free of the wood using a screwdriver. But they may break off at an unexpected spot or get damaged. And with large plugs, prying doesn't work at all. A better method is to slice the plugs free using a band saw *(Fig. 2)*.

**Find the Best Match** — The next step is to test different plugs until you find the one that matches the workpiece best *(Fig. 3)*. You may need to sand the ends of the plugs lightly to get rid of band saw marks and make the grain visible.

**Glue Plugs in Place** — When you're ready to glue the plug in place, it's best to spread glue around the inside of the counterbore, rather than on the plug *(Fig. 4)*. Then tap the plug into the hole.

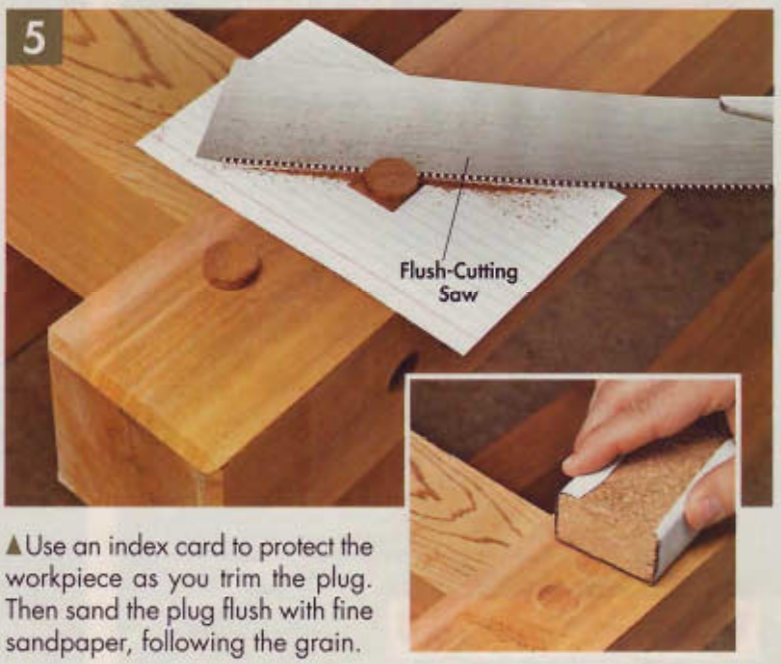
**Cut and Sand** — After the glue dries, you can cut the plug off. Then sand the plug flush with the surrounding surface *(Fig. 5)*.


▲ Always cut to the full depth of the plug cutter. This chamfers the bottom end of the plug to make it slip easily into the hole.


▲ Position a fence to align the band saw blade with the full depth of the plugs. Then cut into the piece to free the plugs.


▲ Cut extra plugs, and then test them to find the best grain and color match. Leave each plug in place while you fit the others.


▲ To reduce squeeze-out, brush glue only inside the hole. Align the grain on the plug with the workpiece and tap it into place.




▲ Use an index card to protect the workpiece as you trim the plug. Then sand the plug flush with fine sandpaper, following the grain.

WORKBENCH®

# MURPHY BED

Issue 289 Volume 61 Number 3 June 2005

## MATERIALS LIST

### MATERIALS & HARDWARE

| | Part | Qty | T | W | L | Material |
|---|---|---|---|---|---|---|
| | **Bed Frame** | | | | | |
| A | Inner Frame Struts | 10 | ¾" | 1½" | 52½" | Maple |
| B | Inner Frame Sides | 2 | ¾" | 1½" | 75" | Maple |
| C | Face Panels | 2 | ¾" | 27" | 75" | Maple Plywood |
| D | Head Rail | 1 | ¾" | 8⅝" | 55½" | Maple |
| E | Foot Rail | 1 | ¾" | 6⅝" | 55½" | Maple |
| F | Side Rails | 2 | ¾" | 6⅝" | 75" | Maple |
| G | Shims | 2 | ¼" | 1½" | 6" | Maple |
| H | Top Rail | 1 | ¾" | 2¼" | 51½" | Maple |
| I | Bottom Rail | 1 | ¾" | 3½" | 51½" | Maple |
| J | Side Stiles | 2 | ¾" | 2¼" | 31⅛" | Maple |
| K | Field Stiles | 3 | ¾" | 2" | 25⅝" | Maple |
| L | Face Frame Ledge | 1 | ¾" | 1½" | 56" | Maple |
| M | Upper Trim Stiles | 2 | ¾" | 2¼" | 45⅞" | Maple |
| N | Leg | 1 | ¾" | 7¾" | 51" | Maple |
| O | Pivot Rail | 1 | ¾" | 2¼" | 51½" | Maple |
| | **Cabinet** | | | | | |
| P | Sides | 2 | ¾" | 15⅛" | 84⅜" | Maple Plywood |
| Q | Side Edging | 2 | ¾" | ¾" | 84⅜" | Maple |
| R | Headboard | 1 | ¾" | 15½" | 56⅜" | Maple Plywood |

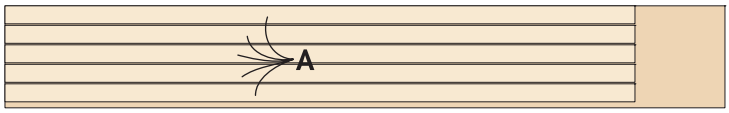
| | Part | Qty | T | W | L | Material |
|---|---|---|---|---|---|---|
| S | Headboard Edging | 2 | ¼" | ¾" | 56⅜" | Maple |
| T | Top Panel | 1 | ¾" | 14⅜" | 56⅜" | Maple Plywood |
| U | End Cleats | 2 | ¾" | 1½" | 14⅜" | Maple |
| V | Front/Back Rails | 2 | ¾" | 2¾" | 56⅜" | Maple |
| W | Bottom Trim Board | 1 | ¾" | 4" | 56⅜" | Maple |
| X | Mattress Support Panels | 2 | ¼" | 27" | 75" | Maple Plywood |

- (1) Create-A-Bed Hardware Kit for full bed, vertical installation (#89624)*
- (12) #10 x 2" Fh Woodscrews & Finish Washers
- (1) ½" Rare-Earth Magnet, Cup & Washer
- (2) ¼" Steel Pin, 3" long
- (4) 3⁄16" Fender Washers (1¼" O.D.)
- (2) 3⁄16" Roundhead Metal Screws
- (2) 3⁄16" Nuts
- (2) #42 Servalite Springs
- (1) 1"-wide Nylon Strap, 10" long
- (20) #8 x 2" Fh Woodscrews
- (18) #8 x 1¼" Fh Woodscrews
- (30) 1¼" Pocket Screws
- (6) #10 x 2½" Fh Woodscrews

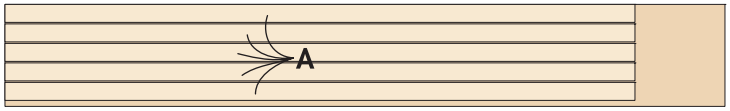
*Item available at 800-279-4441, www.Rockler.com

ONLINE Extras
WorkbenchMagazine.com
**Murpy Bed Cutting Diagram**

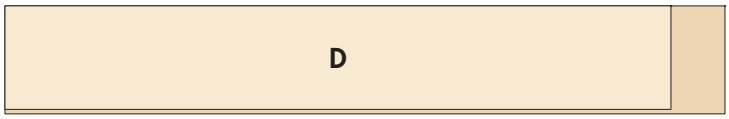
Issue 289 Volume 61 Number 3 June 2005




¾" x 8 ¼" x 60" Maple

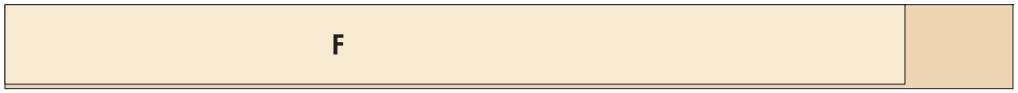



¾" x 8 ¼" x 60" Maple

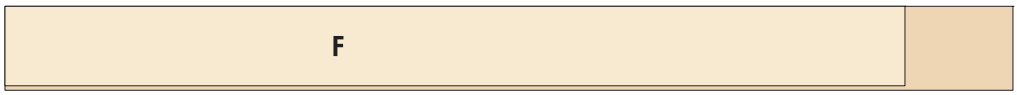



¾" x 9" x 60" Maple

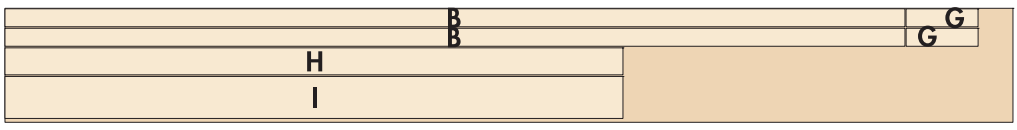

¾" x 7" x 60" Maple




¾" x 7" x 84" Maple




¾" x 7" x 84" Maple

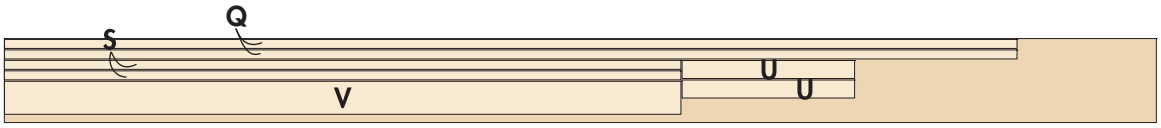



¾" x 9½" x 84" Maple ("G" is ¼" thick)

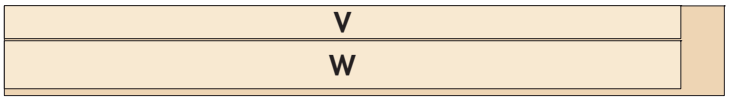

¾" x 9" x 96" Maple

Issue 289 Volume 61 Number 3 June 2005


¾" x 8" x 108" Maple



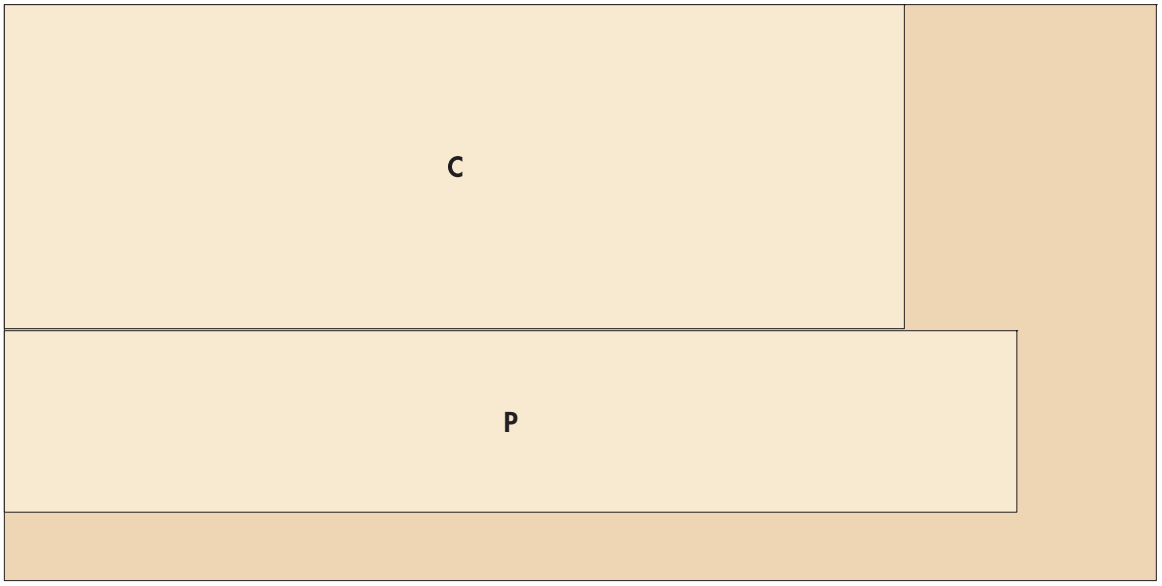

¾" x 7" x 96" Maple ("S" is ¼" thick)



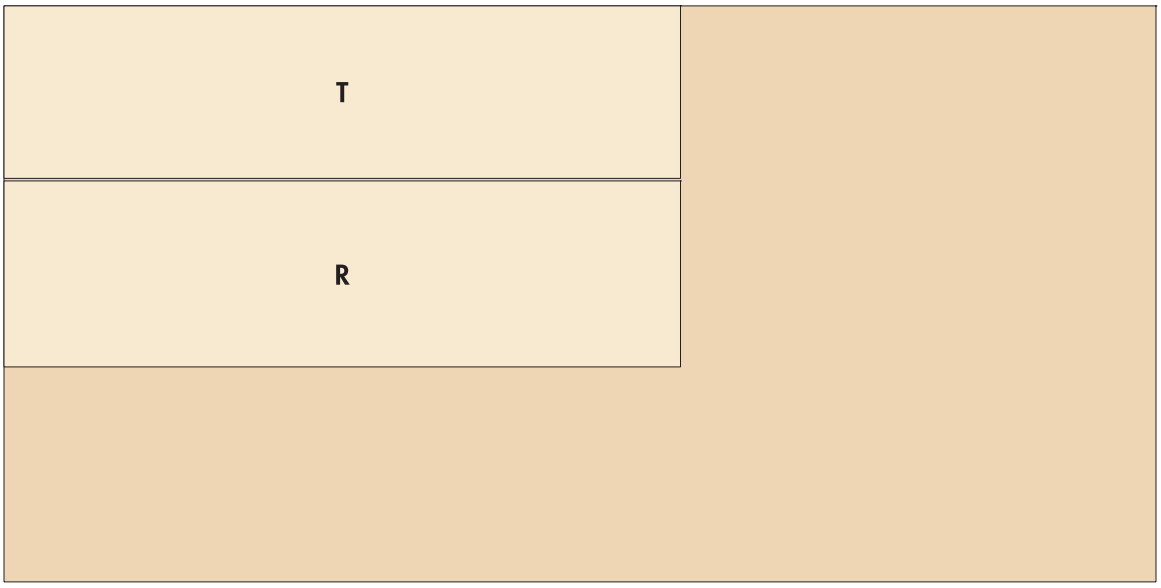

¾" x 7 ½" x 60" Maple


¾" x 48" x 96" Maple Plywood

Issue 289 Volume 61 Number 3 June 2005




**¾" x 48" x 96" Maple Plywood**




**¾" x 48" x 96" Maple Plywood**

Issue 289 Volume 61 Number 3 June 2005


**¼" x 48" x 96" Maple Plywood**


**¼" x 48" x 96" Maple Plywood**

WORKBENCH®

# DISPLAY CASES

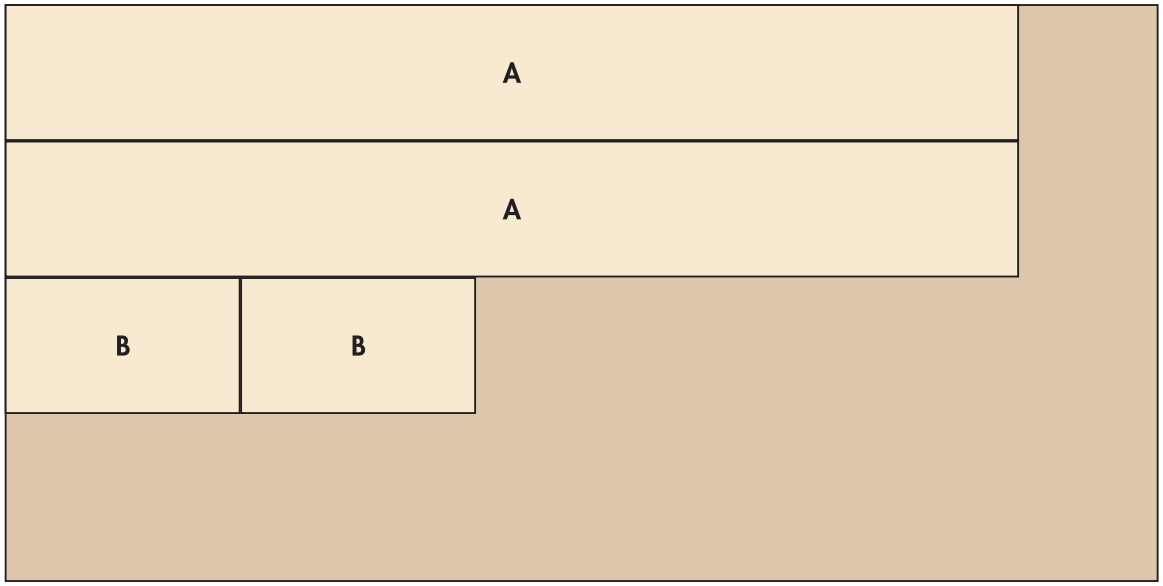
Issue 289 Volume 61 Number 3 June 2005

## MATERIALS LIST

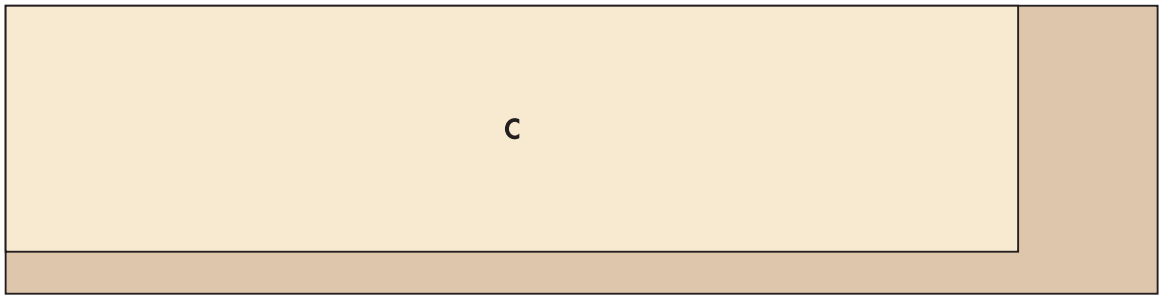
### MATERIALS & HARDWARE

| | Part | Qty | T | W | L | Material |
|---|---|---|---|---|---|---|
| A | Cabinet Sides | 2 | ¾" | 11¼" | 84⅜" | Maple Plywood |
| B | Top, Btm., Fixed Shelf | 3 | ¾" | 11¼" | 19½" | Maple Plywood |
| C | Back | 1 | ¼" | 20½" | 84⅜" | Maple Plywood |
| D | Mounting Cleats | 2 | ¾" | 2" | 19" | Maple |
| E | Lower Stiles | 2 | ¾" | 2¼" | 31¼" | Maple |
| F | Bottom Rail | 1 | ¾" | 4" | 21½" | Maple |
| G | Ledge | 1 | ¾" | 1½" | 21½" | Maple |
| H | Upper Stiles | 2 | ¾" | 2¼" | 45⅝" | Maple |
| I | Upper Rail | 1 | ¾" | 2⁷⁄₁₆" | 17" | Maple |
| J | Fascia Board | 1 | ¾" | 2¾" | 21½" | Maple |
| K | Upper Door Rail | 1 | ¾" | 2¼" | 12⅞" | Maple |
| L | Lower Door Rail | 1 | ¾" | 3⁷⁄₁₆" | 12⅞" | Maple |
| M | Door Stiles | 2 | ¾" | 2" | 31⅛" | Maple |
| N | Doorstop | 1 | ¾" | ¾" | 19" | Maple |
| O | Upper Loose Tenon | 2 | ⅜" | 1⅜" | 2" | Maple |
| P | Lower Loose Tenon | 2 | ⅜" | 2⅜" | 2" | Maple |

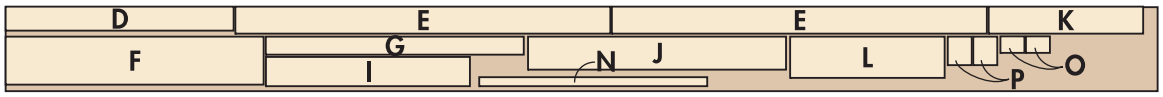
Issue 289 Volume 61 Number 3 June 2005



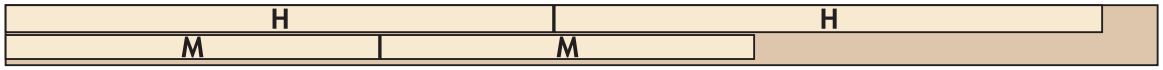

**¾" x 48" x 96" Maple Plywood**




**¼" x 24" x 96" Maple Plywood**




**¾" x 7" x 96" Maple**




**¾" x 5" x 96" Maple**