

KITCHEN DESIGN
CONTEST

WINDOW SHELVES ■ TENON & GROOVE JOINERY ■ SHOP STORAGE

WORKBENCH

THE ORIGINAL HOME WOODWORKING AND IMPROVEMENT MAGAZINE



Kitchen Island
Arched Wall Mirror

April 1997 \$3.95

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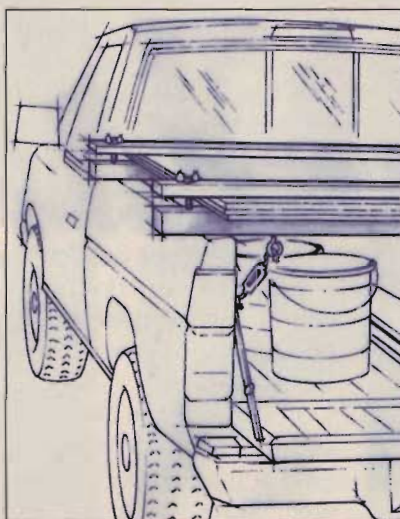
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A Helping Hand

My phone rang the other night, and, thankfully, it was a friend and not someone trying to sell me something. He began to describe the built-in shelves he was planning to begin the next weekend. As he explained his design, I could hear his eagerness to get started. I could also tell he wanted to use me as a sounding board for his ideas. We talked about how to figure the shelf span, which wood to choose, and how to join it all together.



I'll bet you get the same kind of calls from your friends and relatives. As a *Workbench* reader, chances are you've been around the woodworking and home improvement "block" a few times, and all this experience is a valuable resource for others.

Making Time To Help

Even though I'm often up to my ears in my own work, I always find time to help my friends and relatives with their projects. In fact, this is how I think of *Workbench* magazine — as a friend lending a helping hand.

Safety Reminder: Woodworking and home improvement are rewarding hobbies. But there is risk of injury. Use the guards and read the manuals that come with your tools and equipment. And if you're uncertain about a technique, find an alternative with which you are more comfortable. Please take safety seriously.

In this issue, for example, I'll be taking you along with me to one friend's house. About a year ago, I helped Karl and Julie Nash on their kitchen remodeling project. Their request couldn't have been more timely since I was just starting to think about remodeling the kitchen at the *Workbench* house. Karl and Julie's kitchen was a perfect proving ground.

The three of us collaborated on the kitchen design, then the Nashes completed the tearout as well as most of the prep work. My contribution didn't really begin until we got to the cabinets. Karl, who is a budding craftsman, and I built all of them, including the *Kitchen Island* featured on page 20.

Despite its size and the number of construction steps, building the island really isn't difficult. Besides, the reward is well worth the effort. You'll benefit from an enormous increase in storage space and the convenience of a huge working surface.

If you're not in the market for a kitchen island but want to try your hand at the construction methods we used, take a look at the *Arched Wall Mirror* (page 42) and the *Shop Utility Cabinet* (page 46). The *Workbench* team designed these projects with stub tenon and groove joinery, just like we used on the island's frame and panel assemblies. You might find it interesting to see different applications of the same joint.

It's a great issue, full of exciting ideas. Think of it as a helping hand for your projects.

Chris Inman, Editor

WORKBENCH

VOLUME 53

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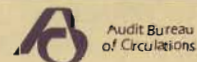
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Questions & Answers

Repairing Drywall

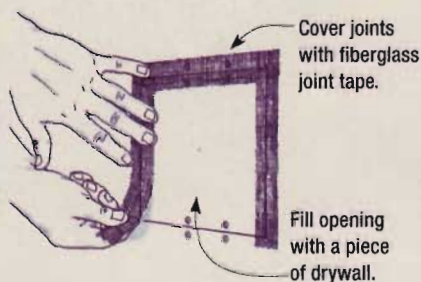
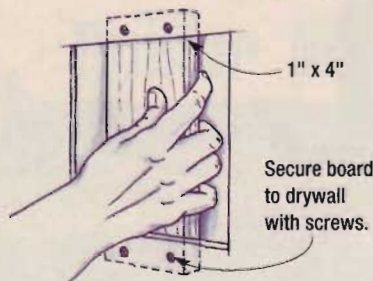
Q I have a hole in my drywall about 4" across (okay, so it's about the size of a fist), and every time I try to repair it with drywall compound, the stuff just falls through the hole. What should I do to fix it?

Stacy Miller
Topeka, KS

A Start by cutting the hole square with a utility knife, so that it ends up about 6" x 6". Slip a 1" x 4" behind the wall and secure it with drywall screws.

Now cut a piece of drywall to fit in the hole, and screw it to the 1" x 4". With the hole filled, you can cover the cracks with 2" adhesive-backed fiberglass wallboard tape.

You'll finish the job with three thin coats of joint compound. Make the first coat thick enough to cover the tape thoroughly. With the second coat, level the surface and spread it out. You can use a fine sponge here,



spreading it out while the compound is still wet. Then sand the entire surface smooth. On the final coat, taper the repair outward so that the edges feather into the unaffected area.

The finished job can use one last sanding, and then it's ready for paint.

Pine Door Creates Sticky Problem

Q I'm having trouble with a storm door made out of pine. I purchased this unfinished door about five years ago, stained it myself, and applied three coats of spar varnish. About a year ago, resin began oozing out. Can you tell me the best way to remove the pitch and restore the finish?

Ralph Willoughby
Raleigh, NC

A Ralph, it's likely that you sealed in your problem, and it just took time to break through the finish. Small areas of varnish are hard to repair. On top of that, spar varnish

is very glossy, so it's difficult for a new coat to stick.

Your best bet is to completely strip the finish off the door, making sure to scrape away any remnants of resin. Sand the door smooth, and to prevent the problem from recurring, seal the door with a sanding sealer such as white shellac (it's actually clear). It's difficult to stain over sealer, so you may choose to finish up with a clear or pre-colored varnish.

It's also interesting to note that even though pine is one of the most popular woods, it is probably the most difficult to finish. Good luck.

Help Wanted!

Workbench is looking for editorial help. If you are experienced with woodworking and home improvement, have excellent writing and communication skills, and are willing to relocate, drop a resume and letter in the mail to:

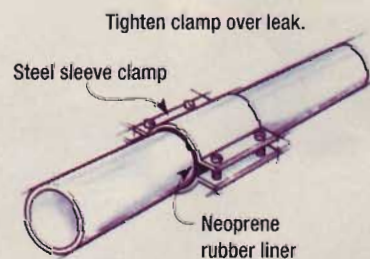
Joyce Moore
Workbench
2200 Grand Avenue
Des Moines, IA 50312

Water Pipe Repair

Q The water pipes in my house are about as old as I am, and they are springing leaks more and more often. I know that one of these days I'll have to get around to replacing the bad ones. In the meantime, I was wondering what you would suggest as a dependable short-term solution so that I don't have to replace a pipe in the middle of the night?

Bob Sharp
Lansing, MI

A You answered half the problem yourself. Yes, the best long term solution is replacement. But sometimes, we all need a temporary, short term fix.



Install a sleeve clamp over the break. If the damage is a large split, you may need more than one sleeve clamp. It's a good idea to keep a few extras on hand at home.

Before you purchase them at your home center, check the diameter of your pipes to be sure you get the right size. Sleeve clamps are handy for both drain and supply pipes. You can even repair PVC pipes in your outdoor sprinkler system.

SHARE YOUR QUESTIONS

If you have a question about woodworking or home improvement, we'd like to see if we can answer it for you. Just write down your question and mail it to WORKBENCH Q&A, 2200 Grand Ave., Des Moines, IA 50312. Please include your name, address and daytime phone number in case we have any questions for you. If you like, Fax us at (515) 283-2003 or e-mail us at workbench@workbenchmag.com.

Sagging Gate

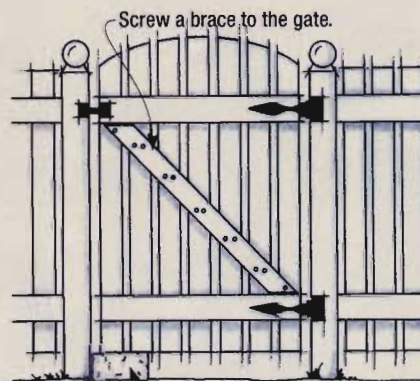
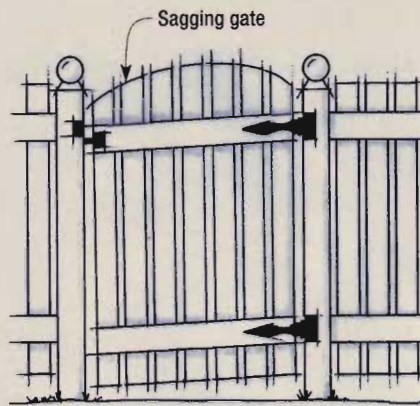
Q I built a white picket fence outside my house, and it's my pride and joy. All except for one problem — the gate sags. What should I do to get it level again and keep it that way?

Brian Matuzak
Omaha, NE

A The gate needs a brace because of the weight and the fact that it's connected on only one side.

Prop up the unhinged side of the gate with a brick, raising it slightly higher than it should be. Find a board to use as a brace that matches the wood in your fence. Size and cut the board into a diagonal brace to fit between the rails. Then attach the brace to each picket it crosses — use two screws per picket where you can.

When you remove the brick, the unhinged side will lower a little bit due to its weight. There should be just enough sag so that the whole gate ends up level.



Use a brick to raise gate slightly above its proper height.

Paint on Bricks

Q We have a brick fireplace that has been painted several times. How can we get the paint off?

Craig Kimpston
Grimes, IA

A Craig, stripping the paint with a chemical paint stripper is the traditional method for completing this job. It's messy and the stripper could be toxic. You could also run into several problems due to the porosity of the bricks and mortar. Try stripping an inconspicuous area to test the results before jumping into the project with both feet. Most likely, you'll find paint remaining in the cracks and crevices — that could give you an antique look, which is quite popular.

If your bricks are outside, sandblasting works in some cases. Test an area first — some new bricks won't tolerate sandblasting. It might be more practical to just repaint. If you do, be sure to choose a good quality masonry paint.

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WHERE TO GET IT.

Shop Tips

Plywood Rack

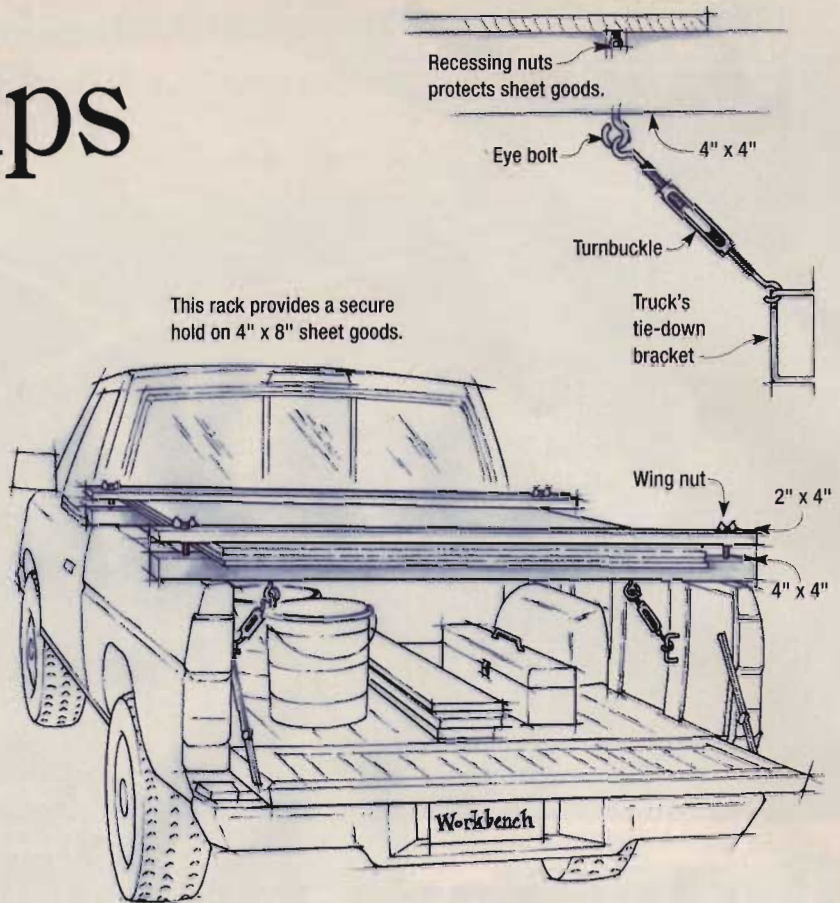
My compact pickup lacks the necessary 4 ft. clearance between wheel wells for loading sheet goods.

This jig provides a good way to raise sheet goods above the pickup bed and secure them for driving.

With eye-bolts, hooks, and turnbuckles, attach two 4" x 4"s to the bed's tie-down brackets. Your pickup may require some modifications of this technique.

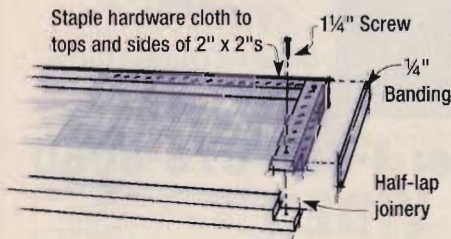
My sheet goods sit on top of these 4" x 4"s. Then a pair of 2" x 4"s rest on top of the sheet goods, and are secured to the 4" x 4"s with carriage bolts. The bolts run through holes in the 4" x 4"s and 2" x 4"s, and wing nuts lock everything in place.

*Reginald Norman
Denver, CO*



Open Air Shelves

I have an open-air shed where I store all my yard tools. It serves my needs, but the shelves were always collecting dirt that fell from my garden tools. So I exchanged my solid surface shelves for some made with hardware cloth on 2" x 2" frames.



Assemble the frames with half-lap joints and water-resistant glue. Reinforce each joint with 1 1/4" screws.

Wrap the hardware cloth over the outside of the frame and secure it with staples on the sides and top. To avoid any exposed edges on the cloth, you can attach optional 1/4"-thick banding around all of the sides.

*Samuel Plunk
Yorba Linda, CA*

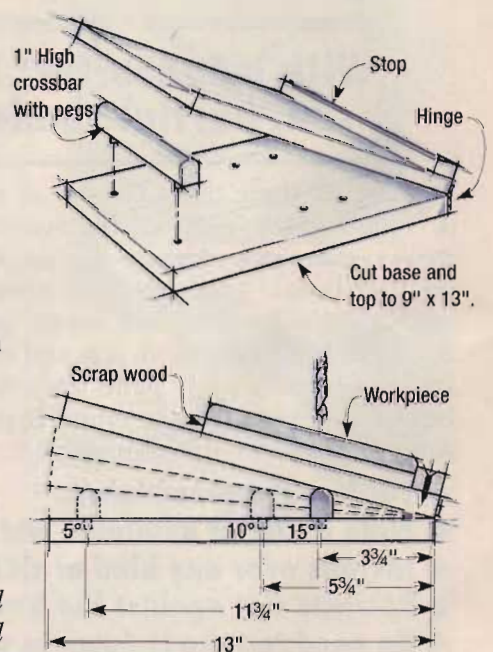
Angle Support

To drill angled holes, I used to just prop up the workpiece with scrap wood on the drill press and hope for the best. Then I was building a coat-rack with multiple pegs when I realized I had a problem.

To improve the accuracy and consistency of my holes, I made this adjustable angle jig, which has proven useful for many projects. The two pieces are hinged together and held at a fixed angle by a crossbar, which has pegs that fit in holes in the jig.

The jig can be designed for a single angle, but I made mine for multiple angles of 5°, 10°, and 15°.

*Percy Blandford
Stratford-upon-Avon, England*



SHARE YOUR TIPS, JIGS, AND IDEAS

If you have a unique way of doing something, we'd like to hear from you. Just write down your tip and mail it to WORKBENCH Shop Tips, 2200 Grand Ave., Des Moines, IA 50312. Please include your name, address and daytime phone number in case we need to reach you. If you like, Fax us at (515) 283-2003, or e-mail us at workbench@workbenchmag.com. We'll pay you \$50-\$150 if we publish your tip.

Water Sediment Causes Problems

Every water heater is susceptible to the same problem — rumbling sounds.

Solids enter the tank as tiny suspended particles that gradually settle downward, accumulating as sediment in the bottom of the tank.

The rumbling sound you hear is due to a buildup of sediment. To

eliminate it, drain a few gallons of water each month from the valve at the bottom of your tank.

When you drain the water, be very careful. The water in the tank is extremely hot and can splash dangerously on your hands.

*Anthony Ruggieri
West Warwick, RI*

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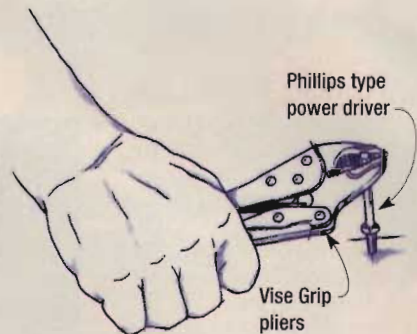
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More Torque

Once in a while, I find that a standard screwdriver just won't work for driving or loosening a screw: there isn't enough clearance, or I can't get the torque I need.

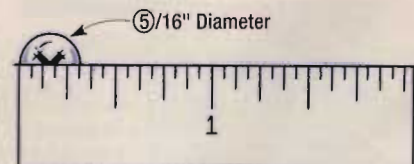


To solve this problem, I take a hex screwdriver bit — the kind used in drills — and clamp it at a right angle into a pair of Vise Grip locking pliers. This creates an offset screwdriver that provides great torque, and I can even get 3" screws to go in easily.

Glen Sheils

Sizing Screws

You may never need this information for your shot on Jeopardy, but it still makes good trivia for impressing your friends.



Example: $5 \times 2 = 10$
 $\quad \quad - 2$
 $\quad \quad \quad 8$

You know how screws are referred to as #6, #8, and so on. But how do they derive those numbers? It turns out there's a simple formula.

Measure the diameter of the head of a screw in 16ths. Multiply that number by 2. Then subtract 2 from that sum. And there you are.

Okay, try this example on for size. A screw head measures $\frac{5}{16}$ " in diameter. Five times two equals ten. Subtract two, and the answer is eight. So the screw is a #8. Amazing.

*Rich Reckemmer
Beardstown, IL*

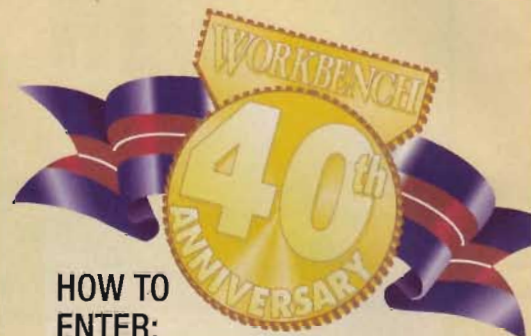
Kitchen Design Contest



Share your remodeled kitchen with fellow *Workbench* readers. Enter the Kitchen Design Contest by August 1, 1997, and the results of your hard work may be featured in a future issue of *Workbench*.

Have you remodeled your kitchen? If you have, I'm eager to see some pictures. Right now I'm planning to re-do the kitchen in the *Workbench* house, and the more ideas I get the better.

Send me a picture or two of your remodeled kitchens and I'll enter you in our Kitchen Design Contest. You'll be eligible to win a Bosch 3610K 14.4-volt cordless drill kit.



HOW TO ENTER:

Your kitchen remodeling entry must be an original design that you helped create. Submit drawings of your plans, along with photographs of you and your kitchen by August 1, 1997. The winner will be announced in a later issue.

The winner will receive a 14.4-volt cordless drill kit from Bosch. Two runners-up will receive a one-year extension to their *Workbench* subscription. Send to Workbench Contest, 2200 Grand Ave., Des Moines, IA 50312.



Kindergarten Woodworking

Carrie Johnson, a teacher in La Canada, California, took on quite a challenge when she introduced her kindergartners to their first woodworking project. They eagerly stared at their bags, ready to begin when she said, "Go ahead, dump it out."

Almost in unison, a jumble of wood blocks, washers, and dowels fell onto their work tables. "Does anyone know what your parts are made of?" she inquired.

"Wood!" the young voices shouted. "It looks like a car with four flat tires," another student sung out. The teacher explained that it was a wood back massager.

The wide-eyed faces watched with rapt attention as she showed them how to attach a wheel. Following her careful instructions, most of the students had their massagers assembled in 40 minutes.



New to teaching, Johnson had been searching for original projects to keep the kids motivated. Then she remembered the back massager she made when she was seven. "I called my dad and he helped me make the pieces."

Before this project, she found it nearly impossible to keep the kids at the tables for an hour. "But look at them now," she says. "They really love working with wood."

Careless Moment

We receive a lot of mail from readers, as they write us about their tips, questions, projects . . . and mistakes.

So it was with some embarrassment that a reader told us this story. In a careless moment one day in his shop, he accidentally drilled into his finger while holding a piece of wood.

After being stitched up, he sheepishly confessed to the doctor that he is a skilled woodworker and should know better than to be so careless. The doctor glanced at him briefly, then turned to write a prescription, which our friend assumed was for a painkiller.

"Here," the doctor said gruffly, handing him the slip of paper. "Give this to your wife."

The prescription read, "This man should not be allowed to work with woodworking equipment!"

WINNERS

Congratulations go to Frank Kosten of Willoughby, Ohio

for winning our "Name the Tools" Contest #19. He wins a Porter-Cable model 9444 profile sander kit, a \$140 value, for identifying the tools as:

- A. Electronic distance measurer
- B. Retractable tape
- C. Carpenter's folding rule
- D. Long tape

We also selected five runners-up, each of whom will receive a one-year extension of their subscription.

Donald F. Elidson; Minot, ND
Harry Hill; Mt. Pulaski, IL
Milton Honeycutt; Emerald Isle, NC
Mike Sapanara; Phillipsburg, NJ
James Alford; Bowling Green, KY

Congratulations to all of you!

We look forward to hearing from you again in our new Kitchen Design contest.

From Munich to Half Moon Bay



This table and matching stool by Robert and Christian Meier is made of fiddleback maple, mahogany, and walnut. Robert builds their pieces, while Christian specializes in finishing.

Identical twins Robert and Christian Meier worked in their native Germany as highly skilled engineers at the BMW plant in Munich. But they had other aspirations.

Half a world away and several years later, they opened their own woodshop and art gallery. The gallery is not only a great place to display their talent; it gives them a chance to show the work of some of the finest woodworkers and artists on the west coast.

The twins learned their second trade at the knees of their grandfather, who restored old churches, repairing wood and stone sculptures that were ravaged by time and war. Through his influence, they learned to appreciate the feel of hand planes and hand-cut dovetails.

Next time you're in the San Mateo area, they invite you to visit Gallery M at 326 Main Street, Half Moon Bay, CA, or call (415) 726-7167.

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Kitchen Workbench

Fine craftsmanship meets fine cuisine. That's what this generously sized island brought to mind when my friend Karl and I completed the installation. And to prove the point,

that night Karl and his wife Julie cooked up a delicious Italian meal to celebrate our success.

I got involved with this project for two reasons. First, because Karl and Julie are my close friends, and they asked for my help. Second, I thought planning and building an island would help me refine the kitchen remodeling ideas I have in mind for the *Workbench* house.

Karl, who developed an interest in woodworking several years ago, wanted to build the island to match his other kitchen cabinets. Before cutting any wood, however, we spent several evenings determining the best size and shape for the island and working out cabinet details. To understand how the island would affect traffic flow in the kitchen, we laid out possible cabinet outlines on the floor using masking tape.

Allow at least 36" of walkway space between the island and a wall. And between another work area and the island, 42" is better, particularly if two people work together in the kitchen.

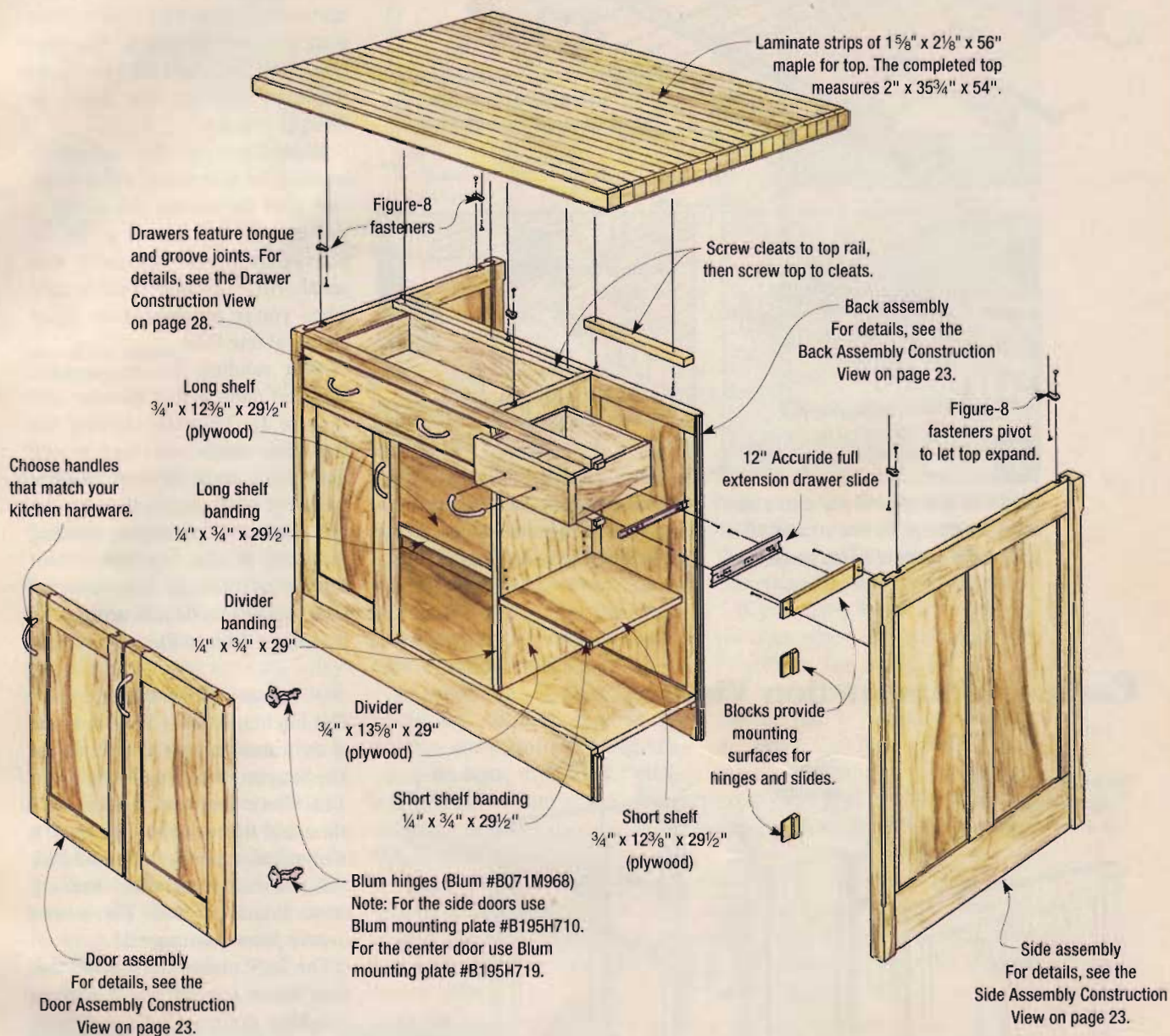
Based on our trial and error tests, Karl and I decided that a 36" x 54"

island would provide enough work surface for preparing extravagant meals, yet leave plenty of space to move around the kitchen easily. And with the top overhang and cabinet cubby hole, two people could comfortably sit at the island for conversation or a casual meal.

One look at the island cabinet will tell you it's a frame and panel assembly. While this may look complicated, I assure you it's not. We took great pains to keep the construction simple, and you can complete most all the joinery with a table saw and dado blade. This construction also allows great flexibility for changing this island to suit your kitchen. Just be sure to carefully check and double-check each dimension if you alter the design.

Project Construction View

OVERALL SIZE: 36" x 35³/₄" x 54"



Making the Top

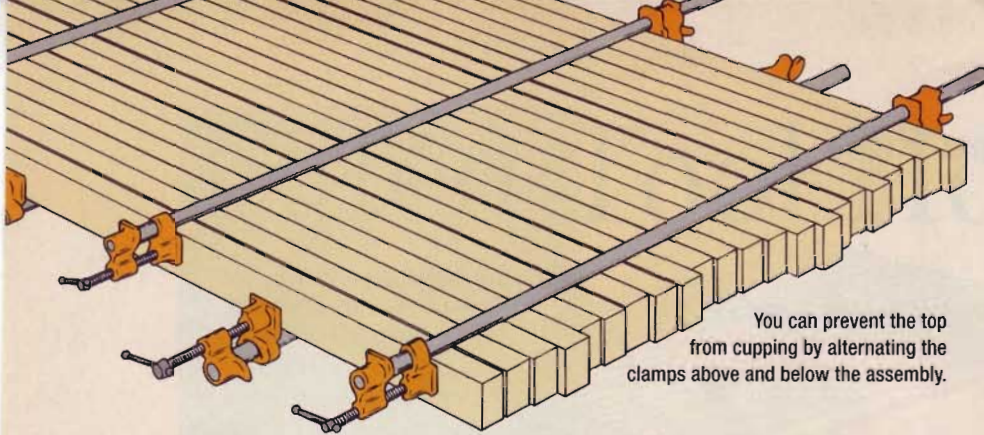
For durability and good looks, Karl wanted a butcher block top for the island. He chose planks of 8/4 select-and-better hard maple at the lumberyard and asked the yardman to plane the stock to a thickness of 1⁵/₈". I recommend taking advantage of this service if it's available, but only if you intend to work on the project right away — freshly planed surfaces tend to bond better with glue than those that have been exposed to air, dirt, and light for a while.

After they're milled to thickness, rip your maple planks into 2¹/₈" wide strips. You'll glue these strips face-to-face to make the butcher block top. By cutting the strips a little wider than the final thickness of the top, you'll allow for some minor slippage while gluing and clamping all the pieces into the top assembly.

By the way, if you don't want to build a top, you might have a local cabinet shop make one. I've searched for a mail order source, but have come up empty handed.

Before gluing the strips together, you need to figure out how you'll flatten the top after the glue dries. Because of its size, the top will be difficult to hand plane or smooth with a belt sander. You can also rule out your surface planer, since it's probably too small for the job.

Karl and I chose to glue all the strips together, then take the top to a cabinet shop and pay to have it sanded on a large surface sanding machine. You may have similar options in your area, either at a local cabinet shop or high school.

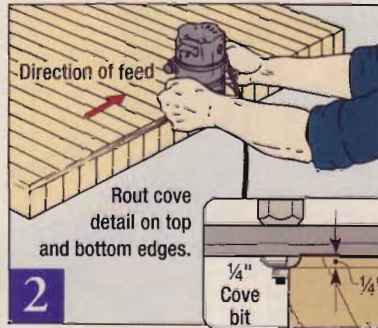


You can prevent the top from cupping by alternating the clamps above and below the assembly.



To avoid overheating your saw, cut through the top in successively deeper passes.

1 Cut the top to length with your circular saw and a straightedge. Be sure to clamp the straightedge square to the top's edges.



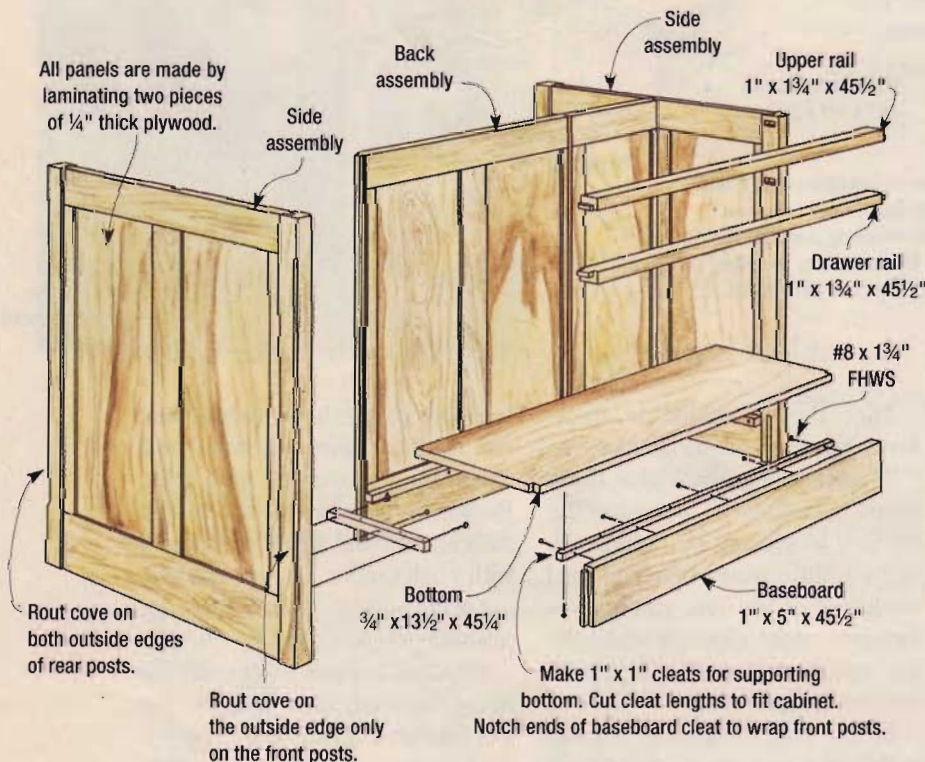
2 The cove detail on the top is repeated on the posts of the base. Make shallow passes to prevent burning the end grain.

If you can't find a surface sander, the next best option is to glue the strips into 10" wide sections and mill each section with your surface planer. After surfacing the sections, you can carefully glue them together, keeping the joints as flush as possible.

Regardless of the assembly method, be sure to use water-resistant glue for joining the strips in the top. In this case I preferred polyurethane glue because it sets up slowly — an important feature when you're assembling so many pieces at one time.

After sanding the top smooth, trim the ends with a circular saw (Figure 1). To avoid burning the thick maple, we used a new blade and took several shallow passes to cut through. Remove the saw marks by thoroughly sanding the ends of the top with a belt sander or random orbit sander, then rout cove details around all the edges (Figure 2).

Carcase Construction View



Base Overview

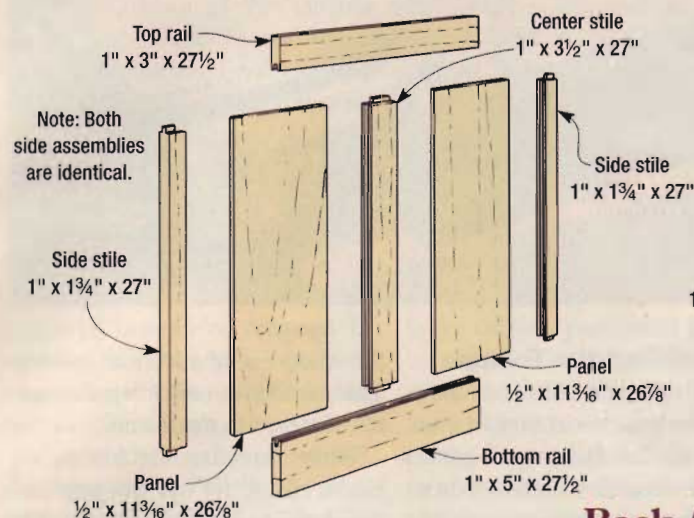
The kitchen island's base is made of six frame and panel assemblies. The longest assembly is the back, then there are two side assemblies, and three doors. The joinery is identical in all these assemblies, and you can read about making these joints in *Stub Tenon and Groove Joinery* on page 34.

The only places we did not use stub tenon joinery are the joints attaching the front rails and baseboard to the side frames. For these, we used mortise and tenon joinery.

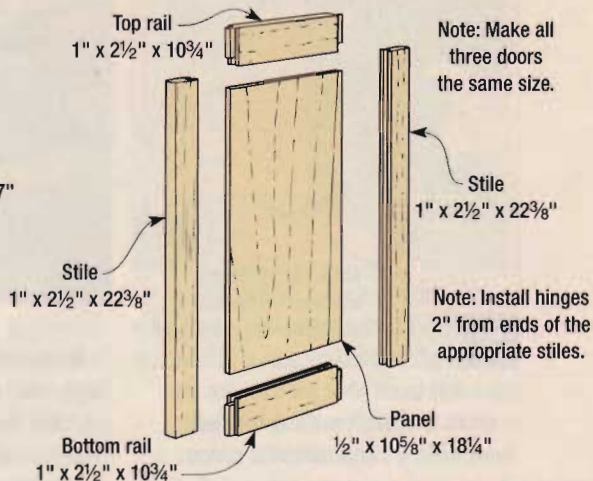
For the panels, Karl and I found that 1/4" plywood was too flimsy, and 1/2" plywood seemed just right. Our problem became finding 1/2" ash plywood. The solution that evolved was to glue together two pieces of 1/4" thick ash plywood.

Having made that decision, we realized that 1/2" thick panels didn't look quite right with 3/4" thick frames. So we ended up using thicker stock for the frames. Karl and I purchased 5/4 ash and had it milled to 1" thick for all the frames.

Side Assembly Construction View



Door Assembly Construction View



Building the Frames

Rip the 1" thick boards to width for the rails and stiles of all the frame and panel assemblies, and cut the pieces to length. Keep in mind that the length of the stiles includes the stub tenon at each end.

Next, set up your table saw for cutting the grooves that will hold the plywood panels and house the stub tenons. Make sure the dado blade matches the thickness of your panels. Because plywood is almost always thinner than the size it claims to be, you'll want to measure the thickness of two pieces of 1/4" plywood sandwiched together. In our case, the measurement turned out to be 7/16".

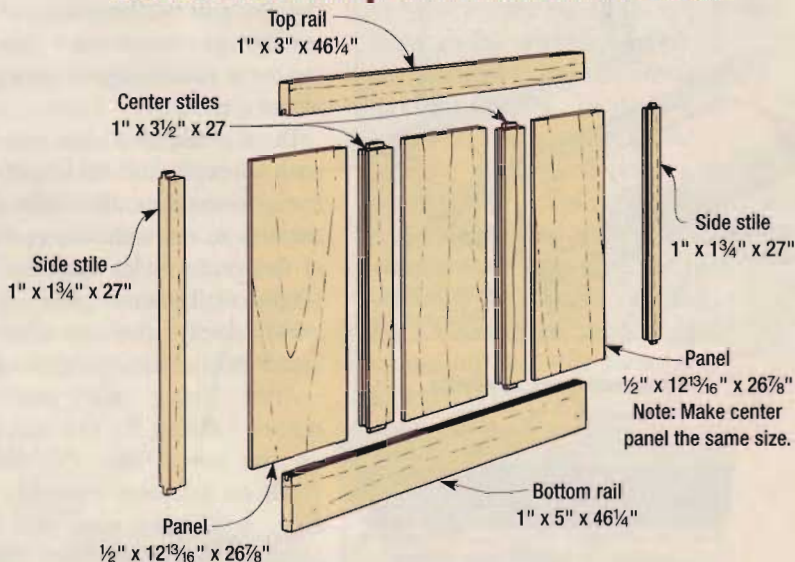
Cut grooves in the appropriate rail and stile edges. You can plan on making plenty of test cuts in scrap stock before cutting into your project material.

Plywood Panels

When making the panels, Karl and I found it best to cut slightly oversize pieces of 1/4" plywood, then join them together with contact cement. Afterward, we trimmed each panel to size.

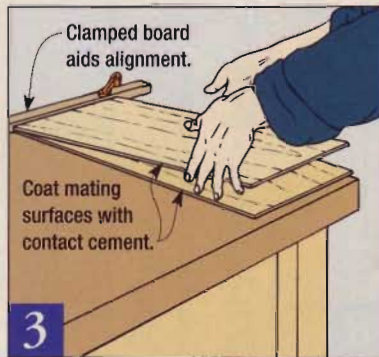
Unlike glue, contact cement doesn't require clamping. Though contact cement is a poor choice for structural joinery, it works fine on large surface areas when the materials are very stable.

Back Assembly Construction View



Spread cement on the lower-grade face of each oversize piece of plywood and allow it to dry to the touch. Apply second and third coats of cement to each piece, then assemble the panels into pairs

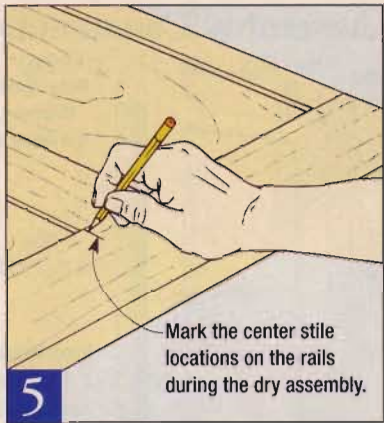
(Figure 3). Now tamp the plywood sandwiches with a mallet (or hammer) and wood block to improve the contact cement bond (Figure 4). You can trim the panels to size as soon as you're ready.



Align two plywood pieces and press them together to make a panel. Be careful — you get only one chance with contact cement.



To ensure a positive bond between the pieces of plywood, strike the panel's surface using a wood block and mallet.



Use a light touch when you mark the stile locations. Pressing can crush the wood fibers, making marks difficult to remove.



Assembling the Frames

With the rails and stiles completed and the panels cut to size, you can put all the frame and panel assemblies together. I always do a dry run first, checking to see that the parts fit as they should. This usually spares me from discovering some awful surprise during the actual glue-up.

During the dry run, position each piece in the back and side frame assemblies, then take a few minutes to mark the intersections of the center stiles with the rails (Figure 5). The marks will help you know exactly where to align the center stiles during the glue-up.

After fixing any problems revealed during the dry run, glue-up the assemblies (Figure 6). Work on just one assembly at a time, and make sure you have plenty of clamps on hand. Spread yellow glue on all the stub tenon cheeks and in the grooves where the rails and stiles meet. Avoid putting glue in the rest of the groove areas except for a drop at

the midpoint of each rail groove. This bit of glue will keep the panels centered in the frames.

While clamping the frames for Karl's island, we did run into one small glitch. When tightening the clamps, there was a tendency for some joints to buckle. We solved the problem by clamping blocks above and below each joint (Figure 6). Laying wax paper between the frames and the blocks kept any drips of glue from bonding the blocks to the frames.

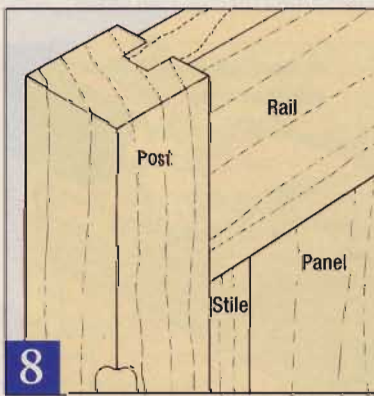
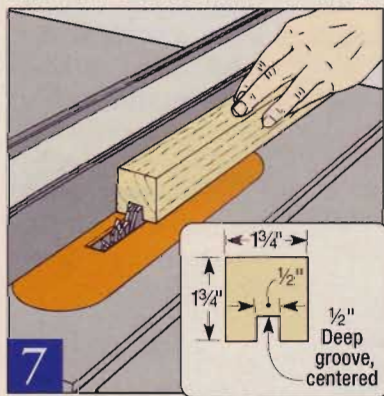
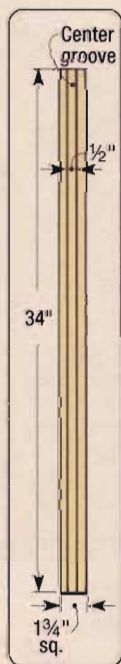
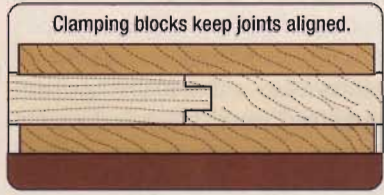
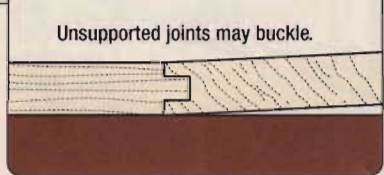
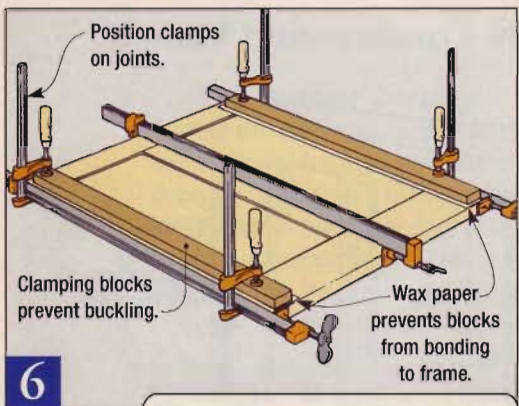
Machining the Posts

While the side, back, and door frame assemblies are sitting in clamps, you can begin working on the four posts. I like the posts because they give the island a sturdy appearance, much like the legs on a piece of furniture.

Start by preparing some 8/4 stock. First plane your plank to a thickness of 1 3/4", then rip four 1 7/8" wide pieces for the posts. Next, using your jointer and your planer, mill your posts to 1 3/4" square. It's worth taking extra care here because the success of many upcoming steps depends on having square posts.

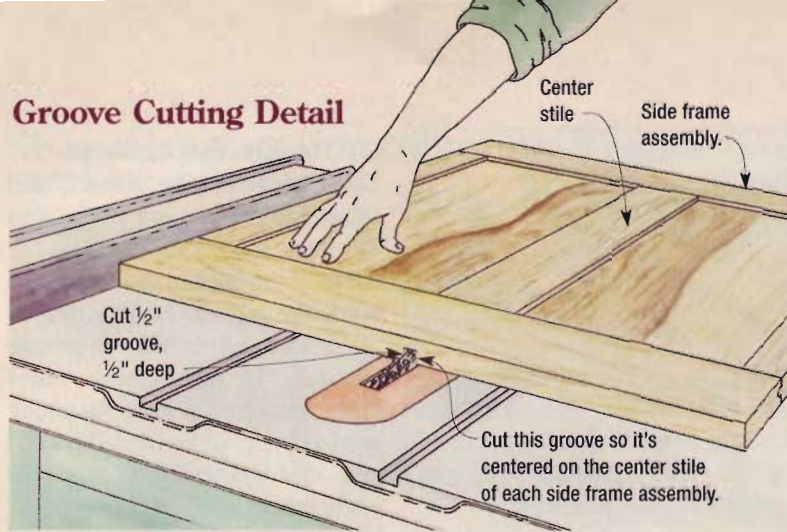
Now cut the posts to length and use a 1/2" wide dado blade to plough the groove in each post (Figure 7). The grooves are for joining the posts to the tongues on the side assemblies (Figure 8).

When cutting the grooves in the posts, take your time to make sure the blade is centered. In fact, I recommend cutting into some scrap post stock until the groove cuts are perfectly centered.



The side frames join the posts with tongue and groove joints. This makes for strong connections that align easily.

Groove Cutting Detail



Tongue and Grooves

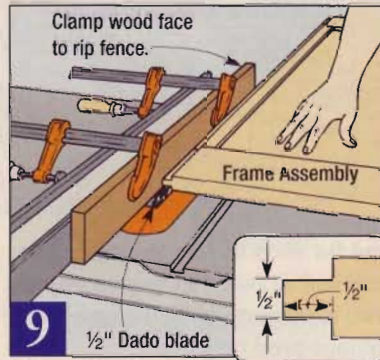
Since you have the $\frac{1}{2}$ " wide dado blade set up in your table saw, this is a good time to cut grooves in the frame assemblies for more tongue and groove joints. Due to the large size of the side and back frame assemblies, Karl and I found it helpful to work together on these cuts. While I pushed each assembly over the blade, he supported the overhanging material.

Adjust the saw fence and cut a groove that's centered in the center stile of each side frame (see the Groove Cutting Detail). Then readjust the saw fence and cut the groove in the back frame (see the Back Assembly Elevation).

After completing the grooves, you can machine a tongue on the ends of each frame assembly (Figure 9). Clamping a wood face to your rip fence during this operation will prevent the blade from damaging the fence. As you did with all your earlier joint cutting steps, be sure to cut a tongue on scrap frame stock and test its fit in a groove before cutting into your frame assemblies. Once again, an extra pair of hands is helpful here.

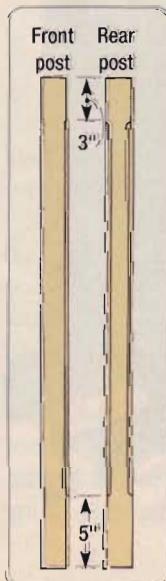
Mortising the Posts

Up until now, all four posts have required the same treatment. But to complete the front posts you also have to form mortises for the upper rail, drawer rail, and baseboard joints. Lay out these mortises, then drill out the bulk of the waste (Figure 10). Complete the mortises by shaving the walls with a chisel (Figure 11).

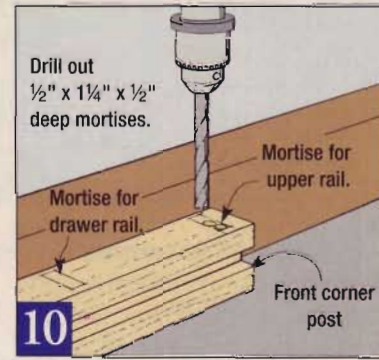
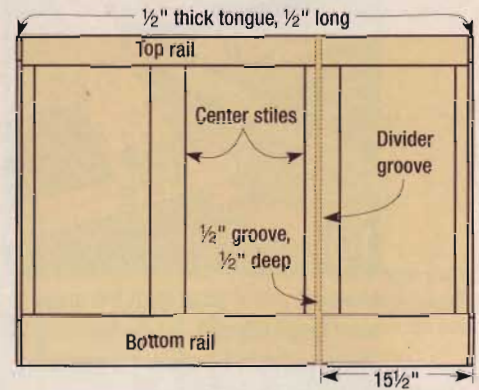


Clamp a wood face to protect your rip fence while forming the tongues along the ends of the frame and panel assemblies.

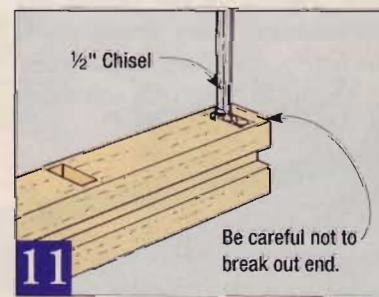
Before moving on, rout coves on the posts to match the coves you routed earlier on the edges of the top (Figure 12). Rout the front posts on the front, outside corner only. And rout the rear posts only on the back corners. Keep in mind that any lingering at the ends of each cut with the router bit may burn the wood. When you're finished routing, glue and clamp the posts to the side frame assemblies.



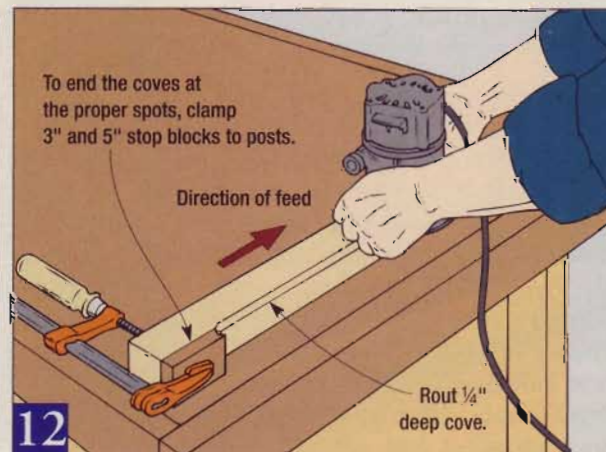
Back Assembly Elevation



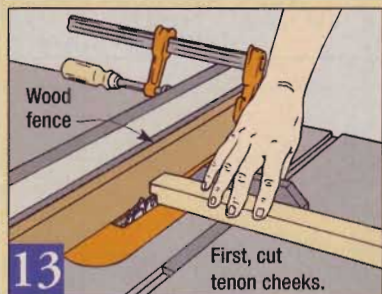
Carefully lay out the mortise locations on the posts, then remove the bulk of the waste using your drill press and $\frac{1}{2}$ " bit.



Square the walls of the mortises with a chisel. Work carefully on the top mortise to avoid breaking out the end of the post.

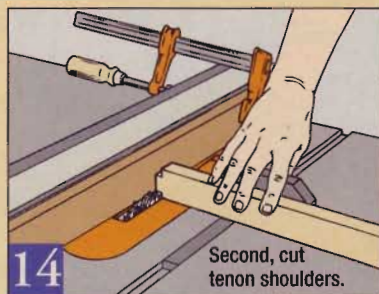
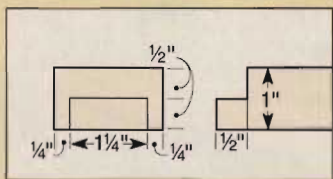


Rout the outside corner of each front post, and both outside corners of the rear posts. Keep the router moving to avoid burning the wood.



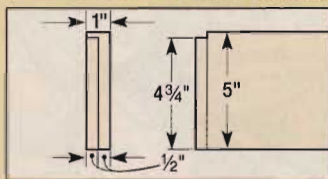
13 First, cut tenon cheeks. Make test cuts in scrap stock first to get blade height adjusted. Cut the tenon's cheeks to match the size of the mortise.

Rail Tenon Detail



14 Complete the tenons by making the shoulder cuts. Raise the blade slightly after each test cut to sneak up on a perfect fit.

Baseboard Tenon Detail

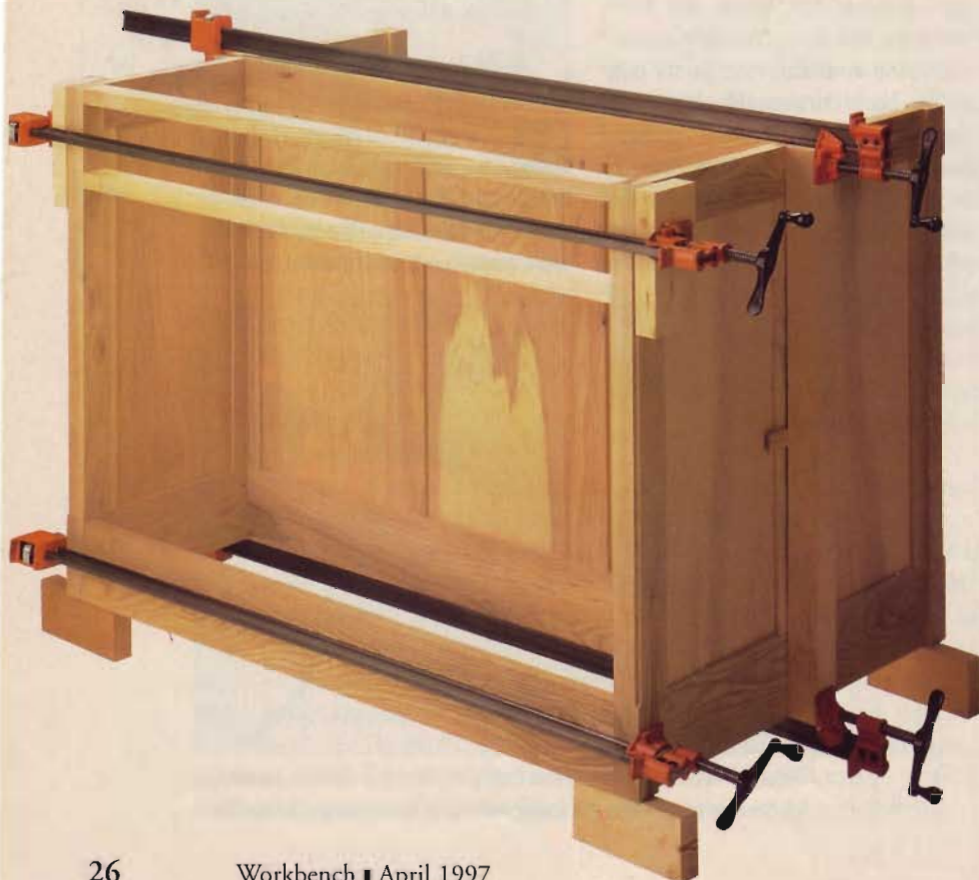


Cabinet Assembly

At this point, you're almost ready to assemble the base. But first you need to make the upper rail, drawer rail, and baseboard. Cut stock to size, then machine tenons on these pieces to fit into the front post mortises (Figures 13 and 14). As you can see in the Tenon Details above, the tenons are offset on the stock, so be sure to make only one cheek

cut for each tenon. Also, the upper rail and drawer rail tenons require two shoulders, while the baseboard tenons need only one.

Now dry assemble the base to see that everything fits correctly. Once you're satisfied, glue all the pieces together. You may need to use a wedge to force the joints tight where the back assembly meets the side assemblies (Figure 15).



Inside the Cabinet

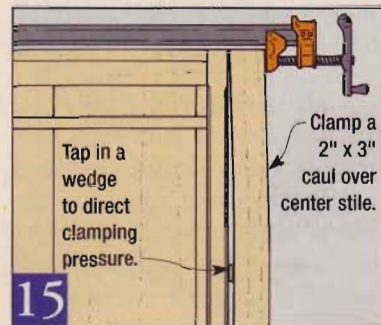
The cabinet bottom, divider, and adjustable shelves are made with $\frac{3}{4}$ " thick ash plywood. While the edges of the bottom will be hidden inside the cabinet, the front edge of the divider and shelves will remain exposed. To make these edges more attractive, I suggest gluing solid ash edging to them. After the glue dries, scrape and sand the edging flush with the plywood.

To support the bottom, Karl and I installed cleats in the cabinet. We screwed the cleats to the bottom rail of the back and side assemblies, as well as to the baseboard (Figure 16). Make the cleats from 1" thick scrap material and install them $\frac{3}{4}$ " below the top edge of the baseboard and bottom rails. You'll have to notch the ends of the baseboard cleat to fit around the front posts.

Lay out the notches on the bottom so it can also fit around the front posts (Figure 16). And while you're at it, lay out the notches on the divider as well (Figure 17). To safely cut the notches, you'll want to make a tall support from scrap plywood and screw it to your table saw miter gauge (Figure 18). Now you can confidently support the panels on edge and align each notch layout with the dado blade before making the cuts.

Secure the bottom in the cabinet by driving screws up through the cleats (Figure 16). Then turn your attention back to the divider for one more step.

The divider requires a tongue to fit into the groove you cut much



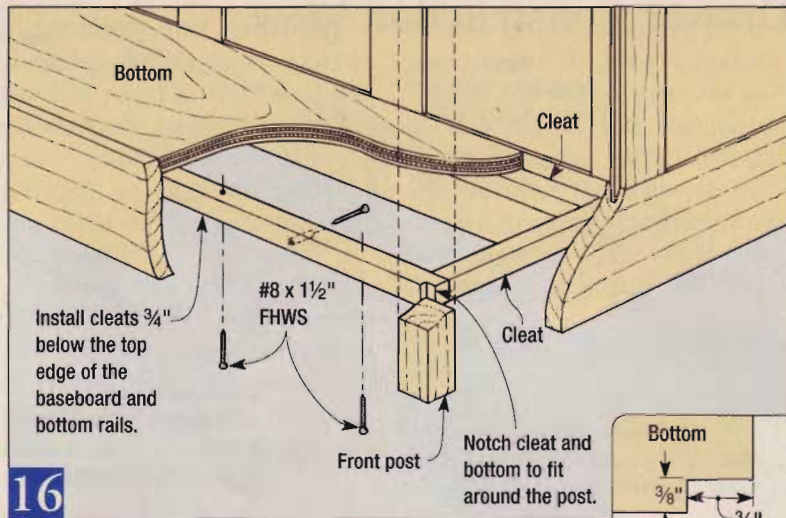
Since conventional clamps can't reach the middle of the side panel, try using a caul and a wedge to force the joints tight.

earlier in the back assembly (Figure 17 detail). Cut the tongue following the same procedure you used for cutting tongues on the frame and panel assemblies. I found that chamfering the tongue with a block plane eased the installation of the divider in the cabinet.

With the cabinet on its back, swing the divider into position and square it to the back assembly (see the Divider Installation Detail). Now, to make drilling pilot holes easy, use a pencil to mark the divider's location on the bottom.

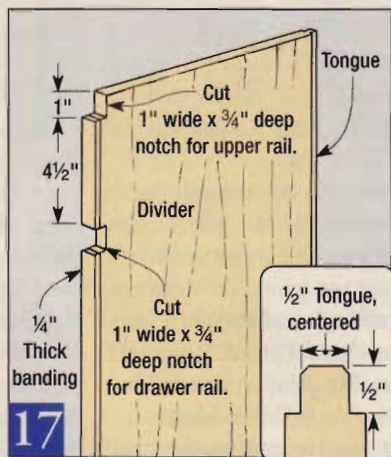
Remove the divider and drill three pilot holes through the bottom, centering the holes between the pencil lines. Once that's done, glue and screw the divider into the cabinet. We also drove a screw through the upper rail for good measure.

To prepare for the shelf support pins, drill rows of $\frac{1}{4}$ " holes in both sides of the divider and in the stiles of each side assembly (Figure 19). Be sure to outfit the drill bit with a stop collar or masking tape to limit the depth of the holes. You'll really feel terrible if the bit goes through — I should know.



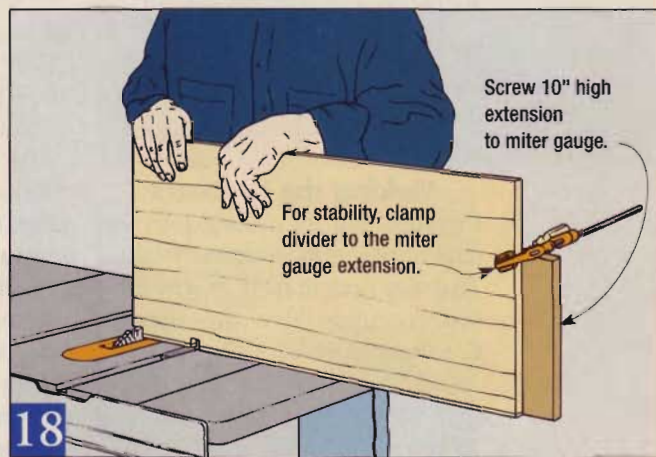
16

The bottom rests on cleats screwed inside the cabinet. After the cleats are secure, set the bottom into position and drive more screws up through the cleats and into the bottom to complete the assembly.



17

Check the notch locations against the rails in the cabinet before cutting. Planing the corners of the tongue makes it easier to install.

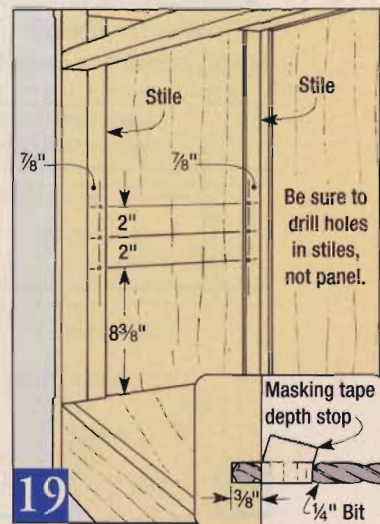
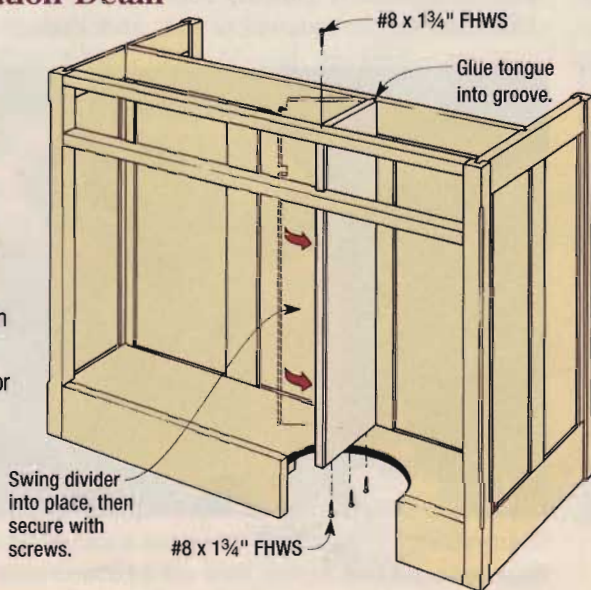


18

Cutting the notches in the divider is a safe and easy operation with this setup. Screw a 10" high extension to your miter gauge, then clamp the divider to it.

Divider Installation Detail

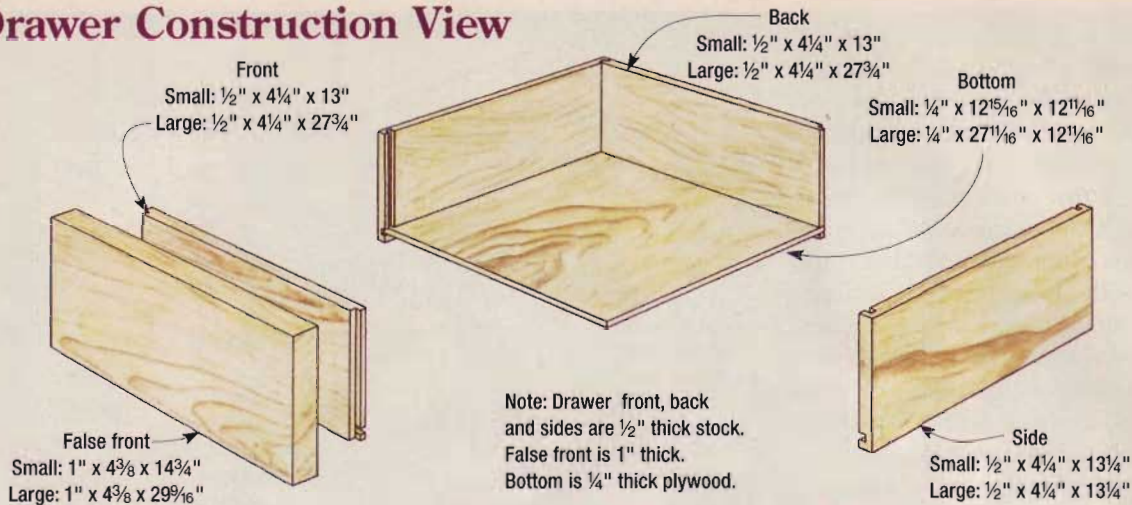
After cutting the notches and forming the tongue, swing the divider into the cabinet (without glue). Square the divider to the back assembly, and use a pencil to mark its position on the bottom. Now you can remove the divider and accurately drill pilot holes for the screws.



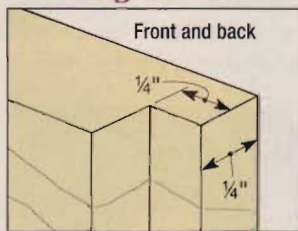
19

Drill holes for the pins that support the adjustable shelf. Put a masking tape flag on your bit as a quick depth guide.

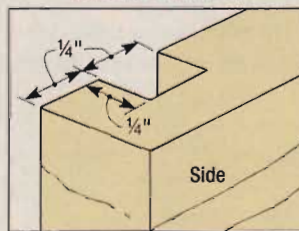
Drawer Construction View



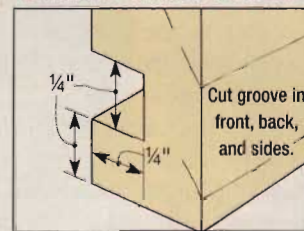
Tongue Detail



Groove Detail



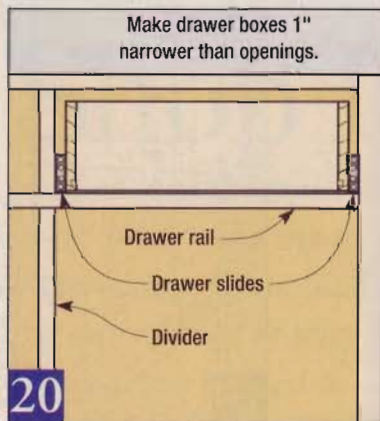
Bottom Groove Detail



Making the Drawers

I typically put off making drawers until a cabinet is completely built. That way I can fit them exactly into their openings (see the Drawer Construction View).

Like the doors, the drawers fit flush with the front of the cabinet. To make room for the drawer slides we wanted to use, Karl and I built the drawer boxes 1" narrower than the actual openings. This allowed $\frac{1}{2}$ " on each side of the drawers for the slides (Figure 20). The false fronts conceal this hardware.



The drawer slides need $\frac{1}{2}$ " of clearance on each side. There's not much margin for error, so measure and cut carefully.

By planning to use smooth operating drawer slides, heavy-duty drawer joinery became unnecessary. Instead, we joined the drawers with tongue and groove joints (see the Tongue and Groove Details). This is an easy joint to cut on the table saw with a $\frac{1}{4}$ " dado blade.

Cut your drawer parts to size and machine the joints, including the grooves for the bottoms (see the Bottom Groove Detail). After a dry run to check the fit, glue the drawer pieces together (Figure 21), and check each one for square.

Hinges and Slides

After all the effort Karl and I spent building this project, we sure didn't want to skimp on the hardware. We bought top-of-the-line, full-extension drawer slides and European-style hinges. The white drawer and door pulls match the pulls on the rest of Karl's kitchen cabinets, but you can do anything you want.

Because of the frame and panel construction of the sides, you'll have to make and install mounting blocks before installing the hinges and drawer slides (Figure 22).



Do a dry assembly to check the fit of the pieces in each drawer, then glue and clamp the tongue and groove joints together. Make sure the drawers remain flat and square.

The blocks create a flat, even surface on which to mount the hardware. However, you don't need any blocks to mount the hardware to the divider panel; you can just attach the slides and hinges directly to the divider.

I learned a long time ago to set pairs of business cards between a drawer and the rails underneath to get the right amount of clearance. As you install the slides and drawers, give this tip a try. Once the boxes are in, fit and mount the drawers' false fronts.

Installing the doors was a cinch given the use of European hinges. For installation tips and more information on this hardware, see *European Hinges* on page 30. Once you have the doors mounted, you'll appreciate the number of ways you can maneuver them in the openings for a perfect fit.

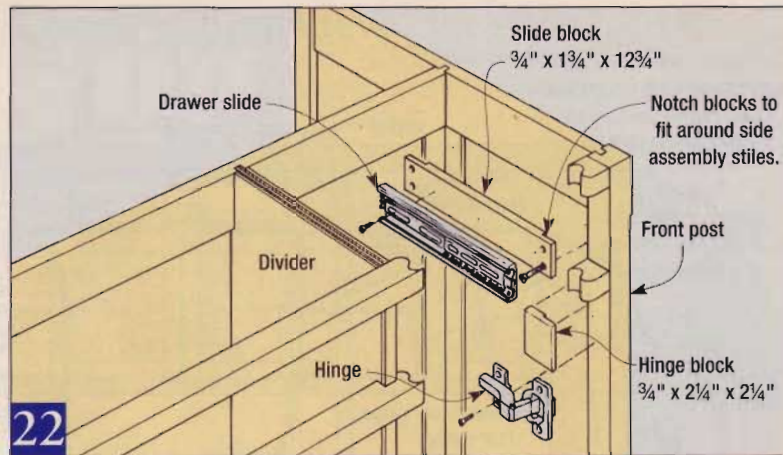
Installing the Top

Remember one critical thing when attaching the top: it's solid wood. This means it will move with seasonal changes in humidity. And with a top this large, the movement can be considerable — as much as 1/4" or more. You can't fight this kind of movement, but you can minimize its effects.

To allow for movement while at the same time keeping the top centered on the base, we used cleats and figure-8 fasteners (Figure 23). Screws driven through the cleats keep the top centered on the base, and the figure-8 fasteners pivot as the top shrinks and expands from this fixed point outward.

Fasten the cleats to the top rail of the back frame with screws (make sure the top of the rail and the top of the cleats are flush). Next, drill the shallow holes in the side frame top rails and the divider for the figure-8 fasteners, and screw them in.

Now center the top on the base and mark the pilot hole locations for the cleat and figure-8 hold-down screws. After drilling pilot holes, drive screws through the cleats and figure-8 fasteners.



Glue and screw blocks inside the carcass to create mounting surfaces for the hinges and drawer slides. Notch them so their face is flush with the edge of the corner posts.

Finishing the Island

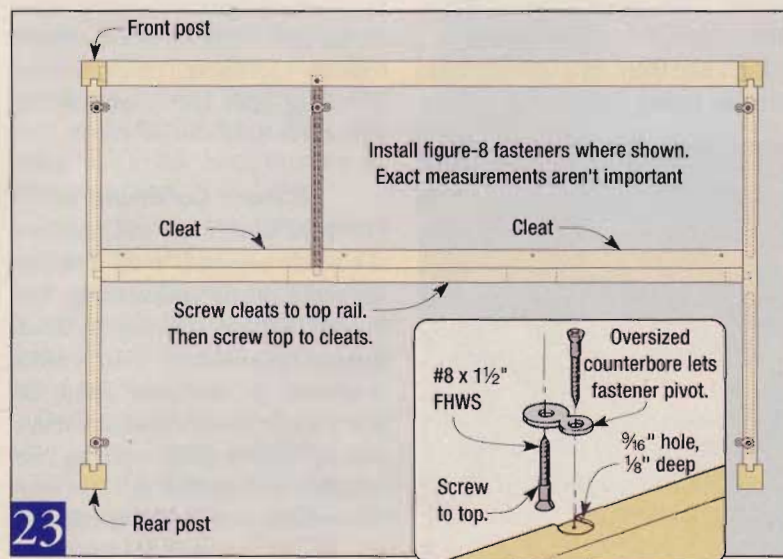
When it came to finishing the cabinet, Karl and I agreed on a two-step process. We used an oil-based sanding sealer for the first coat, and water-based polyurethane for two top coats. The oil sealer gave the ash an amber tone and filled the pores for a smooth surface. The two coats of polyurethane gave the cabinet a tough as nails outer shell. Sanding with 220 grit sandpaper between each coat and after the last coat resulted in smooth as silk surfaces.

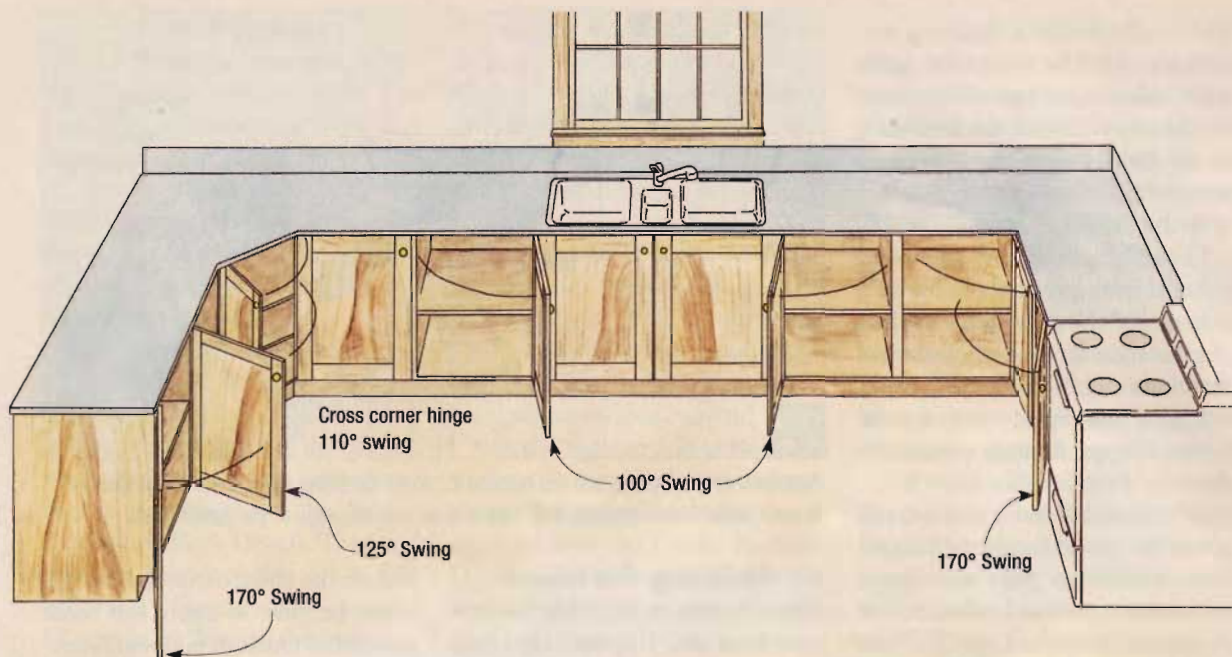
As for the top, we applied four coats of a rub-on tung oil finish. This will be easy to maintain over the years as the butcher block gets used for meal preparation. (Don't worry, once this finish dries it's safe for contact with food.) To

reduce the chance that the top will warp, be sure to apply the same amount of finish to both surfaces.

Securing the island to the floor went like clockwork. We traced the post outlines on the floor, then slid the cabinet aside and drilled a pilot hole through the floor at each location. After repositioning the island, Karl ran down to the basement and drove screws up through the floor into the posts.

Naturally, we had to break in our kitchen workbench, which is what I began calling it. I couldn't help but think of a workbench as Julie clamped her pasta cutter to one end of the top and went to work kneading dough for our Italian feast. For that moment, wood craftsmanship and fine cooking merged together.





European Hinges

Europe is known for its fine wines, fine food, and fine automobiles. Most woodworkers would probably add one more item to this list — fine hinges. One reason European hinges

have become so popular in North America is because they remain out of sight when the doors are closed. This gives a clean, sleek look to furniture and cabinets.

But I like them for other reasons. Besides hiding behind the cabinet

door, they are simple to install and offer many adjustments. By turning a few screws, you can easily position the door for a perfect fit without removing it from the cabinet.

Frankly, there have been times I dreaded hanging cabinet doors. Some hinges are difficult to install, and can be touchy when it comes to achieving consistent gaps between doors and cabinet frames. But the built-in adjustability of European hinges eliminates those challenges. That means no more tedious mortising, plugging and redrilling pilot holes, or fiddling with cardboard shims.

32mm Cabinets

European hinges are just one part of a whole approach to cabinetmaking called the 32 millimeter system (named for the spacing of holes inside the cabinet). This system originated in Germany about 60 years ago as a method of streamlining and standardizing cabinet construction and hardware.

Needless to say, 32mm cabinets are based on metric measure-

ments. In spite of this, the popularity of European hardware continues to grow in the U.S. Cabinetmakers here have adopted much of this system, and by far the most popular components are the hinges.

Cabinet Configurations

Typically, the European system utilizes laminate-covered particle-board for building cabinets, dowels for carcass joinery, epoxy coated roller style drawer slides, and frameless cabinet fronts.

American cabinets, on the other hand, have traditionally been made with solid wood face frames, use full-overlay and half-overlay surface mounted hinges, and plywood for the cabinet boxes.

Manufacturers of European hinges have developed accessory mounting plates to accommodate most of the American conventions. In addition, they offer free-swinging and snap-closing options (snap-closing eliminates the need for catches to hold the doors shut), and a variety of swing ranges from 90° to 170°.



Parts of the Hinge

There are three essential parts to any European hinge — a mounting plate, a cup, and a multi-jointed arm. The cup and arm generally come as a single assembly.

The cup serves two purposes. It provides a stable platform for mounting the hinge to a door. And the recess in the cup creates room for the first arm joint to fold into when the door closes.

Hinge arms vary in size based on the number of joints. The arm of a 170° hinge has several sections, while the arm on a 90° hinge has only one.

To accommodate different installations, mounting plates are available for inset, half-overlay and full-overlay doors. In addition, other accessories allow European hinges to work on face frame cabinets.

Mounting the Hinges

Mounting a European hinge may be quite different from what you're used to. For starters, you'll need a 35mm Forstner type drill bit for boring the holes for the hinge cups (Figure 1). As many woodworkers have learned, you can't drill these holes with a hand held power drill. If the large

Forstner bit catches in the hole, the torque from the drill will painfully wrench your wrist and possibly ruin your workpiece. Therefore, a drill press or drilling jig is required.


Locating your hinge cup is critical for the door to swing properly and close with a good fit. It's the distance from the edge of the door to the cup's center that really matters.

Lay out the cup hole locations according to the instructions that come with the hinges, making sure to extend the center line of each hole onto the edge of the doors.

After drilling the cup holes, position the doors on the cabinet and transfer the cup hole center lines from the door edge onto the cabinet. This gives you the center lines for the mounting plate installation (Figure 2). The hinge instructions will tell you how far from the front edge of the cabinet to drill the pilot holes (this varies by hinge type).

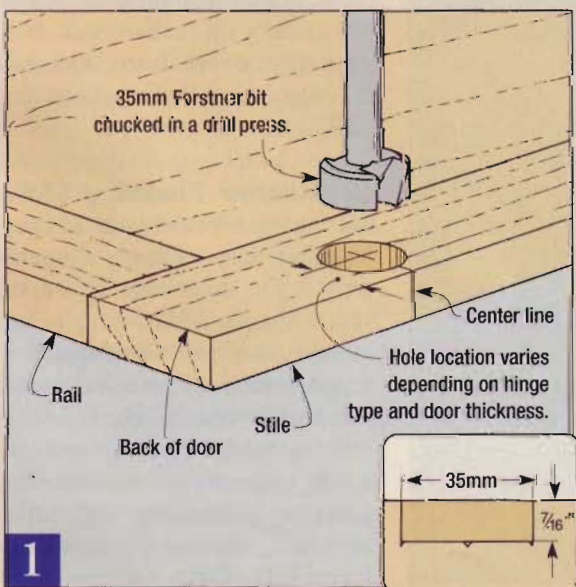
Screw the cups and mounting plates into position, then join the hinge parts together. Standard

European hinges require you to slide the arm into the mounting plate and tighten a screw. For a modest increase in price, you can purchase clip-type European hinges that snap together.

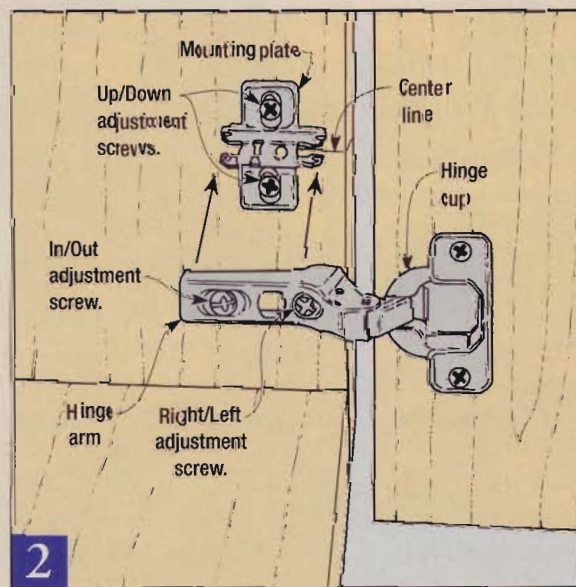
At this point you'll find out the real advantage these hinges offer. To fine tune your door installation, you can adjust the hinges to make the door move side-to-side, in-and-out, or up-and-down. I can't speak for anyone else, but this capability sure has saved me from disaster once or twice. 



Mounting European Hinges

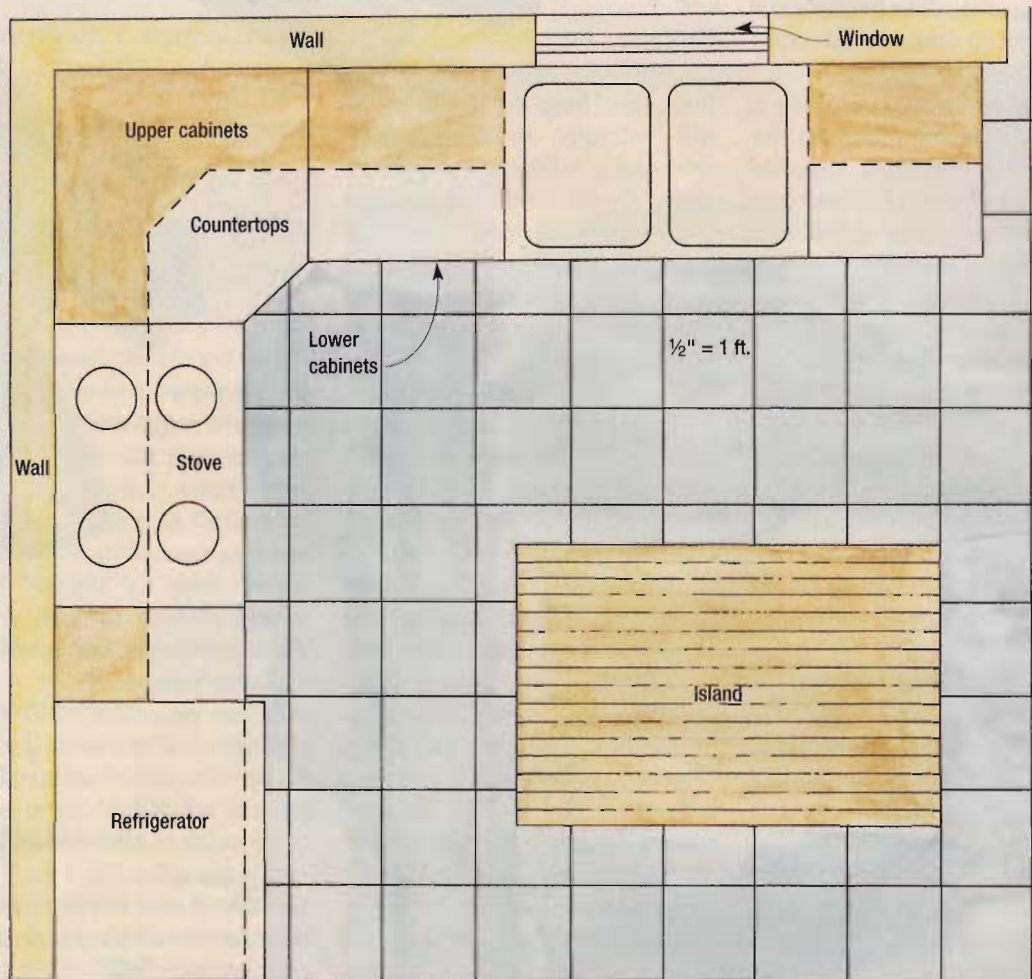


1 Lay out the cup hole, making sure to extend the center line over the door edge. Bore the hole with a 35mm bit in a drill press.



2 Secure the mounting plate to the cabinet wall, then join the hinge parts together. Now you can adjust the hinge three ways.

Kitchen Planner Scale



When Karl and I were building the island for his kitchen, I was strongly tempted to build one for the Workbench house

at the same time. It would save on machine set-ups, plus I would have Karl's help.

But I remembered the time my aunt invited everybody over to see her brand-new 1959 Lincoln. After we all oohed and aahed, she drove it inside the garage. Or at least she tried to do it — that chrome-laden beast was too long to fit. You didn't know whether to laugh or cry.

Although this island is smaller than a car, it's still a good idea to make sure it will fit into your kitchen layout. If it does, you'll gain some outstanding benefits.

The work surface on this island is a generous 13½ square feet, the equivalent of adding nearly 7 lineal feet of conventional base cabinets with countertops. And when I calculated the volume of the island, I had to double-check my figures. The 10 cubic feet of storage capacity is equal to adding a 4-ft. run of wall cabinets to your kitchen!

Plan, Plan, Plan

I've built and installed enough cabinets to know that kitchen remodeling is a major investment, even if you do all the work yourself. So I always take a slow and systematic approach before construction.

As a first step, I chose to draw a floor plan of the *Workbench* kitchen as it exists now. If you've never drawn plans before, this

may sound like a difficult job that requires a lot of drafting tools. But it's actually quick and easy. You need only one specialized tool, and I've supplied that for you on the next page.

The Kitchen Planning Scale

Clip out the Workbench Kitchen Planning Scale. (Make a photocopy if you don't want to cut up your magazine.) Although you can use the scale just like this, a few minutes work will give you a valuable tool for your shop.

Cut a hardwood strip, and use spray adhesive to adhere the paper to it, wrapping the marks slightly around the beveled edge (Figure 1). While you're in the shop, cut a smooth piece of ½" plywood to 12" × 16" for your draw-

ing board, and grab your combination square and compass to complete your drafting tool kit.

Use masking tape to stick down the corners of a piece of plain 8½" x 11" typing paper to the plywood. This size works well for a kitchen up to about 15 ft. x 20 ft. If you have a bigger kitchen, get a larger piece of paper and use a bigger piece of plywood.

You're Ready To Draw

Now, you can use your combination square along the edges of the plywood to easily draw vertical and horizontal lines (Figure 2).

Start by drawing the position of the walls, and include the doors and windows. Use a tape to measure your kitchen, then transfer the information to your drawing, using the Kitchen Planning Scale. Strive for reasonable accuracy, but don't drive yourself crazy trying to account for every tiny detail. For example, don't be surprised if you discover that your kitchen is slightly out of square.

Copy, Then Draw More

At this point, I think it's a good idea to make a few photocopies of your drawing. This way, if you want to try a variety of layouts, you won't have to redraw the basic floor plan each time.

Now, start adding your cabinets. Mark countertops with a solid line, and upper cabinets with a dashed line. Identify the appliances, and use your compass to show how far the refrigerator's door swings.



Clip the scale from the magazine (or make a photocopy), then adhere it to a piece of hardwood to make a valuable drafting tool.

When you complete the floor plan, you can make a separate scale drawing of the kitchen island. Mark the swing of the island's doors for reference. Cut out this drawing, and move it around on the floor plan to see if it will work in your kitchen.

You should allow a clearance of 42" between the top edge of the island and any countertop, but you could probably decrease this to 36". If two people regularly work together to prepare meals, 48" is a better clearance dimension. You can make scale drawings of other items (like a kitchen table or microwave cart), and experiment with their location.

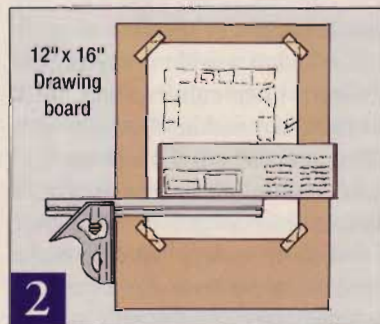
Another Planning Strategy

For the *Workbench* kitchen, the island might be a tight fit. So before I commit the time and money to building one, I decided to quickly nail together a plywood box that matches the size of the island. I put it in the kitchen, and I'm going to see how an island actually works out.

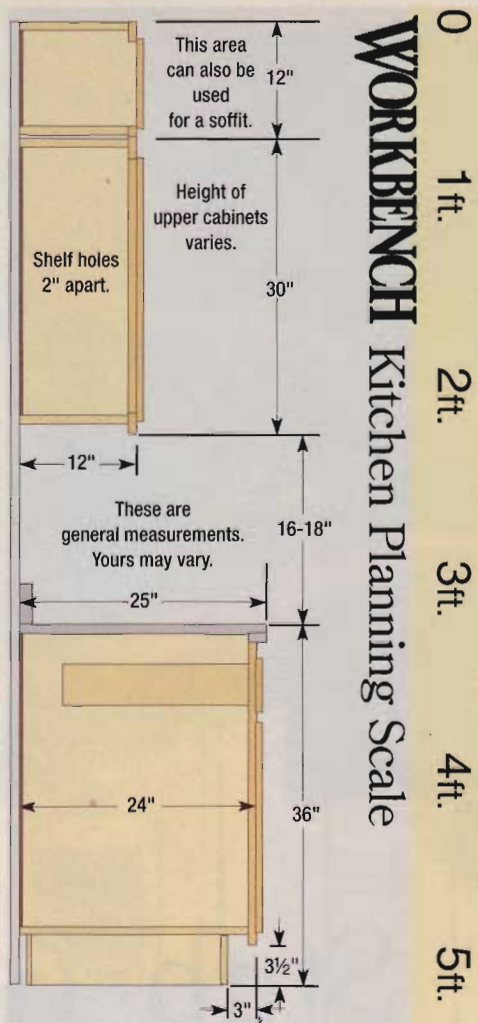
More Uses For the Scale

Of course, you can also use the scale to draw new floor plan ideas for your kitchen, and elevations of cabinets you might want to build. The scale has useful planning information printed right on it.

And once you've mastered the basic skills of creating scale drawings, you'll start using them to plan all your home improvement and woodworking projects.



Hold your combination square snug to the edges of your shopmade drawing board to draw accurate vertical and horizontal lines.



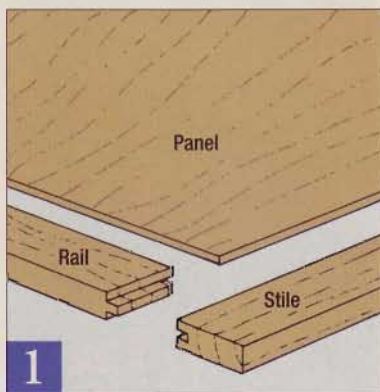
Door(s) to kitchen: 32" or wider
Walkways: 36" or wider
Work aisles: 42" or wider
Sink counter: For primary sink, minimum of 24" on one side and 18" on the other, for secondary sink, minimums are 18" and 3".
Dishwasher: Located within 36" of sink, if possible.
Food prep center: 36" of straight countertop, immediately next to sink.

Cooktop counter: 15" on one side, 9" on the other.
Cooktop vertical clearances: 24" min. to hood, 30" to unprotected surface.
Cabinet above range is typically 18" tall.
Microwave counter: 15" of counter below or next to appliance.
Backsplash: 4" or higher.
Toekick space: 3½" high, 3" deep.
Cabinet above refrigerator: 15" tall if soffit is used; can extend to ceiling.



Stub Tenon and Groove Joinery

Cabinetmakers and carpenters have been using frame and panel construction for hundreds of years, and with good reason. It's attractive, strong, and allows for the natural movement of solid wood panels.



Stub tenon and groove joinery is ideal for light-duty frame and panel construction. All the cutting can be done on a table saw.

Since panels float in the frames without glue, they're free to expand and contract as necessary, as seasonal changes in humidity occur.

You'll find a wide array of specialized bits, cutters, and tools available for making frame assemblies, but the way I build most of mine is with little more than a table saw. I prefer a stack dado set over a wobble-type dado blade to make crisp square corners. You can also achieve fine results with only a standard saw blade — you'll just have to make multiple passes over the blade.

To make frames for several of the projects in this issue of *Workbench*, I chose to use stub tenon and groove joinery (Figure 1). Generally, stub tenons are considered to be any tenon under $\frac{1}{2}$ " in length. For frames that have to withstand lots of stress, you'll benefit from machining deep mortises and long tenons. But for light duty frames, stub tenons and grooves offer plenty of strength.

PRO TIP

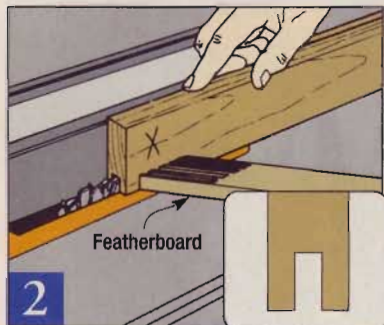
Anti-Rattling Technique

Try inserting foam weather stripping into the grooves of your frame before adding a solid wood panel. The foam will keep the panel from rattling when it contracts due to dry conditions.

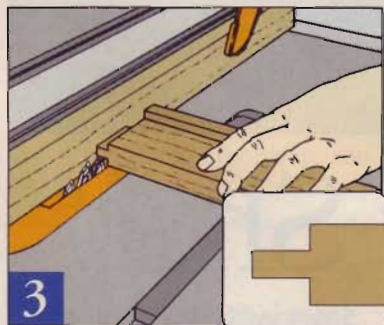
Grooves First

Once you've cut your rails and stiles to size, building a basic frame with stub tenon and groove joinery involves just two easy steps — ploughing the grooves and machining the tenons.

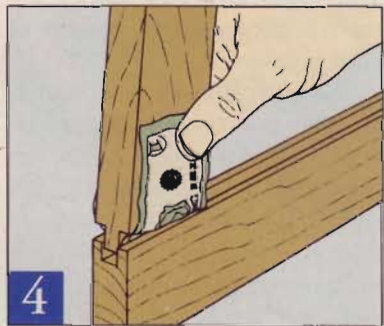
Over the years, I've found that cutting the grooves first is almost always best. As you'll see in the upcoming steps, it's easier to make slight blade height adjustments to change the thickness of a tenon than to fine-tune a dado blade to alter the width of a groove.



To center groove, mark an "X" on one side of each rail and stile. Make first pass with "X" showing, and second with "X" against fence.



Centering stub tenons is easy with this set-up. To keep tenon from bottoming out, make its length slightly less than groove's depth.



A dollar bill will show whether your joint's fit is on the money. Too tight, you risk splitting the rail; too loose, and you get a weak bond.

To cut grooves in your rails and stiles, set the thickness of your dado blade to match the thickness of your panel edges. Panels should fit the grooves snugly, but not so tight that you have to force them into place. Most of the time, I cut grooves $\frac{1}{4}$ " wide by $\frac{1}{2}$ " deep.

Adjust the rip fence to center the frame stock on the blade. Even with careful measuring and test cuts, however, it's easy to set the fence a hair closer or further from the blade than it should be, resulting in grooves that aren't perfectly centered on your stock. Although the grooves may appear to be centered, any error will inevitably show up when the frame is assembled.

To avoid this problem, start by centering the blade on the wood and cutting a test groove in a scrap piece of identical stock. After checking to see that the set-up is on target, mark the front of each rail and stile with an "X" (Figure 2). I also put an "X" on the edges to be grooved (reminding me to position them against the table).

Making the Cuts

Now cut grooves in your frame pieces by running them through the saw twice. For the first pass, run each piece over the blade with the front facing away from the fence. Then, for the second pass, turn each piece end for end so the "X" faces the fence (Figure 2). This procedure guarantees perfectly centered grooves every time. You may end up with grooves that are slightly wider than the panel edges, which is okay.

I also have a couple more suggestions to help improve accuracy. To hold rails and stiles tight against the fence, clamp a featherboard to your table saw. And to ensure consistent groove depth, apply firm pressure while pushing your stock through the blade.

Tenons that Fit

In my view, the key to a strong frame is a good fit between the stub tenons and the grooves.

PRO TIP

Gluing Jig Holds Door Square

Nothing beats this simple jig for holding a small frame and panel assembly square and flat while the glue sets. To prevent glue squeeze out from bonding your assembly to the jig, brush a coat of varnish onto the jig after it's completed.



Which is another reason why I cut the grooves first, then machine the tenons for a custom fit.

I prefer cutting tenons with a protective wood fence clamped to my table saw's rip fence (Figure 3). Moving the fence into position creates a positive reference surface for the end of frame stock. This technique is also quite safety-conscious, because it keeps projection of the dado blade to an absolute minimum.

Set the blade height to cut your tenon cheeks and, using a miter gauge to support a scrap piece of frame stock, cut one tenon cheek. Flip the stock over and repeat the cut to complete the tenon. Test the fit of this tenon in a groove, then make any adjustments to your set-up and cut another test piece. Ideally, you should be able to slip a dollar bill into the groove along with the tenon (Figure 4).

When it comes time to assemble your frames, keep in mind that one of the main benefits of frame and panel construction is that it allows solid wood panels to expand and contract with changes in moisture. Gluing the panels into the grooves would defeat this purpose, so apply adhesive only at the joints. Finally, use a framing square to check for square when clamping up your frames.



Sunlit Window Shelf

As the saying goes, even the best laid plans don't always work out the way we expect. Take my friends Karl and Julie,

for example. One of the features Julie wanted in her remodeled kitchen was a window over the sink. She got the window, along with plenty of natural light. She also got something she hadn't bargained for — a view of her neighbor's ugly garage.

Soon after completing the kitchen, Julie hit upon an idea. Being a gardener got her to thinking about potting benches with

their evenly-spaced slats, and how similarly constructed shelves would allow light to filter through. This idea germinated into these over-the-sink window shelves.

Building these shelves is another lesson in frame construction. Most frames, like those in the *Kitchen Island* project on page 20, are fitted with a panel. But here Karl and I filled the frame opening with dowels. We also chose half-lap joints instead of stub tenons. Given the minimal need for strength, half-laps make a lot of sense for the shelves. In addition, the setup for cutting half-laps is even easier than cutting stub tenons and grooves.

Start with the Uprights

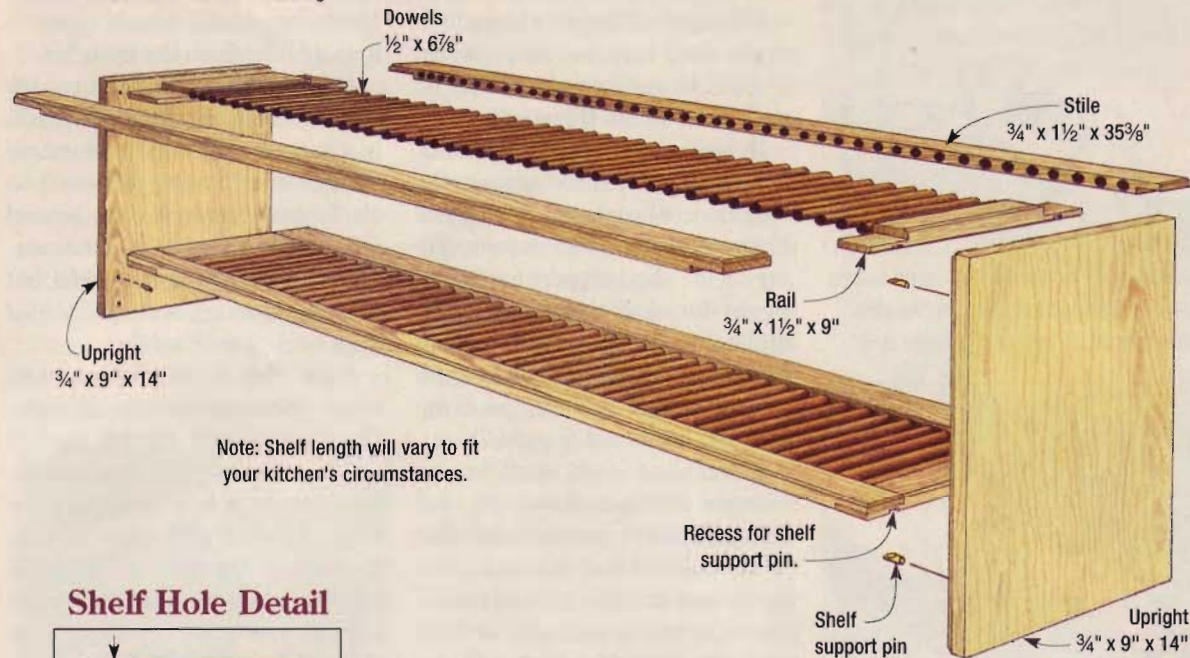
We began this project by gluing up a 10" x 30" solid ash panel for the two uprights. The uprights offer many adjustments for spacing the shelves between the sections of kitchen cabinets.

Glue and clamp as many boards together as necessary (Figure 1). Once the glue dries, scrape off the excess adhesive and cut each upright to size from the panel.

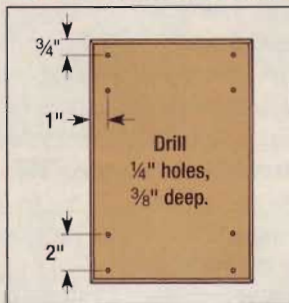
Now lay out two rows of hole locations on each upright for the shelf support hardware (see the Shelf Hole Detail). I favor a drill press for drilling the holes because the results are so consistent.

Window Shelf Construction View

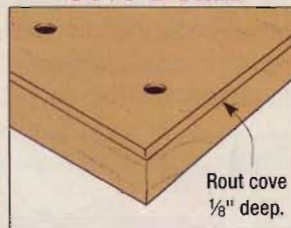
OVERALL SIZE: 9" x 14" x 36⁷/₈"



Shelf Hole Detail



Cove Detail



For a finished look, rout a cove on the edges of the uprights (see the Cove Detail). By the way, this matches a detail on the kitchen island project — you may want something different.

Building the Shelves

Our shelf frames are 9" wide, which is about perfect for straddling between standard 12" deep cabinets.

Be sure to adjust the length of the frames to fit between your kitchen cabinets.

Rip the rails and stiles for the frames and cut them to length (don't forget to subtract 3/4" for each upright when measuring the distance between your cabinets).

Now cut the half-lap joints using a table saw and dado blade (Figure 2). Be sure to cut sample joints first.

You'll know you have a tight joint when the mating surfaces of your pieces are flush with each other.

Following the joint cutting operation, lay out the holes on the stiles for the dowels. To make the layout go a little faster, I clamped the four stiles together and marked them all at the same time (Figure 3). Make sure the ends are flush. To keep your spacing symmetrical, start laying out the holes from the center of the stiles and work toward the ends.

A drill press with a fence will make quick work of drilling these holes. Clamp the fence to the drill press table so that the bit is centered on the edge of the stile. Setting your



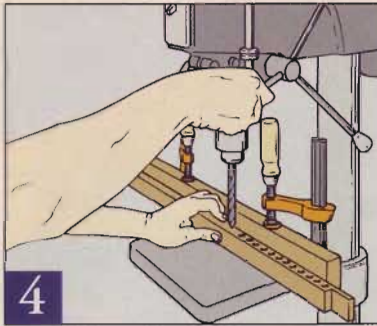
1 Joint the edges of your boards and glueup a 10" x 30" panel. After the glue dries, cut the panel into the two 9" x 14" uprights.



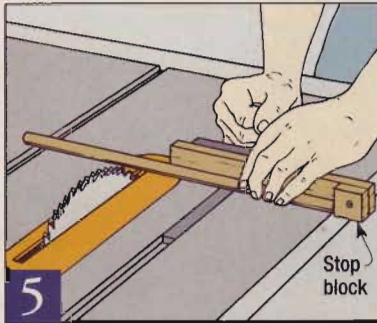
2 To safely and accurately cut the half-laps, clamp a wood face to the rip fence and support the stock with the miter gauge.



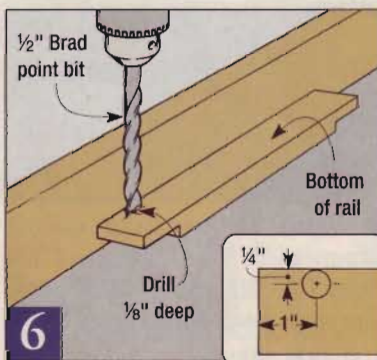
3 For consistent spacing, clamp all the stiles together, then lay out the holes starting at the center of your material.



4 To bore holes for the dowels, clamp a fence to the drill press table to center the stiles under the bit. Set the drilling depth at $\frac{1}{2}$ ".



5 A miter gauge with a wood fence and stop block makes quick work of cutting dowels to length. Cut the dowels $6\frac{7}{8}$ " long.



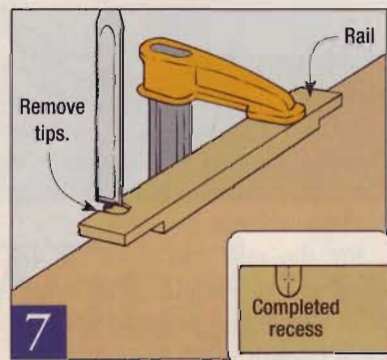
6 Lay out the recesses on the underside of each rail. Then use a drill press to bore a $\frac{1}{8}$ " deep hole at each location.

depth stop will ensure that each hole is $\frac{1}{2}$ " deep (Figure 4).

Cutting the dowels to length is easily done once you screw a stop block to an auxiliary wood fence on your miter gauge (Figure 5).

Before gluing up the shelves, form two small recesses on the underside of each rail. These will help prevent the shelves from sliding off the shelf support hardware. Begin forming the recesses by drilling a $\frac{1}{8}$ " deep hole with a Forstner or brad-point bit (Figure 6), then square up the edges of the holes with a chisel (Figure 7).

Assembling each shelf begins with the dowels and one stile. Put a few drops of water resistant glue in the holes of one stile and press the dowels in. After putting glue in the holes of a second stile, press it onto the assembly. Now add the rails by gluing and clamping the half-laps together — don't forget to measure the diagonals to square up your frames.



7 Once you've drilled holes for the recesses, remove the small tips that remain to square up the outside rim of each hole.

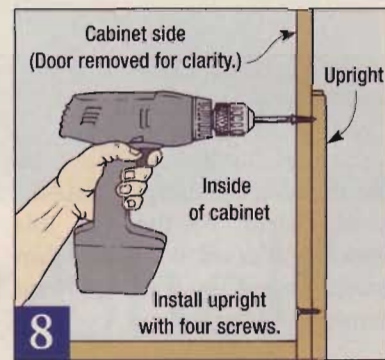
Choosing a Finish

Sand each frame, then rout a cove along the outside edges to match the edge detail on the uprights.

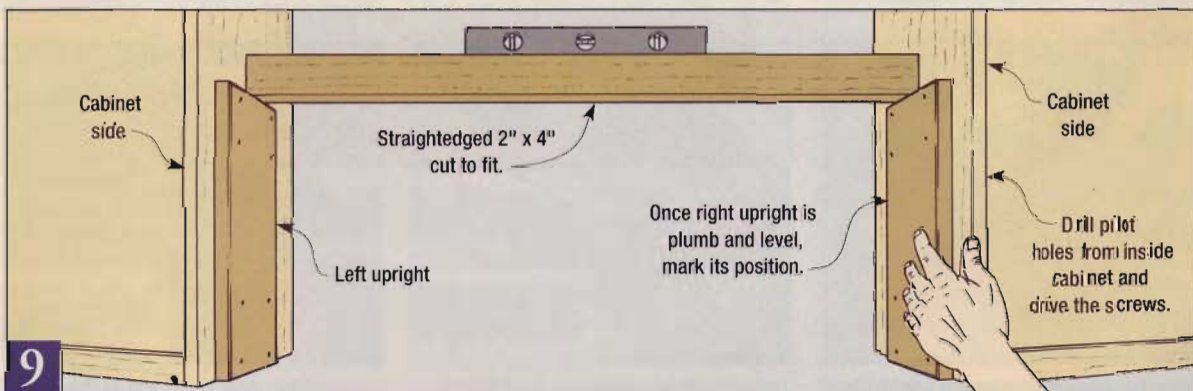
Although Karl and I first considered brushing on a finish, we quickly changed our minds when we thought about coating all those dowels. Instead, we applied an aerosol polyurethane made by Varathane. Admittedly, spraying is wasteful, but the time savings and absence of drips made it worthwhile.

Allow the finish to dry, then secure the uprights to the cabinets. Level and plumb the left upright and mark its position. Use double-faced carpet tape to hold it in place while you drill pilot holes (Figure 8). Remove the tape and drive the screws, then mount the right upright. Use a level to make sure the uprights are aligned (Figure 9).

Now, instead of looking out at the neighbor's garage, Julie enjoys the sunlight bathing her cyclamen and treasured tea kettle.



8 Level and plumb one upright, then drill pilot holes from inside the cabinet. Remove the double-faced tape and drive the screws.



9 Hold the second upright in position and fit a straightedged board between the cabinets. Set a level on the board and adjust the upright so it's level with the first one. Mark the upright's location, then secure it to the cabinet with double-faced tape so you can drill the pilot holes.

DeWalt's New Router

Call me sentimental, but some tools I like so much I get all choked up just looking at them. Others, especially aggressive power tools, have the same

effect when I use them, but for all the wrong reasons. They spew enough dust and shavings to make even the toughest lungs plead for oxygen.

For years I shrugged this off as paying the fiddler for my dancing music. I had to accept the mess in exchange for the speed and convenience power tools offer. Wood chips piled up at my feet and plumes of fine dust drifted through my shop and lungs. If I ever run for political office, I'll have to admit it — I inhaled.

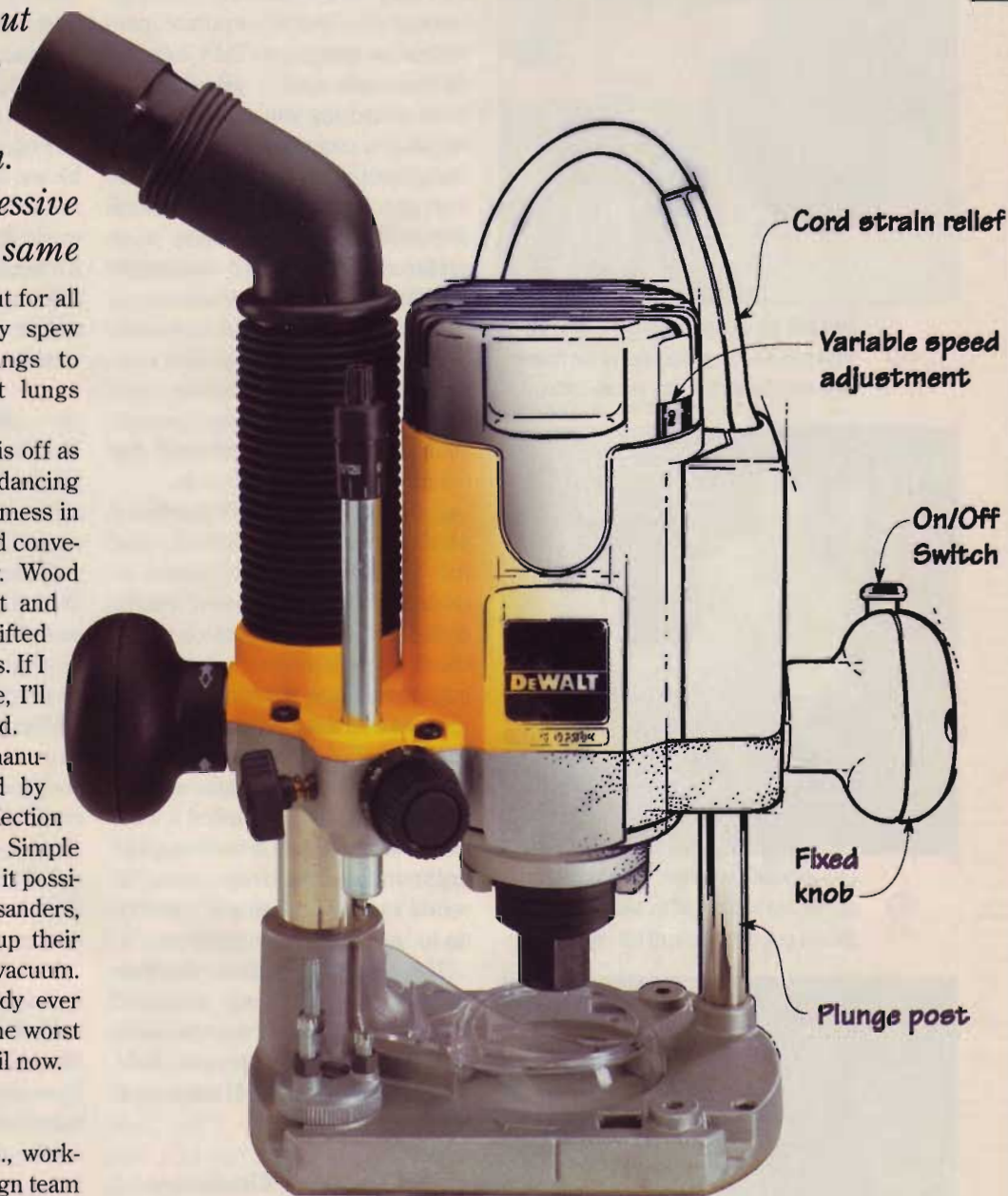
Thankfully, major tool manufacturers have responded by designing integral dust collection features on many tools. Simple extraction ports now make it possible for circular saws, belt sanders, and other tools to clean up their acts with help from a shop vacuum. The only trouble is, nobody ever invited the router, one of the worst offenders, to the party. Until now.

A New Idea

DeWalt Industrial Tool Co., working with the European design team from its Elu division, decided it was time to give the router some manners. Last year they introduced the DW621, a 2-hp plunge router with a dust-defying difference.

At first glance, the new router looks faintly asymmetrical but still familiar. A closer look, however, reveals the change — dust collection built right into otherwise standard components.

Not wanting to sacrifice the compactness that makes routers maneuverable, DeWalt steered

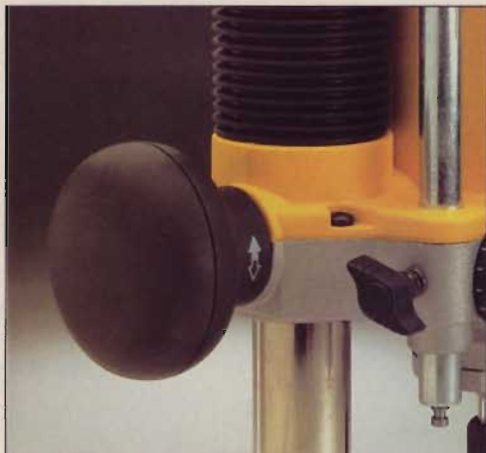


away from bulky add-ons. Instead, the design engineers found the dust route they needed in an unlikely place — a plunge post.

On one side of the router is a conventional solid steel guide post, but its partner was replaced with a hollow steel tube that meets up with a dust extraction port positioned right at the collet. Covering part of the steel tube is a flexible "accordion" boot and a plastic fitting for connecting to a shop vacuum.

For edge routing operations, an optional edge guide mounts to the underside of the router base and collects debris that would otherwise fall to your shop floor.

Routers are arguably the most versatile portable power tools around, which has made it easier to forgive the mess they make. But this new router (and the entries from other manufacturers that are certain to follow) promises to end that dirty legacy.



You lock the plunge depth by twisting the left knob. The large diameter of the hollow post contributes to a very secure setting.



Like a cyclone chamber, this plastic shroud causes the vacuum air to swirl around the bit and pull debris toward the hollow post.



The accorioned discharge tube stretches as the router is depressed. It also turns to keep the vacuum hose connected while routing.

Mandates and Markets

Companies need serious incentives to spend time and money developing truly new products. Black & Decker (DeWalt's corporate parent) is no exception. They have to do the same kind of planning and head-scratching you and I do when we start a complicated woodworking project, then toss in headaches like government regulations and standards, liability issues, user preferences, and the economic realities of a competitive market.

In this case, mandated European standards for woodshop dust control were tightening, and the company's smaller 1 $\frac{1}{4}$ -hp plunge routers were being outsold by competitor's midsize models.

Carter Williams, a woodworking product manager at DeWalt, said the engineering team wanted to raise the bar with a new router design, not simply match what other manufacturers were offering. Adding integral dust collection seemed like the natural next step.

Together with focus groups of woodworkers, the team started with this goal and compiled a wish list of other ideal features: good ergonomics, electronic variable speed control, bit shank capacity up to $\frac{1}{2}$ " , and plenty of power.

The chorus of opinions also produced one constant concern. Woodworkers didn't want to sacrifice the compact size and light weight that made the 1 $\frac{1}{4}$ -hp models so easy to handle.

The Vacuum Challenge

A series of drawings, mockups, and prototypes followed until the design team had what it wanted. Some of the changes along the way — a double-wound motor for durability, and redesigned handles able to survive a 6 ft. drop test — could have been generic to any power tool.

The vacuum capability did, however, introduce one unique challenge. The design engineers couldn't know if the dust extraction feature would always be used, so they had to plan for both sce-

narios. And here's the rub. The fans and air louvers on most router motors are designed to channel air flow forcefully at the bit, blowing dust and chips out of the cut. But the vacuum has to pull air away from the cutting area.

The solution? Balance the air direction and velocity so the fan blows the cut clean when the router's flying solo, but doesn't work against the vacuum when it's hooked up. It's a requirement that didn't surface until the router was tested under actual working conditions.

More Challenges

The router's asymmetrical posts presented another challenge when it came to the plunge lock mechanism. Instead of the typical lever, the router's left handle rotates to lock the plunge depth position, and it cinches against only the larger, dust-clearing post. The large circumference of the post, Williams explained, actually yields more surface area between the post and the lock bushing than a conventional twin-post lock. "It gives you as good or better stability," Williams said, "and with the twist knob control you never have to take your hands off the router."

I was a bit skeptical of the twist lock feature at first, even though it held the depth setting accurately. My misgivings stemmed more from one of my peculiar work habits. When I finish a cut, I often set the router down on my bench using just one hand.

When I've used other routers with this feature and happened to be gripping the twist lock handle, I got an unwelcome surprise. As I turned the router sideways to set it on the bench, the handle spun and released the lock, freeing the plunge springs and nearly bouncing the tool out of my grip. To its credit, the DW621 didn't exhibit this annoying and potentially dangerous habit.

Eventually all the details got sorted out, but when the produc-

tion models first saw the light of day, they appeared only in Europe (under the Elu name). Because the factory was straining to keep up with demand on that side of the Atlantic, it was a full year before the yellow DeWalt version made it to North America.

But Will it Eat Dust?

If you're used to using the expression "getting my hands dirty" when you talk about putting a power tool through its paces, it may be time to come up with another cliché.

The whole point of the DW621's design is to work cleaner, and the built-in dust collection features do an impressive job of capturing the mess that usually ends up strewn about your bench. A port in the router's base casting bridges the gap between the hollow post and the cutter, and a clear plastic shroud helps keep the dust confined and directed into the vacuum stream.

When making closed cuts such as a plunge-routed mortise, that swirling mix of chips and dust has nowhere to go but up the chute. Edge routing offers the debris more of an escape route, but with the optional edge guide attachment the bulk of it gets captured.

The engineering team also did a stand-up job meeting the other design goals set for the DW621. With the on/off switch and plunge lock integrated into the router's handles, there's no groping around for key controls. The elbow for the dust hookup swivels a full 360° around the top of the post, making it easier to set the vacuum up where you want and keep the flex hose out of the way.

Convenience Features


There's also a respectable list of what I like to call convenience features — electronic soft start, two full collet assemblies (not just a 1/2" collet with a 1/4" reducing sleeve), and a variable-speed control dial that's clearly visible and easy to adjust throughout the motor's 8000-24,000 rpm range.

Plunge cuts deep into cherry and red oak boards revealed no tendency for the 2-hp motor to lag or lose speed under a normal load, even with larger 1/2" shank cutters.

The plunge-depth adjustment has the typical 3-step turret, plus a rack-and-pinion mechanism for coarse adjustments (1/16"). When you've got the depth close to where you want it, a fine-tuning dial on top of the rod lets you tweak the setting in increments as fine as 1/256".

All these goodies, in a compact package weighing just 9 pounds!

Freehand use was the only workout I gave the DW621, but there's no reason the router couldn't be mounted under a table. I think fixed-base routers are better suited for this application, however, because you can't really exploit many of the features and the versatility of a plunge router in a router table setup.

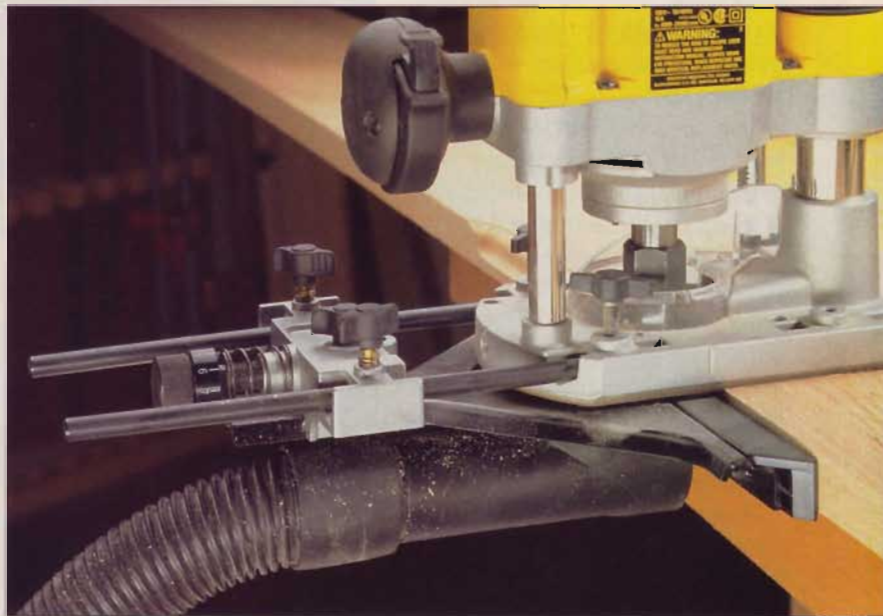
If you're the kind of woodworker who measures progress by the accumulation of dust on your bench, your clothes, and your handkerchief, you'll probably have to find another standard. You might even have to get used to working in (dare I say it?) a clean shop. But make no mistake. This is a good thing. 



Without the plastic shroud, the DW621 performs like any other router, meaning dust piles up on the workpiece, bench, and floor.



With the shroud installed and the vacuum hooked up, the bit area is so clean that you can easily see your routing layout lines.



By capping the top discharge tube and installing the edge guide attachment with side discharge chute, dust can be drawn by the vacuum while edge routing a board.

Arched Wall Mirror

The first mirror I ever owned was an ornately carved classic purchased at an antiques auction. It was love at first sight, and fortunately the competition backed out early.

Since then, I've bought a few more fancy old-timers, and found time to build a couple new mirror frames, too. Whether the frames are ornate or simple, I like the way they add warmth and depth to any room.

The mirror I got at the auction had beveled glass, and when I began planning for this project I wanted the same look. The catch with that idea was the cost. A beveled mirror, with the arched top, would have cost over \$150. The mirror I ended up with cost just \$25. You may decide differently, but my practical side just wouldn't spring for that kind of luxury.

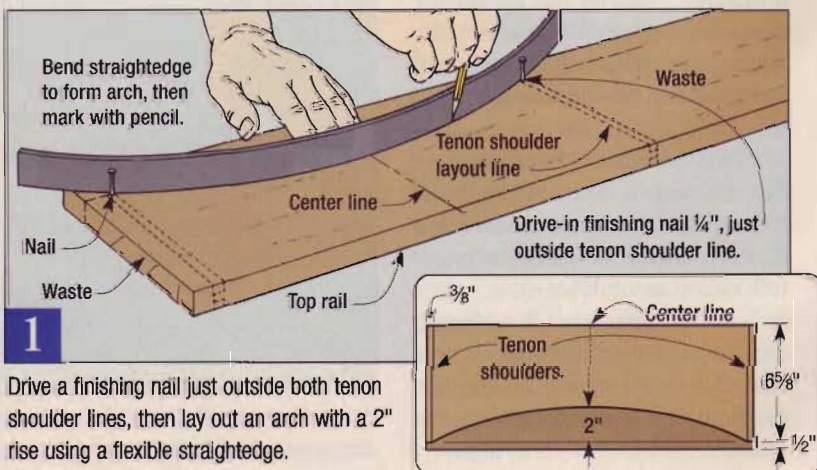
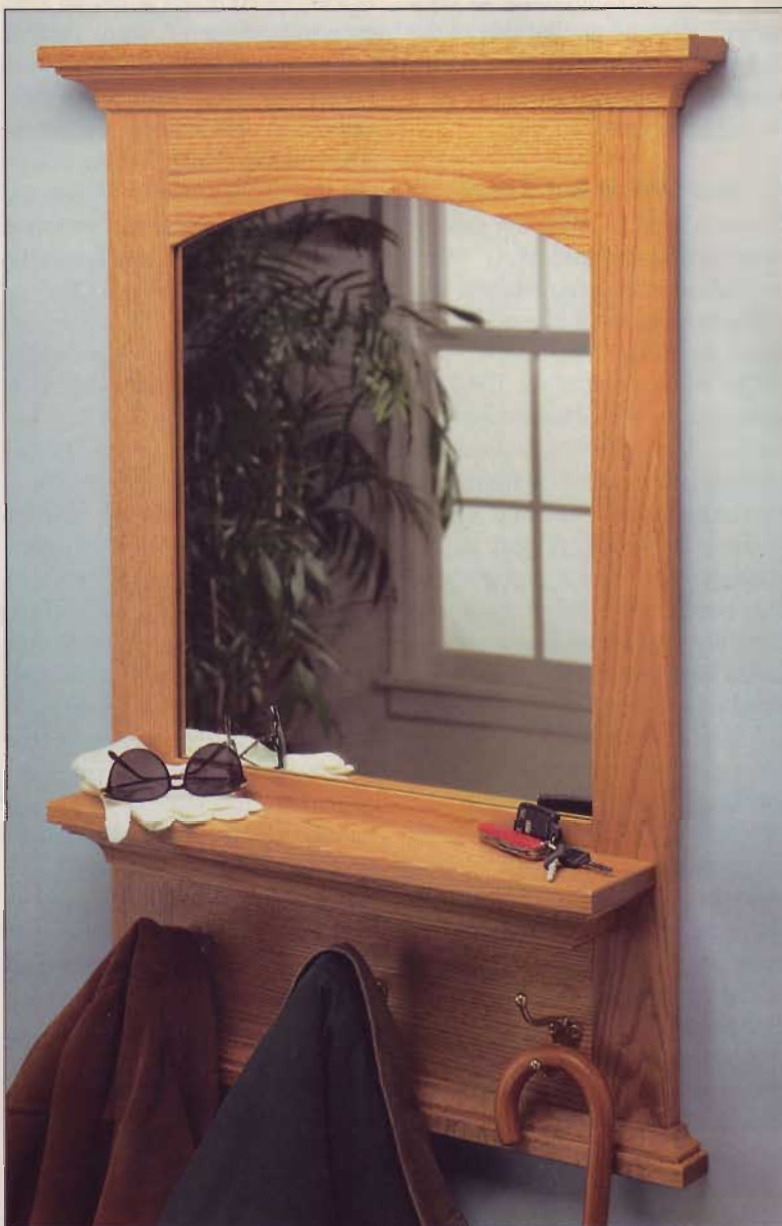
Begin with the Frame

When you get down to basics, my mirror frame has just four pieces. Everything else is added on to this foundation. And making the frame is really no different than making a frame and panel door, with glass for the panel.

The top and bottom rails are both rather wide, so you may need to glue-up stock. Once the lumber is ready, cut the bottom rail to size. Leave the top rail oversize until you've laid out the arch.

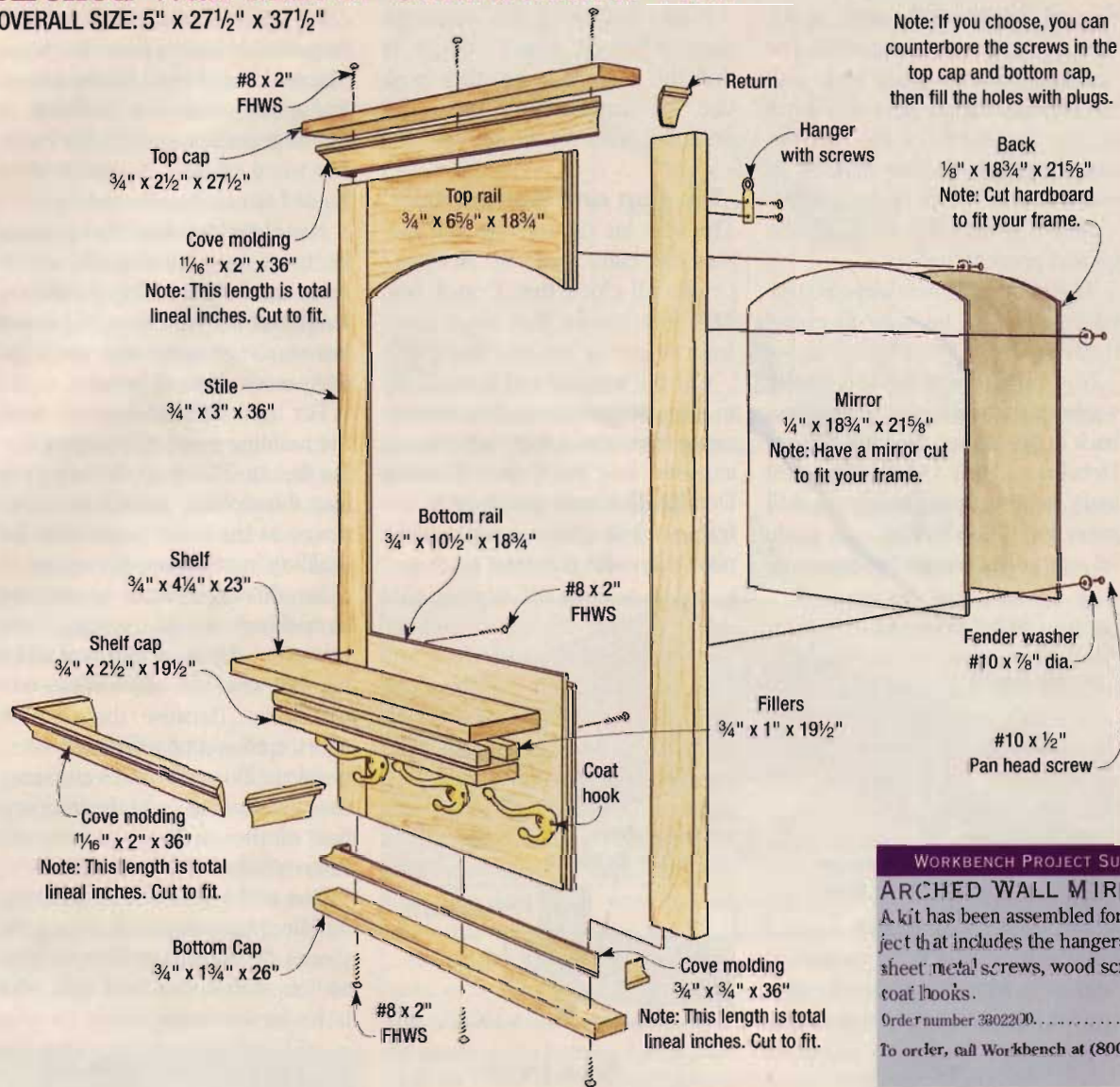
To form the arch, lay out the tenon shoulders on the top rail and drive a small nail just outside each line (Figure 1). Now bend a flexible piece of wood or steel between the nails and lay out the arch.

Having drawn the arch, you can remove the nails and cut the rail to length. I recommend forming the tenons before bandsawing the arch. This will allow you to work with square stock on the table saw.



Arched Wall Mirror Construction View

OVERALL SIZE: 5" x 27¹/₂" x 37¹/₂"



WORKBENCH PROJECT SUPPLIES

ARCHED WALL MIRROR

A kit has been assembled for this project that includes the hangers, washers, sheet metal screws, wood screws, and coat hooks.

Order number 3802200.....\$19.95

To order, call Workbench at (800)311-3994.

Stub Tenons and Grooves

For a light duty frame like this one, nothing beats stub tenon and groove joinery. It provides adequate strength, and forming the joints is a speedy process. Also, the grooves can be easily modified into rabbets for installing the mirror after the frame is assembled.

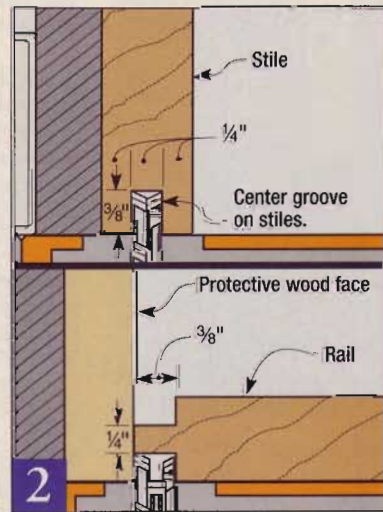
To read more about this joint, refer to *Stub Tenon and Groove Joinery* on page 34. In the meantime, here are the details you'll need for making this mirror frame.

Use a 1/4" wide dado blade in your table saw to cut the grooves, and use a 3/8" wide dado blade for cutting the tenons (Figure 2). When cutting the grooves, adjust

your saw fence so the stock is centered precisely on the stiles of the frame. Cutting the stub tenons requires that you clamp a protective wood face to the fence. The face protects the fence from the blade when you have the two so close together.

I always cut test tenons on some extra stock until I get a perfect fit with the grooves. For insurance, I also dry assemble the frame before the final glue-up — to avoid any surprises.

Once everything is set, glue and clamp the frame together, and measure the diagonals. When the measurements match you'll know the frame is square.



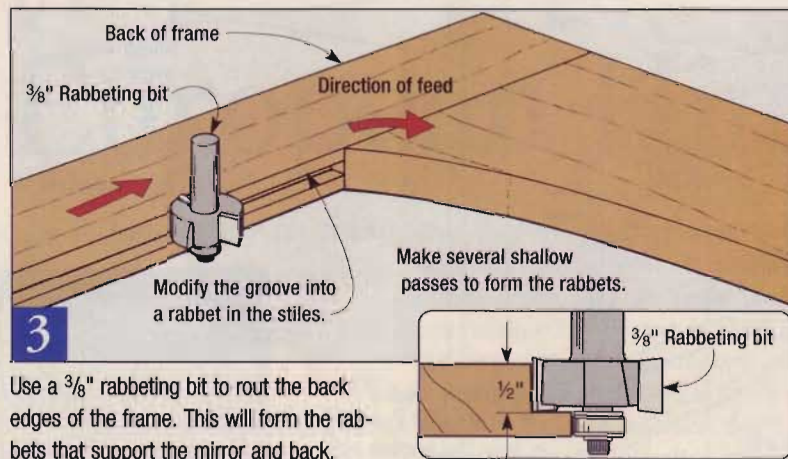
First cut the grooves in the stiles with a 1/4" dado blade, then switch to a 3/8" dado blade and cut the stub tenons on the rails.

Frame Details

Several details on the back of the frame require your attention. For openers, use a rabbeting bit to rout the opening for the mirror (Figure 3). Set the depth of the cut, but make several shallow passes to reach the $\frac{3}{8}$ " width of the rabbets. This will reduce the stress on the bit and prevent tear-out.

The router bit will leave rounded corners, so be sure to chisel them square.

Now drill holes for the fender washers that hold the mirror and back in the rabbets (see the Washer Details and Back Detail). The ideal tools for this operation are a drill press and a Forstner bit — a spade bit may poke through the frame.



Use a $\frac{3}{8}$ " rabbeting bit to rout the back edges of the frame. This will form the rabbets that support the mirror and back.

Installing hangers also calls for drilling shallow holes (see the Hanger Detail). Use a $\frac{1}{2}$ " bit to drill the shallow holes, then position the hangers over them and drill pilot holes for the screws.

Top Cap and Bottom Cap

The idea for the top cap and bottom cap came from an Arts and Crafts tall clock that I once saw. This just proves that ideas come from wherever you can find them.

Cut the top cap and bottom cap to size, then rout a $\frac{1}{8}$ " roundover along the edges that will remain exposed (see the Frame Molding Detail). To attach the caps to the frame, drill three countersunk pilot holes and drive the screws.

Cove Molding

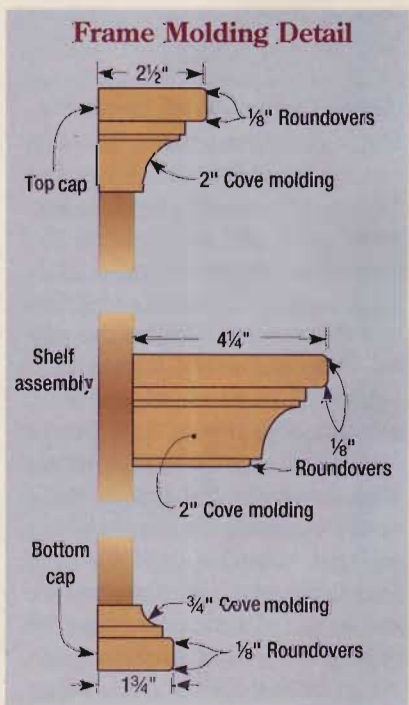
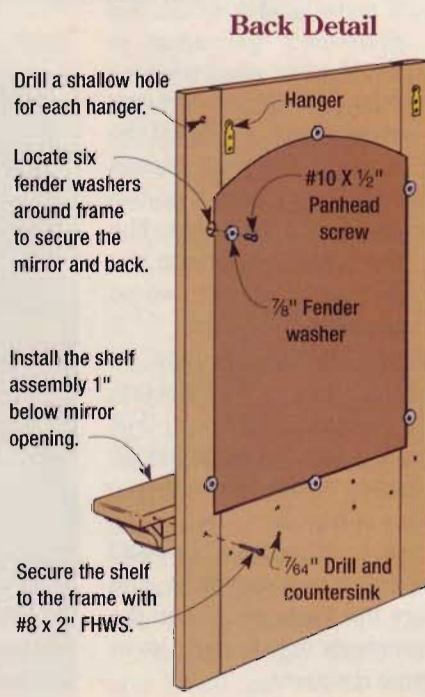
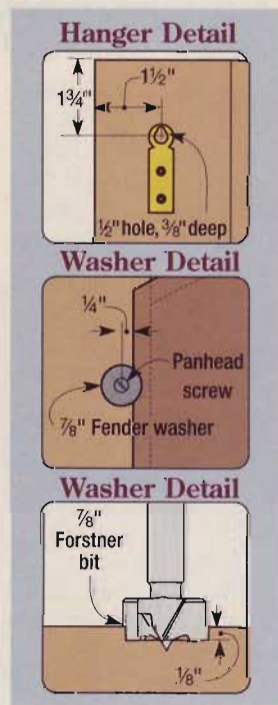
After securing the caps, the next step is mitering the cove moldings. The moldings I used for the mirror frame are commonly available at building centers and lumberyards. My wood choices, however, were limited to oak, maple, and pine.

Needless to say, tight miter joints are one sign of quality craftsmanship. I mitered the molding to length on my table saw, but if you have a power miter saw, you'll get even more accurate results.

For tight miters, you must have the molding properly oriented during the cut (Figure 4). So be sure to lean the molding against the miter gauge at the same angle that the molding installation will require.

In addition, I want to mention something about cutting the returns — the small pieces of molding that wrap the edges of the mirror frame. Because they are so short, cutting returns poses a safety problem. Do not hold them during the cuts. Instead, hold the long section of the molding and let the returns fall away from the blade.

Due to the difficulty of clamping molding, I recommend nailing the pieces to the frame. Spread glue on the pieces first, and drill pilot holes for the brads.





To accurately cut your cove molding, hold the stock against your miter gauge at an angle exactly as if it were being installed.

The Shelf Assembly

I found that building the shelf as a separate unit, then screwing it to the mirror frame, worked well.

The core of the shelf assembly is a pair of filler strips (see the Shelf Assembly Detail). Cut stock to size for the fillers (I used fir, but just about anything will work). While you're at it, cut oak for the shelf and shelf cap, too.

Once again, chuck the $\frac{1}{8}$ " roundover bit in your router and rout the edges of the shelf and shelf cap that will remain exposed after assembly.

Now glue the filler strips to the shelf cap, making sure the edges are flush. After taking this assembly out of the clamps, glue it to the shelf. Make sure the back edges are flush, and measure to see that the shelf overhangs the shelf cap the same amount at both ends.

I recommend clamping the shelf assembly in position on the frame, then drilling pilot holes into the back of the frame for screwing the assemblies together (see the Back Detail). Install the shelf assembly 1" below the mirror opening.

Screw the shelf assembly to the frame so that you can cut the cove molding for a precise fit. With the miters completed, follow through with the molding installation just as you did on earlier assemblies. Spread glue on the pieces and hold them in position, then drill pilot holes and drive in the brads. Do not glue or nail the moldings to the frame.

Sanding and Finishing

To make sanding easier, unscrew the shelf assembly from the frame and sand your project thoroughly. A random orbit sander is ideal for flat surfaces, and hand sanding is the only option for getting at the moldings and details.

You may also prefer to varnish the frame and shelf independently. This will help prevent the buildup of varnish that often occurs on complicated surfaces. Once the varnishing is completed, remount the shelf to the frame.

The Back and Template

Cutting the back to fit the mirror opening also creates an ideal template for sizing the mirror. Rip the back to width and slip it into the frame to trace the arch (Figure 5). Then carefully bandsaw the arch and sand the edges smooth.

Now you can take the back to the glass shop and have them cut a mirror. Ideally, the glass should be about $\frac{1}{8}$ " smaller than the back.

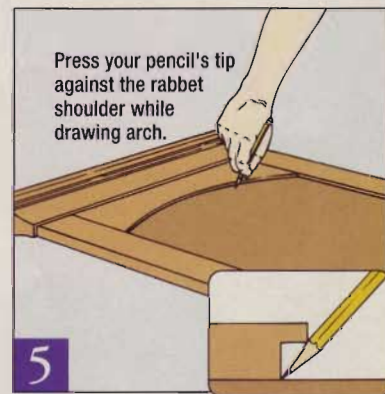
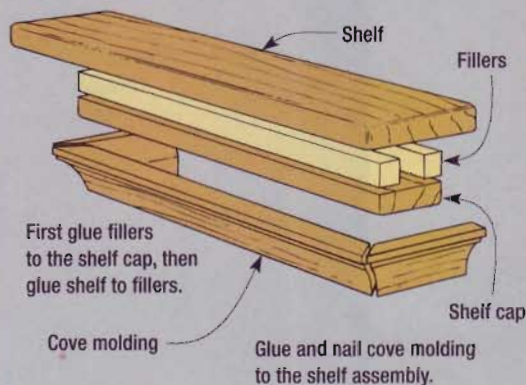
Wrapping Up

There isn't far to go before the mirror frame will be hanging on your wall. Install the hangers, then turn the project over and lay out the coat hook locations (see the Coat Hook Detail). Drill the pilot holes and mount the hooks with screws.

The culmination of all my hard work paid off when I slipped the mirror into the frame. It was a perfect fit, and the fender washers

held the glass and back in the rabbets just fine. To hang the mirror frame on the wall, I used two wall anchors aligned with the mirror frame hangers. Stepping back after leveling the frame, I wondered if some day a long time from now, an eager bidder might claim this prize at an auction.

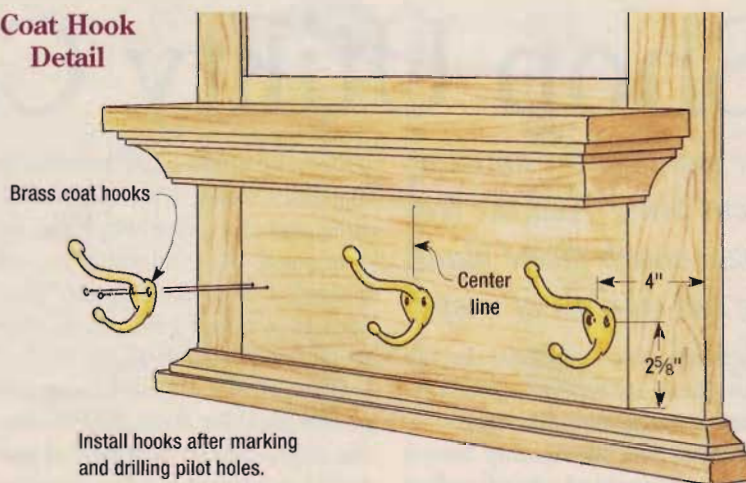
Shelf Assembly Detail



Press your pencil's tip against the rabbet shoulder while drawing arch.

Fit the hardboard back into the mirror opening and trace a line for the arch. Mark inside the rabbet, then bandsaw the arch.

Coat Hook Detail



Install hooks after marking and drilling pilot holes.



Shop Utility Cabinet

Don't you just love the smell of freshly cut pine? And the feel of a razor-sharp plane blade rolling out ribbons of wispy,

paper-thin pine shavings? In my book, these are two very good reasons for being a woodworker.

Besides the memorable aroma and the pleasure of a handworked

edge, pine offers other benefits. It machines easily, it's readily available, and the price won't put an over-sized dent in your project budget. I also like the way pine ages to a honey-gold patina after an oil finish is rubbed on.

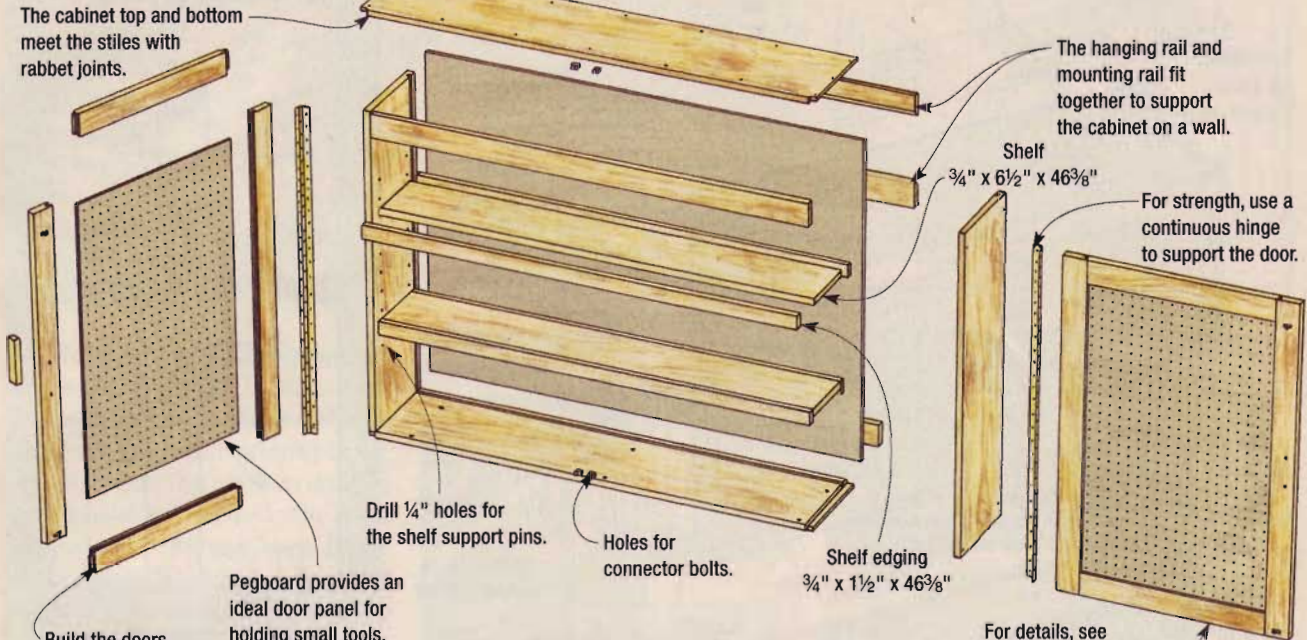
Given all this, I think #2 common pine is ideal for shop projects like the utility cabinet (the first of several storage projects I'm planning

for the *Workbench* shop). Whether you need to store paint cans or power tools, you'll find plenty of room here. And the pegboard door panels provide ample space for hanging hand tools. Although the drawers are optional, I heartily recommend taking the extra time to build them. You'll never regret having a spot to put sandpaper, drill bits, and small hardware items.

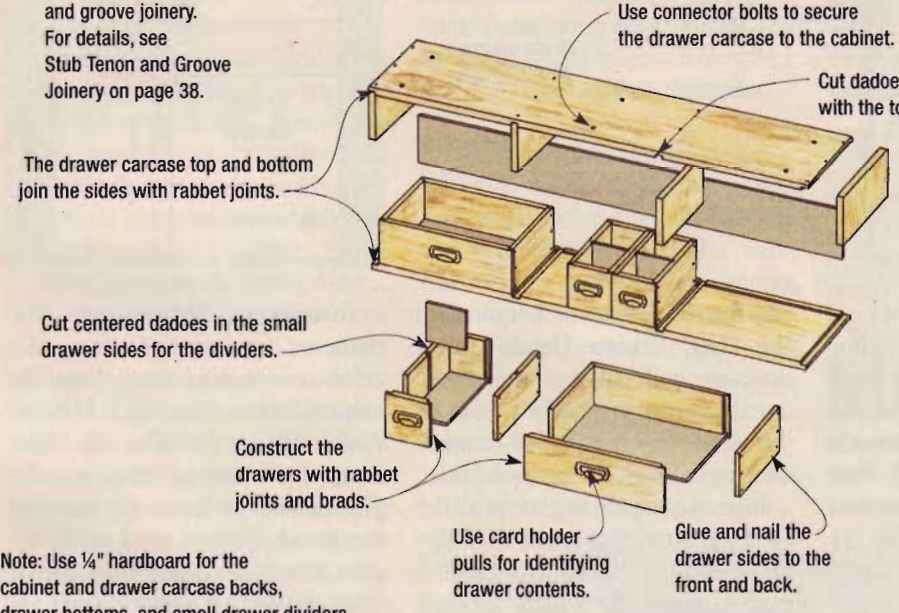
Shop Cabinet Construction View

OVERALL SIZE: 10³/₄" x 48" x 42¹/₂"

Cabinet Assembly



Drawer Carcase Assembly



Note: Use 1/4" hardboard for the cabinet and drawer carcase backs, drawer bottoms, and small drawer dividers.

WORKBENCH PROJECT SUPPLIES

SHOP TOOL CABINET

A kit has been assembled for this project that includes the card holder pulls, connector bolts, hinges, roller catches, and wood screws.

Order number 3302300.....
\$28.95

To order, call Workbench at (800) 311-3994.

Building the Drawer Carcase is optional. For details, see the Drawer Carcase Construction View on page 54.

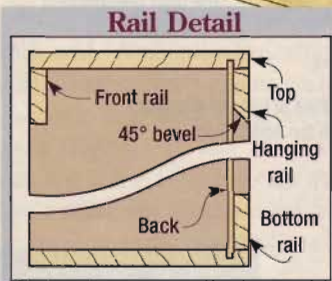
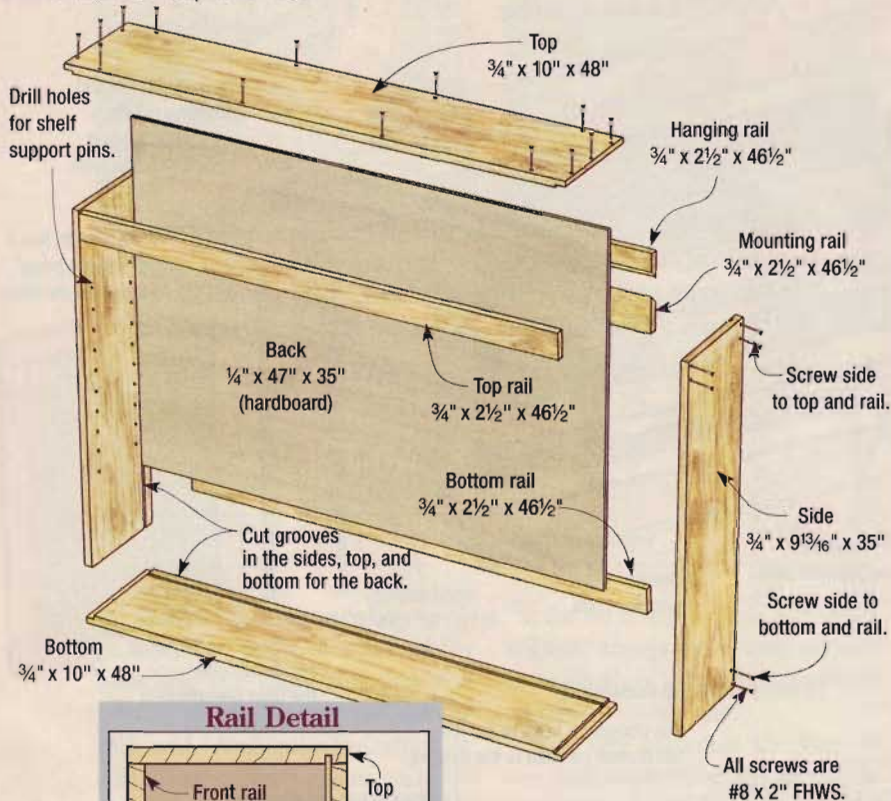
Before You Start Cutting
Whenever I plan on building a project out of #2 pine, I get prepared by doing two things. First, I buy more stock than I need, so that I can cut around any bad knots or pitch pockets. I do, however, expect to keep some knots — they're part of pine's character. Tight knots won't give you any problems, so leave them in. What you want to avoid are knots that are loose or have a

black ring around them; these will eventually fall out.
Second, I carefully look over all my stock, picking out the best boards for the most visible areas of the project — in this case, the cabinet and drawer carcase sides, the door frames, and the drawer fronts.
Because this is a shop project, you may be tempted to leave the cabinet unfinished. But if you're going to hang it in a garage or

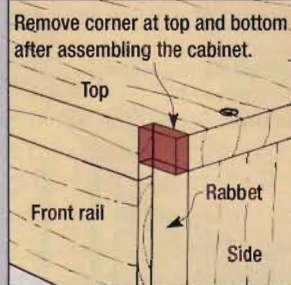
basement that is subject to dampness, I'd recommend wiping on a couple coats of oil finish.
This step takes just a few minutes, and requires only a small amount of finish. But it goes a long way toward protecting the project from dirt and moisture. And as a bonus, an oil finish adds a slight amber tone that helps the pine develop a warm, golden hue that becomes even richer over time.

Cabinet Construction View

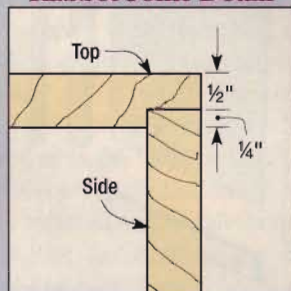
OVERALL SIZE: 10³/₄" x 48" x 36"



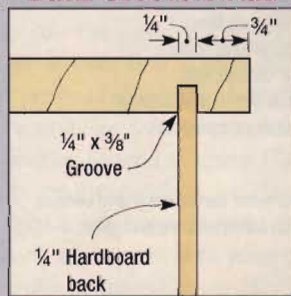
Corner Joint Detail



Rabbet Joint Detail



Back Groove Detail



Building the Cabinet

Mark each board according to how you will use it, then rip and cross-cut your stock for the sides, top, and bottom of the cabinet (see the Cabinet Construction View). Note that the sides are ³/₁₆" narrower than the top and bottom. This creates the rabbets for the continuous hinge that supports each door (see the Corner Joint Detail).

To build the cabinet, I cut rabbet joints in the top and bottom and secured them to the sides with glue and screws (see the Rabbet Joint Detail). Like most softwoods, pine tends to splinter when you're cutting across the grain. You can reduce the splintering by attaching a scrap wood fence to your miter gauge (Figure 1).

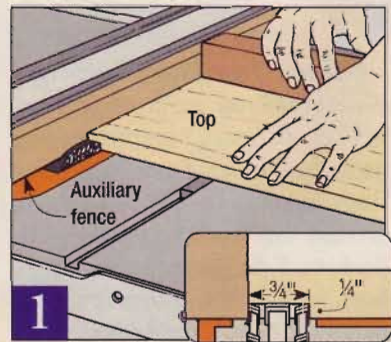
When you've finished cutting the rabbets, switch to a ¹/₄" dado blade and cut the grooves for the back

into the sides, top, and bottom (see the Back Groove Detail). Then measure and cut a piece of ¹/₄" hardboard for the back. Test-fit all the pieces together so you can drill and countersink the screw holes.

Instead of trying to glue up all the pieces at once, first attach the sides to the bottom, making sure that the back edges are flush so the grooves line up. Slide the back into the grooves (without glue), then glue and screw on the top.

Before moving on to the doors, I added three rails to the cabinet. The top, bottom, and hanging rail improve the rigidity of the carcass. The hanging rail also is used to mount the cabinet to the wall (see the Rail Detail). By beveling its bottom edge at 45°, as well as beveling an identical mounting rail for the wall, you'll create a very strong cabinet support system.

To hold the rails in place, glue them to the top or bottom, and drive screws into them from the cabinet sides, top, and bottom. Avoid wiping the glue up right away. This only spreads out the glue and forces it into the pores of the wood. Instead, wait until the glue dries to a rubbery consistency. Then shear it off with a chisel.



To cut rabbets, secure scrap wood to the fence and miter gauge. This will protect the fence and keep the cuts free of splinters.

Storage Doors

I built the doors of this cabinet using frame and panel construction (see *Stub Tenon and Groove Joinery* on page 34). After cutting your rails and stiles to size and machining the grooves and stub tenons, you'll be ready to cut panels to fit the frames.

The panels are the only part of the doors that are a little out of the ordinary. They're made from $\frac{1}{4}$ " pegboard instead of plywood or solid wood. By hanging the tools you use most often on these panels, they'll always be close at hand. Cut the pegboard to size, making sure to center the hole pattern (see the Pegboard Detail). Next, you can glue up the doors.

If you plan to add the drawer carcass below the cabinet, you'll need to plane $\frac{1}{16}$ " off the bottom edge of each door. This provides clearance for the doors to swing. Once this is done, rout a $\frac{1}{8}$ " chamfer around the edges on the front of each door.

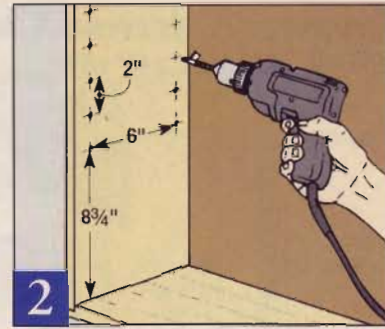
Although they may not seem heavy now, when these doors are loaded down with tools they'll put quite a strain on their hinges. Because of this, I decided to use

continuous hinges, also known as piano hinges, to mount the doors.

If you've shopped for continuous hinges before, you know that they are available two ways — with and without mounting holes. I got the kind with predrilled holes, and cut them to length with a hacksaw. A file removed the small burrs left by the hacksaw blade.

Before you can attach the hinges to the cabinet, you'll need to attend to one small detail. The cabinet sides are $\frac{3}{16}$ " narrower than the top and bottom to create a rabbet for the hinges. But the top and bottom of the cabinet still interfere with these rabbets. So, you need to carefully pare away this extra material with a chisel (see the Continuous Hinge Detail).

Now, install the hinges and doors, and add the catches (see the Door Catch Detail). I made the two door handles from pieces of pine scrap. I just cut the pieces to size and chamfered the front edges a bit with 100-grit sandpaper. After finishing the project, I screwed the handles in place, centering them on the door stiles.



2 Lay out and drill the holes in the cabinet sides for the shelf support pins. Wrap tape on the bit to control the depth of the holes.

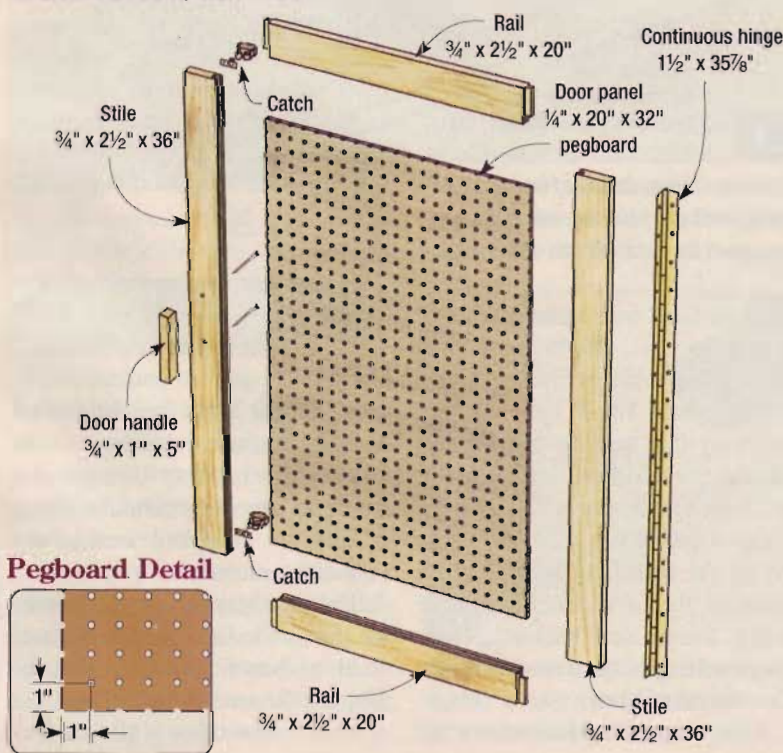
Adding the Shelves

For inside the cabinet I made two shelves for storing tools, finishing supplies, or anything else I might have lying around my shop.

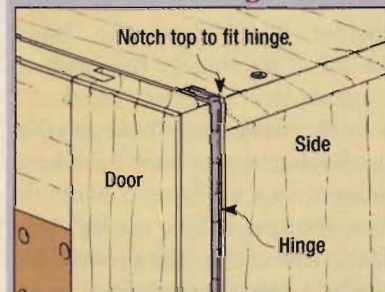
Because the shelves are rather long, I decided to strengthen them to prevent sagging. To do this, I glued $1\frac{1}{2}$ " wide strips to both edges of each shelf (see the Carcase Construction View). After the glue dried, I sanded the strips flush with the shelves and cut the assemblies to length. Drilling holes for the shelf support pins went quickly once the layout was completed (Figure 2).

Door Construction View

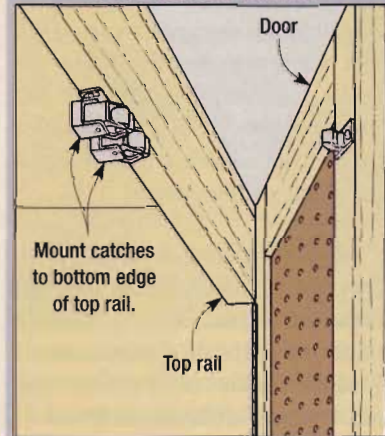
OVERALL SIZE: $\frac{3}{4}$ " x 24" x 36"



Continuous Hinge Detail

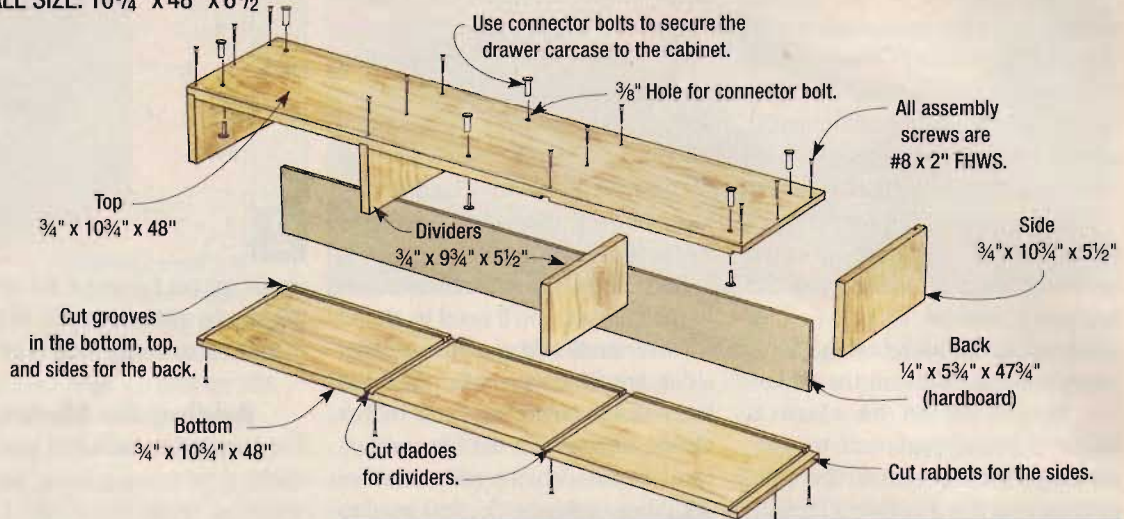


Door Catch Detail



Drawer Carcase Construction View

OVERALL SIZE: 10³/₄" x 48" x 6¹/₂"



The Drawer Carcase

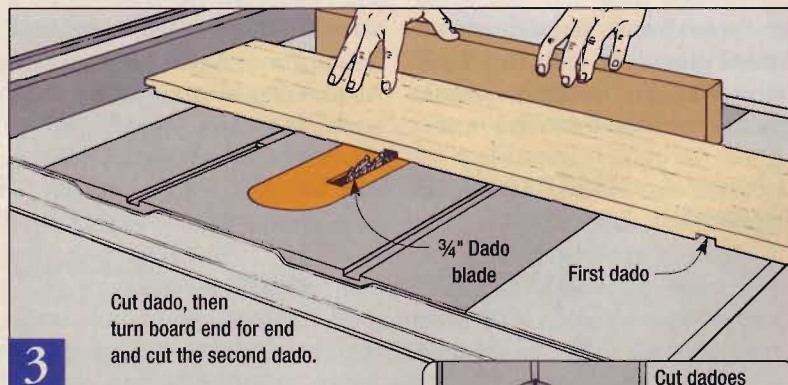
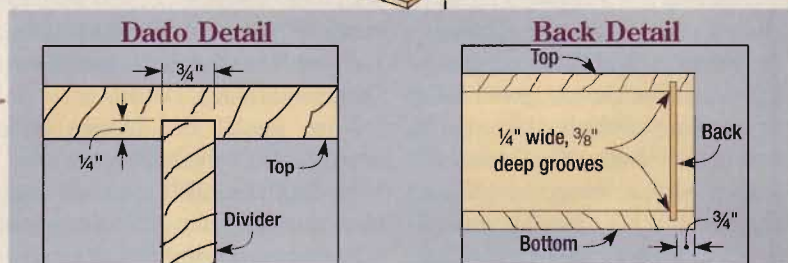
Adding the drawers will give you a convenient place to organize small items like screws and drill bits. You don't have to build this part of the project, but to make this option as attractive as possible, you'll find that the drawer carcase is constructed in essentially the same way as the cabinet (see the Drawer Carcase Construction View).

Cut the top, bottom, and sides to size. Then plough rabbets for the corner joints and dados for the divider joints (see the Dado Detail). Machining the dados requires nearly perfect alignment — otherwise you'll have trouble assembling the carcase. I used the setup shown in Figure 3. Wrap up this step by switching to a 1/4" dado blade and cutting the grooves for the back (see the Back Detail).

After cutting the two dividers from 3/4" stock, you're ready to assemble the drawer carcase. Drill pilot holes, then glue and screw the pieces together. To complete the drawer carcase, rout a 1/8" chamfer on the front outside edges, like you did on the cabinet doors.

Building the Drawers

The drawer carcase contains five drawers — two large and three small. Except for the inside dividers in the smaller drawers, constructing all five is identical.

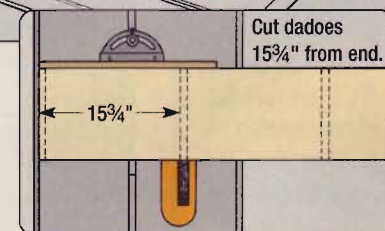


Cut all the divider dados in the top and bottom with one table saw set-up. Be sure to support the stock with the miter gauge.

If you don't own a planer or have access to one, ask to have your drawer stock planed to 1/2" at the lumberyard. You'll have to pay extra for this service, but it beats planing the wood by hand or resawing it on a table saw or band saw.

Once you've got your 1/2" stock, rip all the boards to width for the drawers, then crosscut the drawer sides, fronts, and backs to their proper length (see the Drawer Construction View).

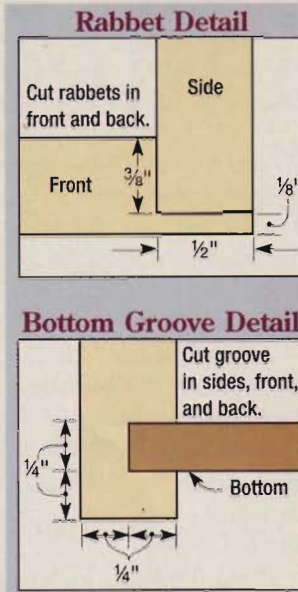
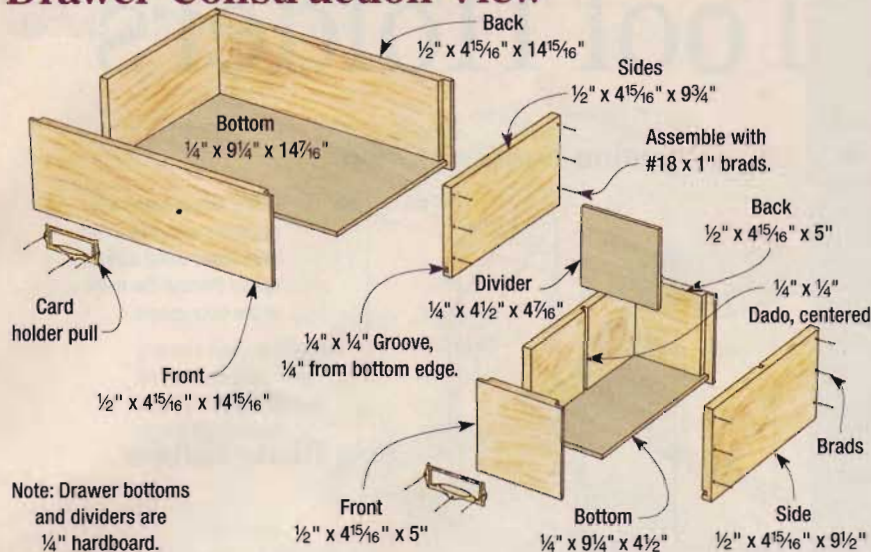
The drawers are constructed



using rabbet joints (see the Rabbet Detail). Because you'll have to cut more than half-way through the stock, be especially careful. Cutting a little too deep will weaken the remaining material.

The next step is to cut a groove on the inside face of each piece to hold a drawer bottom (see the Bottom Groove Detail). Then, cut a dado in the sides of the smaller

Drawer Construction View



drawers to hold a divider. For the dimensions of these grooves and dados, refer to the Drawer Construction View.

The final step before assembling the drawers is to cut the drawer bottoms and dividers from $\frac{1}{4}''$ hardboard. After cutting these pieces and running through a dry assembly, you can glue and nail the drawers together.

The drawers are sized for a close fit in the drawer carcass, so don't panic if your drawers don't fit at first. In order to get them to slide in and out freely, countersink the brads with a nail set, then lightly sand the sides of each drawer. To keep the drawer sides flat, I placed a sheet of self-adhesive sandpaper on my saw table and

sanded the drawers until they fit. Keep in mind that a tight fit might look good at first, but the drawer could bind in humid weather.

For the final touch, attach a pull to the front of each drawer. I chose card holder pulls. That way, I can easily identify the contents of each drawer without opening it.

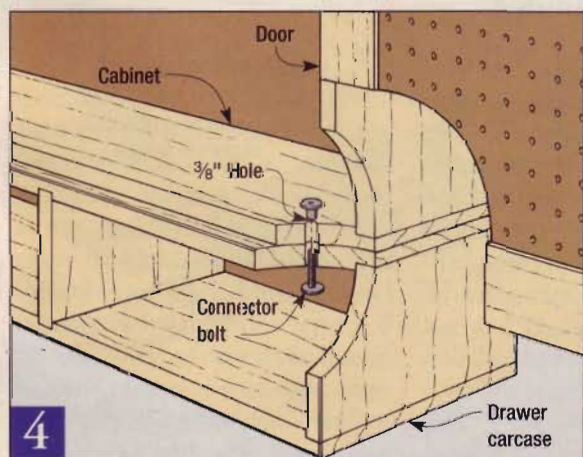
To attach the drawer carcass below the cabinet, remove the drawers and clamp the assemblies together. Now, drill six $\frac{3}{8}''$ holes through the bottom of the cabinet and the top of the carcass. Insert $\frac{1}{4}''$ -20 connector bolts, and tighten them with a hex wrench (Figure 4). You may need to plane or sand the top edge of the drawer backs for them to clear the connector bolts.

Mounting the Cabinet

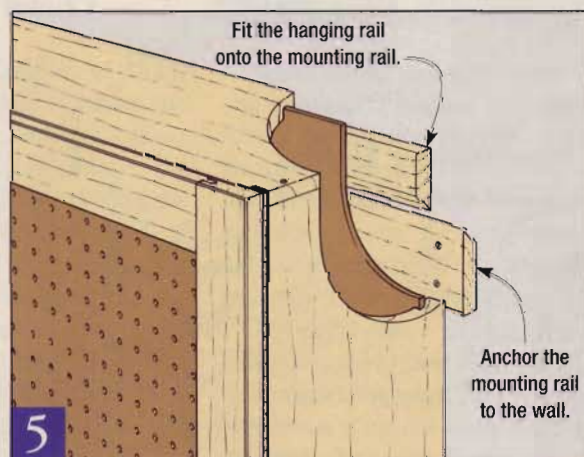
No matter what you plan to store in this cabinet, you'll want to make sure it's mounted securely. And the type of walls in your shop will determine the fasteners you need.

If you have wood frame walls, you can screw the mounting rail directly to the studs. Be sure to use a level when you're positioning the rail. If you have masonry or concrete block walls, use masonry anchors. In my opinion, no drywall anchor will adequately support this cabinet for very long.

After the mounting rail is secure, set the cabinet into place and load it up (Figure 5). Don't be shy — I know first-hand how much you can fit into this rugged shop organizer.



Clamp the drawer carcass to the cabinet and drill $\frac{3}{8}''$ holes for the six connector bolts. Tighten the bolts with a hex wrench.



Level the mounting rail on your shop wall, and secure it with the appropriate anchors. Then set the cabinet into position.

Fitted Tool Holders

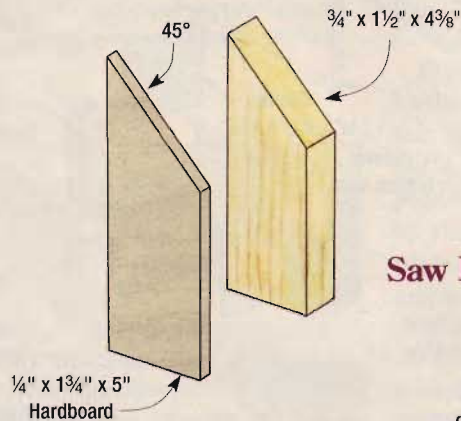
When I went to the hardware store to buy hooks for the pegboard doors of the tool cabinet, I got several surprises. First, the store had a very limited selection to fit $\frac{1}{4}$ " pegboard. But the second surprise was actually a jolt — sticker shock. No wonder the packages in the store looked a bit dusty.

So I went back to the shop and used scraps left over from the construction of the cabinet to make tool holders.

These drawings give you ideas that you can customize to precisely fit your needs. For example, drill some test holes to size a chisel rack that matches your set (the larger chisel sizes may need bigger holes).

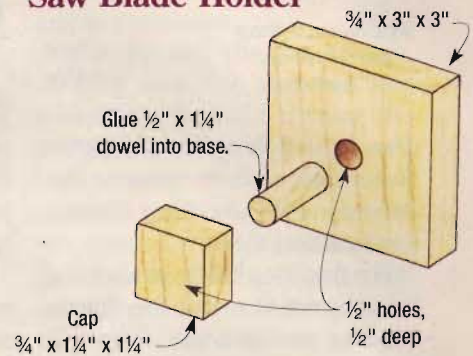


Combination Square Holder

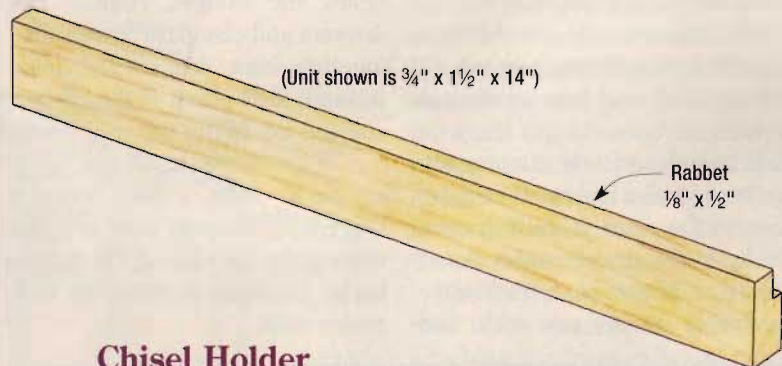


NOTE: Attach holders to pegboard with #10 x $\frac{3}{4}$ " roundhead wood screws driven through the back of the door panels.

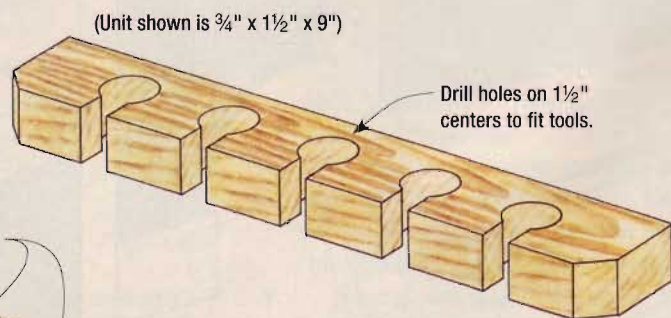
Saw Blade Holder



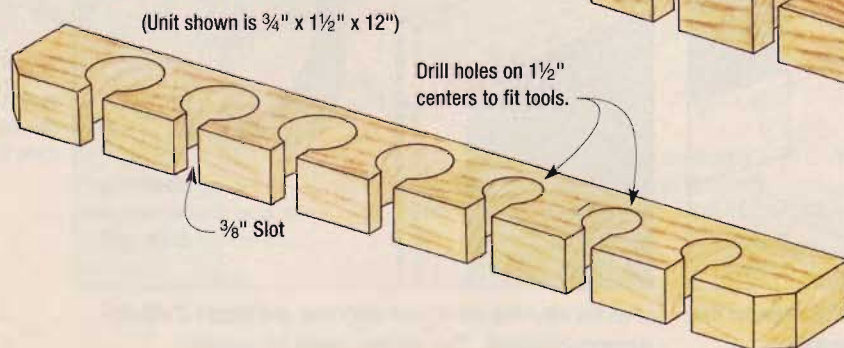
Framing Square Holder



Chisel Holder



Screwdriver Holder



New Home Products



If you're thinking about re-roofing, check out new shingles that contain algae-inhibiting granules. They prevent ugly black streaks on your roof that can lower your home's value.

Algae Streaking on Roofs

Shingles that use 3M Company's new Algae Block System are reported to prevent the formation of black streaks common on many roofs. The granules on these shingles contain a copper oxide layer under the ceramic pigment. The natural weathering process is said to provide a timed release of copper ions to inhibit the growth of algae.

Unightly roof streaks are often caused by a type of algae that produces a dark sheath to protect itself from ultraviolet rays. Chemical treatment to remove stains from existing roofs can be expensive, and sometimes requires annual re-application.

Algae staining may seem to be primarily an appearance problem, but it also affects a roof's ability to reflect heat. In addition, when algae staining makes a home's roof look old to prospective buyers, it can have a significant impact on resale values.

Algae-resistant (AR) shingles, also known as fungi-resistant shingles, are now available from various manufacturers. Initial material cost is higher than for conventional shingles, but installation methods are identical.

For free literature on roof problems, and a list of manufacturers incorporating the 3M Algae Block System, call (800) 447-2914.

Silent Attic Vent Moves Humidity

Attics need to be ventilated during the winter as well as in the summer. Excess moisture in winter can set the stage for roof damage. And summer heat and humidity can shorten the life of your roof.

To make gable-mounted attic ventilators quieter and more efficient, CertainTeed Ventilation has developed the Whisper Cool ventilator.

This new attic

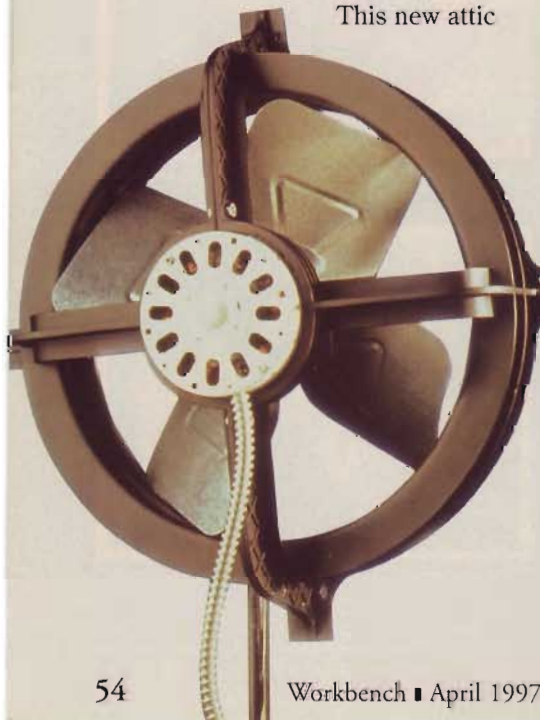
fan employs a patented propulsive thrust ring technology that was originally developed to provide greater efficiency for boat propellers. It features a fan that is enclosed in a series of rings that help move air more easily.

According to CertainTeed, the fan is 35 percent more efficient and 30 percent quieter than the older standard units. The ventilators are available in a variety of models for larger and smaller attics. They feature an automatic thermostat that turns the unit on or off, depending on the temperature in the attic.

One model — the APGH — also has an automatic humidistat that turns the fan on when the humidity in the attic is too high.

The products have a ten-year limited warranty on parts. With built-in mounting brackets and pre-wired electrical components, the ventilators are designed for easy installation by homeowners.

For more information, contact CertainTeed Ventilation, Dept. WB, 3000 W. Commerce St., Dallas, TX 75212, or call (800) 527-1924.



Long Life Alarm



Many home smoke detectors do not work because the batteries are either dead or missing. To alleviate this problem, Fyrnetics has introduced a new smoke detector — the Lifesaver Gold (model 916LL) — equipped with a lithium battery that offers up to ten years of protection without requiring a battery replacement.

Lifesaver Gold is also equipped with a push button silencing mechanism to temporarily silence false alarms caused by particles from cooking or fireplaces. In case of dense smoke, the unit's circuitry overrides, activating the alarm.

The Lifesaver Gold retails for about \$25. For more information, call Fyrnetics Inc. at (800) 654-7665.



Decorative Trim

Decorative millwork, including spindles, railings, louvers, custom door trim, corbels, brackets, gables, and medallions all bring to mind the elegant houses of a bygone era. Style-Mark's high-density polyurethane products are easy to install, and more durable than wood.

For a catalog and list of dealers in your area, call (800) 446-3040.

Keep Cool with High-Powered Blower

Do you want a way to make drywall compound or paint dry faster, refresh the air in your basement, blow heat, dust or odors away from your work area, or just stay cool in a hot working environment? Then consider the Coppus Power Plus.

This new product moves 300 cubic feet of air per minute, and the manufacturer says the stream of cooling air can be easily felt up to 30 ft. away. Equipped with a 14 gauge grounded cord 20 ft long, and two 15-amp grounded receptacles, it can even serve as an auxiliary power center. A multi-sided base lets you change air direction instantly. No-scratch contact pads protect finished flooring.

The Power Plus has a permanently-lubricated, 115 volt motor. Optional inlet and outlet adapters are available that can direct air through a flexible duct into or from hard-to-reach areas.

Because it's lightweight (8 pounds) and compact, the blower is easy to

move and store. The Power Plus is warranted for one year and retails for less than \$150. For more information, call the Coppus Portable Ventilation Division at (800) 556-8057.



Coppus Power Plus is a powerful air-moving tool that can be set up anywhere to blow air in any direction, up to 30 ft. away.



Murray's new line of WideBody Lawn Tractors are designed to meet consumer needs through ergonomic design and easy operation.

Tractor Designed For Easier Use

Murray, Inc has introduced a new line of wide body lawn tractors that the manufacturer says are easier to use and adjust, as well as more comfortable and durable.

Two years ago, Murray began nationwide interviews with both male and female owners of lawn tractors. The research concluded that most individuals find lawn tractors difficult to use. Many complaints

center around controls that are inconveniently located, confusing to interpret, or hard to operate. In addition, the owners say they want a mower that performs like a tractor but handles like an automobile.

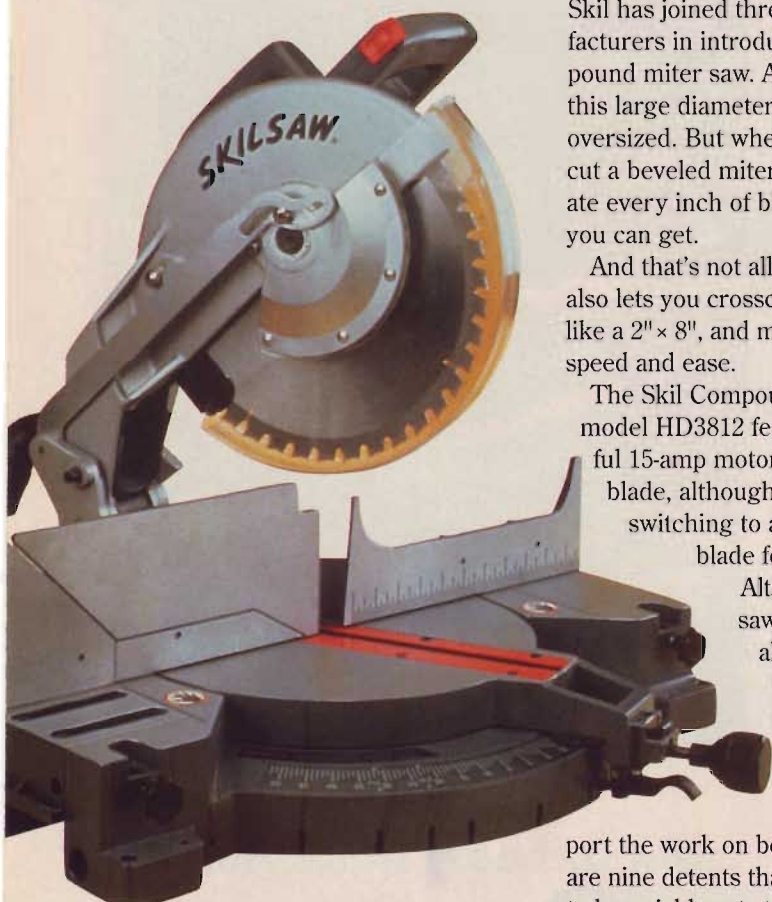
Murray says its response to the research is a new tractor line designed for easier use. The most innovative feature on Murray WideBody Tractors is the exclusive Quick-Level System. This allows users to accurately level the cutting deck without tools in less than one minute. Murray says that deck leveling on competitive models can take up to an hour.

The tractors feature extensive use of steel parts and are based on a rugged, truck-like foundation. This combination gives long-lasting durability and high performance, according to the company.

Murray WideBody Tractors range in price from \$793 to \$1,499. For information, call (800) 251-8007.

New Tools

12" Compound Miter Saw



The Skil miter saw has a miter range of 52° left and right, as well as a sliding base/fence extension for extra support and holding area.

Skil has joined three other manufacturers in introducing a 12" compound miter saw. At first glance, this large diameter blade may seem oversized. But when you need to cut a beveled miter, you'll appreciate every inch of blade diameter you can get.

And that's not all. The large blade also lets you crosscut wider boards, like a 2" x 8", and miter 2" x 6"s with speed and ease.

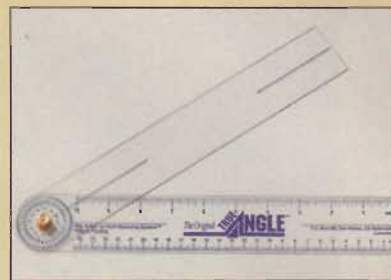
The Skil Compound Miter Saw model HD3812 features a powerful 15-amp motor and a 40-tooth, blade, although you may prefer switching to a 60 to 80 tooth blade for crosscutting.

Although it's a big saw, it's lightweight aluminum base, table, and soft-grip carrying handle make it easy to move.

High fences support the work on both sides. There are nine detents that allow the saw to be quickly set at precise angles.

You'll find the saw available for about \$350. For more information, call Skil at (800) 301-8255.

Easy Angles



Angles are an essential part of the crafts of woodworking and home remodeling. And that's true whether you're planning your project on paper or laying out cuts on a sheet of plywood. So you may be shocked to discover that missing the mark by only 1° on a small protractor grows into a whopping 1 1/4" error in a six foot measure!

Quint Measuring Systems' new product, the Original True Angle, solves this problem. Using it, you can mark any angle on a board up to 8 ft. in under 5 seconds with absolute accuracy. No complicated math, trial-and-error, or guessing is required.

The tool is a precision 360° protractor on pivoting straightedges. It's available in ten sizes from 7" to 96", with prices ranging from \$6.95 to \$249.95.

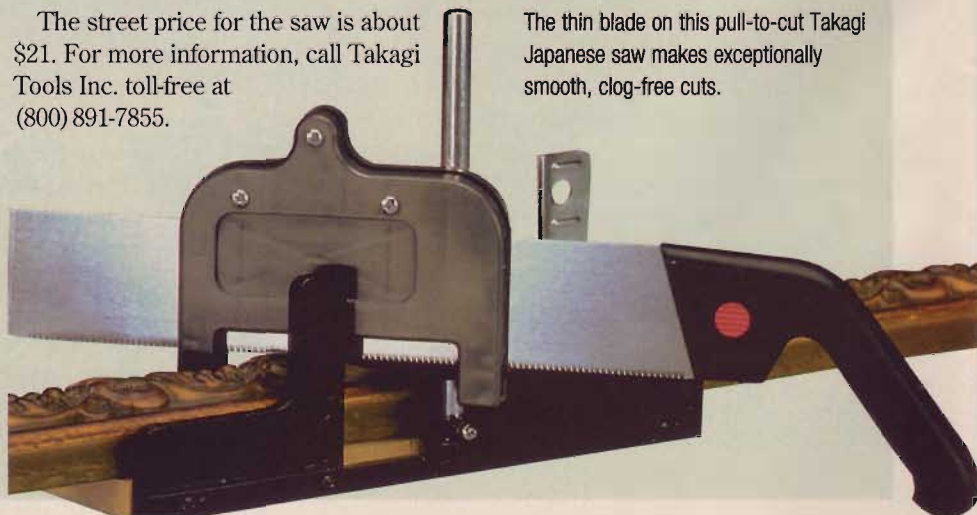
To order or for more information, call Quint Measuring Systems toll-free at (800) 745-5045.

Pull-to-Cut Japanese Miter Saw

For more than 1,000 years, Japanese carpenters have used handsaws that cut on the pull stroke. Because of this cutting motion, the blades of these saws don't buckle or bind during use, and can be made up to 70 percent thinner than conventional push-to-cut Western saw blades.

The Takagi Tool Co., a 135-year-old manufacturer of Japanese handsaws, has just introduced the Sharksaw miter saw. You can use it in most ready-made miter boxes, or you can create your own. And for many cuts, you may find you don't need a miter box.

The street price for the saw is about \$21. For more information, call Takagi Tools Inc. toll-free at (800) 891-7855.



The thin blade on this pull-to-cut Takagi Japanese saw makes exceptionally smooth, clog-free cuts.

12-in-1 Tool

Crescent has introduced its version of a combination tool as "the tool no one should be without." It combines 12 frequently used functions in one convenient package.

Included are a needle-nose pliers with wire cutter, three slotted screwdrivers, a Phillips screwdriver, an awl, a metric/English ruler, a can/bottle opener, a metal/wood file and a knife. It folds up to fit into a sheath.

The Toolzall retails for \$19.95. For more information, fax Crescent at (800) 423-6175.



Router Lineup

Ryobi has introduced three new routers with 1/4" and 1/2" collets. The series begins with the 1 3/4-hp RE170, moves up to the 2-hp R180, and tops out with the 2 1/4-hp RE185.

If you're in the market for a new router, the model RE185 is especially worthy of your consideration. It accepts both 1/4" and 1/2" collets, and has dual scales that are easy to read when using the router freehand or when it's mounted in a table.

Among its other features are a solid die-cast metal D-base with a seamless plastic sub-base, an easy-to-use shaft lock for quick bit changes, and a built-in worklight. Perhaps its best features are the electronic variable speed control (also in the



RE170) and soft-start capability. Soft start means that the motor comes up to speed gradually, without the annoying initial jerk of torque.

The R180 sells for \$129, the RE170 for \$145, and the RE185 for \$159. For more information, call Ryobi at (800) 525-2579.

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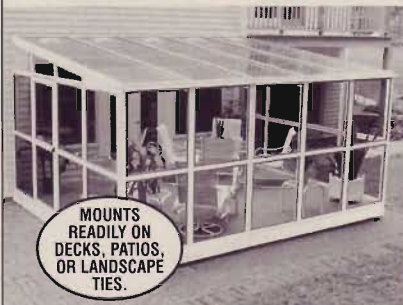
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Cordless Sawzall

Milwaukee's latest tool introduction combines convenience with cutting power. The cordless Power-Plus Sawzall lets you reach difficult-to-access areas of your house without the hassle of tugging on a power cord.

The reciprocating saw is powered by a high-capacity 18-volt battery. Engineers coupled a rare-earth magnet motor to the front end of a standard Sawzall Plus to create a cordless tool that handles like the regular corded saw.

The saw has a 1" blade stroke for fast cuts. A trigger speed control allows you to vary the strokes from 0 to 2000 per minute. Another great

feature included on all the new Sawzalls is a simple twist-to-lock quick-change blade clamp. Now you no longer need to search for the hex key when changing blades.

The list price for the cordless Power-Plus Sawzall model 6516-21 is \$550. A kit, which includes a carrying case and a spare battery, lists for \$650, but we've seen it on sale for as little as \$389.

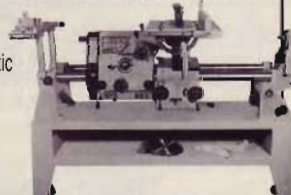
For more information, call Milwaukee Electric Tool Corp. at (414) 783-8311, or fax (414) 783-8529.

Milwaukee claims its new cordless Sawzall has enough juice to cut through 66 feet of 5/8" sheathing.

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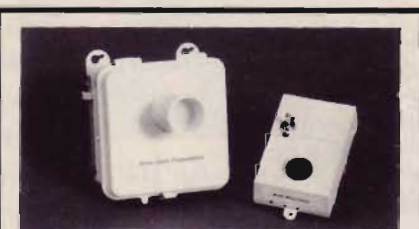


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Barn Drill

When settlers from England arrived in North America, they brought with them more than their language and a fondness for tea. They also imported a well-established timber framing tradition that dictated what buildings should look like and how they should be put together.

This architectural style was satisfying to the English immigrants on a variety of levels. Of course, creating familiar-looking buildings helped them feel more at home on the new continent. The style also made economical use of wood, and virtually eliminated the need for expensive hand-wrought metal fasteners because pegged mortise and tenon joints held a basic house structure together.

At first, carpenters used T-handled drills or a brace and bit to remove waste from the mortises. But a specialized tool gradually evolved for the task. A timber drill, like the one shown here, is essentially a portable hand-powered drill press.

To use it, you place the drill on a timber, sit or kneel on the drill's wood base and whirl the handles with both hands. The lead screw pulls the bit into the timber, and chips climb up the auger's deep flutes. On the drill's vertical frame, a scale and depth gauge pointer (missing from this example) show you when the hole is deep enough. To extract the bit, you flip a toothed rack into position (visible behind the chuck on the right side of the vertical frame), and crank the handles a few more turns. The drilling mechanism climbs up the rack and is ready for the next hole.

Many drills were made with fixed vertical frames, but some, like this one, featured a pivoting mechanism that allows the drilling of angled mortises.

Modern stick building methods eventually replaced timber framing for house construction, but use of this technique thrived until recent times for building barns. Which is why this tool is often called a barn drill.

