ROUTER TECHNIQUE: PANEL FLATTENING

Inside:
The #1 Hand Tool for Any Shop
Dress Up Your Projects with Basic Router Bits
Templates for Better, More Accurate Results
Table Saw Technique — Ripping Thin Strips

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Picking out my next woodworking project is always a challenge — there are too many to choose from. And this issue makes it even harder because it features five great projects. Take a glance above and on the next page, and you can see what I’m talking about.

If you like making your own tools, the miter square (page 22) is sure to draw interest. Brass and hardwood are always a great combination, but the custom “engraving” on the blade really sets it off. And if you’re looking for some much-needed organization, check out the lumber cart on page 34. It’ll hold a sizable amount of lumber and sheet goods — with room to spare.

If furniture is more your style, the end table (page 26) and country hutch (page 40) would fit into any home, and both feature must-know woodworking techniques. The cutting board on page 18 requires some attention to detail along with an interesting router technique for flattening the glued-up assembly. It’s a method that will work on warped boards, as well.

**Designer Wanted.** Finally, we’re looking for a new project designer to join our team here in Des Moines, IA. If you love woodworking, have an in-depth understanding of furniture design, and possess the ability to turn your ideas into detailed, computer-generated shop drawings, send a résumé highlighting your experience to Professionals@AugustHome.com. Or if you’d prefer, you can mail it to Human Resources, 2200 Grand Ave., Des Moines, IA 50312.
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Folding Bit Organizer
I was tired of always having to dig around for the drill bits that I find myself using most. But I also have limited pegboard space in my shop. So to make the most of this valuable real estate, I came up with the simple but compact storage system you see in the photo.

PERFECT PIECES. All the parts are made from plywood scraps that I had left over from other projects. It starts with a mounting base that’s two pieces of plywood glued together and bolted to the pegboard. This base supports four wings that are attached with rods, allowing the wings to fan out.

DESIGN DECISIONS. You can make these wings any length you desire. I chose to keep the twist and brad point bits that I use on a regular basis front and center in the lower wings. As for my Forstner and spade bits that don’t see quite as much use, I store them in the upper wings. To accommodate the larger heads of these bits, it’s best to make the upper wings a little longer.

Thomas Roessler
Appleton, WI

NOTE: Drill holes in wings to suit your bit needs
NOTE: Pins are ¼” steel rods
NOTE: All parts are made from ¾” plywood

Win This Forrest Blade
Simply send us your favorite shop tips. If your tip or technique is selected as the featured reader’s tip, you’ll win a Forrest Woodworker II just like the one shown here. To submit your tip or technique, go online to Woodsmith.com and click on the link, “SUBMIT A TIP.” There you can submit your tip and upload your photos for consideration.

The Winner!
Congratulations to Thomas Roessler, the winner of this Forrest Woodworker II. To find out how you can win this blade, check out the information at left.
The easiest way to start the leveling process is to first make sure the infeed and outfeed table adjustments are loosened and that the tables are well below the level of the bed. Then before adjusting the tables, position the wood and guides as shown above.

**Planer Table Tip**

The balancing act of aligning the infeed and outfeed tables with the main bed on my planer has been a challenge for some time. Keeping these surfaces aligned is critical for accurate stock preparation. I came up with a simple solution that will work easily on any planer.

All that’s needed is a pair of straight-edge guides that are long enough to span your planer’s bed, as well as the infeed and outfeed tables. The guides are used to align the tables. It also requires two straight pieces of hardwood that are the length of the planer bed, plus long enough to clamp in the guides. The boards provide a soft spot to rest the cutterhead while making the adjustments.

I started by sliding the boards and guides into the planer opening. I made sure that the board and guide were sitting soundly on the bed of the planer, and there was no debris underneath either of them. Then I clamped a board to each guide as shown in the inset photo.

To start the tuning process, it was just a matter of lowering the cutterhead onto the hardwood boards and locking them in place. With those set, I adjusted the infeed and outfeed tables so they’re flush with the straightedge guides as shown in the main photo.

*Roger Pozzi*
*Mount Vernon, Ohio*

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**QUICK TIPS**

**Paper Towels on the Go.** Jeff Hougman of Denver, CO, likes to keep paper towels close at hand in his shop. Two dowels and a length of rope give him options for tethering the roll into the round dog holes on his workbench or clamping it in the bench vise.

**Thread Setter.** To remove the risk of snapping the heads of the soft brass screws that came with his hinges, Peter Sherrill of Forestville, WI, epoxied a steel screw to a Phillips bit for the purpose of tapping the threads in hardwood. Once that was done, he installed the softer brass screws.
Kreg Base with Bench Dog

Lately, I’ve been making a lot of projects using pocket-hole joinery. I don’t have the workbench space to dedicate to a permanent setup. But clamping and unclamping the jig on my workbench was getting old.

My answer was a simple portable platform. Just three pieces of plywood and a dowel are all that’s required.

The largest piece is the base. It supports the mount that the platform is attached to. A dowel locks it to the workbench (shown in the inset photo above). A cleat screwed to the base from underneath prevents the whole unit from spinning while in use.

Jim Moorehead
Barrigada, Guam

Simple Shelf Pin Jig

A while back, I had a big project that involved making a lot of cases that called for adjustable shelving. While drilling the shelf pin holes, I found that the hardboard and plywood jigs I had made wore out too quickly. And the fancy store-bought metal types can be expensive.

To keep the project on track and moving forward, I found an answer that is the best of both worlds: An old aluminum ruler. The first benefit is there’s no layout required. Just drill the holes centered on the spacing you want. I chose 1” intervals (inset photo above). The other advantage is that you can start the series of holes at any inch mark on the ruler.

Jim Eckblad
Decorah, Iowa

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Table Saw Extension Supports
Cutting large sheets of plywood by myself can be a daunting task. Instead of asking my wife to lend a hand when I need help ripping these large panels, I made some outfeed supports that mount in the T-tracks of my rolling shop carts.

Centered on the plywood block in one direction, I drilled holes for a hex head bolt that threads into a knob. This ties the supports into the T-tracks. In the other direction, I drilled holes to install the two T-nuts that house the plastic levelers to hold the supports steady (inset photo). The caster mounts in the center and might need to vary in size depending on the distance between the top of your shop cart and the table saw top. The drawings to the right give all the details needed for the versions that I made for my setup.

Joseph Schulz
Appleton, WI

QUICK TIPS

Pet Collar Cord Keeper. To keep all his unruly extension cords in order, Dana Myers of Des Moines, IA, decided to employ an item rarely found in the shop, an old pet collar. As his puppy outgrew its collars, he used them as a binder and hanger for the extension cords.

Shop Vacuum Upgrade. Edward Wargo of Burlington, NJ, was tired of struggling with his vacuum nozzle sticking to the shop floor due to the suction. So he installed a set of shower door replacement wheels (inset photo) that hold the nozzle just above the floor, yet still pick up all the sawdust.
Improved Push Block

Having a push block close at hand is always a smart move. I decided to take a little time to design one that fits the bill of comfort and long life. I landed on a push block with two parts: a simple handle with a replaceable base.

A sliding dovetail joins the two together. The groove is in the top of the base, and the dovetail is on the bottom of the handle, with a spot of hot glue to hold them together. As shown in detail ‘b’, the handle echoes the comfortable grip of a handsaw handle. To start, I made several replaceable bases and centered a dovetail groove in them (as shown in the drawing at right). Then I fashioned the handle. When it came to creating the dovetail, I snuck up on a perfect fit at the router table (see detail ‘a’).

John Gosner
Grand Rapids, MI

Precise Epoxy Mixing. Bill Wells of Olympia, WA, uses two dedicated syringes (purchased from a local medical supply house) for storing his epoxy. This gives him precise control over the amount of hardener and resin needed. The syringes also keep things tidy and ready for future use.

Wandering Workmate Benchdogs. Dennis Rowe of Canoga Park, CA, uses his Workmate all around the house, as well as in the shop. But the Workmate dogs are light and easy to lose. So he drilled a hole in each and used a beaded chain to keep them together and close at hand.
choosing the Right Chisels

If you flip through any woodworking catalog or do an online search using the word "chisels," you’ll find enough different options that it’s likely to make your head spin. With so many choices available, it’s not easy to know which chisels a woodworker really needs for the majority of the tasks they’ll face on a day-to-day basis.

Unfortunately, figuring things out isn’t made much easier when the various retailers all use different chisel terminology. That’s not to mention the differences between American and European terminology.

When you’re looking at a chisel, knowing the characteristics of the main types is the best way to determine what it’s used for. Here, I’ll give a breakdown of the most common types of woodworking chisels, as well as some that are more specialized in nature and can be added to your arsenal of tools as your needs (and budget) increase.

**BENCH CHISELS**

Perhaps the most commonly available (and most used) chisels in many shops are known as bench chisels. Ironically, bench chisels aren’t really a “type” of chisel at all, but rather a broad category that covers the three main types of chisels most often used for woodworking: Bevel-edged chisels, firmer chisels, and mortise chisels (I’ll describe these in greater detail in a bit). For now, here are a few facts that pertain to all three types.

Each type of bench chisel is sold individually or in sets containing anywhere from four to 10 chisels of varying width. They’ll typically be made from superior grades of steel that will hold an edge for a long time. And speaking of the edge, they’re often ground at 25° to 30°, which is a good bevel angle for general use.

Bench chisels should not be confused with the more common construction-grade chisel (margin photo, at left). You’ll most often find these chisels sold in hardware stores and home centers. And while construction-grade chisels excel at rudimentary tasks many homeowners throw at them (think scraping caulk and rough
bench chisels have a longer blade and handle which allows you to use more of your upper body for better leverage and control.

**BEVEL-EDGED CHISELS.** For someone looking for their first set of woodworking chisels, it’s hard to go wrong with bevel-edged chisels (main photo, previous page). This style is defined by the bevels along the edges that allow them to fit into corners and tight spaces.

A bevel-edged chisel is a good all-around chisel that will handle 80 to 90 percent of the woodworking jobs you’ll face. From trimming the shoulders of a tenon to cleaning up a hinge mortise, a bevel-edged chisel excels as a general-use tool. Anyone starting out in woodworking would be well-served by picking up a set consisting of \( \frac{1}{4} \), \( \frac{1}{2} \), \( \frac{3}{4} \) and 1”-wide blades.

**FIRMER CHISELS.** The firmer chisel blade is usually somewhat thicker than that of a bevel-edged chisel and has a squared-off edge. It’s this squared off edge that makes them ideal for “registering” against the edge of a cutout (right photo). While firmer chisels once held a spot in just about every shop, they’re not as common as they once were. But they’re still a very effective chisel for certain tasks.

The beefier size of firmer chisels makes them the ideal candidate for chopping tasks. And in a pinch, they can be used for paring work. But the lack of a beveled edge precludes them from work in tight spaces.

**MORTISE CHISELS.** The third category of bench chisels is mortising chisels (left photo). As their name implies, these thick-bladed chisels are specifically designed for chopping out mortises.

They’re ground with parallel sides and are usually thicker than they are wide to help withstand repeated blows from a mallet. Mortise chisels are often sold individually or in sets with varying blade widths. However, a full set is usually not needed unless you’re frequently making mortises with many different widths.

Selecting the chisels you need for the type of woodworking you do doesn’t have to be a guessing game. Just knowing the features to look for will go a long way in making the process easier. To read more about two specialty chisel types that you may want to pick up down the road, refer to the box below.

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**Task Oriented: PARING & DOVETAIL CHISELS**

Paring chisels are similar to bevel-edged chisels, but with a longer, thinner blade. The tips are beveled at 15° to 20°, making them easier to slice through wood fibers. They also have a longer overall length for better leverage and finer control. This makes them ideal for cleaning up the bottom of a dado (left photo).

If you’ll be building projects with hand-cut dovetails, then a couple of Japanese dovetail chisels might be in order. The beveled edges of these chisels are designed specifically for shaping the pins and tails of a dovetail joint (right photo).
A quick glance inside the router bit cabinet in the Woodsmith shop tells you that our favorite router profile is a roundover. That’s with good reason. A roundover is a simple profile that’s right at home on a wide range of furniture styles.

A closer look at the router bit collection reveals a few similar bits that also create a rounded profile. I decided it was time to gather them all together for a family reunion of sorts. You can see the bits in the lower left photo. The idea is to explore several ways a rounded edge can enhance the look of a project.

**Roundover Bit**

The obvious place to start is with the basic roundover bit. It’s often the bit many woodworkers build their collection around. A roundover eases the edge of project parts to make them more comfortable. The profile protects the workpiece from chipping and splintering due to normal wear and tear.

A single roundover bit is unlikely to meet all your needs, though. These bits come in a range of sizes (described by the radius of their cut) — from a subtle $\frac{3}{8}$” radius up to a bold 1” radius.

As straightforward as it is, the roundover bit is pretty versatile in use. You can set the bit to form a soft, curved edge. Increase the bit height, and you add a slight shoulder or fillet to the profile. This square detail creates a shadow line to add interest to the profile.

▲ With just a handful of bits, you can create a wide range of details on your projects. (Refer to page 67 for sources.)
One way I like to use a roundover bit is to create a bullnose profile. Here, only a portion of the bit is put to use. You can see what I’m talking about in the drawing on the previous page. After making a pass along each edge of the workpiece, you’re left with a gently rounded profile that still has a crisp, but not harsh, line at the top and bottom, as in the right photo on the previous page.

**BEADING BIT**

The next bit I want to highlight bears a close resemblance to a roundover bit—a beading bit. The difference is subtle. In fact, I’ve mistakenly grabbed it thinking it was one of my roundover bits.

The bearing is slightly smaller than the diameter of the cutting edges at the narrow end of the bit. This frames the profile with a fillet on either side, turning the roundover into a beading that’s set off from the rest of the workpiece, as you can see in the upper right photo.

In order to get the best look, set the bit height so that the two fillets match, as illustrated in the drawing above. This profile works well on its own. I often use it on the top of a project or along the outside edges of a face frame.

However, a beading profile is a great team player. When combined with other profiles, the beading can be used to create unique built-up moldings.

Beading bits are available as stand-alone items. And they’re sold in a range of sizes. However, it’s possible to make your own from a roundover bit. Most router bit manufacturers sell sets of auxiliary bearings. So all you need to do is swap out the stock bearing on a standard roundover bit for a bearing with a slightly smaller outside diameter.

**SIDE & EDGE BEAD BIT**

Roundover and beading bits shape a profile that forms one quarter of a circle. The side bead bit (also called an edge bead) creates a half-circle profile. It looks like half of a dowel has been glued into a rabbet along the edge of a workpiece. This bead is set off by a narrow groove called a quirk, as in the drawing at right.

The side bead is a traditional profile that’s been used for hundreds of years. The quirk and bead work together to create a visual transition.

One common use is to cut a bead along the bottom edge of a table apron, as shown in the photo at right. The bead softens and protects the edge and adds an eye-catching detail.

The same is true when the bead is routed on the lower edge of drawer front. The shadow lines created by the bead profile play off the gaps on the sides and top of the drawer.

Side beads can also be used to dress up face frames and dividers. These otherwise plain elements can then contribute to the overall look of the project.

**POINT CUT ROUNDOVER BIT**

At first glance, a point cut roundover bit doesn’t seem to belong with the others. But if you take a look at the profile created by this distant relation, you’ll see the family resemblance.

The bearing on the previous bits limit cuts to the edges of a workpiece. Without a bearing, the point cut roundover is free to rout anywhere on the workpiece.

The main use for these inexpensive bits is to create beaded panels. Sure, you can purchase beaded boards or beadboard panels. But they may not be available in the right material to match your project. As the drawing and photo at left show, a no-fuss router table setup allows you to create custom beaded boards to suit your project.

Since the bit comes to a sharp point, you will notice that the bit may leave a little fuzz in the groove along the rounded profile. But a swipe with a sharp scraper or a folded piece of sandpaper removes the debris in no time.

Basic roundover bits get the job done. But when you add a few other related profiles, you expand the range of details you can add to your projects. W
Many woodworkers (myself included) often turn to a cordless drill/driver or impact driver for installing screws. But there are still plenty of occasions when there’s just no substitute for a regular old screwdriver.

While the basic design of the screwdriver hasn’t changed much over the years, there are newer styles available that are meant to take a little more abuse and, in some cases, have been adapted for specific tasks. Plus, many of these screwdrivers are available in sets containing the most common Phillips and straight slot sizes for very reasonable prices. So it won’t break the bank to splurge on several.

**BRAWNY SCREWDRIVERS**

If you need a screwdriver with a little more toughness, you might consider a set of Wera (left photo) or Narex brand screwdrivers (right photo). They both have features that’ll appeal to most for everyday use. For a little more money, Lee Valley also has a quality set of durable and attractive screwdrivers available as shown in the main photo above and the top of the next page.

**WERA & NAREX BRANDS.** The soft-gripped Wera brand screwdrivers are comfortable to hold. They also have a laser grooved tip designed to grip a screw slot tighter, preventing the accidental “cam-out” common with regular screwdrivers.

**SHARED FEATURES.** There are several elements of the Wera and Narex brand screwdrivers that are shared by both. First, they integrate a hex shape at the top of the steel shank that allows a wrench to be applied (photo above) for extra torque when trying to remove a rusty or stubborn fastener.

Second, they both have shanks that extend all the way through the handle. This allows them to be...
lightly struck with a hammer or mallet. This is beneficial when trying to seat a screwdriver in a rusty or damaged screw. The Narex brand even incorporates a leather washer in the handle to absorb any impact from being struck. I also like the fact that the Narex set includes a large, straight-slot screwdriver with a nearly 1\(\frac{1}{2}\)"-wide tip for those “extra-large” jobs.

**LEE VALLEY HEAVY-DUTY.** If an ergonomic handle is to your liking, then you might prefer a set of heavy-duty screwdrivers from Lee Valley (photo above). The handles have a rounded-triangle shape that fits the hand extremely well. With a through-shank and striking cap, each can also be lightly struck.

\[\downarrow\]
The unique, ergonomic handles of these parallel-ground screwdrivers from Lee Valley are very easy to grasp.

\[\uparrow\]
These heavy-duty screwdrivers from Lee Valley are as comfortable to hold as they are durable.

**PARALLEL-GROUND SCREWDRIVERS**

This next group of screwdrivers is desired by many woodworkers and cabinetmakers who prefer using slotted screws. These are the parallel-ground screwdrivers from Marples (right photo) and an oval-shaped handle design sold by Lee Valley (photo below).

**MARPLES & LEE VALLEY.** As the name suggests, the tip faces on these screwdrivers are ground parallel to each other. This allows it to fit a slotted screw better by seating at the bottom of the slot. Also, each tip is only as wide as the shaft so it won’t tear up the edge of countersunk holes when installing a screw. And as the below left photo shows, the Lee Valley set comes with a burnisher for creating a small hook on the tip, much like a cabinet scraper. When using a brass screw, the hook will bed in the soft brass, keeping the screwdriver from sliding in the slot.

To read more about a few specialty screwdrivers, check out the box below. And to find out where to buy any of the screwdrivers found in this article, turn to Sources on page 67.

English cabinetmaker’s speciality screwdrivers, like this one made by Joseph Marples, are very practical.
A flat, smooth surface invites you to run your hand across it. And it’s the destination I’m aiming for every time I glue up a panel. But highly figured materials or even end grain surfaces, like the cutting boards on page 18, can challenge the capabilities of thickness planers and hand tools alike. Both can leave nasty tearout that requires a lot of sanding.

The solution is to turn your router into an overhead planing tool. A bit cuts a flat plane on the upper surface of the workpiece. All it takes is a simple setup.

**THE RIGHT BIT.** I’ll begin where the rubber meets the road — the bit. While any sharp straight bit could work, a special-purpose bit will do the job more quickly. Three options are shown in the left photo.

The first is a 1\(\frac{1}{4}\)”-diameter dado and planing bit. It’s designed to cut a smooth, flat bottom. Another choice is a bowl and tray bit. These bits also cut a flat bottom. The edges of the bit have a radius that can help reduce tearout.

The third option is a 2”-dia. “mega” planing bit. This bit lets you get done in fewer passes and has four angled cutting edges. Two angle up and two angle down to limit tearout and leave a smooth surface. To use a bit this big, you need to slow the router down to 16,000 rpm.

**ROUTER CARRIAGE.** For the bit to do its job, it requires a router carriage to suspend it above the workpiece, as shown in the drawing on the next page. Long hardwood rails ensure the carriage is rigid. The rails and router are joined together by a base. I used a piece of \(\frac{1}{4}\)” acrylic for a better view of the progress. A piece of plywood or hardboard would work, too.

**WORKPIECE SANDWICH.** The carriage slides on a pair of runners. These are nothing more than some “one-by” lumber that’s been ripped straight. The guide rails sandwich the workpiece and a pair of spacers. The spacers provide clearance so you won’t cut into the runners.
The whole package is secured together and to the benchtop with the help of bench dogs and a vise. You could also clamp it to your worksurface.

**FLATTENING A WORKPIECE**

With all the prep work checked off the list, you’re ready to get started. You’ll get the best results by working down to a smooth surface in a series of light passes.

**FIRST ROUND.** For the first round of cuts, locate the highest point on the workpiece and set the bit to skim off \( \frac{1}{16} \)" from that point. I prefer to move the router back and forth parallel to the runners making slightly overlapping cuts. The first passes will go quickly since you’re only removing a few high points and glue globs, as in the lower left photo.

Subsequent rounds remove more material. On end grain, I remove no more than \( \frac{1}{32} \)" with each pass. Move at a deliberate pace to avoid tearing out the grain. During these passes, you’ll feel slight resistance as the bit cuts.

**FINAL CUTS.** The router work is complete when the bit takes a consistent cut across the entire surface, as in the middle photo. For this cutting board, that took three rounds. On the final pass, lighten up and only remove \( \frac{1}{32} \)" for the smoothest surface. Flattening the opposite face is just a matter of flipping the workpiece over and repeating the steps.

At this stage, you’ll notice faint score marks that line the surface. You can see these more than you can feel them. But don’t worry, they’ll disappear in the next step.

**A LITTLE SANDING.** With flat faces, you can fire up the random orbit sander to complete the work. Start with a 100-grit disc to quickly remove the score marks. Then work your way up through the grits until the smoothness of the surface is to your liking.

This router carriage setup opens up opportunities to work with almost any glued-up panel or one-of-a-kind board. It’s a problem-solving technique you’ll turn to time and again. [17]
Weekend Project

Quilted Cutting Board

With multiple design options, this cutting board has universal appeal. You can choose from one of our four designs or create your own.

A cutting board is the ideal “filler” project in my book. You know, the type of task you can complete in a weekend while you’re contemplating your next big undertaking. And this cutting board is the perfect example.

Inspired by quilt patterns that use individual patches, the entire board is made from identically sized blocks of different wood species. These are flipped on end and arranged into a pattern of your choosing. To add even more visual appeal, I made some of the blocks from two different species by gluing triangle-shaped strips together before cutting the blocks to size (more on that in a bit).

MAKE SOME BLANKS

The first order of business is to surface and square up your lumber. The final thickness of my blanks is 1\(\frac{1}{8}\)", so I planed some 6/4 stock down to 1\(\frac{1}{4}\)" thick. You’ll plane everything to final thickness all at once after gluing up the two-piece combination blanks.

Design Options

![Design Options](image-url)
**How-To: MAKE THE COMBO BLANKS**

**Tilt Blade.** With the table saw blade tilted 45°, cut a strip from one edge of an oversized blank. Turn the blank around, adjust the rip fence, and cut a strip from the other edge.

**Clamping Jig.** Build this simple clamping jig from “two-by” stock and a plywood base. Be sure the glue line is oriented vertically to ensure a tight fit.

For the design shown above, you’ll need enough lumber to make all of the 48”-long blanks shown. I chose to make them 48” long simply so they’d be easier to handle while also yielding enough blocks later on — with some extras. You can rip the blanks oversized to 1 1/4” wide now, but leave some stock extra-wide for making the triangular-shaped strips next.

**Triangular Strips.** Figure 1 below shows the process I used to rip the triangle strips from that wide stock at the table saw. Since the boards are 1 1/4” thick, be sure to make these strips 1 1/4” wide for now, also (Figure ‘1a’). Continue this process until you have enough strips to make the required number of glued-up combination blanks shown above. Again, you want enough to end up with a few extra blocks when you cut them to length later on.

**Clamping Jig.** Bringing the two triangle halves together to form the combination blanks is pretty straightforward using a jig (Figure 2). The jig consists of two pieces of “two-by” stock with a V-notch cut in one face. These act as clamping blocks. One of the clamping blocks is screwed to a base through the edge. The other is used to draw the two workpieces together with a few clamps.

I applied a coat of wax to my jig to keep glue from sticking. You’ll also want to orient the two halves as shown, so the glue line runs vertically.

**Uniform Sizing.** After taking the last combination blank out of the jig, all of the blanks are ready to joint and plane to final size. With the whole blanks, it doesn’t matter which faces you remove material from to arrive at a square blank. But it does matter on the combination blanks. Here you’ll need to remove an equal amount of material from all four faces. This keeps the joint lines even on both corners of the blank.
Completing the CUTTING BOARD

The cutting board pattern that I chose to make requires 196 individual edge-glued blocks. The exact amount of each type of block needed is shown above.

And, as you’d probably expect when gluing up so many pieces, it can be difficult to keep everything square. To assist in this process, I used an assembly jig consisting of a base and some hardwood cleats set perpendicular to each other (main drawing above).

Even using the jig, the glue-up process would be tricky if you tried to apply glue and clamps to all of the blocks at once. So to keep it from becoming overwhelming, I only glued together two rows of blocks at a time. But before getting ahead of the process, the whole and combination blanks need to be cut into blocks.

CONSISTENT BLOCKS. Figure 1 provides the details for cutting the blocks to length from the blanks. I cut all of the blocks ¼” longer than I wanted for the final thickness of the cutting board. This leaves plenty of material for surfacing both faces with a router after assembly.

It’s also worth mentioning that you don’t need to keep the blocks in any particular “grain-matching” order as they’re cut free from the blanks. The end grain of the blocks looks best when it’s laid out in random directions. The blocks should simply be arranged to match the design that you chose.

TEST LAYOUT. After cutting all of the blanks into blocks, stand them on end. Find a flat surface on your workbench, and position the blocks to match your selected pattern. Now’s the time to

How-To: ASSEMBLE THE BOARD & ROUT DETAILS

1. Cutting the Blocks. Use a short stop block attached to the rip fence and an auxiliary miter fence to cut the blocks.

2. Start Assembly. Position the first two rows on the platform. Spread glue on two faces of each block and clamp.

3. Continue Assembly. After scraping the excess glue off the edges, continue adding two rows until complete.
tweak the design if desired, and to remove any “fuzz” from the block’s edges that may remain after cutting them to size. This will also help to guarantee a gap-free glue up.

**ASSEMBLY PLATFORM.** You can build the assembly platform from MDF and hardwood cleats. I put a coat of lacquer, followed by a coat of wax, on the platform and cleats. This helps to keep the glue from sticking to the parts.

**STAGED ASSEMBLY.** As shown in Figure 2 at the bottom of the previous page, the assembly work is best done two rows at a time. Spread the glue on two faces of each block and set them in position on the platform. Since the cutting board is likely to get wet, I used a waterproof glue (Titebond III) with a slightly longer open time. But you’ll still want to move quickly. Then apply clamps in both directions to hold the rows of blocks in place while the glue dries.

After the first two rows have had enough time to set up, loosen the clamps and pull them from the jig. Use a scraper to remove any hardened glue that has squeezed onto the surface where the next row of blocks will attach (margin photo, previous page). You can then move back to the assembly platform and add the next two rows (Figure 3). Follow this sequence to complete the board.

**TRUE SURFACE.** The photo above provides a good overview of the process that flattens both faces of the cutting board. Turn to the article on page 16 for an in-depth look at how to make the router carriage, as well as how to use it.

**ROUNDOVERS.** With both surfaces of the cutting board flat and true, and the edges sanded smooth, just a few things remain to complete this project. First up is to add a roundover to the top edge of the board, as shown in Figure 4 below.

**FINGER GRIPS.** The grips along the bottom edges require just a touch more work. Instead of trying to lay out each individual grip, I opted to make a hardboard template (Figure 5). The template allows for the use of a handheld router equipped with a bowl and tray bit to rout each of the grips.

You’ll want to make progressively deeper passes until you reach the final depth of each finger grip.

A food-safe finish is the final step before this board is ready to use. To see what I used on mine, turn to Sources on page 67 for more information.

### Materials

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**Round Over Edges.** Use a roundover bit in the router table to ease the top edges of the cutting board.

**Four Finger Grips.** Use a bowl and tray bit and a hardboard template to form the finger grips along the edges of the cutting board. Increase the bit depth on successive passes to arrive at the final depth of the grip.
Collecting and restoring old layout and hand tools is somewhat of a passion of mine. (Some might call it a sickness.) So I have no shortage of seasoned try squares in my shop. But when it came to laying out 45° miters, I only had one combination square with questionable accuracy. That changed with this attractive shop project shown here.

This miter square is simple to make from a piece of brass stock and wood. The wood handle features a brass end cap to help keep nicks and dings to a minimum. And a finger groove machined on both faces of the handle ensures a solid grip when in use.

Since the handle isn’t that large, I was able to use an attractive piece of exotic wood that was an offcut from a previous project. In my case, the handle is made from wenge. The blade and handle are held together with two-piece brass rivets. What I like best about this design is that the whole project can be put together in an easy afternoon in the shop.

DECORATIVE ETCHING. I also used this project to try my hand at adding a decorative flair to the brass blade. This scroll design is made through the use of an etching technique that requires just a few special “ingredients.“ These supplies are readily available at most craft stores or online. Check Sources on page 67 for more information. I’ll get into the details of the etching process on page 25.

Precision Miter Square

Sharpen your shop skills by making this custom-designed layout tool. The etching on the brass blade will showcase your attention to detail.

Materials & Supplies

A  Handle (1) 3/4 x 13/8 - 5 1/2
B  End Cap (1) 1/8” Brass - 3/8 x 1 3/8
C  Blade (1) 1/8” Brass - 1 1/4 x 9 1/8
• (1) 3/8” x 1 3/4” - 12” Machinable 360 Brass
• (4) Brass Rivets (2-piece)
• (2) #6 x 1/2” Brass Screws
**SHAPE THE HANDLE**

The handle of the miter square requires several steps to complete, making it the logical place to begin construction. I started by cutting a 3/4"-thick blank to width, but I left it twice as long as needed for now. This extra length allows it to be clamped in a jig for the first machining operation.

**FINGER GROOVE.** Having made layout and hand tools in the past, I know that one important objective is to make a tool that’s comfortable to hold. With that in mind, I used a simple jig to rout a finger groove on both faces of the handle blank (Figure 1). Set the blank aside after completing the grooves.

**BRASS END CAP.** Now grab your piece of bar stock and lay out the end cap and the two mounting holes. (Be sure to make the cap a little oversized. It gets filed flush with the handle sides after it’s attached.) Figure 2 provides the details for drilling the countersunk mounting holes.

The next order of business is to cut the end cap free from the bar stock with a hacksaw. Transfer the hole positions to the end of the handle and drill pilot holes. I then used a dab of epoxy to hold the end cap to the handle while I installed the screws.

After filing the edges of the end cap flush with the handle (and adding a small chamfer on the edges), use a piece of sandpaper on a flat surface to sand everything smooth.

**FINISH HANDLE.** Figure 3 shows how to make the 45° miter on the other end of the handle. You’ll then use details ‘a’ and ‘c’, above to locate the holes for the rivets used to attach the handle to the blade. I used a Forstner bit to drill the counterbores to recess the rivet heads and then drilled the holes. I also took this opportunity to sand a slight chamfer on the long edges of the handle blank. Finally, cut the slot in the end of the handle to house the blade. You’ll make this cut at the table saw using a cradle to hold the handle at 45° (Figure 4).

**How-To: CREATE THE HANDLE**

1. **Finger Groove.** A core box bit and a jig (see page 65) are used to rout the groove.
2. **End Cap.** Drill the holes in an oversized blank before cutting the end cap to size.
3. **Shape Handle.** Use an auxiliary miter fence to back up the mitered cut.
4. **Centered Slot.** A cradle holds the handle at a 45° angle to cut the blade slot.
**Add the BLADE**

Now that the handle for the miter square is complete, you can turn your attention to the blade. Having cut the end cap from your piece of brass bar stock, the first order of business is to cut that end of the blank square again so that the overall length matches the size shown in the drawing at right. I used a table saw blade designed for cutting non-ferrous metals for this step, but a hacksaw would also work.

**BLADE SHAPING.** With the brass stock squared-up, there are just a few items left to complete the miter square. And that starts by mitering the ends of the blade to bring it to its final shape (Figure 1). You’ll notice in the drawing at right that I left a slight flat on each end of the blade to avoid having sharp points.

**ETCHING.** At this point in the game, you have a decision to make. If you’d like to add the decorative scrollwork etching to both sides of your blade, check out the box on the opposite page to see how that’s done. After the etching work is complete, use a piece of 600-grit sandpaper attached to a flat surface to sand a consistent scratch pattern along the length of both sides of the brass blade.

**ASSEMBLY.** To affix the blade to the handle, you’ll use two-piece brass rivets. (Check Sources on page 67 for more information.) But first, the mounting holes in the blade need to be drilled to match the holes in the handle. Here again, I turned to epoxy to hold the blade securely in the handle while I drilled the holes, as shown in Figure 2, below.

**RIVET TIME.** Attaching the blade to the handle with the rivets is pretty straightforward. Simply push the two halves together and then tap them home using the anvil on the end of a machinist’s vise (Figure 3). Finally, sand the rivet heads flush using the same method you used to sand the handle and blade earlier. **m**

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**How-To: MAKE THE BLADE & ASSEMBLE**

**Miter Blade.** Use a non-ferrous metal-cutting blade to miter the ends of the brass blade. Leave a flat on each end.

**Drill Holes for Rivets.** A little epoxy secures the blade to the handle while drilling the mating holes in the brass.

**Add the Rivets.** Gently drive the two-piece rivets together on a solid, flat surface. A vise anvil works well for this.
How-To: ETCH THE DECORATIVE SCROLL

1. Copy the negative of the blade pattern at right onto a piece of toner transfer paper. Cut it out, and use an iron to adhere the paper to the brass blade.

2. Carefully set the hot blade in a bowl of water to cool and let it soak for a few minutes (Photo 2). Then peel the backing away from the brass (Photo 3).

3. To further seal the black toner and to prevent the etching solution from pitting the brass, cut out an oversized strip of GreenTRF Foil and place it on the blade.

4. Use an iron to adhere the green foil to the blade (Photo 5). A sheet of paper prevents melting the foil. After cooling in a bowl of water, the excess foil peels away (Photo 6).

5. Wearing rubber gloves, load a small sponge with ferric chloride and rub back and forth over the scroll designs. Keep the sponge moving for 4 to 5 minutes.

6. Next, spray the blade with Windex (Photo 8). The ammonia will neutralize the acid. Finally, wipe the blade with acetone to remove the green foil and toner (Photo 9).

NOTE: Set printer or copy machine color output settings to "NEGATIVE"
A good-looking end table is a trusty sidekick to an easy chair or sofa. The table is the perfect landing zone for reading materials, a beverage, and increasingly, an electronic device or two.

For all the hats it has to wear, an end table parked alongside a chair isn’t always in the best position. So I created a table that’s a bit of a hybrid to better suit its functions. It’s part end table, part TV tray, and part storage cart.

Underneath the traditional exterior, there are a couple of secrets. The top of the table isn’t fixed in place. As you can see in the photo on the next page, the top extends up and out to create a more convenient surface for using a laptop or tablet or even holding gameday snacks.

The other secret is a set of swivel casters recessed in the base. These make it easy to relocate the table without resorting to lifting or dragging it around.

When you add in a couple of storage compartments, a drawer, and the magazine rack, you end up with a pretty versatile addition to your family room. You may even end up wanting a second one.

The sliding top and magazine rack on the side throw a few wrinkles in the construction, making this end table a pleasure to build. Once you’ve met the challenges, you can relax with the perfect chair-side companion.

This clever living or family room addition holds a couple of surprises. The result is a multipurpose storage solution that’s sure to be a hit.
**Construction Overview**

**OVERALL DIMENSIONS:** 19"W x 24\(\frac{3}{8}\)"H x 20\(\frac{3}{4}\)"D

**OPEN DIMENSIONS:** 30\(\frac{5}{8}\)"W x 26\(\frac{3}{8}\)"H x 20\(\frac{3}{4}\)"D

Roll the table around to the front of your sofa. Then pull out the top to create a handy raised worksurface or serving area.

Plywood top is wrapped with hardwood edging

Swivel casters let you roll end table anywhere

Mitered base reinforced with splines

Angled bin keeps reading materials close at hand

Top slides on steel pins running in hardwood guides

Dadoes join the back of the drawer

False drawer fronts give table a balanced look

Shaped arms allow top to slide out for greater access

Lower storage compartment is open on both sides

NOTE: For hardware sources and finishing information, turn to page 67.
The typical approach for building a cabinet is to begin with the main “box.” Then, after it’s complete, you add the base, top and any drawers and doors necessary. However, the structure of this project is a little out of the ordinary. So it requires a different approach.

SIDE ASSEMBLIES. For now, you’ll focus your attention on the frame and panel side assemblies. The drawing above shows that the two sides aren’t identical. One side is taller than the other. This asymmetrical arrangement creates space for the magazine bin.

Before the joinery, you need to cut a notch on the upper end of the two long stiles to accept the slide-out top, as shown in Figure 1 below.

**STUB TENON & GROOVE.** The sides are joined with stub tenon and groove joinery. This involves cutting grooves on the inside edges of the stiles and rails, as shown in details ‘a’ and ‘b’ above. The width of the grooves is sized to match the thickness of the ⅛” plywood that’s used for the two panels.

Mating stub tenons are cut on each end of the rails to fit in the grooves. After cutting the panels to size, glue up the sides.

MORE JOINERY. Out of the clamps, the side assemblies require some additional joinery to accept the face frames, as well as the horizontal dividers that connect the assemblies into a case. Figure 2 below shows the first step — cutting a rabbet on the front and back edge of each side for the face frame.

Using the same dado blade, adjust the rip fence to cut dadoes across the inside face of the sides (detail ‘c’). Each side has a matching dado to hold the lower divider, as shown in Figure 3.

Another dado in the tall side houses the upper divider. This one is located...
so that the bottom face of the divider matches the height of the short side, as in detail 'c' on the previous page.

**DIVIDERS & ASSEMBLY.** The dividers themselves are plywood panels. Use a dado blade at the table saw to form a tongue to fit the dadoes in the sides.

The case can now be glued together. In order to keep it square, I cut spacers to match the shoulder-to-shoulder width of the lower divider. Clamp the spacers between the sides at the bottom end.

When the clamps come off, there’s one other part to add. The upper side has a groove to match the tongue on the upper divider and a roundover on its lower edge, as you can see in detail ‘c’ on the previous page.

**MOBILE BASE**

Turn your attention now to the base of the end table. The case is attached to a plywood panel edged with hardwood. The panel rests on a mitered base frame.

The edging features a routed bullnose profile, as shown in detail 'a' above. I find that it’s easier to get a seamless look by routing the profile after mitering and gluing the edging in place.

The base panel is screwed to the case so it’s centered front to back on the panel. Detail ‘c’ shows the dimension for locating the side-to-side placement. The screws are driven up into the lower rails of each side assembly (detail 'a').

**MITERED FRAME.** The panel rests on a mitered hardwood frame. The glue joint between the hardwood and plywood is plenty solid. But the miters need a little reinforcement. So I added splines (detail ‘b’). The drawings below step you through this process. Then glue up the frame and attach it to the base panel.

**CONCEALED CASTERS.** One of the key features of the table is the ability to roll it around on casters. A thin plywood plate provides just enough lift to roll the table around but still gives the appearance of a fixed piece of furniture (detail ‘c’).

---

**How-To: MAKE SPLINED MITERS**

1. **Miter Kerfs.** To hold the spline, the saw blade is tilted to cut a kerf that’s square to the face of the miter joint.

2. **Making Splines.** The spline is formed on the end of a long blank so that the spline’s grain runs across the joint.

3. **Cut to Length.** Cut the splines to length by turning the blank on its side and guiding it with the miter gauge.
With the bones of the case fixed to a stable, though mobile, base you can add the finishing touches. That starts with some drawer guides and kickers.

The guides are rabbeted pieces that center the drawer in the opening and keep it running straight and true, as in detail 'd.' Rather than cut a deep rabbet on such small parts, I used the process shown in Figures 1 and 2 on the next page.

The kickers are pretty straightforward. Simply plane them to thickness and cut them to size. Both guides and kickers are glued in place flush with the front and back edges of the dividers.

FACE FRAME. Moving from the inside of the case out, you can see that the arrangement of the face frame matches the unique structure of the case. There's a design detail that I want to point out here. The front and back of the table have the same look. This way, you can position the table on either side of a chair or sofa. As a result, you need to make mirror-image face frames. Marking parts clearly helps you avoid confusion and errors as you go along.

NARROW STILES. The face frame starts off simply enough with the narrow stiles. Each one has a groove cut on the back face to fit over the tongue on the tall side, as shown in detail 'a' above.

The outside edge of the stiles feature a bullnose profile that matches the one you routed on the base edging. You can glue the stiles in place at this point.
WIDE STILES. The other pair of stiles you need to make have a little more going on. After cutting a groove on the inside face (Figure 3), lay out the profile shown in the front view drawing on the previous page. Rough cut them at the band saw, as in Figure 4. Using files and sandpaper, I worked them to final shape.

You could also create a router template to get the job done, as well. The article on page 60 provides some tips on getting good results.

The next order of business is to drill a pair of shallow holes on the inside faces. These are used to attach the bin frame that you’ll get to in a bit.

Routing a bullnose on the outside edge completes the stiles. Glue one of the stiles in place. You need to leave the other one off for the time being while you concentrate on the bin frame.

BIN FRAME
An angled bin frame corrals reading material and keeps it at the ready along the side of the table. The frame consists of a pair of rails and a set of thin slats (drawing on the opposite page).

RAILS & MORTISES. The slats fit into mortises on the inner edges of the rails. I turned to one of my favorite techniques for creating a run of small mortises at the table saw. It starts with cutting a centered groove in the inside edge of the rails, as shown in Figure 5. Take a quick trip to the router table (Figure 6), then drill a hole at each end of the rails as in detail ‘b’ on the previous page.

Back at the table saw, install a dado blade and cut a series of notches in a blank, as in Figure 7. Rip the blank into strips that fit snugly in the grooves in the rails, as illustrated in Figure 8. The strips are glued into the rails.

SIMPLE SLATS. Making the slats themselves goes quickly. They’re sized to slip easily into the mortises.

FRAME ASSEMBLY. To install the bin frame, start by laying the end table down so that the wide stile you glued on is resting on the bench. Glue dowels into the ends of the rails and fit the slats into the mortises. Hold the frame together as you fit the dowels into the stile. Once the remaining stile is glued on, finish up by adding the face frame rails.

How-To: ADD GUIDES, STILES, & BIN FRAME

1. **Drawer Guides.** Cut a wide groove in an oversize blank to create the rabbet for the drawer guides.

2. **Cut to Size.** Switch to a regular blade and set the rip fence to separate the drawer guide from the blank.

3. **Shaping the Wide Stile.** The band saw works quickly to remove most of the waste to create the wide stile.

4. **Rail Groove.** Set the rip fence so the blade is slightly off center. Flip the piece to widen and center the groove.

5. **Cutting Notches.** On the blank, carefully lay out the location of the notches and cut them with a dado blade.

6. **Bullnose Profile.** The bit height is set so the top cutting edges of the bit are centered on the thickness of the rail.

7. **Cut groove in two passes**

8. **Rip strips to final thickness**
A slide-out **TOP**

From this point on, the remaining woodworking occurs at the top of the table. You’ll make and install the moveable top. A drawer and a few false fronts round out the project.

**SLIDE-OUT MECHANICS.** The distinctive feature of this table is the convertible top that slides both up and out. This requires a little work under the hood. A pair of thin hardwood guides fit inside the top of the case (drawing at right). These guides have an angled slot to control the movement of the top. You can find the technique for making that slot in Shop Notes on page 65. After drilling a clearance hole to attach the drawer knob, glue the guides in place.

**TOP & ARMS.** The top is nearly identical to the base platform. The difference is a pair of shallow dadoes cut on the bottom face before adding the edging (detail ‘a’).

Once the edging is glued on, you can start on the arms (detail ‘b’). These hardwood pieces join the top to the case. Notches at the back of each arm hook over the notches in the case. This locks the top in the extended position. I recessed a screw in the arm notch so the top can be leveled after assembly.

You need to drill a pair of holes at the back as well. One hole accepts a metal rod that fits into the slot in the guide. The other hole holds a machine screw to prevent the rod from working its way out over time, as in details ‘a’ and ‘b.’

The lower edge of the arm is cut to a pleasing, curved shape, which also makes sliding the top out easier.

In order to glue the arms in the correct location in the top, I made a couple of small fillers. Glue the longer fillers in the dadoes first. Then add the arm followed by the short filler. Finally, the lower left drawing shows how the top assembly is installed in the case.

**ONE DRAWER, FOUR FRONTS**

Despite its appearance, there’s only one drawer in the table. Three false fronts give the table a better look. All four drawer fronts are the same size, but the false fronts are rabbed for a snug fit in the openings (detail ‘a’ on the next page). The upper false fronts are glued in place.

The drawer is built with locking rabbet joints at the front (Figures 2 and 3).
on the previous page). A dado holds
the drawer back, as shown in detail ‘c’
at right. The bottom sits in a groove.
The drawer is designed to slide into
its compartment from either face of the
table depending on which end of the
sofa the table is located. The remaining
false front and keeper strip shown in the
upper right drawing fill the opening
behind the drawer. If you rearrange
the family room, simply flip the orientation
of the drawer and false front. □

### Materials, Supplies & Cutting Diagram

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<td>Drawer Keeper (1)</td>
<td>1/2 x 1 1/2 - 12</td>
</tr>
</tbody>
</table>

### Drawings

- **A. SIDE SECTION VIEW**
- **B. TOP SECTION VIEW**
- **C. FRONT SECTION VIEW**

**NOTE:** Drawer fronts are 1/4"-thick hardwood. Drawer bottom is 1/4" plywood. All other parts are 1/2"-thick hardwood.

**NOTE:** Drawer fronts are glued in place.

**NOTE:** Upper drawer fronts are planed to 3/8"-thick hardwood.

**ALSO NEEDED:** One 48" x 48" sheet of 3/4" cherry plywood
One 24" x 48" sheet of 3/4" cherry plywood
One 24" x 48" sheet of 3/4" birch plywood

**NOTE:** Part (P) planed to 5/8" thick. Parts (U), (V), and (W) are planed to 1/4" thick.
Sturdy Lumber Cart

Shop space is always at a premium. But this versatile cart earns its place by providing storage and serving as a project staging center.

Lumber storage is one of those shop needs that always seems to be in short supply. Like clamps, you can never have enough of some things. And if you do happen to be lucky enough to have storage space for your wood and supplies, it’s usually at the opposite end of the shop from where you’re working. This little gem is the perfect solution when wrestling with that dilemma.

Between bins, shelves and drawers, this cart has all manner of storage options. It also serves as a staging center for any project that you’re working on.

Stout and mobile, the cart is easy to move around your shop so it’s right where you need it. I made my cart from maple and \( \frac{3}{8} \) Baltic birch plywood. But don’t hesitate to choose other options. You can build it with construction grade plywood and “two-by” material.
Start with the

**BASE FRAME & DRAWER BOX**

The base of the cart starts as a frame made from four pieces of solid wood joined with half laps. As shown in the box below left, a dado blade setup at the table saw makes short work of these rather large half laps. As you glue up these four pieces, check them for square. After cutting out the base, attach it to the frame with glue and screws.

**DRAWER BOX DETAILS.** To house a drawer that’s built later on, I made a simple box consisting of two sides and a bottom that hangs centered on the underside of the base frame. The back for the drawer box is made from a piece of plywood that also serves as the back of the divider compartments, so it will be installed later on.

The easiest way to build this box is to lay the base frame upside down on your workbench. Start by gluing and screwing the cleats to the drawer box sides. Then, fasten the cleats to the base frame with screws, as shown below right.

Since the next few steps will close off the drawer box, I decided to install the drawer slides now as opposed to the challenge of working in a confined area later. The trick here is to install the slides 1/4" up from the bottom of the drawer box. Later, when the drawer is added, those slides will be installed flush with the bottom of the drawer sides. This will give the clearance needed for the drawer. Notice in the drawing above and detail ‘c’ that the slides align with the front of the cleats on the drawer box side.

While the cart is still light and manageable, I added the casters by screwing them to the base frame (detail ‘b’). With that done, you can take the cart off the workbench and move on to the storage structure that’s above the base.

---

**How-To: BUILD BASE FRAME AND DRAWER BOX**

**Base Frame Half Laps.** Set the rip fence to create the shoulder of the half lap. Then nibble away the remaining waste material.

**Drawer Box Cleats.** After gluing the drawer box cleats flush to the back end of drawer box sides, you can attach them to the underside of the base frame with screws. The cleats serve as a stop for the drawer false front also.
Add the

**BACK, DIVIDERS & PANELS**

The upper portion of the cart starts with the back and dividers. The back runs the length of the cart and has two large notches to enclose the back of the drawer box. The dividers are attached to the back of the cart to create five compartments. The How-To box below provides the details for fashioning the tapers and rounding the top edges.

After cutting and notching the back, I marked and drilled all the screw holes (shown in the main drawing above), and attached the back to the cart. This made it easy to install the dividers. To get the ball rolling, I clamped a scrap across the base to trap the dividers against the back. Then it was just a matter of spacing and screwing the dividers in place.

**PANEL POWER**

The three plywood panels used on the lumber cart are the backbone of this project. The rear-most panel attaches to the dividers. The other two panels are sandwiched together and become the main panel. They're doing the double duty of forming the front wall of the storage cavity and the support for the four shelves.
at the front of the cart that come later. Between the panels are two hardwood spacers. They form a large sheet goods storage cavity in the center of the cart. They both have generous roundovers on the ends to funnel material into the cavity, more on those in a bit.

As you can see in the main drawing above, all three panels are identical in size and have the same finished radius on the top corners. So to keep things uniform, I clamped them together and used a jig saw to rough out the radius. Then I smoothed all three panels at the same time using my belt sander.

Focusing first on the divider panel, lay out and drill the pilot holes and countersinks that are needed. Note that you need to drill pilot holes and countersinks from both faces. The drawing above, along with details ‘b’ and ‘c’, shows all this. Once done, you can set it aside.

The main panel has fasteners and lag screws running through it, so the easiest way to keep it all orderly is to glue and screw them together. Use just enough screws to hold the panels together. Then, from the back face of the main panel, lay out and drill the counterbored holes for the lag screws that you will use to attach the shelf brackets to the main panel later on in the process (shown in drawing above and details ‘b’ and ‘c’).

**ASSEMBLY TIME.** The first panel that goes on the cart is the divider panel. It’s glued and screwed to the dividers that you installed earlier. Now install the spacers between the panels. The upper spacer attaches through the back of the divider panel and the front of the main panel. The lower spacer is screwed directly to the cart base and is a great cleat for fastening the main panel to the structure. Finish up this stage by attaching the main panel, as shown in the How-To box at left.
On to the **SHELVING & DRAWER**

At this point, you’ve entered the home stretch. All that’s left are the brackets, shelves, and drawer. The drawer is pretty straightforward and I’ll give it some attention shortly. Up first though are the brackets and shelves.

**STOUT SUPPORT.** The brackets support four shelves that run the width of the cart. As you can see in the drawing above, the brackets are attached to the main panel. There are four brackets per shelf that vary in length. The widest shelf is at the bottom and each successive shelf gets narrower. Details ‘a’ and ‘b’ above show this.

To keep things efficient, I started with hardwood blanks that were wide enough to lay out two brackets on each piece. The blanks are cut to length to match the width of the shelf they support.

Due to the length of lag screws used to attach the brackets, you need to drill pilot holes. Do this at the drill press, where you can repeat the hole locations on all the brackets using a stop simple block (Figure 1). Once that’s done, cut the brackets to final shape (Figure 2).

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**How-To: HEAVY-DUTY SHELF BRACKETS**

1. **Pilot Holes First.** To locate the pilot holes in the brackets, use a stop block clamped to the drill press fence.

2. **Separate the Brackets.** Cut the bracket blanks apart at the band saw. Then sand them smooth.

3. **Attaching the Brackets.** Clamping a guide to the main panel positions the brackets while being attached.

---

**NOTE:** Brackets are 1 1/2"-thick hardwood. Shelves are 3/8" plywood
MOUNTING THE BRACKETS. Attaching the brackets to the main panel isn’t rocket science. But because of the bracket sizes and the fact that you need to use a ratchet to attach them to the main panel, it does take some patience. The best way to attack it is with the help of a mounting guide (Figure 3, previous page). All the info you need to build the guide can be found on page 66.

For ease of installation, I mounted the brackets from the bottom up. I also put a little beeswax on the threads of the lag screws to smooth the installation process. Sixteen brackets later, you can turn your focus to the shelves that are attached to the brackets.

If you glance at the main drawing on the previous page, you’ll see that the shelves are the same width as the brackets they sit on. Once I cut them to size and rounded over the edges, I drilled the pilot holes and countersinks. As with the brackets, I installed the shelves from the bottom up, in this case, because it’s easier to maneuver.

DRAWER DYNAMICS

The generously sized drawer is made from Baltic birch. It’s constructed with a simple rabbet in the drawer sides (detail ‘b’). Before screwing the drawer together, cut the grooves for the drawer bottom in all four pieces (details ‘a’ and ‘c’ above). After the box was assembled, I attached the false front with screws from the inside (detail ‘a’). Then I mounted the drawer slides against the false front and flush with the bottom edge of the drawer. To finish up the building phase, I added a pull to the front of the drawer.

I applied several coats of lacquer to the whole unit. That was an easy choice. But choosing what wood to save and which bits to send to the fire pit is a dilemma that’s ongoing.

Materials, Supplies & Cutting Diagram

<p>| | | | | |</p>
<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>A</td>
<td>Base Frame Ends (2)</td>
<td>1 1/2 x 5 1/2 - 26</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>Base Frame Sides (2)</td>
<td>1 1/2 x 5 1/2 - 48</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>Base (1)</td>
<td>3/8 ply. - 26 x 48</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>Drawer Box Sides (2)</td>
<td>3/8 ply. - 6 x 26</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>Drawer Box Cleats (2)</td>
<td>3/4 x 1 1/4 - 25 1/4</td>
<td></td>
<td></td>
</tr>
<tr>
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<td>Drawer Box Btm (1)</td>
<td>3/8 ply. - 26 x 30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>G</td>
<td>Back (1)</td>
<td>3/4 x 36 3/4 - 48</td>
<td></td>
<td></td>
</tr>
<tr>
<td>H</td>
<td>Dividers (6)</td>
<td>3/4 x 6 - 51 1/2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3/8" x 7" - 108" Hard Maple (5.3 Bd. Ft.)

3/8" x 6 1/2" - 60" Hard Maple (Six boards @ 2.7 Bd. Ft. each)

1 1/2" x 5" - 60" Hard Maple (4.2 Bd. Ft.)

1 1/2" x 6" - 96" Hard Maple (Two boards @ 8.0 Bd. Ft. each)

ALSO NEEDED:
One 30" x 30" sheet of 3/8" Baltic birch plywood
Six 60" x 60" sheets of 3/8" Baltic birch plywood

Q | Second Shelf (1) | 3/4 ply. - 10 1/2 x 48 |
R | Third Shelf (1) | 3/4 ply. - 9 x 48 |
S | Fourth Shelf (1) | 3/4 ply. - 7 1/2 x 48 |
T | Drawer Sides (2) | 3/4 ply. - 5 x 24 |
U | Drawer Frt/Bk (2) | 3/4 ply. - 5 x 26 1/2 |
V | False Front (1) | 3/4 ply. - 5 3/4 x 28 1/4 |
W | Drawer Bottom (1) | 3/4 ply. - 23 x 26 1/2 |

- (18) #8 x 1 1/4" Fh Woodscrews
- (117) #8 x 1 1/2" Fh Woodscrews
- (4) #8 x 2" Fh Woodscrews
- (8) #8 x 2 1/2" Fh Woodscrews
- (16) 3/8" x 5" Lag screws
- (16) 3/8" Washers
- (1) 4" Drawer Pull
- (2) #8 x 3 1/4" Ph Woodscrews
- (1 pr.) 22" Full-extension Drawer Slides
- (4) 8" Locking Swivel Casters
- (16) 3/8" x 1 1/4" Lag Screws
Aside from a table and a set of chairs, a hutch is an important fixture in any home’s dining room. It provides much-needed storage for dishes and other items and can be a great-looking piece that will tie the whole room together.

Since I’ve focused mainly on building stained and finished hardwood hutches for Woodsmith in recent years, I decided to mix things up and take a country tilt with this rendition. Made from poplar and birch plywood and then painted and distressed, it’s a unique look for less formal rooms.

**BIG ON DETAILS.** While the lumber choices keep the price tag under control, that certainly doesn’t mean I skimped on detail. Take a closer look, and you’ll find everything from dovetailed drawers to shop-made cove molding and divided light glass doors. If you’re ready to take on a serious heirloom project that’s sure to upgrade your home, you’re in the right place.

If your style leans more toward the down-home, traditional look of country furniture, then this heirloom hutch is the perfect project.
Construction Overview

OVERALL DIMENSIONS: 66 1/2” W x 83 3/4” H x 19 1/4” D

Top is a built-up assembly featuring shop-made cove molding and an upper panel with bullnose edging.

Divided light router bits used to form glass-panel door joinery and inner mullion strips.

Aged brass hardware lends a distinctive look.

Upper drawers have false fronts and divider strips to look like smaller, narrower drawers.

Door joinery made with a matching set of cope and stick router bits.

NOTE: A separate article on using the cope and stick router bits is on page 54.

Drawers feature machine-cut, half-blind dovetails and raised false fronts.

NOTE: Refer to page 67 for hardware sources and finishing information.

Face frame assembled with pocket screws.

Adjustable shelves rest on shelf supports.

End and back assembly rails and stiles joined with stub tenons and grooves.

Purchased pine planking forms upper cabinet back.

Plywood top has solid-wood edging with a decorative bullnose profile.

Divided light router bits used to form glass-panel door joinery and inner mullion strips.

NOTE: A separate article on using the cope and stick router bits is on page 54.

Aged brass hardware lends a distinctive look.

Upper drawers have false fronts and divider strips to look like smaller, narrower drawers.

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End and back assembly rails and stiles joined with stub tenons and grooves.

Purchased pine planking forms upper cabinet back.

Plywood top has solid-wood edging with a decorative bullnose profile.

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With most large furniture projects, it’s often a good idea to begin constructing near the bottom and work your way up. And this hutch is no exception to the rule. I started with the base cabinet, which consists of a pair of frame and panel end assemblies that sandwich a plywood bottom.

**END ASSEMBLIES.** The end assemblies feature rails and stiles with stub tenon and groove joinery that surround plywood panels. As you’re cutting the rails and stiles for each end assembly to size, you’ll want to note that the two rails and two stiles are different widths (main drawing and detail ‘b’ above).

**STUB TENON & GROOVE JOINERY.** Stub tenon and groove joinery is a common way to create a frame and panel assembly. I like to start with the grooves. By using a two-pass method at the table saw, you can both center the groove and size it to fit the plywood panel (Figure 1). Then switch to a dado blade to cut the mating stub tenon on the ends of the rails, as shown in Figure 2.

**GENTLE ARCS.** Prior to assembling the ends, you’ll want to note the arcs on the bottoms of the stiles (detail ‘c’). Before cutting these at the band saw (Figure 3), I

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**How-To: CUT JOINERY & SHAPE THE ENDS**

**Grooves.** To form centered grooves to fit the plywood, make two passes over the table saw blade.

**Stub Tenons.** With the grooves formed, you can use a dado blade to cut mating stub tenons on the ends of the rails.

**Arcs.** After gluing in a small filler strip, cut the arcs on the bottoms of the stiles at the band saw.
glued small filler strips into the grooves. This leaves a seamless look on the stiles once the cut is complete.

**ASSEMBLY.** After cutting the panels to size, you’re ready to fit the rails, stiles, and panels together with glue and clamps. Then a couple more tasks complete the end assemblies. The first is a dado to accept the bottom (Figure 1). Note the long auxiliary rip fence I used to support the stiles while cutting this. Next up is a rabbet along the back stile to hold the back assembly (Figure 2).

**CONNECT THE ENDS.** A large plywood bottom panel and an upper frame connect the ends to one another. After cutting these parts to size and assembling the frame with pocket screws, the first order of business is a pair of dados in the bottom and upper frame front and back that align with one another (Figures 3 and 4). These accept divider panels later.

You’ll also note the wide, deep rabbets along three edges of the upper frame that form tongues. Later on, these tongues align flush under the case top and are concealed by thick pieces of bullnose edging. For now, you can rabbet them as shown in Figure 5.

At this stage, you’re ready to cut the two dividers from plywood. Then you can glue and screw the case together. You should have the bottom and upper frame connecting the end assemblies, and the dividers in place between the bottom and upper frame. Make sure everything remains square as you tighten the clamps.

**DRAWER RUNNERS & KICKERS.** A series of parts attach to the dividers to accommodate a bank of drawers later on. This includes four runners, two lower runners, and a set of kickers at the top that prevent the upper drawer from tipping out.

The kickers are the easiest parts to handle. They’re cut to size, and then glued and clamped in place at the top of the dividers. The four drawer runners are rabbeted to allow the drawers to slide between them.

There’s not a lot of clearance, so the lower runners only have a thin lip of material beneath the rabbet cut in them (detail ‘f’, previous page). To make them, I rabbeted a wider blank before ripping the runners to size (Figure 6). Once they’re glued in place, you don’t need to worry about that lip of material breaking off.

With the kickers and lower runners installed, I added the remaining runners with screws. I used spacers to position the runners properly on the dividers while doing this.

**ADJUSTABLE SHELVES.** All that’s left before moving on is drilling shelf pin holes in the end assembly stiles and dividers. I used a hardboard template for this. Then, I cut a pair of adjustable shelves to fit the openings, added edging to the front, and set these aside for the time being.
Add face frame, TOP, BACK & DRAWERS

With the basic shell of the base cabinet complete, dressing it out is the next order of business. And that involves adding a face frame to the front, a top, the back, and drawers.

FACE FRAME FIRST. I started with the face frame, which is a fairly simple assembly made up of rails and stiles that are joined with pocket screws. After cutting the parts to size, note that you’ll need to cut an arc on the outer stiles that matches the one on the end assemblies. After that, though, you can drill the pocket holes, position the parts, and drive in the screws (Figure 1). The last item to take care of on the face frame is cutting a decorative stopped chamfer on each outer stile. I handled this detail as shown in Figure 2 below.

TOP. I moved along to the top next, which is a plywood panel with decorative bullnose edging around the front and sides. You’ll notice that this edging is a bit thicker to cover both the edges of the top and the tongues on the upper frame below it (detail ‘c’ above). You’ll start by cutting the top to rest flush with the frame tongues at the front and sides, but fall a bit short at the back (detail ‘c’). Then add it to the assembly.

EDGE THE TOP. Making bullnose edging is fairly simple with a roundover bit, as shown in Figure 3 below. The key

How-To: FORM THE FACE FRAME & TOP

Assemble Face Frame. Carefully position and clamp all the parts before driving in the pocket screws.

Stopped Chamfer. Mark a couple lines to establish the centerline of the chamfer bit and carefully rout it by hand.

Bullnose. The key to a bullnose profile is to make two passes at the router table on a wider blank.
is making two passes on a wide blank before ripping the edging to final width. It’s mitered to fit around the top. You’ll cut a flat piece of edging to fill in the back and rest flush with the back of the end assemblies.

**BRING IN THE BACK.** Since you’ve already successfully built the end assemblies, the back assembly of the base cabinet shouldn’t be too much trouble. It has the same stub tenon and groove joinery and arcs on the bottoms of the outer stiles.

The difference, of course, is it features three panels instead of one, and two inner stiles, as well. But all in all, the steps in making it are largely the same as what was involved with the end assemblies. As you make it, you’ll just need to be very conscious of the sizes of the parts, since you’re building the assembly to fit between the rabbets in the end assemblies. However, you can always trim just a bit off the outer stiles to make it fit after assembly if needed.

The back assembly is installed with screws. But it’s a good idea to leave it off for now while you work on fitting and installing the drawers.

**DOVETAILED DRAWERS**

Speaking of those drawers, there are three of them in total that fill the opening between the two divider panels. Two shallow upper drawers sit above a deep lower drawer. Each is made from 1⁄2"-thick fronts, backs, and sides that are joined with half-blind dovetails. A plywood bottom fits in a groove cut in all the parts. And a false front with a decorative raised field adorns the front of each drawer.

**How-To: BUILD THE DRAWERS**

1. **Groove Drawer Parts.** Use a rip blade to cut a groove in all the drawer parts for the bottom.

2. **False Fronts.** A raised panel bit at the router table allows you to rout the profile on the false fronts.

**CUTTING THE DOVETAILS.** After cutting the parts to size, I set up my dovetail jig in order to cut the joinery on the drawer fronts, backs, and sides. These steps vary based on the jig, so refer to your instruction manual. The dovetail spacing is shown in detail ‘a’ above.

With the joinery complete, you can set up a dado blade and rip fence to cut the groove in all the drawer parts (Figure 1 at left). After cutting the bottom to size, you can assemble the drawers.

The false front is the last part of the drawer to complete. I formed the raised field with a raised panel bit at the router table (Figure 2). It requires a series of passes to form this profile.

Once that’s done, you can glue the false fronts to the drawer fronts and add the knobs. As a last step, I glued some tiny drawer stops into the rabbets at the back of the drawer runners to stop the backward travel of the drawers (detail ‘c’). The goal is for the portion of false front behind the raised field to align flush with the face frame. Now you’re ready to install the back on the case with screws.
Wrap up with the **DOORS**

The final component to add to the base cabinet is a pair of raised panel doors. The doors feature rails and stiles that are joined with mortises and tenons. The solid-wood raised panel fits in a rabbet in the door frame, and pieces of stop are added to secure the panel from behind.

**A DIFFERENT KIND OF DOOR.** If you’re familiar with raised panel doors, you know that most of the time the panel fits in a groove in the rails and stiles. But I did it differently this time for a couple of reasons. For one, I planned to use a pair of “divided light” router bits to create divided light, glass-panel doors on the upper cabinet. And these bits form a rabbet for the glass. For these lower doors, I wanted the look to be consistent. So I opted to use the same router bits to shape the doors, and then I added the raised panel to the rabbet. You can find all the details you need to use the router bits to form the joinery for the rails and stiles in the article beginning on page 54.

**COMPLETE THE DOORS.** Once the door frame is complete, the rest of the door is fairly straightforward. I formed the raised panel as shown in Figure 1 below. Then I cut the panel stops (Figures 2 and 3) and mitered and installed them behind the panels in the frame using small brads. As you can see, the doors feature knobs with decorative escutcheons. A couple of catch blocks installed in the cabinet meet with catches on the doors to hold them securely in place (detail ‘c’).

---

**How-To: SHAPE THE DOOR PANELS & STOPS**

1. **Raised Panels.** Form the profile on the raised panels at the router table with a series of progressively deeper passes.

2. **Rounding Panel Stops.** To round the edges of the panel stops safely, start with a wide blank on the router table.

3. **Rip Thin Strips.** Once the edges are rounded, you can rip the panel stops free from the wide blank.
Materials, Supplies & Cutting Diagram

A  End Assembly Frt. Stiles (2) 3/4 x 3 1/2 - 33
B  End Assembly Back Stiles (2) 3/4 x 4 - 33
C  End Assembly Top Rails (2) 3/4 x 3 1/2 - 11
D  End Assembly Btm. Rails (2) 3/4 x 4 - 11
E  End Assembly Panels (2) 1/2 ply - 11 x 22 1/2
F  Bottom Panel (1) 3/4 ply - 16 1/2 x 59
G  Upper Frame Frt./Bck. (2) 3/4 x 2 1/2 - 61 1/4
H  Upper Frame Sides (2) 3/4 x 2 1/2 - 13 1/2
I  Divider Panels (2) 3/4 ply - 16 1/2 x 26
J  Drawer Runners (4) 3/4 x 2 3/4 - 16 1/2
K  Lower Drawer Runners (2) 3/4 x 3/4 - 16 1/2
L  Drawer Kickers (2) 3/4 x 2 - 16 1/2
M  Adjustable Shelves (2) 3/4 ply - 15 1/2 x 21 1/2
N  Shelf Edging 1/4 x 3/4 - 50 rgh.
O  Face Frame Outer Stiles (2) 3/4 x 4 - 33
P  Face Frame Inner Stiles (2) 3/4 x 2 1/2 - 23 1/2
Q  Face Frame Upper Rail (1) 3/4 x 2 3/4 - 52
R  Face Frame Lower Rail (1) 3/4 x 3 - 52
S  Face Frame Inner Rails (2) 3/4 x 1 3/4 - 13
T  Top Panel (1) 3/4 ply - 18 1/2 x 61 1/4
U  Top Edging 3/4 x 1 - 200 rgh.
V  Back Outer Stiles (2) 3/4 x 4 - 33
W  Back Inner Stiles (2) 3/4 x 4 - 19 1/2
X  Back Rails (2) 3/4 x 4 - 52 1/2
Y  Back Side Panels (2) 1/4 ply - 17 x 19 1/2
Z  Back Middle Panel (1) 1/4 ply - 12 1/2 x 19 1/2
AA  Lwr. Drwr. Frt./Bck. (2) 1/2 x 8 - 12 1/8
BB  Lwr. Drwr. Sides (2) 1/2 x 8 - 15 1/2
CC  Upper Drwr. Sides (4) 1/2 x 6 - 12 1/4
DD  Upper Drwr. Sides (4) 1/2 x 6 - 15 1/2
EE  Drawer Bottoms (3) 1/2 ply - 12 1/2 x 15
FF  Lwr. Drwr. False Front (1) 3/4 x 8 - 12 1/8
GG  Upper Drwr. False Fronts (2) 3/4 x 6 - 12 1/8
HH  Drawer Stops (6) 1/2 x 1/2 - 1/16
II  Door Stiles (4) 3/4 x 2 3/4 - 23 3/4
JJ  Door Rails (4) 3/4 x 2 3/4 - 13
KK  Door Panels (2) 3/4 x 11 3/8 - 18 1/4
LL  Panel Stops 1/4 x 3/4 - 150 rgh.
MM  Catch Blocks (2) 3/4 x 1 3/4 - 2

• (30) #8 x 1 1/4” Fh Woodscrews
• (8) 1/4” Shelf Supports
• (24) 1/4” Pocket Screws
• (3) 1 3/4”-dia. Drawer Knobs w/Screws
• (2) 1 1/4”-dia. Door Knobs w/Screws
• 1/2” Brads
• (2) Knob Escutcheons
• (4) 3/4” x 2 1/2” No-Mortise Hinges
• (2) Spring Roller Catches w/Screws

1/2” x 5” - 96” Hard Maple (Two Boards @ 3.33 Sq. Ft. each)

1/2” x 3 1/2” - 96” Hard Maple (Two Boards @ 2.33 Sq. Ft. each)

1/4” x 5 1/2” - 72” Hard Maple (2.8 Bd. Ft.)

1/4” x 5” - 60” Poplar (2.1 Bd. Ft.)

1/4” x 6” - 84” Poplar (3.5 Bd. Ft.)

1/4” x 6” - 96” Poplar (Two Boards @ 4.0 Bd. Ft. each)

1/4” x 6” - 96” Poplar (Two Boards @ 4.0 Bd. Ft. each)

1/4” x 5” - 96” Poplar (Two Boards @ 3.3 Bd. Ft. each)

1/4” x 6” - 96” Poplar (Two Boards @ 4.0 Bd. Ft. each)

NOTE: Parts ‘KK’ planed to 3/16” thick

ALSO NEEDED:
One 48” x 96” sheet of 1/2” birch plywood
One 48” x 96” sheet of 1/8” birch plywood

NOTE: Part ‘U’ cut to 3/8” thick

NOTE: Part ‘U’ cut to 3/8” thick

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At this stage, the base cabinet is complete, and you can transition to the upper cabinet. It shares some similarities with the base cabinet, but also some significant differences. One key difference is the structure of the upper cabinet, which is formed mainly from plywood rather than frame and panel assemblies. So in a sense, it’s actually easier to build. You can get started by cutting the cabinet sides, top, and fixed shelf to size.

**DADOES & RABBETS.** There’s a bit of joinery to tend to before you assemble the case. First is a dado across each side to accept the shelf. Next are a few rabbets on each side: One on the top end to accept the top, one on the back edge to accept a back later, and a third rabbet on the front edge that forms a tongue to lock the face frame in place. All of these operations are covered in the “How-To” box below.

Out of hardwood, I cut a support to reinforce the long, fixed shelf (detail ‘b’), and a pair of mounting cleats that will be used to attach the upper cabinet to the base cabinet later on. Then I assembled the case.

**FACE FRAME.** The face frame of the upper cabinet shares a lot of similarities with the one on the base cabinet. It’s assembled with pocket screws and features stopped chamfers on the outer stiles for a decorative touch. A few details that are worth noting are the grooves on the back face of the outer stiles (refer to...
detail ‘d’ on the previous page). These lock the stiles into the case sides for a secure connection and also reduce the “footprint” of the upper cabinet on the base cabinet. There’s also a series of shelf pin holes for accepting a pair of adjustable shelves later on, as well as decorative brackets glued below the lower rail (detail ‘c,’ previous page). Once it’s all assembled, glue and clamp the face frame in position.

**TOP ASSEMBLY**

As you can see in the series of drawings on the right, the top of the upper cabinet is an assembly built up in several layers. It features a rabbeted lower frame that supports pieces of shop-made cove molding. At the top is a mitered frame with a bullnose profile that holds a plywood panel.

**LOWER FRAME.** I started with the lower frame, rabbeting the front and side pieces (Figure 1), and then mitering them to match the overhang shown in details ‘a’ and ‘b’ at right. Note that the back piece isn’t rabbeted but simply cut to fit between the sides, as shown in the main drawing. This assembly can now be glued to the top of the cabinet.

**COVE MOLDING.** Making your own shop-made cove molding involves passing boards at an angle over the table saw blade. You’ll guide the workpieces with fences and make small changes in depth until you reach the desired size of the cove. (Refer to Shop Notes on page 64 for more details.)

Once the cove molding is complete, you’ll carefully miter it to fit the rabbets in the lower frame (Figure 2). When you have a nice fit at the corners, you can glue and nail the molding in place with small brads. Then cut and miter a spacer to fit along the back (detail ‘b’).

**TOP.** That just leaves the top, which is a solid-wood frame surrounding a plywood panel. I routed the bullnose profile on the edges of the pieces using the same procedure as in Figure 3 on page 44. Then I cut grooves in all the parts to fit the plywood (Figure 3) and cut tenons on the back to match (Figure 4). After mitering the front edges, you can assemble the top and install it above the cove molding using glue and clamps.

---

**How-To: BUILD THE CABINET TOP**

1. **Rabbets.** The lower frame has a rabbet that allows the crown molding to lock into place.

2. **Miter Cove Molding.** This simple sled allows you to hold the cove molding at its mounted angle as you miter it to final length.

3. **Grooves.** The upper frame parts have a centered groove that’s sized to accept a plywood panel.

4. **Stub Tenons.** Stub tenons on the ends of the upper frame back are cut to fit in the groove.
The upper cabinet features a bank of three drawers that rests on the base cabinet. Each drawer has two false fronts with a divider strip in between to create the illusion of six drawers in the cabinet.

Assembling the drawer bank just requires cutting a few dadoes in the top and bottom panels, as shown in Figure 1 below. Then you're ready to assemble the drawer bank.

The three drawers are constructed similarly to the ones in the base cabinet shown on page 45. Each drawer features 1⁄2"-thick front, back, and side pieces that are joined with half-blind dovetail joints. A plywood bottom panel rests in a groove cut in all the parts.

As mentioned earlier, what's unique is the drawer fronts. While the drawers in the base cabinet had a single false front, these drawers have two false fronts, making a total of six drawers in the upper cabinet without any gaps.

The next step is to add some drawer runners at the bottom of each bank opening. To make them, you'll want to rabbet a wide blank before trimming the strips to size (Figure 2). They are now ready to glue in place.

Routing the profile on the false fronts just takes a few passes on the router table.

Dadoes. The drawer bank top and bottom require a few dadoes to accept the side and divider pieces.

Drawer Runners. Rabbet a wide blank at the table saw before ripping the runners to their final size.

False Fronts. Routing the profile on the false fronts just takes a few passes on the router table.

How-To: CONSTRUCT THE DRAWER BANK
each have two false fronts, with a divider strip in between them.

I made the raised profile on the false fronts with a raised panel bit at the router table, as shown in Figure 3 on the previous page. Then I cut the divider strips to size and glued the false fronts and strips to the drawers before adding knobs.

**INSTALLATION & ASSEMBLY**

In order to add the drawer bank to the hutch, it needs to be slipped into the upper cabinet from behind. So now is a good time to position the upper cabinet above the base cabinet, drill mounting holes (Figure 1, below), and secure the cabinets with the connector bolts and caps shown in detail ‘a.’ After sliding in the drawer bank, cut and install edging strips using glue and brads. A little filler takes care of the holes before painting.

**Cabinet Back.** I wanted the back of the upper cabinet to be a focal point for my heirloom hutch. So instead of plain plywood panels for the assembly, I chose a series of purchased pine planks to fill the openings. Then I finished them with a clear finish to stand out from the painted portions of the hutch. (All the painting and finishing information you need can be found on page 67.)

Other than the planks, the rest of the back assembly is a frame joined with stub tenons and grooves. It features two stiles, an inner divider, and a top and bottom. The first order of business is cutting grooves in the parts to accept the planks as shown in Figure 2. Then you can cut tenons on the ends of the top, bottom and dividers to fit the grooves (Figure 3).

**Completing the Back.** Note that the back has a series of shelf pin holes that match up with those on the face frame to accept adjustable shelves later. Also, some filler strips need to go on the drawer bank top and fixed shelf before the back goes on. These fill the gaps between the parts and the back (detail ‘b’). Once that’s done, you can install the back with screws.

---

**How-To: INSTALL THE UPPER CABINET & ADD BACK**

**1. Connector Bolts.** Position the upper cabinet on the base cabinet, and mark holes to drill for connector bolts.

**2. Grooves.** The pine planking is a hair thicker than 1/4", so you might need to dial in the width of the groove.

**3. Stub Tenons.** Once the grooves are complete, you can cut stub tenons for a perfect fit inside them.
Adding the **GLASS DOORS**

The finishing touch on this hutch is the pair of divided light, glass-panel doors that you see in the drawing above. They feature rails and stiles joined with mortise and tenon joints. Mullion strips that intersect in the middle form the four openings for the glass.

A pair of matching “divided light” router bits form the decorative profile along the front edges of the parts, as well as the rabbets on the back that hold the glass. The coping bit of the set also forms the tenons on the ends of the parts that fit in the mortises. These are the same bits that I used to create the base cabinet doors shown on page 46. But the addition of the intersecting mullion strips makes building these doors a little more involved. There’s an in-depth article that covers the process of using the router bits to make the doors that begins on page 54.

**COMPLETING THE DOORS.** Once you’ve completed all the joinery and assembled the doors, it’s just a matter of getting some glass cut at the hardware store or home center to fit the openings. The rabbets created by the router bits don’t leave a lot of space to install brads in the glass stops as I would usually do, so instead I used silicone adhesive to secure them. The drawings below cover the process for making and installing the stops.

**FINAL DETAILS.** After that, it’s just a matter of installing the escutcheons, knobs, hinges, and catches and mounting the doors. I installed a catch block behind the center face frame stile to hold both doors closed (detail 'b'). I also added a couple of adjustable shelves with edging.

**A WORTHY HEIRLOOM.** At this point, you’ve done a lot of work, so sit back and get a good look at your new heirloom piece of furniture. Then bring it to life with some paint, finish, and glaze.

---

**How-To: MAKE & INSTALL GLASS STOPS**

1. **Cut Kerfs.** An easy way to make the glass stop pieces is to cut kerfs in the edges of a wide blank.

2. **Rip Thin Strips.** Then rip the thin strips to form a couple of glass stops on each edge of the blank.

3. **Apply Glass Stop.** There’s not enough room for brads, so I used beads of silicone adhesive to secure the stops.
### Materials, Supplies & Cutting Diagram

<table>
<thead>
<tr>
<th>A</th>
<th>Upper Cab. Sides (2)</th>
<th>3/8 ply. - 11 1/2 x 46</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>Upp. Cab. Top/SheLF (2)</td>
<td>3/8 ply. - 10 1/2 x 59 1/2</td>
</tr>
<tr>
<td>C</td>
<td>Shelf Support (1)</td>
<td>3/4 x 1 1/4 - 58 1/2</td>
</tr>
<tr>
<td>D</td>
<td>Mounting Cleats (2)</td>
<td>3/4 x 1 1/2 - 10 1/2</td>
</tr>
<tr>
<td>E</td>
<td>Face Frame Out. Stiles (2)</td>
<td>3/4 x 4 - 46</td>
</tr>
<tr>
<td>F</td>
<td>Face Frame Inn. Stile (1)</td>
<td>3/4 x 4 - 24 1/4</td>
</tr>
<tr>
<td>G</td>
<td>Face Frame Upp. Rail (1)</td>
<td>3/4 x 3/8 - 52</td>
</tr>
<tr>
<td>H</td>
<td>Face Frame Low. Rail (1)</td>
<td>3/4 x 2 - 52</td>
</tr>
<tr>
<td>I</td>
<td>Face Frame Brackets (2)</td>
<td>3/4 x 2 1/2 - 4</td>
</tr>
<tr>
<td>J</td>
<td>Low. Top Frame Front (1)</td>
<td>3/4 x 2 - 61</td>
</tr>
<tr>
<td>K</td>
<td>Low. Top Frame Back (1)</td>
<td>3/4 x 2 - 57</td>
</tr>
<tr>
<td>L</td>
<td>Low. Top Frame Sides (2)</td>
<td>3/4 x 2 - 12 1/2</td>
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<tr>
<td>M</td>
<td>Cove Molding</td>
<td>3/4 x 4 rgh. - 96 rgh.</td>
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<tr>
<td>N</td>
<td>Molding Spacer (1)</td>
<td>3/4 x 2 - 63 3/8</td>
</tr>
<tr>
<td>O</td>
<td>Upp. Top Frame Front (1)</td>
<td>3/4 x 2 - 66 1/2</td>
</tr>
<tr>
<td>P</td>
<td>Upp. Top Frame Back (1)</td>
<td>3/4 x 2 - 62 1/2</td>
</tr>
<tr>
<td>Q</td>
<td>Upp. Top Frame Sides (1)</td>
<td>3/4 x 2 - 15 1/4</td>
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<tr>
<td>R</td>
<td>Upp. Frame Panel</td>
<td>1/2 ply. - 16 1/2 x 63 1/2</td>
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<td>S</td>
<td>Drawer Bank Top (1)</td>
<td>3/4 ply. - 10 1/2 x 58 1/2</td>
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<tr>
<td>T</td>
<td>Drawer Bank Btm. (1)</td>
<td>3/4 ply. - 10 1/2 x 54</td>
</tr>
<tr>
<td>U</td>
<td>Drw. Bank Dividers (4)</td>
<td>3/4 ply. - 10 1/2 x 5 1/2</td>
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<tr>
<td>V</td>
<td>Drawer Runners (6)</td>
<td>3/4 x 3/4 - 10 1/2</td>
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<tr>
<td>W</td>
<td>Drawer Fronts/Backs (6)</td>
<td>1/2 x 4 1/2 - 16 1/2</td>
</tr>
<tr>
<td>X</td>
<td>Drawer Sides (6)</td>
<td>1/2 x 4 1/2 - 10 1/2</td>
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<tr>
<td>Y</td>
<td>Drawer Bottoms (3)</td>
<td>1/4 ply. - 10 1/4 x 15 3/8</td>
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<tr>
<td>Z</td>
<td>Drawer False Fronts (6)</td>
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<tr>
<td>AA</td>
<td>False Frt. Divider Strips (3)</td>
<td>3/8 x 1 1/4 - 4 1/2</td>
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<tr>
<td>BB</td>
<td>Horizontal Edging</td>
<td>3/4 x 3/4 - 110 rgh.</td>
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<tr>
<td>CC</td>
<td>Vertical Edging</td>
<td>3/4 x 1 1/4 - 15 rgh.</td>
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<tr>
<td>DD</td>
<td>Back Sides (2)</td>
<td>3/4 x 4 - 46</td>
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<tr>
<td>EE</td>
<td>Back Top/Bottom (2)</td>
<td>3/4 x 4 - 52 1/2</td>
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<tr>
<td>FF</td>
<td>Back Divider (1)</td>
<td>3/4 x 4 - 39</td>
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<tr>
<td>G</td>
<td>V-Groove Planking (14)</td>
<td>7mm x 3 8</td>
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<tr>
<td>H</td>
<td>Filler Strips/Edging</td>
<td>5/8 x 2</td>
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<tr>
<td>I</td>
<td>Door Stiles (4)</td>
<td>3/4 x 2 3/4 - 24 3/4</td>
</tr>
<tr>
<td>J</td>
<td>Door Rails (4)</td>
<td>3/4 x 2 3/4 - 19 3/4</td>
</tr>
<tr>
<td>K</td>
<td>Door Catch Block (1)</td>
<td>1/4 x 1/4 - 192 rgh.</td>
</tr>
<tr>
<td>L</td>
<td>Adj. Shelves (2)</td>
<td>5/8 x 2</td>
</tr>
<tr>
<td>M</td>
<td>Glass Stop</td>
<td>1/4 x 1/4 - 20 x 50mm Connector Bolts</td>
</tr>
<tr>
<td>N</td>
<td>Door Catch Block (1)</td>
<td>1/4 x 1/4 - 20 x 17mm Connector Bolt Caps</td>
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<td>O</td>
<td>Door Catch Block (1)</td>
<td>1/4 x 1/4 - 9 1/2 Glass Panels</td>
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<tr>
<td>P</td>
<td>Door Catch Block (1)</td>
<td>1/4 x 1/4 - 3 Drawers Knobs w/Screws</td>
</tr>
<tr>
<td>Q</td>
<td>Door Catch Block (1)</td>
<td>1/4 x 1/4 - 2 1/2 No-Mortise Hinges</td>
</tr>
<tr>
<td>R</td>
<td>Door Catch Block (1)</td>
<td>1/4 x 1/4 - 30 Spring Roller Catches w/Screws</td>
</tr>
<tr>
<td>S</td>
<td>Door Catch Block (1)</td>
<td>1/4 x 1/4 - 30 Drawer Catches w/Screws</td>
</tr>
</tbody>
</table>

**ALSO NEEDED:**
- One 48" x 96" sheet of 1/8" birch plywood
- Two 48" x 96" sheets of 3/8" birch plywood
- 1/4" Shelf Supports
- 1/4" Drawer Knobs w/Screws
- 1" No-Mortise Hinges
- Spring Roller Catches w/Screws
- Drawer Catches w/Screws
- Drawer Knobs w/Screws
- 1/4" Drawer Knobs w/Screws
- 1/4" Drawer Knobs w/Screws
- 1/4" Drawer Knobs w/Screws
- 1/4" Drawer Knobs w/Screws
- 1/4" Drawer Knobs w/Screws
- 1/4" Drawer Knobs w/Screws
To create the doors of the country hutch on page 40, I used divided light router bits. They're a modified version of cope and stick bits with just two things separating them from their cousins.

First, the coping bit makes a standard (longer) tenon, instead of a stub tenon. This throws mortises into the mix for stronger doors. Second, the sticking bit shapes the back side of the door differently. Instead of creating a groove to hold a panel, there's a rabbet that holds a piece of glass. The photo below shows a set of these bits and the accessories that come with them. Look for these important details when shopping.

This system works great for the upper glass doors that are shown on page 52. And they do just fine for the base cabinet doors being built on page 46 with the addition of a stop to trap the panel.

Basically, using divided light bits is a relay race. As with a good relay team, the critical moment is in the handoff. The same holds true here, the relay is between the mortising, which sets the stage for creating the cope cuts on the rails, and in turn, transferring that information to an accurate stick cut on the stiles and rails. Then finishing strong with a chisel and back saw brings all the door pieces together.

SQUARE & FLAT. As you mill all the pieces to final width and thickness, make sure you have extras of all the parts for test fitting and covering mistakes. Trust me, the farther along you get in the process, the happier you'll be with testing on scrap wood before committing your crafted pieces to the bit.

Moving forward, it's time to cut the pieces to their final length. This is easy enough when it comes to the stiles. But to determine the length of the rails and mullions you will have to allow for the

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The Amana Divided Light Cabinet Door Bit Set comes with a coping bit that cuts a tenon and cope on the ends of the parts, and a sticking bit that cuts a rabbet and mating profile.

---

COPING BIT

STICKING BIT

Shims for joinery adjustments

A The Amana Divided Light Cabinet Door Bit Set comes with a coping bit that cuts a tenon and cope on the ends of the parts, and a sticking bit that cuts a rabbet and mating profile.
length of the tenons. Since the tenon length can vary depending on the bit set you’re using, it’s best to refer to the bit manufacturer’s instructions. To keep things in order, mark the back side of all the pieces. When you rout them later, this is all done face-down, so you’ll know at a glance you’re working on the correct side. With all the pieces properly sized, you’re at the first leg of the relay, making the mortises.

**Mortise Locations.** First, the vertical mullions have no mortises, so set them aside for the moment. The stiles have a mortise at each end for the rails, and a smaller, centered mortise for the horizontal mullion. The rails and horizontal mullion have a mortise centered on their length for the vertical mullions as shown in the drawing at right. All the mortises are centered on the thickness of the door.

It’s critical that the mortises for the mullions be exact in location and size. The mullion tenons have no shoulder so take your time laying these out. I started the whole process with the stiles, Figure 1 below shows how to do this.

Notice that the tenons on the rails only have one shoulder (drawing above). I used the rail itself to mark the inside end of the mortise on the stile. Then I drew a line $\frac{1}{2}$" in from the ends of the stiles to locate the outer end. A pencil and a square made short work of all this.

Turning your attention to the rails, draw in the centered mortise for the vertical mullions. Then to keep all the parts perfectly aligned, set the horizontal mullion on top of the rails and mark the location of it’s centered mortise using the rail as a reference. Now you can move on to the making of the mortises.

**Master the Mortise.** You could easily do these mortises at the drill press, but I recently added a mortising machine to the shop, so I’m putting it through its paces every chance I get. Figures 2 and 3 below provide the details on how this is done. As with most mortises, it’s wise to make them slightly deeper than needed so the tenons won’t bottom out when the frame is assembled.

Since the mortise on the horizontal mullion is a through mortise, set it on a scrap piece to prevent the back side of the mullion from blowing out when the chisel breaks through. With the stiles, rails, and mullions sized and mortised, you’re ready for the next leg of the race, which involves the coping bit.
**COPE & TENON**

The coping bit does two things; it forms the coped profile on the ends of the rails and mullions that matches the decorative profile made by the sticking bit. Also, it creates the tenon that fits into the mortise in its mating piece.

For all of this to work smoothly, it takes a little setup and tweaking. This starts with putting the coping bit into the router table and setting it to the proper height. I used the mortise that was cut in one of the stiles to calibrate the coping bit, as shown in Figure 1 below. With the board face down, I set the height of the bit so the cope cutter touches the outer wall of the mortise.

**TENON TWEAKING.** To further dial in the bit, slide the fence flush to the bearing and make a quick cut in one of the test pieces. One thing you’re checking here is the thickness of the tenon. If you find you have to make some adjustments to the tenon, the bits come with shims that allow you to fine-tune the center and upper cutter head to control the thickness of the tenon. The other test you’re doing here is getting a feel for the feed rate. If you’re going too slow, you’ll burn the workpiece. Whether you’re making test cuts or the final pass on rails and mullions, you’ll find that a backer is mandatory. A simple MDF block that rides square to the fence will do (photo above and Figure 2).

Now you’re ready to cut the cope profile on the ends of the rails and mullions. Keep the pieces pressed firmly against the backer, fence, and table. I ran the pieces from big to small, getting more confident with the feel of the setup as I went. By the time I finished with the last vertical mullion, I was thinking about the next handoff, the sticking bit.

**How-To: COMPLETE THE DOOR FRAMES**

1. **Setting the Coping Bit.** Start the process of positioning the coping bit by setting the height of the cope profile to match the mortise in the stile. Adjust for tenon thickness if needed.

2. **Rout the Cope & Tenon.** When routing the ends of the rails and mullions, use a large, square piece of wood or plywood as a backer to prevent tearout.

3. **Coping the Mullions.** Using a stout backer behind the thin mullions is critical for safety reasons as well as tearout concerns. Adjust the feed rate to prevent burning.

4. **Dial in the Sticking Bit.** Use the milled end of the rail to set the initial position of the sticking bit. Make sure that the profile on the test piece fits the cope on the rails.
THE STICKING BIT

The sticking bit, as mentioned earlier, cuts a profile that matches the cope and creates a rabbet to hold the glass. It, like the coping bit, has to be calibrated to the parts of the door you’ve created so far. Start by mounting the bit in the router table. What you’re aiming for here is aligning the profile to the cope, as shown in Figure 4 on the previous page. As earlier, make some test cuts to ensure things are lining up and the feed rate is acceptable. The critical junction is how the cope and profile meet. That’s where you need to be sure that it’s dead-on.

The milling process is the same otherwise: Start by routing the profile on the stiles and rails first (Figure 5). But when it comes to the mullion, it’s too small to rout comfortably by itself. So to safely and accurately cut the sticking profile on the mullion, I made a special push block (Figure 6). The details can be found on page 66. This finishes up the joinery phase of the doors. But before gluing up, there’s a little bit of handwork to do.

HAND WORK TO FINISH UP. The machining on all these pieces took care of the lion’s share of the work involved in making a solid door. All that’s left to complete the deal is a few things at the bench. Tool-wise, I used a back saw and a sharp chisel. Start by creating the shoulder on the tenons and trim the stiles to fit, as shown in Figure 7. Also, the junction at the center of the mullions needs some fine-tuning. Figure 8 shows the work needed on the tenon at one end of each of the vertical mullions.

That’s the end of the fitting and fussing, at last. You’ve completed all the legs of the relay with success at each step along the way. But I do believe all the effort makes for a great-looking door.

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5. *Rout Sticking Profile & Rabbet* Use the sticking bit on the inside edges of the rails and stiles. Be careful not to burn the profile by feeding the workpiece too slowly.

6. *Sticking Profile Push Block.* To safely rout the sticking profile on both edges of the mullions, use a push block that holds the small pieces firmly in place. Details on page 66.

7. *Fine-Tune the Tenon & Stile.* Cut the shoulder on the tenon and trim the profile on the stile. A back saw and sharp chisel are all that’s needed for these cuts.

8. *Trim Mullions to Fit the Mortise.* Trim both of the vertical mullions to fit snugly into the horizontal mullion. Take equal amounts off both vertical mullions and test the fit.
If power tools were baseball players, sanding machines would be the middle-relief pitchers of a workshop — unsung workhorses that efficiently get the job done. A good example is the belt/disc sander. In a previous article (No. 227), I looked at how to get the best results with the disc portion of the tool. Here, I’ll turn the spotlight on the belt side. A tool with a 4”- or 6”-wide belt gives you a good capacity and the power to handle a wide range of operations.

Sticking with the pitcher analogy, a stationary belt sander works great for the middle innings of your woodworking tasks. It shines for refining shapes rather than heavy stock removal. The surface it leaves will be fairly smooth; however, you still need to do additional sanding to get a finish-ready surface.

BELT OPTIONS. Sanding belts are available in a wide range of grits. It isn’t necessary to own one of each. In fact, I usually keep a 120-grit belt on the machine. It sounds coarse, but it does a good job of quickly removing material, running cool, and leaving a consistent surface behind. I find that it’s too easy to burn a workpiece with higher-grit belts to make them worth the effort to buy.

MACHINE SETUP. With a belt in place, there isn’t much you need to do to be up and running with a belt sander. The box on the next page highlights the two settings you need to be aware of.

In use, a belt sander is pretty straightforward. Compared to the disc sander, the belt is capable of greater control for refining flat surfaces, complex shapes, and curved parts. About the only tricky aspect of using one is learning to “land” a workpiece on the belt without gouging the workpiece. The key is easing the workpiece onto the belt with a steady, but not white-knuckled, grip. Don’t worry, you’ll get the hang of it in no time.

Part of what makes the belt sander so handy is all the ways you can configure it to suit different needs. Let’s take a look at a few of the setups.

HORIZONTAL SANDING. For me, the most common setup for a belt sander is in the horizontal position, as shown in the photos on this page. I use it for creating a flat surface on all kinds of project parts — from wide pieces and completed assemblies down to parts that are too small to safely run across at a jointer.

You can use the sander “freehand” in this configuration especially for working on complex shapes. However there are a couple of accessories that can increase your control over the workpiece and to achieve consistent results.

FENCE. The first is the fence. It’s used just like the fence on a jointer. With it, you can keep a workpiece square to the belt as you’re sanding. This is helpful for trimming joinery flush, like the miter splines shown in the photo above.
**ANGLED FENCE.** Most of the time, the fence is set parallel to the belt, but the fence on many sanders also has an angled setting, as shown in the lower left photo on the previous page. While it looks strange, the angled fence setup is great for flattening boards or panels that are wider than the belt.

Here’s how it works. You hold the workpiece against the fence and pass it forward across the belt in a motion that’s similar to using a jointer. This technique results in a surface that’s much flatter than trying to simply move a wide panel side to side parallel to the belt.

I’m sure you can think of the downside to this method. It does create an angled scratch pattern on the workpiece. However, like I mentioned earlier, I’m not looking for a final surface from a belt sander — just a flat one. You’ll find that a random orbit sander removes those angled scratches quickly and easily.

**END STOP.** The other accessory used in horizontal sanding is the end stop. This metal bar runs across the back end of the belt, as you can see in the upper left photo. I use it as a way to pivot a workpiece onto the belt without worrying about the belt grabbing the part and pulling it out of your hands.

With a workpiece resting against the stop, you can move it side to side to help prevent loading the belt with sawdust or burning the workpiece.

**END SANDING.** Sanding flat, straight edges and faces are the bread-and-butter tasks of a belt sander. But it can tackle curves, too. One surprising operation is to use a belt sander to refine and smooth an inside (concave) curve, as shown in the left photo. The way to do that is to flip up (or remove) the upper/end guard and use the idler drum.

It works similar to a sanding drum on a drill press. The caveat is that you’re limited to curves that match or are larger than the radius of the drum. I find it’s a handy way to remove band saw blade marks and work down to a layout line.

**UPRIGHT.** In addition to a horizontal arrangement, the sanding belt can be rotated into a vertical position. (Actually, you can lock it in at 45° as well, but I don’t find that setting especially helpful.) When the belt is upright, the fence rotates around to become a table to support the workpiece.

Why bother switching things around? A vertical setup makes it easier to control a workpiece while sanding the ends, as shown in the upper right photo. I use this setup for sanding small projects and refining outside curves.

The operation of the vertical position is similar to the disc sander side of the machine. However, you can work with wider parts on the belt since you don’t need to worry about the piece contacting the upward rotating half of the disc.

You can even adjust the angle of the table to smooth angled cuts. However, unless the workpiece is wide, this is a task best handled on the disc sander.

Deciding which tools to have in your shop often comes down to a balance between space and utility. Once you weigh the options, adding a belt/disc sander is worth the upgrade.

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**How-To: ADJUST FOR BEST PERFORMANCE**

**END VIEW**

**TENSION & TRACKING.** To work right, the sanding belt has to be pulled taut between the drums (tension) and set to run straight and true (tracking). On most sanders, a knob is used to adjust each setting. Set the tension first, then adjust the tracking in small increments while the sander is running to keep it centered on the drums.
Making multiple project parts that are identical to one another is generally pretty easy — as long as your project parts are all straight and square. I often use my table saw’s rip fence, or a stop block attached to an auxiliary miter fence, to handle the job.

But when you have multiple, identical curved or irregularly shaped pieces in a project, that’s when things can get a little dicey. Luckily, there’s an easy technique for solving this problem. And that’s to use a template combined with a router to create the final shape of all the parts.

WHAT IS A TEMPLATE? If you’ve never worked with a template before, it’s a pretty simple concept. It’s essentially the final shape of a part that’s formed on a separate piece of material. Once complete, this template can be used in several ways: To trace the shape of the part onto the actual project material, to cut around, and even to rout or sand along as you’re forming the final shape of the part (main photo above).

WHEN TO USE A TEMPLATE. There are several instances where a template might come in handy for your project. As mentioned earlier, they’re great for identical curved parts, but they also help if you have one curved part that you want to get exactly right. The curved legs and lower rail on the chest at left are good examples.

Other times, one curve has to match another, such as a round door and a round face frame (take a look at the clock in the lower left photo). You can also use a template in this instance to make sure one shape matches the other with an even gap all around.

TEMPLATE TIPS. If you decide that a part (or parts) on your project could use a template, it’s a good idea to make it out of something that’s relatively easy to machine and inexpensive. Hardboard is my material of choice because it’s flat, stable, easy to cut, and cheap. However, one layer of ¼” hardboard

▲ When you have a project that calls for identical, elaborate curved parts, using a template is the way to go.

▲ Templates can help you shape curved parts that need to match up precisely, such as this curved door rail and upper molding.
While the router table is my go-to tool for flush-trimming smaller parts, I use a couple of different tricks when it comes to trimming parts that are too big for the router table.

**LARGE PIECES.** First, I’ll turn to a hand-held router to complete the flush-trimming on a larger part. However, I still like to have the template on top for more control while performing this operation. This requires using a pattern bit to rout rather than a flush-trim bit, as you can see at right. The pattern bit has a bearing on the shank, so it allows you to rout along the template with the bearing above the workpiece.

**HALF A TEMPLATE.** If one side of your large, curved project part is a mirror image of the other side, another trick to save some material is to make a template for just half of the part (photo below). That way, you can simply move the template to the other side of the project part after you’ve done trimming the first side flush, as shown in the inset photo.

**SHAPING THE TEMPLATE.** When it comes to making the template, the best advice is to take your time and cut carefully. The shape of any given template can vary widely, so you’ll want to choose the best tool for the job. For example, if a portion of the template involves straight lines, you can use a table saw to cut them. Or if the profile features a common radius, I like to use a Forstner bit to drill out those portions (upper left photo).

As far as the curved portions of the template go, your best bet is to rely on the band saw and cut just outside the layout lines (upper middle photo). Then some careful sanding is the key to completing the template. Disc sanders work great for sneaking up on outside curves (upper right), while spindle sanders are helpful for inside curves (right).

**MAKING PARTS.** Once you have the template in hand, the rest of the process is easy. You can actually use the template to lay out the shape of the part on your project material. Then, as before, you’ll cut outside the layout lines, often at the band saw for curved parts.

As for the final trimming, I’ll approach that differently based on the overall size or shape of the part. For smaller parts, I’ll stick with a standard flush-trim bit at the router table. This lets you rout with the bearing and template on top for more precision and control (main photo, previous page). For larger project parts, a hand-held router and a pattern bit might be your best bet, as shown in the box below. Either way, the result is sure to be accurate, consistent project parts.
Whether it’s for edging, face frames, or filler strips, ripping thin strips at the table saw is an operation that comes up quite frequently in woodworking projects. Yet despite how common it is, many woodworkers tend to approach this cut with a measure of trepidation. When you really take a look at the cut, it’s easy to understand why it might give you pause. After all, ripping a thin strip has a tendency to put your hands and fingers a little too close to a spinning saw blade for comfort. Luckily, there are some very simple ways to enhance both the accuracy and comfort level with which you can rip thin strips. Here are three ways that I like to go about it in my shop.

**NOTCHED PUSH BLOCK**
Push blocks and push sticks are nothing new in woodworking. But the problem when ripping very thin strips (¼" to ¼") is that the space between the rip fence and the spinning blade is so tight that you run the risk of cutting into your push block or push stick.

The simple solution, instead, is to craft a push block that’s designed to be cut into, as shown in the main photo above and the drawing at left. As you can see, it’s just a scrap piece with a notch on the bottom edge that slips over the workpiece. I make mine about 8" long, so it can also serve as a hold-down as I push the workpiece through the blade.

You’ll want the push block to be wide enough that it won’t rock or shift as you use it. Since I often have scraps of dimensional lumber around my shop, I typically use pieces of 2x4 to
How-To: CREATE EFFICIENT SHELF EDGING

**Setup.** The jig is set to leave a $\frac{1}{4}$" gap between the blade and jig on one end, and $\frac{1}{8}$" on the other end. Just butt the workpiece between the rip fence and jig.

**Cut.** Remove the jig and make a pass to cut a thin strip from the board.

**Reset.** Now you can replace the jig in the miter slot and repeat the steps in order to cut additional thin strips.

**USE AN INDEXING JIG**

If you’re still hesitant to rip a thin strip with such close quarters between the rip fence and the saw blade, another option is to rip it so it falls to the waste side of the blade instead.

To do this, you simply need an indexing jig, as shown in the drawings above. This simple jig consists of a runner that fights tightly in the miter slot, and an arm that establishes the thickness of the edging strip. To make it, you’ll want to position and install the arm so that the distance between the end of the arm and the blade matches the width of strip that you want. I made mine so that one end will do $\frac{1}{4}$" strips, and the other end does $\frac{1}{8}$" strips.

With the jig assembled, using it is easy as shown in the drawings above. Just butt the wood against the jig, lock the fence, remove the jig, and make the cut. After ripping a strip, shut off the saw and repeat the process of resetting the fence to make another strip. You can continue to repeat this process, cutting as many thin strips as you need.

**SAFE & SIMPLE STRIPS**

More often than not, you’re cutting thin strips to serve as edging for shelves. If that’s the case, another simple method for creating them is shown below. Whichever you choose, these techniques offer some accurate options for thin strips that are sure to keep your hands safe.

**FIRST.** Glue an extra-wide hardwood workpiece between two of your plywood shelves. Make sure that the thickness between the parts is a perfect match.

**SECOND.** Set the table saw rip fence to match the desired width of the shelf plus the edging strip. Make a pass to complete one of the edged shelves.

**THIRD.** Now all that’s left is to flip the second shelf end for end. Make another pass with the same rip fence setting to complete the second shelf.
To cut the cove molding for the hutch (page 40), you'll need to pass the workpiece over the table saw blade at an angle in a series of passes (photos at right). This cut isn't difficult to make, but it's important to set up a pair of fences at the correct angle for guiding the workpiece.

The best way to do this accurately is to use a template like the one shown in Figure 2 below. The template is just a piece of cardboard with an opening that matches the width of the cove.

To use the template to set up the cove cut, you'll first need to raise the table saw blade to the final cove height ($\frac{5}{16}$" in this case, Figure 1). Then place tape on the saw table where it contacts the teeth at the front and back of the blade, and use the template to mark the angle (Figure 2).

**SET FENCES & CUT.** You now have the angle of the cut, but the actual fence position needs to match the width of the workpiece beyond the cove ($\frac{3}{32}$" here). So measure and strike a second line at this location (Figure 3). After setting both fences, cutting the cove just requires a series of very light passes (about $\frac{1}{16}$") until you reach the final shape (Figure 4). Finish up by beveling the edges to complete the cove molding (Figures 5 and 6).
**Groove Routing Guide**

The miter square on page 22 has shallow finger grips on both sides of the handle. A 1”-dia. core box bit in a handheld router, aided by the jig shown at right, works perfect for making these grooves. I sized my jig for a 57⁄8”-dia. router base. Adjust the dimensions to suit your router.

This guide is simple to set up. The oversized handle blank is clamped to the workbench, surrounded by two base pieces and a small stop. The rails and spacers are glued together. With the guide rail assembly clamped in place (Figure 1), rout from end to end and side to side to form the groove.

**Routing Angled Slots**

The slide-out top on the end table (page 26) operates on a simple system. Pins mounted in arms below the top run in angled slots cut in hardwood guides installed in the case. The goal is for the top to slide in and out without bumps and catches. So the trick is coming up with a way to create a smooth, angled slot in a rectangular piece.

**Lay out end holes.** The first step is laying out the location of the slot, as shown in Figure 1a. At the drill press, drill out the end of each slot (Figure 1).

**Routing a slot.** I often use a straight bit in the router table to create a smooth groove. So it only seems natural to use the same setup to cut an angled slot.

Since the slot isn’t parallel to an edge on the workpiece, I used a piece of hardboard as straightedge to guide the workpiece. The straightedge is secured to the guide with double-sided tape (Figure 2).

One edge of the straightedge is set flush with the edge of the slot.

With the straightedge in place, set up the router table fence by dropping the workpiece over the bit and aligning the fence with the straightedge.

Since the guide is only 1⁄4” thick, you can rout the slot in a single pass, as in Figure 3. When you reach the end hole, turn off the router and wait for the bit to stop spinning before lifting the workpiece.

**Miter Square Cradle**

The miter square also requires a slot on the end to house the brass blade. But because the end of the square is mitered at 45°, some support is needed to pass the handle over the saw blade. I quickly created this simple cradle to support the workpiece at the proper angle. With the height of the saw blade set, clamp the handle to the cradle and pass the whole assembly over the blade.
**Mullion Routing Jig**
The horizontal and vertical mullions on page 57 are too small to comfortably work with at the router table. The jig shown here lets you safely rout the sticking profile on these narrow pieces. Begin by making the jig long enough to support the horizontal mullions. Once you have routed the profiles on these longer pieces, you can trim the jig down to hold the vertical mullions.

**Lumber Cart Taper Jig**
Six hardwood dividers create five storage compartments on the back of the lumber cart on page 36. These parts feature a partial taper that extends from the top end of the dividers to where they meet up with the back panel in the completed cart. To quickly and accurately repeat this cut on all six divider pieces, I built the table saw taper jig that you see at left.

The base of the jig is a long piece of plywood with two cleats attached to it. One cleat is a stop for the bottom of the divider; the other holds the divider at the correct angle to cut the taper. To locate the cleats, lay out the dimensions of the taper on one of the dividers and align it to the cutting edge of the sled. Then position the cleats, screw them in place, and attach the toggle clamps as shown at left.

**Lumber Cart Assembly Guide**
The brackets that attach to the main panel of the lumber cart are thick pieces of hardwood that would be difficult to install without some assistance.

That help comes in the form of a simple guide that is shown at right. The guide features four large notches that I cut with a dado blade at the table saw. These notches are spaced to align with the pre-drilled holes on the main panel.

Once the guide is complete, align it to the bottom set of pilot holes and clamp it in place. To aid in the smooth installation of the lag screws, I rubbed a little beeswax on the threads of each of them.

I started by threading the lag screw into the bracket by hand. Then, as I secured the bracket to the main panel, I made sure it was nesting properly in the guide before tightening it down with my ratchet.
Most of the materials and supplies you’ll need to build the projects are available at hardware stores or home centers. For specific products or hard-to-find items, take a look at the sources listed here. You’ll find each item and part number listed below the company name. Refer to the right margin for contact information.

**SCREWDRIVERS (p.14)**
- Amazon
  - Wera Set ............ B000ZEAP9C
- Infinity Cutting Tools
  - Narex Set ............ 101-746
- Lee Valley
  - Chipbreaker ............ 1-SD-4
  - Handle Nut/Cap ............ 1-SD-5
  - Frog Adjuster ............ 1-SD-7

**ROUTER FLATTENING (p.16)**
- Infinity Cutting Tools
  - 1½" Planing Bit ............ 52-503
  - 2" Mega Planing Bit ............ 52-506
- Woodcraft
  - Bowl & Tray Bit ............ 825834

**CUTTING BOARD (p.18)**
The cutting board is finished with two coats of General Finishes Butcher Block Oil.

**MITE SQUARE (p.22)**
- McMaster-Carr
  - Brass Rivets ............ 96082A200
  - Machinable Brass ............ 8954K144

**SLIDING TOP END TABLE (p.26)**
- Lee Valley
  - 2" Casters ............ 00W09.01
  - 1¾" Knobs ............ 02W15.59
The end table was stained with a mixture of three parts Zar cherry stain and one part Wood Kote jel’d stain (cherry). Then it was sprayed with two coats of lacquer.

**LUMBER CART (p.34)**
- Rockler
  - 24" Drawer Slides ............ 48656
- Grizzly
  - 8" Casters ............ G8179
- Essentra Components
  - Drawer Handle ............ KHO-10
The lumber cart was finished with two coats of clear lacquer.

**COUNTRY HUTCH (p.40)**
- Amana Tool
  - Raised Panel Bit ............ 54133
- Lee Valley
  - 1½" Knobs ............ 02W15.53
  - 1½" Knobs ............ 02W14.24
  - Knob Escutcheons ............ 02W32.74
  - No-Mortise Hinges ............ 00H52.23
  - Spring Roller Catches ............ 01L03.01
  - 1" Knobs ............ 02W15.51
  - Shoulder Bolt ............ 00N14.50
  - Shoulder Bolt Cap ............ 00N20.17
- Rockler
  - Shelf Supports ............ 33902
- Lowe’s
  - V-Groove Paneling ............ 304510

The hutch was painted with two coats of General Finishes milk paint (“Antique White”). Then I sanded the paint in wear areas like corners and around hardware. Next, a thin coat of General Finishes “Van Dyke Brown” glaze was brushed on and wiped off these areas to simulate natural aging. The paneling on the upper cabinet back was finished with General Finishes Seal-A-Cell and glazed in a similar fashion. Finally, a protective coat of lacquer was applied to the entire hutch.

**DIVIDED LIGHT DOORS (p.54)**
- Amana Tool
  - Router Bit Set ............ 55360

**HARDWARE & SUPPLIES SOURCES**
Final Details

Looking inside

**Lumber Cart.** Lumber storage is a challenge for most woodworkers. This sturdy cart offers plenty of storage for boards, sheet goods, and cutoffs, all in a compact space. Turn to page 34 for complete plans.

**Sliding Top End Table.** With a top that slides out and rises up, this rolling end table is the perfect armchair or sofa companion. Find out how it works by turning to page 26.

**Quilted Cutting Board.** A cutting board made from end grain blocks provides a tough, long-wearing worksurface. But it also gives you the opportunity to create some interesting patterns. Plans begin on page 18.

**Country Hutch.** This heirloom project hits all the right notes — raised panels, divided light doors, aged brass hardware, and a beadboard back. We walk you through the steps of building it starting on page 40.