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THE ORIGINAL HOME WOODWORKING AND IMPROVEMENT MAGAZINE



How To Install  
Kitchen Cabinets

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0 09281 01683 0 04 >

Display until April 27, 1998

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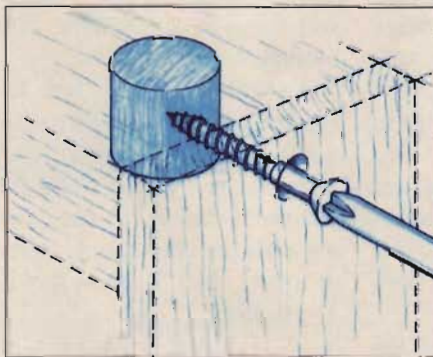
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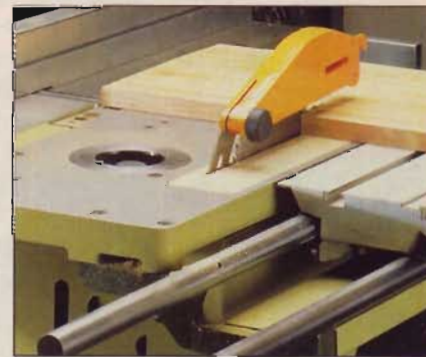
Over 100 years ago an inventor took decorative woodworking in a new direction.



Knowing how they're built is the key to *Selecting Cabinets*, page 25.



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*Doing The Twist* means more than just a fancy dance step, page 64.

# The Dark Side

Anyone watching home improvement TV shows and reading magazines could believe, as I once did, that every project goes along without a hitch. As planned, each phase begins and ends on time, materials are on hand and in the right amounts, the pieces all fit together, and all days end with everything on the list accomplished.

"Not!," as the kids in my neighborhood like to say.

Although it took a while, I now know better—mostly because I've gone through the process many times. They say you ignore history at your peril, and in my case it has taken more than the average number of whacks on the head to knock off the rose-colored glasses.

## Oh No, Not a Kitchen

Of all projects, kitchen remodels are the most troublesome. There are just so many things that can go wrong, and do! When you start to alter plumbing and electrical systems, rearrange framing structures, then throw in cabinets, flooring, and decorating, you have the potential for lots of things to go haywire.

Take my friend Bob Settich's kitchen remodel, for example. His kitchen is featured in this issue (*Installing Cabinetry* on page 18), and we've been helping him with the project.

Now, Bob is an easy-going guy. His wife Barbara is equally calm and gracious. They both endured having us in their home while we made their entire first floor look like a tornado had just passed through.

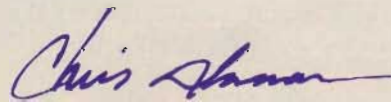
But the day we tore the old plaster from the walls and found a rotten sill joist and several rotted studs, then dove further into the tearout and discovered termite-damaged joists under the flooring, we could tell Bob had reached his limits. He was seeing the power of home improvement's dark side, and we were the agents of that evil force.

From here on out we couldn't tell if Bob was pacing because of the panoramic view of his basement, or because he knew Barbara would be coming home soon.

As for us, being simple fellows, we saw our role clearly. We just jumped into the basement, cut the termite-damaged wood out of the joists, and scabbed in new material. We've all been in this pickle before.

And there we were, heads dipping and weaving as we worked furiously to install the last sister joist when Barbara walked in. "What the . . .," she immediately gasped, ". . . what are you doing to my kitchen? Is that the basement?"

We looked at Bob, Bob looked at Barbara, and for an instant an hour's worth of silence gripped us all. We weren't sure whether to tell her about our problems, lie, or run. Then without even breaking stride, Barbara said in a wry tone, "I guess this isn't like TV, eh Bob?"



Chris Inman, *Editor*

# WORKBENCH

VOLUME 54

NUMBER 2

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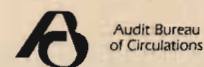
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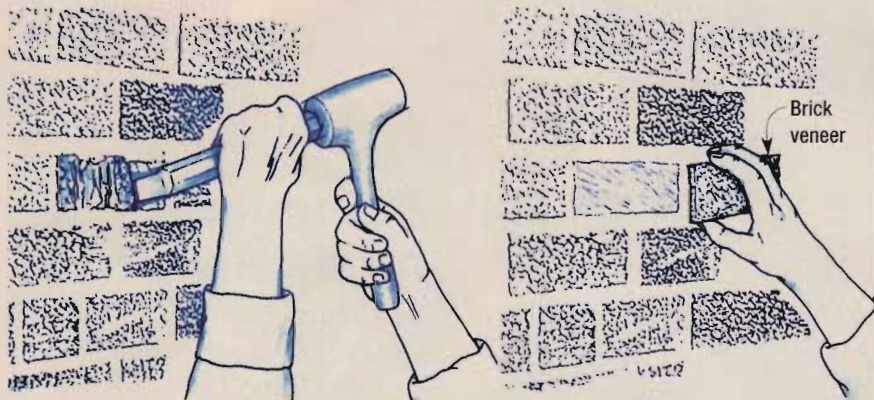
Subscription rates: Single copy, \$3.95. One year subscription (6 issues), \$15.95. Canadian/Foreign, add \$6.00 per year. Periodicals postage paid at Des Moines, IA and at additional offices. "USPS/Heartland Press Automatable Poly."

Postmaster: Send address changes to *Workbench*, PO Box 37272, Boone, IA 50027-0272.

Printed in U.S.A.



# Questions & Answers



## Patching and Sealing Spalled Brick

**Q** I've noticed that the surface of several bricks on the exterior of my chimney has crumbled and split off. What's causing this and how can I repair the bricks?

K.M. Larson  
Holstein, IA

**A** The problem you've described is called spalling, and it's caused by moisture penetrating the surface of the brick. When the temperature dips below freezing, the water expands as it turns to ice, causing the outer layer of the brick to expand with it. Over time, this expansion pops the surface layer loose from the rest of the brick. Once the top layer spalls off, the process continues at an even faster rate.

Normally, the surface glazing on bricks keeps moisture out. But loose, peeling paint can trap and hold moisture where it penetrates the glaze. Another culprit is sandblasting. While it cleans up a brick surface, it also removes the glazing and exposes the brick to the elements.

To fix the problem, clean the brick surface of any loose debris and remove as much paint as possible. (A power washer can speed up this job.) Small spalled spots can be patched using a masonry caulk that contains fine aggregate. Available at home centers, it comes in different colors to match the brick.

Patch deeply spalled bricks by leveling off the brick's face with a mason's chisel, then apply a brick veneer using thin-set mortar mixed with latex bonding adhesive. Once the patches have cured, apply a masonry sealer to protect the brick from further water infiltration.

To protect and conceal a heavily patched surface, you may want to paint the chimney when the brick is thoroughly dry using a quality masonry paint. If the brick has seriously deteriorated, you may have no choice but to remove the loose material, repair the mortar joints, then cover the entire chimney with stucco. Getting the opinion of a masonry contractor is probably wise at this point.

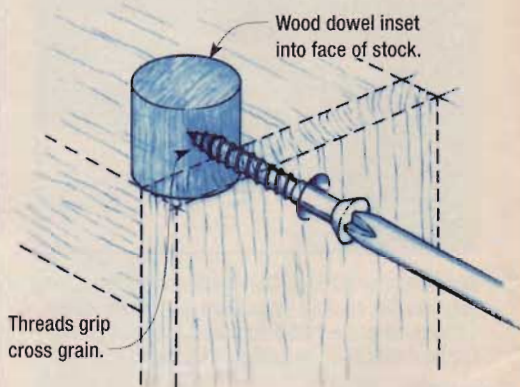
## Driving Screws into End Grain

**Q** I've tried repeatedly to get wood screws to hold in the end grain of a board, but they keep stripping out. What can I do?

Greg Fritz  
Mankato, MN

**A** The reason screws don't hold well in end grain is that they are lined up parallel with the wood fibers. Consequently, they tend to push the fibers aside or cut them, giving the threads little to get a bite on. Installing a screw in cross grain lets the wood fibers maintain their position so they fill in behind the threads when you drive the screw.

One easy way to deal with putting fasteners in end grain involves drilling a hole partially through one face of the board and installing a wood dowel. Then drill a pilot hole through the end of the board and into the dowel. When you drive the screw, its threads have cross grain to grip once the screw reaches the dowel.



## SHARE YOUR QUESTIONS

If you have a question about woodworking or home improvement, write it down 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 send an E-mail message to [workbench@workbenchmag.com](mailto:workbench@workbenchmag.com).

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## Peeling Soffit Paint may be Due to Poor Ventilation

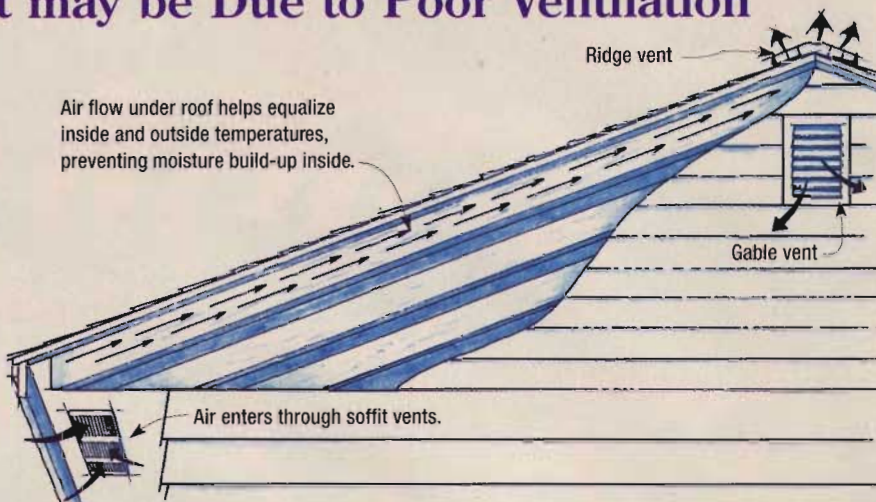
**Q** I just repainted my soffits several months ago. I prepared and painted the surfaces correctly, but the paint is already peeling. What could be causing this to happen?

John Donnelly  
Minneapolis, MN

**A** If your attic space is inadequately ventilated, excessive heat and moisture build up under the roof and inside the soffits. The heat and moisture have to escape, and through the soffits is a likely route. The bare wood on the soffits' inside surface absorbs the moisture, which then migrates through to the outside, weakening the bond of the paint and primer to the wood.

Install soffit vents if you don't currently have them, or add more vents. Soffit vents can run continuously along the length of the soffit, or you can space them at regular intervals.

In addition to soffit vents, you



Air flow under roof helps equalize inside and outside temperatures, preventing moisture build-up inside.

should have vents in your roof or in the gable ends of your house. In combination with the soffit vents, they allow airflow under the roof. You'll need 1 sq. ft. of free vent area for every 150 sq. ft. of attic. Locate at least 50% of the vent area at the highest point — along the ridge or in the gables. You can locate the remaining vents in the soffits.

For adequate airflow, you need to make sure insulation isn't laying directly against the underside of the roof. Leave at least 1" of free air space between the insulation and the underside of the roof sheathing. Plastic or cardboard vent chutes are available that you can install between the rafters. They allow you to insulate under the roof without restricting airflow.

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## Defining Grit

**Q** I know that sandpaper comes in different grits. But what's the story with all the other numbers and designations such as paper weights and open and closed coatings?

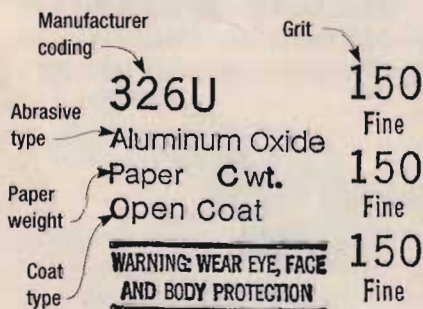
Phil Iosca  
Portland, OR

**A** Sandpaper is primarily classified by grit, or the size of the particles, which range from 12-grit (extra coarse) to 2,000-grit (micro fine). Generally, sandpapers from 60- to 220-grit cover the majority of wood-working needs.

A sandpaper's weight refers to the thickness of the backing paper. The weight is designated by a letter from A to F, with A being the lightest. Most common papers come in C weight for coarser grits and A weight for finer grits. Cloth-backed abrasives have their own weight designation system — J, X, Y, T, and M rated from lightest to heaviest.

Open coat and closed coat papers differ in the amount of grit applied to the surface. A closed paper has grit of a particular size over 100 percent of its surface, while an open coat paper has only 40 to 70 percent of the surface covered. Open coat papers are less prone to clogging and heat buildup. However, closed coat papers cut faster, particularly on bare wood.

Another way manufacturers reduce clogging is to give the sandpaper a stearate coating. Stearated papers have a whitish color and a waxy or powdery feel. They are particularly useful when sanding between coats of finish, where a normal paper would quickly load up with gummy finish.



## Keep Casement Window Tracks Clean

**Q** What can I do to make my casement windows open more easily?

Nina Petersen  
Denver, CO

**A** Dirt, paint, and old grease accumulate in the track, making it hard for the window's sliding arm to

move. Use a wire brush to remove the deposits, then apply a multipurpose lubricant. Likewise, the gears in the crank handle assembly may be gummed up. Remove the entire mechanism and soak the gears in solvent. Then repack the gears with new grease, and reinstall the assembly.



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# Tips & Techniques

## Locking Rabbets Add Style to a Simple Curio Box

Last year I built small curio boxes as holiday gifts for several friends and family members. I designed them with a unique way to fit the lid.

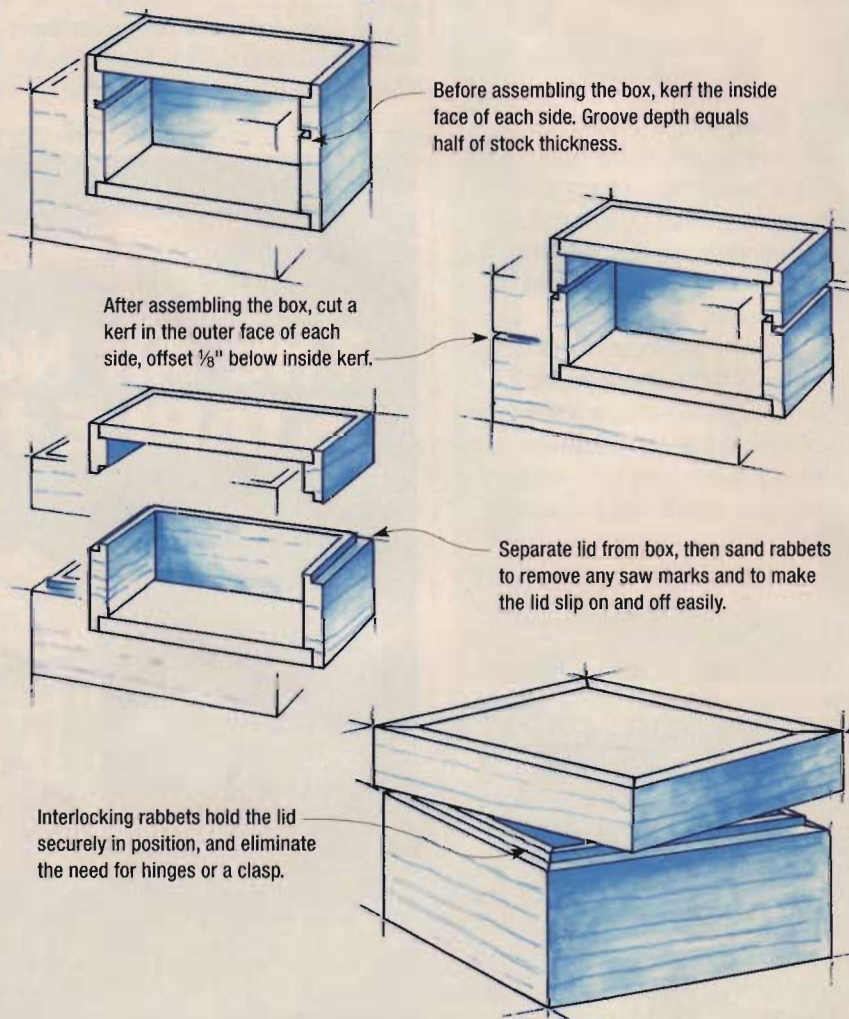
Usually, I build a box by assembling all of the pieces into a complete unit. Then I cut the top free with my table saw. This way I know the lid fits correctly and its grain matches well. To complete the box I add hinges and a clasp to hold the lid shut.

But this time, for my curio boxes, I used a different technique. Instead of needing hinges, the tops are held in place with mating rabbet joints. Before assembling the boxes, I cut a  $\frac{1}{8}$ "-wide by  $\frac{3}{16}$ "-deep kerf in the inside face of each  $\frac{3}{8}$ "-thick box side. Then I glued up the boxes.

I set up my saw to cut the lids free by again raising the blade to half the stock thickness, and setting the fence  $\frac{1}{8}$ " farther from the blade than when I cut the inside kerfs. Cutting a kerf in the outer face of each side split the boxes and lids apart, leaving two opposing sets of rabbets.

A little light sanding on the lids and bases cleaned up the saw marks, and the lids nested securely in place.

*Dave Stone*  
Workbench Staff



## Simple Lines Keep Boards in Proper Order for Gluing

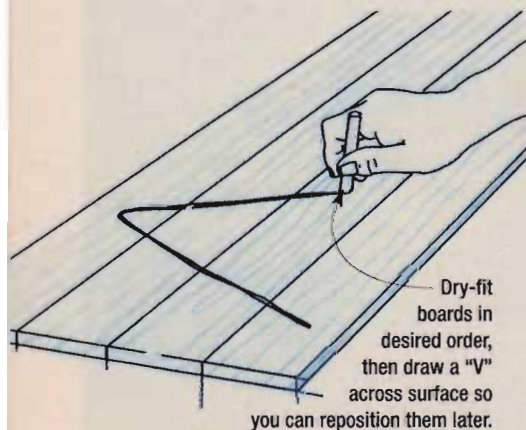
In the December, 1997 *Questions and Answers* column, you explained how to orient boards in a glued-up panel to keep the panel from warping.

After spending all that time figuring out how to arrange the boards, I don't want to accidentally get them out of sequence when I'm gluing them. So

after I've got the boards positioned, I draw a large "V" across the face of the panel using chalk.

When I glue up the panel, all I have to do is line up the "V" and I know I've got the panel together as I intended.

*Rick Austin*  
Grand Marais, MN



### SHARE YOUR TIPS, JIGS, AND IDEAS

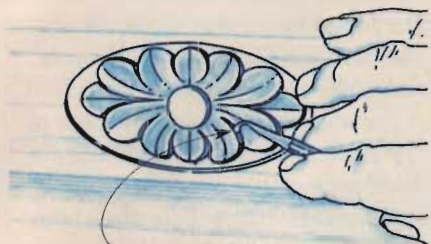
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## Refinishing Picks

When stripping old finish from antique furniture, I use dental picks to get into hard-to-reach areas like carvings, moldings, and mitered corners. The picks have a variety of point shapes.

*Hank Ross  
Montgomery, AL*



Use dental picks to remove finish and stripper from hard-to-reach areas.

*Editors Note: Dental picks are available in sets at drug stores and some hardware stores. Or you can get them through woodworking catalogs. A set of five or six usually costs under \$10.*

## Shop-Made Plugs Offer Perfect Match

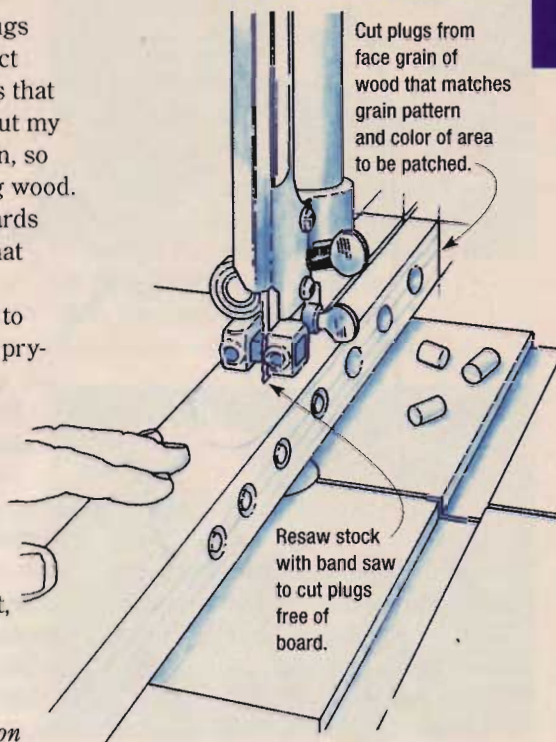
I always make my own wood plugs from leftover scraps of my project stock. Unlike store-bought plugs that are often cut from end grain, I cut my homemade plugs from face grain, so they blend with the surrounding wood.

I cut the plugs from parts of boards with a grain pattern and color that match the area on my project.

After cutting the plugs, I used to break them free of the board by prying them out with a screwdriver. But sometimes the plugs would break or get badly dented. That was a pain, especially when I had taken care to cut the plugs to match a specific wood color or grain pattern.

Now rather than pry them out, I stand the board on edge and slice all the plugs free using my band saw.

*Ron Jamison  
St. Louis, MO*



## It's not the elements that ruin most decks. It's rotten advice.



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EuroShop offers machines in several packages — the SC-30 and C-300, larger units driven by three separate motors, and the C-220, a compact design that shares a single 2.4-hp powerplant among its five functions (table saw, shaper, jointer, planer, and slot mortiser). Because it's smaller, less costly, and intended for home shop woodworkers short on elbow room, we decided to bring the C-220 into the *Workbench* shop for a closer look.

### The Nature of the Beast

With any combination machine, it's a given that you have to live with some compromises to get all those functions into one package. And there's the rub. Though each individual system in the C-220 provides the heft of a small industrial machine, the package suffers from the awkward maneuvers it takes to change and perform operations.

Taken alone, each station's shortcomings are nothing more serious than limited capacities or small table space. Start moving around the machine, though, and you'll find your work flow stalls.

The reason? There's a whole lot of sharing going on. The shaper spindle, planer table, and mortiser table all travel on the same vertical adjustment mechanism, so setup changes on one undo the others — a pain if you need to return to that setting. Also, the spring-loaded jointer guard interferes with many workpieces being run through the shaper and table saw. Quick-release hardware would provide an obvious solution here, but instead you have to hunt for a hex key wrench every time.

The table saw ripped nicely, and the sliding table worked beautifully for crosscutting, but miter fence adjustments were clumsy. Also, the stamped steel extension table mounted awkwardly with hard-to-reach hardware, almost like it was stuck on as an afterthought.

More seriously, the table saw lacks a tilt-arbor feature, and it won't accept a stacked dado blade.

This means cutting dados and beveling edges has to be done on the shaper, and will be limited by the tooling you have available (a 1/2" router collet is included).


Shifting the motor drive among the different stations is done via an external locking lever — a convenient feature, but one that gave us a scare during a crosscut operation on the table saw. The jointer guard was off to make room for the end of the workpiece, and the drive belt failed to disengage completely from the jointer cutterhead — leaving three exposed knives to spin dangerously around. The distributor assured us that proper belt adjustment prevents this.

### A Place for Everything?

Certainly there is a niche for this machine, but it has to be a blend of very specific conditions — tight shop space coupled with the need for several heavy-duty machines at a reasonable cost. (The C-220 sells for about \$3,500, versus the more than \$6,500 it would take to buy separate tools of similar quality.) If that fits you, and if you don't mind the setup aggravations, the C-220 will certainly get the job done.

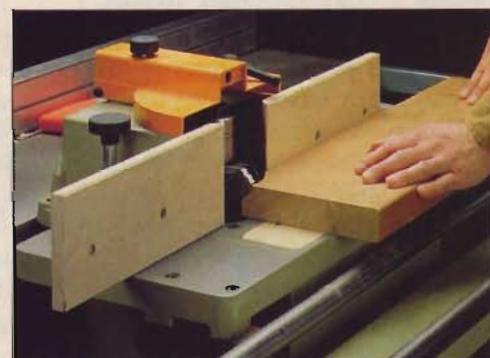
But a place for everything can't ensure that everything's in the right place, and at the right time. Some woodworkers with space and budget limitations might be better served with separate medium-duty or even benchtop tools.

If your heart is set on a heavy-weight machine, EuroShop's larger sibling, the SC-30, looks much more promising. It's powered by three motors, features a 10" tilt-arbor saw, a 12" jointer/planer, a shaper, and independent setups so the different operations don't overlap as much. It weighs more but is still compact, and sells for \$4,700 — a small increase for the added features. Again, the issue is trade-offs, and no one but you knows the balance that's best for your work.

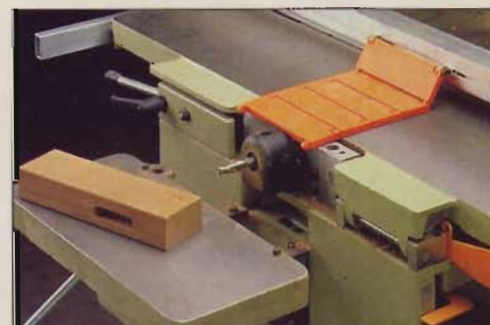
For more information, contact Old World Machinery Co., San Clemente, CA (800)203-0023. 



The jointer tables fold up to reveal the planer. The hinged dust hood pivots in place for either operation — a nice touch.



Room is tight, but the shaper/router can mill edge profiles or joinery details. The table saw can't dado, so that's done here.



Though the table mount seems lightweight (only two bolts), the mortiser was fast and produced accurate results in this 2x stock.



An external lever controls the belt drive system, switching between functions. It can require monitoring to work properly.

# News and Events

## Celebrating American Architecture

As we build our homes, workplaces, roads, and cities, we shape the world that surrounds us. In turn, the world we construct helps define who we are. This is obvious in our nation's capital, where monuments and government buildings conjure up images uniquely American. The National Building Museum in Washington, D.C. celebrates the structures Americans build, and how they help establish who we are.

Created by an act of Congress in 1980, the museum opened its doors to the public in 1985. Since then, it has hosted exhibitions on subjects as diverse as how dime-store architecture shaped main street America, and tools as art. Some exhibits are permanent, others run for a limited time.

An exhibition titled "Do It Yourself: Home Improvement in 20th-Century America," is dedicated to those of us who tackle our own projects, and how we influence everything from home styling to how tools are made.

It starts this May and runs through February 1999.

Even the museum's home is an exhibit of sorts. Built between 1882 and 1887 for the United States Pension Bureau, the building boasts unique features including a carved exterior frieze depicting the Civil War, and a great hall with some of the world's largest interior columns.

In addition to exhibits, the museum sponsors youth education programs that attract over 12,000 participants annually from across the nation. Students in many classes get hands-on building experience. Others learn urban planning and design skills they'll need to help shape their communities.

The museum operates as a private, non-profit organization, and relies on membership fees and private support for funding. Admission is free. For information on upcoming events and exhibitions, call The National Building Museum at (202) 272-2448.

The National Building Museum in Washington, D.C. celebrates American architecture, and stands as a fine example itself.



Photos by Jack E. Boucher/HABS

## Craftsman's Kids

When I talk to kids about how they spend their spare time, I'm amazed by how many of them say "on the internet." It seems few kids today enjoy one of the favorite hobbies of my youth — woodworking.



As high-tech pastimes replace more traditional pursuits, fewer opportunities exist for youngsters to work with tools. But through the new Craftsman Kid's Club from Sears, you can help kids between the ages of seven and ten learn the ways of working wood.

Membership in the club is free, and includes a quarterly newsletter that introduces members to tools and their uses, as well as to woodworking safety. Games and puzzles help kids learn terms, and in each issue Woody Sanders, the club's animated host, walks kids step-by-step through a project. The projects usually require using only simple tools, and they aren't very expensive to complete.

To enroll your child in the club, inquire at a Sears store or call (800) 682-8691.



# Installing Cabinetry

*Building cabinets certainly isn't the most difficult kind of woodworking there is, but the projects that require cabinetry — kitchen and bath remodels, especially — can get pretty*

complicated. The cabinets themselves aren't the problem. They're just large wood boxes with a lot of straight lines, square corners, and straightforward joinery in the face frames and doors.

Remodeling a kitchen means more than new cabinets, though. Doing the job right means thinking about electrical and plumbing connections — especially any changes

to make during the renovation — plus other decisions about countertops, flooring, and the like. As the scope of the project becomes clearer, a home-shop woodworker might wonder whether building his or her own cabinets makes much sense.

Even if you have the tools you need and feel confident your skills are up to the task, you'll be adding another layer to an already complicated project. Besides, it takes a lot of shop space to assemble an entire set of cabinets, and you can have the kitchen torn up for weeks if you do the installation piecemeal. A compromise might be the best solution — think about buying manufactured cabinets and doing the installation yourself.

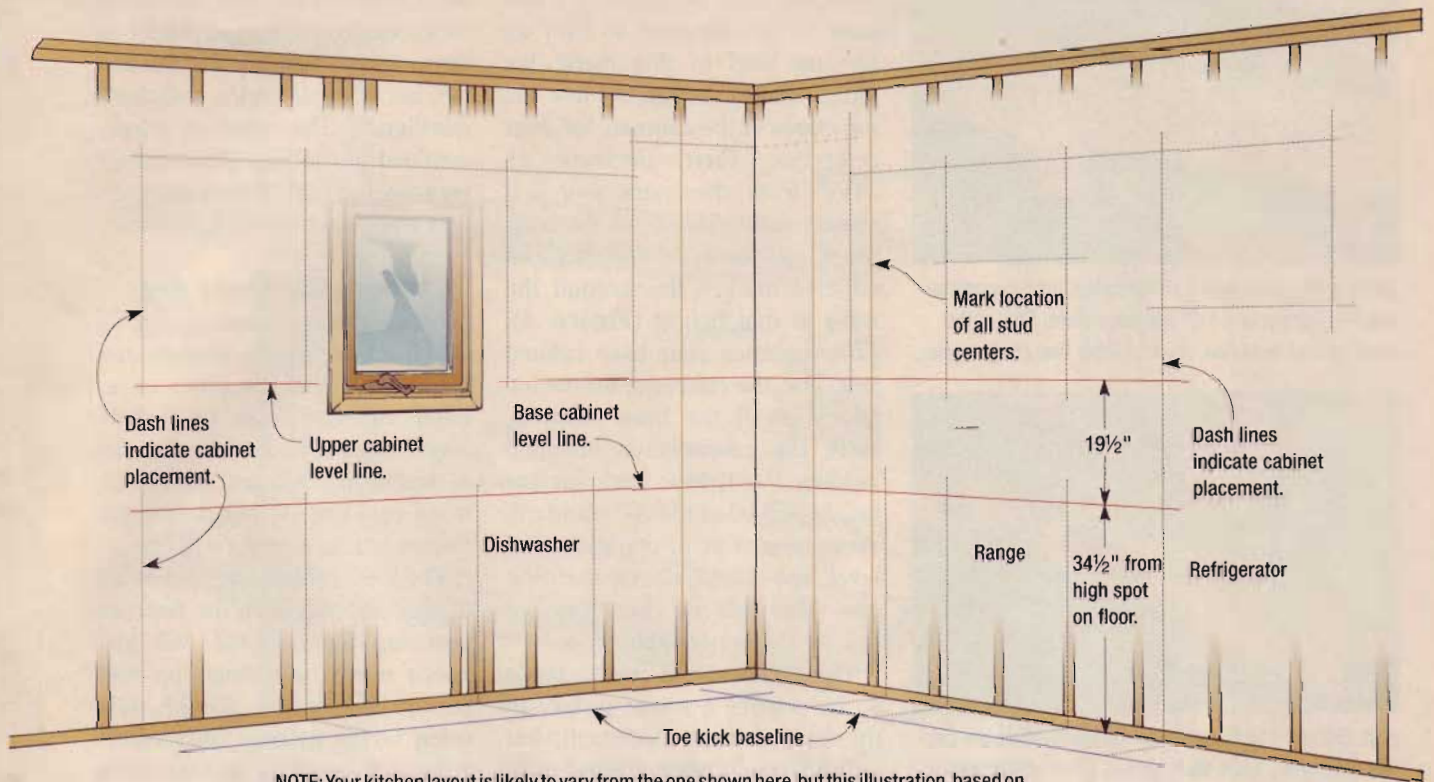
Ready-made cabinets will of course cost more than the raw materials, but the money you save doing the installation can help offset that expense, and you'll likely get the project organized, underway, and finished a lot sooner.

## Focus on Planning

When the *Workbench* staff started planning a series of articles on a kitchen remodel, we knew using manufactured cabinets would be a choice many readers could make (see *Selecting Cabinets* on page 25).

Bob Settich, our contributing editor, had just the site for us, and he'd been planning a renovation for over a year. While he began the demolition of his old kitchen and did some

## Cabinet Installation Layout



NOTE: Your kitchen layout is likely to vary from the one shown here, but this illustration, based on the Merillat installation guide, provides a basic outline of the layout marking you'll have to do. All the cabinet layout lines and stud locations should be marked. Also, pay attention to plumbing and wiring connections — you may have to cut or drill clearance holes in the cabinet backs to accommodate them.

electrical work, we discussed the material options for the new flooring and countertops.

Since Bob and his wife were going to live with the kitchen, they got the deciding vote on these matters. For the cabinets, they chose a Merillat design ("Spring Valley") in a natural maple finish. These were ordered from a local distributor and arrived about two weeks later.

### Establishing Layout

Measuring and marking the kitchen accurately is the critical first task (**Cabinet Installation Layout**). You'll have some irregularities to deal with, so knowing the terrain is essential. Layout marks on the walls and floor will indicate not only the cabinet placement and stud locations, but where adjustments or shims will be required.

The primary guides are the base and upper cabinet level lines, but you need to work up to them. First, mark lines on the floor 22" from the walls where the toe kicks of the base cabinets go (**Figure 1**). Within that zone, use a level and a straightedge to locate the highest spot on the floor (**Figure 2**). Then transfer that height mark from the floor to the walls (**Figure 3**).



1 Begin by marking a line 22" from the walls for aligning the front edges of the base cabinets. This line may need adjusting later.



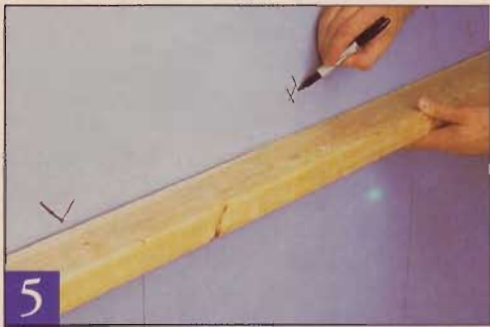
2 Staying within your toe kick baseline marks, use a straight 2x4 and the longest level you have to find the high spot on the floor.



3 Transfer the high floor mark to adjacent walls. The bottom edges of all base cabinets will have to be shimmed to this level.



**4** Using a long level and a straightedge, mark a continuous line from your 34½" reference point. This is the base cabinet level line. Mark another line 19½" higher.



**5** High (H) and low (L) spots on the walls affect the cabinet alignment. Mark them so you know where shims must go or where bumps might force the cabinets out.



**6** An out-of-square corner might require you to adjust the location of the toe kick baseline on the floor, so check each one.



**7** Use a magnetic or electronic stud finder to hunt for stud locations, then confirm each one with a nail test and mark the center.

When the base cabinets are installed, their bottom edges will have to be shimmed so they all line up level to this mark. It's much easier, though, to use the top edges of the cabinets for your reference. First, measure up 34½" from the mark you just placed at the bottom of the wall. Then use the level and straightedge to mark a line around the walls at that height (**Figure 4**). This becomes your base cabinet level line, the reference for the top edges of all the base cabinets. With the countertops installed (adding 1½"), your work surface height will be at the 36" standard. While you're at it, mark another level line 19½" above the first one. This will be the reference line for the upper cabinets.

The layout marks you've made so far provide a rough picture of the base cabinet placement, but you still need a more detailed map. The wall surfaces affect the cabinet alignment, so use a straightedge to locate and mark any high and low spots (**Figure 5**). The low spots may require shims behind the cabinet, and severe bulges in the wall might push the cabinets over the toe kick baseline. Mark also the wall contours in the area where the upper cabinets go.

Finally, check any corners with a framing square (**Figure 6**). If a corner is out-of-square either way, the cabinet placement (and countertop) will have to be adjusted to compensate and to keep the cabi-

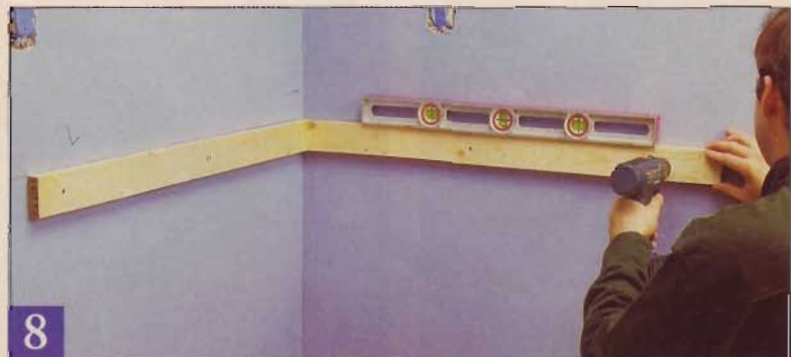
net faces in a straight line. More often than not, the irregular angle stems from a buildup of plaster or drywall joint compound in the corner, not from an entire wall that's misaligned. The offset is usually confined to the immediate corner area, so the gap behind the cabinets won't keep growing larger.

### Where the Studs Are

Locating the wall studs wraps up the layout marking procedure, and it's as critical as the other steps. Each cabinet must be solidly anchored, and no surface material — wallboard, lath and plaster, or wood paneling — will do the job like structural framing will.

The base cabinets get nearly all of their support from the floor, so fastening them to the wall just keeps everything lined up and steady. The uppers, though, rely solely on the fastener connections to keep them afloat, and the studs provide critical muscle.

A magnetic or electronic stud finder will indicate where studs are buried in the wall (**Figure 7**), but don't stop there. Pipes and electrical conduit can create false readings, so don't rely on guesswork. Drive a 6d nail to locate the edges of each stud you find, and mark the center. Never assume that the spacing will be the standard 16" on-center. Window and door openings, plumbing vent stacks, and just plain shoddy carpentry may have positioned some studs off of the layout you expect.



**8** Our "pie cut" corner base cabinet had a rounded back, so we had to screw cleats to the wall studs for countertop support. Use the base cabinet level line as your reference. If you're installing a square-back or a blind corner cabinet, you can skip this step.



**9** Do a test fit with the cabinets to identify any problems in the cabinet sizes or your layout marking. If its sides don't extend back to the wall, the corner cabinet will have to rely on adjacent units for correct positioning.



**10** It may take some time to shim and adjust your first cabinets, but this step sets the precedent for everything that follows, so don't rush and expect to make it up later. At this stage, these units aren't fastened together.

### Here Come the Cabinets

When your cabinets arrive, you'll get some paperwork telling how to unpack them and check for shipping damage or other problems. Inventory and measure each cabinet so you know your order was filled correctly, and remove all the doors, drawers, and shelves.

Odds are you'll have at least one corner to deal with in your project, and that's where the installation

begins. If not, start at an end unit.

Bob opted for one-piece corner cabinets — one base and an upper unit — but manufacturers also offer separate cabinets made to fit together (see *Turning the Corner* below). Bob's "pie cut" base cabinet features a rotary shelf system, and the back wraps around in a three-quarter circle rather than a sharp 90° corner. This type of construction is less affected by wall

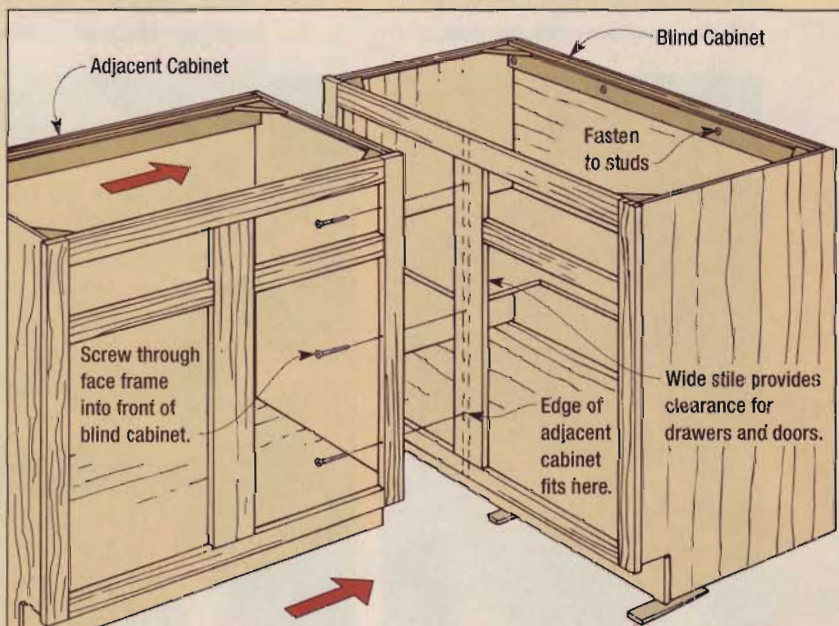
irregularities, but it doesn't provide full support for a countertop. To compensate, we attached two 1x4 cleats to the walls, fastening them to the studs (**Figure 8**).

Because the back of our corner cabinet didn't extend to the wall, we had to secure it by connecting it to adjacent cabinets (**Figure 9**). First, we set the units next to each other and shimmed underneath to align and level them (**Figure 10**).

## Turning the Corner: "Blind" Cabinets Still An Option

Before rotary shelves and "pie cut" corner cabinets made their way into kitchen design, turning the corner from one wall to another usually meant installing a "blind" cabinet — one that is partially hidden by the adjacent cabinet on the other wall. There's nothing inherently wrong with this approach, but it does sacrifice some of the accessibility that dedicated corner cabinets offer. You have to reach further if you want to get at that space.

Installation is as straightforward as with any other cabinet, but the blind cabinet often has one wide face frame stile where the edge of the mating cabinet's frame abuts. If you use a filler strip between them, drive the screws from inside the blind cabinet, through the wide stile into the filler's edge.



**NOTE:** If a filler board is required between the cabinets, screw it to the adjacent cabinet first. Then clamp the entire assembly together and drive screws through the blind cabinet's wide stile into the edge of the filler board.

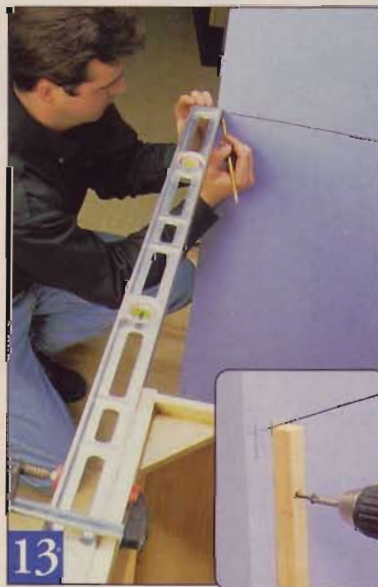
As soon as they lined up, we clamped the cabinets together at the face frames (**Figure 11**). Standard bar clamps will work, but we used this opportunity to try out



The Cabinet Claw not only clamps the face frames flush, it has a swing-away guide for drilling and for driving screws.



When you have the cabinets aligned and fastened together, anchor them to the wall. Place any shims over the studs.



If you use a filler board at the end of a run of cabinets, mark and install a support cleat before the end cabinet goes in.

a new special-purpose tool from Adjustable Clamp Company. Dubbed the "Cabinet Claw," this new clamp is designed expressly for the installation of face frame cabinetry (**Pro Tip**). Its aluminum jaws pull the frames of two cabinets together, and a front clamp aligns them flush with each other.

You can align and fasten together an entire section of base cabinets before you secure them to the wall. When you're ready to cinch them down, drive screws through the cabinet's back rail and into the wall studs (**Figure 12**). If a shim is required, place it directly over the stud, drill a pilot hole, and send the screw right through it.

Incidentally, never use nails to fasten the cabinets in place, especially the uppers. Aside from voiding the manufacturer's warranty, this shortcut almost guarantees that the cabinet and wall will part company at some inopportune moment. There's a reason the force that brings objects crashing to earth is called the *law* of gravity. Not the suggestion of gravity. Not the useful notion. The law.

If the end of the cabinet run butts against another wall, you'll probably need a filler strip to make up the last few inches. Custom

cabinets are built to fit so spacers like this aren't required, but with standard cabinet sizes you almost always have to make up the gap with trim. Cabinet manufacturers anticipate this, and offer filler boards in various widths. They're the same thickness and species as the face frames, and prefinished, so using them doesn't really slow you down that much.

If your installation requires this technique, leave the last cabinet detached from the rest of the group. Clamp a straightedge to the face of the nearest installed unit, extending far enough for you to put alignment marks on the end wall (**Figure 13**). Allow a  $\frac{3}{4}$ " offset behind those marks (for the thickness of the filler piece) and fasten a cleat to the wall. Then install and fasten the last cabinet and measure the gap between its face frame and the wall.

If the wall is flat, simply rip the filler board to the required width and fasten it in place. If the wall is irregular, you'll have to scribe-fit the filler board (**Figure 14**).

Start by setting a marking compass to the width of the gap, then place a strip of 1"-wide masking tape along the filler board in the area where it needs to be trimmed.



If the end wall is irregular, scribe-fit the filler board. Plumb it against the end unit, trace the contour, then cut on the line.



Drive screws from the end face frame into the edge of the filler board, then nail the other side to the support cleat.



## PRO TIP

### Essential tools for the Job

A 4-ft. level, a 12-volt or larger cordless drill/driver, and a few one-handed bar clamps will help your installation proceed according to plan. I also recommend a pair of Jorgensen "Cabinet Claws". These sell for \$60 a pair (1-312-666-0640). Another item to have on hand is Lloyd's Original Ackempucky, a fastener lubricant that's finish-friendly — 3 pocket-size tubes sell for \$9.95 (call NuResearch at 1-800-514-4410).



Clamp the board to the end cabinet's face frame, then trace the wall contour with the compass. Remove the board and cut along the scribe line with a jig saw, then reinstall it to check the fit. When it's right, drive screws through the adjacent face frame into the edge of the filler board. Nail the other side to the cleat (Figure 15).

### Working Your Way Up

The temptation to take a break at this point was very strong, but we dove right into the installation of the upper cabinets. The sequence is similar to that used for the base cabinets, though you don't have the floor to support the weight of the cabinets.

We made a pair of T-braces to help out here. Glued and nailed together from scrap stock and plywood, these 19"-tall braces propped up the front of the upper cabinets as we installed them.

We also cut some plywood for temporary countertop surfaces.

This gave us a place to set tools, and provided support for the T-braces.

Before hanging the first cabinet, though, we had some prep work to do.

First, we cut up some of the cardboard shipping cartons and used them to protect the base cabinets (Figure 16). (Be sure to remove any staples from the box flaps — they can scratch the finish.)

If you'll remember, earlier we marked a second level line on the walls, 19½" above the base cabinet level line. This line marks the bottom edge of the upper cabinets. Allowing 1½" for the final countertop thickness, we'll have the standard 18" clearance between the upper and base cabinets.

The T-braces provide an extra "hand," but alone they can't support the cabinets. The bulk of that chore actually falls to ledger boards fastened to the wall along the level line (Figure 17). These are only temporary, but they'll be supporting nearly the full weight of the cabinets, so make sure you screw them to the studs.

Again, we started the installation at the corner and used a one-piece unit, but this cabinet had a square back rather than the "pie cut" shape of the base cabinet.

Before lifting any of the upper cabinets into place, predrill screw holes through the top and bottom hang rails (Figure 18). Use the cabinet layout and stud location



16 Use the cardboard cartons and some plywood to protect the base cabinets from damage while you install the wall units.

marks on the walls to transfer measurements to the cabinet backs (note the spacer on the cabinet side, which registers the ¼" offset of the face frame). When used properly, this system ensures you'll hit studs when you drive the mounting screws.

Set the corner cabinet on the ledger board, prop the T-brace under the front, and check the frame for plumb (Figure 19).



17 Ledger boards, set at the upper level line, provide temporary support for the upper cabinets. Make sure the screws hit studs.



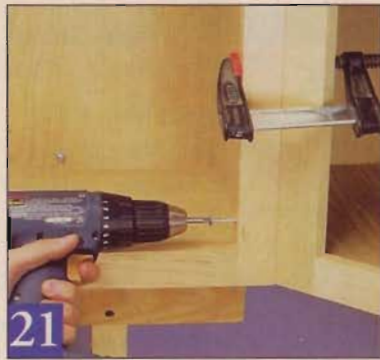
18 The cabinet and stud layout on the wall helps you locate the screw holes in each cabinet. Drill into the rails from the back.



19 Set the corner wall cabinet on the ledgers and, if necessary, shim it until the frame is plumb. A T-brace supports the front.



**20** Drive mounting screws through both the upper and lower hang rails in each upper cabinet. Aim for a stud on each wall.



**21** The face frame of the upper corner cabinet is cut at 45°, so we substituted standard bar clamps for the "Cabinet Claws."



**22** When the last cabinet has been secured, you can replace the doors, drawers, and shelves. These hinges provide adjustment.

Insert shims behind the cabinet where necessary, and when the unit's aligned to your satisfaction, screw it in place (**Figure 20**).

Except that you won't be hanging large assembled groups of upper cabinets as a single unit, the rest of this procedure resembles the sequence used for the base cabinets. Our upper corner cabinet had a 45° face frame, though, so we used conventional bar clamps rather than the "Claws" to hold the adjacent cabinets while we fastened them (**Figure 21**). As you work, keep the face frames aligned and flat. Any twist will affect the fit of the doors.


### Wrapping up the Details

When the last upper cabinet has been secured, you can start reinstalling the doors. The shelves and drawers block your access to the inside of the cabinets, so leave them out until the doors are on.

Also, keep the ledger boards in place for now. Fitting the doors usually reveals any problem with your installation, because if a cabinet face has been twisted out of plumb its door(s) won't lie flat against it. You might have to back off the mounting screws to adjust your shims, and leaving the ledgers in place keeps the cabinet supported while you do this.

Most of the European-style cup hinges have a built-in adjustment feature, so you may have some room to tweak the fit without fussing with the cabinet (**Figure 22**).

We'll be covering the countertop installation in a later issue, but fastening those also requires getting your head and arms inside the base cabinets. Don't bother reinstalling those shelves and drawers until that step is complete.

Finally, install trim along the toe kicks to hide any shims or gaps between the cabinets and the floor. Also, you may want to add a cornice molding to dress up the top of the cabinets. 

## Reality Check (Or, What Actually Happened)

With our cabinet installation safely completed and photographed, we can take a little time to walk you through the exciting developments (read "chaotic mayhem") we encountered during this renovation. Actually, the project went fairly well once underway, but we were greeted by a few surprises in the demolition and prep phases.

Bob gutted nearly his entire kitchen for this remodeling project, and he hit some serious roadblocks right from the start. After he removed the sink base cabinet, for example, he discovered a small leak in the cold water supply line. Water had crept undetected along the back of the cabinet and saturated the subfloor planking underneath, causing it to rot. When he cut away the unsound wood, he saw that the floor joist below also showed signs of water damage. He figured he'd just pull up a little more subfloor so he could replace the damaged edge of the joist.

Got any idea where this is going?

It turned out the joist wasn't rotted badly and could be patched from the top, but that silver lining was just hiding another dark cloud. An active termite colony had consumed sections of the mud sill and the wall studs. The necessary repairs added two full days to the project, all before a single cabinet could be set in place.

If there's a lesson in this cautionary tale, it's to expect the unexpected. The techniques we've shown, and even some of the construction details designed into manufactured cabinets, evolved to accommodate the realities of remodeling. I know the foundation of my home has settled more times than a trial attorney, and I suspect I'll be buying shims by the truckload when I tackle my own kitchen renovation next year.

Still, out-of-square walls and uneven floors aren't insurmountable obstacles. They're detours, bumps in the road that might cost you some time and money, but you can still make it home.



# Selecting Cabinets

*If you think about it, buying kitchen cabinets has a lot in common with shopping for a new car or truck. Once you overcome the sticker shock, you soon*

realize there's a huge difference in price and convenience between the stripped-down models and those with all the options. And whether you're talking cabinets or cars, the base model will do the job, even though it lacks the fancy trim and the doors don't shut with that solid sounding thud.

While a banker actually set the budget for contributing editor Bob Setlich's kitchen remodeling project, most home lenders and remodelers suggest limiting a kitchen redo to 15 percent of the home's value. Since I offered to help him with the installation work

and he wasn't replacing many appliances, Bob figured he could spend up to 70 percent of his budget on the cabinets.

Imposing a spending limit means you have to do your homework and be willing to shop around for a dealer who can put together the best package. Before buying new cabinets, Bob and his wife pored over the glossy brochures to get acquainted with product lines and various options. Next, they made a checklist of both needs and wants, and I helped them make a detailed drawing of the kitchen space (see the April 1997 *Workbench* for tips on how to do this). Then we all set out to buy the cabinets.

## Stock or Custom

You can purchase stock cabinets off a home center's showroom floor, or order custom cabinets with exactly the features you want. With stock cabinets, we found a

reasonable selection of woods, styles, and finishes. Most manufacturers offer stock cabinet lines in traditional (face frame) and frameless construction, but carry only the most commonly used sizes and drawer and door configurations (see *Cabinet Anatomy* on page 26 to find out about general dimensions and construction).

This standardization and limited selection means stock cabinets cost less and are readily available. It also means that if you have an odd-size space in your kitchen, you'll need to order filler strips to close in the gaps.

Custom cabinets, as the name implies, are built to fit your particular kitchen space. Because cabinet widths vary, you won't find filler strips (and wasted space) in a custom installation. You also have a wider selection of woods, styles, finishes, and options, but these features boost the overall cost.

Some manufacturers offer semi-custom cabinets that give you the best of both worlds. These units are standardized, but come in a wider range of sizes, materials, and styles than stock cabinets. This gives a kitchen designer greater flexibility to work within the given space and your budget.

Most home centers and cabinet distributors have dedicated designers and computerized planning software that lets them create different options with a few clicks of the mouse. We even saw one

program that gave us a three-dimensional color view of what the new kitchen would look like. Programs like these help tally up the costs so you can see how far you've strayed from budget reality.

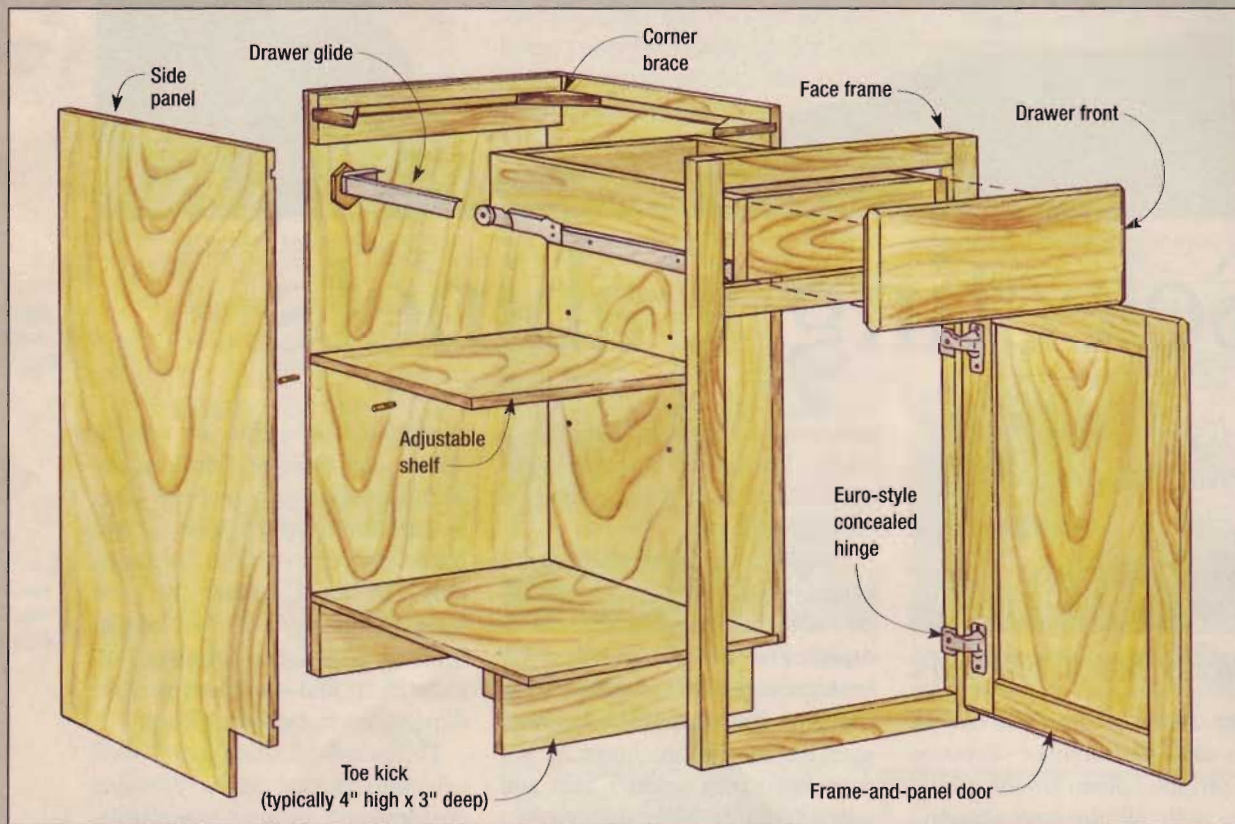
### Cabinet Anatomy

While custom cabinet sizes may vary, cabinets are generally built to standardized heights and depths. Upper cabinets are 12"-deep and range in width from 9" to 48" (in 3" increments). Standard height is 30", but you can install

36"- or 42"-tall cabinets to gain extra storage if your kitchen ceiling height permits the taller units.

Base cabinets are typically 24"-deep and 34½"-high, so a 1½"-thick countertop brings the final counter height to 36" — an industry standard for cabinets and appliances. Base cabinet widths generally mirror the width of the upper cabinets above them (9" to 48") and can include all drawers or a door and drawer configuration. Visual proportions dictate that door width never exceeds door

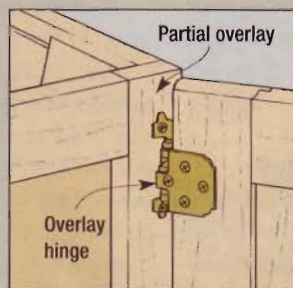
## Cabinet Anatomy: Taking a Look Inside the Box



### Face Frame Cabinet

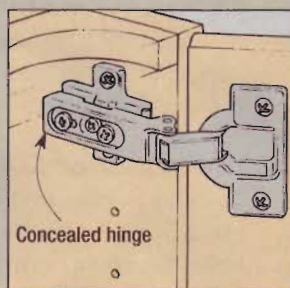


Raised panel door



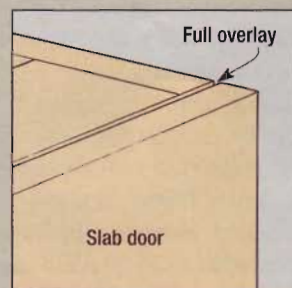
Partial overlay

Overlay hinge



Concealed hinge

### Frameless Cabinet



Full overlay

Slab door

NOTE: The hardware and features shown here are the most common for these cabinet styles, but they aren't the only options.

height, so wider cabinet units will always have two or more doors.

If you want extra counter or storage space, you can get 30"-deep base cabinets, but use 15"-deep upper cabinets to keep everything proportionally appealing. Tall utility cabinets, often used as pantries or broom closets, are available in 84", 90", and 96" heights, and come in standard wall or base cabinet depths.

These standard dimensions apply to both framed and frameless-style cabinets. Traditional framed cabinets have a face frame that provides a great deal of structural support to the cabinet. Door hinges mount to the frame and doors and drawer fronts typically overlay the frame.

Frameless (European-style) cabinets are basically open boxes usually built from  $\frac{5}{8}$ "-thick melamine-covered particleboard. Since this style lacks a face frame, the door hinges mount directly to the cabinet sides to give wide-open access to the interior space. Because they lack the face frame, the boxes get their structural strength from the thicker material used in the sides, back, and bottom, which typically are joined with glued dowels.

### Where Quality Counts

At a glance, it's sometimes hard to tell quality cabinetry from economy versions, since many of the features wind up hidden from view once the cabinets are installed. To get a better idea of the differences, I compared a high-end base cabinet with a similar economy model, and was surprised by what I found.

The economy version had  $\frac{3}{8}$ "-thick vinyl-coated particleboard for the cabinet sides and bottom, and  $\frac{1}{8}$ "-thick fiberboard for the back. The cases were held together with stapled butt joints.

The high-end model had  $\frac{3}{4}$ "-thick veneered MDF sides and the



Higher-quality cabinets feature wooden corner bracing glued into grooves cut into the front and side panels. Side panels are also  $\frac{5}{8}$ " or  $\frac{3}{4}$ " plywood or MDF.

case was built with glued tongue-and-groove joints. It also had wood corner bracing glued into place. (The economy model had plastic braces that were stapled in).

While both cabinet units had solid wood face frames, I found the high-end model had two dowels in each joint. The economy model came with stub tenon-and-mortise joints that were glued and stapled.

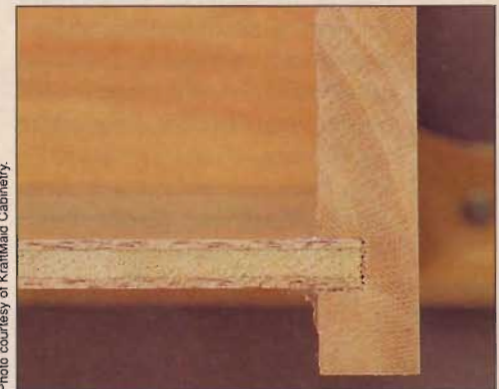
The drawers on the high-end cabinet had  $\frac{1}{2}$ "-thick solid wood sides, fronts, and backs (although you could even upgrade to  $\frac{3}{4}$ "), that were assembled with dowel joinery, an inset plywood bottom, and an adjustable drawer front. The unit's heavy-duty drawer glides gave the drawers a smooth, solid feel when opening or closing them. The manufacturer used these same glides on the cabinet's pull-out shelves.

The economy model's drawer was stapled together from  $\frac{1}{2}$ "-thick vinyl-coated particleboard and it wobbled in the glides when I pulled it out. The drawer also rattled when I closed it, compared to the solid thud of the other model.

When I compared the doors, I found similar differences in materials and construction. The makers of the high-end model used solid wood for frame-and-panel doors, while the economy model came with a veneered panel. The more expensive unit also featured adjustable, concealed hinges that let you precisely align the doors.



Better quality cabinets will often feature  $\frac{3}{4}$ "-thick solid wood drawer sides and front, joined together with glued hardwood dowels or routed dovetails.



Another construction plus on high-end units — drawer bottoms cut from plywood rather than particleboard. Some also get plastic-laminated for easier cleaning.



Most European-style hinges, like the one shown here on a face frame cabinet, allow you to adjust the doors vertically and horizontally for proper alignment.

While self-closing, the economy model's hinges weren't adjustable.

Warranties also gave an indication of quality. The high-end model carried a seven-year warranty on materials and workmanship and a lifetime warranty on hinges and drawer glides. The other model had a one-year limited warranty.



As expected, the only place the economy model came out ahead was price. The cost was one-third that of its high-end counterpart. However, dealer incentives, seasonal discounts, and overstocks can all affect the price of cabinetry, so it pays to shop around when you're ready to buy.

**Certified Seal**

While I enjoy figuring out how things are built, you may not share

my investigative enthusiasm. If not, you can find one indicator of quality just by looking for the blue and white certification seal of the Kitchen Cabinet Manufacturers' Association (KCMA). To display the seal, manufacturers must meet a series of minimum requirements for materials, and the construction must pass a number of rigorous structural and durability tests.

For example, drawers are loaded at 15 lbs. per sq. ft. and must survive 25,000 open-and-close cycles with no failure of the drawer box assembly or glides. Even a cabinet's finish has to pass muster, or mustard as the case may be. To test stain resistance, finishes are subjected to a number of household substances, including alcohol, vinegar, coffee, fruit juice, ketchup, and mustard. After cleaning, the finish must show no appreciable discoloration, stain, or whitening.

**Loads of Options**

As the photograph below shows, you have dozens of options when it comes to accessorizing your cabinets. The combination of accessories you choose depends on your budget, needs, and the designer's creativity. Regardless of which accessories you select, you'll need to make choices in the following major categories:

**Materials.** While oak is still popular, we found that hickory, maple, and cherry have gained favor for frames, doors and drawer fronts. Birch was also available, but not as universally. Cabinet interior surfaces are often covered with wood-grain vinyl, although maple and birch veneer are also widely used.

**Finishes.** Manufacturers offer a range of natural finishes, as well as frosted and brightly colored tints. Many frameless styles fea-

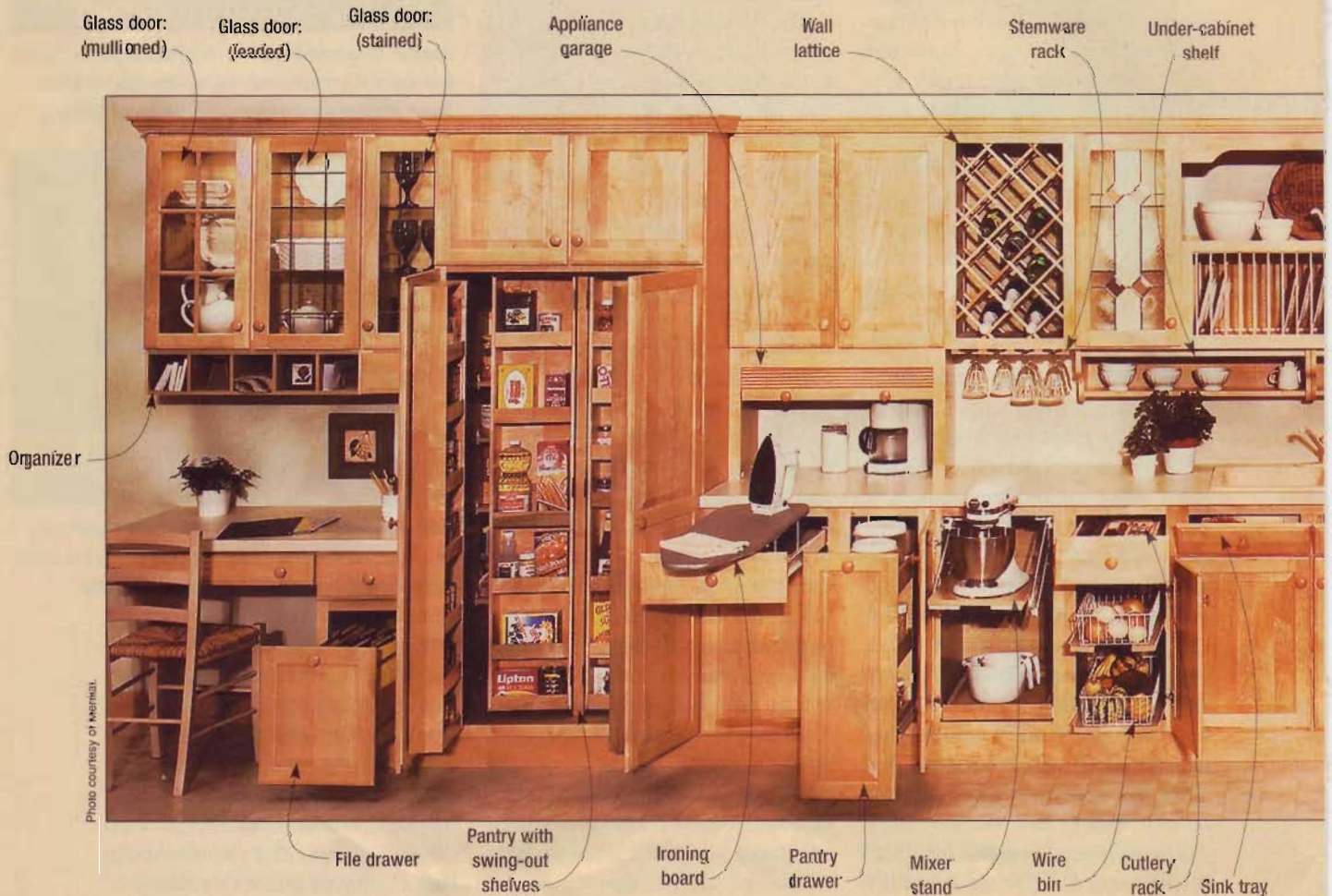


Photo courtesy of Merillat.

ture Thermo-foil finish — a thin, colored plastic film that is heat-molded and glued to a medium-density fiberboard (MDF) core.

**Door styles.** Doors fall into three basic categories: flat panel, raised panel, and slab. The first two have rail-and-stile frames, and the upper rail may have an arch or crown shape. Slab doors are single panels of glued-up solid or veneered stock. Doors may be inset, partially overlay the frame or case, or conceal it (full overlay).


**Door panels.** While most doors come fitted with flat or raised wood panels, glass inserts present another option. Styles include multiple panes separated by mullions, stained glass, and leaded glass. You can even have the glass etched with your monogram.

**Add-on moldings.** Many manufacturers offer optional trim moldings to give your cabinetry a

refined look. Most manufacturers offer suggestions for using these moldings in various combinations to achieve different looks.

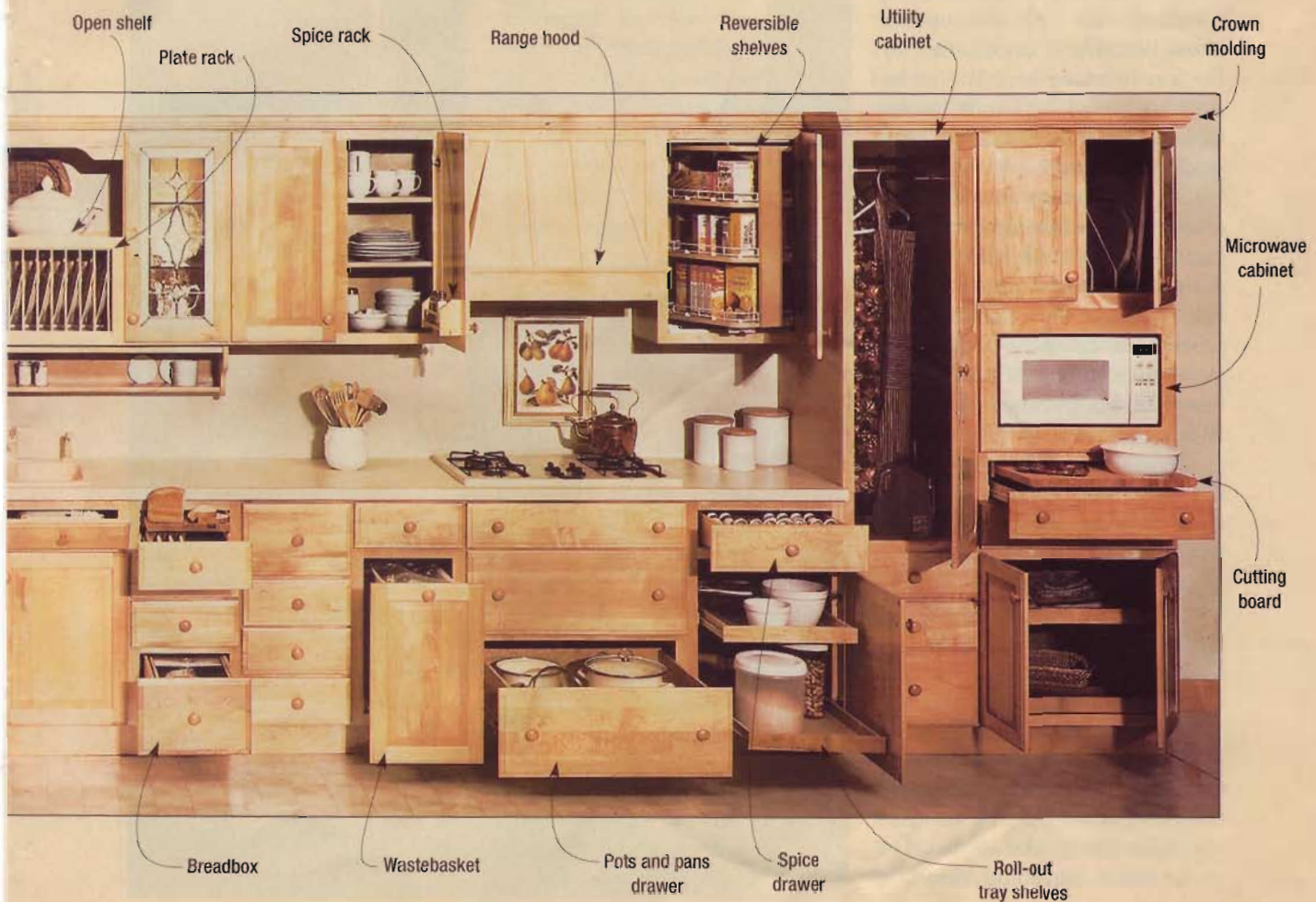
**Appliance panels.** To make appliances blend into the kitchen landscape, you can add wood door

panels to match the cabinet doors.

By knowing what to look for in construction and materials, you can get the most cabinet for the money, and maybe have enough left over to work a few fancy extras into the plan. 

## Sources

- American Woodmark Corp. (540) 665-9100
- Aristokraft, Inc. (812) 482-2527
- Homecrest Corp. (219) 533-9571
- KraftMaid (440) 632-5333
- Marsh Furniture Co. (910) 884-7363
- MasterCraft Cabinets (303) 375-8220
- Medallion Kitchens of MN (612) 442-5171
- Merillat Industries, Inc. (517) 263-0771
- Mill's Pride Ltd. (561) 655-3955
- Quality Cabinets (972) 298-6101
- Schrock Cabinet Co. (614) 529-2000
- Triangle Pacific Corp. (214) 887-2000
- Wellborn Cabinet, Inc. (205) 354-7151
- Wood-Mode, Inc. (717) 374-2711
- Yorktowne Inc. (717) 244-4011



# Country Cupboard

*Last year, Minniette Bieghler joined the Workbench staff.*

*When I met her, I knew she was a perfect fit. Although I had to consider her skills as a graphic designer, what really*

interested me was her enthusiasm for woodworking and home improvement. She had been busy tackling projects on her house in bits and pieces over the years, and while she had no woodworking experience to speak of, she was certainly eager to learn.

A few months after she started, I noticed she was hanging out at the shop a lot. When she showed up shortly before the Christmas holiday with an oak table for her kids, I realized what she'd been up to. I knew then she'd been bitten by the woodworking bug. The entire staff applauded her work on the table, and we all wondered what would come next.

Well, what came next was this country-style cupboard. Minniette came to me for some help with the design, and asked me to guide her through the building process. It was a rewarding experience for both of us. She tested herself with new skills and techniques, and I was challenged to explain some of the shop methods I've been using for years. It was a win-win situation that I recommend for every shop and home improvement nut, and it offers an opportunity to expose fresh talent to our favorite pastime.

## **What's the Use?**

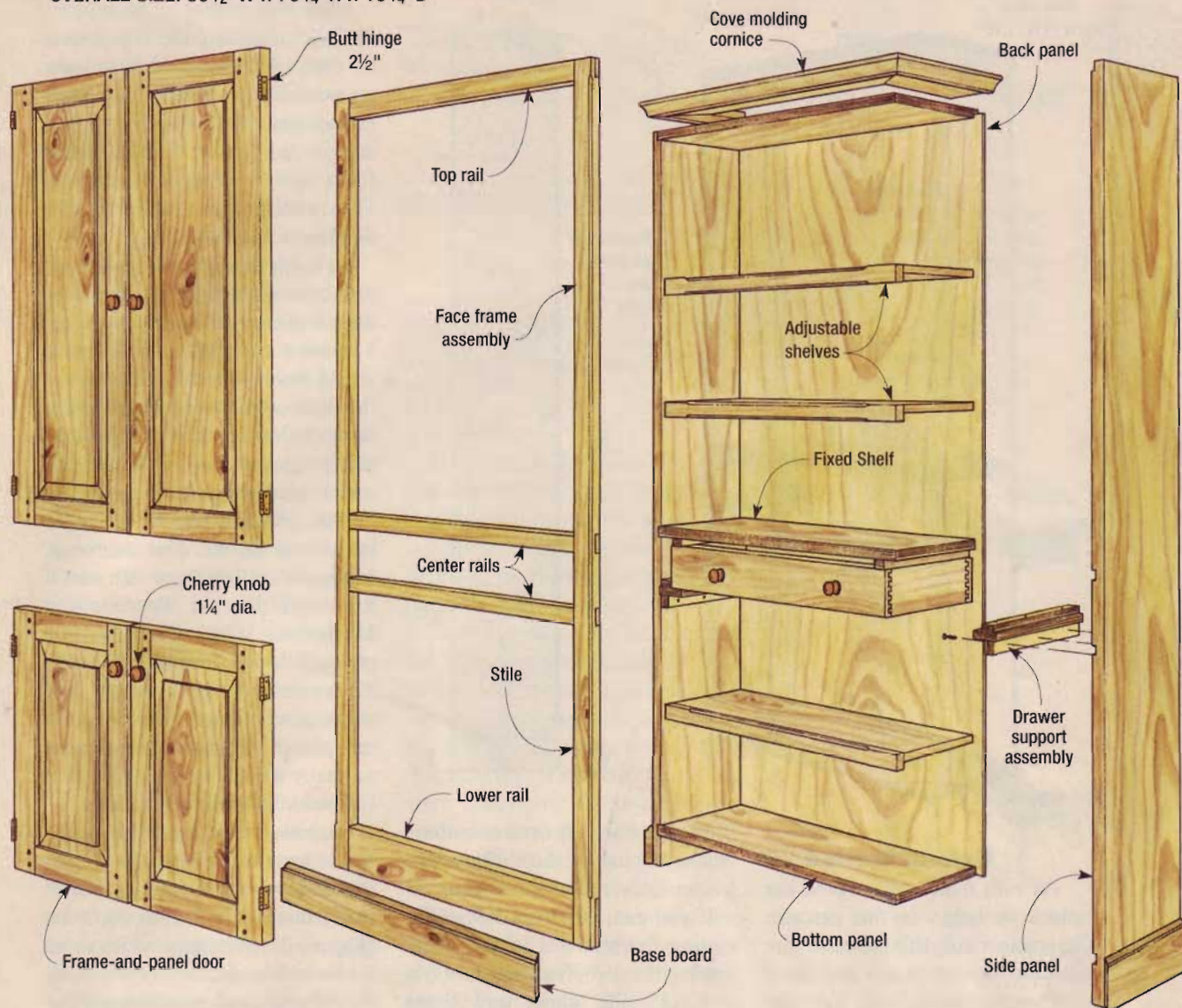
Originally, Minniette intended that this cabinet be used for storage in her garage. As we closed in on the end of the project, however,





## Cabinet Construction View

OVERALL SIZE: 36½"W x 78¾"H x 13¼"D



### What You'll Need

#### Lumber

- (1) ¾" x 4 ft. x 8 ft. pine plywood
- (1) ¼" x 4 ft. x 8 ft. pine plywood
- 48 lin. ft. 1x12 pine (#2 com.)
- 3 lin. ft. ¼" cherry dowel
- 6 lin. ft. ¼" pine cove molding

(Note: The quantity of 1x12 pine assumes a waste factor of about 15%. Allow for more if you use lower-grade lumber.)

#### Hardware

- (6) ¼"-dia. wood knobs
- (4) pr. 2½" butt hinges
- (4) Door spring catches
- (22) #8 x 1¼" FH wood screws
- ½ lb. each 4d & 6d finish nails

she started thinking that it was too nice for the garage and would look great in the house, especially as a pantry in the kitchen.

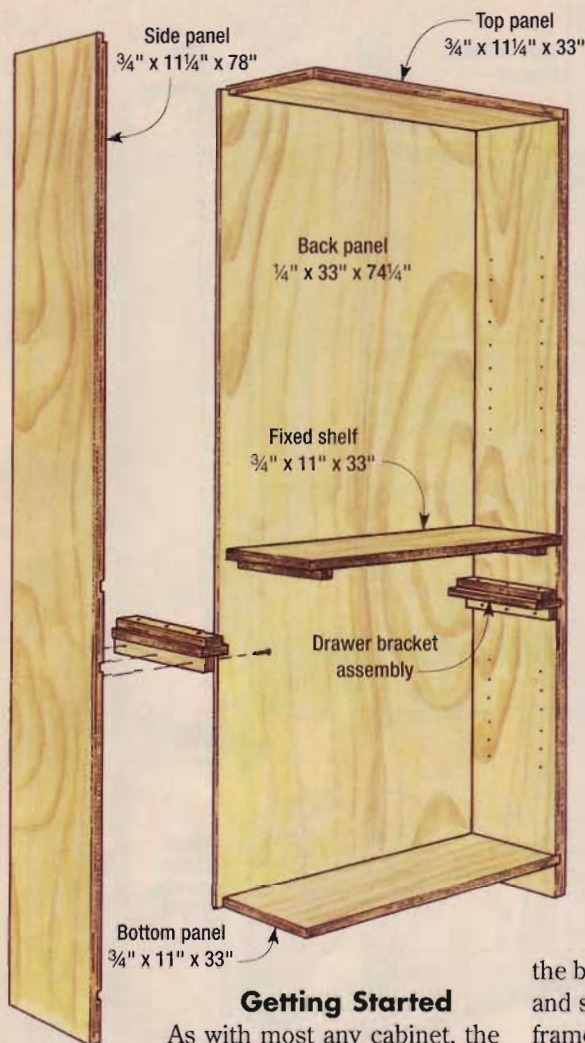
I could hardly argue with her on this point. It's a handsome cabinet, and would work for a variety of purposes. I can easily imagine it in a shop, a kitchen, a bedroom, or a living room. It may not be deep enough to use as an entertainment center, but I think it would be ideal for a wardrobe cabinet.

Given that the cabinet's original purpose was rather humble, Minnette chose to use pine plywood and solid pine for the project. Pine is relatively inexpensive

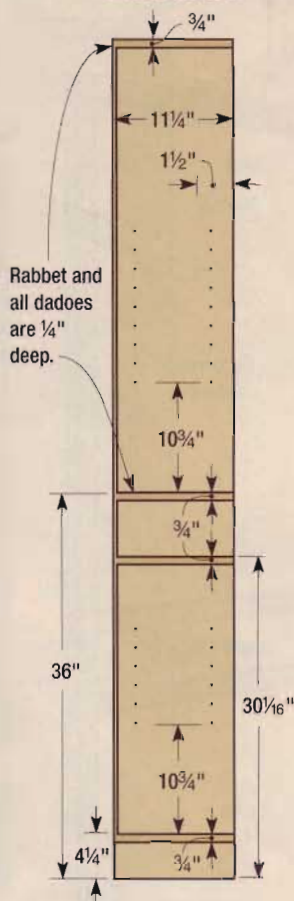
and easy to machine — virtues that made it a natural choice for her first really big project. She liked how the look of pine contributed to the classic but simple design (**Cabinet Construction View**). I use mostly hardwoods for furniture projects, but I think Minnette was right with her choice for this cabinet.

We tried to keep the techniques straightforward, too, producing the raised-panel doors, the face frame, the carcass joinery, the shelves, and the dovetailed drawer all with just a table saw, a drill, a router, a dovetail jig, and some basic hand tools.

# Cabinet Assembly View



# Side Panel Elevation



and rabbets in the sides and top panel (**Side Panel Elevation**).

Even with two of us to support the stock, dadoing the side panels on the table saw would have been an awkward procedure. The panel proportions make them unwieldy, and we didn't want to risk ruining them if they shifted in mid-cut. The solution was a simple router jig (**Dado Jig Details**).

By using this jig and a router, we didn't have to balance the long panels on the table saw, and we got a cleaner cut than a dado blade would have provided. The rails of the jig kept the router base captive so it couldn't stray from the cut, and we got a snug fit despite the undersize plywood thickness.

That reminds me — when we broke for coffee one morning, Minniette cornered me with one of the Seven Eternal Woodworking Mysteries. "Why," she asked, "is plywood thinner than they say it is?"

I explained the industry line about how skimming that 1/32" off millions of plywood sheets saves so many trees, but she still didn't like working with the odd size.

Because a 3/4" router bit would have given us a sloppy fit, we cut the dados and end rabbets with two passes of a 1/2" straight bit (**Figure 1**). The jig provides room for the router plus a 7/32" offset for the second pass, to create a 23/32" dado. After making those cuts, we used the table saw to rabbet the rear edge of the top and each side panel (**Figure 2**).

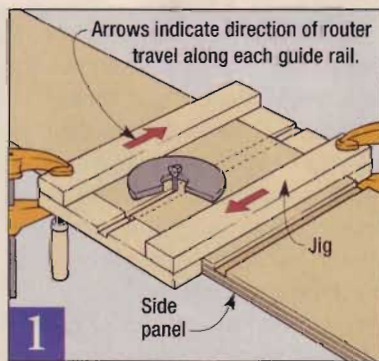
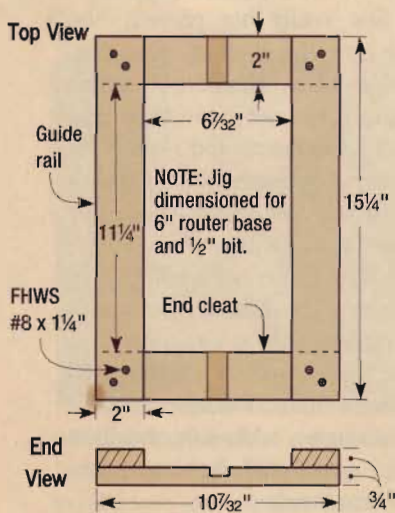
## Getting Started

As with most any cabinet, the place to begin is the carcass. The panels for this one — the sides, top and bottom, and fixed shelf — are made with 3/4" pine plywood. We used 1/4" plywood for

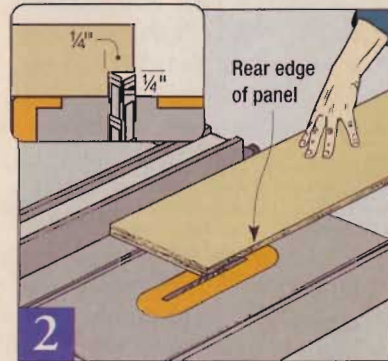
the back panel and drawer bottom, and solid pine for the shelves, face frame, drawer, doors, and trim.

If you can, recruit a helper for cutting the plywood to size. After ripping the 3/4" plywood sheet (rip one 11"-wide piece and three pieces 11 1/4" wide), crosscut the pieces to length for the various panels. Set the shelf and bottom panels aside while you cut dados

## Dado Jig Details



Guide the router along one rail of the dado jig for the first pass. A second pass along the other rail produces the required width.



Cut a rabbet in the rear edge of the side and top panels to accept the cabinet's 1/4" plywood back. One setup does all three.

### Assemble the Carcase

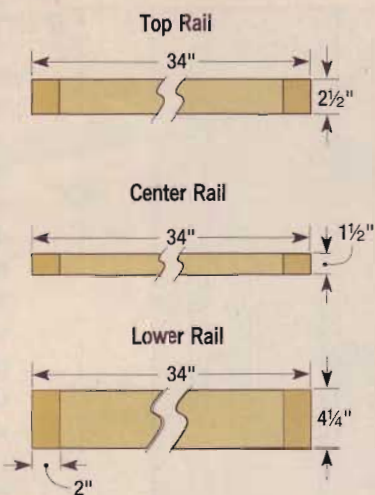
With the dadoes and end rabbets machined into the side panels, you can glue the top, bottom, and fixed shelf into position. Get your clamps ready and spread glue in the dadoes and rabbets. Slip everything together, making sure the front edges of all the pieces align. Pad the clamp jaws so you don't dent the plywood, and clamp the assembly lightly. Check the carcase for square, then crank the clamps.

As long as you have the carcase on your bench, you might as well install the drawer tip-out cleats, drawer supports, guide runners, and support cleats (**Drawer Bracket Detail**). We cut these parts from plywood remnants and fastened them in place with glue and screws (**Figure 3**). The guide runners provide the 1/4" offset for the drawer to get by the face frame, and the tip-out cleats prevent the drawer from tipping forward when it's opened.

### Make the Face Frame

The beauty of a face frame is only partly cosmetic. Its biggest virtue is the rigidity it brings to a box assembly. For this cabinet frame, we used half-lap joints throughout (**Rail Elevations, Stile Elevation, and Face Frame Assembly View**). Minnette liked the simplicity of the half-laps, and I assured her they were plenty strong for her cabinet frame.

### Rail Elevations

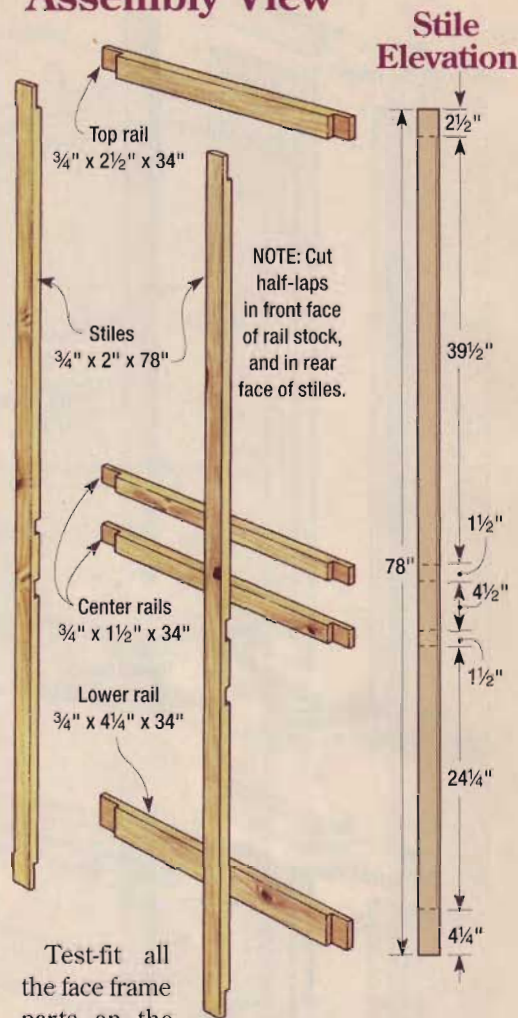


Rip pine for the stiles and rails and cut the pieces to length. As you do this, check the width and height of your carcase — the length of the rails and stiles should match these measurements.

Next, set up a dado blade to cut the half-lap joints (**Figure 4**). As a precaution, we cut a sample joint in some extra stock to make sure the blade height was exactly half the material thickness. Once we were happy with the test cuts, we machined the half-laps on the ends of the rails. Be sure to cut the front face of the rail stock here.

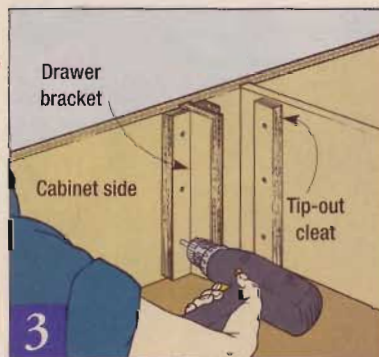
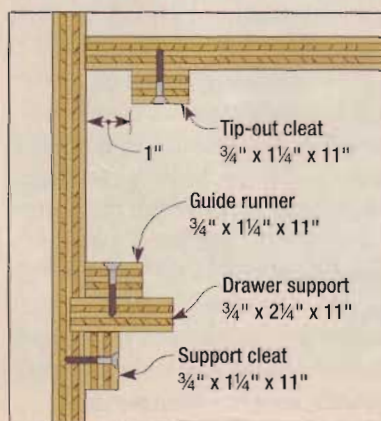
The half-laps at the ends of the stiles can be cut using the same method, but you'll be cutting these on the rear face of this stock. For the half-lap joints that accept the two center rails, we just drew layout lines carefully and used the miter gauge to guide the cuts.

### Face Frame Assembly View



Test-fit all the face frame parts on the carcase, but work piecemeal when you start the installation. Glue and finish-nail the lower and top rails first, and they'll provide registration for the stiles and center rails. Set and putty the heads of the finish nails, then cut the cabinet's back panel and nail it in place.

### Drawer Bracket Detail

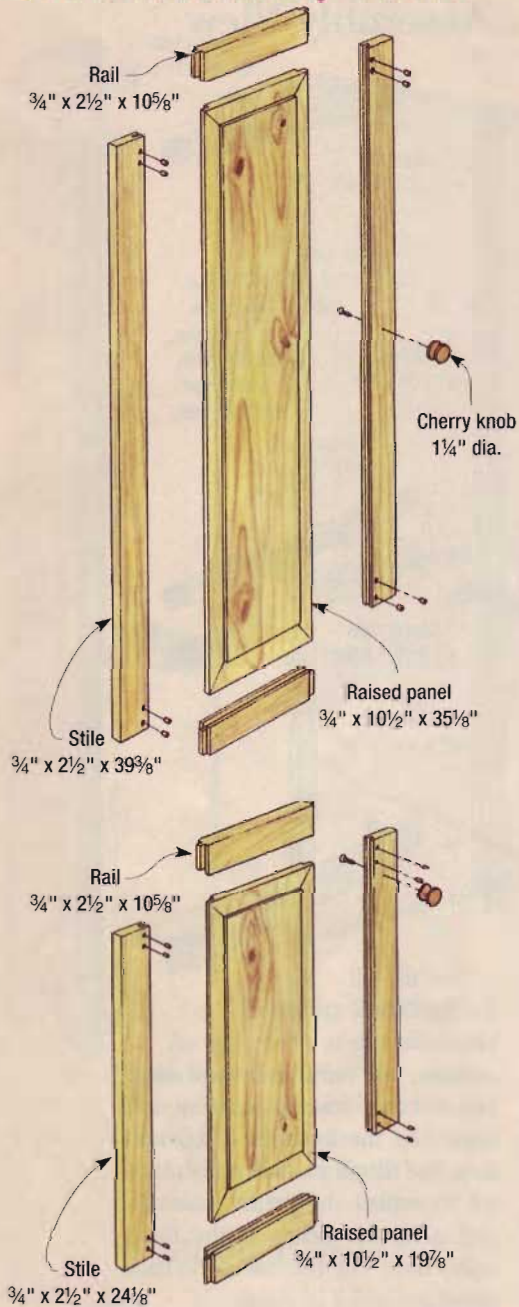


With the carcase panels assembled, glue and fasten the support cleats, guide runners, and tip-out cleats for the drawer.

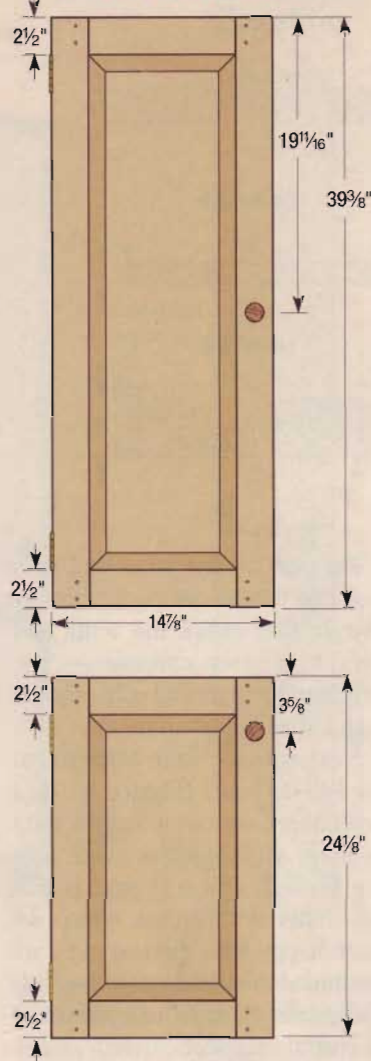


Using a miter gauge with a wood extension, cut half-lap joints in the frame stock with a dado blade. The rip fence acts as a stop.

## Door Assembly Views



## Door Elevations



## Pin Detail



## Making the Door Frames

The construction of the doors provoked a lot of conversation in the shop (**Door Assembly Views**). Minniette had made tongue-and-groove joints on her last project, so she knew the technique, but now she asked about drawbored door frames. My suggestion was to add the pins for looks only. With modern glues and the light weight of these doors, large mortise-and-tenon joints with real drawbored pins would be overkill, and a lot more work.

Begin work on your doors by cutting the rails and stiles to size (**Door Elevations**). Then select and cut your panel material. We were lucky enough to find wide, flat pine boards to use for the panels, but if you don't have that kind of good fortune you can always glue up narrow boards edge-to-edge. This technique usually provides a more stable panel, though the single boards Minniette used behaved themselves and looked a little nicer than a glued-up panel.

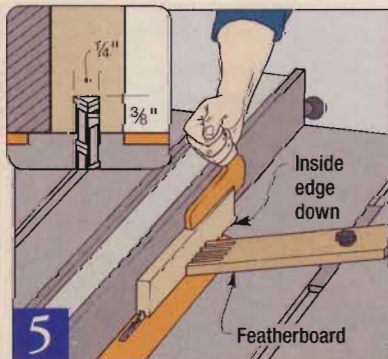
Next, install a 1/4"-wide dado blade in your table saw and cut a groove in the inside edge of each rail and stile (**Figure 5**). These grooves will house the panels.

Now bump the dado width to 3/8", adjust the blade height, and cut the rail tenons (**Figure 6**). Cut a test piece first to work out the fit of the tenon in the groove.

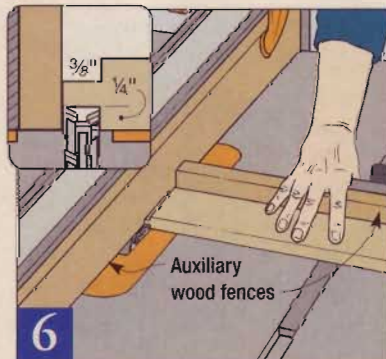
While you have the frame pieces apart, lay out and drill the 1/4" pin holes in the stiles (**Pin Detail**). The pins are cosmetic only, so we drilled just 1/2" deep into the wood.

## Raising Panels

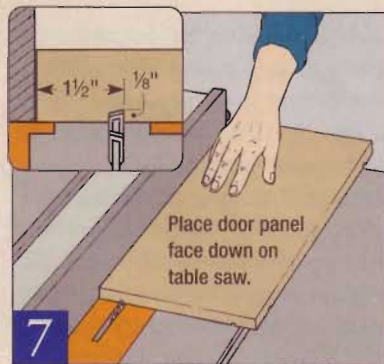
Like making the door frames, cutting raised panels can be done in a variety of ways. Most home shops don't have a shaper, but the router table will do the job if you don't mind facing down a 3 1/2"-diameter cutter. Minniette wasn't thrilled with that prospect, and she wanted to learn some new table saw techniques, so that's what we used.



After you cut all the stiles and rails to size for the door frames, use a 1/4" dado blade to cut a panel groove in each inside edge.



Add another 1/8" chipper to your dado blade (for 3/8" total) and reset the blade height to cut the stub tenons on the door frame rails.



**7** Shallow scoring cuts define the shoulders of the raised panels for the doors. The kerf leaves a square edge after the bevel is cut.

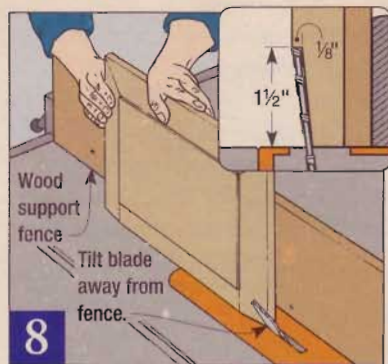
First, we set the blade  $\frac{1}{8}$ " high and cut kerfs to define the raised field of each panel (**Figure 7**).

The kerfs set up the next step — cutting the bevels. We installed a tall auxiliary wood fence to steady the panels, then tilted the blade  $7^\circ$  and ran the panel on edge through the cut (**Figure 8**). Here I shared another tip with Minnette — cut the bevels on the cross-grain ends first, so the long-grain cuts that follow will remove any tearout.

To fit into the rail and stile grooves, the edges of the panels must be rabbeted (**Figure 9** and **Bevel & Rabbet Detail**). We did this with a  $\frac{1}{2}$ " dado blade. Adjust the depth of cut to get the panels to fit right. In dry months (winter), leave the fit loose so the panels have room to swell come summer. In humid months, aim for a snug fit so the panels can shrink without getting loose in the frame.

Dry-assemble each door to check the fit of the joints and the panel. Make any corrections, then glue the frames together. As with any solid wood frame-and-panel construction, you don't want to glue the panel in place. It needs to "float" so it won't split if the wood shrinks.

While the glue sets in the door frame joints, cut some inch-long sections of  $\frac{1}{4}$ " cherry dowel for the pins. To make their insertion easier, chamfer one end of each pin with sandpaper. Remove the clamps from the doors, squirt glue in each hole, and tap in the pins. Cut them off close to the frame



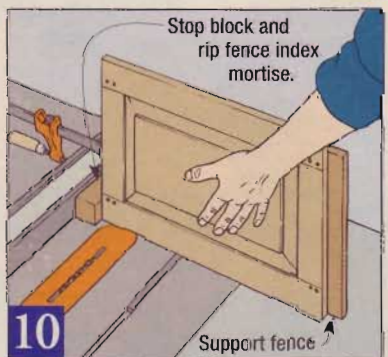
**8** We "raised" our panels by cutting  $7^\circ$  bevels on the table saw. Use a tall fence to stabilize the panels, and bevel the ends first.

surface with a handsaw, then trim them flush with a chisel or a block plane. Use sandpaper for touch-up.

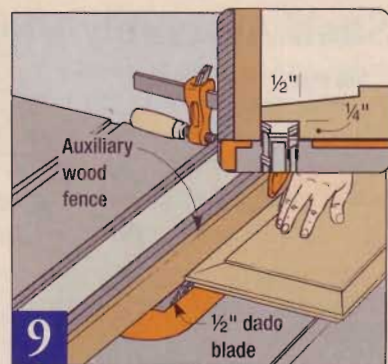
### Fitting the Doors

Once you've installed and sanded the pins, check the lower outside corner of each door for square. That will be your reference corner, so make sure it's right. With inset doors like these, a uniform fit is a must. I've always liked a  $\frac{1}{16}$ " gap all around, and you can get that along the bottom by placing a couple of pennies under each door. Then trim the other edges to get the same gap at the tops and sides.

After you size the doors, mount a  $\frac{1}{2}$ " dado blade in your table saw to cut the hinge mortises. Screw a tall wood fence to your miter gauge for support (**Figure 10**). To keep things simple, we cut mortises in the door frames only, and none in the face frame. We adjusted the mortise depth so the hinge sits  $\frac{1}{16}$ " proud of the edge.

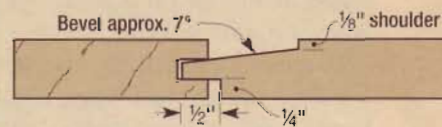


**10** Use a dado blade to cut the shallow hinge mortises on the door frames. Fasten a tall wood fence to the miter gauge for support.



**9** A  $\frac{1}{2}$ " dado blade cuts the rabbets on the back of each panel. Test fit the first edge in the frame stock before cutting all the rest.

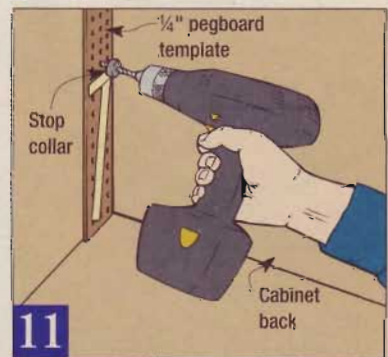
### Bevel & Rabbet Detail



Complete the doors by drilling holes for the knob screws, then set them aside until later.

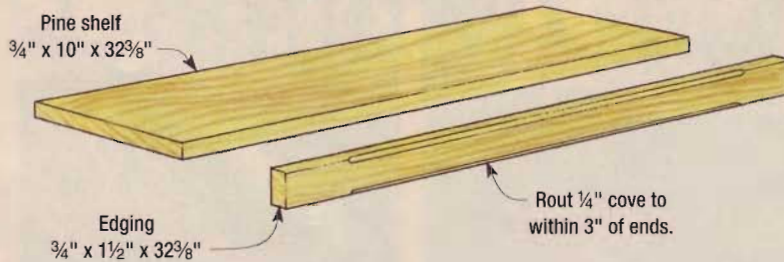
### Shelf Peg Holes

At this point, you can attend to other details on the cabinet, starting with the holes for the shelf support pegs. Professional cabinet shops use specialized line-boring machines and jigs for this job, but we drilled an accurate series of  $\frac{1}{4}$ " holes using a pegboard template (**Figure 11**). We chose 2" increments, using the edges of the guide to register each row of holes  $1\frac{1}{2}$ " from the face frame and the cabinet back. As long as the sides match up, though, the hole spacing increment isn't really critical.



**11** A pegboard template makes an inexpensive but accurate guide for drilling the shelf pin holes. Use a stop collar on the bit!

## Shelf Assembly View



Whatever method you use, put a stop collar on the drill bit to prevent going all the way through the cabinet side. Also, it's easy to get absent-minded during repetitive drilling tasks, so mark the pegboard template to indicate the holes you want drilled.

To check our work, we inserted a set of metal shelf pegs, then ripped and crosscut some 1x12 pine for the adjustable shelves (**Shelf Assembly View**). After trying the fit, we removed them and glued pine edging along the front of each shelf for strength and support. A few 6d finish nails held the edging tight while the glue set. In an hour the squeeze-out had hardened, and we cleaned it off with a chisel.

### Building the Drawer

By this stage in the project, both Minniette and I could see how well the cabinet was taking shape, but her enthusiasm faded a little when

I mentioned building the drawer. It turned out she was a little intimidated by my suggestion that we use dovetail joinery. I knew this wasn't really necessary, but I figured we could cut half-blind dovetails with a router and jig (**Drawer Assembly View**). The drawer certainly wouldn't lack for strength, and Minniette would have an opportunity to try another technique. She warmed up to the idea when she learned that we'd be saving the hand-cut through-dovetails for another project that was a little bit simpler.

I know the geometry of routed half-blind dovetails is complex, but the jigs that produce these joints make the process easy. No headaches from crunching numbers — you just have to size and cut your material correctly and follow a straightforward sequence. (For a glimpse at how these jigs work, see *Routing Half-Blind Dovetails* on the next page.)

We began constructing the drawer by cutting the front

and back to size, but left the sides a little long (**Drawer Elevations**). Our drawer length had to come in at exactly  $11\frac{3}{4}$ " to keep the front flush with the face frame, so we did test cuts to see how the half-blind joinery would affect the drawer dimensions, then cut the sides to length. We chose a drawer height of  $4\frac{3}{8}$ " to create a symmetrical layout, leaving half-pins at each end of the joint.

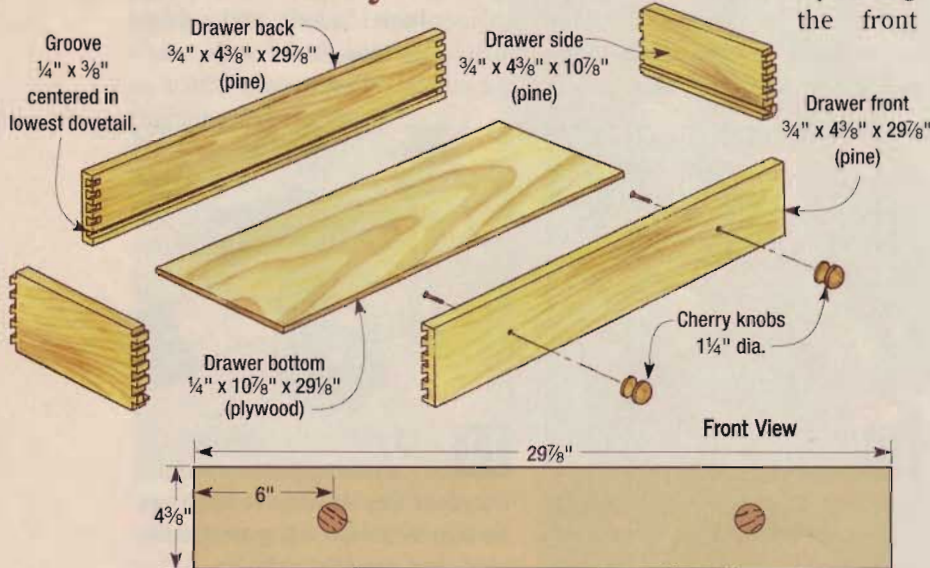
### Fine Tuning Pays Off

After we had the jig and router settings tuned in, we worked through the sequence of clamping and routing all the parts, then cut the groove for the drawer bottom.

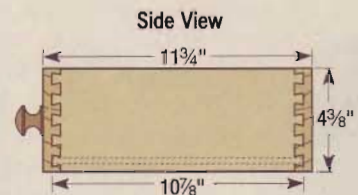
While I cleaned up all the router dust, Minniette grabbed the drawer front and headed to the drill press. She drilled the holes for the knob screws, then got all the drawer parts together on the bench so we could glue them up. All through the routing sequence she'd been talking about how strange the exposed joint halves looked and how I bullied her into this, but the drawer corners went together easily and looked great.

The grin on Minniette's face widened as she cinched up the last clamp and checked the drawer with a square, and I had to hold back an "I told you so." A little dignified restraint on my part, I thought, and maybe she'll think I'm some sort of chisel-wielding Zen master. But she was already moving on to the next step.

## Drawer Assembly View



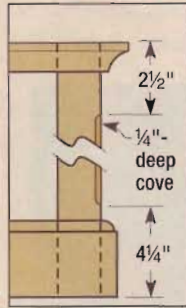
### Drawer Elevations



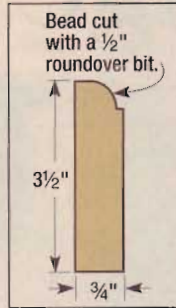
NOTE: The length of the drawer sides may vary depending on your router jig and its settings.

NOTE: If board dimension (width) is a multiple of  $\frac{7}{8}$ " (e.g.  $4\frac{3}{8}$ " =  $\frac{7}{8}$ " x 5), the dovetail spacing will be symmetrical.

## Cove Routing Detail

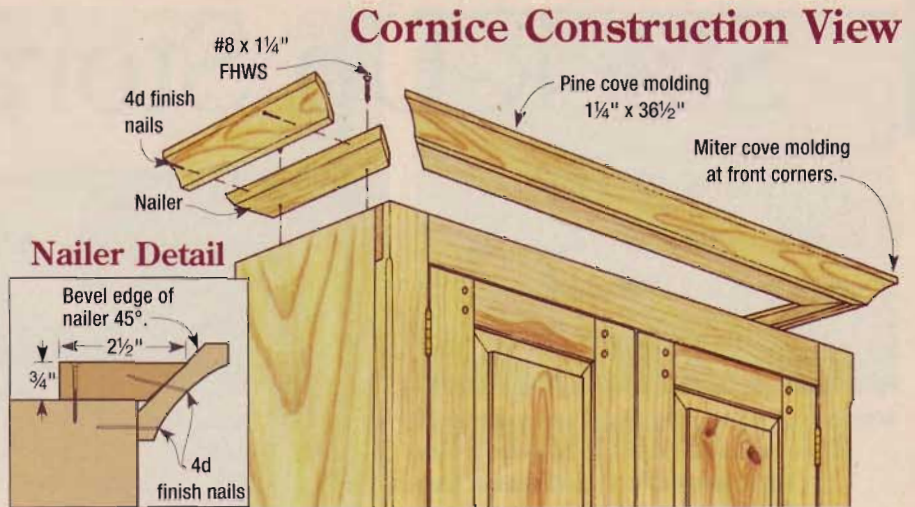


## Baseboard Detail




### Finishing Touches

We were down to the last details now. We routed a cove on the face frame edges, then machined a bead on some 1x4 pine stock for our base molding (**Cove Routing Detail** and **Baseboard Detail**). Also, Minniette bought pine cove molding for a cornice, so we used screws to fasten a nailer to the cabinet top, then cut and installed this



### molding (**Cornice Construction View** and **Nailer Detail**).

Minniette wanted to reinforce the country look with the finishes, so she chose a burgundy latex enamel for the cabinet interior and clear satin varnish for the shelves, doors, and exterior surfaces.

After a few days curing time, we installed the doors and hardware, and sat back to look at Minniette's craftsmanship. She'd done a great job despite my coaching, I told her, and had a work to be proud of. I even learned a few things myself. Maybe we'll team up again. 

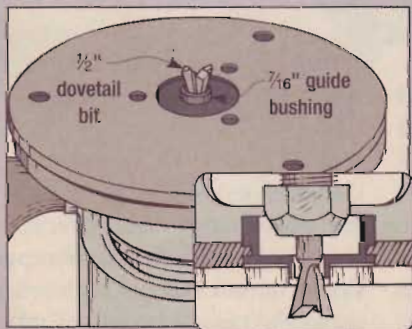
## Routing Half-Blind Dovetails

In the woodworking universe I inhabit, the half-blind dovetail reigns supreme as *the* joint for drawer building. It doesn't disturb the face of the drawer front, and it's strong enough to withstand all but the most brutal pulling and slamming the assembly might suffer.

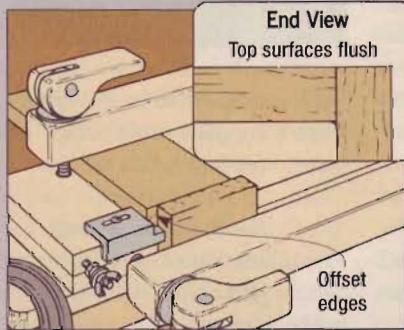
Though both workpieces get cut to form the corner, half-blind dovetails are visible from only one face of the joint, hence the name. They're harder to hand-cut than through-dovetails, but router jigs make the job simple.

You'll find minor variations on the theme, but all jigs for routing half-blind dovetails share some key features. The jig base itself has a top platform and a perpendicular front face, and attached to both are pressure bars that clamp the stock in place against those surfaces. You mark the inside face of each drawer part and clamp up

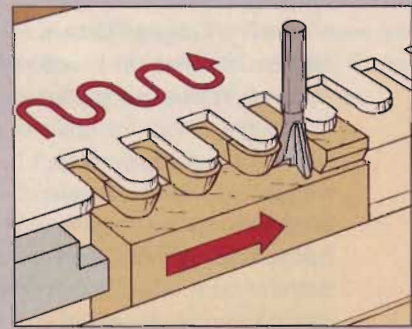
adjacent sides. A "finger" template nests atop the stock, and a guide bushing controls the router's travel as you work across the jig, routing between the template fingers. The workpieces are offset by about a pin width, and the dovetail bit cuts both halves of the joint simultaneously. The process leaves two strange-looking machined ends, but when you assemble the joint there's no evidence of the round cutter that produced it. (Note: The jig we used is available in kit form (item 5002-200) through the *Benchmark Catalog* — call (800) 475-9259 for details.)



Two standard requirements for the router base are a 1/2-inch-diameter dovetail bit and a 7/16-inch guide bushing. Test fits determine cut depth.



The jig's pressure bars clamp two adjacent parts — one vertically, one horizontally — in place for routing. Note offset edges of stock.



Guided by the template, the router cuts the pins and sockets simultaneously. The round contours are hidden after assembly.

# Stack-Up Storage

*In my shop, I seldom have to hunt for any of the tools that I regularly use when building my projects. Over the years, I've made a point of putting them away in the same place after*

I'm done working with them. But then there are those seldom-used tools and supplies that I find only when I *don't* need them.

For example, a while ago I needed to replace a window screen. I was certain I had a coil of spline and a spline roller stashed somewhere. But after digging through two plastic ice cream buckets, a milk crate, and three coffee cans of "stuff," I gave up in frustration, headed for the hardware store, and bought a package of spline and another roller.

Driving back home, I realized that my lack of organization was costing me not only the time lost searching, but also the money spent on needless duplications.

To bring order to this costly chaos, I devised a set of eight stacking drawers that slide neatly into a simple carcass. By making the drawers removable and adding built-in carrying handles, I also won't waste time running back to my shop for another part or different size screw or bolt. I can tote everything I need for a job right to where I'm working. Best of all, the entire unit takes up less than 2½ sq. ft. of precious shop floor space.

Impressed with the unit's organizational affect on my shop, I built a couple more. One is headed for the mudroom to keep shoes, boots, inline skating pads, mittens, and scarves. The other is a toy room catchall for cars, stuffed animals, dolls, and Legos. A neighbor of mine built one to house his hunting and fishing gear. In fact, the possi-



bilities are endless — craft and hobby supplies, collectibles of all types, sporting goods . . . .

## Built for Service

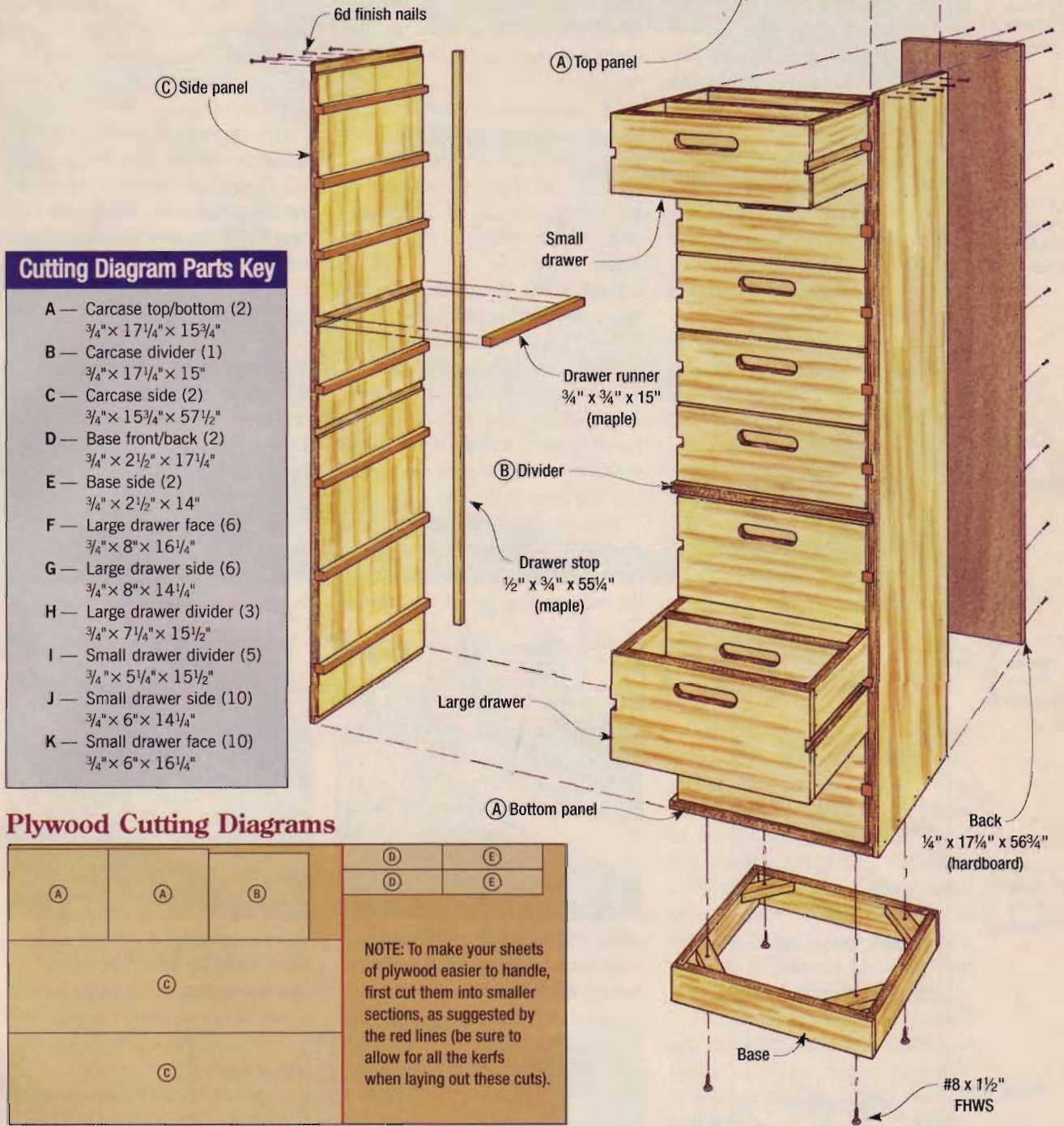
The utilitarian nature of this project means you can build it from shop-grade plywood. However, to avoid filling in gaps on the exposed edges, consider buying void-free plywood, such as Baltic Birch.

Using simple rabbeted joints makes the construction straightforward and strong (**Stack-Up Storage Construction View**). I managed to cut all the components (except the hardboard drawer bottoms and back) from two sheets of plywood (**Plywood Cutting Diagrams**).



# Stack-Up Storage Construction View

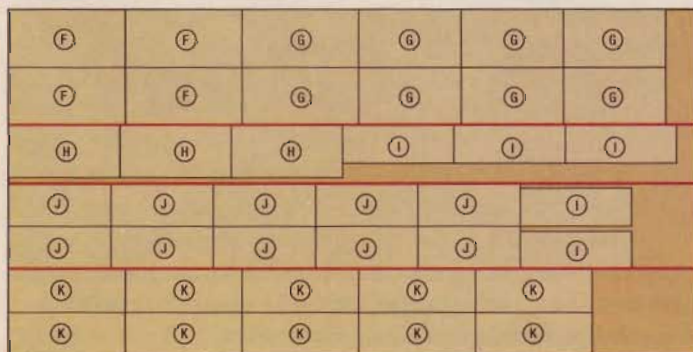
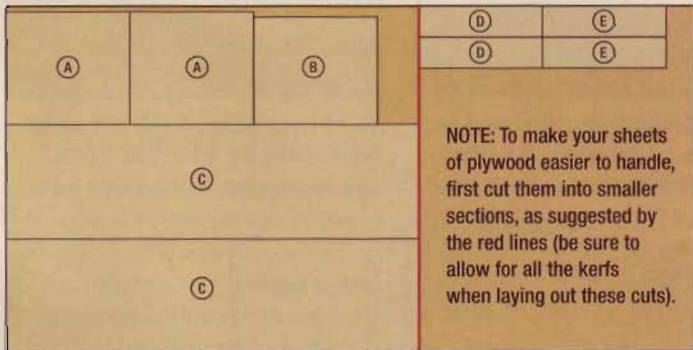
OVERALL SIZE: 15 $\frac{3}{4}$ "D x 18"W x 60"H



**Cutting Diagram Parts Key**

- A — Carcase top/bottom (2)  
 $\frac{3}{4}$ " x 17 $\frac{1}{4}$ " x 15 $\frac{3}{4}$ "
- B — Carcase divider (1)  
 $\frac{3}{4}$ " x 17 $\frac{1}{4}$ " x 15"
- C — Carcase side (2)  
 $\frac{3}{4}$ " x 15 $\frac{3}{4}$ " x 57 $\frac{1}{2}$ "
- D — Base front/back (2)  
 $\frac{3}{4}$ " x 2 $\frac{1}{2}$ " x 17 $\frac{1}{4}$ "
- E — Base side (2)  
 $\frac{3}{4}$ " x 2 $\frac{1}{2}$ " x 14"
- F — Large drawer face (6)  
 $\frac{3}{4}$ " x 8" x 16 $\frac{1}{4}$ "
- G — Large drawer side (6)  
 $\frac{3}{4}$ " x 8" x 14 $\frac{1}{4}$ "
- H — Large drawer divider (3)  
 $\frac{3}{4}$ " x 7 $\frac{1}{4}$ " x 15 $\frac{1}{2}$ "
- I — Small drawer divider (5)  
 $\frac{3}{4}$ " x 5 $\frac{1}{4}$ " x 15 $\frac{1}{2}$ "
- J — Small drawer side (10)  
 $\frac{3}{4}$ " x 6" x 14 $\frac{1}{4}$ "
- K — Small drawer face (10)  
 $\frac{3}{4}$ " x 6" x 16 $\frac{1}{4}$ "

## Plywood Cutting Diagrams



- What You'll Need**
- Lumber**
- (2) 4 ft. x 8 ft. sheet of  $\frac{3}{4}$ " plywood
  - (1) 4 ft. x 8 ft. sheet of  $\frac{1}{4}$ " hardboard
  - 8 lin. ft. of  $\frac{3}{4}$ " x 3 $\frac{1}{2}$ " maple
- Hardware**
- (12) #8 x 1 $\frac{1}{2}$ " flat-head wood screws
  - $\frac{1}{2}$  lb. 6d finish nails
  - (8) brass card file label holders (opt.)

Car Wax & Cloths

**Start with the Carcase**  
Look over your plywood and select the best surfaces for the exterior of the carcase and the drawer faces. I marked the chosen surfaces so that I could avoid cutting the dados and rabbets in the wrong side.

Plumbing Supplies

Rip the top, bottom, side, and divider panels to width, and cross-cut them to length. To rabbet the panels, install a  $\frac{3}{4}$ " dado blade in your table saw and attach an auxiliary board to the fence to protect your regular fence (**Figure 1**). Now, cut a  $\frac{1}{4}$ "-wide rabbet along the inside rear edge of the top and bottom panels. Then adjust the fence, and rabbet the ends and rear edge of the side panels.

Carving Tools

Because the side panels mirror each other, you only need to lay

out the dados on one panel (**Side Panel Elevation**). Then, after you set up for each dado cut on your table saw, machine both side panels before moving the fence for the next dado.

Cutting dados in the long side panels can be awkward, so I tackled the job in two stages. This kept roughly half of a panel balanced on the table saw at all times and improved my ability to make accurate cuts.

First, I cut the dados for the upper drawer runners with the top end of each side panel bearing against the fence (**Figure 2**). Then, I rotated the side panels  $180^\circ$  and cut the dados for the lower runners and the divider with the bottom end of each side panel bearing against the fence.

To assemble the carcase, spread glue in the divider dado and the rabbets at the top and bottom of the side panels. Insert the divider

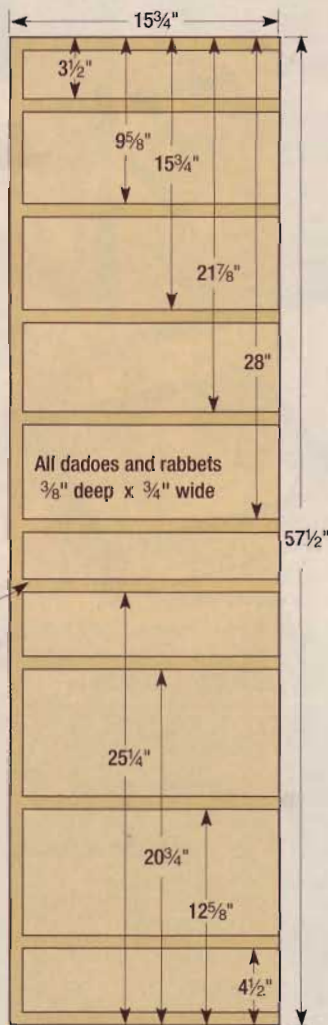
and the top and bottom panels, and clamp them in place (**Figure 3**). I glued up the carcase face-down on my workbench, relying on the bench's flat surface to help keep the front edges of the carcase pieces lined up.

The carcase assembly must be square to ensure that the drawers will fit properly later on. Measure the diagonals and adjust the carcase until the two measurements are equal. For added strength, drive five evenly spaced 6d finish nails into each joint.

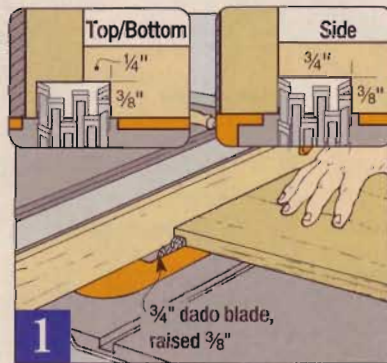
### Ready the Runners

When the glue dries on the carcase assembly, it's time to add the drawer runners. I used maple for the runners to withstand the wear of loaded drawers rubbing against them. Rip and crosscut the runners to size, and install them one at a time, spreading glue in the dado and clamping the runner in

### Side Panel Elevation



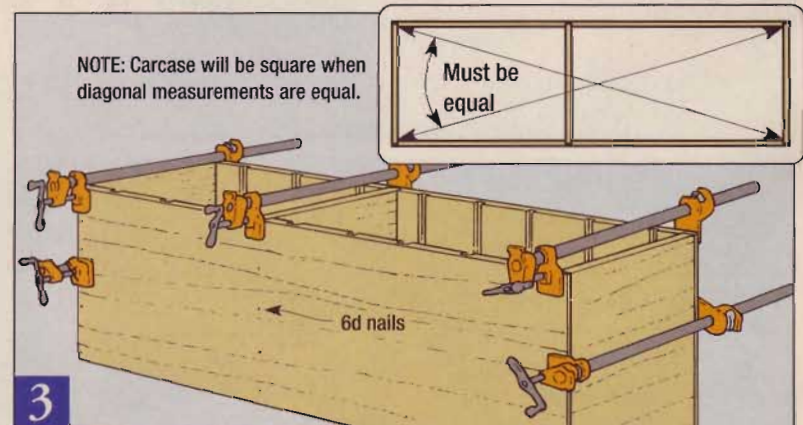
Building Blocks



1 Using a  $\frac{3}{4}$ " dado blade and an auxiliary wood fence, cut the rabbets in the top, bottom, and both side panels.



2 Cut matching dados in both side panels before moving the fence. Dado for the upper runners first, then the lower runners.



3 Glue and clamp the carcase assembly together, keeping the edges of the panels flush. Measure the diagonals to check the carcase assembly for square.

Ball Gloves & Cleats

place (**Runner & Stop Details**). Remove any squeeze-out with a cabinet scraper or chisel once the glue dries. Attaching 16 runners is as tedious as it sounds, but I sped things up with a few extra clamps borrowed from a neighbor.

### Stops Spare the Back

The carcass back presented me with a minor design dilemma. My penny-pinching conscience told me to use the 1/4" hardboard I already had on hand instead of buying a third sheet of 3/4" plywood. Yet, I was concerned that shoving in a drawer filled with pipe fittings and wrenches might blow the thinner material right off the cabinet.

I realized that by installing 1/2"-thick hardwood drawer stops to absorb the brunt of the blows, I could use the hardboard after all (**Runner & Stop Details**). Glue and nail the drawer stops in place, but leave the hardboard back off for now to make fitting the drawers and applying the finish easier.

### Add the Plywood Base

It occurred to me that I needed to provide some ground clearance for the bottom drawer, so I decided to put a base under the carcass (**Base Construction View**). Once the base front, back, and sides are cut to size, rabbet both ends of the base front and back. Then glue the assembly together (**Base Elevation**).

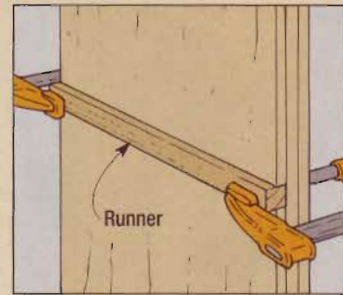
Corner braces add strength as well as means to attach the base to the carcass. To make them safer and easier to fabricate, lay the braces out on a 24"-long piece of stock, then use your table saw to make the 45° cuts (**Figure 4**). To keep the blocks uniform in length, I installed a wood extension with a stop block on my miter gauge.

Clamp the four pieces together and, with a drill press, bore the countersunk screw holes in the corner braces (**Figure 5**). Then unclamp the braces and drill the 1/4" base mounting holes.

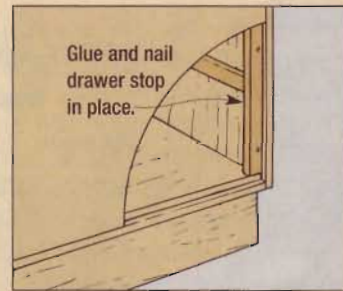
Mount the corner braces by cutting a piece of 2x scrap to temporarily hold the braces flush with the top edge of the base assembly. When you get the braces aligned, glue and screw them in place.

Delay installing the base on the carcass until after you've applied finish to the project. This will allow you to seal the edges of the plywood base against moisture from damp floors.

## Runner & Stop Details



With the case assembled, apply glue to the dadoes and clamp the drawer runners in place.



Glue and nail the drawer stops in place along the rabbeted back edges of the case sides.

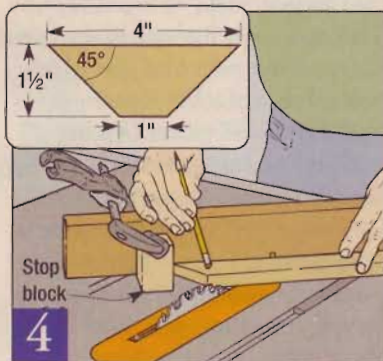
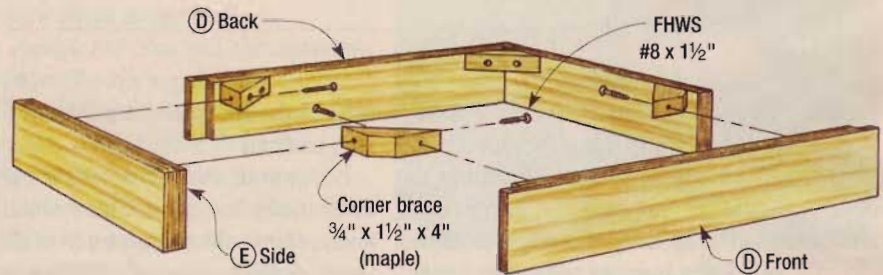
Ribbons & Bows

Binoculars & Maps

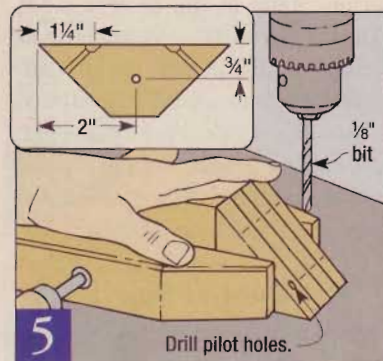
Pet Supplies

Paint Brushes

## Base Construction View

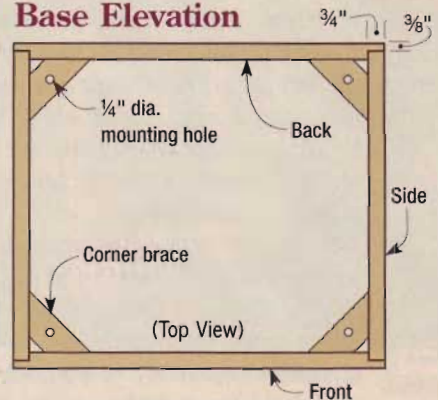


Cutting the four corner braces from a 24"-long piece of stock allows you to safely miter the ends using your table saw.

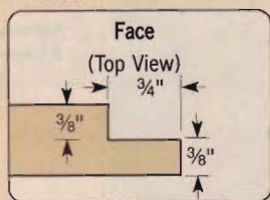


Drill the pilot holes by clamping the corner blocks in a handscrew clamp with the mitered face on the drill press table.

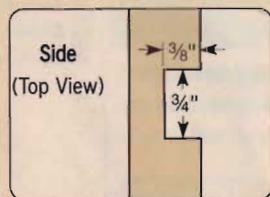
## Base Elevation



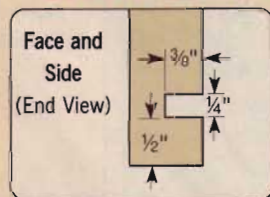
## Rabbet Detail



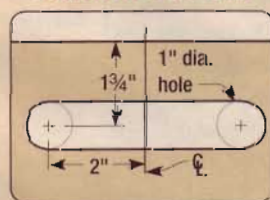
## Dado Detail



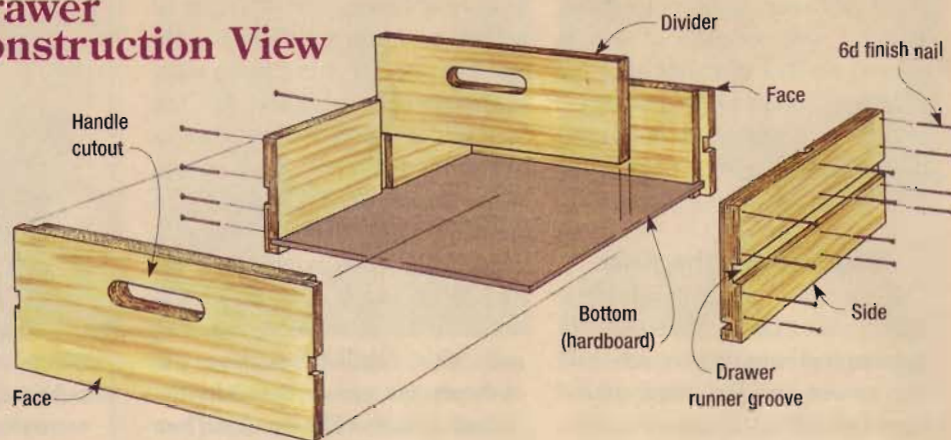
## Groove Detail



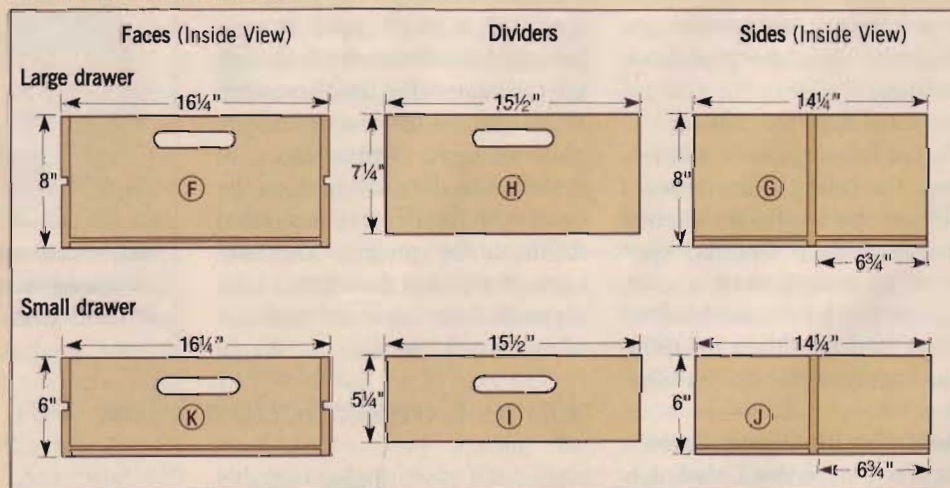
## Handle Detail



## Drawer Construction View



## Drawer Elevations



Electrical Supplies

Mittens & Gloves

Flower Seeds

### Machine the Drawer Parts

I designed the drawers with a couple of things in mind. I wanted to make them easy to carry and divided to keep small parts separated. Each drawer features a handle cutout on the front and rear face which eliminates hardware and lets me get a two-handed grip on extra heavy loads (**Drawer Construction View**). A third handle cutout in the divider lets me carry the drawer like an old-fashioned carpenter's tool tote, and a sturdy, inset hardboard bottom completes the package.

Round up all the face and side pieces for both the small and large drawers. Because they look roughly the same size, stack the faces and sides separately so you don't mix them up. (I had to make an extra side piece after I accidentally

rabbeted one while cutting the face pieces.)

Equip your table saw with a  $\frac{3}{4}$ " dado blade and an auxiliary wood fence, then rabbet both ends of all the drawer faces (**Drawer Elevations** and **Rabbet Detail**). Next, adjust your fence and cut the divider dado in the drawer sides (**Dado Detail**), although you should omit this step if you want undivided drawers. Next, switch to a  $\frac{1}{4}$ " dado blade, reset the fence and cut the groove for the drawer bottom in all the drawer faces and sides (**Groove Detail**).

### Cut Out the Handles

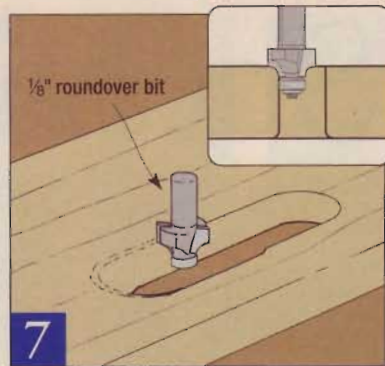
Creating the 24 handle cutouts was my least favorite part of this project, but I found a rhythm after cutting a few. First, layout the center point of the 1" holes at each

end of the handle cutouts on all the drawer faces and dividers (**Handle Detail**). With a drill press, drill the holes where marked, using a backing board to prevent tearout. Next, use a jig saw to rough out the waste between the holes (**Figure 6**). File the handle slots to your layout lines and sand the edges smooth. To ease the edges of the handle holes, I routed a  $\frac{1}{8}$ " roundover on both faces of all pieces (**Figure 7**).

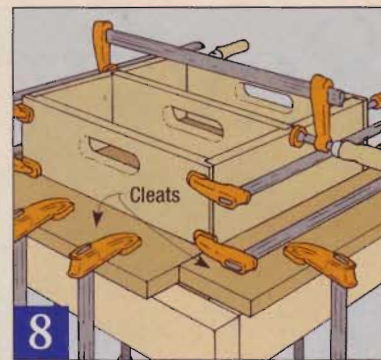
With the drawer bottoms cut to size, dry-fit each drawer before the final assembly. To keep the assemblies square, I glued up the ends, sides, dividers, and bottoms by butting them against two cleats clamped to my workbench at a right angle (**Figure 8**). Drive 6d finish nails into the corner and divider joints to help hold the



**6** Use a jigsaw to remove the waste between the 1" holes to form the handle cutouts. File and sand the edges smooth.



**7** Chuck a 1/8" roundover bit in your router, then relieve the edges of the handle cutouts on both faces.



**8** Glue and clamp the drawer assemblies against right angle cleats attached to your benchtop to keep things square.

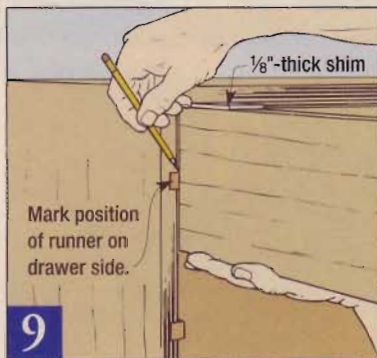
drawers together. (Be sure not to drive any nails near where you'll soon cut the 3/16"-deep grooves for the drawer runners.)

### Fitting the Drawers

With the drawers glued up, you're on the home stretch and it's time to cut the grooves in the drawer sides for the runners. Starting with the top drawer, hold it in place against the carcass with a 1/8"-thick shim to position the drawer below the top panel, then mark the location of the grooves (Figure 9). Set the cutting height of your 3/4" dado blade at 3/16", then cut the groove in each side of the drawer (Figure 10).

Check the fit of the drawer on the runners. If the drawer fits tightly between the runners, raise the dado blade very slightly — the overall effect doubles because you're making a pass in both sides — and cut the grooves deeper. If the groove edges fit tightly on the runners, shim or adjust your dado blade to cut a slightly wider groove. Following this same procedure, fit the remaining drawers by shimming them off the bottom edge of the drawer above them.

Because the drawers are constructed of plywood, wood movement shouldn't pose a problem. However, the hardwood drawer runners may swell and shrink with seasonal changes in humidity. If the drawers do tighten up later on, sand the runners until the drawers operate smoothly, then reapply



**9** Mark the position of the runners on the drawer, using a 1/8" shim to maintain spacing between the drawer and top.

some finish. Rubbing parafin on the runners also helps keep the drawers sliding freely.


### Finishing Up

When you're satisfied with the fit of the drawers, fill in any nail holes or voids with wood putty, and sand the case and drawers. Before I nailed the back in place, I applied finish to the inside of the carcass and the interior surface of the back. Apply two coats of water-based polyurethane, sanding lightly between coats with 220-grit sandpaper. Then nail on the optional brass label holders, centered below the handle slots.

While I waited for the last coat of finish to dry, I sorted my pails, crate, boxes, and cans of stuff into logical piles. I managed to fit everything into six drawers, leaving extra room for future expansion. And true to my theory about lost tools reappearing once they're not



**10** Use a 3/4" dado blade to cut the grooves in the drawer sides to accommodate the hardwood drawer runners.

needed, one drawer now contains two spline rollers and enough spline to replace every screen in the house. But now that I have the tools and supplies ready to go, I'll probably never have to replace another screen. 



- Model Paints
- Drywall Supplies
- Fishing Tackle
- Knitting Supplies

# Savvy Shelving



*Around my house, there's never enough display shelf space. Wall-mounted, adjustable track shelving is hard to beat for sheer flexibility and ease of*

installation — if only it didn't look so bare and institutional. However, building such shelves entirely out of wood poses a real challenge in terms of strength and aesthetics. Build them heavy enough to support a load of books or an aquarium, and the things wind up looking just plain clunky. Construct

them with thin, eye-pleasing lines from anything except high-strength, space-age materials, and they can't handle the weight. But I figured out how to have my cake and eat it too. By combining store-bought adjustable shelf hardware with handcrafted wooden housings, I got beautiful shelving that still has strength and flexibility.

## A Heart of Steel

At the heart of this project is Element Decorative Heavy-Duty Shelving from Knape and Vogt Mfg., (800) 253-1561. This system, which can be found at most hardware stores and building centers,

features metal standards that mount to the wall, and U-shaped metal shelf support brackets that lock solidly into the wall track.

These beefy standards have a double row of slots in a heavy-gauge 1"-wide track. My design partially conceals these standards by fitting them into a groove cut into the front plate of the column assemblies (**Shelving Construction View**).

Improving the appearance of the metal shelf brackets called for a somewhat more creative approach. I decided to sandwich them between two pieces of 1/4"-thick stock. A 1/2"-thick spacer joins these thin outer covers and also conceals the underside of the metal brackets. (If you want to produce your own thin stock for this or other projects, refer to *Safe Resawing: Two Techniques* on page 47.)

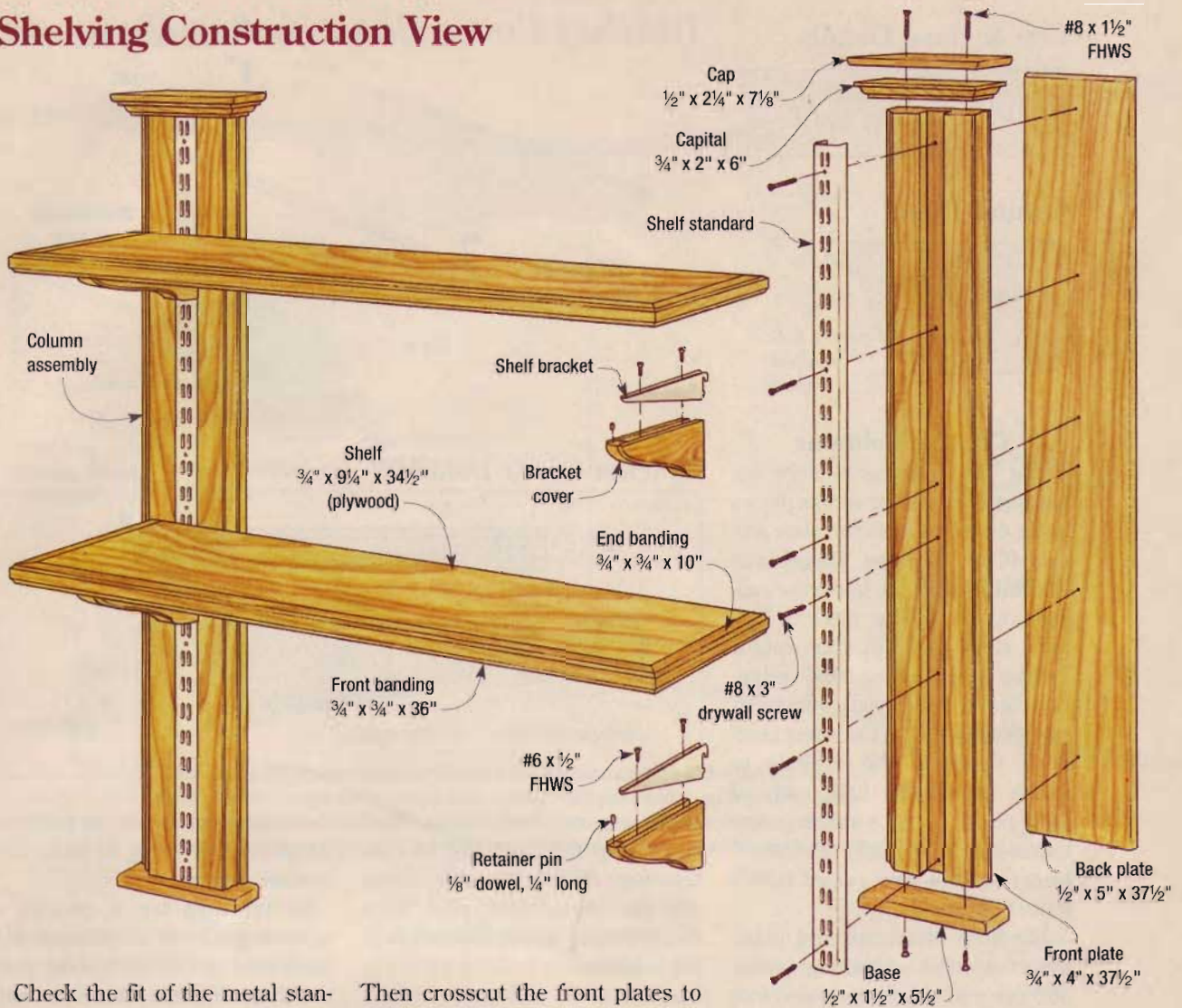
The shelf boards complete the system. For greater dimensional stability and to keep the cost down, I built these from 3/4" oak plywood, then used thicker-than-usual edge banding to add more rigidity.

## Start with the Columns

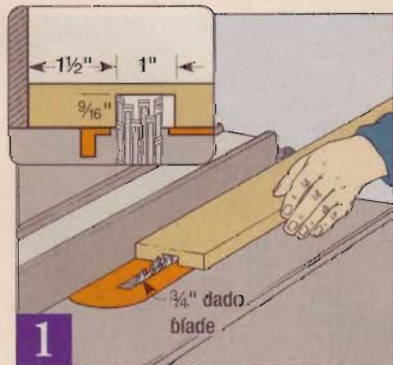
The metal standards are the backbone of this shelving system, so I started by building the front plate and back plate of each column assembly. Rip some 3/4"-thick stock to size for the front plates, and rip some scrap material (no sense in wasting good stock) to this same width for use in the next step.

Set up your table saw with a 3/4" dado blade — you'll have to cut the 1" wide grooves in two passes. Now adjust your fence to cut a groove in a piece of the scrap material (**Figure 1**). Make one pass, then rotate your scrap board end-for-end and make a second pass without changing the fence setup.

# Shelving Construction View



Check the fit of the metal standard in the groove — a snug fit, flush with the surface is best. Adjust the fence position and blade height, if necessary, and cut another test piece. Once you're satisfied with the fit of the standard in a test piece, cut the grooves in your front plate stock.



**1** Plough the groove in the standard housing in two passes. Rotate the workpiece end-for-end before making the second pass.

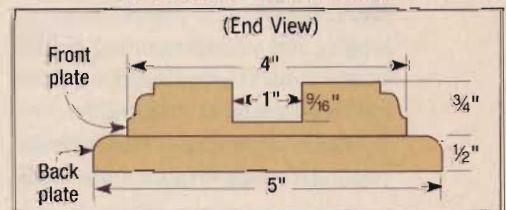
Then crosscut the front plates to length to match the length of your metal standards.

How you choose to dress up the edges of the front plates is a matter of personal preference. For example, I wanted mine to match other woodwork in my family room, so I routed a Roman ogee profile in the edges of each piece (**Column Elevation**). For ideas on other profiles, see *Shelving Variations* on page 48.

Gluing a back plate to each front plate improved the visual and structural quality of the column assemblies. Cut your black plates to size, then rout a 1/4" roundover on the front edges of each piece so they blend better with the routed edges of the front plates.

When gluing the back plates to the front plates, be sure to keep the ends flush.

## Column Elevation



## What You'll Need

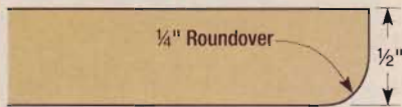
### Lumber

- 1/2 sheet of 3/4"-thick oak plywood
- 3 bd. ft of 3/4" oak
- 4 1/2 sq. ft. of 1/2"-thick oak
- 3 sq. ft. of 1/4"-thick oak

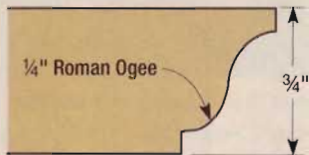
### Hardware

- (2) Knap & Vogt 3200-095 shelf standards
- (6) Knap & Vogt 3210-22 shelf brackets
- (12) #6 x 1/2" flat-head wood screws
- (8) #8 x 1 1/2" flat-head wood screws
- (8) #8 x 3" drywall screws

## Cap & Base Details



## Capital Detail

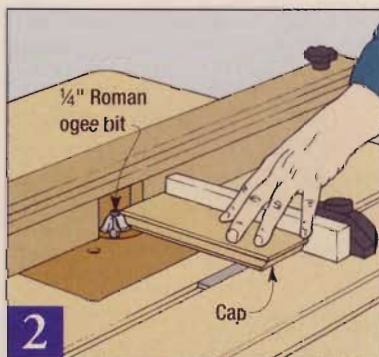


### Cap the Columns

I gave the columns a more finished look by adding simple pieces to the ends that echo the plate profiles (**Cap & Base Detail** and **Capital Detail**). To make the capitals, rip an 18"-long piece of  $\frac{3}{4}$ "-thick stock to width, then rout a Roman ogee along one edge. (Machining small parts from over-size stock is always the safest practice.) Crosscut the capitals to length and profile both ends of each piece, using a miter gauge extension to support the small pieces against your router table's fence (**Figure 2**).

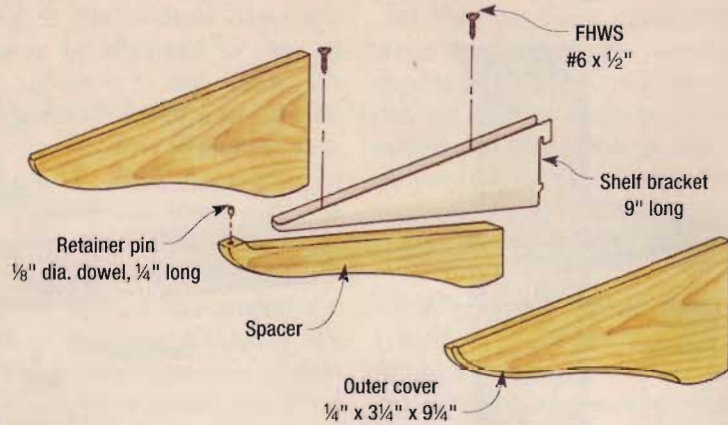
Machine the cap and base pieces from an extra-long (about 36") piece of  $\frac{1}{2}$ "-thick stock. First, rip the board to  $2\frac{1}{4}$ "-wide, and rout a  $\frac{1}{4}$ " roundover on one edge. Next, crosscut the cap pieces to length. Rip your remaining length of stock to  $1\frac{1}{2}$ "-wide, then crosscut the base pieces to length.

Finish up at the router table by routing roundovers on both ends

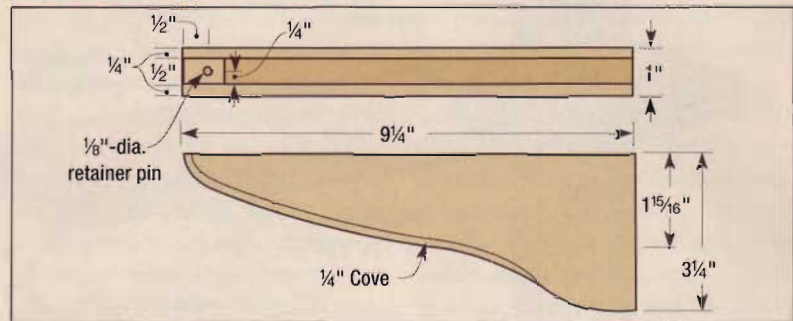


2 Rout the profiles in the ends of the cap pieces. Supporting the cap pieces with a miter gauge extension prevents tearout.

## Bracket Cover Construction View



## Bracket Cover Details



of the cap and base pieces. Glue and clamp the caps and capitals together. When the glue dries, drill the countersunk pilot holes and screw the pieces to the ends of the columns.

### Build the Bracket Covers

After sizing up some books, I decided to make my shelves 10" wide, which called for 9" metal shelf brackets. (There are seven other bracket sizes for shelf widths from 6" to 24".) Whatever size brackets you choose, have

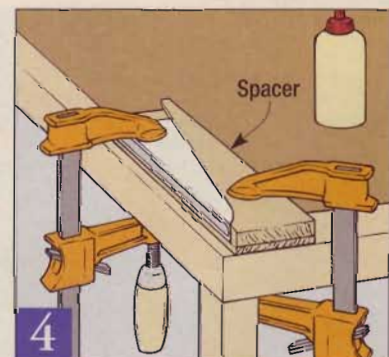
them on hand to use as patterns when you get ready to make the bracket covers.

Rather than try to plough a tapered groove in 1"-thick stock, I contoured a  $\frac{1}{2}$ "-thick spacer to the shape of the bracket and sandwiched it between two outer covers of  $\frac{1}{4}$ " stock (**Bracket Cover Construction View**).

To make each cover, begin by tracing the shape of the bracket onto an over-size piece of stock (**Figure 3**). Use a jig saw or band saw to cut the spacer to shape,



3 Mark the bracket's shape on a piece of  $\frac{1}{2}$ "-thick stock, keeping the top and rear edges of the board and bracket aligned.



4 Clamp the bracket to a piece of  $\frac{1}{4}$ "-thick stock, then glue and clamp the  $\frac{1}{2}$ "-thick spacer in place against the bracket.



then sand the edge smooth. Mark and drill a  $\frac{1}{8}$ " hole for the retainer pin (Bracket Cover Details).

I glued up the bracket covers in two steps. First, I laid an outer cover on my workbench and loosely clamped a metal bracket to it with the top and rear edges aligned (Figure 4). I applied glue to the spacer, positioned it against the bracket, and clamped it in place. When the glue dried, I unclamped the pieces.

Second, I placed the remaining outer cover on the workbench, applied glue to the other side of the spacer, then clamped the cover-spacer assembly to the second cover piece, making sure to align the edges.

### Shaping the Covers

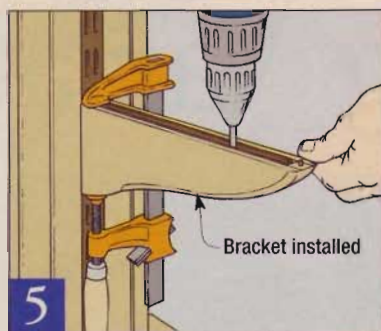
Make a pattern of the bracket cover shape out of heavy cardboard and use it to layout the shape on the blanks (Bracket Cover Details). With a jig saw or band saw, cut the bracket covers roughly to shape, sawing to the waste side of the line. I chucked a sanding drum in my drill press to do the final shaping. A  $\frac{1}{4}$ " cove routed along the bottom edges completes the covers.

### Make the Shelves

Fabricating all the bracket covers made building the shelves seem simple. Cut the shelf boards to size on the table saw. Next, rip oak banding to width, miter the ends, then glue and clamp it on the front edge and ends of the shelf boards. When the glue dries, scrape off any squeeze-out, and rout a  $\frac{1}{4}$ " cove in the top and bottom edges of the banding pieces.

### Finishing Up

With all the pieces sanded to 180-grit, I applied a coat of stain to everything, then followed up with two coats of wipe-on oil-varnish. Because the metal standards come in only white or black, I gave them a coat of dark brown spray enamel to better match the stained oak.

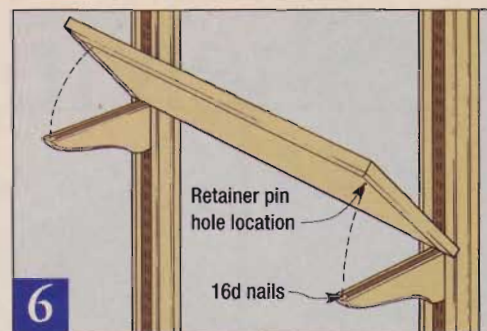


With the metal bracket installed, clamp the cover in place and drill  $\frac{1}{8}$ " pilot holes  $\frac{1}{4}$ " deep. Then drive the screws.

See the metal standards into the front plate grooves, then drill  $\frac{3}{16}$ " pilot holes through the columns at each of the standard's mounting screw holes. Attach the columns to the wall studs with  $\#8 \times 3$ " drywall screws.


Tap the metal brackets into their locked position, and clamp the bracket covers in place. Drill  $\frac{1}{4}$ "-deep pilot holes in the covers, using the holes in the metal brackets as a guide (Figure 5). Install  $\#6 \times \frac{1}{2}$ " wood screws to hold the covers to the brackets.

Position the retainer pin holes in each shelf board by clipping or



Temporarily install clipped 16d nails in the retainer pin bracket holes. Press the shelf down to mark the location for the pin holes.

hacksawing  $\frac{1}{4}$ " off the pointed end of two 16d nails, and inserting them point up in the holes in the bracket covers (Figure 6). Center the shelf, then press it onto the nail points to mark the pin hole locations. Drill a  $\frac{1}{8}$ " hole,  $\frac{3}{16}$ " deep at the marks, install a  $\frac{1}{4}$ " length of  $\frac{1}{8}$ "-dia. dowel in the bracket covers, then seat the shelf onto the pins.

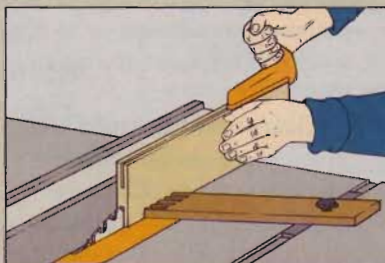
My shelves are now home to a collection of yet-to-be read novels and some keepsakes retrieved from storage. Seeing how quickly these shelves filled, I should have doubled the "recipe." Keep that in mind when you build yours. 

## Safe Resawing: Two Techniques

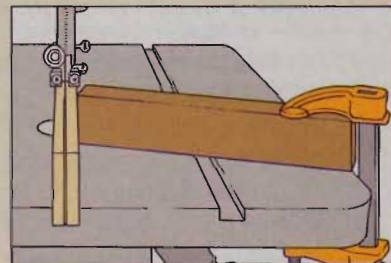
Resawing is cutting stock through its width to obtain thinner pieces. Most home woodworkers have two options when it comes to resawing, and each has its advantages.

You can use a table saw and make progressively deeper cuts from two edges, then finish the cut with a handsaw. The other way is to make the cut on a band saw, using a fence. With either method, the width of the stock to be resawn is limited by the saw's depth of cut.

The table saw yields smoother stock, but the blade cuts a wider kerf than the band saw. Even with a fence, the band saw will leave a rippled surface that requires more sanding or planing. Always cut the stock slightly thicker than you need, then plane or sand the stock to final thickness.

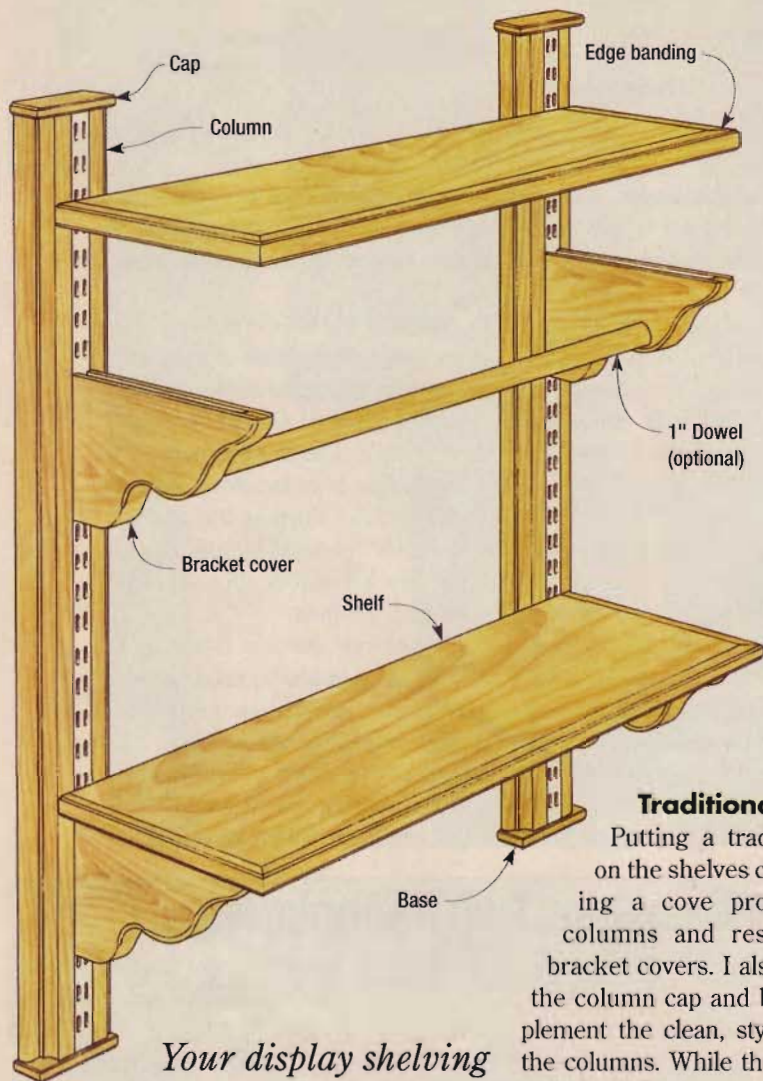


Make progressively deeper cuts in both edges, keeping the same face of the board against the table saw's fence.



If your bandsaw doesn't have a fence, or if the blade doesn't track squarely to the table, try using a single-point fence.

# Shelving Variations



*Your display shelving needs and home decor may call for a much different set of shelves than those shown on the previous pages. But that's where the beauty of*

our design shines through. Because the moldings and bracket covers change the appearance of the metal shelving hardware without affecting its functionality, the design possibilities are unlimited. Whether you build one of the options shown here or create your own, just follow the same basic building techniques as described in *Savvy Shelving* on page 44.

## Traditional Styling

Putting a traditional spin on the shelves calls for routing a cove profile in the columns and reshaping the bracket covers. I also simplified the column cap and base to complement the clean, stylish lines of the columns. While the traditional-style bracket covers measure 5<sup>3</sup>/<sub>4</sub>" wide, you should still be able to resaw the necessary thin stock on a 10" table saw.

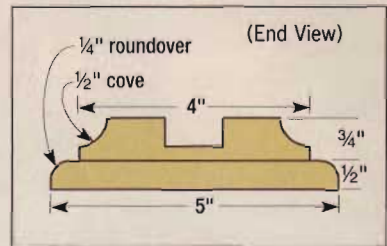
By drilling holes in the opposing faces of two bracket covers, you can mount a dowel between the brackets that can serve as a towel bar in a bathroom installation, or to display a piece of fabric art or a quilt.

## Clean and Simple Lines

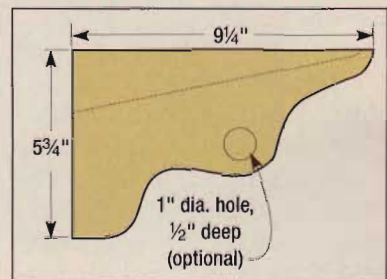
For a more straightforward look, you can scale back the width and thickness of the columns and straighten the lines of the bracket covers. Not only is this design cleaner looking, it's easier to build. The one-piece column consists of

## Traditional Styling

### Column Profile



### Bracket Cover Profile

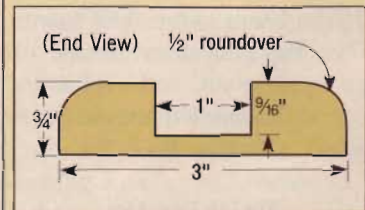


only a standard housing that has a simple 1/2" roundover routed in the front edges.

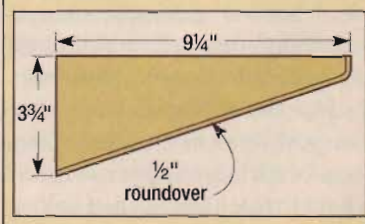
I also eliminated the cap and base from this design to keep things simple. Repeating the 1/2" roundover on the exposed, lower edges of the bracket covers ties them visually to the columns.

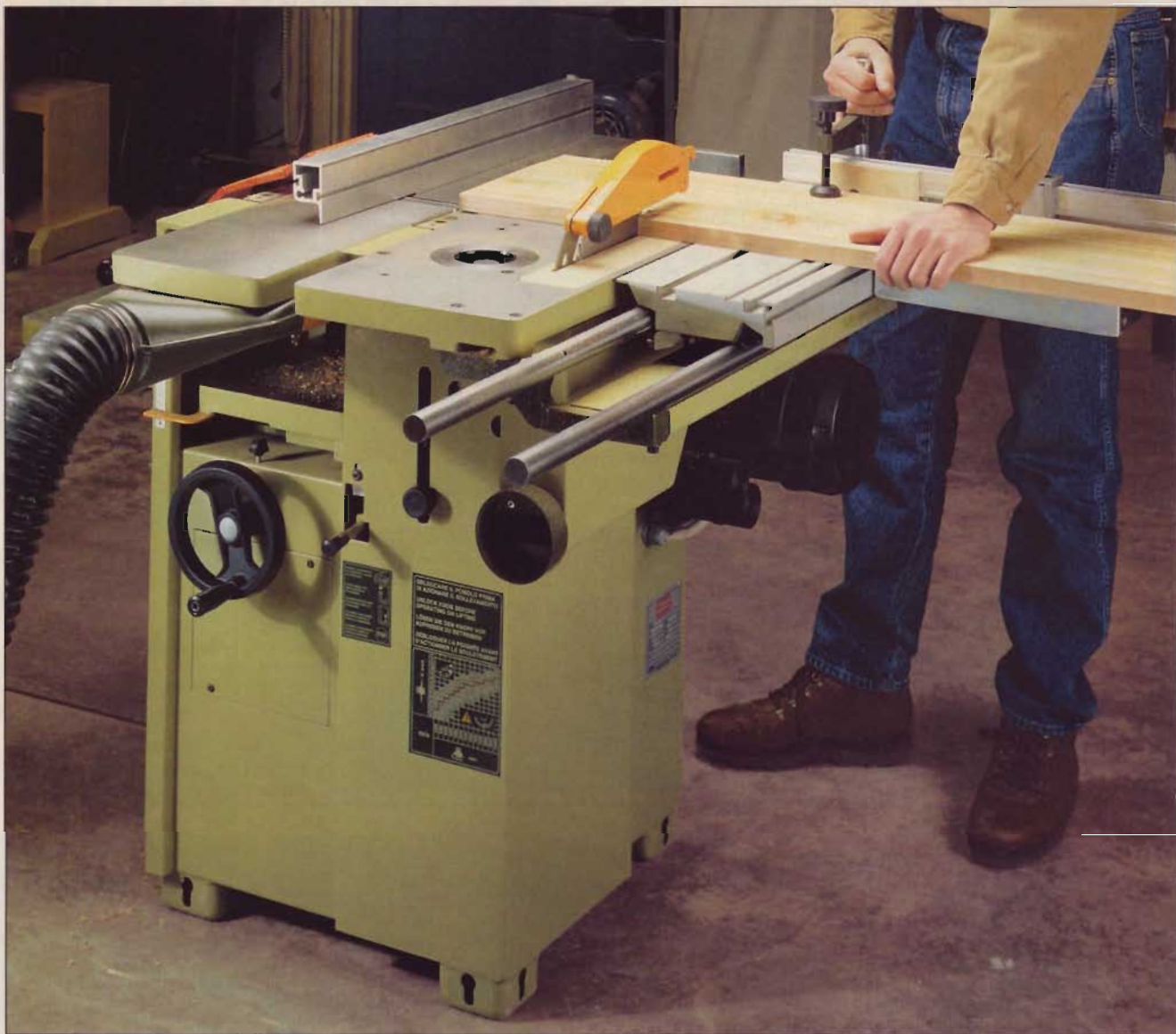
## Contemporary Styling

### Column Profile



### Bracket Cover Profile





# EuroShop C-220

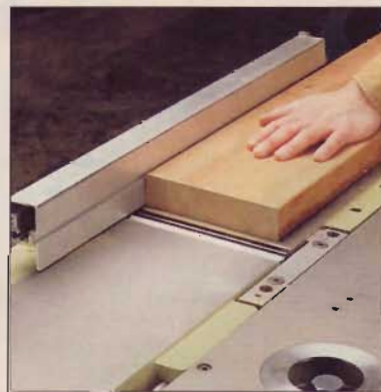
*With the exception of the Shopsmith-style equipment, most serious combination machines have been born and bred in Europe. There, these hybrids mesh well with local*

woodworking traditions and the relative scarcity of shop space.

In the states, though, such machines have had to compete for a different audience — woodworkers used to single-purpose equipment.

## **Newcomers From Italy**

While the U.S. market for combination machines may be a tough sell for importers, the demand has been steady enough for companies like Felder and Robland (of Austria and Belgium, respectively) to ship their wares across the Atlantic and maintain a modest sales and service network. These two veterans were joined recently by EuroShop, an Italian competitor with three new combination machines aimed directly at North American woodshops.



The jointer will surface stock up to 8" wide, but requires a bit of a reach. (The swing-away guard has been removed.)

EuroShop offers machines in several packages — the SC-30 and C-300, larger units driven by three separate motors, and the C-220, a compact design that shares a single 2.4-hp powerplant among its five functions (table saw, shaper, jointer, planer, and slot mortiser). Because it's smaller, less costly, and intended for home shop woodworkers short on elbow room, we decided to bring the C-220 into the *Workbench* shop for a closer look.

### The Nature of the Beast

With any combination machine, it's a given that you have to live with some compromises to get all those functions into one package. And there's the rub. Though each individual system in the C-220 provides the heft of a small industrial machine, the package suffers from the awkward maneuvers it takes to change and perform operations.

Taken alone, each station's shortcomings are nothing more serious than limited capacities or small table space. Start moving around the machine, though, and you'll find your work flow stalls.

The reason? There's a whole lot of sharing going on. The shaper spindle, planer table, and mortiser table all travel on the same vertical adjustment mechanism, so setup changes on one undo the others — a pain if you need to return to that setting. Also, the spring-loaded jointer guard interferes with many workpieces being run through the shaper and table saw. Quick-release hardware would provide an obvious solution here, but instead you have to hunt for a hex key wrench every time.

The table saw ripped nicely, and the sliding table worked beautifully for crosscutting, but miter fence adjustments were clumsy. Also, the stamped steel extension table mounted awkwardly with hard-to-reach hardware, almost like it was stuck on as an afterthought.

More seriously, the table saw lacks a tilt-arbor feature, and it won't accept a stacked dado blade.

This means cutting dados and beveling edges has to be done on the shaper, and will be limited by the tooling you have available (a 1/2" router collet is included).

Shifting the motor drive among the different stations is done via an external locking lever — a convenient feature, but one that gave us a scare during a crosscut operation on the table saw. The jointer guard was off to make room for the end of the workpiece, and the drive belt failed to disengage completely from the jointer cutterhead — leaving three exposed knives to spin dangerously around. The distributor assured us that proper belt adjustment prevents this.

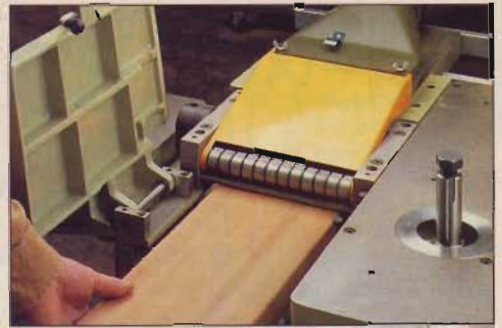
### A Place for Everything?

Certainly there is a niche for this machine, but it has to be a blend of very specific conditions — tight shop space coupled with the need for several heavy-duty machines at a reasonable cost. (The C-220 sells for about \$3,500, versus the more than \$6,500 it would take to buy separate tools of similar quality.) If that fits you, and if you don't mind the setup aggravations, the C-220 will certainly get the job done.

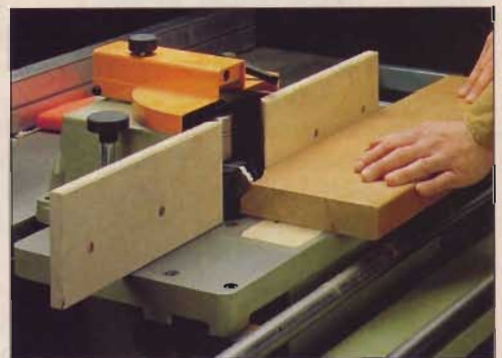
But a place for everything can't ensure that everything's in the right place, and at the right time. Some woodworkers with space and budget limitations might be better served with separate medium-duty or even benchtop tools.

If your heart is set on a heavy-weight machine, EuroShop's larger sibling, the SC-30, looks much more promising. It's powered by three motors, features a 10" tilt-arbor saw, a 12" jointer/planer, a shaper, and independent setups so the different operations don't overlap as much. It weighs more but is still compact, and sells for \$4,700 — a small increase for the added features. Again, the issue is trade-offs, and no one but you knows the balance that's best for your work.

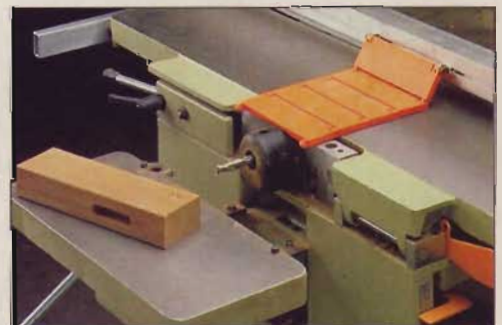
For more information, contact Old World Machinery Co., San Clemente, CA (800)203-0023.



The jointer tables fold up to reveal the planer. The hinged dust hood pivots in place for either operation — a nice touch.



Room is tight, but the shaper/router can mill edge profiles or joinery details. The table saw can't dado, so that's done here.



Though the table mount seems lightweight (only two bolts), the mortiser was fast and produced accurate results in this 2x stock.



An external lever controls the belt drive system, switching between functions. It can require monitoring to work properly.

# New Tool Offerings

## Porter-Cable Drives Nails Without Air Hose

I've always wanted an air nailer, but as a do-it-yourselfer, I didn't think I could justify buying one. I tried to convince myself I didn't need one — that dragging around the air hose would be cumbersome, and that it would be a hassle to buy special nails. Besides, I always figured the money I'd spend for a nailer and the compressor to run it would buy me a lot of Ben-Gay to soothe my aching arm.

In the past couple years though, I've had more trouble convincing myself not to get a nailer. Prices have come down, and manufacturers have developed new power sources to drive the nailers, eliminating the need for a compressor.

The latest manufacturer to offer an airless version of this tool is Porter-Cable Corp. The company's Bammer Cordless Nailers use some impressive technology to make a nailer that works not just without air, but without batteries, chargers, or motors.

Power for the Bammer line comes from a disposable liquefied gas fuel cell. When ignited, the cell drives a piston that pounds in the nail. Each cell will drive around 3,000 nails.

Other cordless nailers use a battery to provide a spark that ignites the fuel. Bammer nailers, though, have triggers that convert mechanical movement into electrical energy

using Piezo electric technology. (For those of us who remember phonographs, it's the same way a needle moving back and forth in a record groove makes an electric pulse to create sound.)

Porter-Cable offers two Bammer nailers that use the same fuel cells. The first model, CDA250, drives 15-gauge finish nails from 1 $\frac{1}{4}$ " to 2 $\frac{1}{2}$ " long. It's designed for fastening molding and trim, and has an angled nail magazine to make reaching into tight places easier. You can drive 16-gauge nails of the same lengths using the CFN250 nailer.

In addition, the line includes the CMS200 medium-crown stapler.

All of the tools share a number of design features in addition to their fuel cells and Piezo electric triggers. You don't have to add lubricating oil that, with traditional air nailers, can be released with the fastener and possibly stain the workpiece.

An adjustable depth guide means you can set each tool to drive and countersink nails to the depth you want. Nail magazines are made of anodized aluminum to save weight, but have steel nail guides designed

to wear longer and resist scoring. The tools' safety tips have a non-mar cover to protect the wood from damage.

Each Bammer comes in a plastic carrying case and includes a removable belt hook, one fuel cell, and a pair of safety glasses. Each of the guns will retail for around \$300. Fuel cells will be around \$7. For more information, call Porter-Cable Corp. at (800) 487-8665.



## Combination Drill/Driver Bits Speed Screw Installation

Combination drill and driver bits speed up boring pilot holes and installing screws, since you can switch between bits without readjusting the chuck. Unfortunately many of them use drill bits, drivers, and chuck adapters designed just for that set. Break a bit, and you're stuck until you purchase a new bit from the manufacturer.

New Jack Rabbit combination bits are different. They use an easily

replaceable standard drill bit inside a  $\frac{3}{8}$ "-diameter countersink body. Chuck any  $\frac{1}{4}$ " hex driver in your drill and you can lock the Jack Rabbit on with a friction collar that holds the bit

securely but releases it easily. Jack Rabbits are available for #6, #8, or #10 screws, and each retails for around \$20. For more information call Giffen Tec at (303) 449-9142.



## Base Turns Your Rotary Tool into a Router

As a guitar builder and repairer for over 27 years, Bishop Cochran became very familiar with the Dremel Multi-Pro rotary tool.

Like many others sharing his vocation, he uses the Dremel for a variety of tasks, from routing and inlay work to circle cutting. He used the tool for years with Dremel's router base attachment, but he longed for a base that would offer the level of precision demanded by his delicate inlay work, plus the plunge capability of a full-size router. Finally, he decided it was time to design such a base.

The result is the Bishop Cochran rotary tool Plunge Router Base, which looks like a miniature version of the base you'd find on a full-size plunge router. It accepts a Dremel Multi-Pro or Ryobi Multi-Tool (with an optional adapter). Looking at the base shows that Mr. Cochran paid careful attention to details. Quality construction is evident in the base's anodized aluminum and

hardened steel components, simple layout, and smooth operation.

Both types of rotary tools mount to a carriage on the Plunge Base using the same threaded collar that ordinarily accepts a flex shaft. I was impressed with the simplicity of mounting the tool, and with how securely the base holds the rotary tool in place.

Once mounted, the tool and carriage ride on two vertical steel guide rods. A large thumb wheel allows you to raise and lower the bit, making plunge cuts possible. Like a full-size router, there is an adjustable depth-stop rod, and a carriage lock.

The Plunge Base also features an adjustable edge guide that has a retractable pin, making it useful as a circle cutting guide as well.

With a retail cost around \$150, the Plunge Base isn't cheap. But it does give rotary tools a level of control and performance missing from their standard router base attachments. For information call Bishop Cochran Guitars at (503) 231-5694.



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# Products For Your Home

## Texture Stencil

In past issues of *Workbench*, we've brought you a number of good tips for repairing holes in drywall. Of course, the key to a good repair job is making the patch invisible, but even a well-fitted repair may show if you can't match the texture of the surrounding area.

To make hiding repairs in drywall and plaster simpler, Bondex International, Inc. has come up with Texture Repair Stencils. They allow you to recreate three commonly used textures — orange peel, splatter, and knockdown.

Choose which stencil matches the surrounding texture, then place it over the repair area. Use a wide-bladed putty knife to spread joint compound or spackle into the stencil's holes. Peel off the stencil, and paint when the compound dries.

A pack of three 8" x 10" reusable stencils retails for about \$10. Call Bondex at (800) 225-7522.



## 2-Cycle Mowers Reduce Emissions

As pollution and air quality regulations become increasingly strict, manufacturers of lawn and garden equipment have to substantially reduce their products' emissions. Companies are investing in technologies to ensure their gasoline engines comply with current and future federal standards.

Lawn-Boy Inc. is among several manufacturers developing new reduced-emission engines. The company has spent five years and over \$10 million designing new 2-cycle engines for all its mowers.

Dubbed DuraForce, these engines boast a 50% reduction in emissions, allowing them to meet or exceed current Phase 1 government requirements.

Lawn-Boy achieved this reduction by redesigning the combustion chamber, improving ignition, strictly regulating carburetion, and switching to a leaner 50:1 gas/oil mixture (previous Lawn-Boys used a 32:1 mix). The new mowers also produce less of the visible smoke common with 2-cycle designs.

This higher efficiency and a slight increase in engine displacement yield increased horsepower over Lawn-Boy's previous engines. The DuraForce engines produce 6.5-hp (up from 4.75-hp). They also feature



Lawn-Boy's Duraforce 2-cycle engines run 50% cleaner than the company's old engines.

electronic ignition and a polymer-bodied carburetor that never needs tuning and won't corrode. Other engine improvements include a beefed-up crankshaft, bigger bearings, and a larger air cleaner.

According to Lawn-Boy engineers, emissions stay constant throughout the engine's life, while 4-cycle engines' emissions can worsen with wear.

Lawn-Boy will outfit their mowers with Duraforce engines starting with the 1998 season. Prices are expected to start around \$270. Call Lawn-Boy at (800) 526-6937.

## Furnace Filters Capture Odors

No matter how much you clean, household odors are always present, especially during the winter months when homes are sealed against the cold and don't get much fresh air.

This struggle against stale air is the target of a new furnace filter called the Absorber from Web Products. In addition to an electrostatic element that captures

up to 91% of particles as small as .245 micron, the filter has an activated charcoal element designed to absorb odors for up to 90 days.

The Absorber has a plastic mesh frame and comes in one size that you can cut to fit openings from 14" x 20" to 20" x 25". It sells for around \$10. Call Web Products at (800) 875-3212.



# Universal Design Makes Kitchen Cabinets More Accessible

Commonplace though it may seem to most of us, navigating through a kitchen or reaching into cabinets is a challenge for people with physical disabilities. Just getting a sauce pan from a cabinet or washing dishes in the sink can be a daunting task.

To make kitchens more accessible, KraftMaid Cabinetry, Inc. has introduced a new line of kitchen cabinets. Called Passport, these cabinets meet specifications of the American Disabilities Act (ADA), and are certified for use in Universal Design — a philosophy of designing products and environments that are useable by everyone, regardless of their physical or cognitive limitations.

Until now, cabinets designed for accessibility often had an institutional appearance or had to be custom-built in order to blend into standard kitchens. KraftMaid has designed Passport cabinets to better match

home decors and to be more economical than custom units.

Some features that differentiate the Passport line from standard cabinets include higher toe kicks and special sink bases that allow wheelchair access. Base cabinets can be equipped with tambour doors that roll up out of the way, rather than conventional swing-out doors. Cabinets are available that position the dishwasher and stove at more convenient levels, and pull-out shelves and bins eliminate the need to reach inside to retrieve items. You can order upper cabinets with lights and see-through Plexiglas shelves to make their contents visible from below.

You can outfit a kitchen entirely from the complete selection of Passport base and upper cabinets and storage accessories. Or purchase just the components you need and match



the wood and door styles with other cabinets in the company's lines.

To learn more about Passport cabinets or to find a retailer in your area, contact KraftMaid at (800) 571-1990.

## Econ-Abrasives

WE MAKE ABRASIVE BELTS ANY SIZE, ANY GRIT!

### Standard Abrasive Sheets

#### CABINET PAPER

	50/pk	100/pk
60D	\$16.70	\$30.00C
80D	15.60	27.80C
100 thru 150C	14.50	25.60C

#### FINISHING PAPER

80A	\$ 11.15	\$18.90C
100 thru 280A	10.00	16.70C

#### NO LOAD PAPER(white)

100 thru 400A	\$12.25	\$21.25C
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"C" = 100 SHEETS

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8 Hole pattern for Bosch sanders

Dia.	Grit	Price
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\* Available in 5 hole pattern \*

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### ABRASIVE BELTS

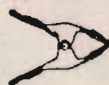
Belts are resin bond cloth with a bi-directional splice, specify grits.

1X30	\$.81 ea	3X24	\$.93 ea
1X42	.81 ea	3X27	.96 ea
1X44	.81 ea	4X21 3/4	1.06 ea
2 1/2X16	.85 ea	4X24	1.10 ea
3X18	.86 ea	4X36	1.35 ea
3X21	.90 ea	6X48	3.50 ea
3X23 3/4	.93 ea	6x89	6.24 ea

### OTHER SIZES ON REQUEST

### HEAVY DUTY SPRING CLAMPS

Clamps come w/PVC tips and grips.



Size	Price
4"	\$1.75 ea
6"	2.25
8"	3.50

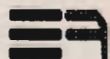
### JUMBO ROUTER PAD(24" x 36")

It will not allow small blocks of wood to slip out under router or sanding applications. ROUTER PAD ONLY \$8.95ea.

### JUMBO BELT CLEANING STICK ONLY \$8.80

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Product Information Number 180

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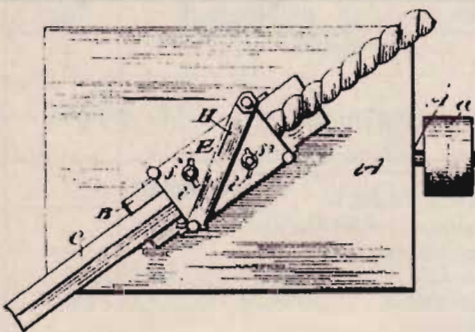
# Doing The Twist

If you visit Cleveland, Ohio these days, you can see Chubby Checker memorabilia at the Rock and Roll Hall of Fame and Museum. But more than a century ago, Moses Y. Ransom, a planing mill owner, was already doing the twist in that city.

When Ransom applied his skills to decorative wood specialties, he developed and patented a system for cutting helical moldings. A clever fellow, he designed the jig with a full range of adjustments — to vary the shape and depth of the cut, control the pitch of the spiral, and even produce right- and left-handed twists. This versatility then allowed Ransom to thread the completed spirals together into intricate patterns, earning him another patent in 1885.

The authentic examples shown here are part of an extravagant 1889 installation at the Amelia Givins Public Library in Mount Holly Springs, Pennsylvania. The spirals started as sturdy 1"-diameter dowels, but when the milling was completed, three-fourths of their original weight lay in shavings on the shop floor.

Moses Ransom's original jig has disappeared, but these twisted moldings survive as a fitting testament to a man with an inventive turn of mind.



Moses Y. Ransom holds two U.S. patents for methods of making and using spiral moldings.

These drawings are part of his 1884 application.

