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you can build in a weekend



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*See page 82 for more
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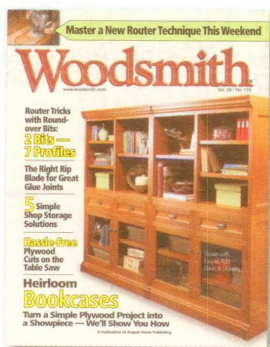
EDITOR'S NOTE

One of the things that I love about woodworking is that there is always an opportunity to learn something. Whether it's a brand-new technique, or just a different approach to a routine task, there's always a challenge. And that's what keeps me going back to the shop.

It's also what this book is all about. You'll find it's filled with a wide range of woodworking techniques — from cutting simple dadoes and grooves, to making intricate marquetry patterns with a scroll saw. But the best part is that you can master each technique in a weekend or less.

And to help you put all these newly acquired skills to use, we've included several exclusive projects at the end of each section. Like the techniques, each of these projects is designed to be completed in a weekend (give or take a day). So you'll not only learn a skill, but you'll have something to show for it.

Terry



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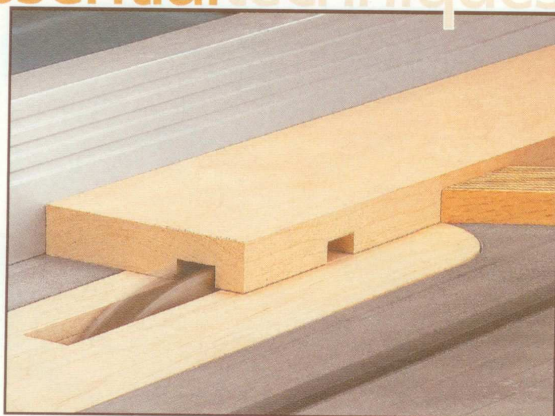
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A table saw is all you need to make sturdy joints. Learn the secrets and strategies for dead-on accuracy.

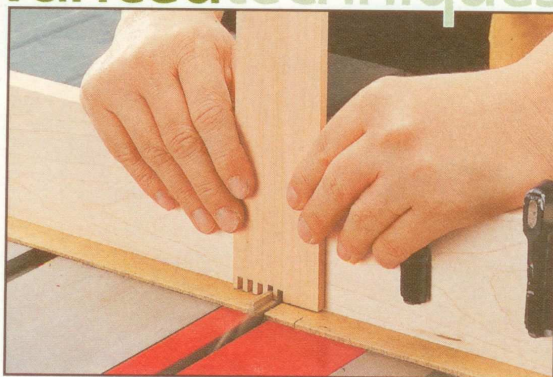
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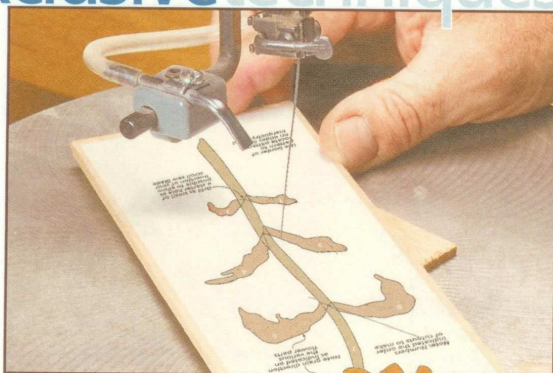
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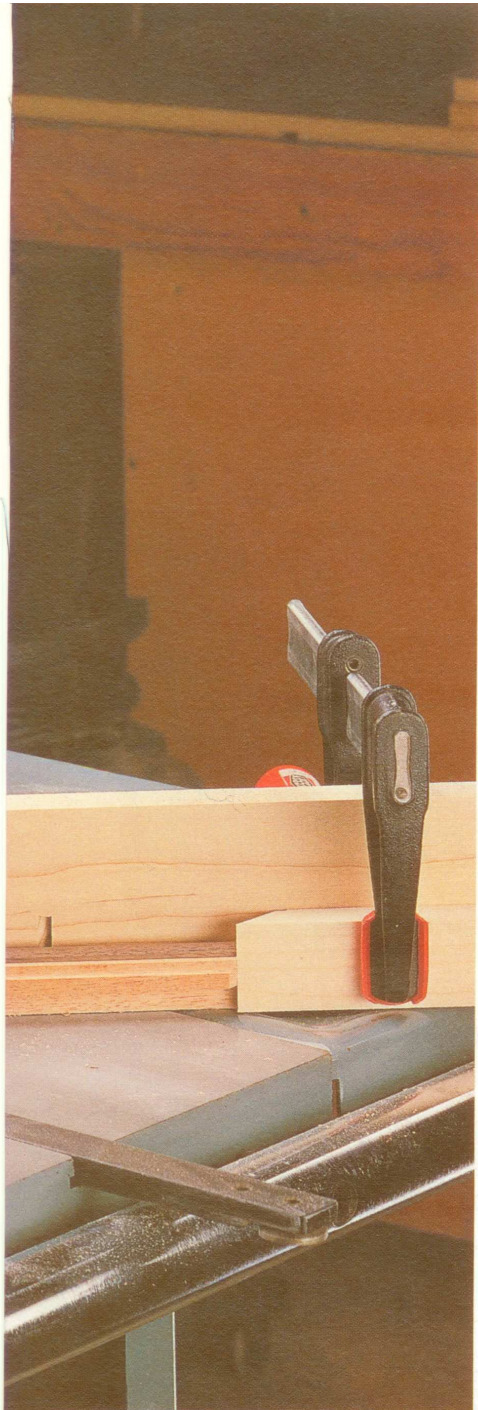
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essential

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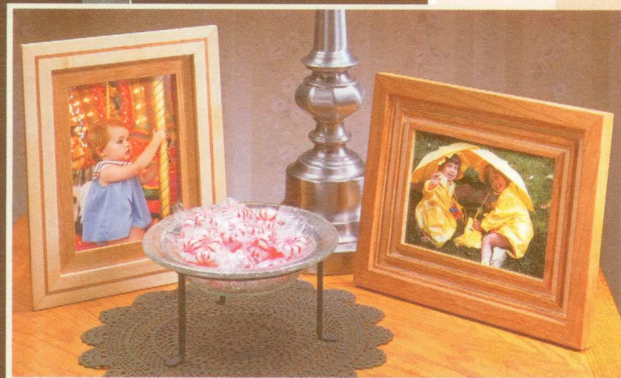
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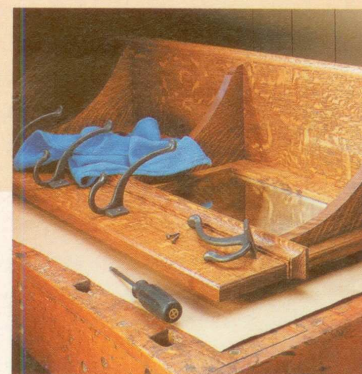
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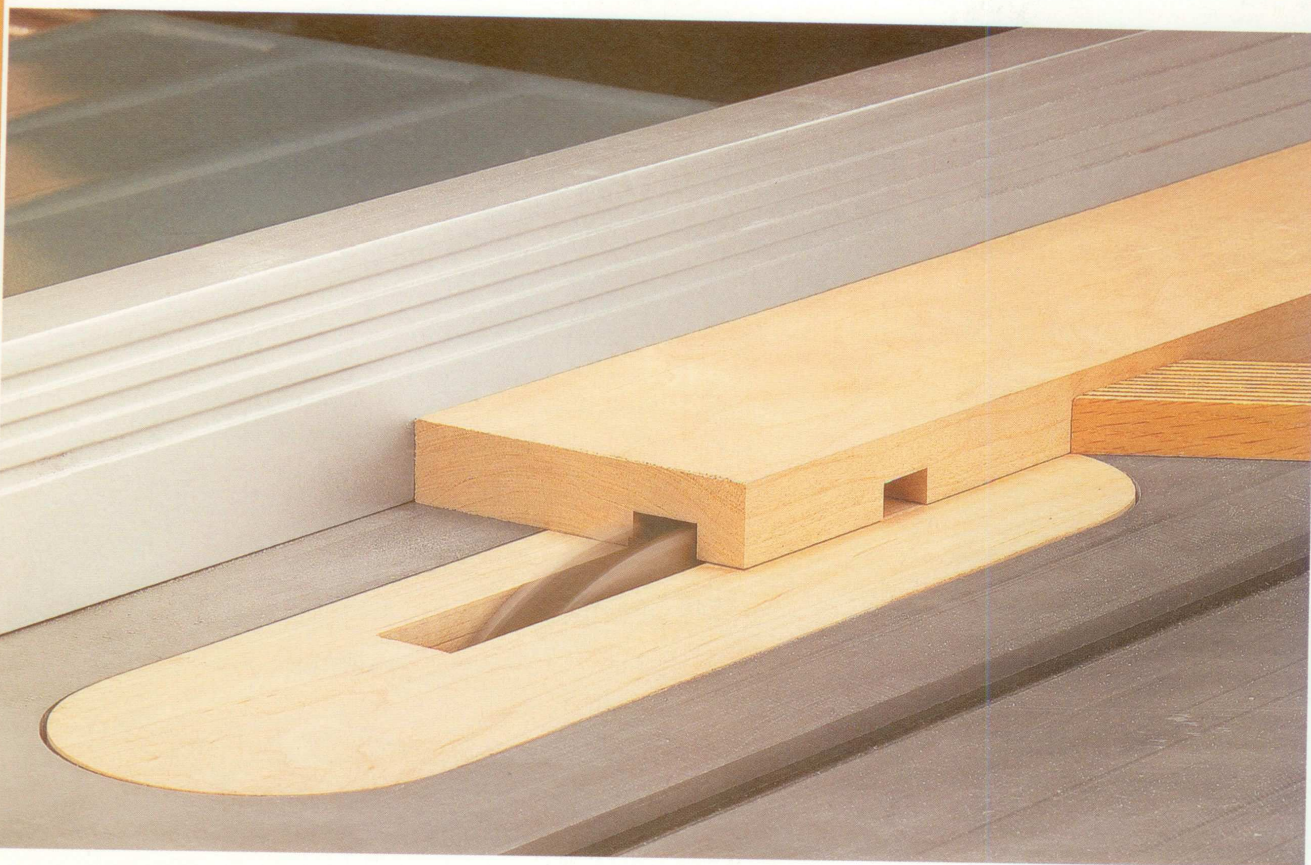
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Making Dadoes & Grooves

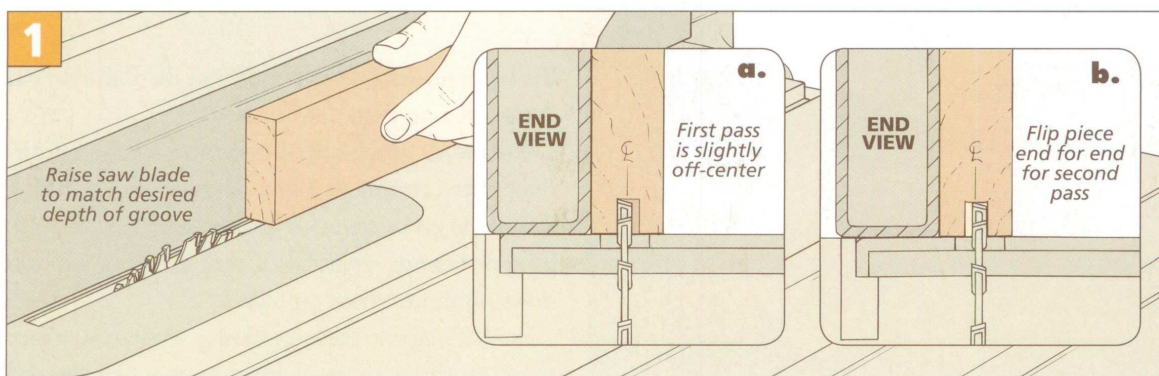
Don't overlook them. Dadoes and grooves are a quick and simple way to improve alignment and add strength to many of your woodworking projects.

If you stop and think about it, dadoes and grooves are the foundation of many of the woodworking joints we use on a regular basis. But even so, it's pretty easy to take them for granted. After all, they just don't demand the same kind of attention as box joints or dovetails. And making dadoes and grooves doesn't involve any fancy, impressive jigs or special tools.

Despite their simplicity, dadoes and grooves are unmatched in their versatility. There's a wide variety of ways they can be used to build furniture: to strengthen joints, to keep pieces aligned, and to hold panels and drawer bottoms. Dadoes and grooves are often combined with other types of joints, like tenons and half laps, as well. And they can be used with glue alone or with screws.

USES. There's not a whole lot involved when it comes to making dadoes and grooves. In the past, they were made entirely by hand, using chisels and planes. Today, all you need to complete the task is a table saw and a dado blade. (As an alternative, you can use a router and a straight bit.) But there's more to dadoes and grooves than just knowing how to make them. It's also important to know how to use them when building furniture projects.

Here's a look at a few ways we commonly use dadoes and grooves and some tips for getting a perfect fit. While this is by no means a complete list of all the ways they can be used, it will hopefully give you some ideas on how you might be able to incorporate dadoes and grooves into your next woodworking project.



NARROW GROOVES

One place where I use grooves all the time is for holding panels, such as the panel in a frame and panel assembly. Grooves can trap a panel and hold it in place effectively. Plus, when combined with stub tenon joinery, the result is a very strong assembly.

Quite often though, the panel is a piece of $\frac{1}{4}$ " plywood or $\frac{1}{4}$ " hardboard. And since these materials are usually a bit under $\frac{1}{4}$ " in thickness, you can't use a stack dado blade to cut the grooves.

SINGLE BLADE. Instead of the stack dado blade, I like to cut the narrow grooves with a single saw blade. The first thing you need to do is to set the rip fence so the blade is roughly centered on the thickness of the stock. Then, raise the blade to match the desired depth of the groove. After that, make a couple passes over the blade, as you see in Figure 1, flipping the workpiece end-for-end between passes.

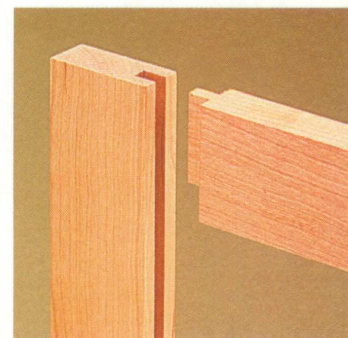
(This centers the groove on the thickness of the workpiece.) If you find that the groove is too narrow, nudge the fence away from the blade just a hair, and try again.

WIDE GROOVES

When it comes to case construction for furniture projects, I often use wide grooves. They're great at doing two things. First, they lock the individual components together, which increases the strength of the carcass and its ability to resist racking. And second, they make the assembly a whole lot easier, since all the pieces lock together and can't shift out of place.

STACK DADO SET. For most projects, I cut grooves to match the thickness of the stock I'm working with. In these cases, I use a stack dado set to cut the grooves. The trick is to get the dado set adjusted to the correct width. To do this, you'll need to use a combination of chippers along with the outside blades of the dado set. And if you're working with plywood, you'll probably need to use shims between the chippers to fine-tune the fit. This method is shown in Figure 2 at left. Note: It's a good idea to make a few test cuts before cutting the grooves in the actual workpieces.

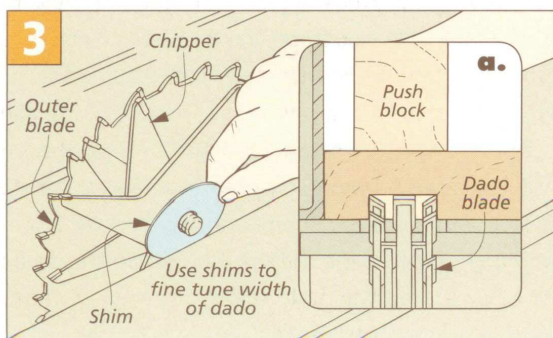
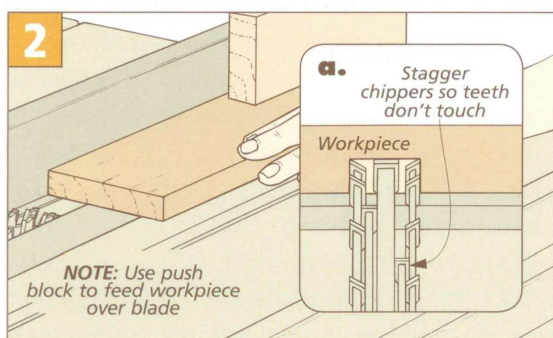
As you can see in Figure 3, cutting grooves on a table saw is nearly identical to ripping a board (except for the fact that you aren't cutting all the way through the workpiece). You can use the rip fence to guide the workpiece and to position the groove on the face of the board. Also, although the dado blade will be covered by the workpiece, it's still a good idea to use a push block.

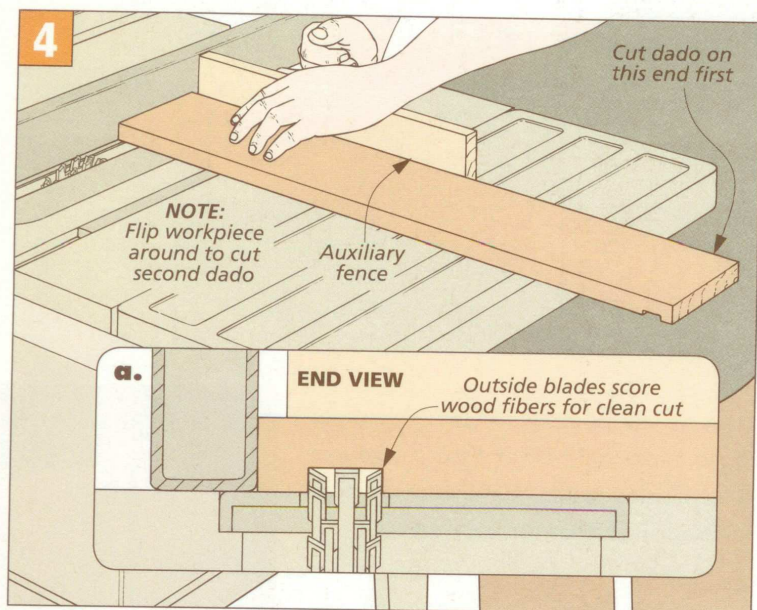


Narrow grooves can be used to hold panels for doors or drawers. Or they can be combined with stub tenons to create strong frames.



Wider grooves are useful in case construction to add strength and simplify assembly.





DADO JOINT

Joining end grain to face grain is always a tough task. Neither glue nor screws hold very well in end grain. This is where a dado joint, like the one shown in the left photo below, comes in handy.

By cutting a dado in one piece, you create a pair of shoulders or “ledges” to hold the mating piece. This locks the piece in place, preventing it from twisting and racking.

To create this joint, I usually use the table saw. Here again, I set up the dado blade to match the width of the dado I want to cut (which is determined by the thickness of the piece that will be going into the dado). To cut the dado, I use the miter gauge to support the workpiece. And I use

the rip fence as a stop to position the dado on the workpiece, as shown in Figure 4.

CROSS-GRAIN CUTS. Cutting dados is a little bit different than cutting grooves. Because you’re cutting across the grain, there’s a greater tendency for chipping or tearout. There are a couple things you can do to minimize these problems.

First, it helps to back up the cut with an auxiliary fence attached to your miter gauge, like the one shown in Figure 4. This fence prevents the dado blade from “blowing out” the back edge of the workpiece as it exits the cut.

SPLINTERING. In addition to tearout at the back of the cut, you may also have to deal with splintering along the edges of the dado. As you can see in Figure 4a, some dado sets have outer blades with teeth that are designed to “score” the fibers of wood along the dado sides and minimize splintering. But depending on how sharp your blade is and the type of material you’re cutting, you may still experience some splintering.

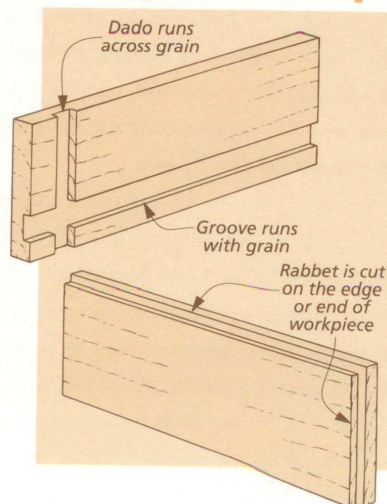
In this case, I often find that a slower feed rate helps to reduce splintering. And if the splintering is really bad, I install a zero-clearance insert in the table saw. This way, the grain is supported on both edges of the cut and is less prone to splintering, as shown in the main photo on page 8.

EVENLY SPACED DADOES. Quite often, I need to make a series of dados that are evenly spaced. Here’s a handy tip to accomplish this efficiently: You can cut them in “pairs” by flipping the workpiece end-for-end before readjusting the rip fence for the next set of dados.



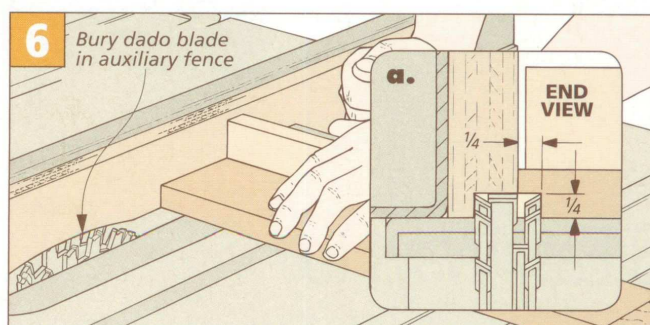
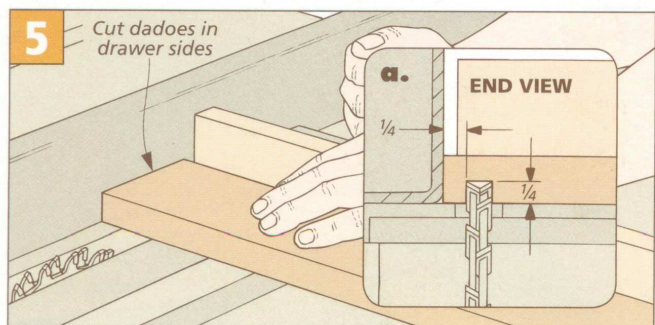
A dado joint can be used to hold a shelf in a bookcase or to join the parts of a cabinet.

Dado, Groove, or Rabbet?



What’s the difference between a dado and a groove? It all has to do with grain direction. A dado runs across the grain of the wood. And a groove runs with the grain of the wood. This is really the only distinction. You can see what I mean in the top drawing at left.

Rabbet. And what about a rabbet? A rabbet is nothing more than a dado or groove that is cut on the end (or edge) of a board. You can see an example of this in the bottom drawing at left.

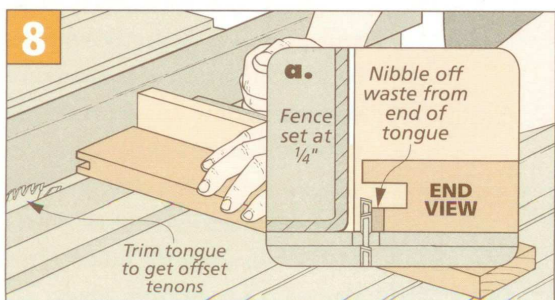
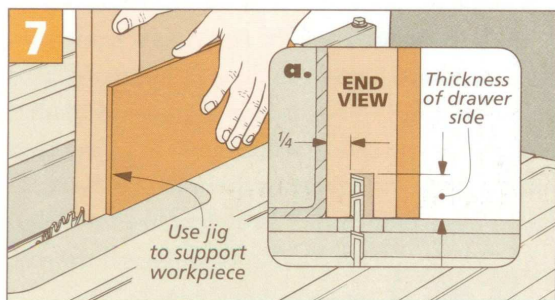


DADOES FOR DRAWERS

One place where dados come in handy is in making drawers. Drawer joints need the added strength because they're subjected to a lot of strain from the constant opening and closing of the drawer.

Although you could join the sides of the drawer to the front and back with butt joints or rabbets, neither of these provides much strength. And setting up to make dovetails can be time-consuming and tricky. So, I often use a tongue and dado joint, like the one shown in the top photo at right. This joint offers a good compromise — it's reasonably strong and isn't difficult to make on a table saw.

Basically, tongues that are cut on the ends of the drawer front and back fit into dados cut in the sides. This creates an interlocking joint that stands up to the tugging of the drawer as it's opened and closed. (This joint works best with false front drawers. For drawers without false fronts, see the locking rabbet joint.)



TWO-STEP. As you can see in the drawings above, this joint is made in two steps. First, dados are cut near the ends of each drawer side (Figure 5). I usually do this with a dado blade, using the rip fence as a stop and the miter gauge to guide the workpiece through the saw.

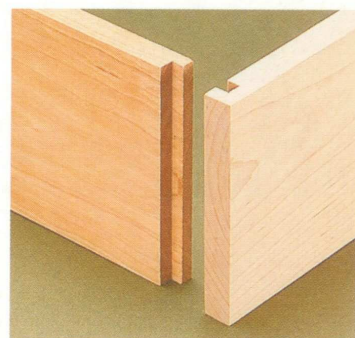
The second step is to create the tongues on the ends of the front and back. This is done by cutting a rabbet on each end. As you can see in Figure 6, I "bury" the dado blade in an auxiliary fence that's attached to the rip fence. The trick is to size the tongues to fit snugly in the dados cut in the drawer sides.

LOCKING RABBET

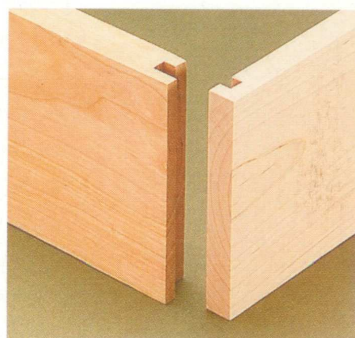
One of my favorite joints for making drawers is a locking rabbet joint. It's similar to the tongue and dado joint, but it provides more glue surface. This joint works well even if you aren't using a false front.

In this joint, the drawer front and back get a slightly different treatment. First, a centered dado is cut on each end of the drawer front and back (Figure 7). This dado is cut in two passes, turning the workpiece around after the first pass. The goal is to create a tongue that will fit into dados cut in the sides of the drawer. You'll need a jig to hold the workpiece upright while cutting the dados. For more on building this jig, go to WoodsmithSpecials.com. Finally, trim back the tongues by nibbling away the waste in a couple passes, as in Figure 8.

The sides of the drawer are dadoed just like in the previous joint (Figure 5). When the drawer is assembled, the drawer sides should be flush with the ends of the drawer front and back.

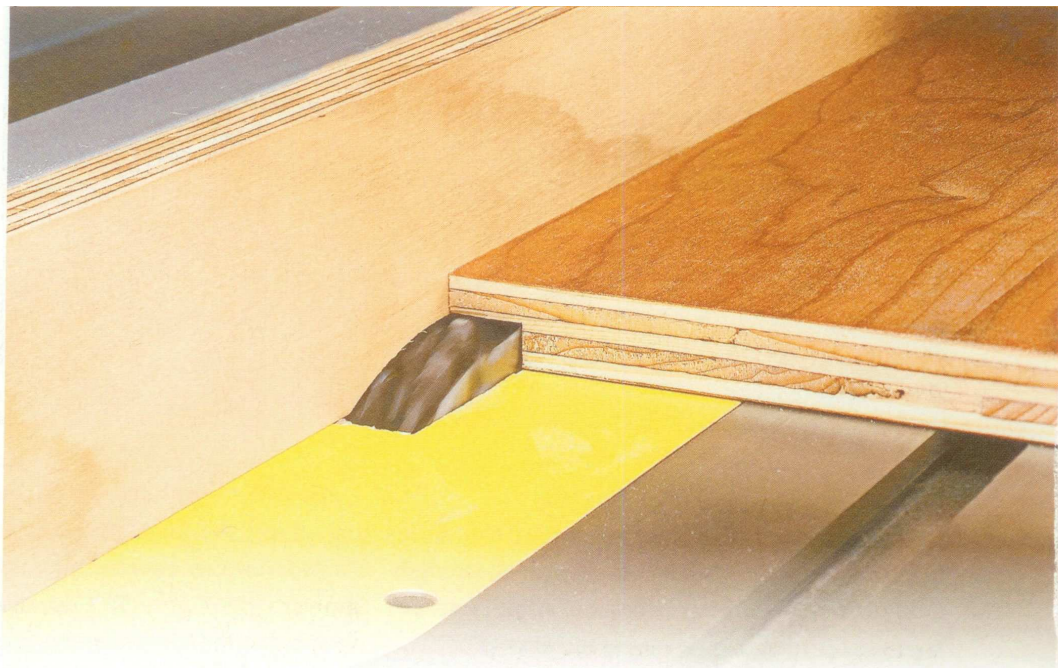


The drawer front and back interlock with the sides using this tongue and dado joint.



A locking rabbet joint looks good, is easy to make on the table saw, and provides a good amount of strength.

3 Easy Ways to Cut a Rabbet



Flat, square rabbets are an essential part of many woodworking projects. These table saw techniques make cutting them a breeze.

There aren't many woodworking projects I tackle that don't involve cutting at least a couple rabbets. Now the old saying goes, "There's a right way and a wrong way to do everything." For the most part, you can't argue with that. But I'll add that sometimes there's more than one right way to do a job. And that's the case with cutting rabbets on the table saw.

QUICK AND EASY

At certain times, I'll use a really simple approach to cutting rabbets on the table saw. This just involves making multiple passes across the blade. And I'll give you a couple examples of when this method might be the best way to handle the job.

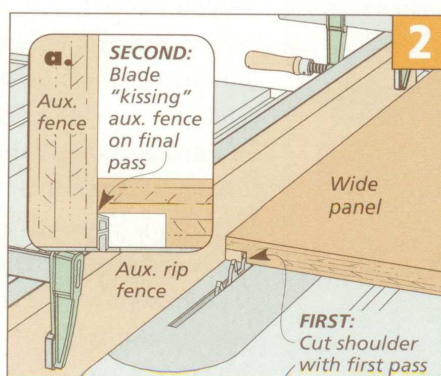
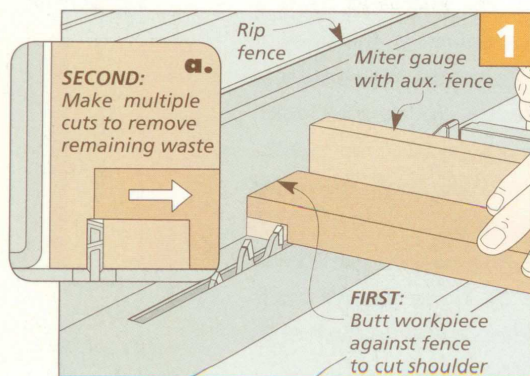
NARROW WORKPIECE. Figures 1 and 1a below show a quick way to cut a rabbet across the end of a long,

narrow workpiece using multiple cuts. Here, the rip fence is set up as an end stop to set the width of the rabbet. And the miter gauge is used to feed the workpiece square to the saw blade.

The setup is pretty straightforward. The distance between the fence and the outside edge of the blade gives you the width of the rabbet, while the height of the blade gives you the depth. It's hard to hit the blade height dead on, so I like to start with the blade set a bit low and then "sneak up" after the first pass.

Once you're set to go, the first pass is made with the workpiece butted up against the fence. This pass gives you a clean, square shoulder. And after making any necessary adjustments, you can start nibbling away the remaining waste. Just back the workpiece a little further away from the fence after each cut until you reach the end, as shown in Figure 1a.

Closely overlapping saw kerfs will give you a pretty smooth bottom. But for an even smoother surface, I follow up with a simple trick. Just use the miter gauge to support the workpiece as you slide it sideways across the blade at several points along the rabbet. This cleans up any leftover ridges.



A WIDE PANEL. Figures 2 and 2a on the opposite page show a similar method for large panels. The difference is that instead of using the miter gauge, you install an auxiliary rip fence on the saw.

As before, the rip fence is set so that the first pass cuts the shoulder of the rabbet. Then, unlock the rip fence, give it a nudge toward the blade, and make a second pass. Just keep nudging the fence over and nibbling away at the waste. On the final pass the saw blade should be barely “kissing” the auxiliary fence. This is illustrated in Figure 2a.

TWO CUTS

A different technique works great for cutting a rabbet up to about 6" wide in the edge of a workpiece.

If you think about it, a rabbet is basically just a 90° notch. So, creating a rabbet can be as simple as making two intersecting, perpendicular cuts. Using this “two-cut” method, you can get the job done quickly and accurately with minimal setup time.

THE TRICKS. The goal here is both to size the rabbet accurately and to make the cuts safely. There are a couple simple, yet important tricks in doing this.

Figures 3 and 4 show the correct way to make the cuts. You'll want to start by making a clean shoulder cut on the face of the workpiece, as you can see in

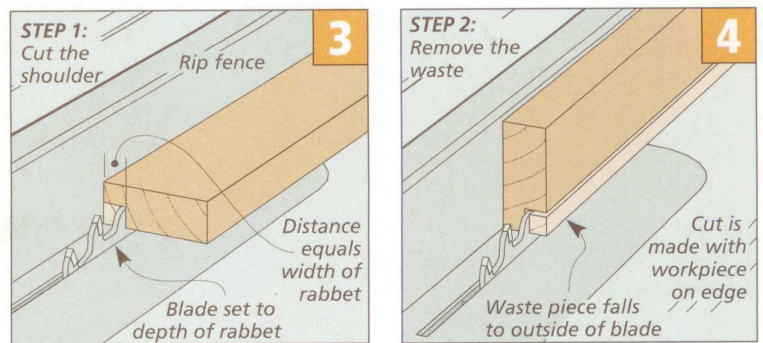


Figure 3, above. Then, just as before, the rip fence is set to establish the width of the rabbet.

The two cuts you make should create a sharp, square corner. So the height of the blade for both cuts has to be right on. I like to start with the blade set a tad low and then “tweak” it up.

The cut that removes the waste has to be made with the workpiece on edge. Figure 4 shows the safe way to do this. You don't want the waste piece trapped between the fence and the saw blade because there's a good chance it will be “kicked” back. The trick is to make the cut so the waste falls safely to the outside of the blade. This just means you'll need to set the fence to the width of the remaining piece, as in Figure 4.

For a technique that's more efficient if you're cutting a lot of rabbets, check out the box below.

Dado Blade Method

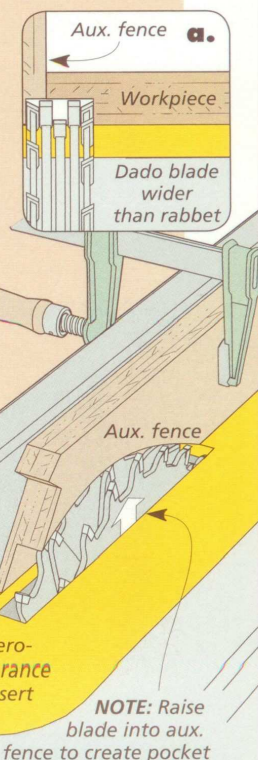
With a good dado blade on the table saw, cutting rabbets enters a whole new world. You'll find rabbeting with a dado blade takes a little extra “setup” time, but afterward you'll zip through the cuts, and the results can't be beat. It's my method of choice when a project calls for some “serious” rabbeting.

The Setup. A dado blade rabbeting setup is pretty straightforward. First comes the blade — a good stack dado set works best. It will give you a clean shoulder and a nice, flat bottom. Whenever possible, you want to put a “stack” on the saw that's slightly wider than the rabbet you're going to cut, as you can see in detail ‘a,’ at right. This allows you to cut the rabbet with a single pass. And then once the blade is installed, I like to cover it with a zero-clearance insert. The cut will be cleaner and the work safer.

Bury the Blade. The final piece in the setup is key. As you can see in the drawings, one edge of the dado

blade is “buried” in an auxiliary fence that's clamped to the rip fence of the saw. You'll use this auxiliary rip fence to guide the cut, and the dado blade will be free to cut right up to the edge of the workpiece.

The Cut. The great thing about rabbeting with a dado blade is that after the saw is set up, you're pretty much home free. Once you've set the fence by measuring to the outside of the blade, use the first workpiece to “sneak up” on the cut depth. When you're right on the money, give each workpiece a pass across the blade. Just apply downward pressure and you'll get quick, consistent results from one workpiece to the next.





Picture-Perfect Miters

Cutting and assembling miters can be a hassle. But with a careful setup and some fine-tuning, you can create perfect, tight-fitting frames.

A miter joint isn't very difficult or complicated. It's just two 45° angles that fit together to form a right angle. And to make one, you simply adjust your miter gauge to 45°, and make a cut on the end of two pieces of wood. You might have to do a little "tweaking" to the miter gauge, the saw blade, or both. But all in all, it's not too challenging to get the two pieces to fit together in a nice, tight joint.

But when you're dealing with more than one miter joint (like the picture frame project on page 26), it's another story. That's because if just one of the miters is off, it will throw the other three out of whack as well. In this case, fitting the miters is every bit as important as cutting them.

Making a picture frame, or any mitered project with perfect-fitting joints, is really a matter of

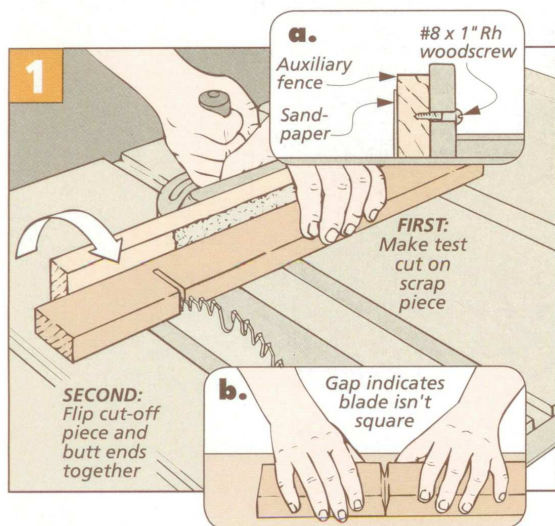
following a sequence of steps. And setting up your equipment properly is the first step.

TABLE SAW TUNE-UP. In order to cut accurate miters, it's important to start with a well-tuned table saw. So, if you haven't tuned up your saw in a while, now is a good time to do so.

First off, the saw blade must be parallel to the miter gauge slots. If it's not, you'll need to realign the trunnions of your saw. (Refer to your table saw manual for tune-up procedures on your specific table saw.)

You'll also want to inspect the fit of the miter gauge in the miter gauge slot. It should slide freely without any side-to-side movement.

After taking care of any play in the miter gauge, check the saw blade to make sure it's set exactly 90° to the saw table. A good way to do this is



shown in Figure 1. Make a test cut in a piece of scrap, flip the cut-off piece over, and check for a gap between the two pieces.

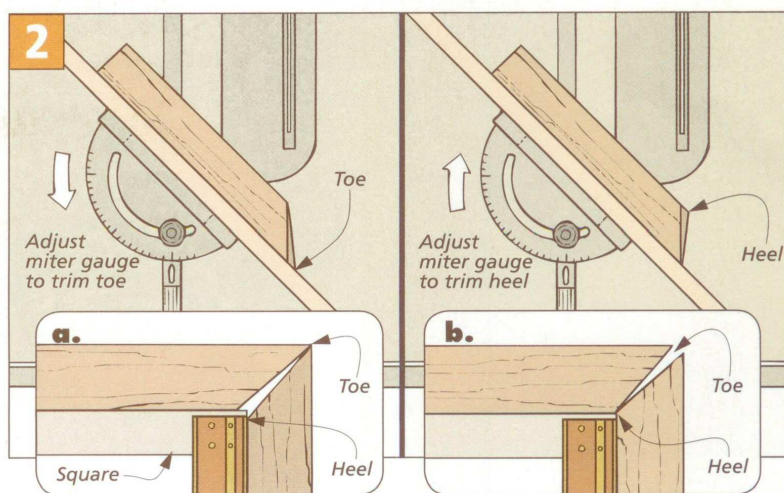
If you have a good crosscut blade, you'll want to use it. A crosscut blade will leave a smooth cut with a minimal amount of splintering. But if you don't own one, a sharp combination blade should work fine.

AUXILIARY FENCE. When cutting miters, I like to attach an auxiliary fence to the face of my miter gauge. This does two things. First, it helps back up the cut to prevent chipout. Second, it gives you plenty of support — making it easier to hold the workpiece while pushing it through the saw blade. And to prevent the workpiece from “creeping” while making the cut, I add a strip of adhesive-backed sandpaper to the face of the miter gauge for a little extra gripping power, as shown in Figure 1a.

When setting my miter gauge to 45°, I don't rely on the markings on the gauge. Instead, I use my combination square. By simply removing the graduated rule from the head of the square, you can easily check the angle of the miter gauge in relation to the saw blade (see margin photo).

TEST CUTS. Although the combination square is pretty accurate, the real proof is in the pudding. So before cutting any of my frame stock, I like to do one final check by making a couple of test cuts. If the two test pieces fit together in a perfect right angle, you're ready to move on to your frame pieces. If not, you need to do a little “fine-tuning” of your miter gauge and make another pair of test cuts (Figure 2).

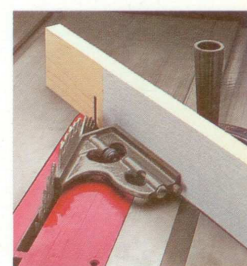
CUTTING THE MITERS. After the test cuts are done, you're ready to start cutting the miters on the actual workpieces. The first thing to do is miter one end of each



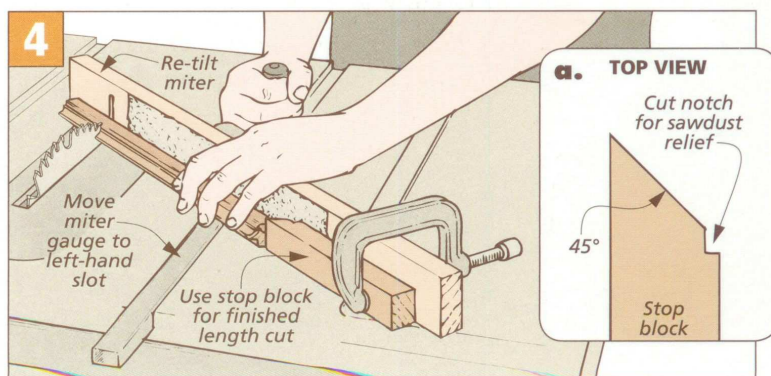
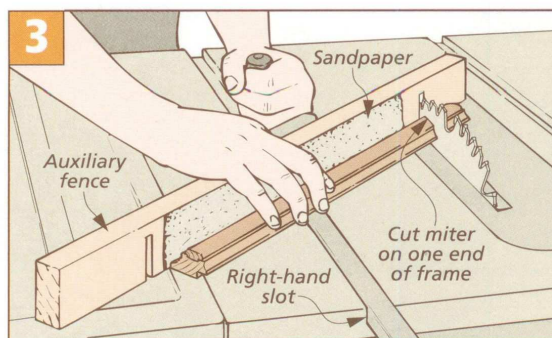
frame piece, as shown in Figure 3. Make sure you hold each workpiece firmly against the miter gauge while making the cut to prevent it from slipping.

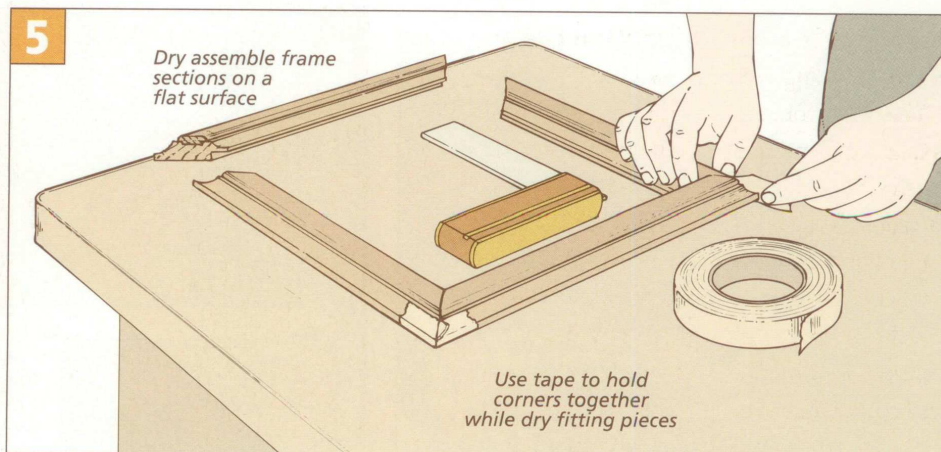
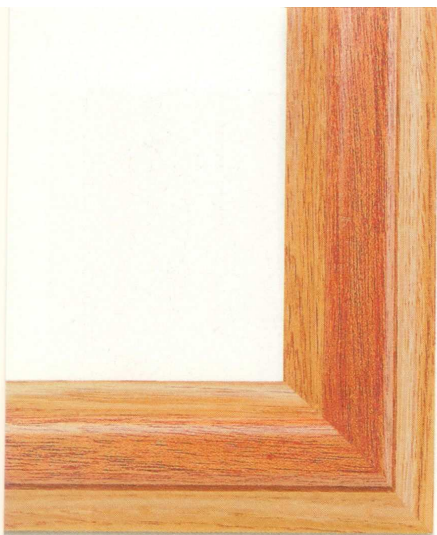
To miter the opposite end of each piece, you need to move the miter gauge to the slot on the other side of your saw blade, and readjust it to the opposite 45° setting, as in Figure 4. (Don't forget to make test cuts again on a few scrap pieces.)

To make sure the opposing frame pieces end up the same length, I use a stop block to position the pieces when making the second miter cut (Figure 4). Note: If the end of the stop block is also mitered, it will provide better support (Figure 4a).



Use the head of a combination square to set the miter gauge to 45°.





ASSEMBLE THE PIECES

Once all of your frame pieces are mitered to finished length, your tendency may be to hurry and glue up the pieces in order to finish the frame. But patience is the key here — you'll get much better results if you take your time and make sure the pieces fit together perfectly before you begin gluing.

DRY-FITTING. The first step in assembling a frame is dry-fitting. This gives you a chance to correct any slight imperfections in the fit of the joints.

I like to dry fit the frame on a nice, flat surface, using tape to hold the corners together, as you can see in Figure 5. You can use a square to check the frame, but don't be too concerned with getting a perfectly square frame. It's more important to examine the fit of each joint individually.

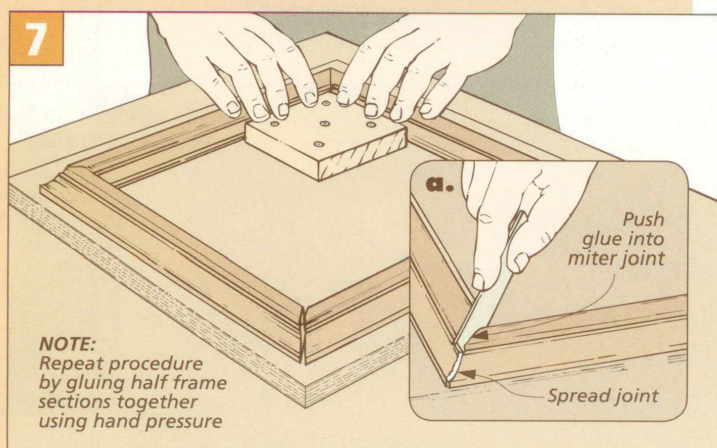
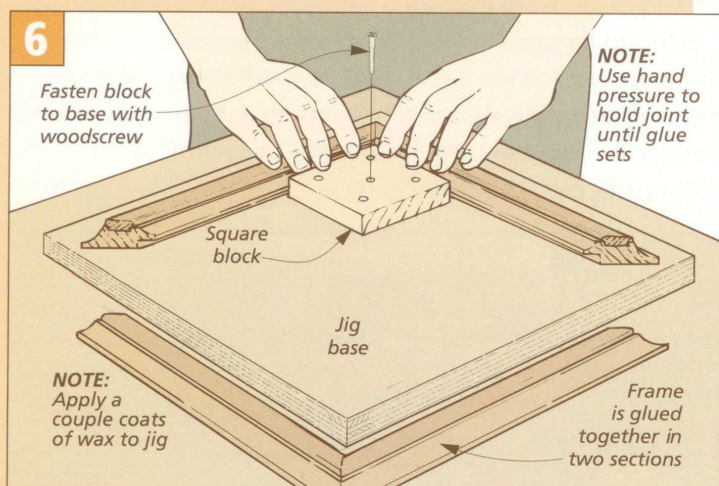
TRIMMING. If the joints aren't tight, you may have to pare away material from the ends of the workpieces with a chisel until the two pieces come together. It helps to create a small hollow on the face of the miters by undercutting the surface a bit, as shown in the photo on the opposite page.

Trim just a small amount and keep checking the fit as you go along. Don't rush the fitting stage of the assembly — this is your main opportunity to work with the pieces until you're satisfied with the results. Once all the joints fit together, you're ready to start gluing up the frame.

When it comes to gluing up picture frames, there are a lot of commercial clamps that allow you to assemble the entire frame at once. However, I've found I get better results by working on just one corner at a time. It takes a little longer, but it allows me to focus my attention on a single joint, rather than on all four at once. Another advantage is that you don't need to go out and buy any special clamps.

SMALL FRAMES

For gluing up small frames, I use something better than clamps — my hands. This allows me to hold the pieces together and apply just the right amount of pressure exactly where it's needed while the glue



sets up. (This usually takes about five minutes if you're working with yellow glue.)

The only problem with holding the pieces by hand is that they tend to slip. To help overcome this, I use a simple jig. It's nothing more than a square block of wood screwed to a piece of plywood, like you see in Figure 6. This block is a handy backstop and provides a way to hold the pieces square.

I like to start assembling my frame pieces by gluing up one corner. Then, while the glue is drying on that corner, I glue up the opposite corner.

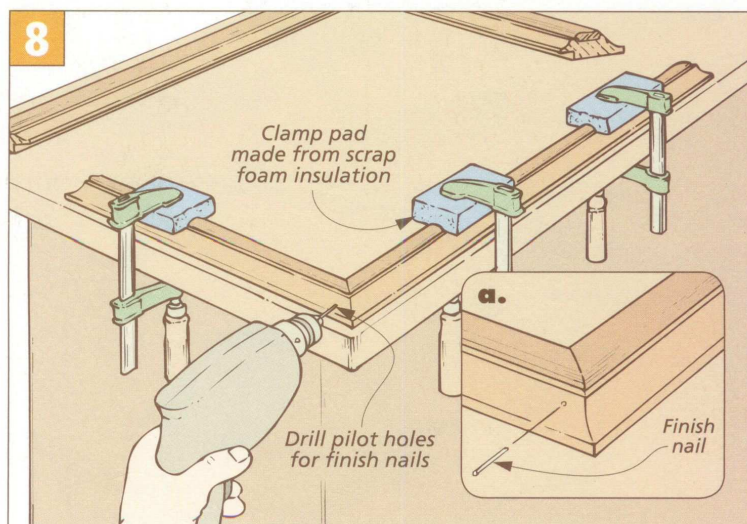
Once these joints are dry, the two halves of the frame can be glued together. Here again, I work on just one corner at a time. When you get down to the last corner, however, you'll need a way to get glue into the joint. In this case, a thin piece of cardboard (or an old playing card) can be used to spread the glue on the mitered faces of the workpieces, as shown in Figures 7 and 7a.

LARGE FRAMES

I use a different approach when it comes to assembling larger frames. I still work on just one corner at a time, but because of the extra weight, I like to nail the joints, as well as glue them.

The only drawback to this approach is that it's difficult to hold the pieces together while you're driving in the nail. To solve this, I clamp the pieces to a flat surface (like a workbench), as you see in Figure 8.

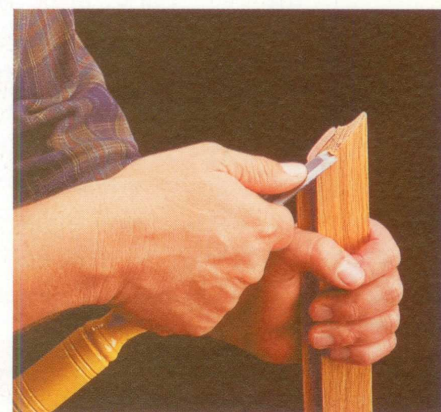
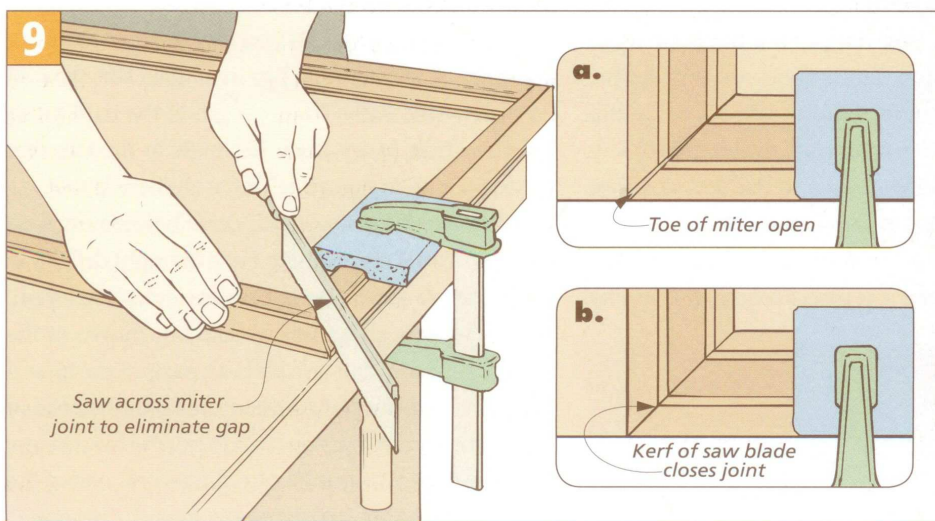
I start by clamping the first piece down along the edge of my bench. Note: To avoid damaging the profile of the molding, try using clamp pads made out



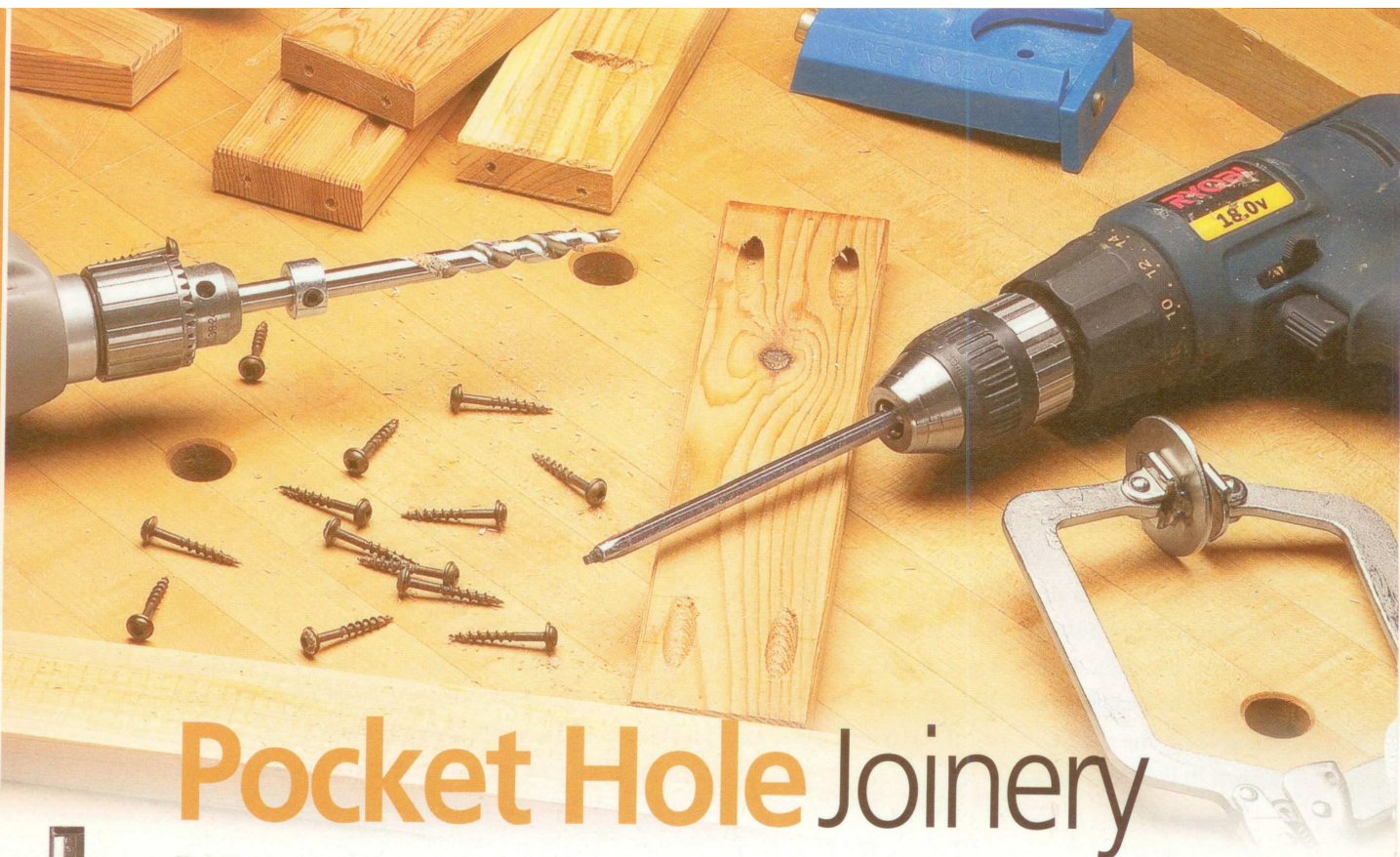
of some scrap pieces of foam insulation (blueboard). With the first piece clamped securely, I apply the glue and clamp the second piece in place.

Once both pieces are clamped securely to the bench, you can drill a pilot hole and drive in a finish nail. Nailing not only strengthens the joint, but allows you to move on to the next corner without waiting for the glue to completely set up.

The two halves of the picture frame are glued together one corner at a time. And just like a small frame, you'll need to fit each joint individually before gluing and nailing. But sometimes the last joint doesn't quite fit together. Instead of trimming it with chisel, I use an old trim carpenter's trick. I simply saw through the joint with a backsaw (Figure 9). Then I glue the pieces together and nail the joint. The completed frame is well-fit, sturdy, and picture-perfect.



To ensure a tight-fitting miter, it may be necessary to undercut the face of each piece slightly.



Pocket Hole Joinery

Drill it, clamp it, and drive it — you'll be impressed with how quickly pocket hole joinery can pull a project together.



The bit used for pocket hole joinery drills both the counterbore and shank hole in one operation.

When it comes to woodworking techniques, it doesn't get much simpler than pocket hole joinery — basically just butt joints that are screwed together. But the screws aren't driven straight through the workpiece like you might expect. Instead, they're installed through the face at a slight angle (15°). This means the screw enters the face of one piece and "bites" into the edge of the mating piece, as you can see in the photo below.

BENEFITS. It doesn't take long to see the benefits of this joinery technique. Since these are butt joints, cutting pieces to length requires almost no math. You don't have to add or subtract the lengths of any tenons or allow for the depths of dadoes, grooves, or rabbets. Just measure, mark, and cut.

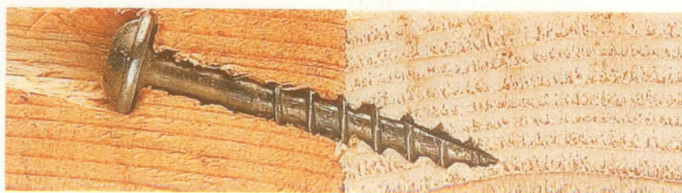
Creating the joint is fast as well. You just drill the pocket holes and screw the pieces together. The only

clamping that may be necessary is to keep the pieces from shifting while you're driving the screws. For additional reinforcement, you can also use a bit of glue. Either way, you can move on to the next joint as soon as the screws are in place.

POCKET HOLE JIG. It sounds simple enough. But like any method of joinery, you need to have the right tools on hand in order to work quickly and efficiently. This means you need a pocket hole jig.

In the box on page 21, you can see that there are a variety of pocket hole jigs available. But they all do exactly the same thing — guide the drill bit as it drills a hole at a precise 15° angle to the face of a workpiece, as in Figure 1. That's all there is to it.

DRILL BIT. But there's more to pocket hole joinery than just a jig. You'll also want to have the right drill bit to make the job quick and the pocket holes consistent. What's unique about this special bit, shown in the margin photo, is that it drills both parts of the hole at once. The oval-shaped counterbore holds the head of the screw. It's just deep enough to put the head below the face of the workpiece. And the second part of the hole is for the shank of the screw to pass through.



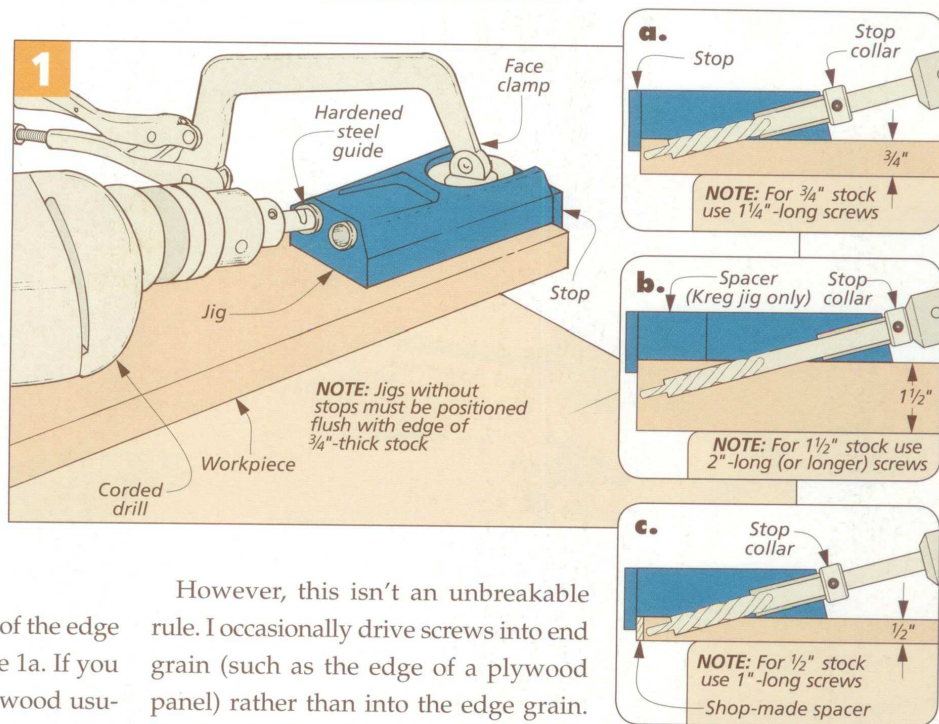
To do this, the drill bit is “stepped” — about $\frac{1}{2}$ " of the tip is a smaller diameter than the rest of the bit. I like the bits with square “steps” or shoulders (not the tapered ones). This way, the head of the screw has something solid to stop against, and there’s less chance it will wedge in too far.

CONSISTENT DEPTH. Of course, the holes have to be drilled to a consistent depth. So you need to have a stop collar for the drill bit. (Not all come with them.) And to set this collar, you need to know where the hole should stop.

I like the shank hole to stop just short of the edge of the workpiece, as illustrated in Figure 1a. If you drill completely through the piece, the wood usually splinters, which may prevent the pieces you’re joining from fitting together tightly.

CORDED DRILL. When drilling the pocket holes, I use a corded, electric drill. It has more power and speed than a cordless drill, which is helpful when drilling into hardwoods. Plus, you won’t have to worry about running down the battery with repeated use.

WHICH WORKPIECE? As far as the basics go, that’s about it. But there are a couple more things to mention. First, you need to decide which workpiece to drill the pocket hole in. Here, I like to think of the screws as if they were tenons. So, the piece I’d normally cut the tenon on is usually the one that gets the pocket holes. This means the screw threads will be cutting into edge or cross grain, which is much stronger than if the screws were being driven into end grain.



However, this isn’t an unbreakable rule. I occasionally drive screws into end grain (such as the edge of a plywood panel) rather than into the edge grain. But I typically only do this if I’m trying to hide the screws on my workpiece.

STOCK THICKNESS. The other thing to mention is that pocket hole jigs are designed to work primarily with $\frac{3}{4}$ "-thick stock (Figure 1a). When the jig is aligned with the edge of the workpiece, the screw will come out roughly centered on the thickness of the stock.

However, the jig also can also be used to join $1\frac{1}{2}$ "-thick (“two-by”) stock and $\frac{1}{2}$ "-thick stock, as you see in Figures 1b and 1c. But you’ll have to adjust the position of the jig on the piece and reset the depth collar on the bit. There can be a bit of trial and error here. To check the setup, just run a screw through a test piece to see where it exits (and how far). Note: The Kreg jig shown here has a spacer for use with $1\frac{1}{2}$ "-thick stock.

Choosing the Best Pocket Screw



Thread Type. Fine threads (top) are used for hardwood, and coarse threads (bottom) are for softwoods.



Head Style. Use washer head screws (top) for plywood and pine. Pan head screws (bottom) are for hardwoods.



Screw Length. Choosing the right screw length depends on the thickness of the workpiece you’re using.



ASSEMBLY

As soon as the holes have been drilled, you're half the way to a strong pocket hole joint. The second step is to screw the workpieces together. This is just about as simple as it sounds. However, you need to consider some important differences from the way you're probably used to working with woodscrews.

SELF-TAPPING SCREWS. The first big difference is in the type of screws that are used. Instead of regular woodscrews, pocket hole joinery uses special, self-tapping screws. These have an auger point, which allows them to drive into the mating workpiece without splitting the wood.

Because these screws are self-tapping, you'll want to match the threads on the screws with the type of material you're using. This is really just a matter of choosing between a fine or coarse thread.

Generally speaking, fine-threaded screws are for hardwoods, like oak, maple, and cherry. The threads have a shallow pitch, so the screw drives in a bit slower than those with coarse threads. This way, the screw is less likely to break when being driven into a hard piece of wood. (The shank of the screw is also thicker for the same reason.)

Breaking screws is less of a concern when working with softwoods and plywood, so you can use a coarse-threaded screw — it drives in

noticeably faster. However, you need to make sure you don't drive the screws in too far. This is a real possibility — even with the square shoulder of the counterbore and the panhead on the screw.

DRILL WITH CLUTCH. The way to prevent driving the screws in too far is to use a drill with a clutch. (Here, I use a cordless drill.) You can play with the setting, but with softwoods, it will be fairly light.

If you don't have a drill with a clutch, you can drive the screws in most of the way with your regular drill and then tighten them with a screwdriver.

LONG DRIVER. Besides a drill with a clutch, you'll also need a long

driver. (Most pocket hole screws are square drive.) You can get by with a 3"-long driver (it's a good idea to have one on hand for tight corners anyway), but you'll find a 6"-long driver is easier to work with. It lets you drive the pocket screws in at a shallow, 15° angle and still have enough clearance for the chuck of the drill.

ASSEMBLY. When you're ready to screw the two pieces together, it's important to make sure they're not going to shift. Remember, the shank hole is a smaller diameter than the threads of the screw, and it's not drilled completely through the first piece. So, the two pieces will want to push apart as the threads start to engage the mating piece (especially with the more aggressive, coarse-threaded screws). And although the screws will pull the joint tight, the pieces may shift slightly — leaving a small shoulder between them.

There are a couple of ways to prevent the pieces from shifting. *Kreg* offers a face clamp that has a large, flat disc welded to one of the pads. The disc is positioned across the outside faces of the workpieces to hold them flush. This doesn't actually keep them from separating. Instead, it prevents the faces from shifting out of alignment. And in my experience, the screws always pull the two pieces back together with no shoulder.

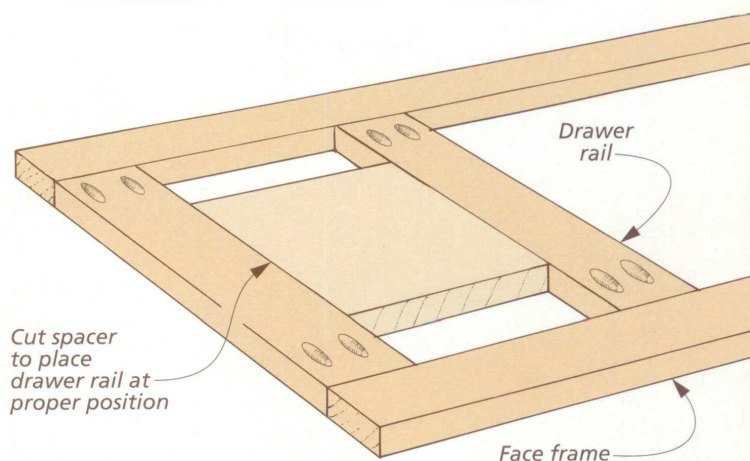
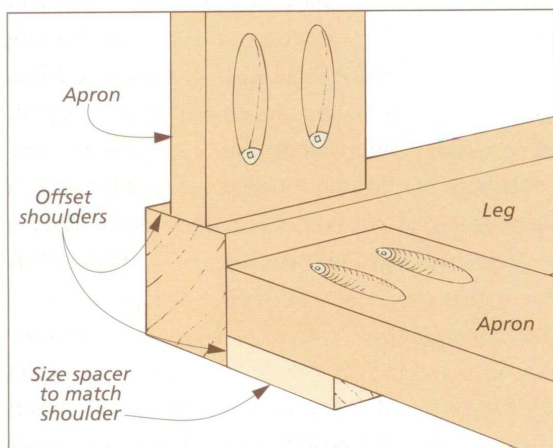
The other way to hold the workpieces is simply to clamp them like you would if you were assembling

them with some other method — only you won't need to leave the clamps on. Or for flat assemblies, like face frames, you can make a simple assembly platform. Just attach two fences at 90° to each other on a plywood platform, and then place strips of adhesive-backed sandpaper across the base.

GLUE. Keep in mind that whether or not you add glue to the joint is up to you. Even though the pocket screws are plenty strong, I generally think it's a good idea. Just go light on the glue so there isn't a lot of clean up.

ASSEMBLY TIPS

That's essentially all there is to assembling a pocket hole joint. But not all assemblies are quite so straightforward. There are plenty of situations when you could use a little help positioning a workpiece. However, it's really just a matter of getting used to a new method of assembly with a different set of challenges than traditional gluing



and clamping. And the solution is usually as easy as adding a scrap spacer or cleat.

DRAWER RAILS. Take for example a face frame with a drawer opening. Once the outside frame has been assembled, I cut a scrap piece to match the height of the opening, as in the drawing above. This spacer makes positioning the drawer rail easier and more accurate — especially if you're building more than one.

OFFSET SHOULDERS. Another instance in which a spacer comes in handy is when you don't want the faces to end up flush. When building a table base, I usually set the aprons back from the outside faces of the legs, as in the drawing at left. To create this shoulder, all you need to do is slip a small spacer under the piece you want to offset.

All in all, I'd have to say that pocket hole joinery is pretty impressive. It's fast and strong, and there are lots of times when that's exactly what I need. It won't replace traditional joinery in my shop, but a pocket hole jig is a great tool to have on hand.

Picking a Pocket Hole Jig

When you're ready to try pocket hole joinery, you won't have any trouble finding a jig. As you can see in the photo, there are a variety available — and you can find them just about anywhere. But when comparing the costs, make sure you know what you're getting — and what you're not.

Jig. When choosing a jig, there is really just one essential: hardened guides. (Most jigs have them, but not all.) I also found the positioning stop on the end of the Kreg "Rocket" and some of the other jigs to be helpful. As far as being able to adjust the width between

guides, it's often just as easy to reposition the jig.

Drill Bit. Having the right drill bit is as important as finding the right jig. As I mentioned, I like a bit with square shoulders (instead of tapered). And in addition to the bit itself, you'll need to get a stop collar for the bit.

Other Items. Besides these two items, you'll need a long power driver and some special screws. Plus, Kreg sells a face clamp that's pretty handy.





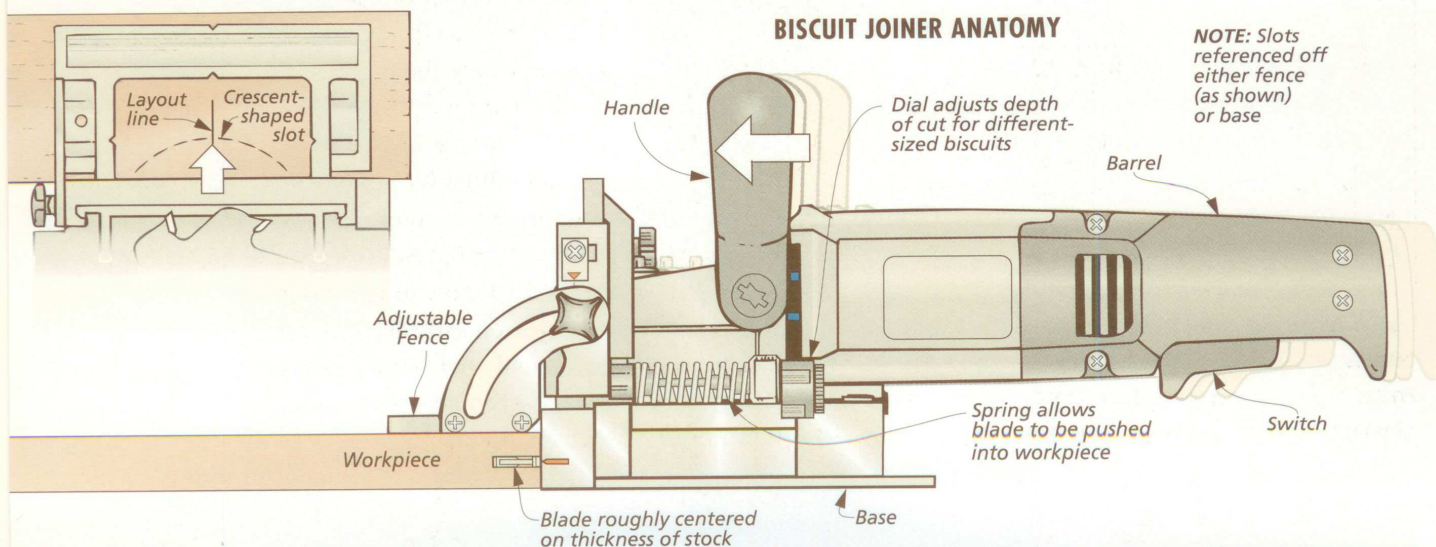
Biscuit Joinery

In terms of speed, nothing beats a biscuit joiner. You can have a joint cut and assembled in the time it takes to lay out a traditional joint.

Pull a new biscuit joiner out of its box, and in a few minutes you can be building a project. Getting the basics down hardly takes any time at all. And when you start working, you'll be amazed how quickly things go. A joint can be laid out, cut, and assembled in minutes — with the same accuracy as traditional joints, which could take up to a half hour to complete.

SIMPLICITY. The reason a biscuit joiner is so quick is because it's simple. It does one thing — scoop out a circular-shaped slot (drawings below). Matching slots are cut in mating workpieces that butt together. Then, the joint is glued up with a special spline: a “biscuit” that's shaped like a football (lower drawing, opposite page). This biscuit is a compressed piece of solid wood. When you add the glue during assembly, the biscuit swells, creating a tight fit in the slots.

The first time I used a biscuit joiner, I thought it looked, felt, and sounded like a right angle grinder.



It's as if the grinding wheel was replaced by a small circular saw blade, though you don't see this blade — it's covered by the joiner's faceplate and fence.

PLUNGING MOTION. But unlike a grinder, the biscuit joiner works with a quick, plunging motion. With one hand gripping the trigger barrel and the other on the handle, you simply butt the fence and faceplate against a workpiece and squeeze the trigger (see the drawing on the opposite page). Pushing on the handles compresses a spring and plunges the blade into the wood. Although you never see the blade, you know the tool is doing its job by the "whine" of the motor and the clean slot left in the piece.

This quick plunging motion is all there is to cutting the slots. But cutting the slot is only one part of the process. You also have to lay out the joint and set up the joiner for the cut. Fortunately, these tasks are almost as quick as cutting the slot.

LAYING OUT SLOTS. The layout is as easy as locating the center of each biscuit slot. And the spacing of the biscuits isn't critical, either. So, you don't need any layout tools. Fit the two pieces together and draw a line across the joint, as shown in Figure 1. Then, when you cut the slots, just align the layout line with the reference line on the plate joiner (Figure 1).

If you're like me, you'll lay out the first few joints with the same precision as a hand-cut dovetail. But a biscuit joint isn't a glove-tight fit. The slots are wider and deeper to provide some built-in "breathing room," as you see in the drawing below. Because of this extra room, you'll be able to adjust the workpieces during assembly to make sure they align.

SETTING UP THE JOINER. To set up a joiner, you have to set the depth of the slot, center the blade, and occasionally angle the fence. This sounds like a lot more

work than it really is. That's because 95 percent of the time I'm working with $\frac{3}{4}$ "-thick stock and a square fence, so all I have to do is set the depth of the slot. And even this is easy.

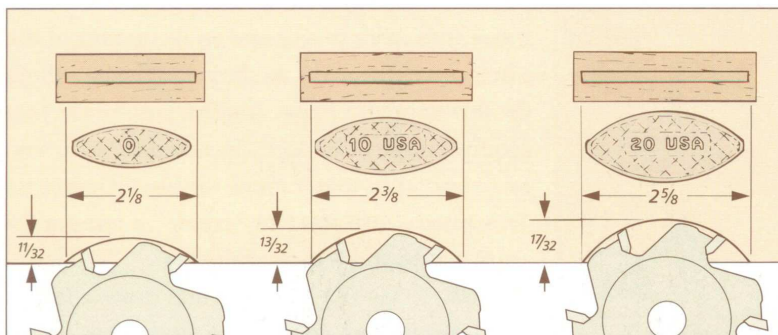
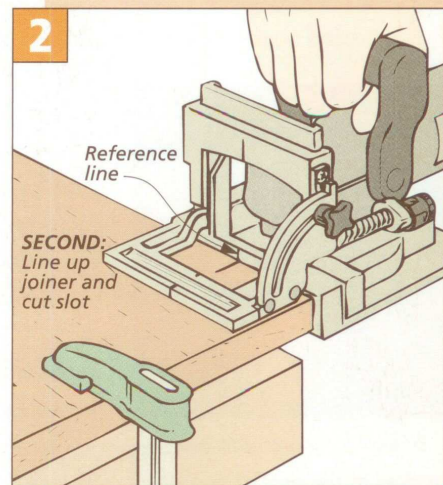
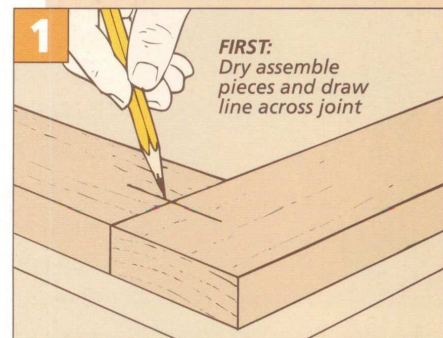
DEPTH OF CUT. There are three sizes of biscuits (shown in the drawing at the bottom of the page), and the slot depths are all preset. So all you have to do is turn a dial to the right biscuit size, and you're ready to begin cutting the slots.

FENCE HEIGHT. As for the fence, it should be set so the slots are roughly centered on the thickness of the pieces. As I mentioned earlier, the majority of the time I'm using $\frac{3}{4}$ "-thick stock, so I don't have to adjust the fence very often (and it only takes seconds).

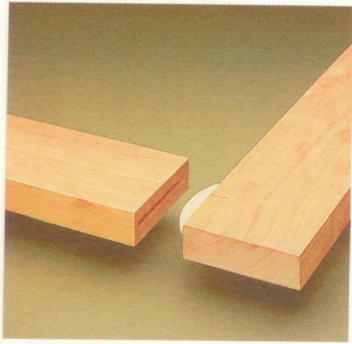
Note: When working with $\frac{3}{4}$ "-thick stock, you can also use the base as a reference. Just be consistent. Don't use the base for one piece and the fence for its mating piece — the two slots may not line up with each other.

FENCE ANGLE. With the depth of cut and the fence set, you're ready to cut the slots. For some joints, however, you also need to angle the fence. There are a number of ways to do this depending on your particular model of joiner. Many fences adjust to trap the point of a 45° bevel, and others fit over the inside corner of the bevel. But again, you typically won't have to worry about this.

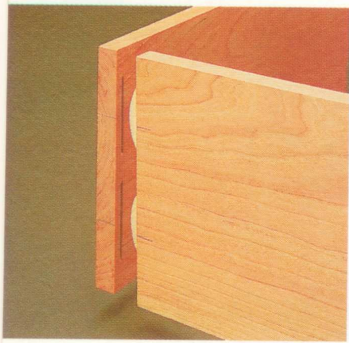
These are just some basic points. But before you get started with a biscuit joiner, there are a few simple setups to learn. On pages 24 and 25, you'll find more information on the common joints you can build with your biscuit joiner, and some things you need to watch out for.



Biscuit Sizes. There are three standard sized biscuits (#0, #10, and #20). Preset depth settings adjust the depths (and widths) of the slots, which are slightly oversize. The #0 biscuit requires a workpiece about $2\frac{1}{4}$ " wide.



All it takes is a single biscuit in each corner to create a strong and rigid face frame.



To join a corner with biscuits, cut slots in the end of one piece and in the face of the other.

FRAME JOINTS

Biscuit joinery is perfect for frames, as shown in the upper photo at left. A slot is cut in the end of one piece and the edge of the other. And you don't have to worry about allowing for tenons — the rails and stiles simply butt together. The only limitation you'll run into is with narrow boards. Even with a #0 biscuit, the workpieces have to be at least 2¼" wide, or the slots will go all the way across the ends. Note: When laying out narrow pieces, it's a good idea to center the layout lines exactly.

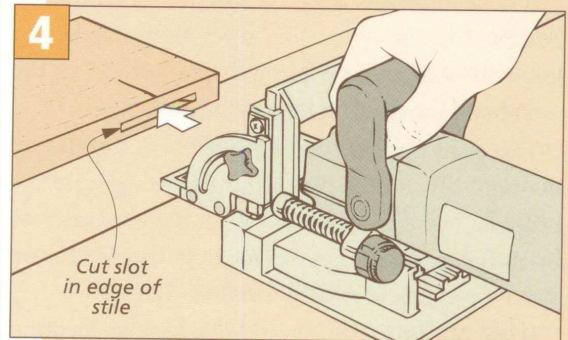
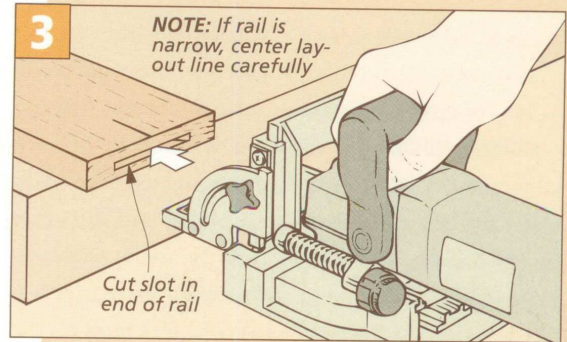
To make a frame, first dry assemble each corner, and draw a layout line across the joint, as shown in Figure 3. Then just clamp each piece down and cut its slot, like you see in Figures 3 and 4.

CORNER JOINT

A corner is also easy to create with a biscuit joiner. Here, the end of one piece is slotted and butts into the face of the other piece, as shown in the lower photo at left. But there's more to this than you might think.

LAYOUT. A corner joint begins like any other biscuit joint. The pieces are set together and layout lines are drawn on the outside face and end. Then, the slots can be cut in the end of one piece (Figure 5).

The trick comes when you're cutting the slots on the face of the mating piece. Here the fence rests on the end of the board, and it's a bit of a balancing act to keep both the fence and faceplate tight against



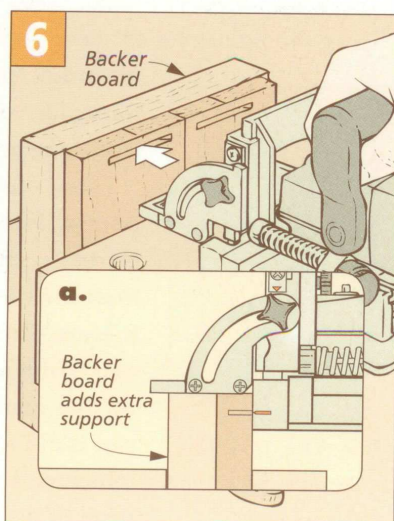
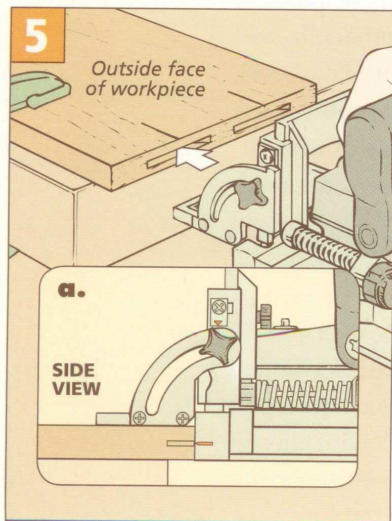
the workpiece. It's hard to know whether or not the joiner is sitting square on the thin end of the board.

BACKER BOARD. However, there's a simple solution. I clamp the piece vertically in a vise, as you see in Figure 6. And to make the end "thicker," I place a backer board behind the piece (Figure 6a).

LONG WORKPIECES. Unfortunately, this technique won't work when you have long workpieces because you can't stand them on end. So instead, I lay the pieces down and treat them like a T-joint (explained in the next section). And to support the joiner, I also add a spacer block. You can learn more about this by going to WoodsmithSpecials.com.



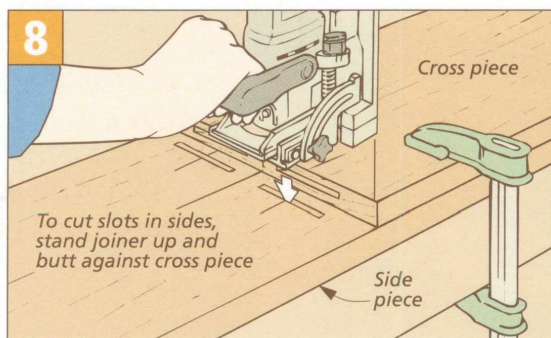
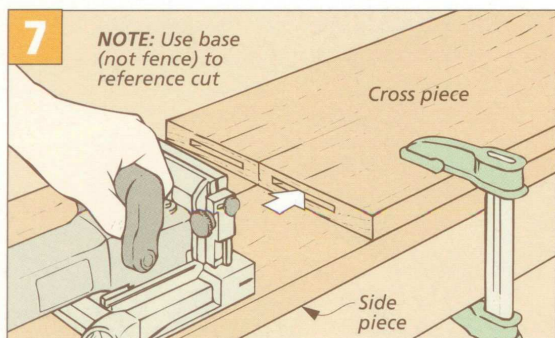
For more tips on biscuit joinery, go to our website: WoodsmithSpecials.com



T-JOINT

A T-joint has slots cut in the end of one workpiece (the cross piece) and in the center of the other piece (the side), as shown in the top photo on the opposite page. It's the side piece that requires more attention. The reason? There's no edge or corner to reference the biscuit joiner to. This means you have to "create" a temporary corner to butt the tool against.

LAYOUT. To lay out a T-joint, first draw a line to locate the bottom edge of the cross piece on the side piece. Then clamp the cross piece flush with this layout line, like you see in Figure 7. Now you can lay out the centers of the biscuits on both the



side and the cross piece. Once the layout is complete, you're ready to begin cutting the slots.

USE BASE. A T-joint is unique in another way. You can't use the joiner's fence to reference the cuts on the side pieces — so you can't use the fence on the cross pieces either. Instead, the base is used for both. First, set the base on the side piece, and cut the slots in the end of the cross piece (Figure 7). Then, cut the slots in the face of the side piece by simply standing the joiner up and setting its base tight against the cross piece (Figure 8).

MITER JOINTS

Because no end grain is visible, I like the clean look of a miter joint. But it's nice if they can be reinforced. Here, a biscuit joiner really earns its keep. Adding a biscuit is a quick way to strengthen a miter joint, whether the workpieces are part of a frame (as in the middle photo at right) or part of a cabinet base (lower photo at right).

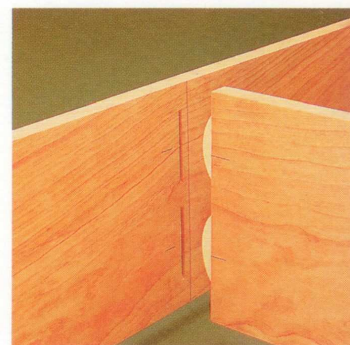
MITERED FRAME. Using biscuits to join a mitered "frame" (where the pieces are mitered across their widths) is almost identical to using them to build a face frame (opposite page). You don't even have

to change the angle of the fence — the joiner cuts straight into the mitered end (Figure 9). The only difference is that the slots are cut in the ends of both pieces.

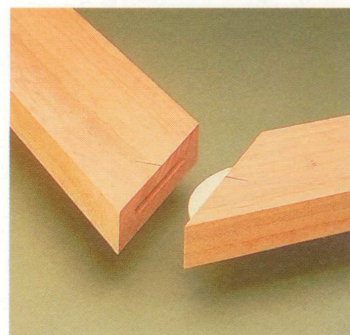
Also, because a 45° miter is longer than the width of the workpiece, you can add a biscuit to a narrower piece — down to 1 $\frac{1}{16}$ " wide — without the slot being visible.

BEVELED MITER. As well as being mitered across the face, a workpiece can also be beveled across the ends, as you see in the bottom photo at right. This means you may have to adjust the fence to 45°. There are two ways a biscuit joiner fence will tilt, depending on the model. Some sit on the face of the workpiece, straddling the inside corner. But I prefer to have the joiner trap the point of the workpiece, as shown in Figure 10, because it feels more secure.

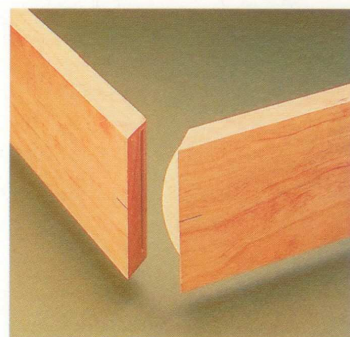
The thing that's critical when cutting a slot into the beveled end of a workpiece is the position of the fence. Instead of centering the slot on the thickness of the



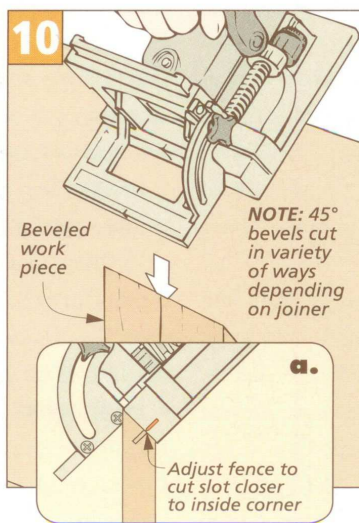
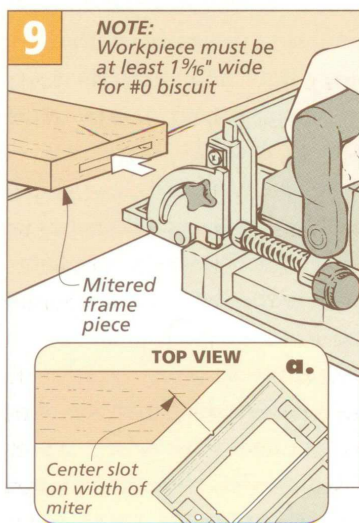
To cut slots in the side piece of a T-joint, create a temporary corner for the joiner.



Adding a biscuit to the ends of mitered pieces is a quick way to strengthen a frame.



A biscuit also strengthens a beveled miter. To do this you angle the fence.



piece, I set the fence so the slot is closer to the inside corner, as you see in Figure 10a. This way, you can use a larger biscuit without worrying about "blowing" through the outside face with the joiner blade.

Adding biscuits to a joint is a quick way to add strength. You can find more tips on biscuit joinery at WoodsmithSpecials.com.



Desktop Picture Frames

A simple design makes these desktop picture frames easy to build. The molded profiles and contrasting wood make them good-looking as well.

ACCENT STRIP FRAME

Whenever I think about making a picture frame, two things come to mind. First, it should be quick and easy to build. Second, the picture frame must look good too. These desktop picture frames satisfy both of my requirements.

In fact, you can probably take a photograph, have it printed, and finish its frame all in the same weekend. And what you end up with isn't just some ordinary picture frame. A simple, yet attractive design makes these frames as special as the photos inside.

BUILT-UP MOLDINGS. One of the things that sets them apart is the "built-up" moldings that are used to make the frame pieces. We made two different moldings, as you can see in the photos at left. One is for the accent strip frame on the opposite page, and the other is for the fluted frame

shown on page 28. These frame moldings are made by gluing up individual strips of wood.

CONTRAST. One advantage to making your own frame moldings is that it allows you to use different types of wood to produce a nice contrast. Here we used maple and cherry. But if your scrap bin is getting full, this is a good opportunity to experiment with other types of wood, as well.

PROFILES. The built-up moldings also allow you to create a profile that appears quite complicated using an ordinary set of router bits. (We used a straight bit, a roundover bit, and a core box bit.) You simply rout a profile on one strip of wood, then combine it with another to form the final profile.

FRAME SUPPORT. There's one last thing that any frame meant to sit on a desk or table must have — a support to prop it up. To make this, I fit a simple wood spline into a groove in the back of the frame.



FLUTED FRAME

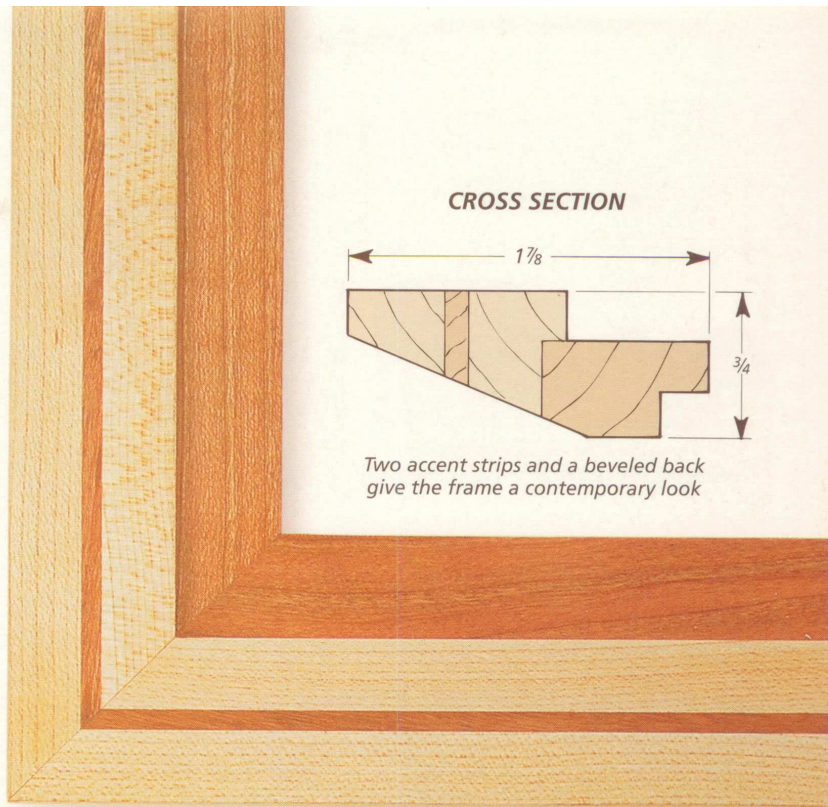
ACCENT STRIP FRAME

At first glance, it's the two accent strips on this picture frame (shown at right) that catch your eye. It's a subtle detail that gives this frame a contemporary look. To make the frame appear thinner than it is, the back edge is beveled at a slight angle.

ACCENT STRIPS. The outer part of the frame is highlighted by a thin strip of cherry that's sandwiched between two strips of maple. A wide strip of cherry runs around the inside edge of the frame.

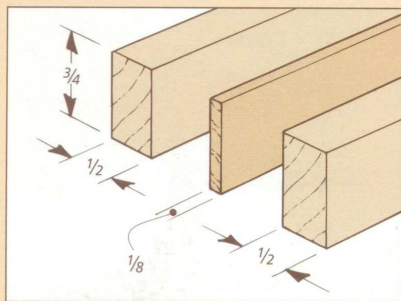
FRAME MOLDINGS. To make a frame for a 5" x 7" photograph, you'll need about four lineal feet of frame molding. An 8" x 10" photo will require six feet. Once you make the frame molding, as shown in the box below, simply miter the frame pieces to length, and glue up the frame (refer to page 29).

GROOVE & BEVEL. There are only two things left to do to complete the frame. First, rout a groove for the frame support, as shown in Step 4. And second, cut the bevel on the back edge of the frame, as you see in Step 5.

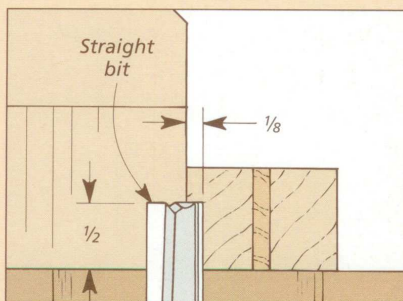


Two accent strips and a beveled back give the frame a contemporary look

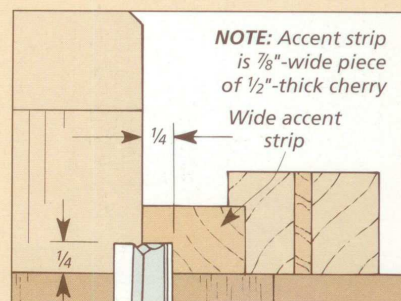
Making the Frame Molding



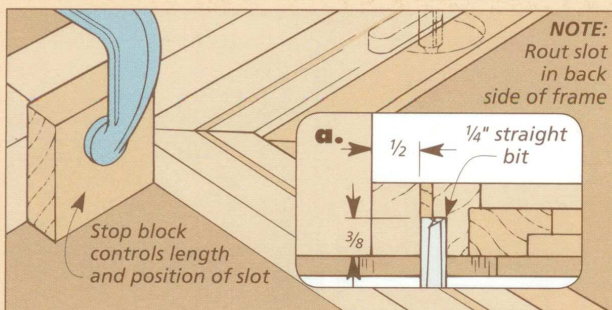
1 To create the frame molding, first glue a thin accent strip (cherry) between two pieces of contrasting wood (maple).



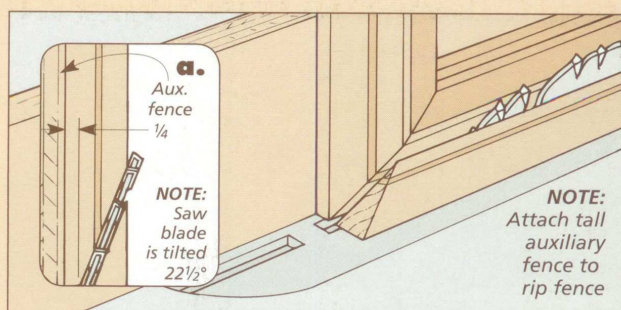
2 Routing a rabbet in one edge of the glued up piece creates a lip for the wide accent strip that's added next.



3 With the accent strip glued in place, you can then rout a rabbet for the glass and the backing board.

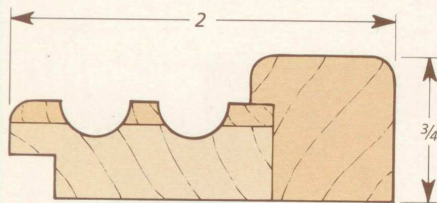


4 Next, miter the frame pieces to length and glue up the frame. Once that's complete, a stopped groove for a wood support needs to be routed into the back.



5 To complete the frame, clamp a tall auxiliary fence to the rip fence on your table saw. Then, tilt the blade to 22½°, and bevel the back edges of the picture frame.

CROSS SECTION



Fluted profile creates contrast by revealing light-colored wood underneath

FLUTED PICTURE FRAME

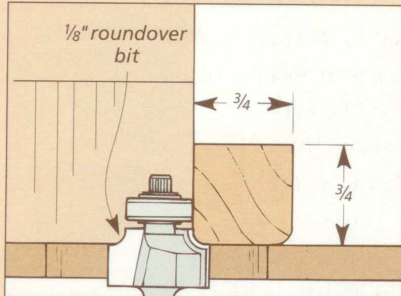
It's not so much the fluted profiles that make the picture frame you see at left look so attractive. It's really the dramatic contrast that occurs when the two curved flutes are "scooped out."

LAYER CAKE. To produce this contrast, the inner part of the frame molding is glued up like a layer cake. There's a thick piece of light-colored wood (I used maple) on the bottom, and a thin strip of a darker-colored wood (cherry) on top. This is illustrated in the cross section drawing at left.

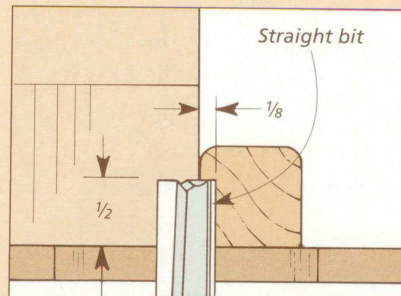
When you rout the flutes, the maple is revealed at the bottom of the "furrows." The cherry highlights the raised areas that remain, and it creates a soft shadow line along the curved sides of the flutes.

FRAME MOLDING. Although this creates a profile that looks quite complicated, the molding for this picture frame is simple to make. The box below illustrates the steps. Note: You'll need the same amount to make each size frame as with the accent picture frame.

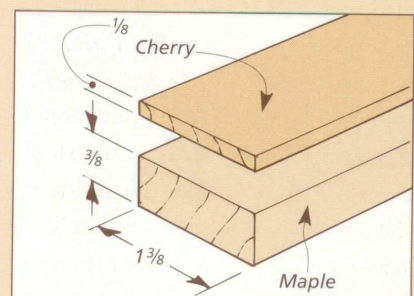
Making the Frame Molding



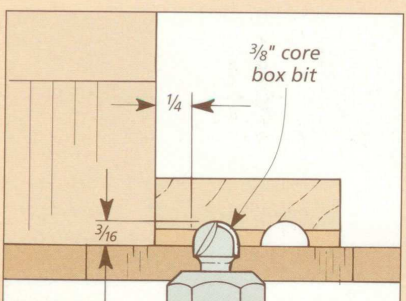
1 Begin building this frame by rounding over two of the edges on the outer strip (cherry) of the molding.



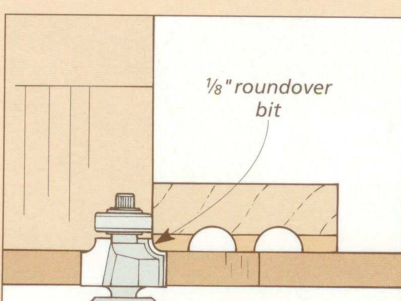
2 Routing a shallow rabbet in one edge creates a recess for the inner part of the frame molding to fit into.



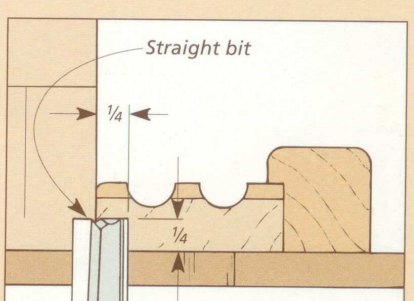
3 The inner part of the molding is formed by gluing a thin strip (cherry) to a thicker piece (maple).



4 Now, rout the two curved flutes using a core box bit. To do this, flip the workpiece between each pass.



5 Next, you can round over one of the top corners — this will soften the edge around the inside of the frame.



6 With both components of the molding glued together, rout a rabbet for the glass and backing board.

ASSEMBLING THE FRAMES

Once the frame molding is complete, you're halfway done. At this point, you're ready to glue up the picture frame.

LENGTH. The first step is to establish the length of the individual frame pieces. It's not the outside length of each piece that matters here — it's the length of the inside edge of the rabbet that holds the glass, picture, and backing board, as shown in the drawing at right.

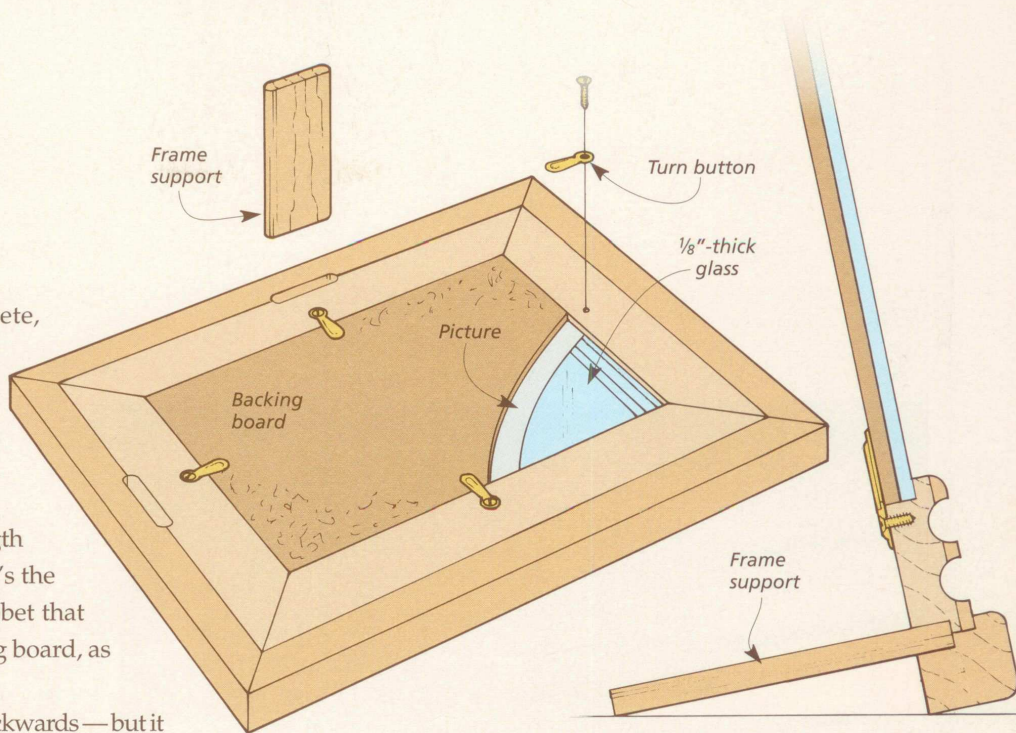
It may seem like you're working backwards — but it makes sense. When the pieces of the frame are assembled, the picture has to fit between the rabbets.

To make it easy to slip the picture into place, the goal is to miter each frame piece to length so that the outside edge of the rabbet is $\frac{1}{16}$ " longer than the length (or width) of the picture.

First, you need to miter one end of each piece to rough length (Figure 1). Then, after measuring the picture (don't forget to add $\frac{1}{16}$ "), transfer this measurement to the frame piece and miter it to final length.

To get a tight-fitting joint, the two frame pieces that are opposite each other need to be identical in length. So I clamp a stop block to an auxiliary fence on the miter gauge when cutting the frame pieces.

TEST FIT & ASSEMBLY. At this point, you'll want to dry assemble the frame and check the fit of the joints.

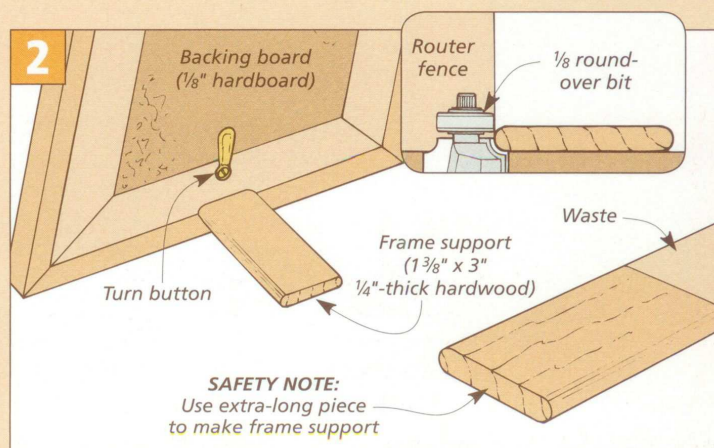
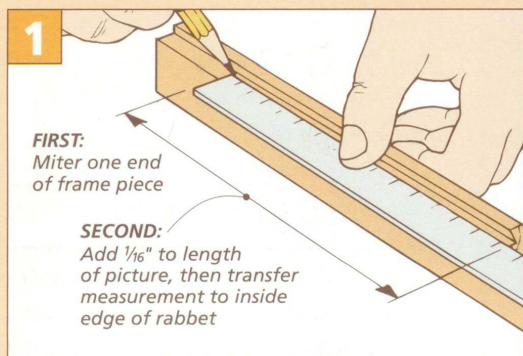


If you find that there's a slight gap, you can use a piece of sandpaper to "true up" the mitered ends. If the gap is more severe, double-check the saw setting and adjust your miters. Once you're satisfied with the fit, it's just a matter of gluing up the frame.

FRAME SUPPORT. When the glue dries, you can add the frame support illustrated in Figure 2. It's a short piece of hardwood that fits into a groove in the back of the frame. Rounding over the edges of the support allows it to fit the curved ends of the groove. This is shown in Step 4 on page 27 and in the detail of Figure 2.

FINAL DETAILS. Now all that's left is to cut a piece of glass to fit the frame, and add the picture. The glass and photograph are held in place with an $\frac{1}{8}$ " hardboard backing board and four turn buttons.

Frame Assembly





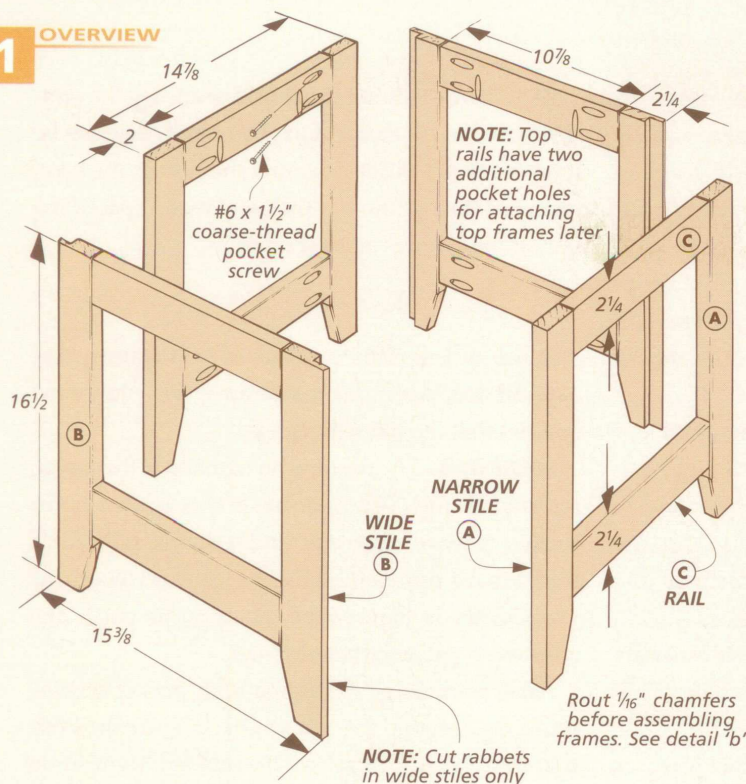
Tile-Top Table

How do you build a sturdy outdoor table without any tricky mortise and tenon joinery? Using pocket screws makes it quick and easy.

Ceramic tile is usually meant for floors. But after seeing the dozens of colors, finishes, and textures available at the home center, I knew it would be perfect for the small, outdoor table I'd been planning. The tile will surely withstand whatever the elements (or a drinking glass) can dish out.

You may be surprised by how quickly this table comes together. The secret is that it's made up of half a dozen frames put together with pocket screws. There are four frames that form the base; two more surround and support the ceramic tile.

1 OVERVIEW

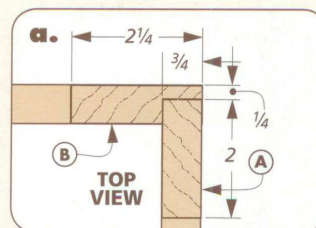


BUILD THE BASE

The first set of frames you'll need to make are the ones that form the base of the table.

STILES. I started by making the stiles (the longer pieces of each frame). There are four narrow stiles and four wide stiles, as you can see in Figure 1. When the base is assembled, the edge of each narrow stile will fit into a rabbet in a wide stile, as shown in Figure 1a. This way, the stiles all appear to be the same width.

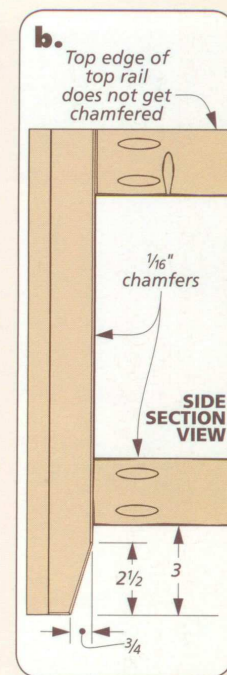
After cutting the stiles to size, you can cut the taper at the bottom of each one, as shown in Figure 1b. The last thing to do to the stiles is to



route chamfers on the edges with the tapers, and also along the bottom edges, like you see in Figure 1b.

RAILS. Each pair of stiles is joined by a couple of rails. If you look at Figure 1 again, you can see that all the rails are identical in size, with two pocket holes drilled near each end.

There are a couple of differences between the top and bottom rails. The top rails have two more pocket holes that are used later to secure the top of the table. Also, the bottom rails have



chamfers on all the long edges, while the upper edges of the top rails remain square (Figure 1b). This provides a flat surface to attach the table top.

The pocket screws make it quick and easy to fasten the rails to the stiles. You can reinforce the joints with a water-resistant glue or polyurethane. Just make sure each assembly has two stiles of the same width.

RABBETS. After screwing the frames together, cut a rabbet along the edge of the wide stiles (Figure 1a). I did this with a dado blade, but it also can be done with a regular blade. You can find more about this technique online at WoodsmithSpecials.com.

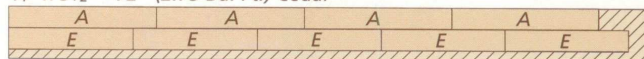


For more tips on cutting rabbets, go to our website: WoodsmithSpecials.com

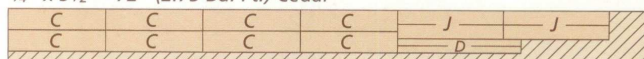
HARDWARE, MATERIALS, & CUTTING DIAGRAM

- | | | |
|---|-------------------|---|
| A | Narrow stiles (4) | $\frac{3}{4}$ x 2 - 16 $\frac{1}{2}$ |
| B | Wide stiles (4) | $\frac{3}{4}$ x 2 $\frac{1}{4}$ - 16 $\frac{1}{2}$ |
| C | Rails (8) | $\frac{3}{4}$ x 2 $\frac{1}{4}$ - 10 $\frac{7}{8}$ |
| D | Cleats (2) | $\frac{3}{4}$ x $\frac{3}{4}$ - 13 $\frac{7}{8}$ |
| E | Slats (5) | $\frac{3}{4}$ x 2 $\frac{1}{4}$ - 13 $\frac{7}{8}$ |
| F | Molded rails (2) | $\frac{3}{4}$ x 3 $\frac{1}{4}$ - 10 $\frac{3}{8}$ |
| G | Molded stiles (2) | $\frac{3}{4}$ x 3 $\frac{1}{4}$ - 16 $\frac{7}{8}$ |
| H | Top rails (2) | $\frac{3}{4}$ x 3 - 11 $\frac{7}{8}$ |
| I | Top stiles (2) | $\frac{3}{4}$ x 3 - 17 $\frac{7}{8}$ |
| J | Spacers (4) | $\frac{7}{16}$ x 1 $\frac{1}{2}$ - 11 $\frac{7}{8}$ |
- (56) #6 x 1 $\frac{1}{2}$ " Coarse thread pocket screws
 - (18) 1 $\frac{1}{4}$ " Deck screws
 - (1) 12" x 12" Ceramic tile

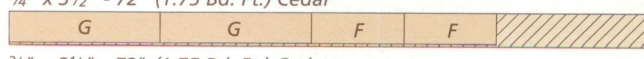
$\frac{3}{4}$ " x 5 $\frac{1}{2}$ " - 72" (2.75 Bd. Ft.) Cedar



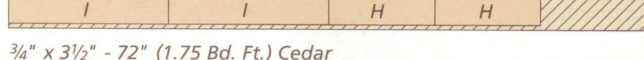
$\frac{3}{4}$ " x 5 $\frac{1}{2}$ " - 72" (2.75 Bd. Ft.) Cedar



$\frac{3}{4}$ " x 3 $\frac{1}{2}$ " - 72" (1.75 Bd. Ft.) Cedar



$\frac{3}{4}$ " x 3 $\frac{1}{2}$ " - 72" (1.75 Bd. Ft.) Cedar



$\frac{3}{4}$ " x 3 $\frac{1}{2}$ " - 72" (1.75 Bd. Ft.) Cedar





BASE ASSEMBLY & SHELF

Once you've completed the four frames, you're ready to glue them into the base and build the shelf. When dry assembling the frames, I had trouble keeping things square. But you can find an easy solution to this in the photo at left.

Once the base is assembled, I hid the joint lines with the chamfering trick that's illustrated in Figure 2b. Simply adjust the height of the bit until it just touches the joint line.

A couple of squaring forms cut from scrap plywood help keep the base square while the band clamps are tightened.

CLEATS. The shelf in the bottom of the table is simply made up of a series of slats. To support them, I cut two cleats to fit inside the base (Figure 2c).

If you look at Figure 2a, you'll see that slats are eventually screwed to the cleats. So, I drilled the shank holes and countersinks for these screws, before the cleats were glued in place. Finally, the cleats are glued to the base so the slats (added next) will sit flush with the tops of the rails.

SLATS. Figure 2 shows the details of adding the slats. After they're cut to size and chamfered, they can be screwed to the cleats. To center the slats in the base, I secured the middle one first, and then I spaced the remaining slats $\frac{1}{2}$ " apart (Figure 2a).

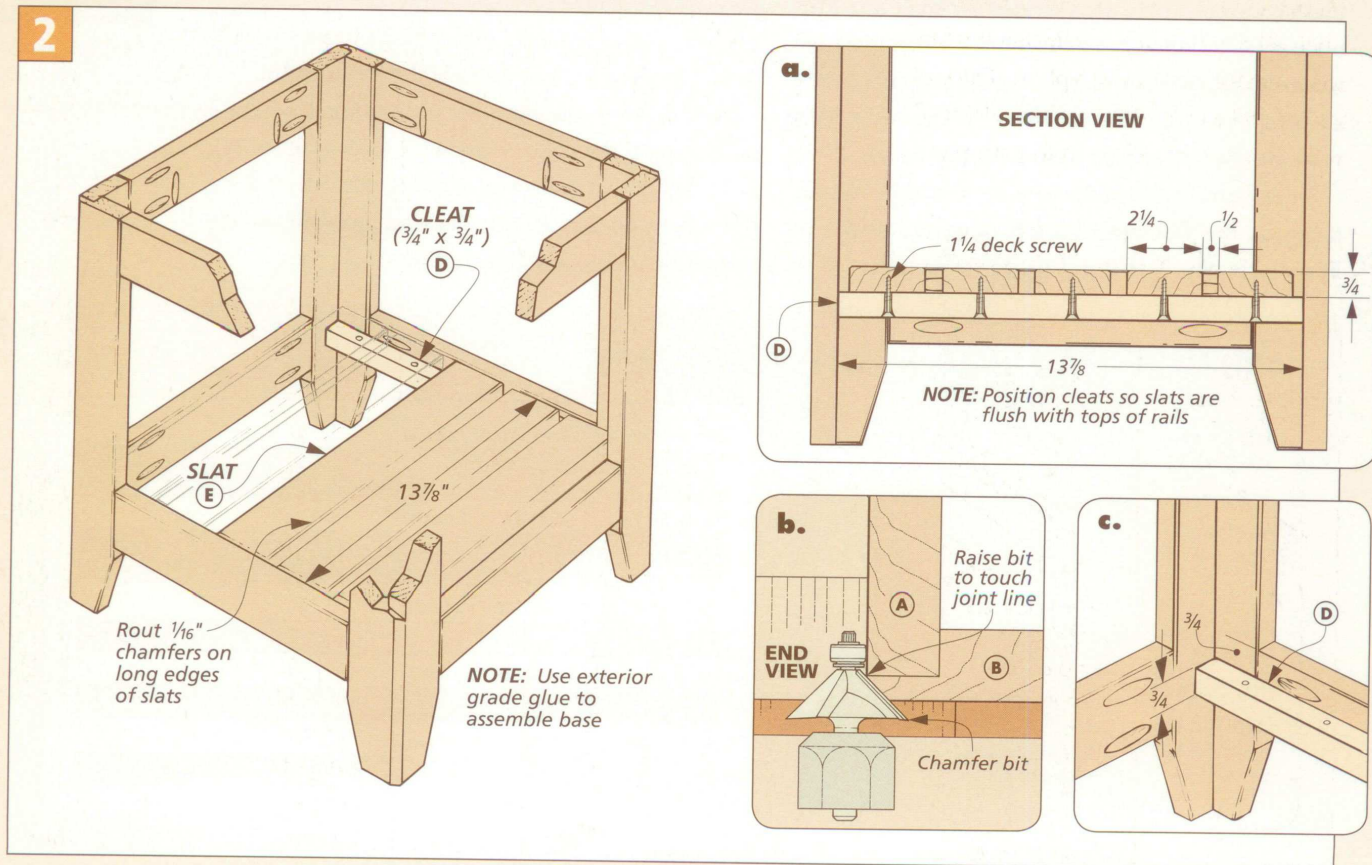
TABLE TOP

The top of the table consists of two frames that support and surround the ceramic tile, plus some spacers that the tile will rest on.

MOLDED FRAME. The first frame to make is the lower, molded frame. The rails have two pocket holes drilled toward each end and a shank hole for a screw that's centered on their width and length, as you can see in Figure 3 on the opposite page. The stiles each get three shank holes.

After assembling the frame with pocket screws, rout a cove around the bottom edge (Figure 3b). With that completed, you can set the molded frame aside for now and move on to the top frame.

TOP FRAME. The exact lengths of the rails and stiles for the top frame will depend on your tile size. What you want to end up with is a $\frac{1}{16}$ " gap between each edge of the tile and the top frame. To accomplish this,



just measure the width of the tile and add $\frac{1}{8}$ " to find the length of the top rails. When you're finished, the top stiles should be 6" longer than the rails. (This accounts for the combined width of the rails.)

Before assembling the frame with pocket screws, rout a chamfer around both faces of each piece, as you see in Figure 3 at right.

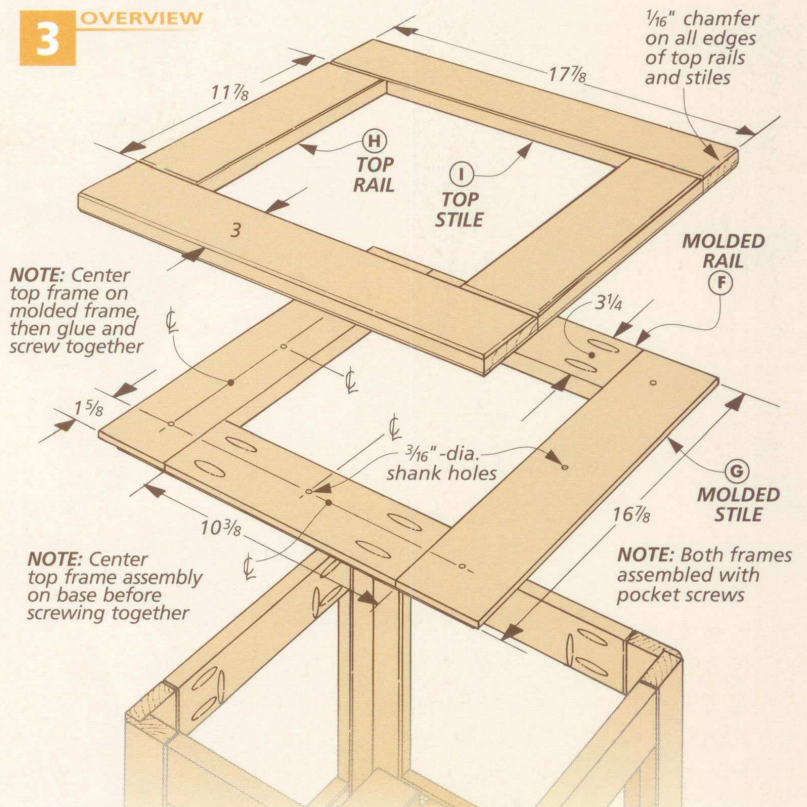
Once both frames have been assembled with pocket screws, they can be glued and screwed together. As you can see in Figure 3a, I used deck screws for this. The two things to keep an eye on here are that the molded frame is centered on the top frame and that the joints are offset. This strengthens the assembly, as illustrated in Figure 3.

At this point, you can center the frames on the base and screw them in place using the two pocket holes in each of the top rails of the table base.

SPACERS. The table is nearly complete, but there are a few things to do before adding the tile. You'll need to make spacers to support the tile flush with the top frame, as you see in Figure 4a. The spacers will have to be planed or resawn to thickness. Then they're glued to the molded frame (Figure 4).

FINISH & TILE. After that, wipe on two coats of an outdoor oil to provide a weather-resistant finish. Then all that remains is to fasten the tile in place, as shown in the right margin photo. Once it's complete, you can take your tile-top table outside and enjoy the practical, durable addition to your patio or deck.

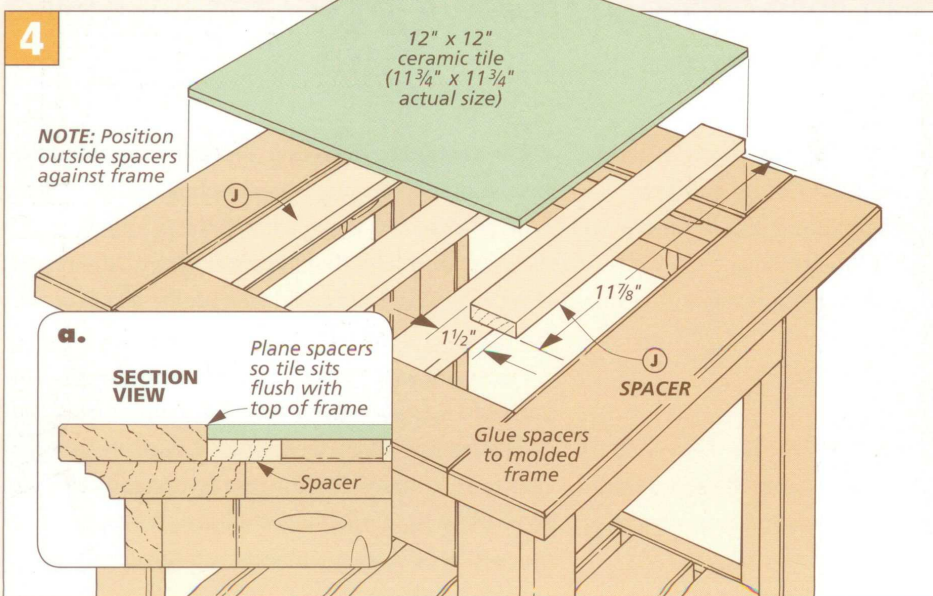
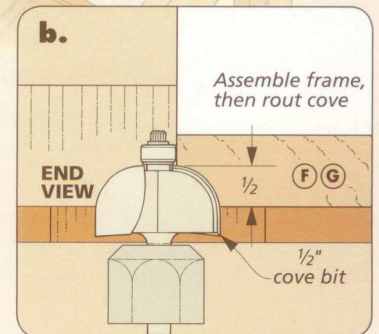
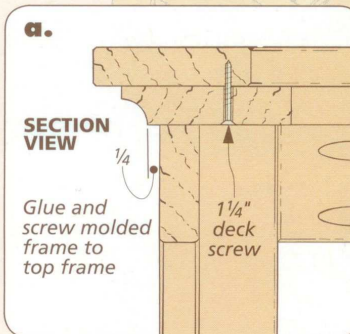
3 OVERVIEW



NOTE: Center top frame on molded frame, then glue and screw together

NOTE: Center top frame assembly on base before screwing together

NOTE: Both frames assembled with pocket screws



NOTE: Position outside spacers against frame

a. SECTION VIEW
Plane spacers so tile sits flush with top of frame
Spacer
Glue spacers to molded frame



To secure the ceramic tile, put a dot of silicone adhesive near both ends of each spacer, and then press the tile firmly into place.



Mirrored Coat Rack

With Craftsman-style details and modern joinery, this is a project you'll be proud to hang your hat on.

This mirrored coat rack looks as though it was hand-built generations ago. With its quartersawn white oak, beveled mirrors, and tall, Craftsman-style coat hooks, it's easy to see why.

What's less obvious, though, is the fact that this coat rack is built using modern joinery methods — beechwood biscuits and glue.

BENEFITS OF BISCUITS

I chose biscuits for this project over the more traditional techniques, such as mortise and tenon, because biscuits offer so many advantages.

For instance, by using biscuits I avoided the precise layout, drilling, and chiseling that goes along with mortise and tenon joinery. Every joint is just an ordinary butt joint that's reinforced with the proper size biscuit. All I had to do was cut the pieces to size, cut the biscuit slots, and assemble the coat rack.

As simple as it sounds — and actually is — the biscuits add a great deal of strength to a typical butt joint.

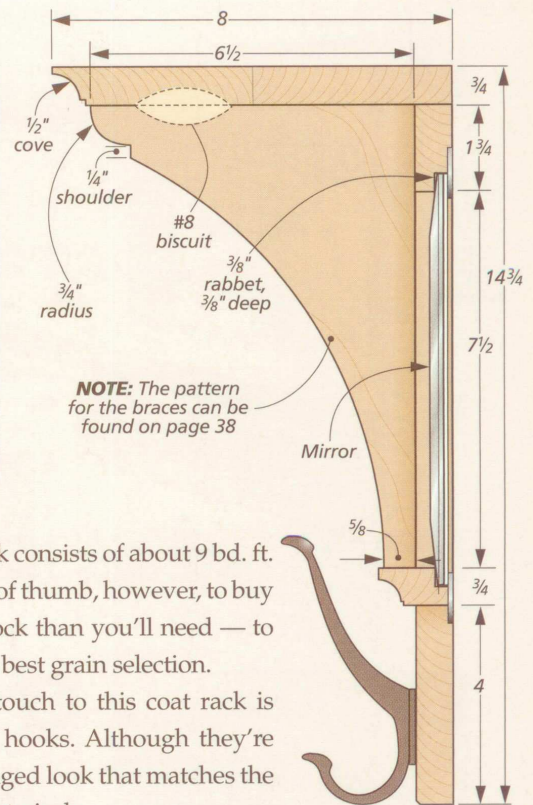
The biscuit joiner techniques I used in this coat rack are highlighted on the next few pages. Once you have these fundamental techniques down, you'll be amazed at how many projects you can use them on.

HARDWARE, MATERIALS, & SUPPLIES

- | | | |
|-------------------|--|---|
| A (1) Top rail | $\frac{3}{4}$ " x $1\frac{3}{4}$ " x $47\frac{1}{2}$ " | (8) #8 x $1\frac{1}{4}$ " Fh woodscrews |
| B (4) Stiles | $\frac{3}{4}$ " x $2\frac{1}{2}$ " x $7\frac{1}{2}$ " | (12) 1"-dia. Fender washers |
| C (1) Middle rail | $\frac{3}{4}$ " x $1\frac{1}{2}$ " x 49" | (12) #6 x $\frac{1}{2}$ " Fh woodscrews |
| D (1) Bottom rail | $\frac{3}{4}$ " x 4" x $47\frac{1}{2}$ " | (6) Craftsman-style coat hooks |
| E (1) Shelf | $\frac{3}{4}$ " x 8" x $49\frac{1}{2}$ " | (3) $8\frac{1}{8}$ x $13\frac{1}{8}$ Beveled mirrors |
| F (4) Braces | $\frac{3}{4}$ " x $6\frac{1}{2}$ " x $9\frac{1}{4}$ " | (2) $1\frac{3}{4}$ " x $\frac{1}{4}$ " x $1\frac{1}{2}$ " Flush-mount clips |

NOTE: Coat rack requires nine board feet of $\frac{3}{4}$ "-thick lumber

(3) Cardboard backers
Spray-mount adhesive for pattern
#0, #10, #20 Biscuits



NOTE: The pattern for the braces can be found on page 38

CROSS SECTION VIEW

MATERIALS

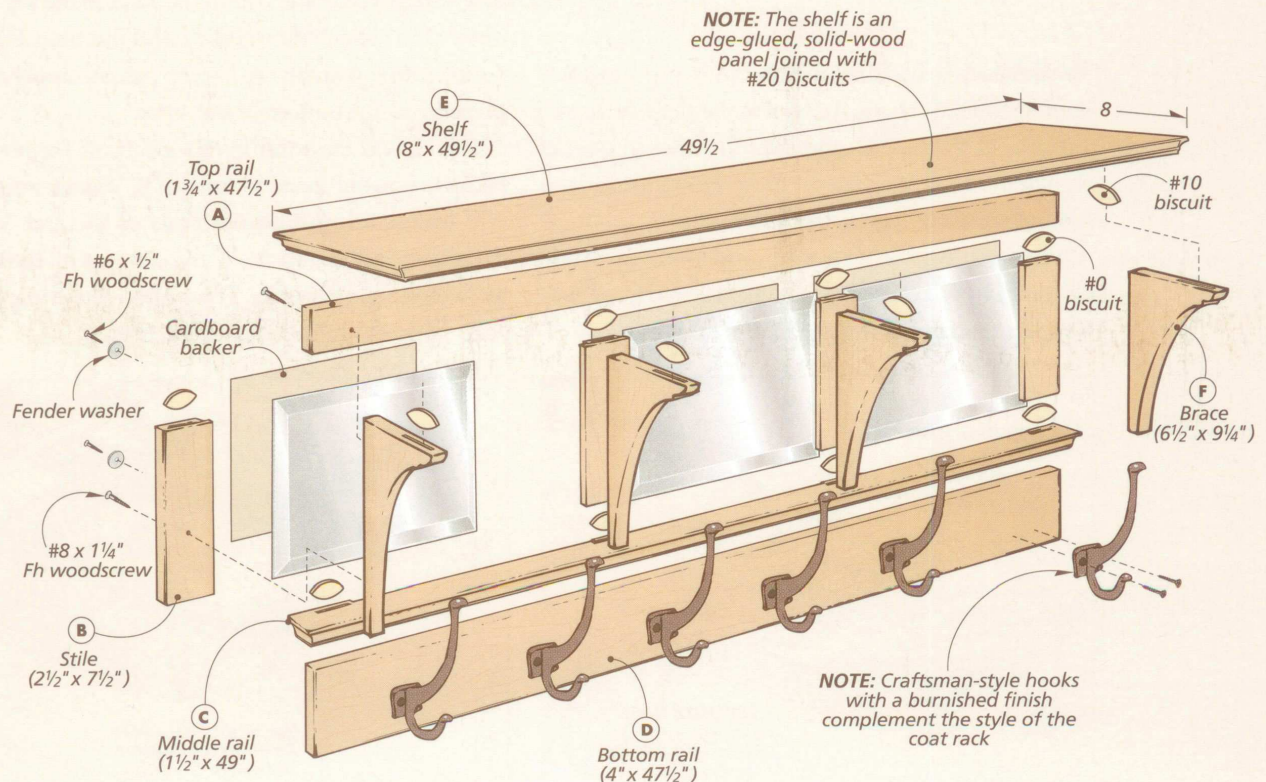
In the spirit of the coat rack's Craftsman styling, I decided to use quartersawn white oak for this project. In the photo on the opposite page, you can see how the swirling rays, which are characteristic of quartersawn white oak, stand out beautifully from the straight-grained wood.

Now take a look at the curved shelf supports and how the rays in the white oak's grain follow the graceful curves of the braces. It took a little extra time to select the perfect stock to produce this effect, but the end result was well worth the effort.

Altogether, this coat rack consists of about 9 bd. ft. of lumber. It's a good rule of thumb, however, to buy about 20 percent more stock than you'll need — to account for waste and the best grain selection.

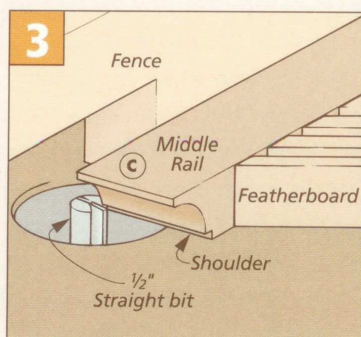
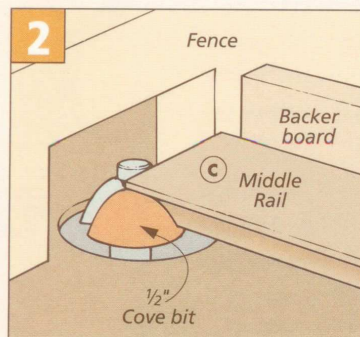
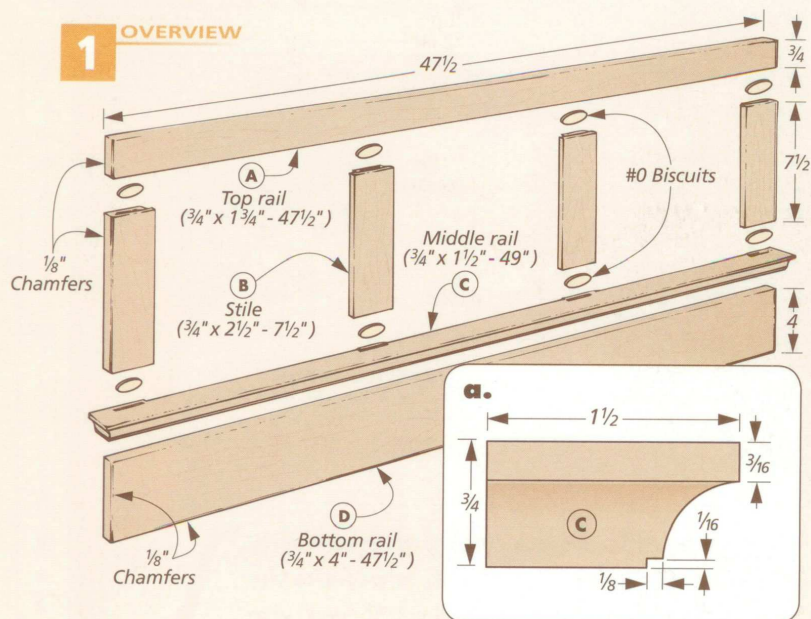
Another "traditional" touch to this coat rack is the long, burnished coat hooks. Although they're brand new, they have an aged look that matches the old-time look of the project nicely.

Also, notice how the Craftsman-style hooks are carefully positioned so that, not only are they an equal distance apart, but each pair of hooks aligns precisely the same way in front of each mirror.



NOTE: The shelf is an edge-glued, solid-wood panel joined with #20 biscuits

NOTE: Craftsman-style hooks with a burnished finish complement the style of the coat rack



FRAME FIRST

The first step in building the coat rack is to construct the rail and stile frame that holds the three mirrors.

First, cut the top rail and the four stiles to size, as shown in Figure 1. Then set these pieces aside for a moment and cut the middle rail to size.

Now you're ready to rout a decorative profile on the front edge and ends of the piece (Figure 1a). Routing this profile is done in several steps.

Begin by routing the cove. This should be done in two passes to avoid burning the wood. Use a backer board to prevent tearout as you rout the ends of the rail, as you can see in Figure 2. And then to finish up the profile, use a straight bit to rout a shoulder on the bottom of the rail (Figure 3).

BISCUITING THE FRAME. With the profile complete, you're ready to cut the biscuit slots in the mirror frame. Because the stiles are just 2½" wide, only the smallest standard size biscuit (#0) will fit this joint.

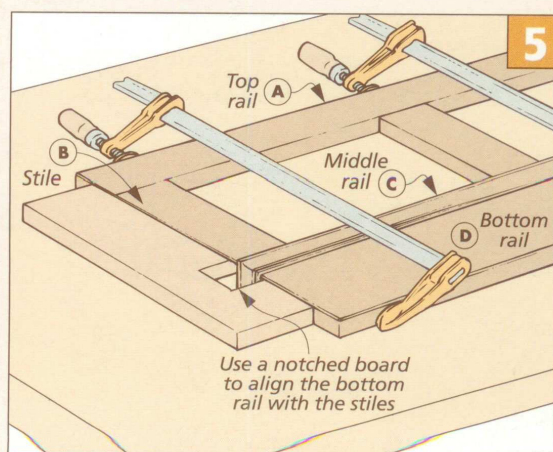
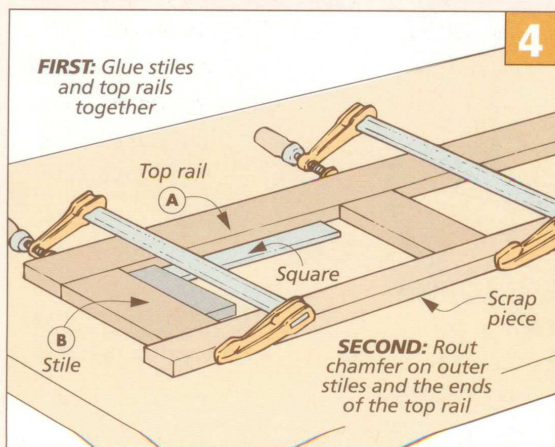
Although these joints seem similar, there are actually two different plate joiner techniques used for cutting the biscuit slots.

The first technique makes a face frame joint — to join the top rail to the stiles. And the second technique creates a T-joint, which is used for the joints between the middle rail and the stiles. For details on mastering these two biscuit joiner techniques, check out WoodsmithSpecials.com.

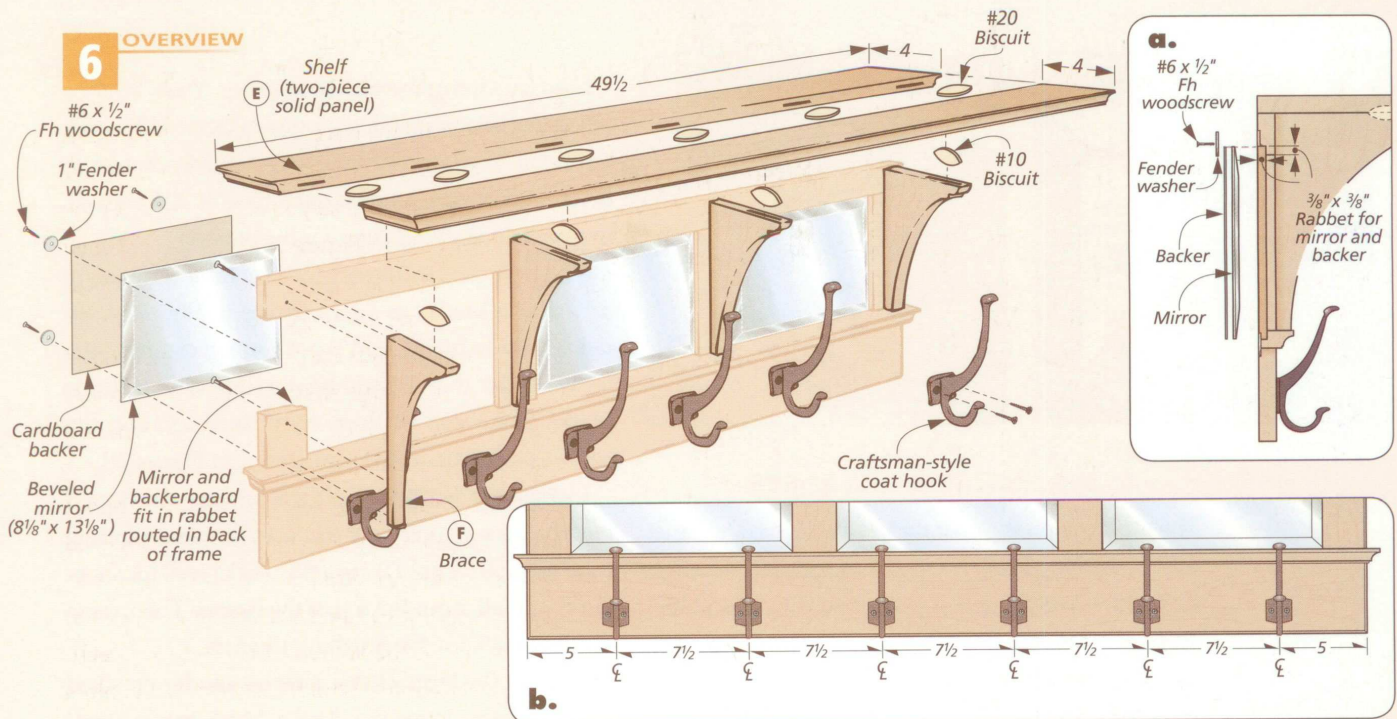
ASSEMBLING THE FRAME

After the biscuit slots are cut in the stiles and rails, dry assemble the frame to ensure that all the pieces align. Once you're satisfied with the results of the dry run, you can glue and clamp the stiles to the top rail. Note: Don't attach the middle rail at this time. Figure 4 shows how you can use a scrap piece to apply even pressure to the bottom of the stiles.

The reason the middle rail is left off for now is because you still need to rout an ⅛" chamfer on the two end stiles and on the ends of the rail. With the middle rail unattached, you can rout all the way to the bottom of the stile. Then, after you do so, glue and clamp the middle rail to the frame.



6 OVERVIEW



BOTTOM RAIL. While you're waiting for the glue to dry, you can cut the bottom rail to size. Then rout a $\frac{1}{8}$ " chamfer on the ends and the bottom edge of this piece. (You'll need to leave the top edge square where it butts against the middle rail.)

Now you can glue this piece to the frame. One problem I ran into here is that, because the middle rail extends past the edge of the frame, you can't use a straightedge to align the bottom rail to the frame assembly. My solution was to use a board

with a notch cut out of it to align the bottom rail to the stiles, as illustrated in Figure 5.

You don't need biscuits because this long-grain joint is strong enough on its own. You can keep the parts aligned by clamping them on a flat surface.

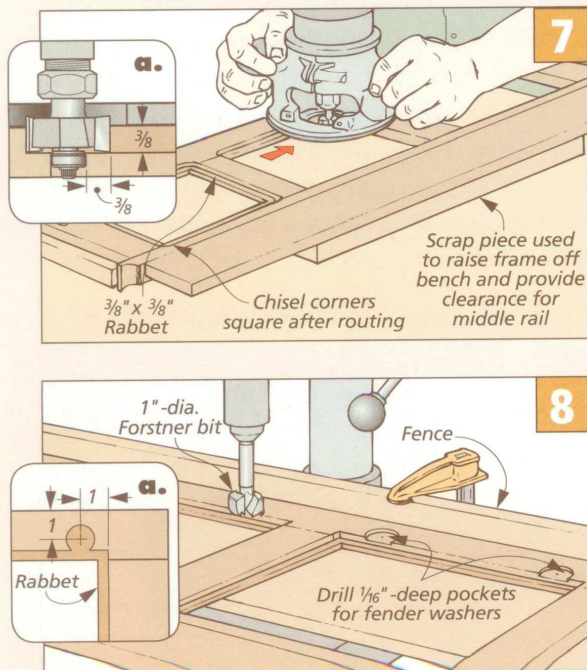
MAKE WAY FOR THE MIRRORS

Now that the frame is built, it's time to get it ready to hold the three beveled mirrors. The mirrors rest in rabbets in the back of the frame and are held in place with fender washers, which nest in shallow pockets, as shown in Figure 6a.

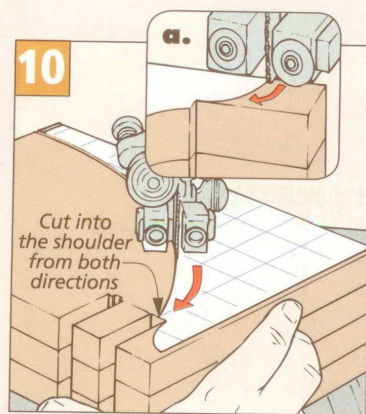
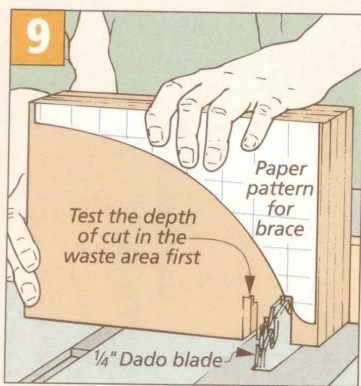
The first step is to cut a rabbet around the openings in the back of the frame — deep enough to hold the mirror and a cardboard backer. I used a router and a rabbeting bit for this, as you can see in Figures 7 and 7a. Then I used a chisel to square up the round corners left by the bit (right margin photo).

The next step is to make the shallow pockets for the fender washers to nest in. The washers I used have a 1" diameter, so creating the pockets was as simple as drilling them with a Forstner bit.

You can drill the pockets on the drill press, as shown in Figure 8. One problem you'll come across is that, when you flip the frame around to drill the bottom pockets, the middle rail won't let the frame sit flat on the drill press table. This is easy to overcome, though, by supporting the frame above the drill press table with a couple of thick scrap blocks.



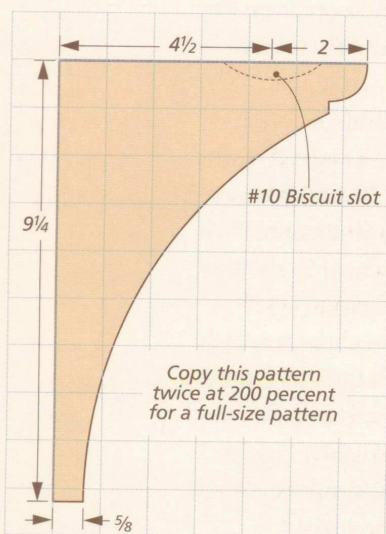
Use a chisel to square the corners after routing with a rabbeting bit.



BUILDING THE SHELF & BRACES

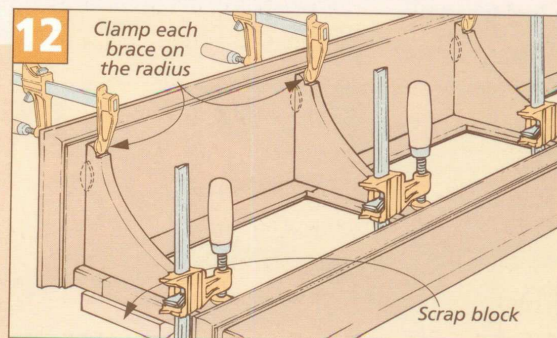
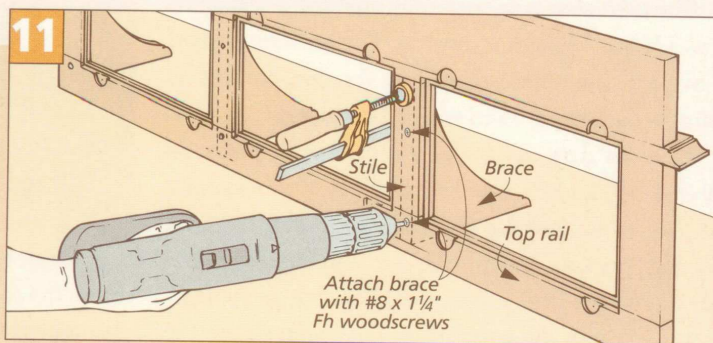
The top shelf on the coat rack is a solid-wood panel made by edge-gluing two boards together. Although this edge-to-edge joint is plenty strong, I used biscuits to keep the boards aligned when I applied clamping pressure. (For more on creating this joint, refer to WoodsmithSpecials.com.)

After gluing up the shelf, the next step is to rout a decorative profile on each end and the front edge. This is the same profile as on the middle rail, so you can follow the same steps to rout it.



MAKING THE BRACES. Now you're ready to make the four braces that support the shelf. These do a lot more than just hold up the shelf. The sweeping arc of the braces and the rounded top corner make them as decorative as they are functional.

The biggest challenge with these braces is making them as identical as possible. And the best way to do this is to "gang cut" them — that is, fasten them together with double-sided tape and cut all four pieces at once.



Start by taping the blanks together. Then, apply a paper pattern to one of the outside faces with spray adhesive. You can use the pattern shown below to do this. Just copy it twice, each time at 200 percent, to make a full-size pattern for the braces.

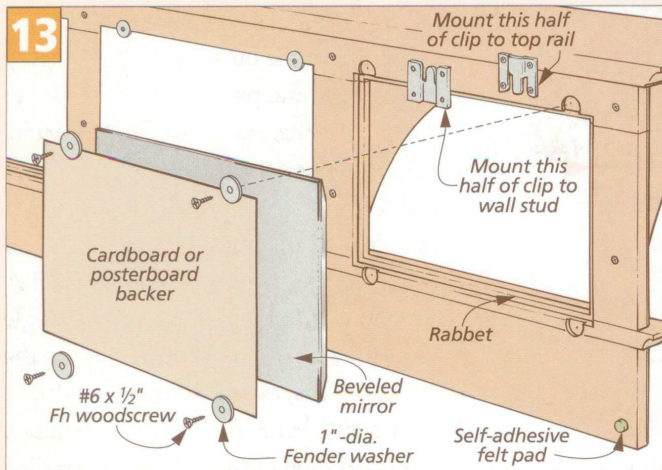
The first cut I made was on the table saw using a 1/4" dado blade, as you can see in Figure 9. By using a dado blade, you'll get a much cleaner, flatter shoulder than would be possible with a single blade. Once you've done that, finish cutting the braces on the band saw, as shown in Figure 10.

SHAPING AND SANDING. With the braces still taped together, it's a good time to start filing and sanding them to final shape. Using a file works well for shaping the small arc at the top of the braces. Then, use a sanding stick for the finishing touches.

To sand the large curve, a drum sander chucked in a drill press is a good choice. Most drums aren't tall enough for a 3"-thick block, though. My solution was to separate the braces into two blocks of two and sand them that way. Be careful to not round the corners at the bottom of the braces, as this is sure to show up on the finished coat rack.

BISCUIT THE BRACES. Now that all the components of the coat rack are made, you can lay out and cut the biscuit slots that will join the braces to the shelf when you get to the final assembly. To do this, first lay out and cut the biscuit slots on the braces. When those slots are cut, attach the braces to the mirror frame with glue and screws, as shown in Figure 11.

BISCUIT THE SHELF. The final piece of the coat rack is the shelf. But before this can be attached, it needs to have biscuit slots cut in it to match those in the braces. You can find an explanation of how to accurately cut the biscuits to brace the shelf, as well as the biscuit slots on the braces, online at: WoodsmithSpecials.com.



FINAL ASSEMBLY

With the biscuits to provide support, the next step is gluing the shelf to the frame and brace assembly. Start by spreading glue on the edge of the top rail. Then put glue on the top of each brace and in the biscuit slots. Now, squeeze a bit of glue into the biscuit slots on the shelf. Finally, place the biscuits in the slots on the braces and clamp the pieces together, as illustrated in Figure 12.

A FINE FINISH. When it came time to apply a stain and finish to the coat rack, I wanted a combination that would give the project an aged look, while still showing off the beautiful figure of the white oak.

I decided to apply one coat of *Watco* Black Walnut stain and three coats of *Watco* Natural Danish Oil finish. (You can see how this combination looks in the photo above.) The stain gave the oak a medium brown color that made the coat rack look like an heirloom. And the oil finish added a light sheen that really accentuates the ray flecks in the grain, without "out-shining" the mirrors.

COAT HOOKS. After your finish has had plenty of time to dry, you can add the Craftsman-style coat hooks. Position the hooks using the dimensions in Figure 6b (page 37). Notice how these dimensions place a pair of hooks at the same place in front of each mirror pane. The vertical placement of the hooks is intended to align the bottom of the hook with the bottom of the rail. You should mount the hooks with the screws provided.

HANGING HARDWARE. The coat rack is almost complete, but first you'll need to add the hanging hardware. For simplicity's sake, I used extra-thin, flush-mount hanging clips. These two-piece, interlocking clips are

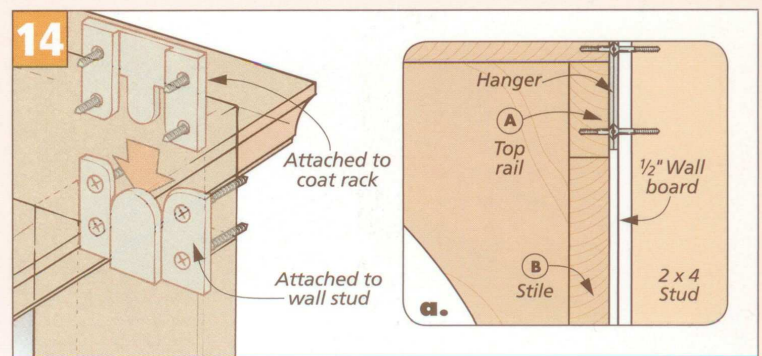
designed so one piece attaches to the coat rack, and the other to the wall, as you can see in Figure 14.

One word of caution here: Because of the weight of this coat rack, you'll need to fasten it securely to the wall. For a strong, safe installation, find the wall studs in the area you're planning to hang the coat rack. Then, position the mounting hardware on the coat rack so they land on those studs.

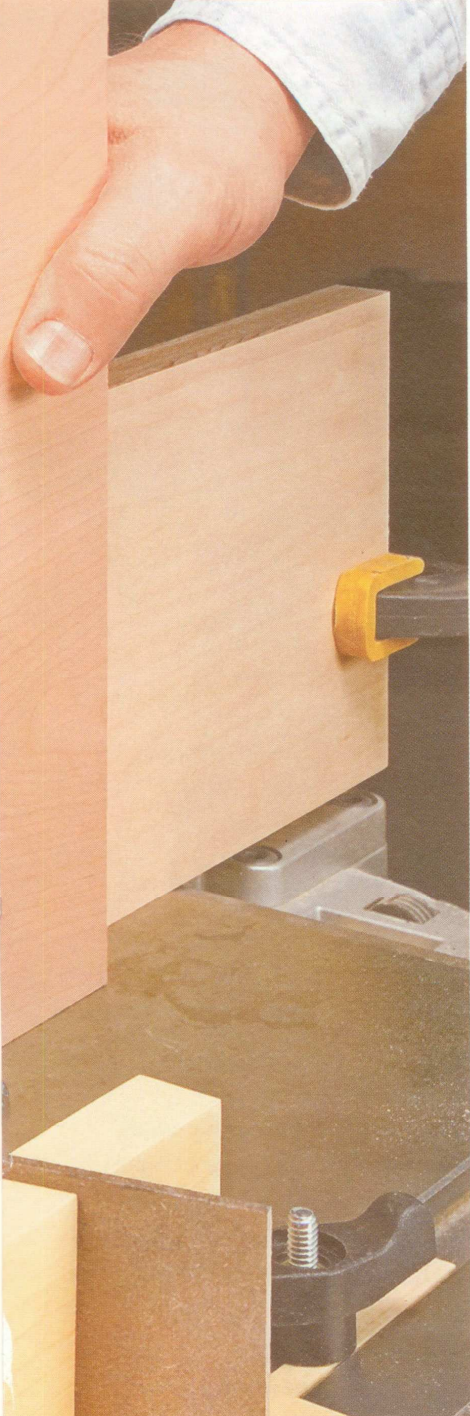
Also, these mounting brackets stand away from the back of the coat rack by about $\frac{1}{8}$ ". To keep the mirror from tilting, add a couple of self-adhesive felt pads to hold the bottom of the rack away from the wall.

MIRROR INSTALLATION. The final step is to add the three beveled mirrors. You can have these custom made at just about any local glass and mirror shop (check your local Yellow Pages under "glass.")

I used $\frac{1}{4}$ "-thick mirrors with a 1"-wide bevel on all four sides. (The mirrors cost me about \$60 and took two weeks to be made.) To mount the mirrors, place them in the rabbets, along with a cardboard backer. Then to complete the project, hand-tighten a woodscrew through each of the fender washers until the mirrors are secure, as shown in Figure 13.







advanced techniques & projects

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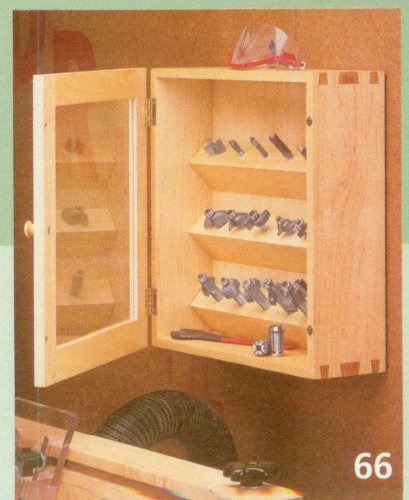
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Frame & Raised Panels

Build professional-looking raised panels in your shop? You bet. The frame is simple, and there are two options for making raised panels.

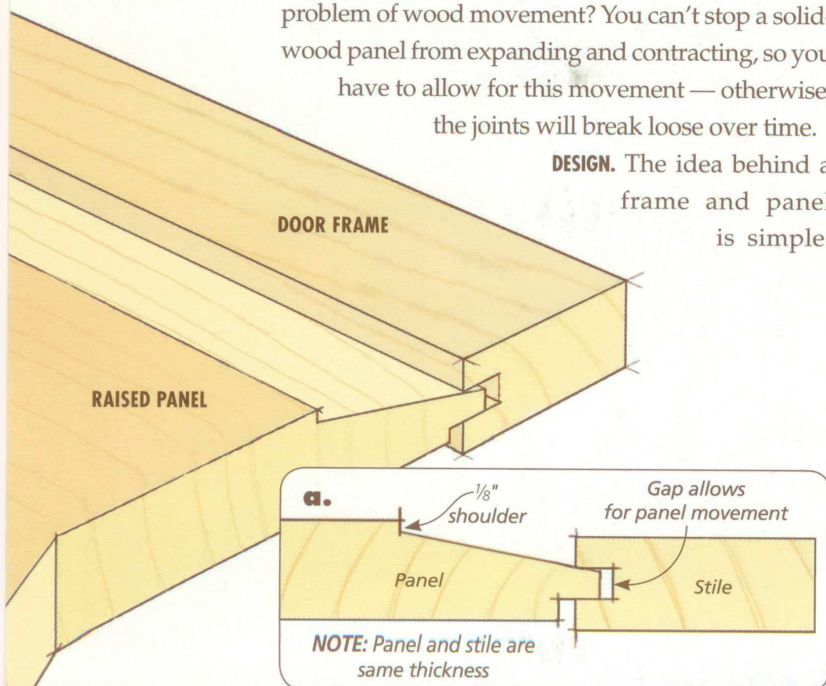
Frame and panel construction has always been one of the best solutions in a woodworker's "bag of tricks." After all, what better way is there to deal with the problem of wood movement? You can't stop a solid-wood panel from expanding and contracting, so you have to allow for this movement — otherwise, the joints will break loose over time.

DESIGN. The idea behind a frame and panel is simple.

A frame is built with grooves cut on its inside edges, as shown in the photo above and in Figure 1 on the next page. These grooves trap the beveled edges of a solid-wood panel. The panel is cut slightly smaller than the depth between the grooves, leaving small gaps inside, as in Figure 1a. This way, the panel is free to expand and contract, while the overall assembly remains stable and strong.

FRAME STRENGTH. Of course, there's a bit more to it than that. For one thing, you have to decide how strong the frame needs to be. When the assembly is going to become part of a box or case, there won't be a lot of stress on the joints. So, I cut stub tenons to fit the grooves — they're plenty strong and quick to build, as you'll find out on the next page.

However, when you're building doors, it's not quite so cut-and-dried. There can be a lot more pressure on the hinged side of the frame, and you might want to consider building a frame that's stronger. (You can find some useful tips on how to do this online at WoodsmithSpecials.com.)



MAKING THE FRAME

When building a frame and panel assembly, I generally like to start with the rails and stiles of the frame. And most of the time, I choose to build this frame with stub tenon and groove joints.

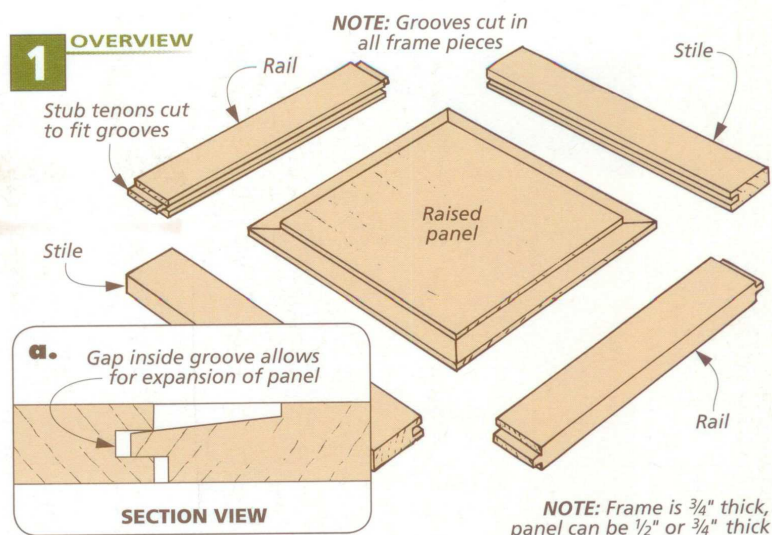
GROOVES. After the frame pieces have been cut to size, the first thing to do is cut the grooves, as shown in Figure 2. These grooves are centered on the inside edges of all four frame pieces. (Centering the grooves makes the stub tenons easier to cut later.) And when working with solid wood panels, I cut these grooves so the stub tenons could be cut a full $\frac{3}{8}$ " long.

You may have noticed by now that I cut the $\frac{1}{4}$ "-wide grooves with a standard blade (Figure 2). You could use a dado blade, but you'll spend more time centering it. Instead, I start with the single blade roughly centered on the piece. Then I cut each groove in two passes, flipping the piece end-for-end before the second pass. This automatically centers the groove.

Usually, I'll have to bump the fence over and repeat this process to get the groove close to $\frac{1}{4}$ " wide. But the width doesn't have to be exact. It's easy to sneak up on the size of the stub tenon later.

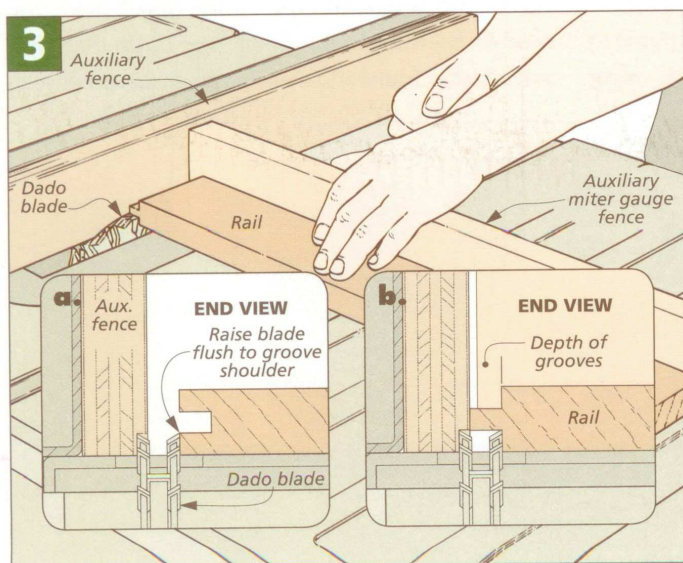
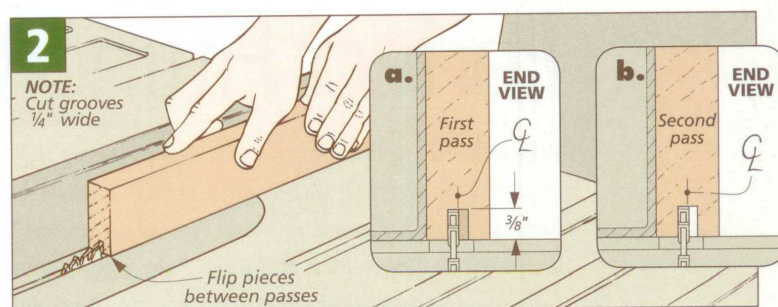
STUB TENONS. When the grooves have been cut, the two stiles of each frame can be set aside while you cut the stub tenons on the ends of the rails. I like to cut each shoulder in a single pass over a dado blade, (Figure 3), but you could do this with a regular blade, too. Either way, you'll want to support the pieces with an auxiliary fence screwed to the miter gauge.

To set up the cut, I use one of the grooves I just cut. First, the saw blade is raised to match the shoulder of the groove (Figure 3a). Then, the fence can be

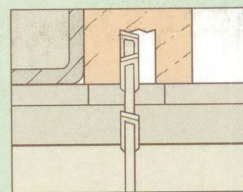


positioned so the length of the tenon matches the full depth of the groove, as you see in Figure 3b.

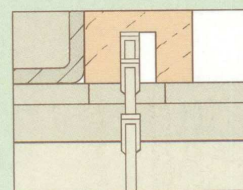
Still, you'll want to test your setup and probably adjust the height of the blade. I shoot for a friction fit, which means the pieces should fit together with hand pressure. But, in doing this, make sure the fit isn't too tight, or the stub tenons can end up breaking the shoulders of the grooves. Once you have the frame pieces complete, you can move on to the raised panels.



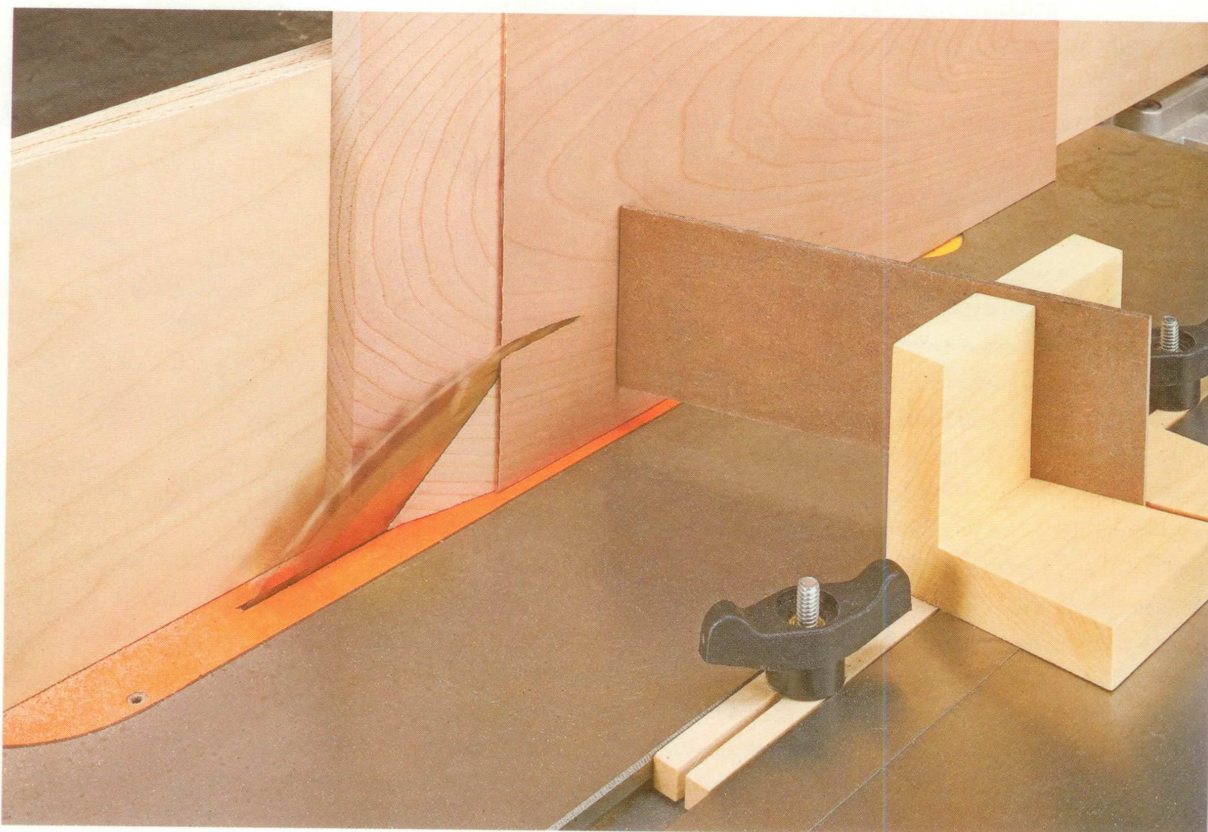
The Best Blades



Most combination blades have beveled teeth, which cut a groove that ends up with tiny gaps once the stub tenon is glued in place.



A rip blade that cuts a flat-bottomed kerf will give you the best fit when it comes time to glue the stub tenon into the groove.



Perfect Fitting Raised Panels

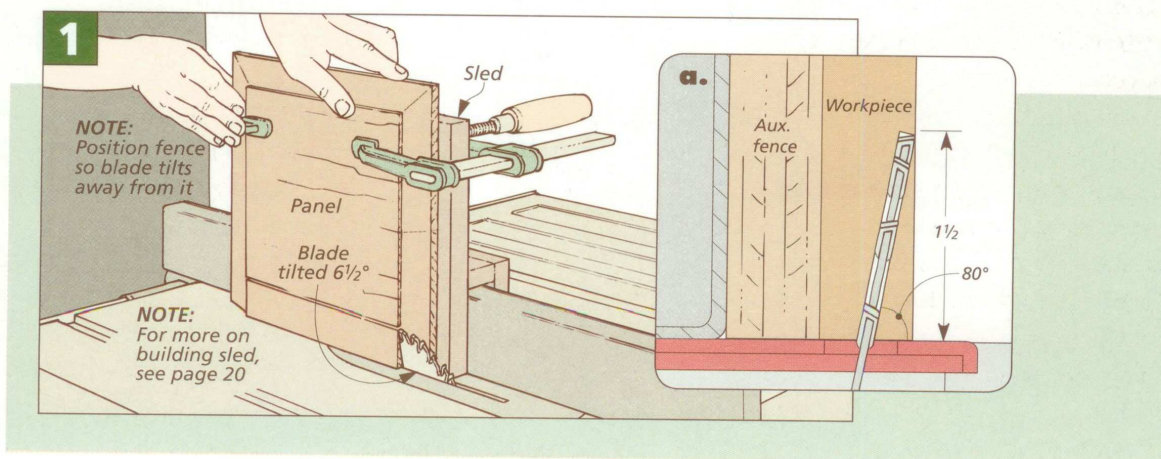
When building the frame for a raised panel, the goal was to make it strong and sturdy. Now the focus is on the appearance of the panel — after all, the panel will get all the attention. Fortunately, you can create a quality raised panel on your table saw using a simple two-step process.

The first step is to bevel the edges of the panel to raise a “field” in the center, as you see in the drawing

on page 42. The second step is to cut a rabbet along the back edge of the panel so it fits in the door frame, as shown in detail ‘a’ of that drawing.

CREATING THE FIELD

Before you begin working on the raised field, you need to cut the panel to final size. To do that, dry-assemble the frame and measure the distance between





the grooves. Cutting the panel $\frac{1}{8}$ " to $\frac{1}{16}$ " narrower will allow it to move with humidity changes.

With the panel cut, you're ready to make the raised field. The first thing you'll need to do, though, is set your rip fence and saw blade.

SETUP. What's important here is to tilt the blade *away* from the fence to avoid trapping the waste between the blade and the fence. And because the panel will be standing on edge during the cut, you'll want to use a zero-clearance insert and a tall auxiliary fence to provide solid support.

I've found that tilting the blade 10° and raising it $1\frac{1}{2}$ " gives you a nice-looking panel. Then, to add a three-dimensional feel to the panel, all you have to do is set the fence so the blade will leave a $\frac{1}{8}$ " shoulder between the field and the bevel, as you can see in Figures 1 and 1a.

MAKING THE CUT. Now, it's just a matter of cutting a bevel on each edge of the panel by running it on edge across the blade. Since the end grain is more likely to tear out near the end of the cut, it's a good idea to cut these edges first. Any tearout will be removed when you cut the two long edges.

To keep the panel firmly against the fence and my fingers out of the way, I also like to use a tall featherboard. Details on how you can make a featherboard can be found at WoodsmithSpecials.com.

CLEANING UP. After you make the cuts, it's not unusual to find saw marks on the bevels. Plus, the shoulder isn't square to the face of the panel. A simple way to fix both problems is to use the beveled sanding block that's shown in Figure 2. As you sand away the swirl marks, it squares up the shoulder of the field at the same time, as you can see in Figure 2a.

CUTTING THE RABBET

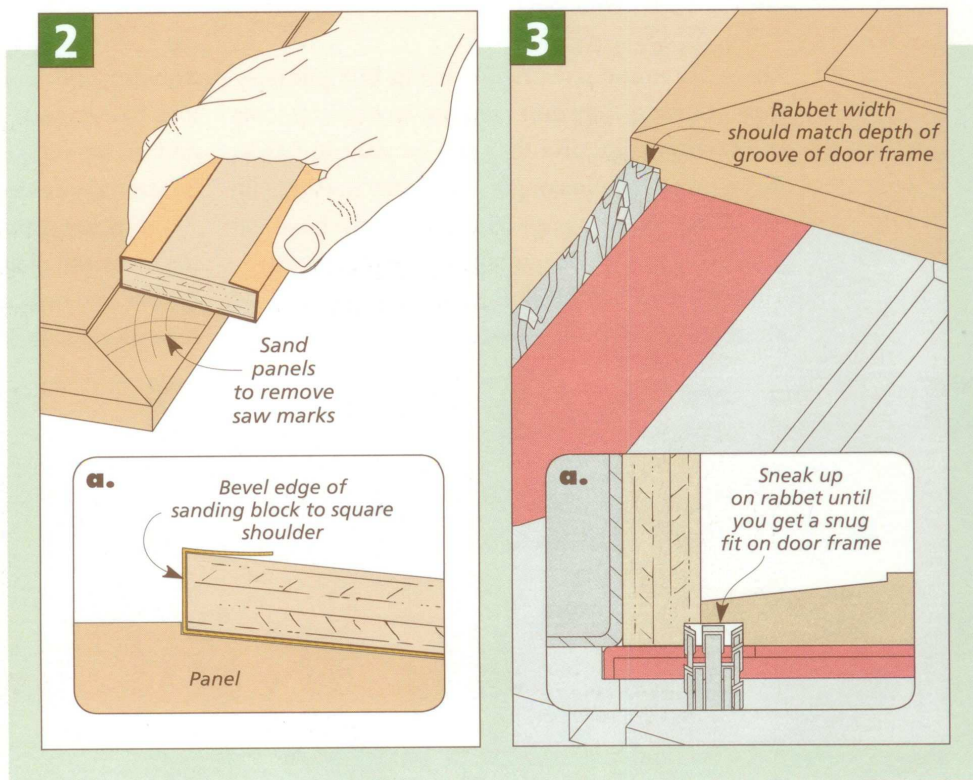
At this point, you're halfway through the process of creating a raised panel. You'll notice that the edge of the panel is too thick to fit into the groove of the door frame. That's where the second step of the process comes in — cutting a rabbet along the back edges of the panel to get a nice fit (Figure 3).

The rabbet is sized so the panel can slide into the frame, but not so loose that it rattles around. The best way to fit the panel is to "sneak up" on the depth of the rabbet until it just slips into place. The rabbet should be as wide as the groove is deep to allow the panel to expand and contract, as illustrated in Figure 3a.

And that's it — two simple steps and your raised panel door is ready for the frame.

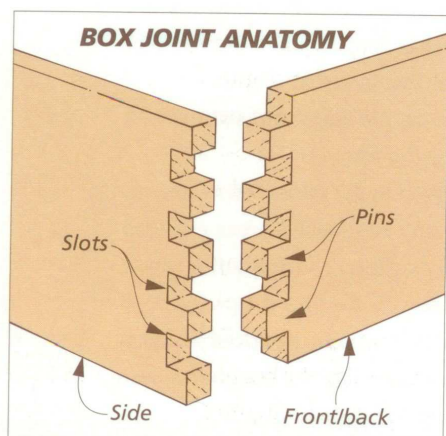
It's best to apply a finish to the panel before assembly, so there won't be any unfinished areas exposed if it shrinks later. You can then assemble the frame around the panel and secure it with a drop of glue in the grooves at the center of each rail. Just double-check that the raised field is centered before the glue dries.

A flat-beveled, raised panel is easy to create with just a table saw and a simple, shop-made sled.



Box Joints

Box joints are strong and attractive. And they don't require any special tools — just a table saw, a miter gauge, and a simple, shop-built jig.

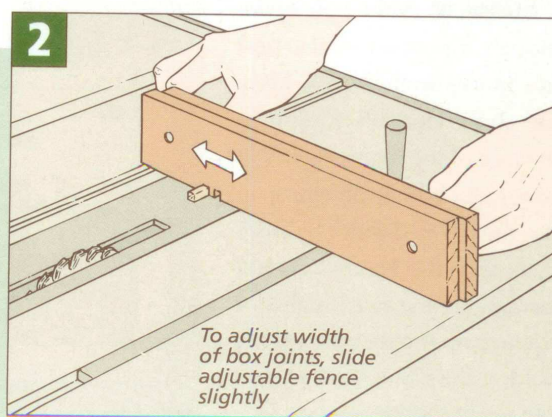
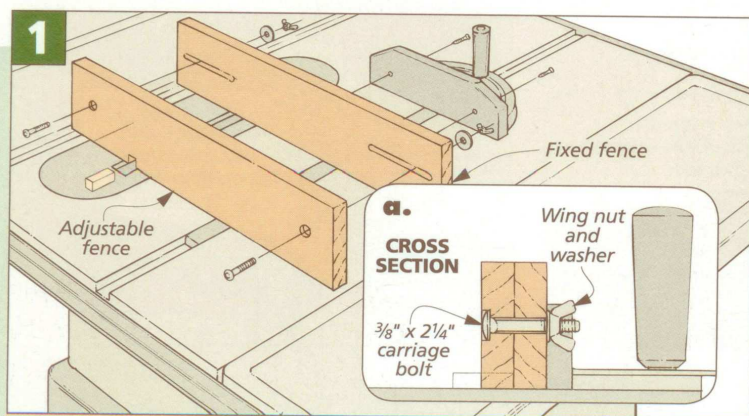


There are many reasons for using box joints — they're strong, they don't require any special tools or expensive jigs, and they can be used to "dress up" a project. For example, box joints provide the magazine boxes on page 58, as well as the boxes on pages 60 and 63, with stately, traditional looks.

INTERLOCKING FINGERS. Box joints are made up of alternating pins and slots, as you can see in the

drawing above. The pins on mating pieces interlock like fingers. This creates a lot of glue surface and makes for a strong joint. But in order for it to be strong, you need to have a snug, accurate fit.

The trick to getting a good fit on a box joint is matching the width of the pins to the width of the slots. To do this, you need a jig that uses a small key. (The key determines the width of the pins and slots.)



But first, you have to decide whether to use the table saw or the router table. The jig for each is essentially the same. But most of the time, I like to use my table saw. It does the job quicker than a router, especially when cutting large box joints.

BOX JOINT JIG

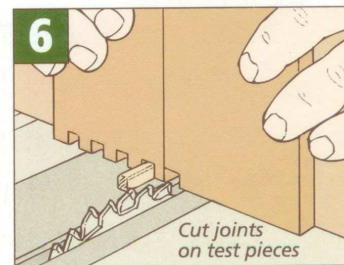
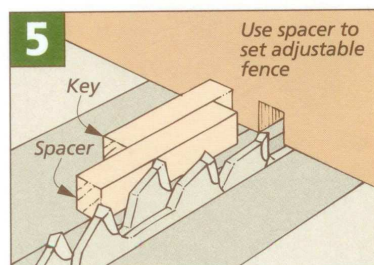
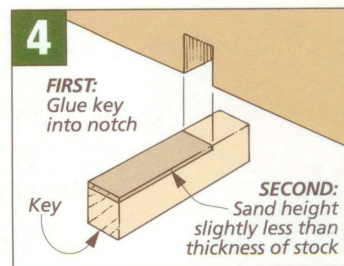
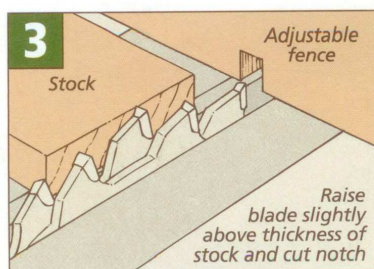
To cut box joints with a table saw, you need three things: a dado blade, a miter gauge, and a jig. The jig can be very basic — all you need is a pair of auxiliary fences and a hardwood key.

FENCES. Figure 1 on the opposite page shows how the fences are joined with carriage bolts and wing nuts. The fixed fence is screwed to the miter gauge. It's slotted so the fence in front can be adjusted side-to-side.

KEY. There's also a small, hardwood key that's glued into a notch in the front fence, as shown in Figures 3 and 4. The nice thing about using a key is that once the jig is set up, cutting the box joints is just about automatic. But it also means that the size and the position of this key must be perfect.

The width and height of the key are determined by the dado blade you use to cut the notch. The width of the dado determines the spacing of the box joints. And the height of the dado determines the length of the pins. Note: For my box joints, I set the dado blade a hair above the thickness of the workpiece, as shown in Figure 3. Then after the key is glued in place, I sand it down, so the workpiece won't bottom out on the key, as you see in Figure 4.

The key's position is important because it determines whether the pins will fit or not. To get the key

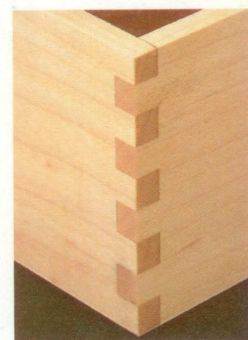


close to where it should be, I use an identically sized spacer to position it, as illustrated in Figure 5.

TUNING THE JIG. At this point, the jig just needs to be fine tuned. This involves cutting a test corner. And for an accurate test, I use scrap wood that's roughly the same width as the finished pieces.

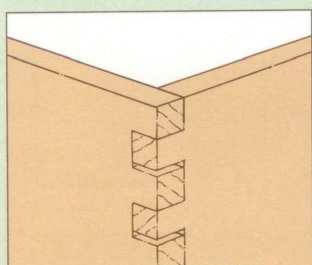
To cut a test corner, butt one piece up against the key, and cut a slot. Reposition the piece so the slot straddles the key, and make another pass. Repeat this process until you reach the end of the board. Then do the same on the mating piece, as in Figure 6.

Test the fit of the two pieces and make any necessary adjustments. You can find the solutions for some common problems in the box below. The goal is to get a snug fit — without being too tight. The pieces should only require a few taps with a mallet to go together.

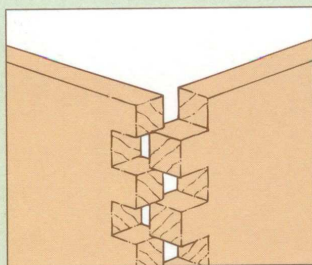


For a perfect box joint, the two pieces will fit snug, and the pins will be flush after a little sanding.

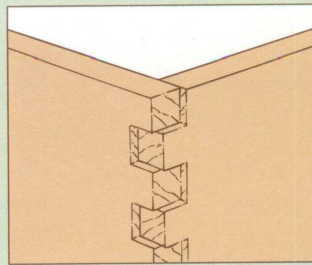
Troubleshooting



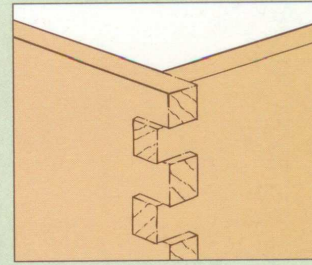
Loose Fit. If there's a gap between each pin, you can simply slide the key away from the blade, as shown in Figure 2.



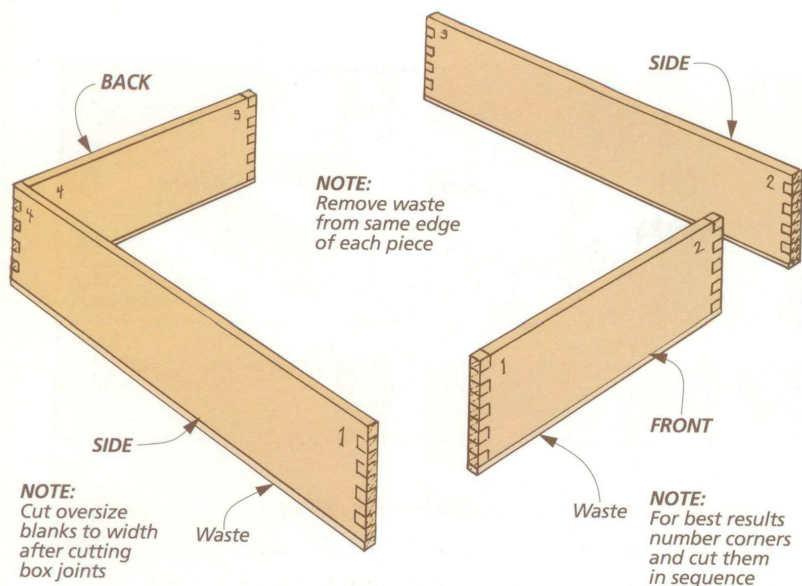
Tight Fit. If the pins won't fit into the slots at all, you'll need to slide the key towards the blade (Figure 2).



Short Pins. If the dado blade is set too low, you'll end up with pins that are too short. So, raise the blade slightly.



Long Pins. If the pins extend too far beyond the sides, the dado blade is set too high and needs to be lowered.



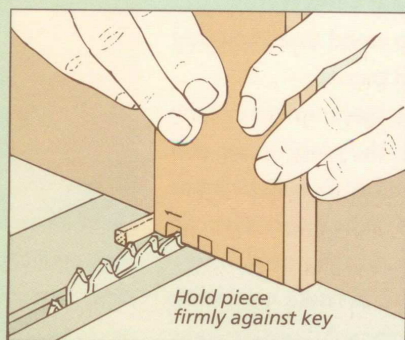
With the box joint jig complete, you're ready to get down to business. An accurately set up jig makes cutting box joints easy, but there are still a few things that can give you trouble.

ACCURATE BOX JOINTS

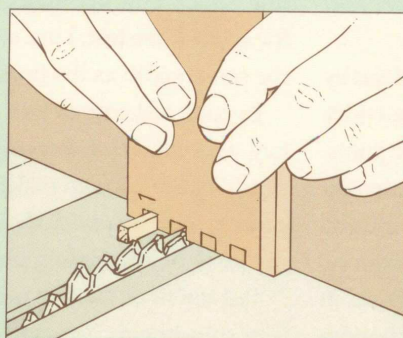
When building a project with box joints, I shoot for appearance rather than dimensional accuracy. For instance, the magazine boxes are supposed to be 11³/₄" tall. But whether they end up exactly that height or not, the important thing is that there's a full pin (or slot) at the top and bottom of each piece.

EXTRA-WIDE PIECES. To do this, I start with workpieces that are extra-wide and trim them after I cut the box joints, as you can see in Step 6 below.

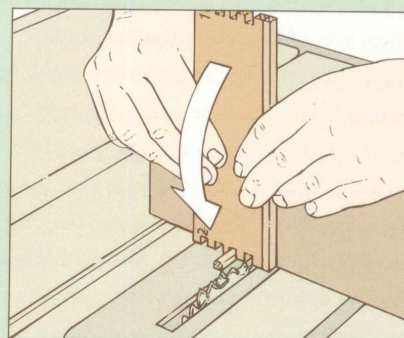
Cutting Box Joints



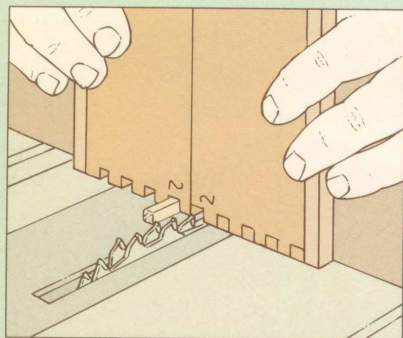
1 To begin, set the top of the first workpiece against the key, and hold it tightly against the fence and the table saw. Then, cut the first slot.



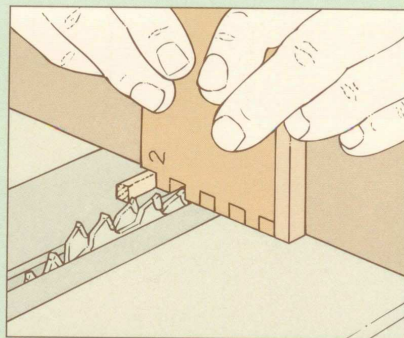
2 Move the piece so the first slot straddles the key, and cut a second notch. Repeat this process until all the slots on this end are cut.



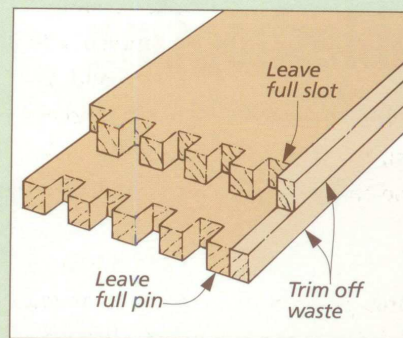
3 After all the slots are cut on one end, flip the piece end-for-end, keeping the waste edge on the same side. You can then cut the slots on this end.



4 Next, rotate the first piece so the waste is outside and the first slot fits over the key. Butt the mating piece against the first, and cut the first slot.



5 Now, slide the slot you just cut in the mating piece up tight to the key. Continue this procedure until the box joints are cut on all pieces.



6 Before assembling the box, rip the waste edge off each piece so that there's a full pin and slot on the top and bottom of each one.

Of course, there are times when a workpiece has to be a specific dimension (like when building a drawer), but I still start with an oversize piece. I simply trim the same amount from the top and the bottom.

LABEL PIECES. Another thing I like to do is label the front, back, and side pieces, and number the joints so I can cut them in sequence. This is shown in Step 4 and in the drawing on the opposite page.

CONSISTENT PRESSURE. The steps on the opposite page show you the procedure for cutting box joints. As you make the cuts, it's important to be consistent. Even a slight shift in pressure can affect the fit of the box joints. So, I hold the jig with both hands and perform each pass exactly the same way.

CLEAN BOX JOINTS

You'll find that even if your box joints fit perfectly, you may run into some other challenges, such as chipout and uneven slots.

CHIPOUT. Chipout is inevitable — sooner or later it's bound to happen. But there are a few things you can do to minimize it. First, make sure your blade is sharp. Also, don't push the piece through the blade too quickly. If you're getting a lot of chipout, slip a scrap piece of hardboard behind the workpiece so the cut can always be backed up completely.

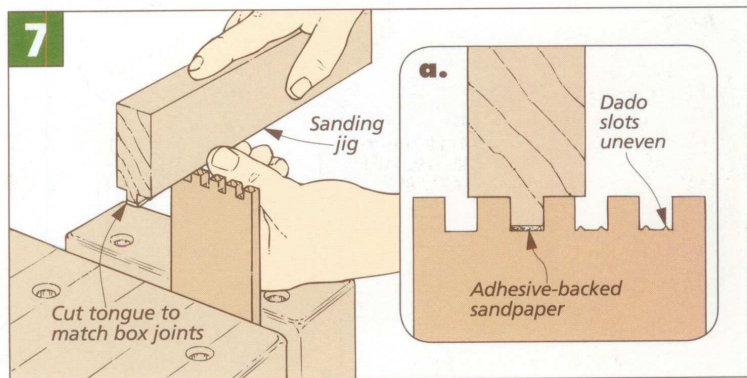
CLEANING THE SLOTS. Another problem is uneven slots cut by the dado blade. You can see this in Figure 7a. What you want is to get them flat without affecting the accuracy of the fit.

To accomplish this, I made a simple sanding jig. Start with a piece of scrap, and cut a tongue on one edge, as you see in Figures 6 and 6a. The tongue should slide smoothly in the slot and match its depth. Then, attach a piece of adhesive-backed sandpaper to the bottom of the tongue, and sand the slots flat.

SMOOTH ASSEMBLY

At this point, you're ready to assemble the box. Here's where things can get a little tricky. But I take a few precautions to avoid any trouble.

First, I try to avoid slopping glue around and making a mess. So, I tape the inside edges of the pieces, as shown in Figure 8. This way, any glue that squeezes out can be carefully peeled away later.



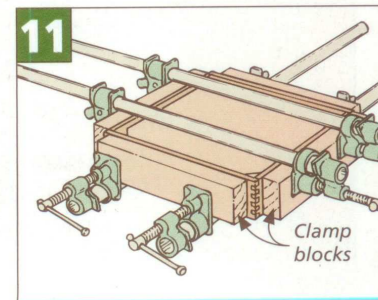
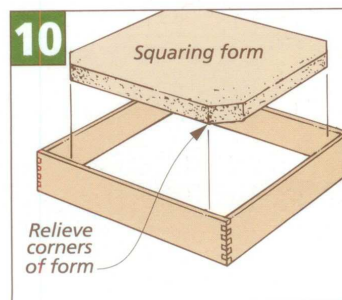
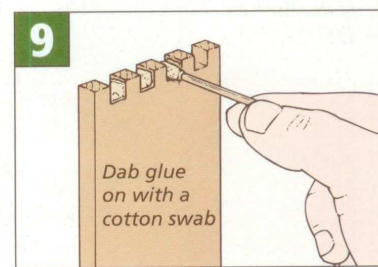
TIME SAVERS. And to buy myself a bit of extra time, I use white glue instead of yellow. White glue sets up slower, which is helpful when there are a lot of box joints to assemble. You'll see what I mean when you get to the magazine boxes on page 58.

Also, to apply the glue quickly, I use cotton swabs and dab it onto the sides of the pins, as you can see in Figure 9. You don't need much glue, though. Just a little bit creates a strong joint.

CLAMPING. When it comes to clamping up box joints, I do a couple things so there are no surprises.

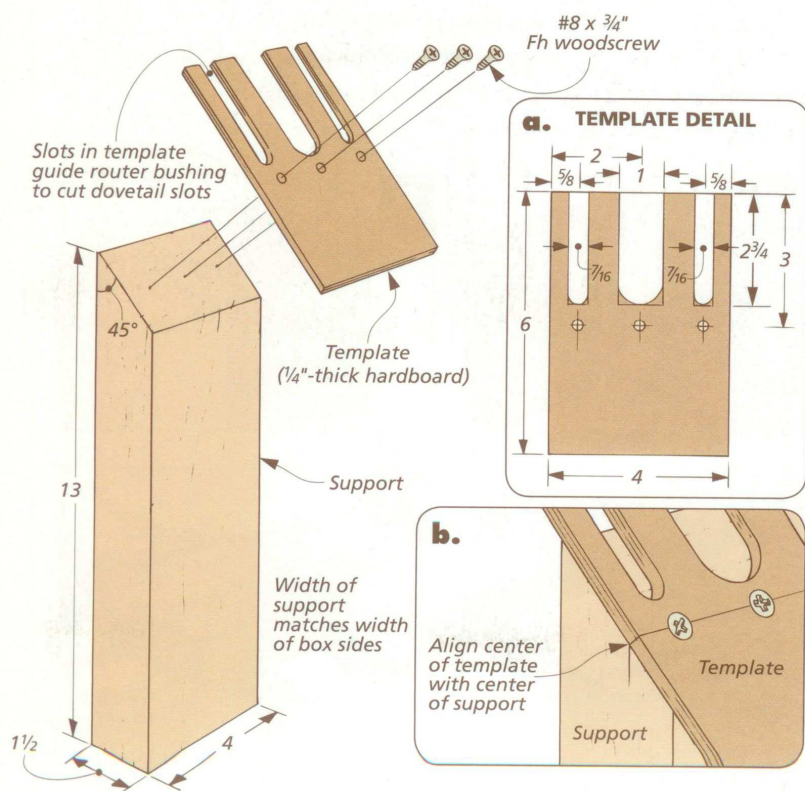
After dry assembling the project, I often make a squaring form out of scrap wood (Figure 10). I also make sure I have the right clamping blocks, like those you see in Figure 11. The important thing here is that they don't cover the box joints. Otherwise, they might prevent the joint from pulling tight.

Once the glue is dry, all that's left to complete your box joints is to sand the pins flush with the sides. The resulting box joints will be flawless.



Dovetail Key Joinery

Adding dovetail keys to a small box is one way to strengthen mitered corners. And with this unique jig, it's easy to rout slots for these keys.



Building simple boxes, like the one used for the router bit cabinet on page 66, is pretty straightforward. You just make the sides, miter the ends, and glue the pieces together. But sometimes mitered joints need reinforcement, so I add dovetail keys at the corners.

JIG. You could rout the slots for these keys on the router table. But to make the task easier, I designed a jig that clamps to the side of a box, as you see in Figure 1 (opposite page), and used my hand-held router.

You'll notice in the drawing at left that this jig consists of just two parts. There's a hardboard template on top to support and guide the router. And a support block underneath holds the template at the proper angle for routing the slots.

TEMPLATE. The template for this jig is a piece of 1/4" hardboard with slots cut in one end. These slots are for the guide bushing on the router. Just be sure to cut the slots wide enough to fit the outside diameter of the guide bushing you plan on using.

For the router bit case, I cut three slots (detail 'a' at left). Simply "stop" the slot by drilling a hole at one end, and then remove the waste in the middle.

SUPPORT. A 1½"-thick support is glued and screwed to the template, as you see in detail 'b' on the opposite page. A 45° miter cut on one end determines the angle for the template. And before

driving in the screws, I positioned the center of the template over the centerline of the support block.

USING THE JIG. With the jig assembled, clamp it to one corner of the box, as in Figure 1. Then, adjust your bit depth as needed (Figures 2a and 3a). In my case, the bit was extended below the template on the jig to create a 7/16"-deep slot. The depth can vary, but just make sure you don't rout through to the inside of the box.

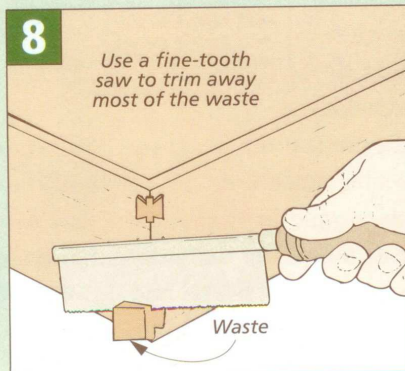
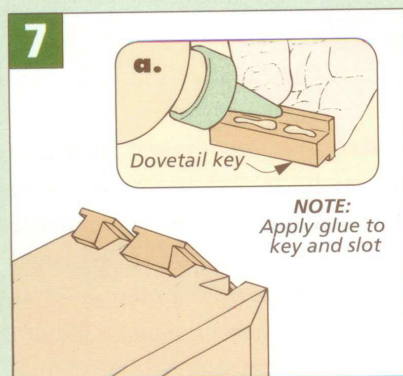
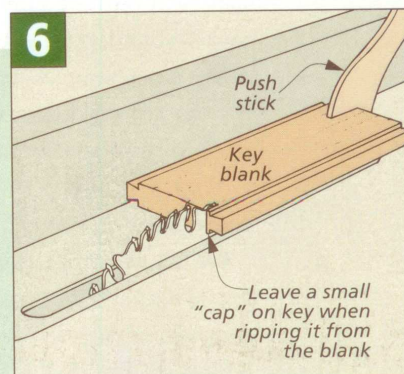
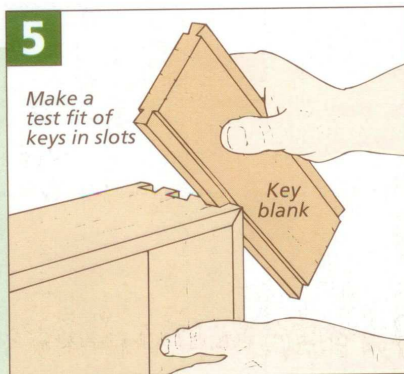
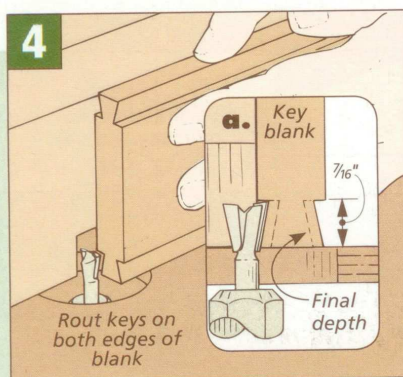
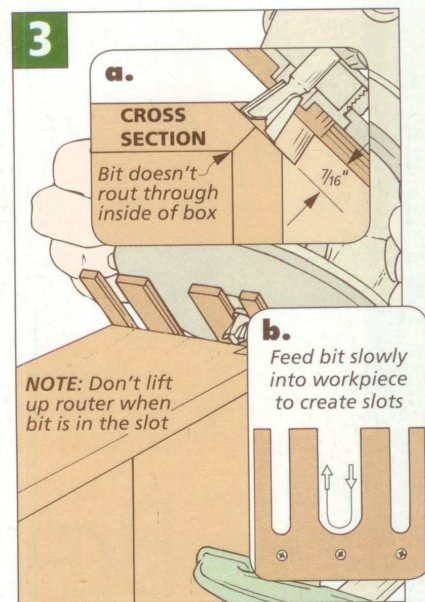
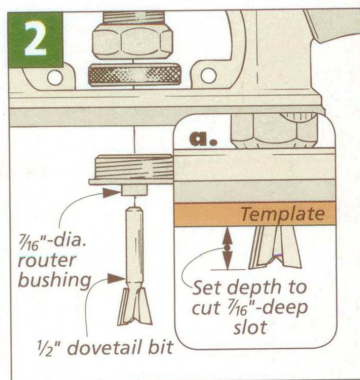
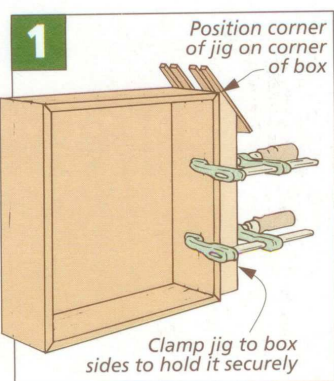
To rout the dovetail slots, the guide bushing follows the template (Figures 3 and 3b). But as you do this, avoid lifting up the router — it will damage the template.

KEYS. Once the slots are cut, keys to fill them can be made at the router table. I started with a wide blank and adjusted the bit height to equal the depth of the slots, as you can see in Figure 4. Use a ¾"-thick blank

for the small keys and 1¼"-thick piece for the large one. Then "sneak up" on the thickness of the key for a snug fit. To save stock, I routed keys on both edges of the blank. Also, it's a good idea to check the fit of each key in the slots, as illustrated in Figure 5.

When the keys fit, they can be ripped free of the blank (Figure 6). You don't need to cut them to an exact height — leaving a "cap" on top makes them easier to handle. Then, glue the keys into the slots, as in Figure 7.

Once the glue dries, the keys need to be trimmed. I used a small back saw to remove most of the waste (Figure 8). Finally, sand the keys flush with the sides of the box, as shown in Figure 9.





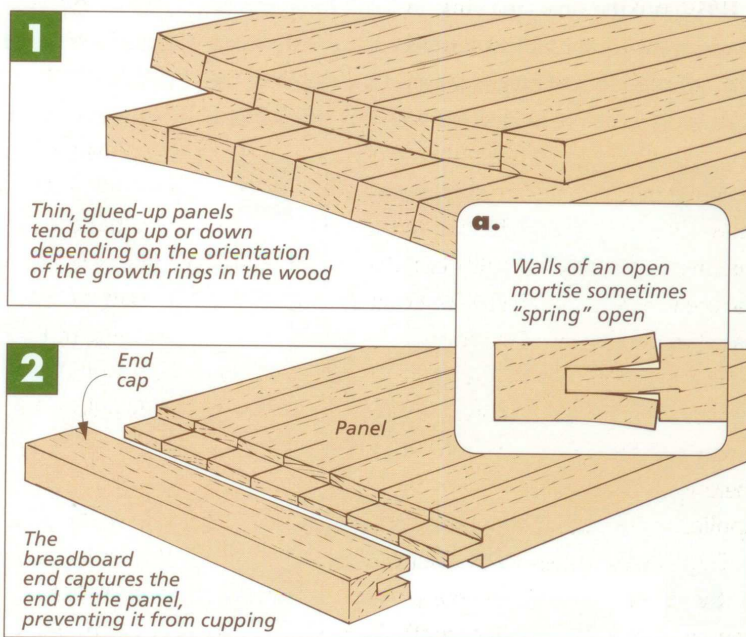
Breadboard Ends

Despite the name, breadboard ends aren't just for breadboards. They can be used anytime you have a flat panel that you want to keep flat.

Here's a riddle for you: What do workbenches and breadboards have in common? If you said that each one is a good place to make a sandwich, you're close. Since workbenches and breadboards are work-surfaces, they need to be relatively flat. Which is why you often find breadboard ends on both.

FLAT TOP. Breadboard ends help prevent glued-up panels from cupping, as you can see in Figure 1. How do they do this? It's really pretty simple. The breadboard ends are just caps that fit over tenons on each end of the panel. By capturing these tenons and holding them flat, the end caps prevent the glued-up panel from curling up like a big potato chip.

But doing that is not as simple as it sounds. The end caps also have to allow for the side-to-side expansion of the wood as it swells and shrinks with seasonal changes in humidity.



To accommodate this movement, breadboard ends aren't usually glued in place. Instead, they're often pinned with dowels or secured with hardware. (I'll explain more about this later.)

OPEN MORTISE & TENON. There are a number of ways to join a breadboard end to a panel. One of the

simplest is to cut a groove on one edge of the end cap to fit over a tenon cut on the end of the panel (an open mortise and tenon), as shown in Figure 2.

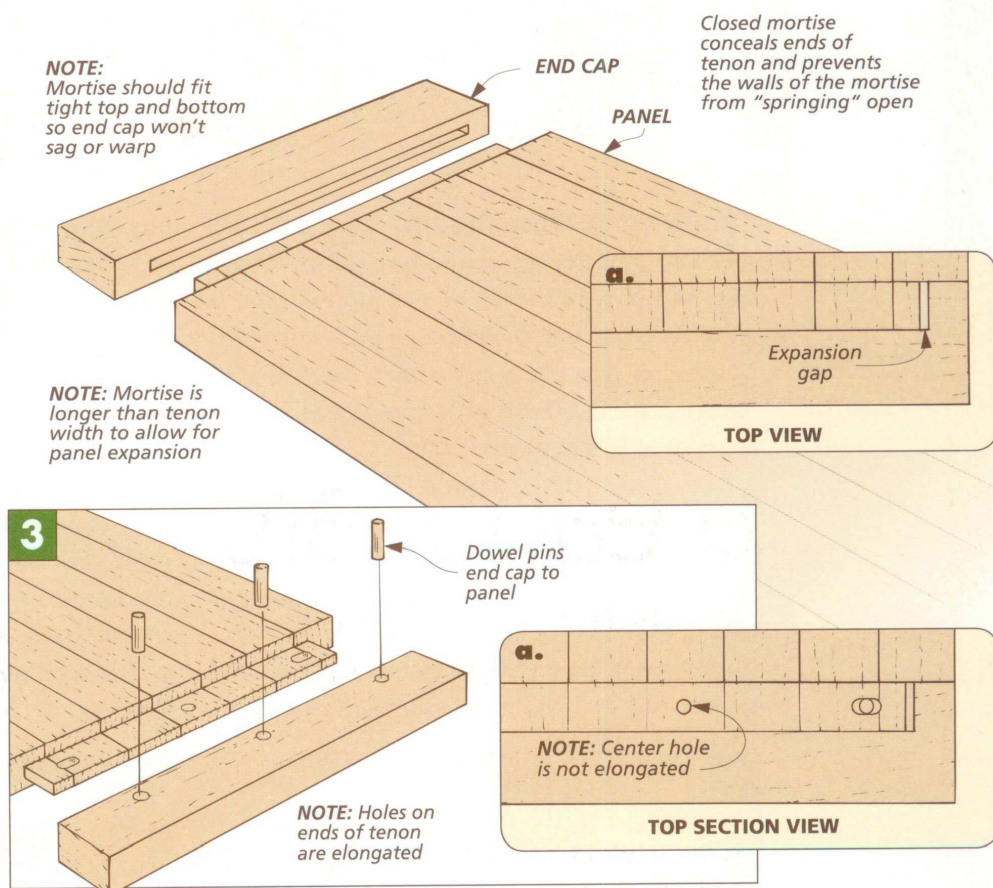
This method works fine. But on a couple of occasions, I've had trouble with the walls of the breadboard end "springing" open after a while (Figure 2a). In addition, some people don't like the fact that you can see the exposed tenon on the edges of the panel. For these reasons, I like to use a different style of breadboard end.

CLOSED MORTISE. By making a closed mortise in the breadboard end, the walls of the mortise can't spring open. (Take a look at the upper right drawing to see what I mean.) And then once the cap is installed, the tenon is hidden from view. This is typically the construction I use when making small projects with breadboard ends, like the breadboard on page 55. The trick is to allow the panel to move *inside* the mortise.

GROWING ROOM. When you were a kid trying on new shoes, remember how the salesperson would pinch the toe of the shoe to show your parents there was plenty of growing room? The same thing applies to the mortise on a breadboard end.

The mortise needs to be longer than the width of the tenon in order for the panel to "grow," as shown in detail 'a' (above right). Typically, I allow $\frac{1}{4}$ " at each end of the tenon for panel expansion. (On larger projects, I might even increase this to $\frac{1}{2}$ ".)

PINNING THE JOINT. Making an extra large mortise provides the *room* for expansion. But the end cap has to be attached to the panel in such a way as to give it the *freedom* to expand as well. That's where the dowel pins come into the picture.



Instead of gluing the cap onto the panel, it's pinned with dowels, as illustrated in Figure 3. Normally, I pin mortise and tenon joints by drilling a hole through both pieces, driving in a short length of dowel, and trimming it flush with the surface. But when attaching breadboard ends, an additional step is required.

To allow the panel to move, I elongate each of the holes in the tenon (except the center one) before driving in the dowels, as shown in Figure 3a. This allows the panel to expand in both directions, while the center pin anchors the end cap to the panel.

LARGE PANELS. I also use breadboard ends on larger projects, but for a slightly different reason. Consider a table, for instance. The breadboard ends are really more for appearance than for keeping the top flat — they help to hide the wide expanse of end grain on the ends of the large panel. But since the top is attached to a base, cupping isn't as serious a concern as with the smaller panel of the breadboard on page 55, for example.

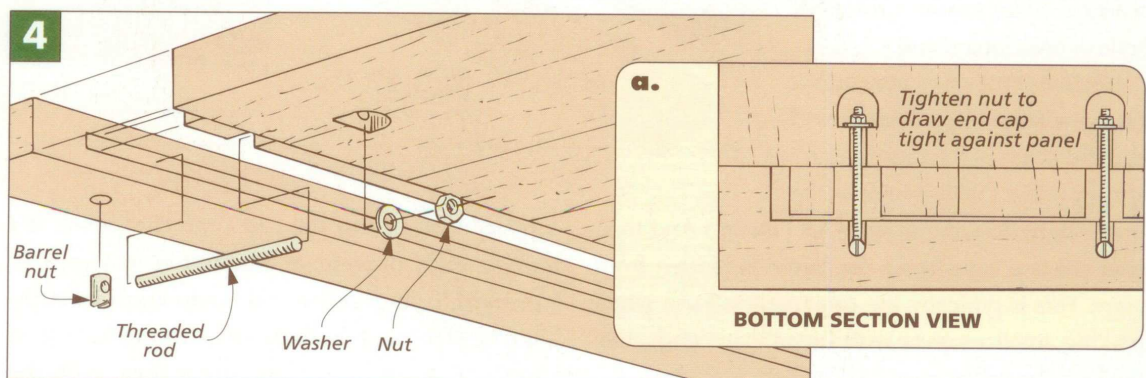
BREADBOARD ENDS ON LARGE PROJECTS. Although the reasons for adding breadboard ends to a table (or other large project) are different, the end caps still have to allow for wood movement across the width of the panel. And since the panel is fairly large, it's not unreasonable to think that the movement could be as much as $\frac{1}{4}$ " between seasons.

Also, the size of the top will introduce a couple of problems. Because the ends of a table are subjected to a lot of stress from people leaning on their elbows, regular dowels may not be strong enough to hold the end caps to the panel.

Another concern with a large workpiece is the greater width of the end caps. With changes in

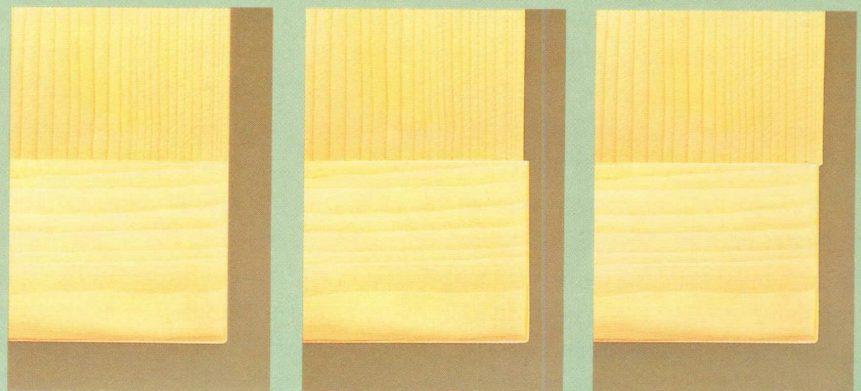
humidity, the end caps themselves might shrink in width. And this could possibly create a loose joint between the end cap and the panel. To solve these problems, it's a good idea to use mechanical fasteners to attach the breadboard ends to tables or other large projects, as you see in Figure 4.

By drilling oversize holes for the hardware, mechanical fasteners still allow the panel to expand and contract. But they offer greater strength than wood dowels. And if the end cap should shrink, the hardware can simply be cinched down a bit, pulling the end cap back tight against the panel, as illustrated in Figure 4a. This way, you know your tabletop will always be flat and look good.



Wood Movement

Panels with breadboard ends tend to be a bit finicky when it comes to humidity levels. An end cap may be perfectly flush with the edge of the panel when it's first attached. But depending on the time of year you build the project, the panel may expand or contract when the humidity level changes, as you see in the photos.



Breadboard

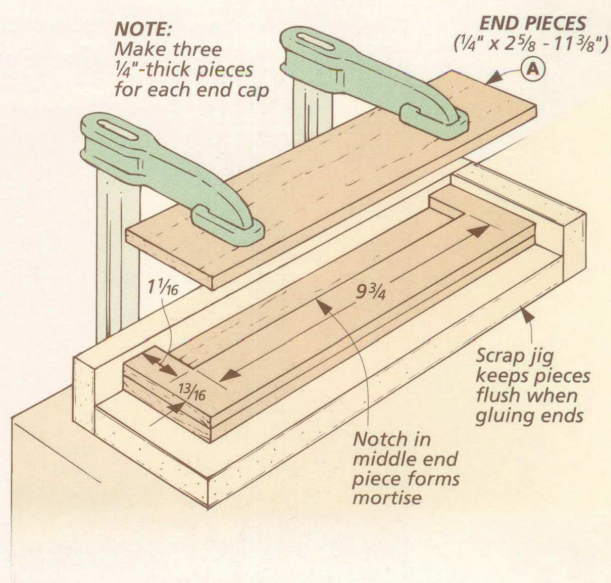
With its clean lines, curved ends, and recessed finger grips, this practical kitchen project is too nice to hide in a drawer.



When growing up, I often watched my mother bake bread. I would stand on a chair pulled next to the kitchen counter and ask her questions: "What's the yeast for? Why do you knead the dough? When's it going to be ready to eat?"

These days, I'm the one wearing the apron (though it's covered with sawdust, not flour). And typically, I get a few questions while I'm working. With this cherry breadboard, there was one question that kept coming up: "What are the end caps for?"

The answer is simple. The end caps prevent the thin panel from cupping. The trick is to attach these end caps so the panel can still expand and contract with changes in humidity. To do this, I used a traditional mortise and tenon joint. But instead of just gluing them together, I pinned them with dowels. (For more on breadboard ends, refer to the article beginning on page 52.)



BREADBOARD ENDS. To make this breadboard, I started with the ends. The mortise on each of these pieces is $9\frac{3}{4}$ " long. So rather than drill or rout it, I avoided cutting a mortise at all. Instead, I made each end cap out of three $\frac{1}{4}$ "-thick blanks, cutting each to finished size ($2\frac{5}{8}$ " x $11\frac{3}{8}$ "), as you can see in the drawing on page 55.

For now, you can set all but two of the blanks aside. These two blanks will become the center layer of each end cap. On these blanks, I cut a simple notch ($1\frac{1}{16}$ " x $9\frac{3}{4}$ "). This way, when each end cap is glued together, the notch will form the mortise.

When gluing the end caps together, the important thing is that their edges are flush. So to keep the blanks aligned, I made a simple jig with an L-shaped corner, as shown in the drawing on page 55. (Be sure to wax the jig so the pieces aren't glued to it permanently.)

SHAPE ENDS. After the end caps are glued up, the last thing to do is shape them. First, a small, round channel is routed on the edge so the breadboard is a little easier to pick up. Then a curve is cut along its outside edge.

The rounded channel on the ends gives your fingers a little shoulder to grab when picking up the breadboard. And to rout this semi-circular profile, you don't need any curved fences or special jigs; it's routed while the blank is square. So all you need is

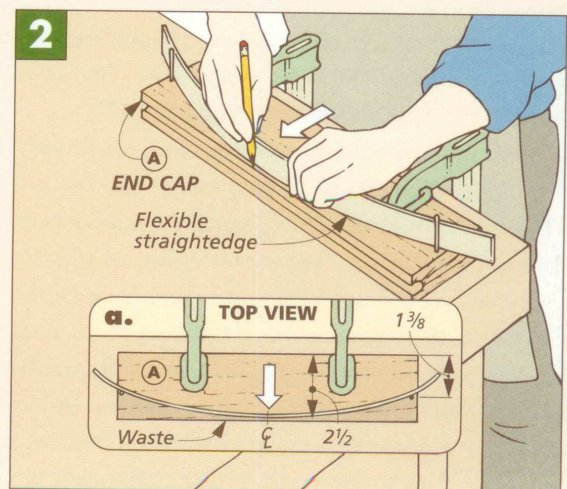
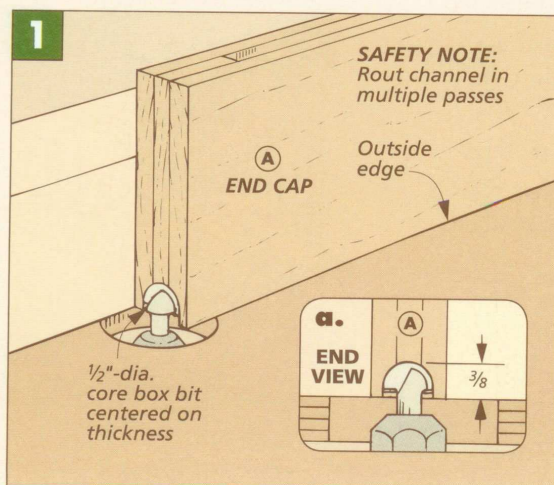


a $\frac{1}{2}$ "-dia. core box bit and a router table, like you see in Figure 1. Simply center the bit on the thickness of the pieces and make multiple passes, raising the bit until the groove is $\frac{3}{8}$ " deep (Figure 1a).

With the cove routed, you can lay out and cut the curve on the ends. Figure 2 shows an easy way to do this. Then after sanding the curves smooth, work can begin on the breadboard panel.

BREADBOARD. The secret to a durable breadboard is to use straight, tight grain. And the best place to find this grain is on the edge of a board. So to make the panel, I started with $1\frac{5}{8}$ "-thick boards (8/4 stock). Then I ripped $\frac{13}{16}$ "-wide pieces from the blanks, flipped the pieces over, and glued them back together (Figure 3). When the glue is dry, the panel can be planed or sanded so it's $\frac{3}{4}$ "-thick and cut to size ($11\frac{3}{8}$ " x 17").

Next, I cut the tenons on the ends, as shown in Figure 4. The only thing critical is the thickness of each tenon — they should fit fairly snug. Otherwise,



I cut the length of the tenon $\frac{1}{16}$ " short of the depth of the mortise, as you can see in detail 'a' of the drawing at right. And I allowed a $\frac{1}{4}$ " gap at each end.

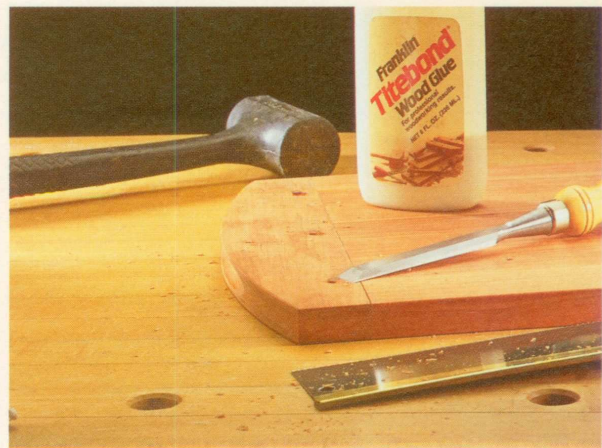
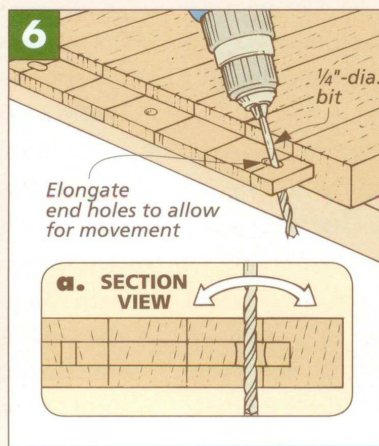
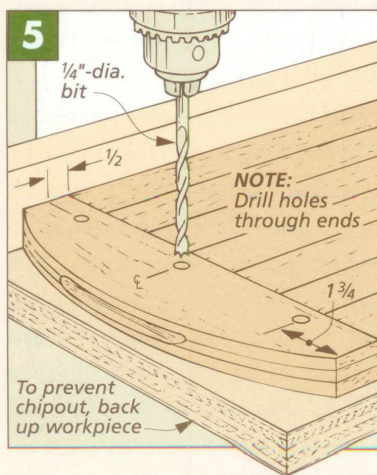
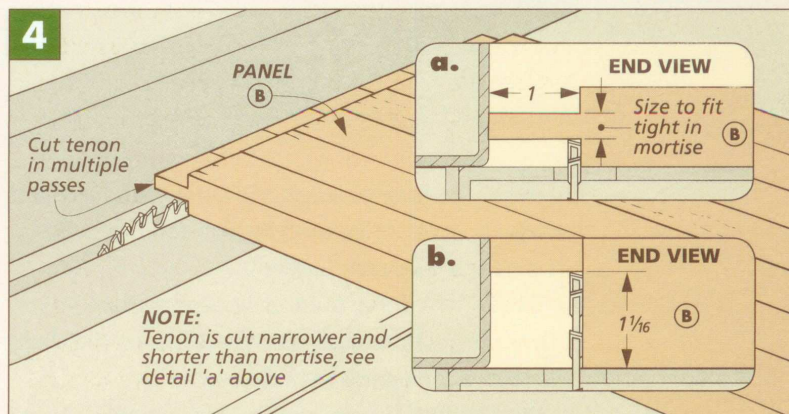
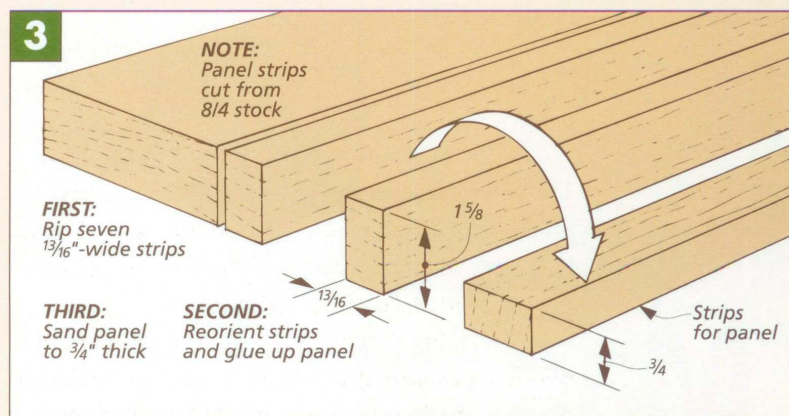
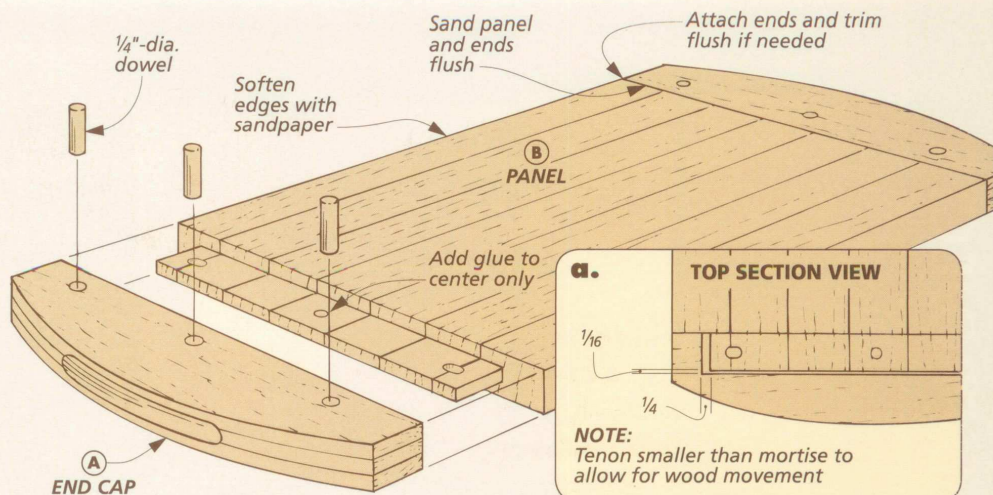
ASSEMBLY. Now the ends can be attached to the panel. The goal is to allow the panel to expand and contract with changes in humidity. The solution is a combination of glue and $\frac{1}{4}$ "-dia. dowel pins (drawing at right).

First, dry assemble the ends on the panel and drill three $\frac{1}{4}$ "-dia. holes all the way through the ends and tenons, as illustrated in Figure 5. (Make sure that you back up the cuts so there isn't any chipout on the bottom face of the end caps.)

Next, remove the ends and slightly enlarge the holes near the outside of the tenon, as shown in Figure 6. (Leave the center hole alone so the panel will expand out from the center.)

Now the ends can be glued to the panel. I spot glued the tenon at the center and put just enough glue on the pins to keep them in place. Trim and sand the pins flush. Then sand the panel and ends flush. I sanded with the grain of the panel first. Then I "hit" the ends to remove the cross-grain scratches.

A finish on a breadboard, to my way of thinking, is strictly optional. But if you'd like to add a coat or two, I'd recommend a penetrating oil finish that won't build a film on the surface.





Magazine Boxes

These simple boxes provide a convenient and stately way to store magazines. Plus, they don't take much time or material to build.

It seems like magazines pile up faster than I can read them. And once I've read them, I can never find a convenient place to put them.

That's why I like these magazine storage boxes. They keep your magazines organized, and they look handsome on a shelf or bookcase.

GLUE UP PANELS. I began building the boxes by gluing up panels from $\frac{1}{4}$ "-thick stock. Each box requires three 12" x 10" panels. I built a simple clamping jig to hold the panels flat. (For more on building this jig, go to WoodsmithSpecials.com.)

Once the glue dries, you can cut the panels to length. (They'll be cut to width later.) Cut the two side panels to a length of $9\frac{3}{4}$ ". Then, cut the third panel into two $4\frac{1}{2}$ "-long pieces for the front and back.

BOX JOINTS. The sides and ends of the box are joined with box joints. While they may look difficult,

they're actually easy to make using the simple jig shown on page 46.

When you're cutting a long series of box joints, it's important to set up the jig as accurately as possible. Even if you're off by just a fraction of an inch, that error can really add up when you multiply it by the number of pins you're cutting. So much so, that the pins and slots might not even fit together when it comes time to assemble the project.

To prevent this, I tested my setup by cutting box joints on a couple of 12"-long scrap pieces. Then I made sure they fit together smoothly.

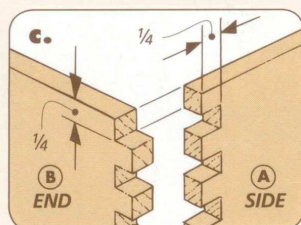
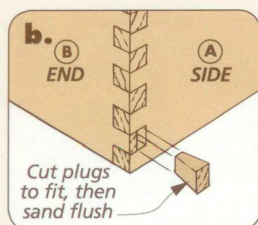
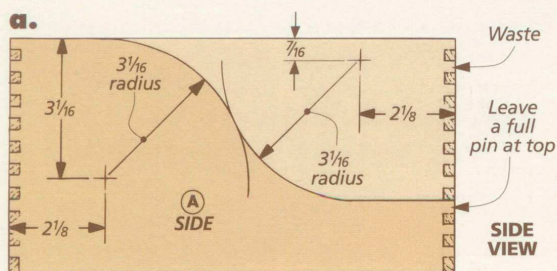
BOTTOM. After cutting the box joints, the pieces can be cut to finished width. I cut mine $11\frac{3}{4}$ " wide, but the exact dimension isn't critical. What you want to end up with is a full pin at the top and bottom of each side piece, and a full slot at the top and bottom of each end piece (Figure 1c on the opposite page).

The next step is to cut a $\frac{1}{8}$ "-deep groove on the inside face of all four pieces. The width of this groove is sized to hold a $\frac{1}{4}$ " hardboard bottom, as you can see in the margin drawing on the opposite page.



For more on building a jig to help you glue up thin panels, go to our website:

WoodsmithSpecials.com



To determine the width and length of the bottom, dry assemble the box and measure the opening, including the depths of the grooves. Now subtract $\frac{1}{16}$ " from each dimension to allow for clearance. Then cut the bottom piece to size.

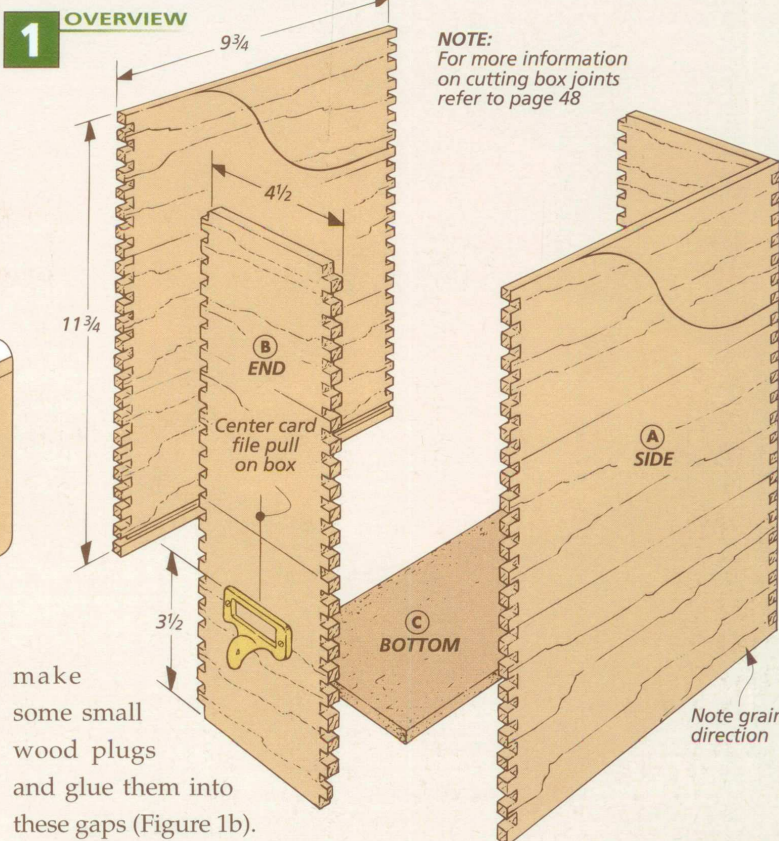
ASSEMBLY

To make it easier to get magazines in and out, the back corner of the box is cut away. But if you do this before assembling the box, it's difficult to position a clamp across the top of the box. So I glued and clamped up the box before starting on the cutaway.

And even though this is a small project, the box joints can make assembling it a bit tricky. To give myself a little more time, I used white glue, which doesn't set up as fast as yellow glue.

I also used a lot of clamps to help pull the box joints together, as shown in Figure 2. You may need to reposition some of the clamps as you're assembling the box to apply pressure where you need it.

One more thing. Since the grooves for the bottom are visible on the sides of the box, you'll need to



NOTE:
For more information
on cutting box joints
refer to page 48

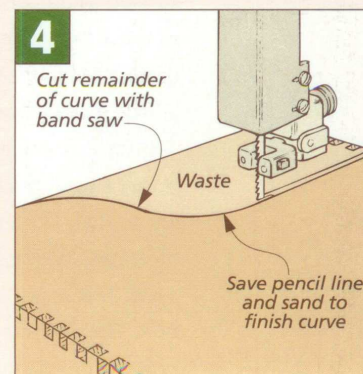
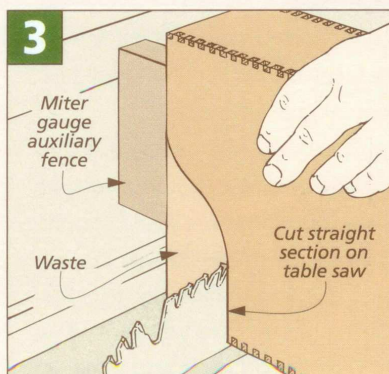
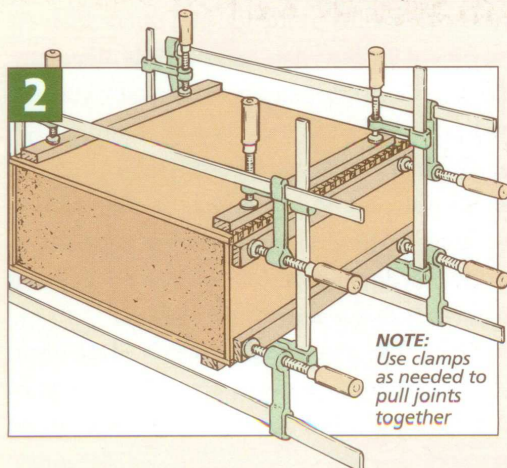
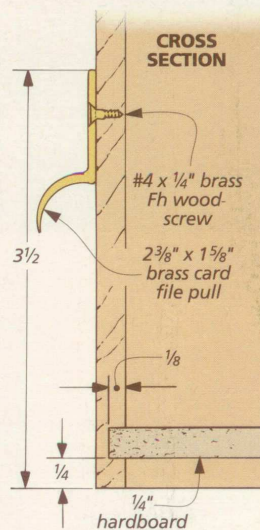
make some small wood plugs and glue them into these gaps (Figure 1b).

CUTAWAY. After the glue was dry and the pins were sanded flush, I laid out a gentle double-curve on one side of the box, as in Figure 1a. (I used a compass to draw the arcs.)

To get a smooth cut on the straight section of the cutaway, I used a table saw (Figure 3). Then I completed the cut using a band saw, as shown in Figure 4.

After cutting the curve, sand it smooth with a drum sander. Then round over all the outside edges with a $\frac{1}{8}$ " roundover bit and a router.

ADDING A PULL. After wiping on an oil finish, I added a brass card file pull to make the box easier to pull off a shelf. Note: The $\frac{1}{2}$ " screws that come with the pull are too long. You'll need to purchase $\frac{1}{4}$ " brass screws to use as replacements (see margin drawing).





Sliding Lid Boxes

Box joints make these boxes strong as well as attractive. The sliding lids are a great practical addition.

Before plastic and cardboard, people stored and carried things in wooden boxes. The smaller versions of these boxes were often joined with box joints — a quick joint that's easy to mass produce. And with just a little glue, a box joint is quite strong, too.

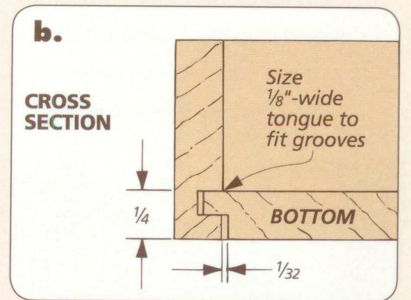
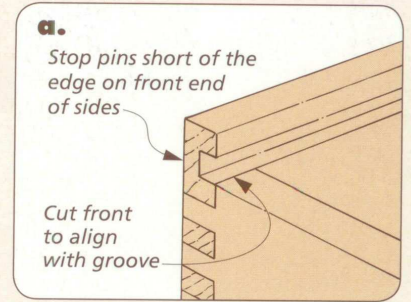
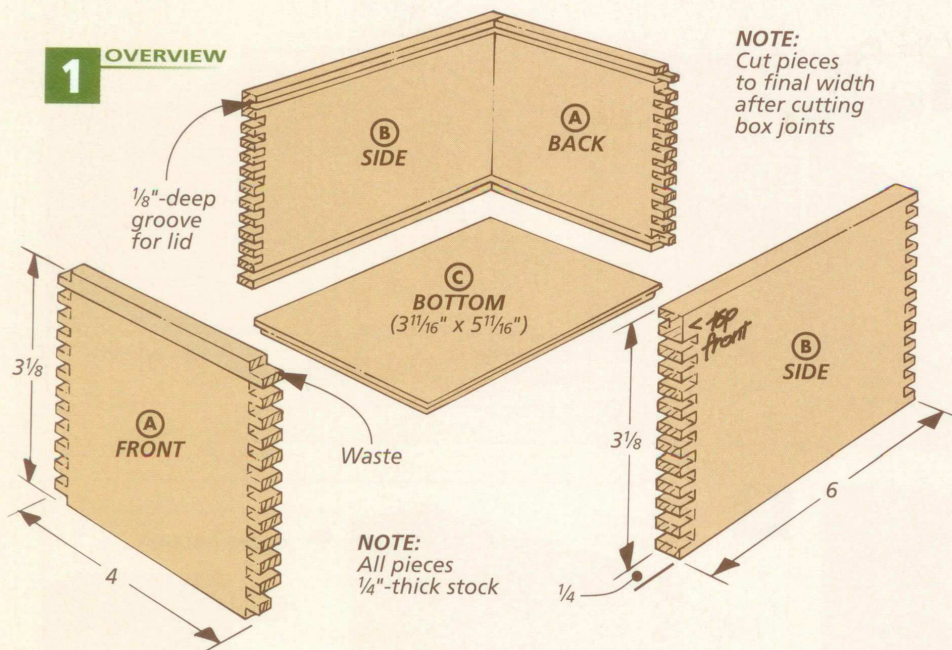
I use box joints for those very same reasons. I can build a box quickly using a table saw and a simple jig. In fact, I can build a lot of boxes in just a couple of hours, as you can see in the photo above.

LID. The other thing I like about these boxes is the lids. They're irresistible — as soon as you pick up a box, you just have to slide the lid open and shut.

Because the lid fits inside the box rather than on top, the pins of the box joints are cut a little differently than those in the article on page 46. Basically, you just eliminate a pin at the top front corners, as you can see in the margin photo on the opposite page.

Note: The step-by-step drawings on the next few pages feature the pine box you see at left in the photo above. Overall dimensions for the other boxes in the photo are included in the box on page 62.

SIDES & ENDS. These boxes start out as $\frac{1}{4}$ "-thick front, back, and side pieces, cut about $\frac{1}{8}$ " oversize in width. Then the box joints can be cut, and the box can be



assembled as shown in the technique article on page 46 — except for a few important differences.

FRONT ENDS. When laying out and marking the pieces, I labeled the front end of each side piece so I would remember to cut them differently. As I mentioned, the pins on these pieces aren't cut all the way to the top edge, as you can see in Figure 1a.

What I do is start with the back end of these pieces and count the number of passes I make over the blade (thirteen for the box you see in the illustration above). Then, when cutting the front end, you can simply make two fewer passes over the blade (eleven, in this case). Note: The thirteen slots on the back end will be reduced to twelve after the waste has been trimmed off the top edge.

GROOVE FOR LID. Before trimming the front piece, I cut the groove for the lid near the top of the inside face of the back and side pieces. This groove is identical to the one for the bottom ($\frac{1}{8}$ " x $\frac{1}{8}$ ").

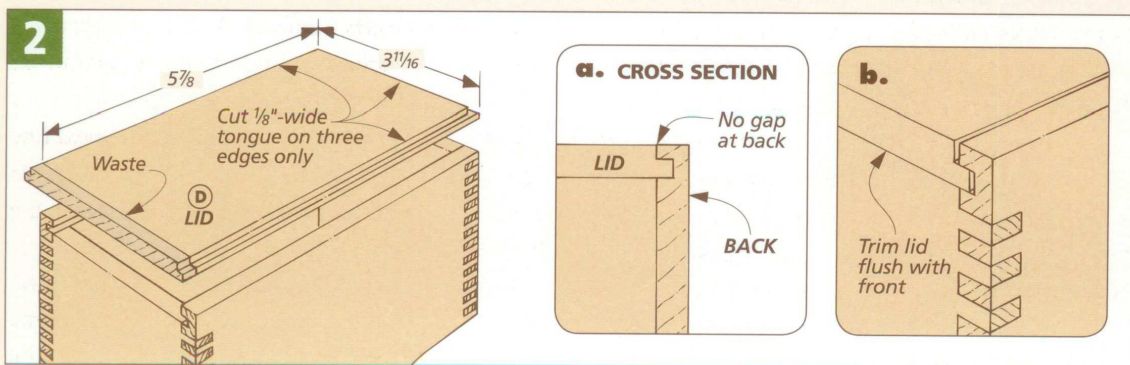
TRIM FRONT PIECE. After the grooves for the lid have been cut, raise the blade and trim off the top edge of the front piece. You'll want it to line up with the bottom of the groove perfectly, as shown in Figure 1a. Now, a $\frac{1}{4}$ "-thick hardwood bottom can be added, and the box can be glued together (refer to page 49).

LID. With the box assembled, work can begin on the lid, as shown in Figure 2. The lid is nearly identical to the bottom of the box. But it's $\frac{3}{16}$ " longer so it ends up flush with the front of the box. And instead of cutting a $\frac{1}{8}$ "-wide rabbet along all four edges, only three edges of the lid are rabbeted.

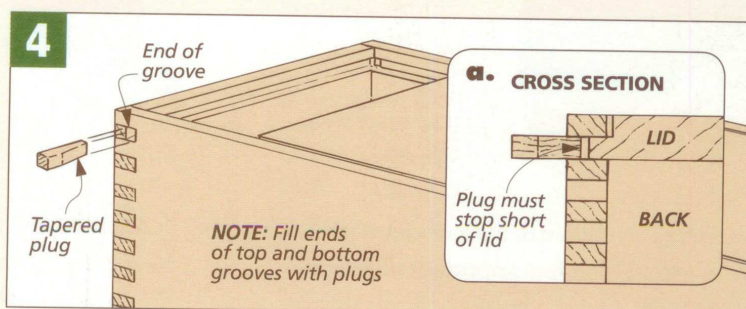
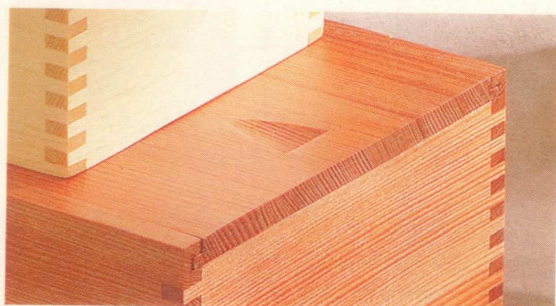
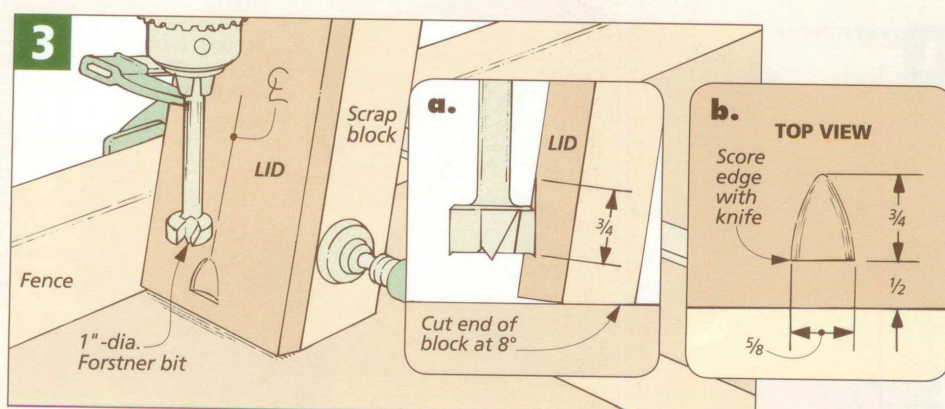
I sized the tongues created by these rabbets so they would just fit into the grooves in the box. Then, I sanded the tongues on the sides of the lid so it would slide in and out easily. But leave the back edge tight so it will hold the lid securely in place.



The lid on this box slides into shallow grooves cut in the sides and back.



Drilling the Finger Pull. An angled stop block supports the workpiece, allowing the Forstner bit to drill out a shallow recess.



FINGER PULL. At this point, the lid will fit into the box. So next, I added a small recess, as shown in the photo above, so I could pull it out easily with the tip of my finger. Figuring out how to cut a clean pull can be a challenge. Figure 3 shows a quick and easy method that uses a drill press, a 1"-dia. Forstner bit, and an angled scrap block.

First, I laid out the position of the pull (Figure 3b). Then to prevent chipout, I scored the pull's straight edge $\frac{1}{2}$ " from the front of the lid.

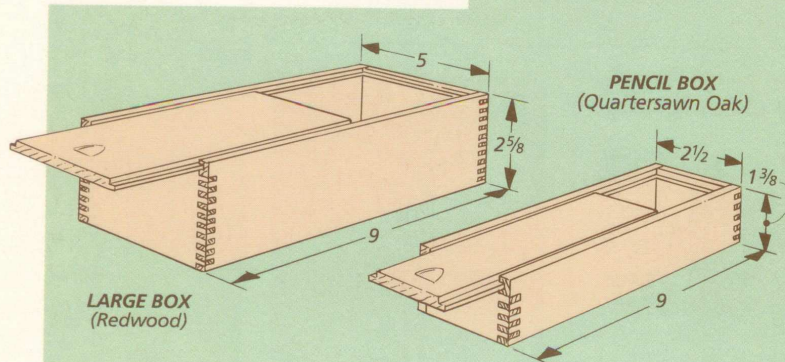
Now to support the lid, I trimmed one end of a scrap piece of 2x4 at 8° so it would hold the lid at a

slight angle, as you can see in Figures 3 and 3a. Next, position the lid so the drill bit starts cutting at the "point" of the pull. Once that's complete, you can lower the bit to the scored line.

PLUG GROOVES. All that's left to do is plug the holes left by the grooves at the top and bottom of the box. But take special care with the plugs at the top (Figures 4 and 4a). If they extend too far into the groove, they could prevent the lid from closing. For more on making these plugs, take a look at the box on page 64.

Finally, with the plugs glued in and trimmed flush, sand the box smooth, and wipe on an oil finish.

Alternate Box Sizes

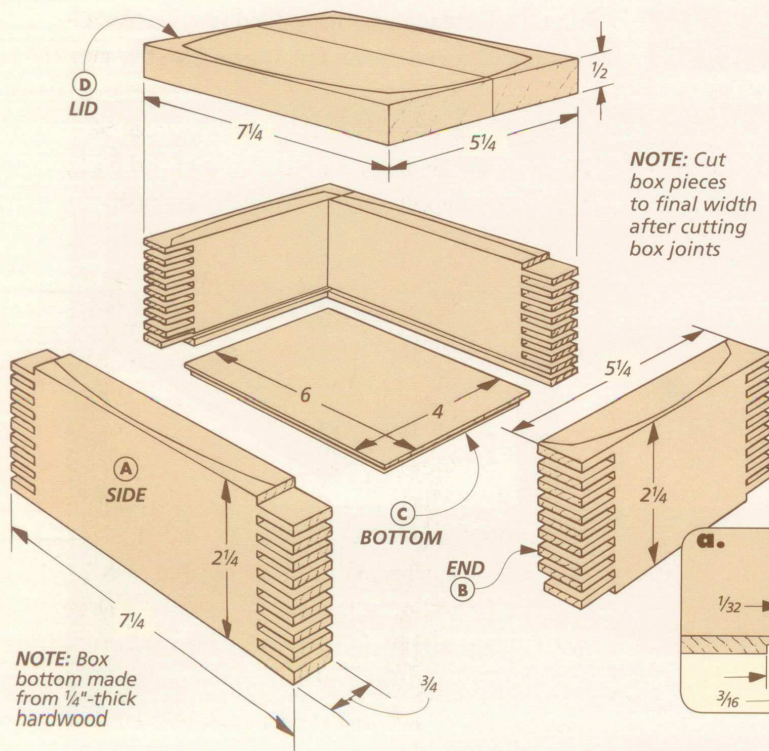


I like these boxes because I can turn out two or three in no time at all. In fact, I found myself trying different woods and changing the size of the boxes. You can see examples of this in the drawing at left and in the main photo on page 60. One note of caution, though. If you're building a box that's wider (or taller) than 5", you need to use stock thicker than $\frac{1}{4}$ " — otherwise the lid will be more likely to cup.



Curved Box

The curved sides on this box make the pins look curved too. But actually, the box and the pins start off square — and the sides are curved after it's assembled.

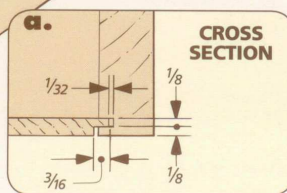


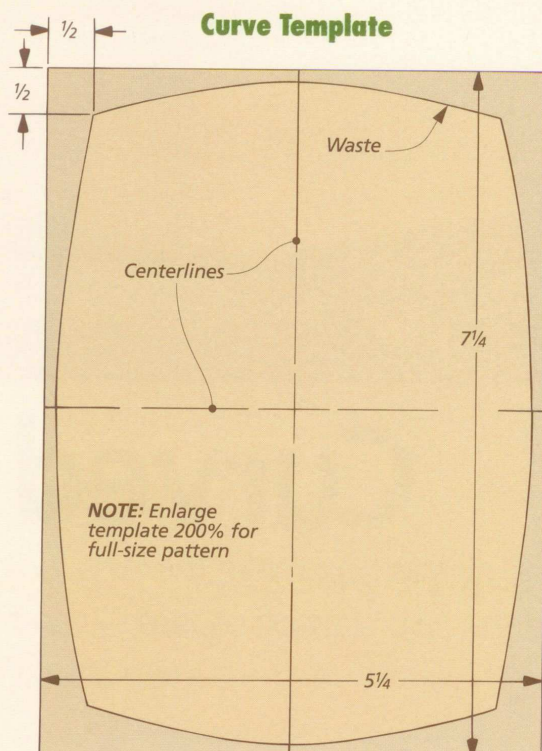
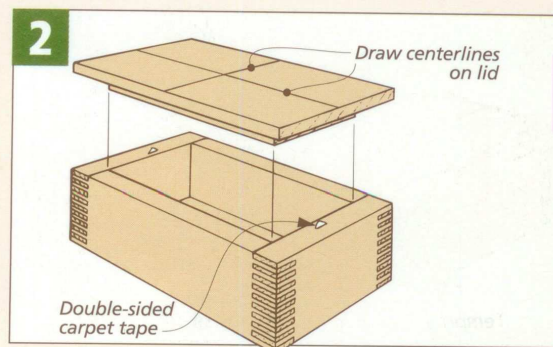
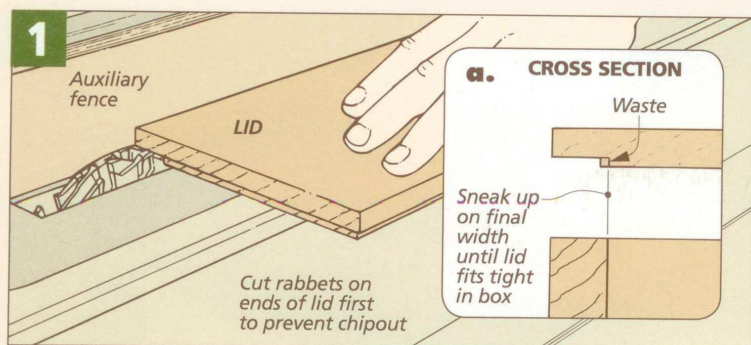
It's always amazing to me how one simple detail can change the whole look and feel of a project. Take this box, for instance. After building several square boxes, I built this small box with gently curved sides.

Now, you might think that the curves would make this box complicated to build, but they really don't. The pins are cut while the box is still square. And the lid starts out square, as well. In fact, the curves are cut only after the box and lid are pretty much complete.

BUILD BOX. To build the box, I started with $\frac{3}{4}$ \"-thick maple stock and cut the sides and ends to final

length. (I left them a little wide at this point.) Then, I cut the pins on each of the pieces, as you can see in the drawing at left. (For more on cutting box joints, see the article on page 46.)





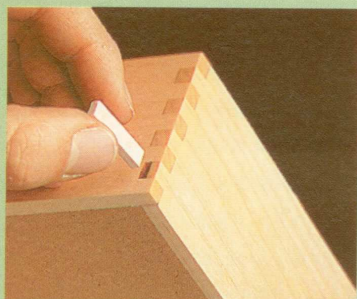
When trimming the box pieces to width after cutting the pins, I did something a bit out of the ordinary for box joints. I trimmed the side pieces so there was a pin at the bottom but a slot at the top (instead of a pin at both the top and the bottom). The end pieces are just the opposite: there's a slot at the bottom and a pin at the top. This allows for the pin-width chamfers that will be routed along the bottom edge later.

Now grooves can be cut in the box pieces, and a 1/4"-thick hardwood bottom can be cut to size and rabbeted to fit the grooves. See detail 'a' on page 63 and the article on page 46 for more information.

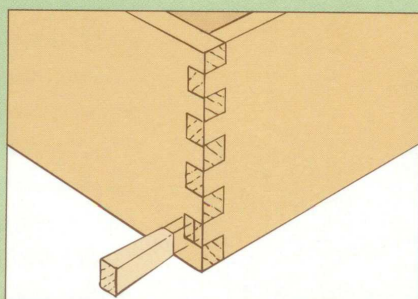
ADD LID. Once the box is assembled, work can begin on the lid, as shown in the drawing on page 63. Since it matches the size of the box (5 1/4" x 7 1/4"), you could cut the lid from a single board. However, I decided to glue up two pieces of 1/2"-thick mahogany to reduce the chance of cupping.

After the lid blank was cut to final size, I rabbeted the bottom edges so it would fit into the box, like you

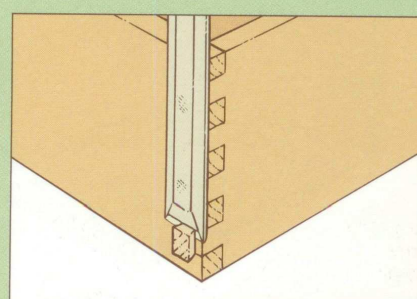
Hiding the Groove



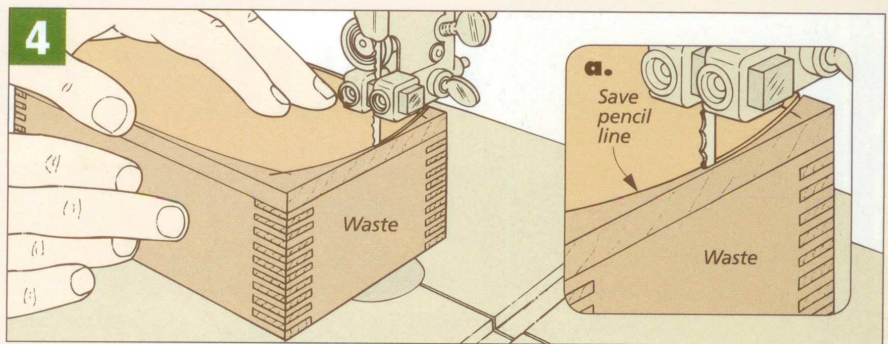
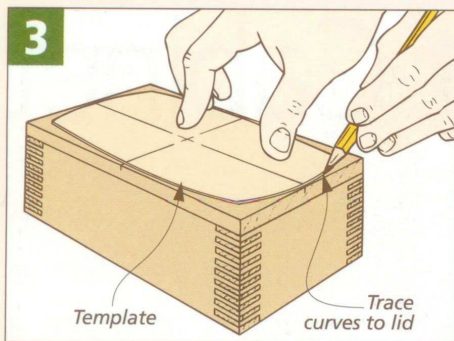
Filling in the Gaps. Cutting the grooves for the bottom panel leaves a small hole. You can fill these holes with end grain plugs and make them disappear.



Plug the Hole. You can begin hiding the groove by cutting an extra-long plug to fit inside the hole. Then, taper the sides of the plug slightly to get a snug fit. Finally, glue it in place.



Trim the Plug. Next, you'll need to pare off the excess length of the plug. Using a chisel, work your way around the plug until you cut through the center. Then sand it smooth.



see in Figure 1. The width of these rabbets should match the thickness of the box sides ($\frac{3}{4}$ "). But don't try to cut them exactly to size the first time. It's better to "sneak up" on the final width of the rabbet so you end up with a tight fit, as illustrated in Figure 1a.

CUT CURVES. Once the lid is fit, it's time to cut the curves. I used carpet tape to hold the lid to the box so I could cut them both at the same time (Figure 2). But don't use too much carpet tape, or it will be hard to remove the lid later.

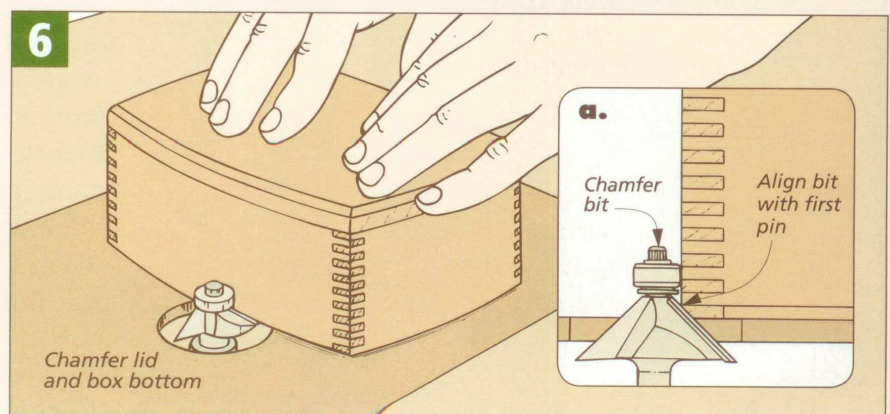
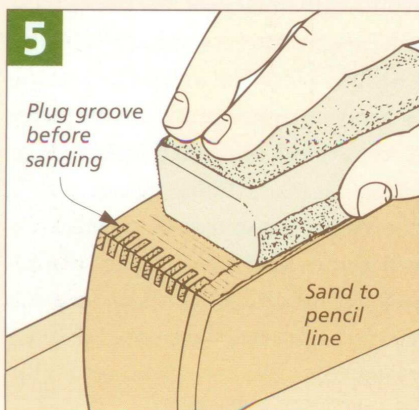
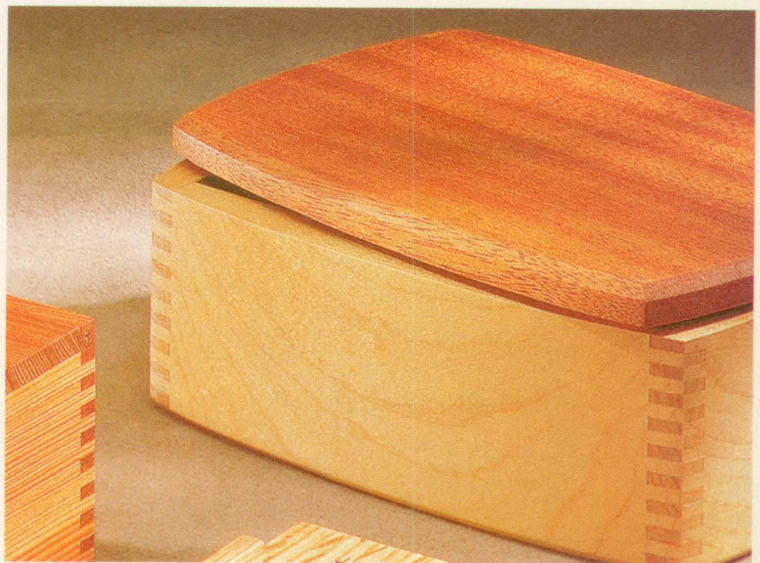
To lay out the curves, I simply marked out three points: one at the center and two more $\frac{1}{2}$ " in from the outside corners. Then I connected them, drawing the gentle curve freehand. You could also photocopy the template on the opposite page at 200% and trace around it, as shown in Figure 3.

With the curves drawn on the lid, the shape can be roughed out on the band saw. This is illustrated in Figure 4. There's no trick here — just be careful to stay about $\frac{1}{16}$ " outside each line.

PLUG GROOVES & SAND. Now, while the box and lid are still rough, I plugged the exposed ends of the grooves and trimmed the plugs flush. Then, I clamped the box in the vise and hand-sanded everything smooth, as you can see in Figure 5. Note: The box and lid should still be taped together at this point.

ROUT CHAMFERS. The last step is to rout a chamfer around the box and lid (Figures 6 and 6a). The idea is to align the edge of the chamfer bit with the first pin at the bottom of the box (Figure 6a). Start by routing the chamfer around the bottom edges of the box (beginning with the ends), and then chamfer the sides. Next rout an identical chamfer around the top of the lid.

Now you can remove the lid and apply a couple coats of a wipe-on finish. Before you know it, you'll have an eye-catching, curved box to use and to display.



Router Bit Cabinet



Dovetail keys at the corners reinforce the joints to make a stronger cabinet. Plus, a clear, plastic door panel lets you see what's inside.

Router bits and neckties have a lot in common. It doesn't take long before you accumulate a sizable number of each. Quality ones are fairly expensive. And most of the time there's really no good way to store them. Since I prefer router bits to neckties, I built a storage cabinet to help organize and protect my

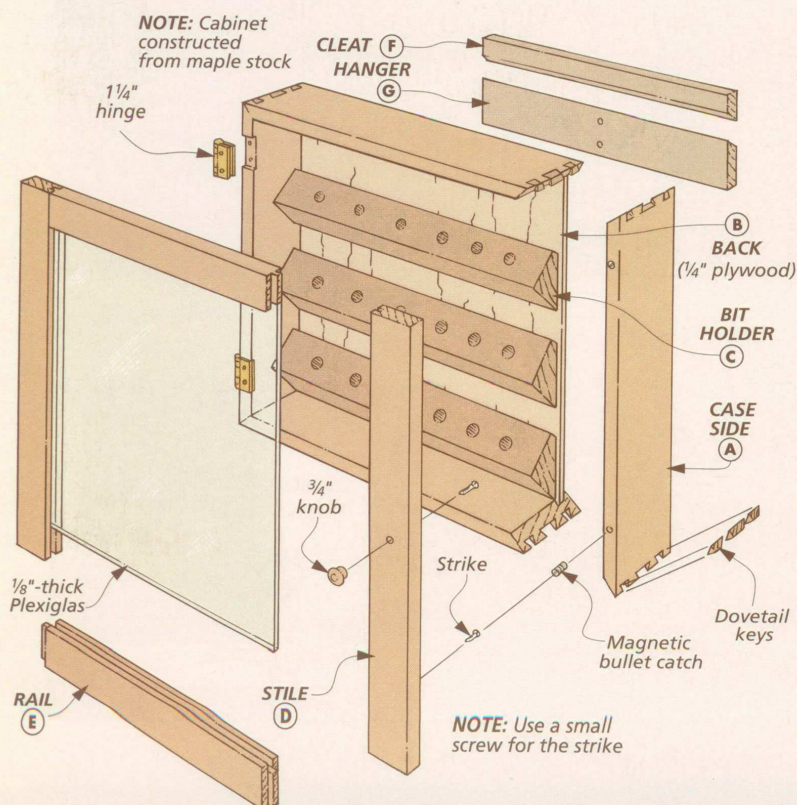
router bit collection, as shown in the main photo.

As you can see, the design for this cabinet isn't elaborate. However, the dovetail keys and a *Plexiglas* door add enough of a challenge to make building this router bit cabinet interesting.

MITERS. To start on the cabinet, I made a square box. It consists of four case sides cut to the same width (4") and mitered to length (13½"), as you can see in the illustration at the top of the next page.

To end up with a tight miter joint, the pieces must be cut to the same length. After cutting a 45° angle on one end of each piece, I installed a stop block on the auxiliary fence of my miter gauge and cut the pieces to final length. A stop block prevents the pieces from moving away from the blade during the cut.

GROOVES. After cutting the miters, the next step is to cut a ¼"-deep groove near the back edge of each piece for a ¼"-thick plywood back, as shown in detail 'a' on the next page. Notice that the groove is located ½" in from the back edge. This provides room for the mounting cleat you'll add to the back.



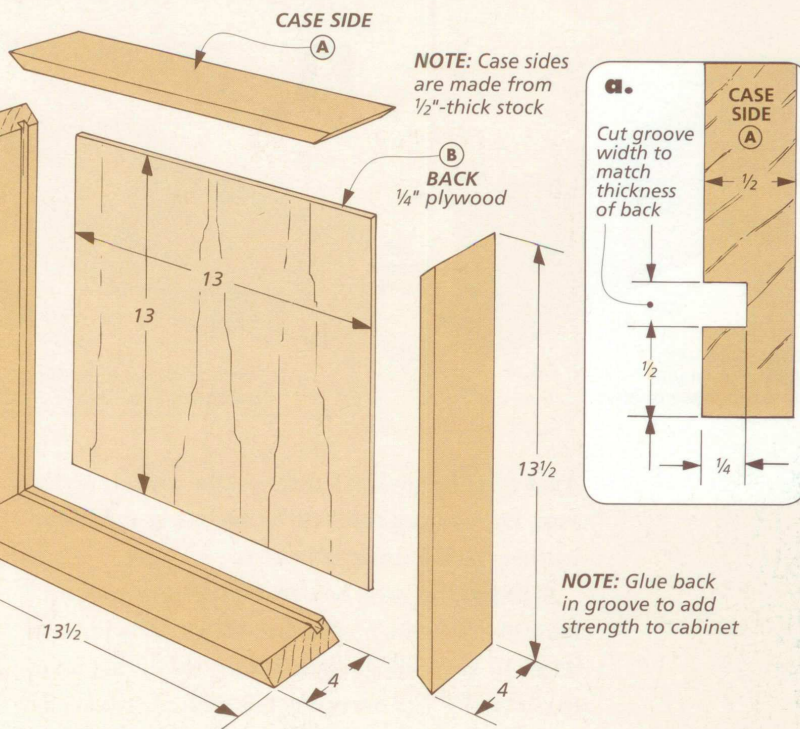
I couldn't use my dado blade to cut this groove since it had to be less than $\frac{1}{4}$ " wide (the thickness of my plywood was less than $\frac{1}{4}$ "). So, I cut the groove by making a couple of passes with a standard combination blade to sneak up on the width. This way, it's easy to check the fit between passes.

BACK. With the grooves complete, you can begin working on the $\frac{1}{4}$ " plywood back. The important thing is sizing the back so that the miters will fit together tightly. To check this, it's a good idea to dry assemble the side pieces and back before you do anything else. Then, if there's a gap at any of the corners, the back can be trimmed down.

ASSEMBLY. When you're satisfied with the fit, glue and clamp the case sides and back together. (Note: Gluing in the plywood back is a good way to add strength to the case.)

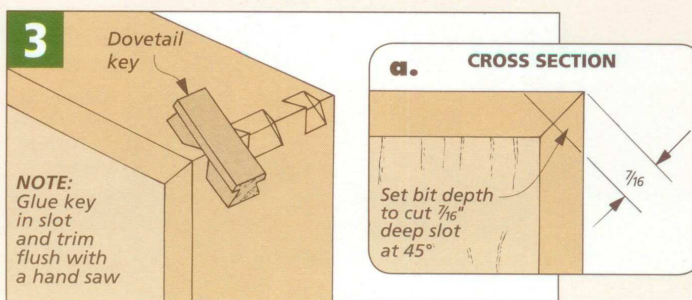
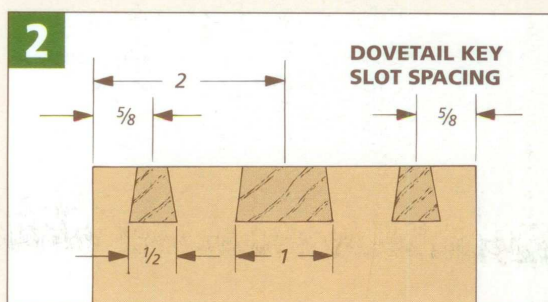
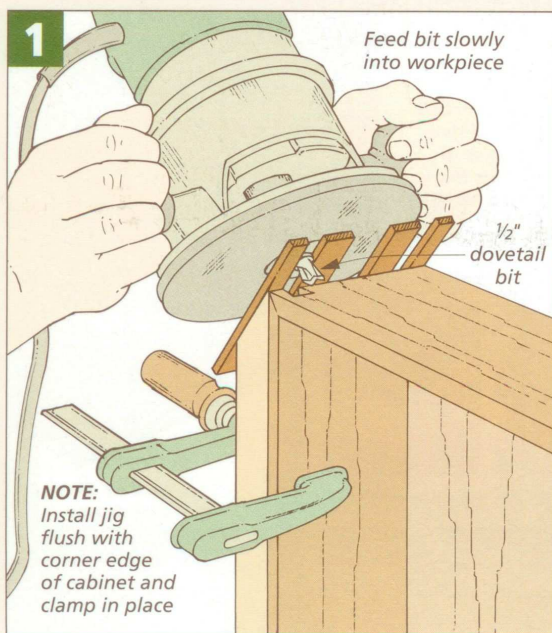
DOVETAIL KEYS. When I glue a box together with mitered corners, I usually add splines for strength—and this time is no different. But instead of putting them on the inside of the joint, I added them across the outside corners (see drawing on previous page). These splines have a dovetail shape, but they aren't just decorative. The splines create more gluing surface, so you'll end up with a stronger joint.

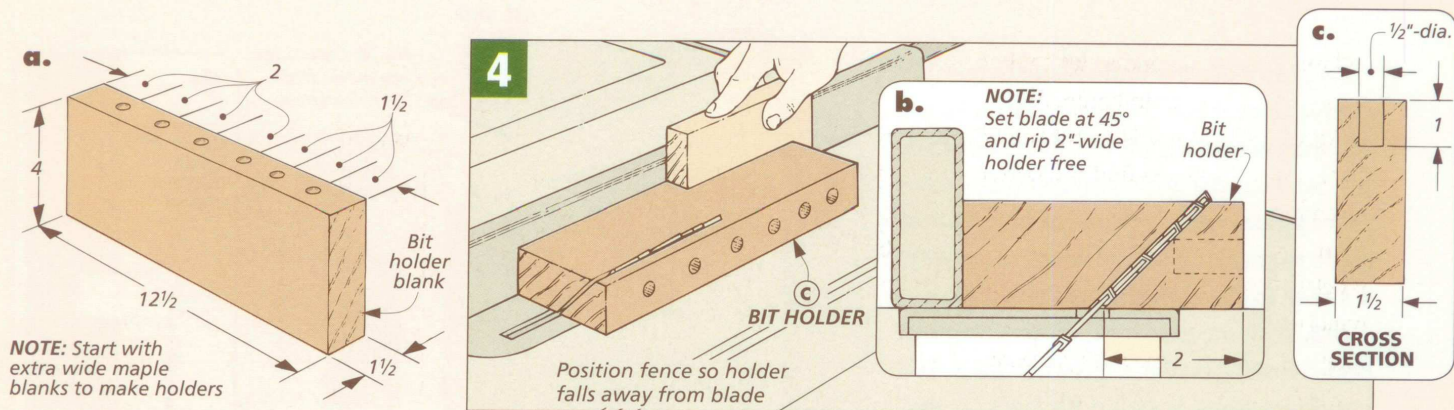
Cutting slots for these splines requires using the easy-to-build jig you see in Figure 1. The technique is explained in the article on page 56. This jig



automatically tips the router at an angle so the slots can be cut perpendicular to the corner. A guide bushing attached to the router base follows a template on the jig, and a $\frac{1}{2}$ " dovetail bit cuts the slots.

I routed three slots $\frac{7}{16}$ " deep at each corner of the box, as you can see in Figures 2 and 3a. The spacing of the slots is simply decorative, so you can space them any way you want. Then, make your keys to fit snugly in these slots (Figure 3). Finally, you can trim them with a hand saw and sand them flush with the sides of the box, as illustrated in Figure 3.





After sanding the keys flush on the outside of the case, I turned my attention to the inside and began working on the three bit holders.

BIT HOLDERS. These bit holders are cut from three 1½"-thick blanks with ½" diameter holes drilled in one edge. To keep things simple, I drilled all the holes the same size. For my router bits with a ¼"-diameter shank, I used nylon sleeves to adapt the holes. How far apart you drill the holes depends on the size of the router bits in your collection, as in detail 'a.'

Once the holes are drilled, I ripped the holder from the blank by cutting a 45° bevel on one edge. This angle tips the holder so you can access the bits easily in the case. To cut this bevel safely, I started with an extra-wide blank (4"). This keeps your hands a safe distance from the blade (Figures 4 and 4a).

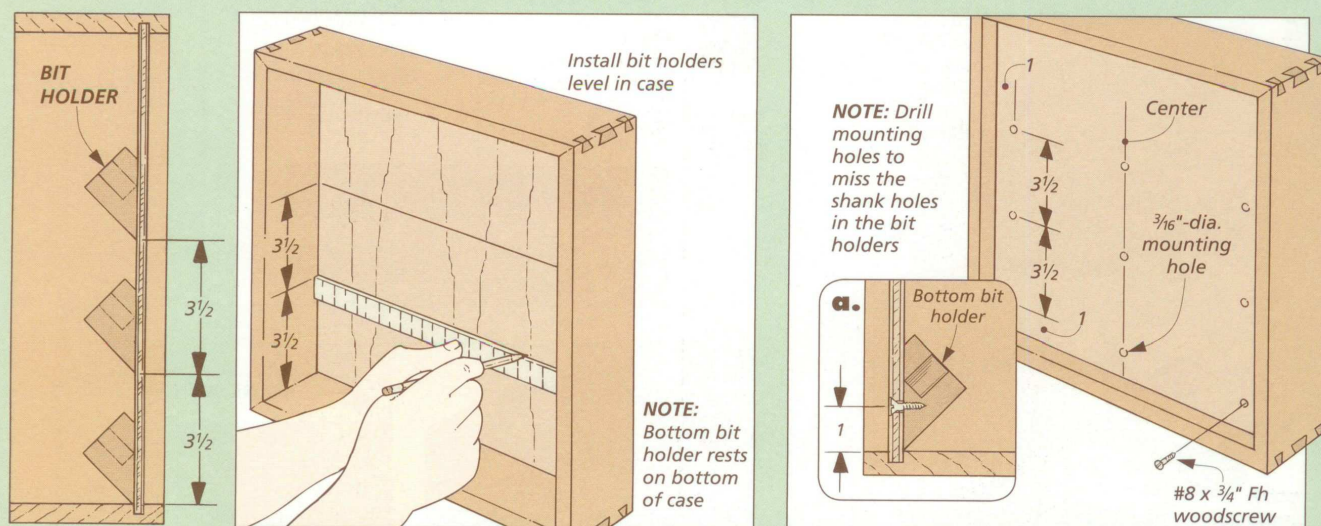
After the three bit holders are cut free, they can be screwed to the cabinet back. You can find more details on this in the box below.

DOOR. With the bit holders installed in the case, the next thing to do is build a door to fit on the front. I decided to use a full overlay door — this means it must be sized to match the overall case dimensions. The door is constructed with a pair of stiles and rails with a ⅛"-thick *Plexiglas* panel sandwiched in the middle, as shown in Figure 5 on the next page.

To hold the *Plexiglas* panel in the door, a ⅛"-wide by ¼"-deep groove is centered on the edge of each door piece (Figure 5a). Besides the panel, the groove holds a stub tenon cut on the ends of the rails.

Before cutting the stub tenons, I switched to a dado blade. Then, I removed stock from both sides of the

Cabinet Assembly



Rack Location. I used a ruler and pencil to mark lines 3½" up from the bottom and then 3½" up from the first line to keep the racks level and evenly spaced.

Mounting Holes. Be careful where you drill the mounting holes. They must be positioned so they don't go through the holes for the router bit shanks.

rail until the tenon ended up centered on the thickness, as you can see in Figure 5b.

All that's left now is to cut the *Plexiglas* panel to size. A quick way to find the correct size is to dry assemble the stiles and rails and measure the opening. Next, add in the lengths of the tenons ($\frac{1}{2}$ "), subtract $\frac{1}{8}$ " for clearance, and cut the panel to size. In my case, the panel ended up $10\frac{7}{8}$ " x $10\frac{7}{8}$ ". Then, glue the stiles and rails together with the *Plexiglas* panel in place.

HINGES. With the door built, it's ready to hang on the case. To do this, I mortised the hinges into the case and screwed them to the door (Figures 6 and 6a).

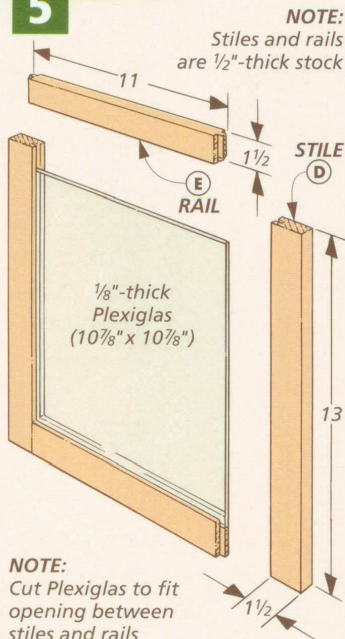
KNOB & CATCHES. To keep the door closed, I installed a pair of magnetic catches, as in Figure 6b. The instructions that came with the catches recommended using a $\frac{5}{16}$ "-dia. drill bit, but the fit was a little too tight. Instead, I drilled the holes a bit oversize ($\frac{11}{32}$ "). To make sure the catches would stay put, I coated the inside of the holes with epoxy before installing them.

The door strikes came next, but I couldn't use the ones that came with my catches. The small metal washers were too thick for my door size. (It made the door look like it was hanging open.) To solve this, I used a short steel screw (#6 x $\frac{1}{2}$ ") for the strike.

Finally, install a birch knob on the stile (Figures 6 and 6c). The knob is centered on the height of the door and fastened to the stile with a screw.

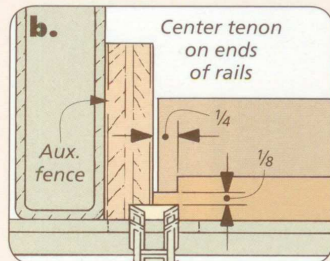
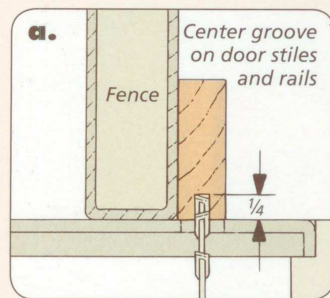
CLEAT. To finish up the cabinet, I added a beveled cleat and hanger to the back of the case. This makes

5 OVERVIEW



NOTE:

Stiles and rails are $\frac{1}{2}$ "-thick stock

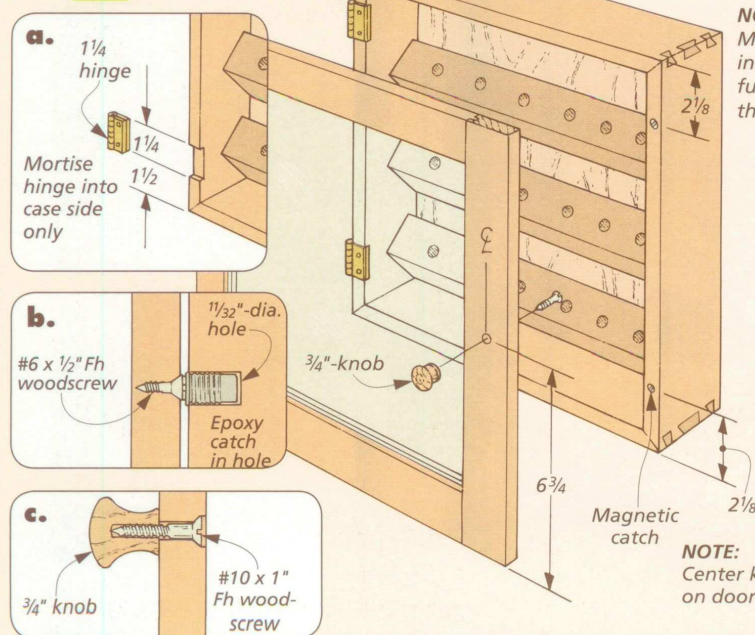


NOTE:
Cut Plexiglas to fit opening between stiles and rails

it easy to hang the cabinet on the wall and easy to remove if you want to take it to a job site.

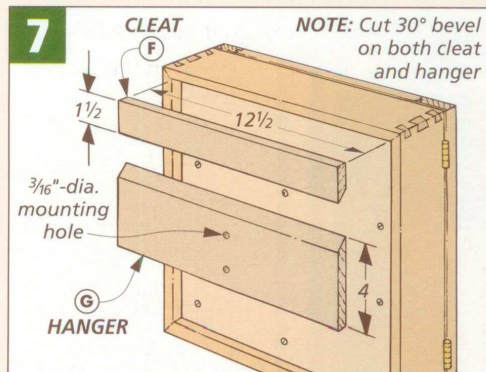
The cleat and hanger are both made from $\frac{1}{2}$ "-thick stock with a 30° bevel cut on one edge (Figure 7). I cut the cleat to size, and glued it to the case back. Then I leveled the hanger and mounted it with long woodscrews. To hold the case securely, be sure the screws hit a wall stud.

6 OVERVIEW



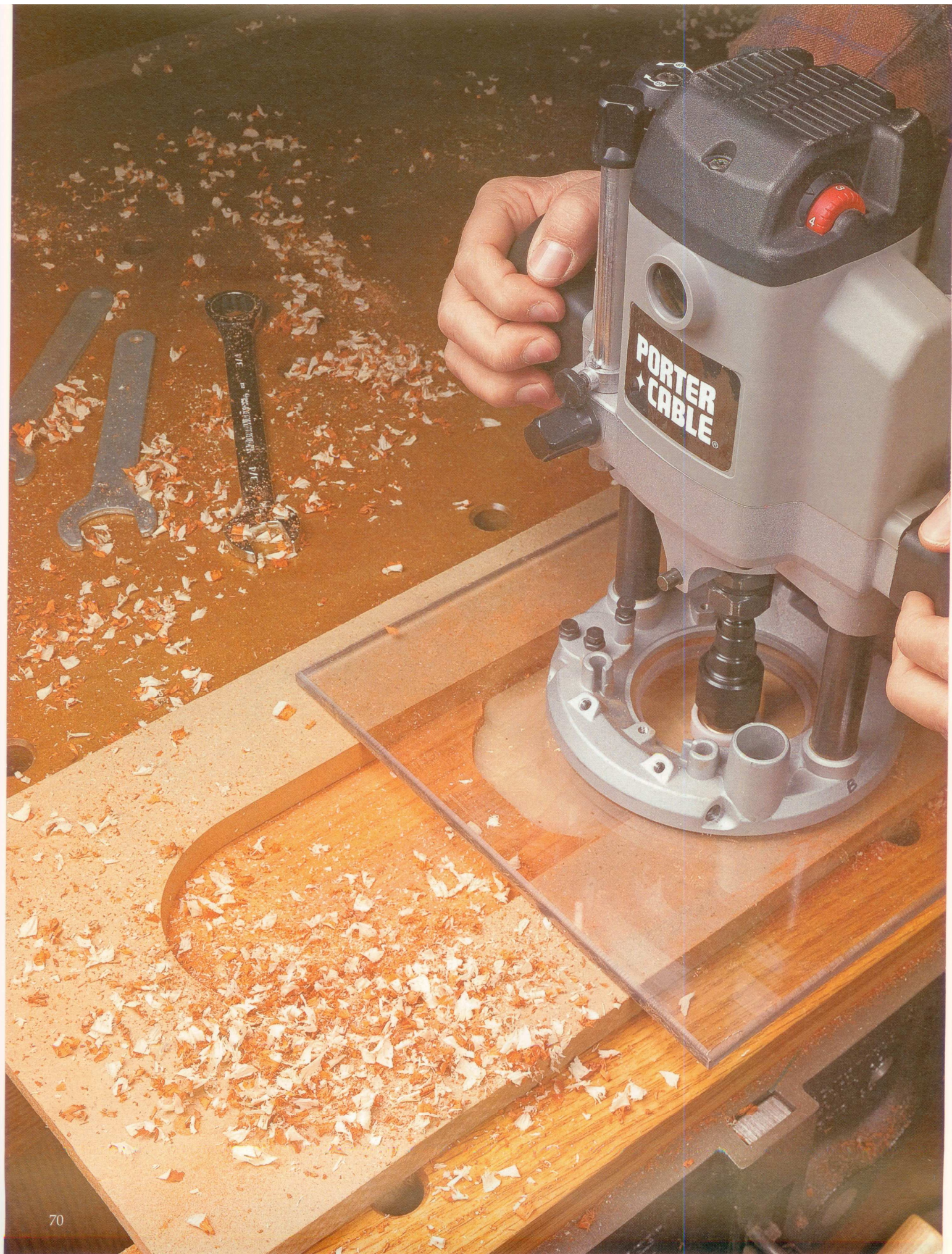
NOTE:
Mortise hinges into case side the full thickness of the hinge barrel

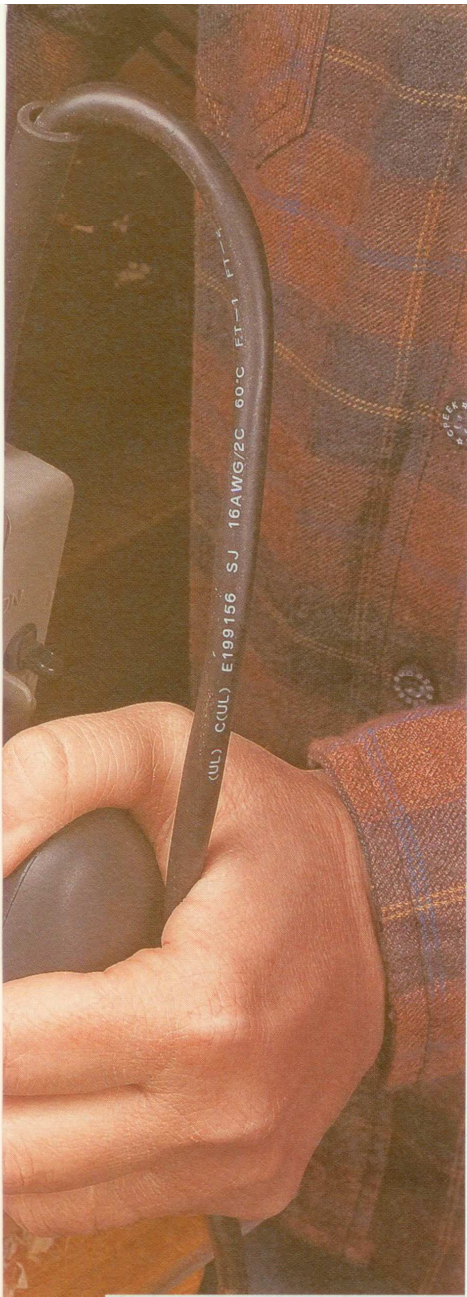
NOTE:
Center knob on door stile



MATERIALS LIST

- A Case Sides (4) $\frac{1}{2}$ x 4 - 13 $\frac{1}{2}$
- B Back (1) 13 x 13 - $\frac{1}{4}$ ply.
- C Bit Holders (3) $1\frac{1}{2}$ x 2 - 12 $\frac{1}{2}$
- D Door Stiles (2) $\frac{1}{2}$ x 1 $\frac{1}{2}$ - 13
- E Door Rails (2) $\frac{1}{2}$ x 1 $\frac{1}{2}$ - 11
- F Cleat (1) $\frac{1}{2}$ x 1 $\frac{1}{2}$ - 12 $\frac{1}{2}$
- G Hanger (1) $\frac{1}{2}$ x 4 - 12 $\frac{1}{2}$
- (9) #8 x $\frac{3}{4}$ " Fh woodscrews
- (2) #6 x $\frac{1}{2}$ " Fh woodscrews
- (1) #10 x 1" Fh wood-screw
- (1) $\frac{1}{8}$ " Plexiglas panel $10\frac{7}{8}$ " x $10\frac{7}{8}$ "
- (1 pr.) $1\frac{1}{4}$ " Brass butt hinges w/screws
- (2) Magnetic catches
- (1) $\frac{3}{4}$ "-dia. wood knob





exclusive techniques & projects

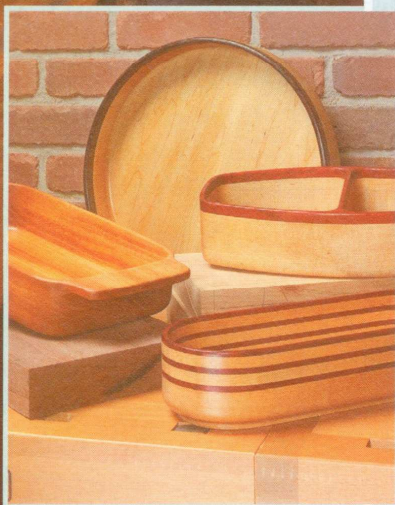
BUILT-UP CROWN MOLDING72

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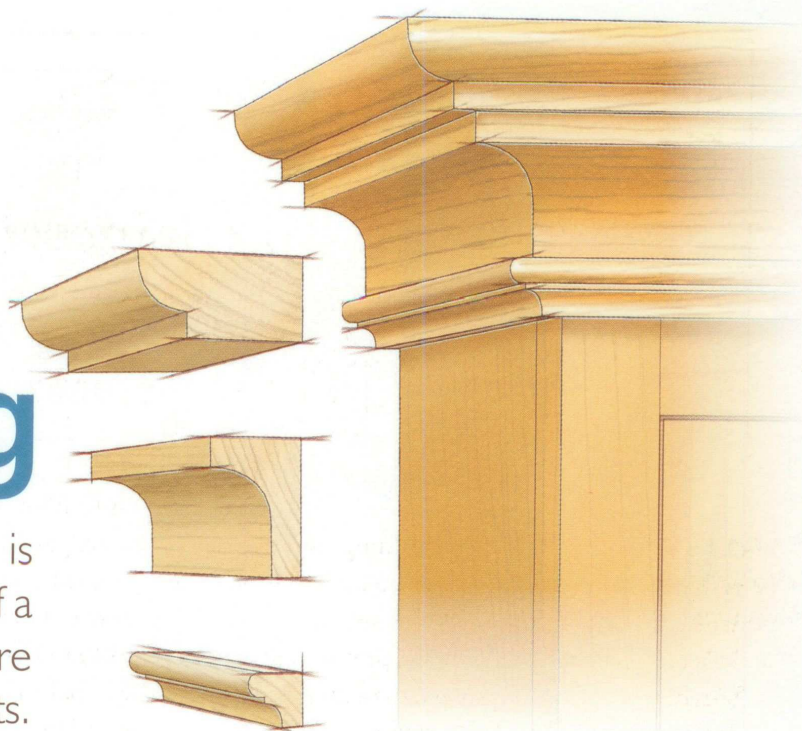
88



94

Built-up Crown Molding

A large crown molding is the perfect way to top off a case project. All it takes are a few common router bits.



A crown or cornice molding serves as the exclamation point at the top of a large case piece. Without it, the case would look unfinished.

But making a large molding can be a challenge. Most often, I rely on my router table to provide the moldings for a project. As you can imagine, I'm limited by the size of the router bits available and the size of the piece I can handle safely. However, this logistical problem doesn't need to stop you from making "fancy" crown moldings.

The solution is to make the elements of the molding separately and glue them together into a finished, "built-up" crown. This simplifies the process, and the result is indistinguishable from a one-piece molding. (This works well for other types of moldings, too.)

WELL-DESIGNED MOLDING. Most moldings use a combination of basic profiles, such as: cove, quarter-round, bead, ogee, and flats (fillets). All of these profiles can be made with common router bits. The trick is to arrange them in a way that creates a pleasing, well-proportioned molding.

Before making a molding, you need to design it. There are a few simple guidelines I like to follow. First, as a general rule, a large molding looks better when its height is greater than its depth. This draws your eye up and down to add a sense of height and lightness to the case. The molding in the photo at left demonstrates the principle.

Second, keep the molding from becoming too busy. I like each profile, large or small, to stand out, and at the same time, blend together. If the individual profiles are small and closely-packed, the molding becomes a "blur." Fillets help to separate the profiles so they remain distinct. Finally, keep proportion in mind — the assembled crown molding should be a good fit to the scale of the project.

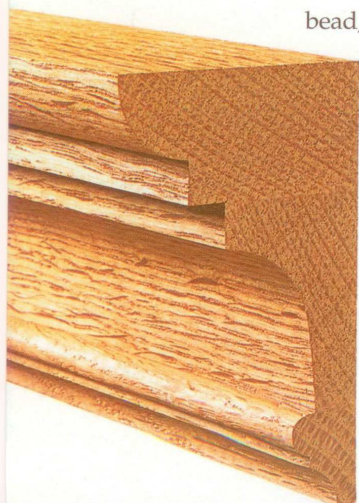
DESIGN ON PAPER. Design the molding on paper using the router bit profiles as patterns. Making a full-scale drawing allows you to get the size and proportions right. Plus, you can see how the individual pieces can be assembled to make the molding.

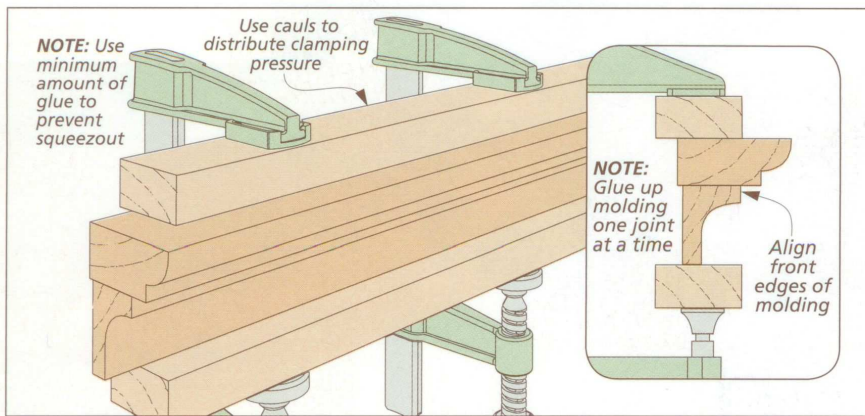
The molding above is a good example of how to "build" a crown molding. As you can see, it's made in three sections. First comes a small, "bead and cove" profile that ties it to the cabinet and creates a smooth transition. Then, a large, simple cove section is used to add height and depth. The cap, separated from the cove by fillets, is a roundover that ends sharply to punctuate the crown.

MATCH YOUR WOOD. Before talking technique, I should mention wood selection. The idea is to make the molding appear as if it were one piece. So, pay attention to the color and grain match of the individual pieces.

When possible, cut all the sections from one board. If necessary, you can use the pieces in different orientations — edge grain or face grain. The routed profiles do a good job hiding any change in grain direction.

The crown molding below was shaped in three sections, but from the face it looks like a single piece.





MAKING THE CROWN

Once you've designed the molding, the work is pretty routine. To make the crown molding shown here, I started with the large cove section.

Figure 1 shows the process. The profile is cut with a $\frac{5}{8}$ "-rad. cove bit — elongating the cut creates the illusion of a larger radius. This requires cutting the cove to full width and then raising the bit to extend further into the workpiece. The bottom section is flat — the upper rounded section is what catches your eye.

For safety, I started with a wide piece of 1"-thick stock. This leaves you with plenty of surface riding against the fence as the cove cut is extended. When complete, the cove section is cut to height on the table saw.

A BEAD AND COVE. Next is the small bead and cove piece that sits below the large cove. The bead stands proud of the bottom edge of the cove to add depth.

Again, this small molding is made on the edge of an oversized piece of stock (Figures 2 and 3). First, cut the bead with a single pass across a beading bit. (You can also use a $\frac{1}{8}$ " roundover bit to cut the bead in two halves.) When cutting the bead, you'll also create the short fillet that separates the bead and cove.

The cove is routed with a $\frac{1}{2}$ "-dia. core box bit. (Make sure to leave at least a $\frac{1}{16}$ " fillet separating the profiles.) Then I ripped the molding free, leaving it a little wide to make the final assembly easier.

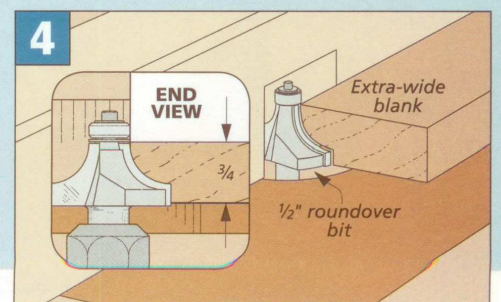
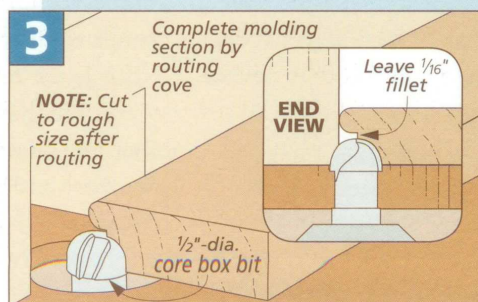
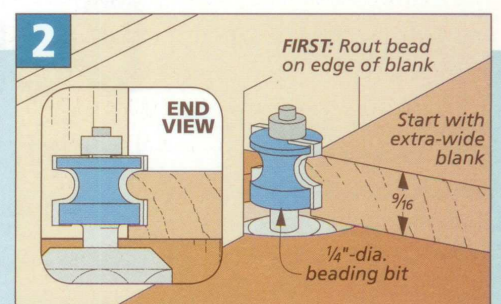
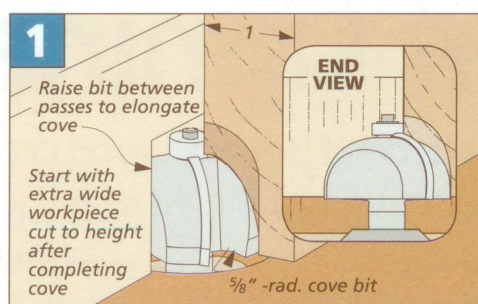
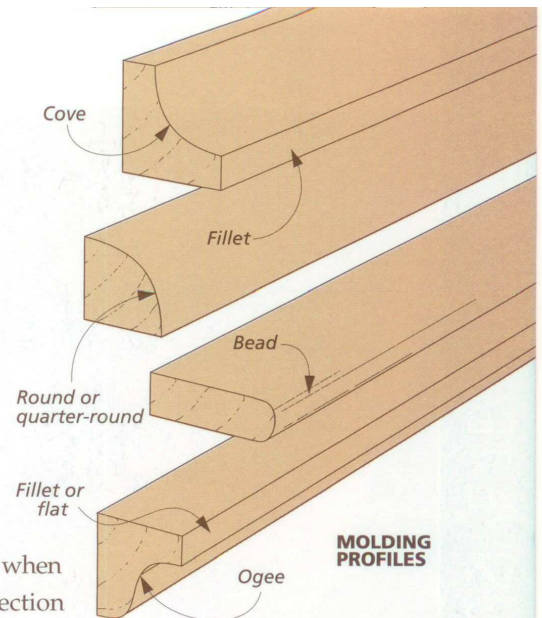
A SIMPLE ROUNDROVER. Rout the top "cap" on a wide piece with a $\frac{1}{2}$ " roundover bit. The roundover arc should end sharply, giving you a crisp end point at the top of the molding (Figure 4). It also leaves

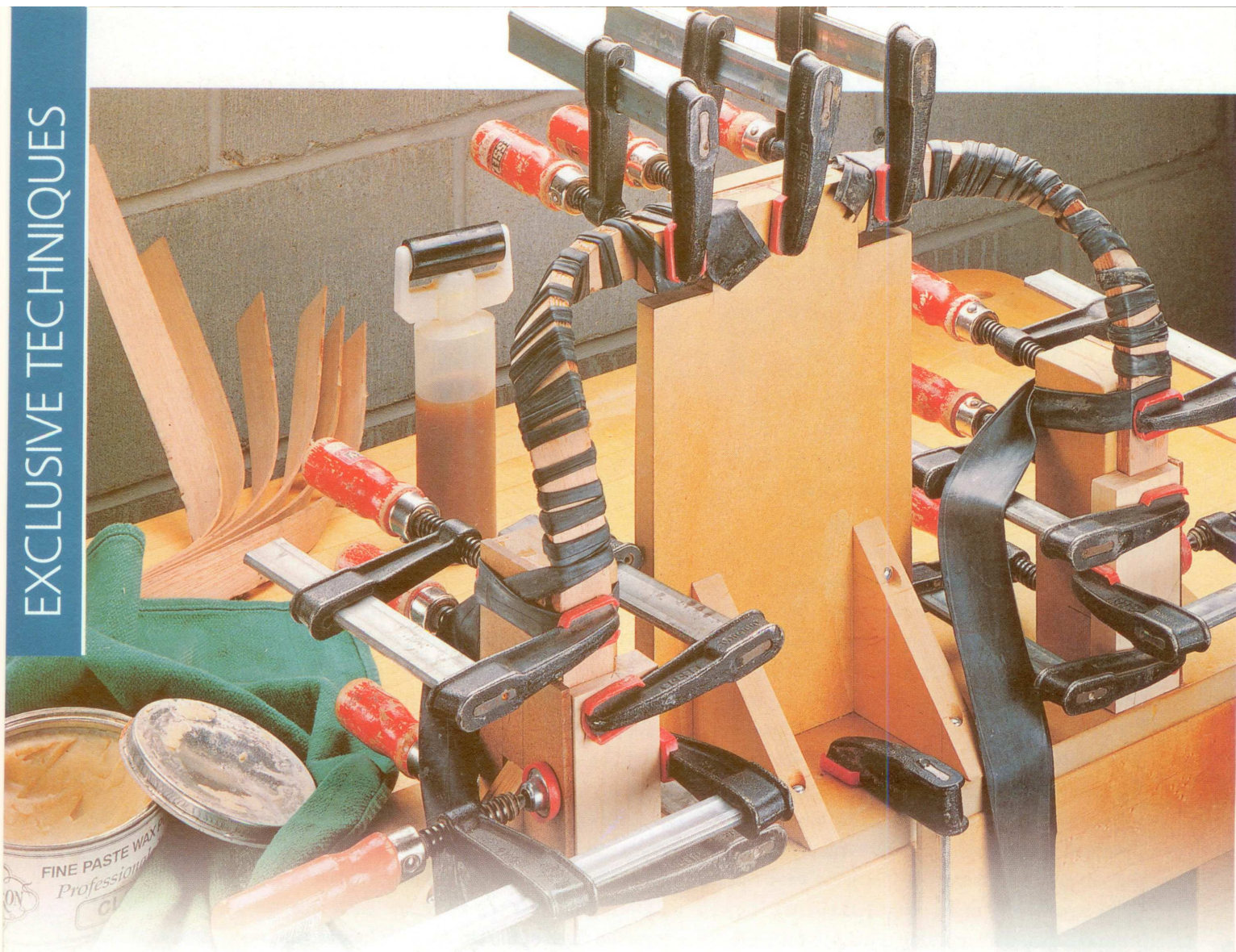
a wide fillet along the lower edge of the piece that, when combined with the cove section below, adds a "stairstep" detail.

ASSEMBLY. Once the pieces are made, the assembly goal is two-fold: the molded edges should be aligned properly, and the glue joints should be tight. The best way to do this is to glue up only two pieces at a time.

The keys to the glueup are: plenty of clamps, cauls to distribute the clamping pressure, and a minimal amount of glue. There will be very little stress on the glue joint, so strength isn't a big concern. I apply glue sparingly, keeping it to the back edge of the joint, and let it tack up for a minute. Then, align the molded edges (don't worry about the back face) and clamp the pieces, making sure they stay in place.

Once glueup is complete, the back face can be trimmed flush at the table saw or jointer. And once it's installed on your project, only you will know the secret of your "pieced" crown molding.





Bent Lamination

Learn how to bend strips of wood into a graceful curve — it's all about using the right technique.

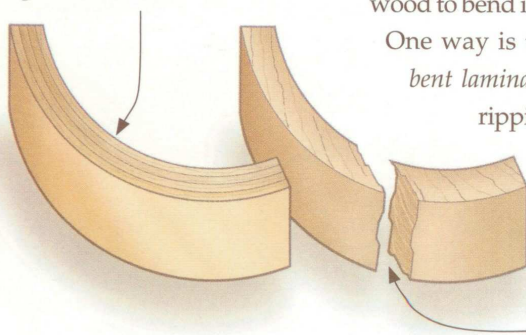
Strong Grain. The key to the strength of a curved part that's made by gluing up thin strips of wood is simple — the grain "follows" the bend.

How do you get a straight, rigid piece of wood to bend in a smooth, flowing curve?

One way is to use a technique called *bent lamination*. It basically involves ripping a bunch of thin, flexible

strips of wood and applying glue to each one. Then the strips are stacked in layers like a sandwich, bent around a bending form, and squeezed together with clamps while the glue dries.

This is the most challenging part of the process — and the messiest. The strips slide against each other, and glue oozes out everywhere. But when the glue dries and you remove the clamps, the reward is worth it — a piece of wood that's bent to the perfect shape. Granted, it's covered with a thick crust



Weak Grain. Cutting a curved piece from solid wood creates weak spots where the grain "runs out," so it's likely to break.

of dried glue. But with a little scraping and sanding, a beautiful bent lamination workpiece with smooth, graceful curves begins to emerge.

SIMPLE & COMPOUND CURVES

Depending on the design of the project, you can bend wood into either a simple or a compound curve.

SIMPLE. To create a simple curve (like the frame of the fishing net on page 88), the wood strips that are bent around the form remain in a single, flat plane.

While a simple curve is attractive by itself, you can use wood strips that contrast in color to produce more dramatic results. The walnut accent strip in the frame of the fishing net is a good example.

COMPOUND. Bending wood into a compound curve is a bit trickier. This is because the wood strips are bent and twisted around the forms, as shown in the main photo on the opposite page. They bend around the corner while also “twisting” 90°.

STRENGTH

It may seem like a bent wood workpiece would be extremely fragile. But in fact, it’s considerably stronger than a curved piece cut from solid stock.

GRAIN DIRECTION. The reason has to do with grain direction. When you glue up thin strips into a curved form, the grain runs around the bend, as you can see in the drawing on the opposite page. The grain acts like a continuous thread that reinforces the piece.

If you cut a solid piece of wood into the same curved shape, it has a weak spot where the grain runs through the curve. And even a small amount of pressure can cause it to break.

THIN STRIPS

Grain direction also plays a big part in how difficult it is to bend the thin strips around the form.

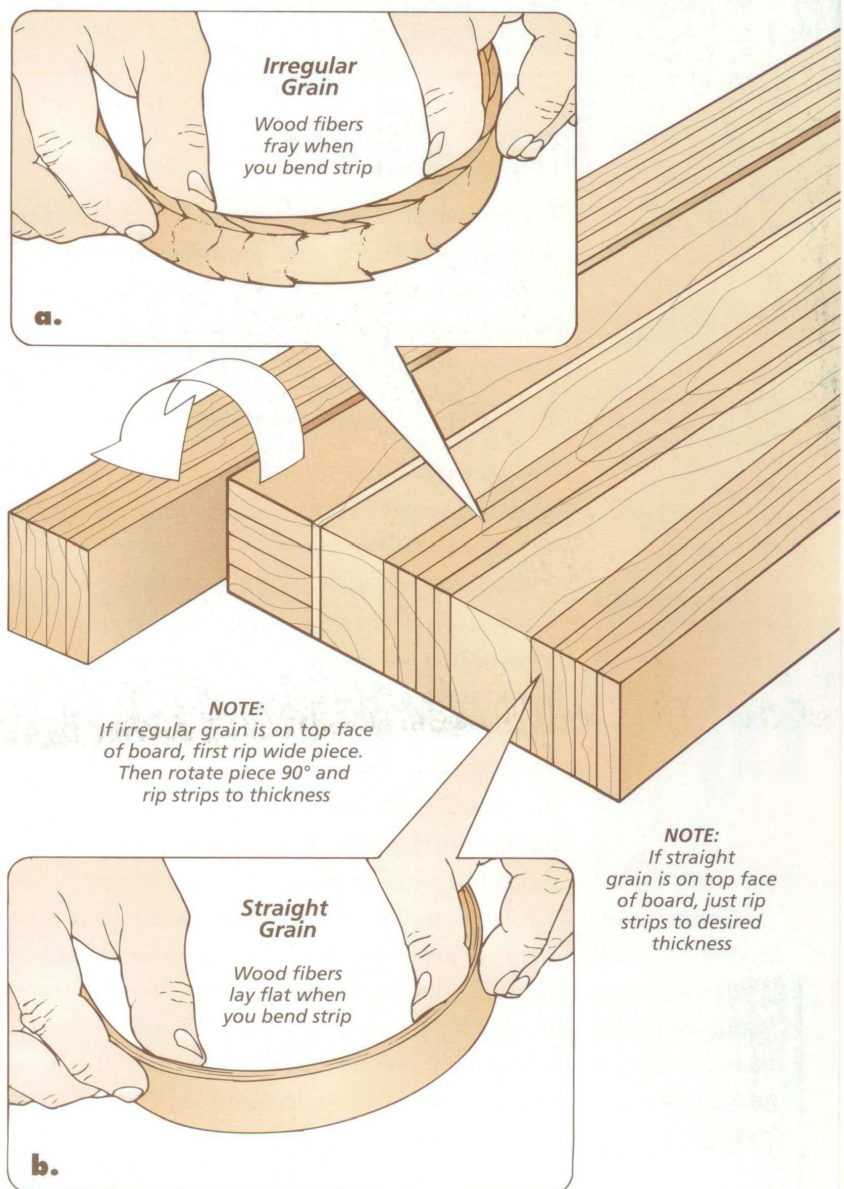
STRAIGHT GRAIN. To prevent the strips from breaking, the goal is to end up with straight grain on the edge. This way, the wood fibers will lay flat when you bend the strip (detail ‘b’). If the grain runs straight along the face of the board, you can just rip the strips to the desired thickness. (For more on ripping thin strips, refer to WoodsmithSpecials.com.)

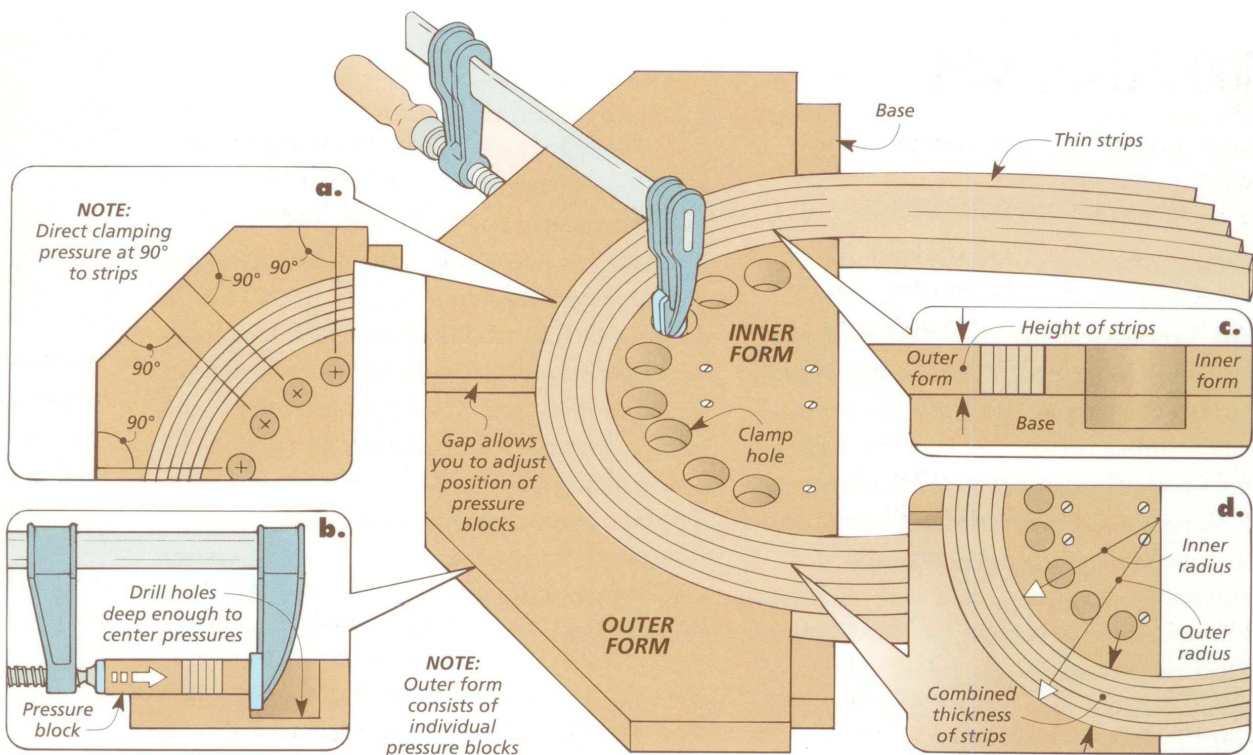
IRREGULAR GRAIN. But if the grain on the edge of the strip runs in an irregular pattern, the wood fibers will start to fray as you bend it (detail ‘a’). And that’s a good indicator that the strip will break.

RIP & FLIP. If the straight grain is on the edge of the board (not the face), rip a piece to the width of the finished strips (plus $\frac{1}{16}$ " to allow for clean-up), as shown in the drawing below. Then, flip that piece on edge, and rip the strips along the straight grain.

THICKNESS. In addition to grain direction, another consideration is the thickness of the strips. I use the thickest strip I can bend around the jig without breaking. Depending on how tight the bend is, that’s usually between $\frac{1}{16}$ " and $\frac{1}{8}$ " thick. To find out for sure, bend a test strip. If it starts to break, try one that’s $\frac{1}{32}$ " thinner. It doesn’t seem like much, but it may be the difference between bending and breaking.

SOAK STRIPS. To make the strips more flexible, you can soak them in water and pre-bend them. This made the strips I used for the fishing net extremely pliable.





Simple Curves

To bend wood in a simple curve, I use a form that works like a press. The strips are stacked together and laid on edge, as shown in the drawing above. After bending the strips around an inner form, they're held tight by an outer form that's clamped over them.

EVEN PRESSURE

The key to clamping the strips together so there are no gaps is to apply even pressure all the way around the inner and outer forms.

HEIGHT. Even something as simple as the height of the forms makes a difference — especially along the top edges of the strips. To draw these edges together, make the forms at least as tall as the strips (detail 'c').

SHAPE. Another thing that affects how evenly the clamping pressure is applied is the shape of the inner and outer forms. To press the strips tightly together, the curved edges of these forms should fit against the strips like a mold.

Establishing the curved shape of the inner form is easy. It just depends on the design of the project. The trick is getting the curved edge of the outer form to mold tightly around the strips. To do this, you'll need to take the combined thickness of the strips into account, as shown in detail 'd.' Then add this dimension to the radius of the outer form.

SAND EDGES. To get a good fit between the forms and the strips, the curved edges of the forms need to be sanded. This way, no irregularities are transferred.

PRESSURE BLOCKS. Once the edges are sanded smooth, it's a good idea to cut the large outer form into smaller pressure blocks. (The small blocks are easier to work with.) I leave a $\frac{1}{4}$ " opening between adjoining blocks. This allows me to nudge a block one way or the other to close up any gaps during glue-up.

CLAMP POSITION

One last thing that affects how tightly the strips squeeze together is the clamps' position on the jig.

CLAMP HOLES. The clamps are hooked into holes along the perimeter of the inner form. Don't worry about getting these holes too close together — it's better to have too many clamps than not enough.

Just be sure the holes are deep enough that the clamping pressure is centered on the edge of the pressure block (detail 'b'). This way, the pressure blocks won't lift up when you tighten the clamps.

90° PRESSURE. Finally, you want to direct the clamping pressure across the strips at right angles (detail 'a'). Trimming the corners of the pressure blocks at an angle provides a good clamping surface that will help orient the clamps and keep them from slipping.



Simple Curve.

Bending thin wood strips in a single (flat) plane creates a simple curve. A walnut accent strip highlights the curve.

Compound Curves

If you're bending wood into a compound curve, the process for making the form is reversed. Start by bending a single strip to the shape you want, as shown in the margin photo. Then build a jig to support it.

FREE-FORM. The biggest difference here is that you'll be bending the strip of wood in mid-air like a free-form sculpture. To get the strip to hold its shape, you'll need to anchor one end. First, I clamp the strip to a scrap block that's attached to a base. Then, after bending and twisting the strip to the desired shape, I secure the opposite end with another scrap.

CLAMPING SYSTEM

A single strip is fairly easy to bend into a compound curve. But to bend a stack of strips, you'll need a clamping system that will squeeze them together.

CLAMPING SURFACES. The first step is to create clamping surfaces for the straight sections of the strips. These are just vertical supports that are securely attached to the base, as you can see in the drawing below. To keep the sharp edges of the supports from digging into the strips as they're bent, you'll want to round over the corners, as shown in detail 'a.'

FLEXIBLE CLAMP. A rigid clamping surface can crush the edges of the strips where they bend and twist. So I use a flexible "clamp" instead. It's just a piece of tube from a bicycle tire, but it applies a lot of pressure as you stretch and wrap it around the bend. Just be sure to keep it flat and leave some space between each wrap so you can check for gaps (detail 'b').

ALIGNMENT. As you bend the stack of strips, the edges may splay out of alignment (detail 'c'). Clamping a block against the strips will keep them aligned.

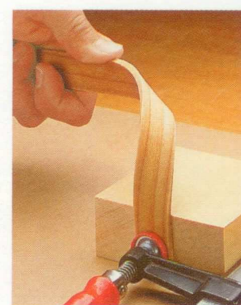
GLUE-UP

Whether you're making a simple or a compound form, gluing up the strips is basically the same.

VARNISH & WAX. Before you get started, make sure you varnish the jig and apply a coat of paste wax. This keeps the glue from adhering to the parts of the jig.

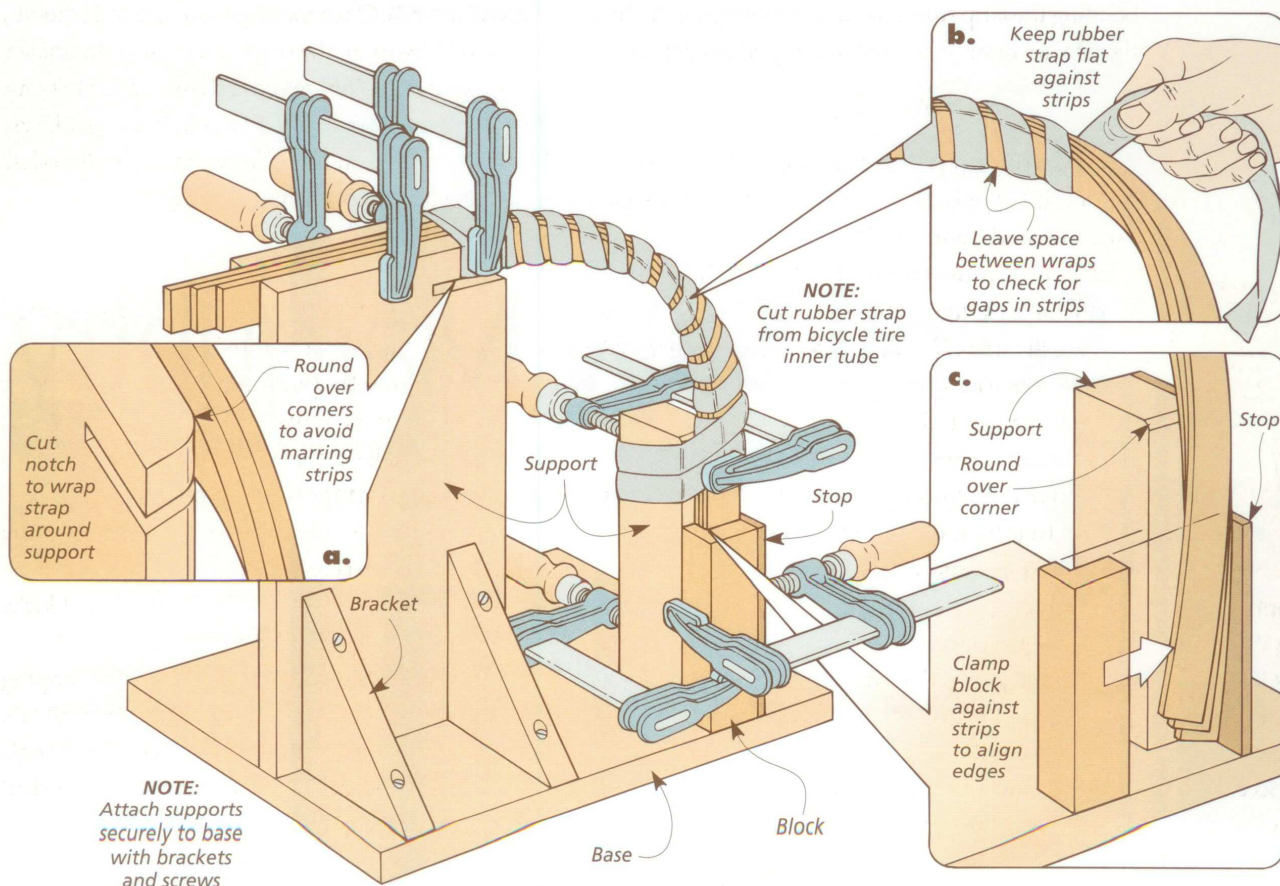
WORKING TIME. I use a white glue or hide glue to give myself plenty of working time. Or, if the glue needs to be waterproof, a polyurethane glue is ideal.

Once you apply the glue and bend the strips around the jig, it's best to leave them clamped overnight to ensure a strong bond.



Compound Curve.

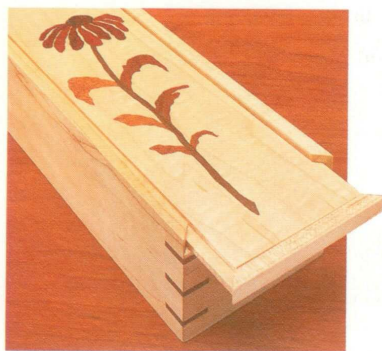
To create a compound curve, the wood strips are bent and twisted around a jig to form a dramatic bent wood shape.





Scroll Saw Marquetry

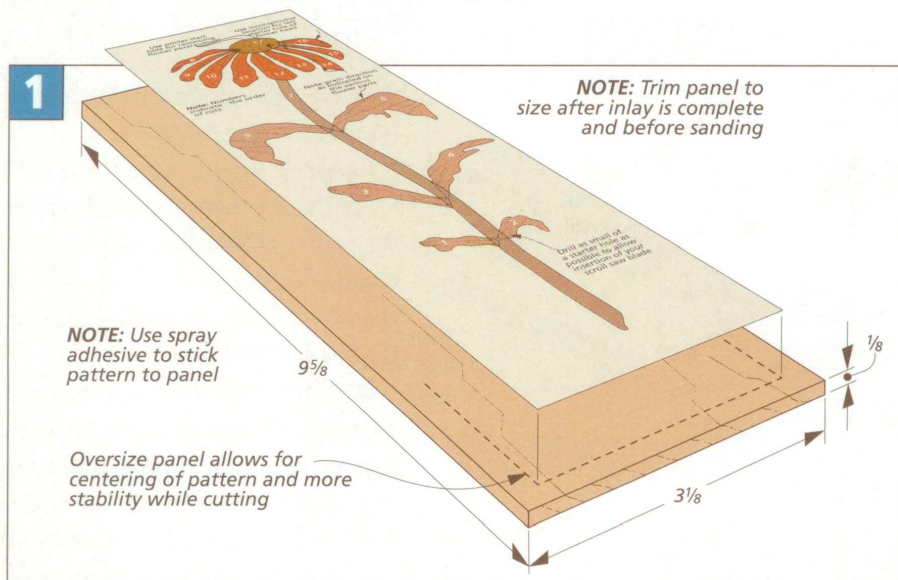
A picture in wood is what you get when you add marquetry to a project. And it's actually easier than you might think.



Add Detail to a Project.

A box lid is a great place to add a decorative, scroll saw marquetry pattern.

This marquetry technique involves cutting out a pattern on the panel and replacing the pieces with small inlays of other kinds of wood to form a design or picture. All you need is a scroll saw, some small pieces of wood, and a bit of patience. By following a few simple steps, you can give your project a custom look. (See page 94 for a project idea using [this technique](#).)



PATTERN SET-UP

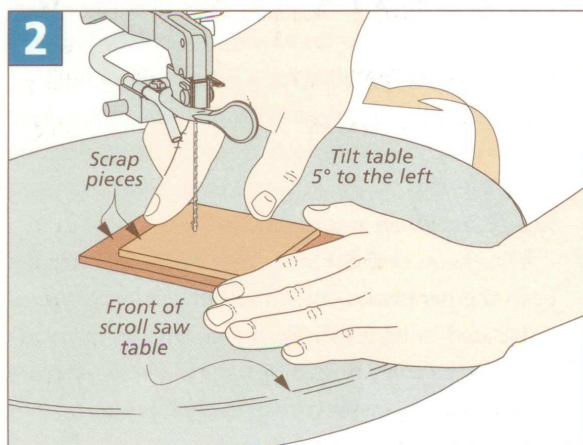
One of the first things you'll need to do is choose a marquetry pattern. They're available from many veneer suppliers and woodworking stores. Keep in mind that you can use almost any illustration, or do what I did, and design your own pattern.

Next, you'll want to prepare the panel by planing a piece of oversized stock to 1/8" thick. You'll also need several different species of wood for inlays. These pieces should be the same thickness as the panel. So this is a good time to plane your inlay stock pieces to 1/8" thick, as well. You'll want to make a few extras to use for the scroll saw setup later.

After that, go ahead and apply a little spray adhesive to the pattern, and center it on the panel. You'll trim the panel to its final size later on.

SCROLL SAW TABLE SETUP

One of the keys to this technique is taking a few minutes to set up your scroll saw properly and

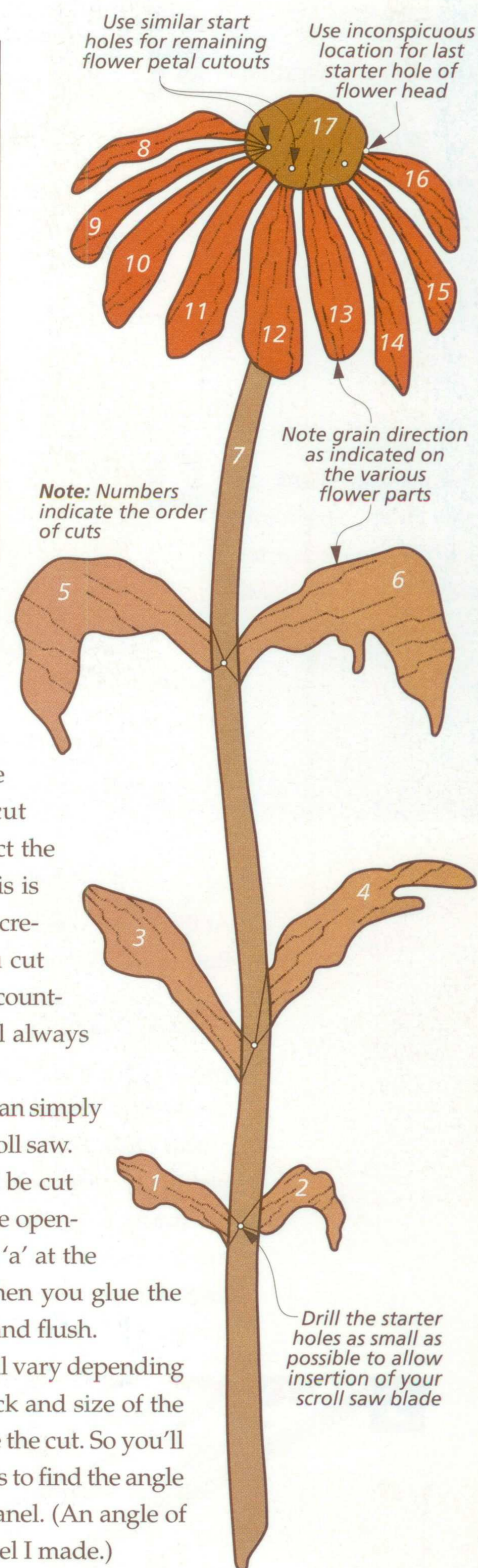
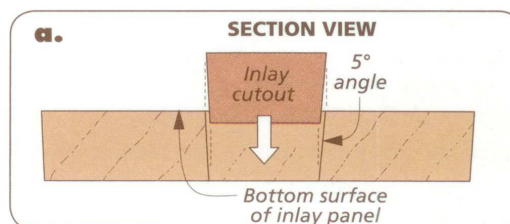


making some practice cuts. Doing this will ensure the inlays fit just right.

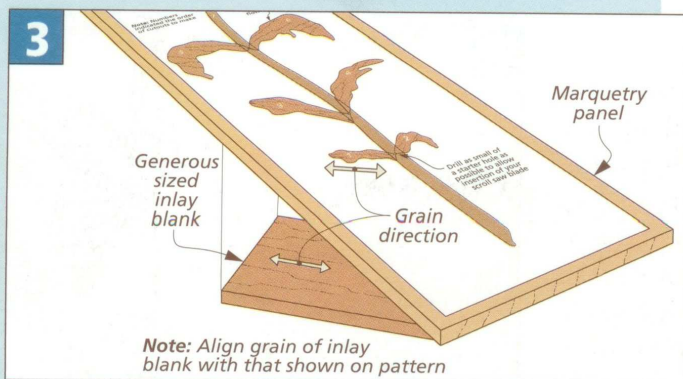
Because you'll be cutting the panel and the inlay at the same time, you can't just cut around the pattern and expect the inlay to fit. The reason for this is that as the saw blade cuts, it creates a narrow kerf. So, if you cut around the pattern without accounting for the kerf, the inlay will always be smaller than the opening.

To avoid this problem, you can simply angle the work table of the scroll saw. This way, the inlay piece will be cut slightly larger so it fits into the opening like a wedge, as in detail 'a' at the bottom of the page. Then when you glue the inlay in place, it will fit tight and flush.

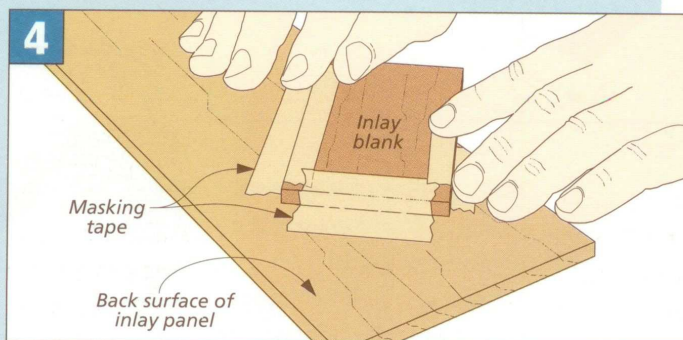
The angle of the table will vary depending on the thickness of the stock and size of the blade you're using to make the cut. So you'll want to make a few test cuts to find the angle that works best for your panel. (An angle of 5° worked well for the panel I made.)



Make sure the grain direction of the inlay piece matches the direction indicated on the pattern.

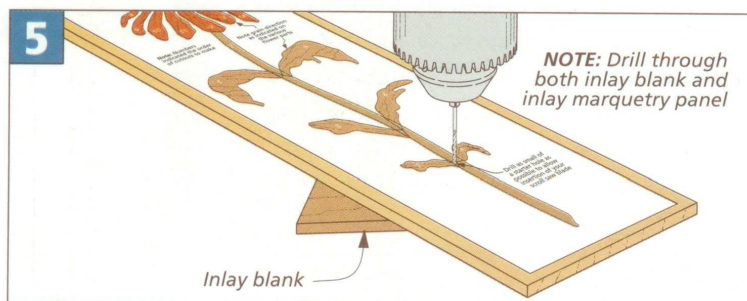


Secure the Blank to the Panel. Use masking tape to secure the oversized inlay blank to the underside of the marquetry panel.



At this point, you're ready to start cutting the inlays. But before you make any cuts, there are a few things you'll want to think about. A little bit of planning here will really make a difference in the final appearance of your marquetry project. Just take note of the simple tips offered here to get the best results.

INLAY COLOR. First, you'll want to spend some time picking out the wood to be used for each part of the marquetry. The idea is to choose wood that has the right contrast and color to accent the pattern you've chosen. For the flower design used on this panel, I chose to use a dark wood (walnut) for



Starter Hole. Drill a starter hole through the panel and inlay blank so it's just large enough for the scroll saw blade. If you can position the hole where it will be cut out later, you won't need to fill the starter holes in the finished piece.

the stem and a slightly lighter wood (mahogany) for the leaves.

I wanted to be sure that the petals of the flower really stood out on the panel, so I used an inlay of dark bloodwood for this part. A piece of cocobolo provided a great contrast for the head of the flower.

GRAIN ORIENTATION. After selecting the wood, you'll need to orient the grain so it provides a natural flow and direction to the inlays. You'll notice the grain of the walnut stem is oriented vertically to accent the way the stem would grow. And the grain in the leaves is angled in an upward direction. The petals need to droop down, so I angled the grain of the wood to follow the shape of the petals, too.

SECURE THE BLANK. It's a good idea to use a generous-sized blank for your inlay. That way, you'll be sure

to cover the entire cutout area.

Once the inlay is positioned correctly on the bottom of the panel, you can tape it down. This will hold the blank securely in position as you make the cut with the scroll saw. You'll find masking tape works great for this. Just secure it like you see in Figure 4, above.

Now that you have the inlay blank secured to the bottom of the panel, you can turn both of them face up again. The next step is to drill a small entry hole in the panel for the scroll saw blade.

The size of the saw blade you're using to cut out the inlays determines the diameter of the hole you'll need to drill. For example, the #5 scroll saw blade I used to cut out my inlays called for a 1/16"-dia. entry hole.

If you can, try to position the entry point in a place that will be cut away later (refer to the pattern on page 79). This way, you won't have holes that need to be filled when you're finished.

When you drill the hole, be sure to drill through both the panel and the underlying inlay piece, as illustrated in Figure 5. Then you can slip the blade through the entry hole, attach the blade to the scroll saw, and get ready to cut out the first piece.

CREATING THE INLAY

There are a couple of things to remember as you make the cut. First, if you angled the table down to the right, make the cut in a clockwise direction. And if it's angled down to the left, go counterclockwise.

You'll also want to keep the part you're cutting out on the "uphill" side of the table. That way the inlay piece will always have a wedge shape and fit perfectly when you insert it into the back of the panel.

It's important to try to cut on the inside of the line. This leaves you some extra room in places, such as the petals, where the lines are close together.

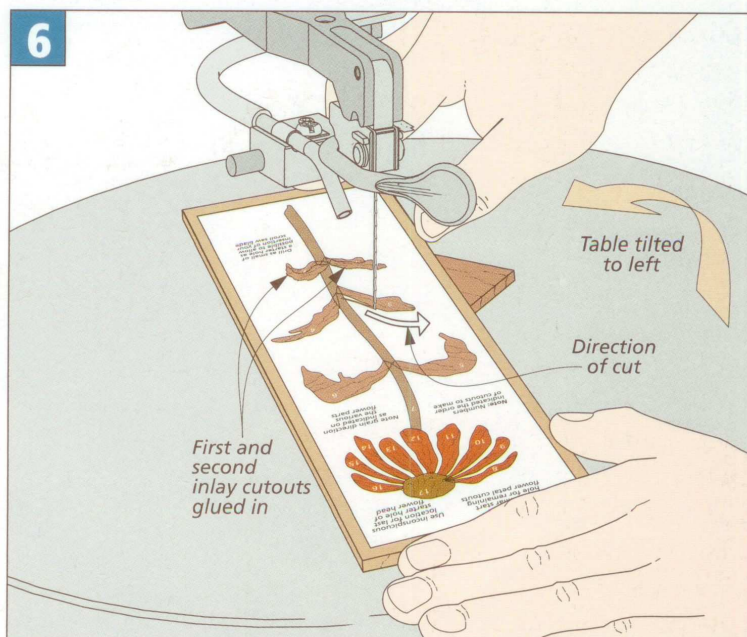
After making the cut, you'll have two pieces. Just separate the pieces and dry fit the inlay piece into the void in the panel.

GLUE THE INLAY. I like to glue the pieces into the panel as I go — this keeps the panel strong and rigid as you make each cutout. This is especially important when making the cutouts for the flower petals. Since the petals are so close together, you'll want to replace the cutout with inlay material to keep the thin fibers of wood between the petals from breaking apart.

Now you can move on to the next inlay part and cut it out using the same procedure. Continue until all the inlay pieces have been glued into place.

FINAL STARTER HOLE

You'll need to drill one last hole in order to cut out the final part. Since you won't be able to cut away this entry hole, try to pick a place that is the least visible.

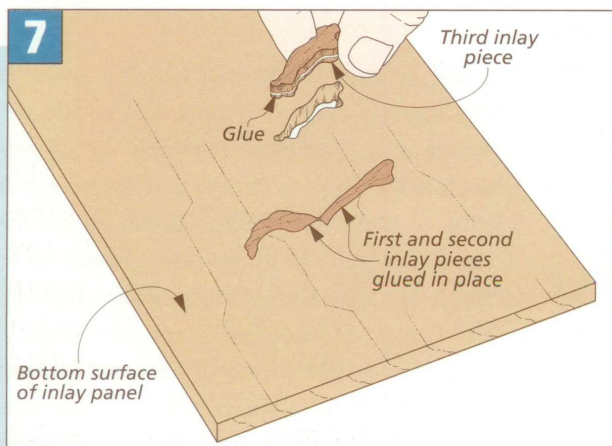


Cutting Inlay on Tilted Table. In order to get the best inlay fit, make sure the part you cut is positioned on the "uphill" side of the blade and moved in the correct direction (clockwise or counterclockwise).

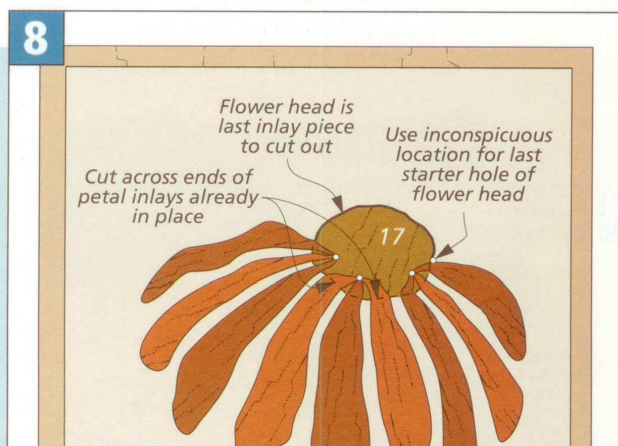
Then, simply use a little matching wood filler in the hole before you finish the panel. You can see what I mean in Figure 8, below.

Once all the inlays have been glued in place, go ahead and sand away the pattern. You'll also want to sand everything flush with the panel.

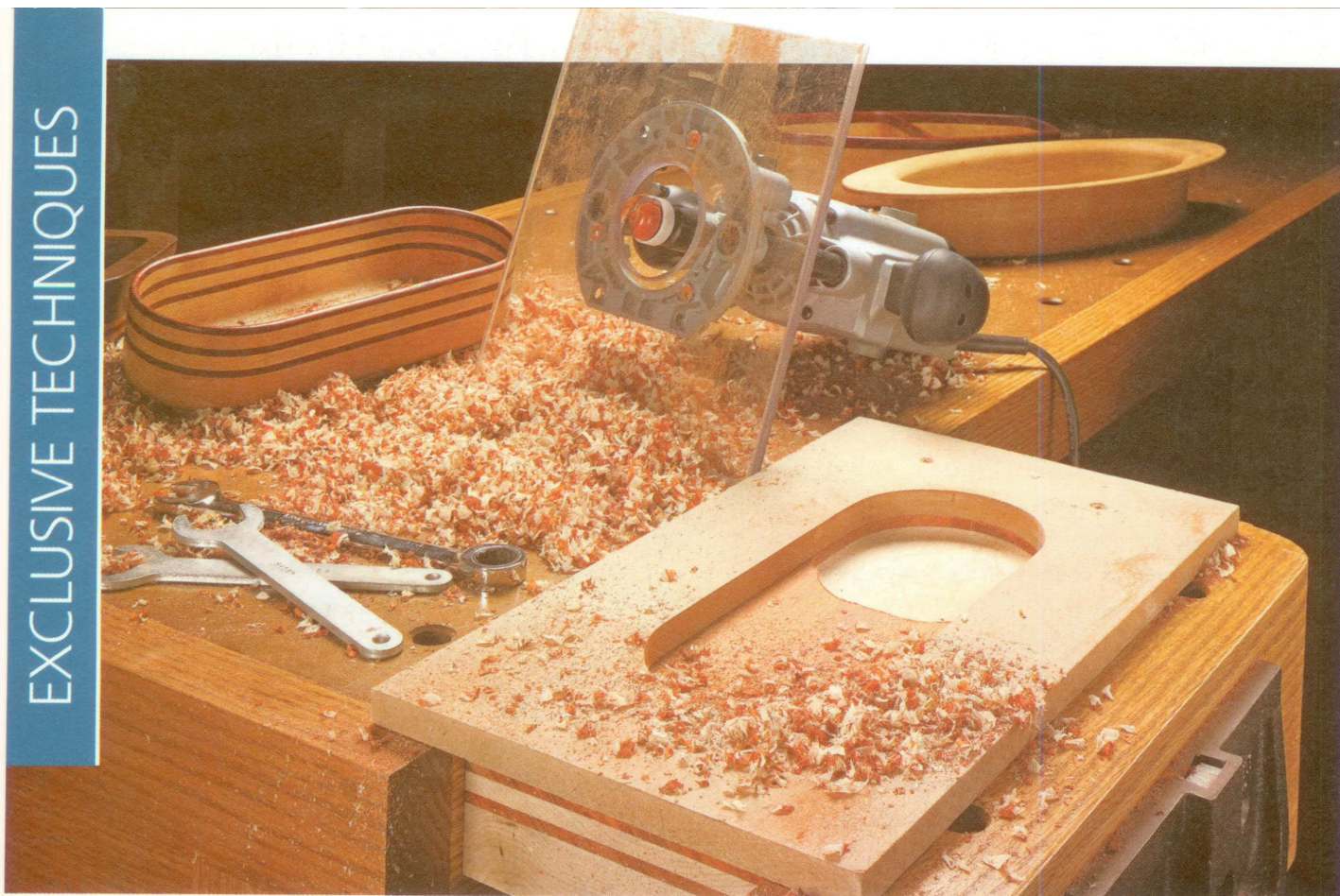
Finally, cut the panel to size, and add it to your project. Then all that's left is to add your choice of finish to the panel for a unique, decorative look.



Gluing in Inlay. In order to glue the inlay piece, apply glue to the edges, slip it into position from the back side of the panel, and hold it in place until the glue sets up.



Final Starter Hole. Since you won't be able to cut away this entry hole, choose a spot that will show the least. Then fill the hole with some wood filler when you're done.



Bowl Routing

You can make great looking wood bowls without turning or carving. A template and simple router accessories make it easy.



Collet Extension and Standard Bowl Bit.

A collet extension allows you to make deep cuts with your plunge router, and the bowl bit cuts a flat bottom with rounded edges.

I've always liked the look of wooden bowls. But without a lathe or carving tools, they're difficult to make. So as an alternative, I came up with a way to create bowls using a router. All you need is a router, a template, and a few common router accessories.

The bowls you see in the photo above, as well as those on page 84, were made using a hand-held router. The technique is easy — and even better, you can make bowls in a variety of sizes and shapes.

The greatest challenge to making bowls with a router is figuring out a way to make a deep enough cut to form the inside of the bowl. But by adding a collet extension to your router, you can solve this problem easily. Then, all you need to do is follow a simple, shop-built template, and you'll be making professional-looking bowls in no time.

Setting up your Router

Before you begin routing bowls, there are a few things you'll need to take care of. The first of these is to make sure you have the right type of router and that it's set up properly for the job.

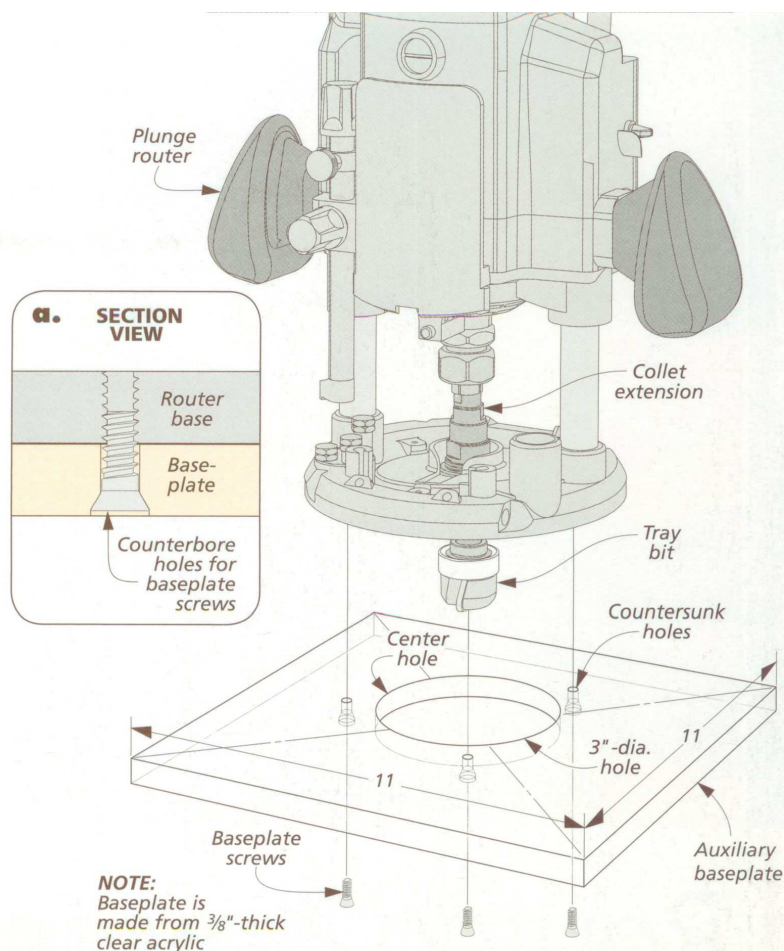
ROUTER. I used a plunge router because it was a bit easier to make the frequent depth changes required when hollowing out the bowl. But you can use any router (at least 2 horsepower) that has the ability to handle the 1/2"-dia. shank collet extension and the bit you'll be using to make the cuts.

COLLET EXTENSION. As I said before, the key to routing out a bowl is adding a collet extension to your router (box below). The extension adds about 2 1/4" to the router's cutting depth. This allows you to rout deep enough to easily form the interior of the bowl.

With the extension in place, you can then install a bowl and tray bit. This bit makes a cut that's flat along the bottom and rounded at the corners — allowing you to shape the inside of the bowl.

ADD A WIDE BASEPLATE. There's just one other thing before you begin routing. You'll need to modify the router baseplate so you can use it with the bowl template you'll build later.

Since the template opening is fairly large, you'll probably have to replace the baseplate that came with your router with a larger auxiliary baseplate,



as shown in the drawing at right. This larger base allows the router to ride steadily over the template without falling through the wide opening.

You can make the base from a number of different materials. I chose to use 3/8"-thick, clear acrylic (Plexiglas) for my base. This made the base strong and rigid so I wouldn't have any flexing. And the clear acrylic allows me to see what I'm doing as I rout.

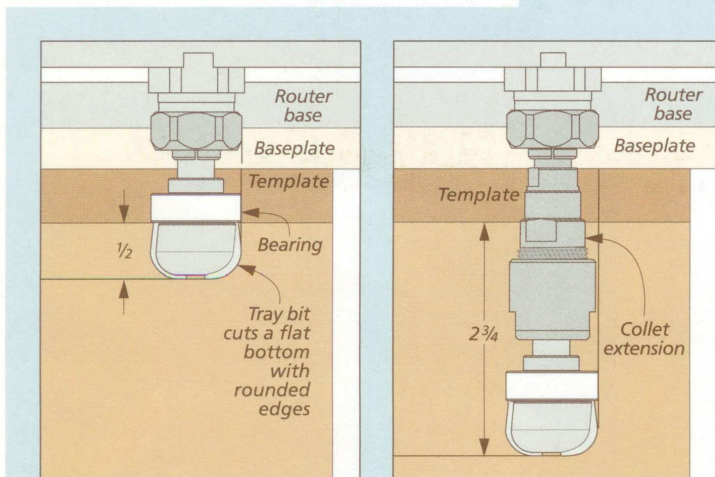
Building a new base is pretty straightforward. First, trim the base to size. Then, draw lines from corner to corner to find the center. I suggest using the original baseplate as a template to accurately mark, drill, and countersink the mounting holes. Finally, use a hole saw at the drill press to cut out the center hole.

With the new baseplate installed and the collet extension mounted, you're ready to tackle the bowl projects on the next page.

ONLINE EXTRA video workshop

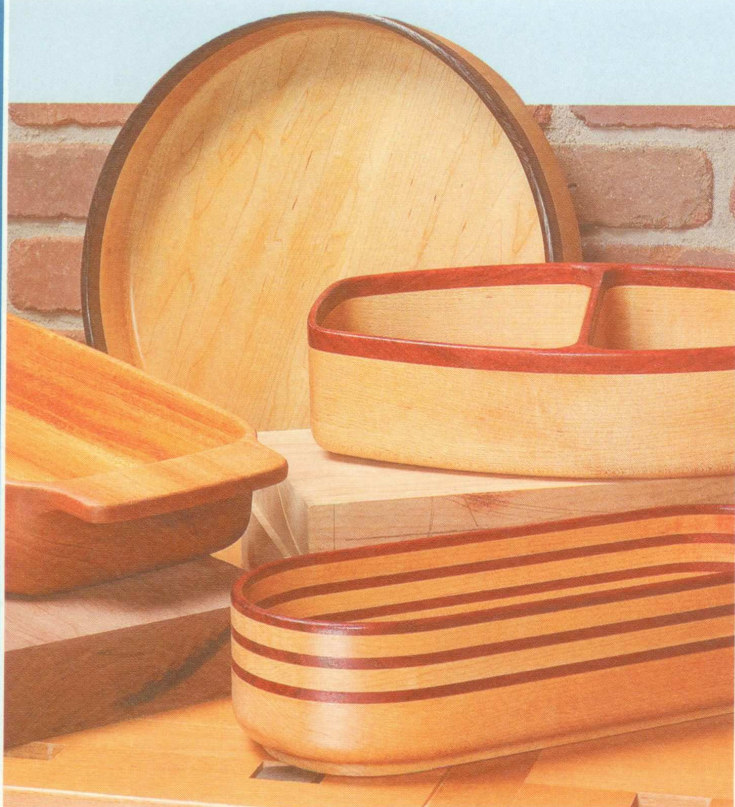
To see a video demonstration for using the router bowl bit extension, go to our website: WoodsmithSpecials.com

Bowl Bit & Extension



Using a standard setup, most routers will only allow you to make a cut about 1/2" deep.

With the addition of a collet extension, you can add 2 1/4" to your router's depth of cut.



Routed Bowls

The thing that makes these routed bowls interesting is the variety of shapes and sizes you can create. But no matter the style you choose, the process is the same.

First, you'll need to glue up the bowl blank. This is important since it will determine the color and appearance of the bowl. Start by choosing the type of wood to use, and then decide on the size, shape,

and appearances you might want. All these factors determine how you'll want to shape the blank.

MAKE THE BLANK. The next step is to trim the materials for the blank to size, apply glue to the layers of wood, and clamp them together, as shown in the top drawing on the opposite page. I like to keep the blank less than 3" thick. This way, you won't exceed the cutting depth of the router and bit when the template is added.

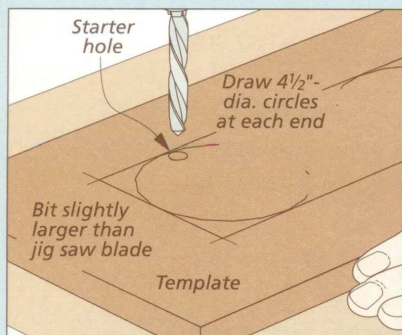
After the glue dries, you can remove the clamps, and then move on to making the template.

TEMPLATE. To rout out the inside of the bowl, you'll need a template to guide the router. (I used $\frac{3}{4}$ " MDF for my template.) And because I wanted to have a stable base for the router to ride on, I sized it about $1\frac{1}{2}$ " larger than the blank on all sides. Then you can cut away the area in the middle to match the inside shape of the bowl, as illustrated in the box below.

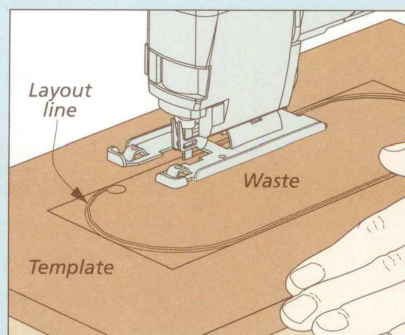
Finally, attach the template securely to the blank with screws. Once you've done that, you're ready to begin routing out the inside of the bowl.



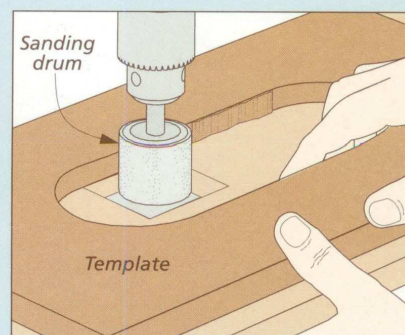
Bowl Template



Starter Hole. To cut out the template, first drill a hole near one edge that's slightly larger than your jig saw blade.



Cut Out the Waste. After inserting the blade into the starter hole, cut along the scribed line and remove the waste.



Smooth the Edges. A sanding drum on the drill press removes blade marks and smooths out the template curves.

Shaping the Bowl

Shaping the bowl is pretty simple and requires just two basic steps. First, use your router and the template to rout out the inside of the bowl. Later you'll cut away the outer portion of the blank at the band saw to give the bowl its final size and shape.

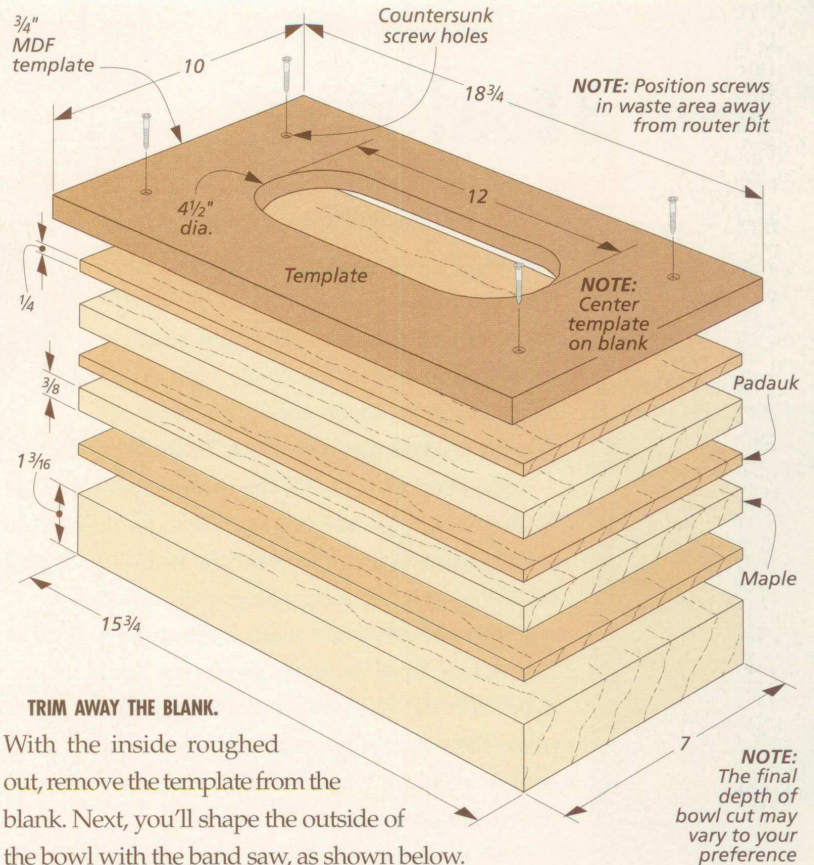
Since your blank is ready to go, all you need to do is install the collet extension and tray bit in your router. Just be sure the extension and bit are tightened down firmly.

SECURE THE BLANK. Next, secure the blank in position for routing. When I clamp the blank in the vise on my workbench, the template sits unobstructed above the benchtop. This way, I can tighten the jaws firmly around the blank to keep it from moving around.

ROUT OUT THE INSIDE. With the blank secured, you can set the bit to make a $\frac{3}{16}$ "-deep cut. Then turn on the router and place it over the template. The extension and bit project past the plate, so it's easiest to tip the router slightly, and slowly lower the bit onto the surface as you begin to make the cut. Once the bit cuts a small pocket, you'll be able to set the router flat on the template and use the bearing to guide the bit in shaping the inside of the bowl.

Since you're removing so much material, the bit creates a lot of chips as it cuts. You'll need to vacuum up the chips from inside the bowl frequently as you rout away the waste.

After the first pass, lower the bit another $\frac{3}{16}$ " and remove a second layer of material. Repeat this process until the recess is cut to depth, leaving $\frac{3}{8}$ " at the bottom. Then you can move on to shaping the bowl's outer surface.

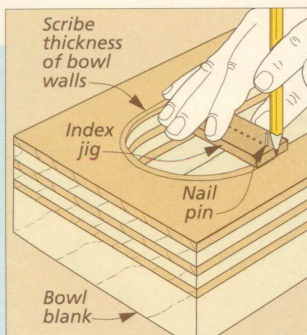
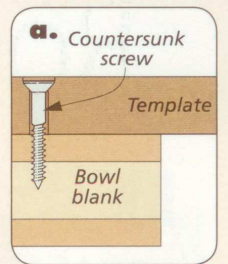


TRIM AWAY THE BLANK.

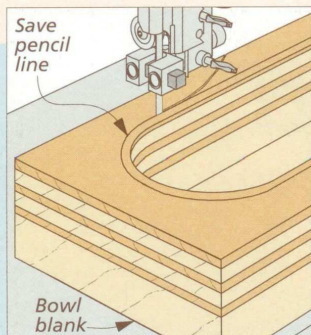
With the inside roughed out, remove the template from the blank. Next, you'll shape the outside of the bowl with the band saw, as shown below.

To do this, begin by marking the thickness of the bowl walls on the blank (first drawing below). I like to leave a bit more than $\frac{1}{4}$ " so I have some extra thickness to sand the walls smooth. After marking the bowl, you can move to the band saw, follow the layout line, and cut away the waste (second drawing below).

SAND AND FINISH. Once you've cut out the rough shape, use a power sander to smooth out the saw marks and a hand sander to finish up. Finally, I added a small foot to the bottom of the bowl. I used a router with a roundover bit for this job. The fourth drawing below shows you how it's done. After applying salad bowl finish or mineral oil, it's ready for use.



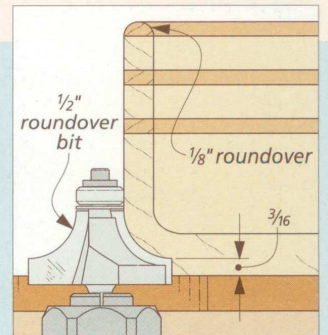
Lay Out Walls. A piece of scrap wood with a series of holes and a nail help you lay out the walls.



Trim the Waste. Follow the outer trim line with your band saw to shape the outside wall.



Shaping the Walls. A power sander will quickly shape the walls to the desired thickness.



Decorative Foot. A pass at the router table with a roundover bit adds a decorative foot.

3 Bowl Options

BOWL WITH HANDLES

In addition to making a variety of bowl shapes, options like handles can be added (photo at right). To do this, you'll need to modify the blank and complete a few extra steps. Begin by lengthening the blank so you'll have enough extra stock for the handles.

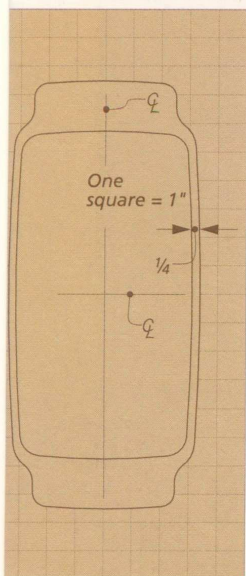
Then you can rout out the inside of the bowl as before. When you're done with that, you'll need to flip the blank over and work from the bottom with a second template to help you create the handles.

BOTTOM TEMPLATE. You'll want to be sure the bottom template is sized correctly, so use the template you used to make the bowl's inside to help out. Just place the original template on a piece of MDF, as shown in Figure 1, below. Then, trace the pattern of the cutout onto your MDF template.

Once the pattern is drawn, you can go ahead and remove the original template. Next, enlarge the pattern by $\frac{1}{4}$ " all the way around, and trim the template to shape using your band saw.

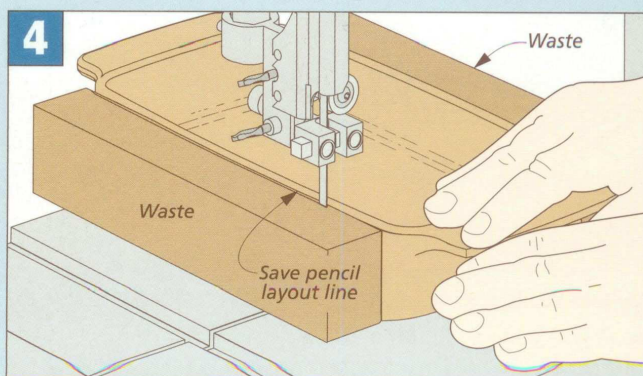
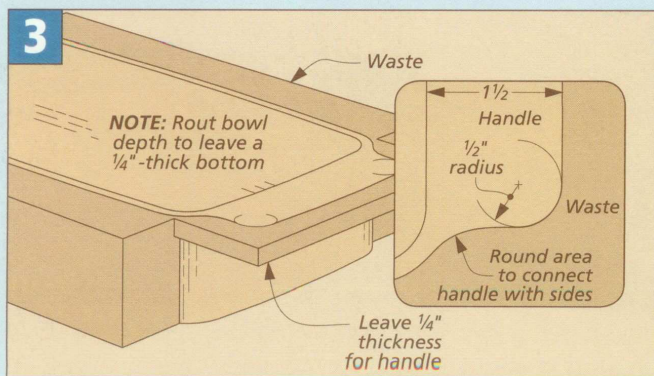
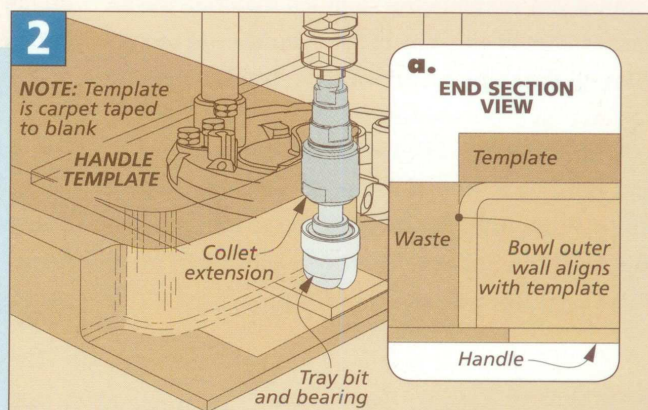
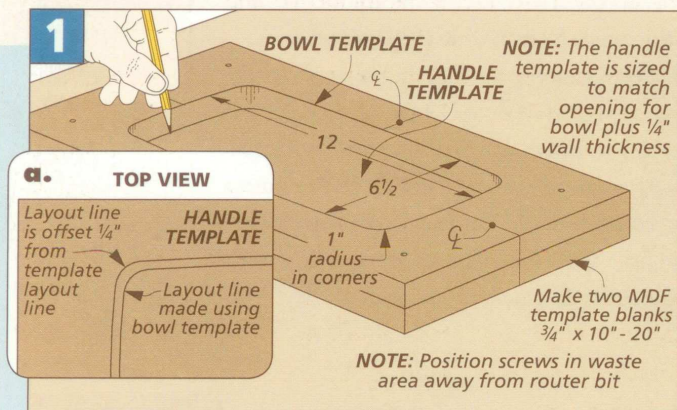


BOWL TEMPLATE



After that, you can use carpet tape to attach this template to the bottom of the blank, as you can see in Figure 2. With the template secure, use it to guide your router as you rout away the stock at both ends of the blank. Just be sure to leave about $\frac{1}{4}$ " thickness at the bottom for the handles (Figure 2).

OUTER SHAPE. With the routing done, you can flip the blank over and trim away the waste, making curved cuts to transition from the sides to the handles (Figures 3 and 4). A little sanding will smooth the curves around the handles of the bowl.



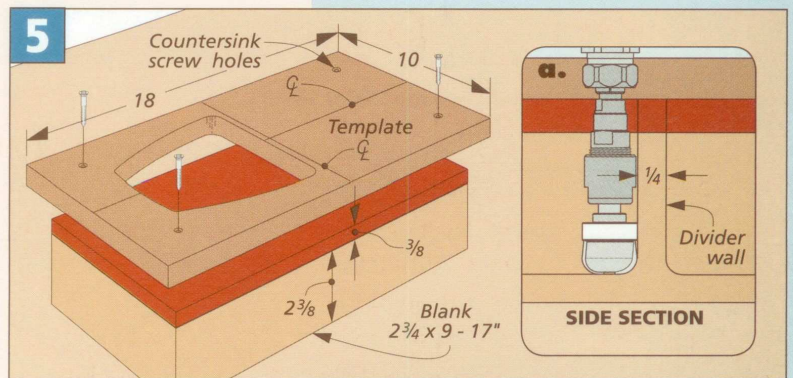


DIVIDED BOWL

Adding a divided compartment, as in the bowl above, is easy. All it takes is a little template planning.

First, cut a piece of $\frac{3}{4}$ " MDF slightly larger than your blank. Then, divide the length and width of the template into two equal parts and draw lines to mark these points, like you see in Figure 5.

Next, you'll want to lay out the area of the bowl's interior that is to be routed away. To ensure the compartments are identical, just lay out and cut one side of the template. This allows you to rout one compartment, and then simply turn the blank around, secure the template again, and trim away the stock on the other side, as shown in Figure 6.



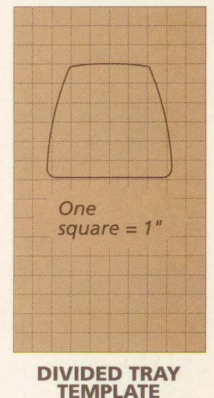
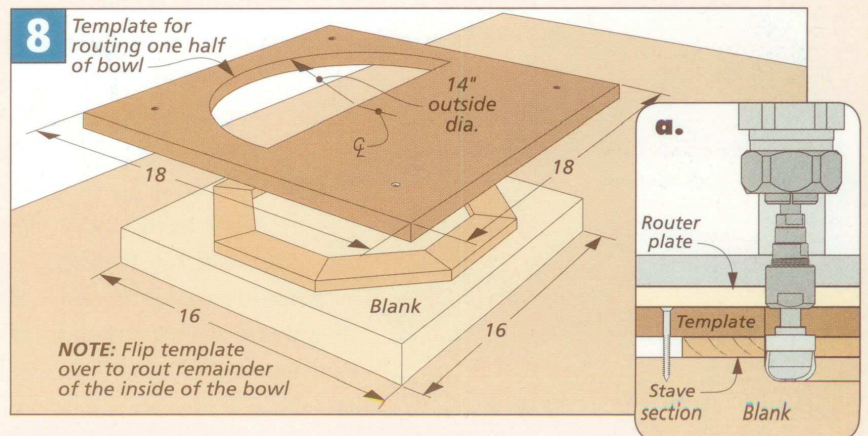
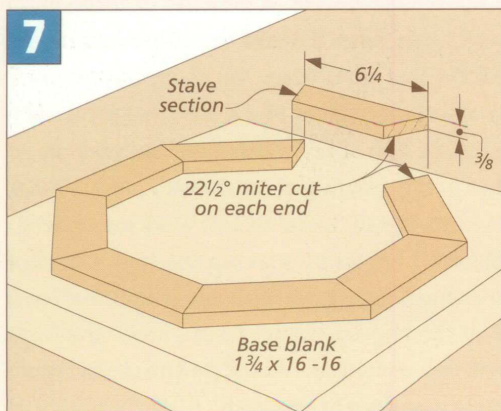
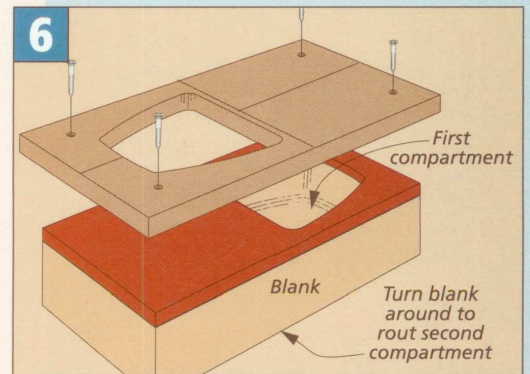
Be sure to leave at least $\frac{1}{4}$ " total along the center line to create the divider as the stock is removed (Figure 5a).

LARGE ROUND BOWL

Adding contrasting wood to the rim, as shown in the photos on this page, enhances the appearance of a bowl.

You can do this and conserve stock by gluing wood staves to the blank just around the rim, as illustrated in Figure 7, below. Then, lay the template over the staves, and rout out the inside (Figure 8a).

Another thing you'll encounter when making large bowls is the challenge of keeping the router from falling into the large template opening. You can solve this problem by simply cutting out only half the opening in the template, as you can see in Figure 8, below. This way, you can rout one side, then flip the template over, and rout away the material in the other half.



DIVIDED TRAY TEMPLATE

Fishing Net



This is one woodworking project you'll definitely get some use out of.

Whenever I get a group of folks together, it's a pretty safe bet that the conversation will eventually get around to two things — woodworking and fishing. So, it's not surprising that this fishing net project generated a lot of excitement.

Not only is it a practical project for a fisherman, but it offers an interesting challenge to a woodworker as well — to make

a wood frame for the net that bends in a graceful curve.

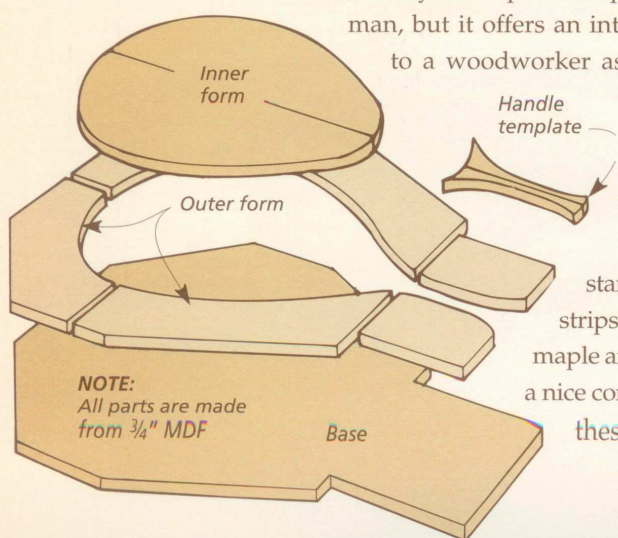
The secret is to start with thin, flexible strips of wood. (We used maple and walnut to create a nice contrast.) By bending these strips around a

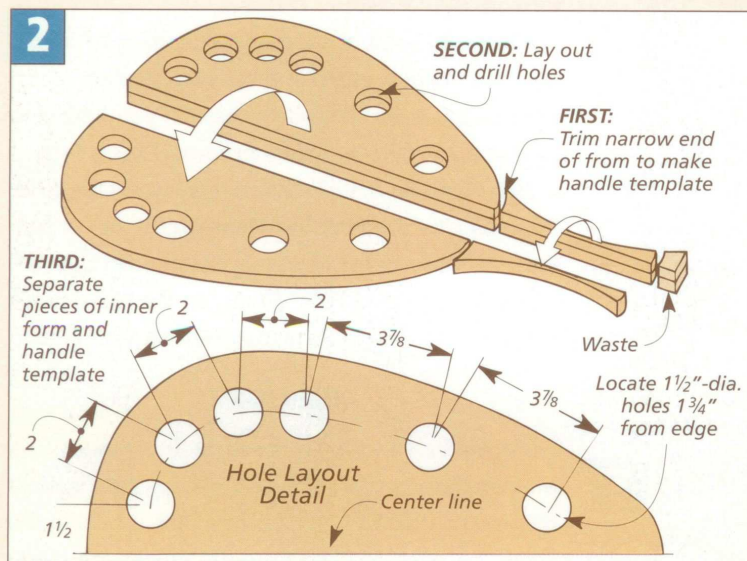
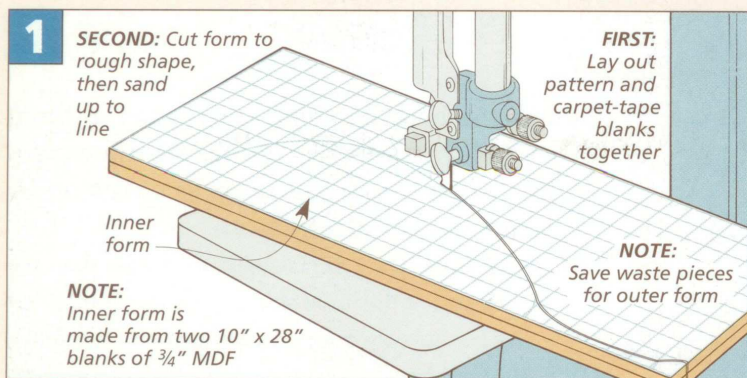
form and gluing them together, you end up with a curved frame that's both rigid and strong. (For more information on bent lamination, refer to page 74.)

BENDING FORM

Before you get started on the frame, you'll need to make the bending form. It consists of three main parts: an inner form to bend the strips around, an outer form that distributes the clamping pressure evenly against the strips, and a base that serves as a work surface. You can see how these components go together in the drawing at left. Note: I used $\frac{3}{4}$ " MDF for the form, but plywood would work just as well.

INNER FORM. I began by making the two halves of the inner form. The inner form determines the basic shape of the curved frame. Each part of the form starts off as a rectangular blank, as you see in Figure 1. Then, a pattern that shows the basic shape of half

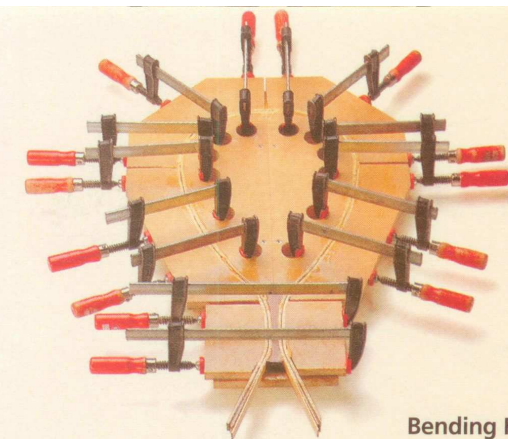




of the frame is drawn on one blank. (This frame pattern is shown in Figure 3.)

To produce a smooth, consistent curve all the way around the frame, both parts of the inner form should be identical. So it's best to carpet-tape the two blanks together and shape both of them at the same time.

Start shaping the form by cutting to the waste side of the layout line with a band saw (or jig saw),



Bending Form.

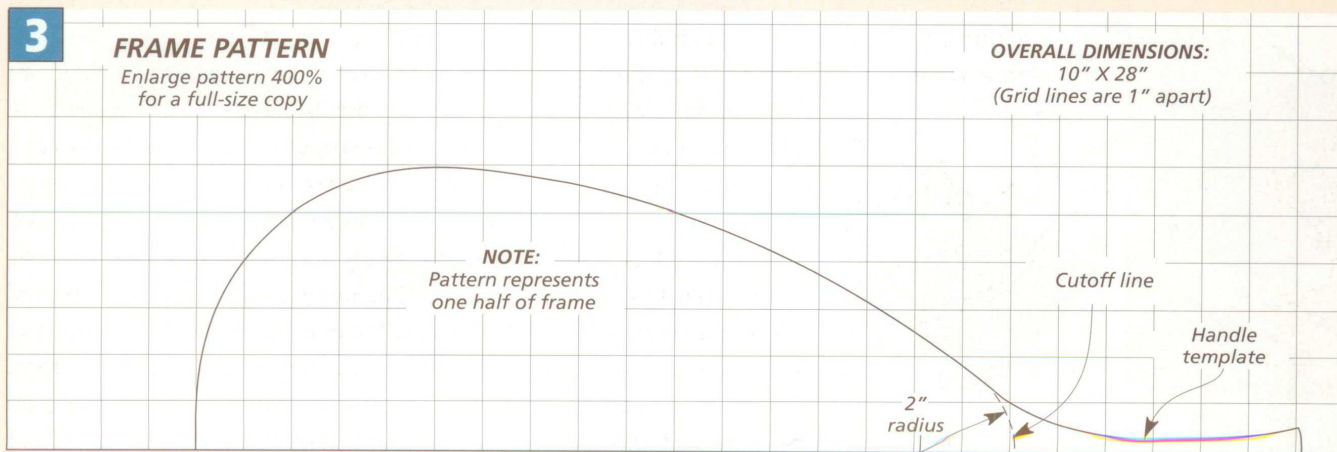
After you apply glue to the thin strips that make up the curved frame of the fishing net, they're bent around a form and clamped in place.

as shown in Figure 1. Just be sure to save the "waste" piece — it's used later to make the outer form.

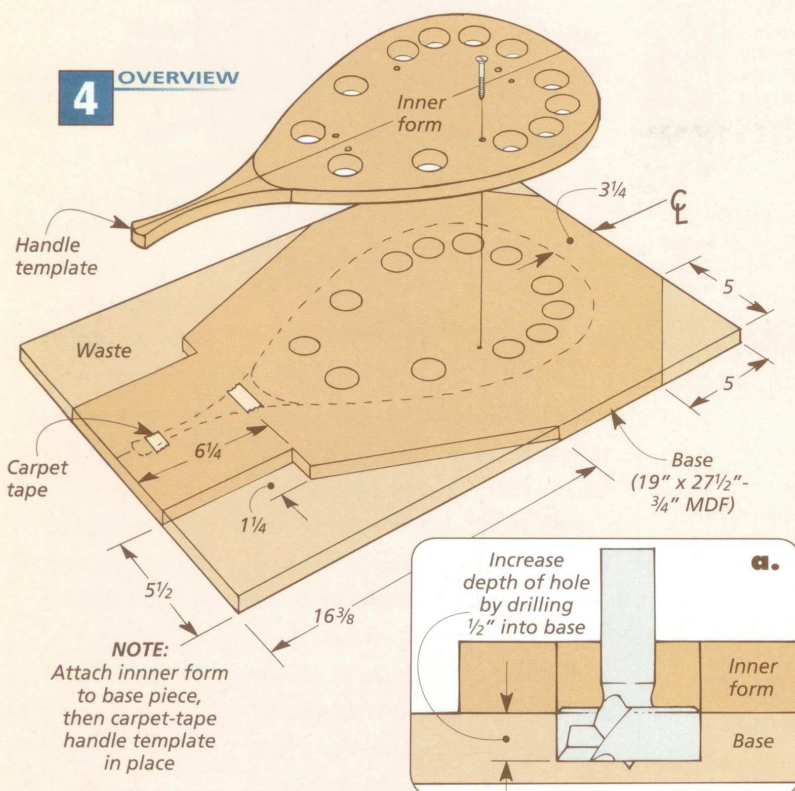
SAND EDGES. After cutting the blanks to rough shape, the next step is to sand the edges up to the line. (I used a drum sander on my drill press to do this.) To ensure the inner form doesn't "telegraph" any irregularities onto the strips, you should make sure the edges are as smooth as possible.

HANDLE TEMPLATE. At this point, there's a bit more shaping to be done. In order to make a template for the handle later, you'll need to trim off the narrow end of the form, as shown in Figure 2. Then just separate the handle pieces, and set them aside.

DRILL HOLES. Before separating the halves of the inner form, the last step is to drill holes around the perimeter, as shown in Figure 2. When you use the form to glue up the strips, these holes form pockets for the heads of the clamps (photo above).



4 OVERVIEW



BASE

With the inner form complete, you can now turn your attention to making the base. The base anchors the inner form and also serves as a platform for both the inner and outer forms.

SIZE & SHAPE. The base is about 1" smaller than the overall size of the inner and outer form blanks. Yet it still has to support the outer form. So the shape of the base "mirrors" the angled edges of the outer form, as you can see in Figure 4.

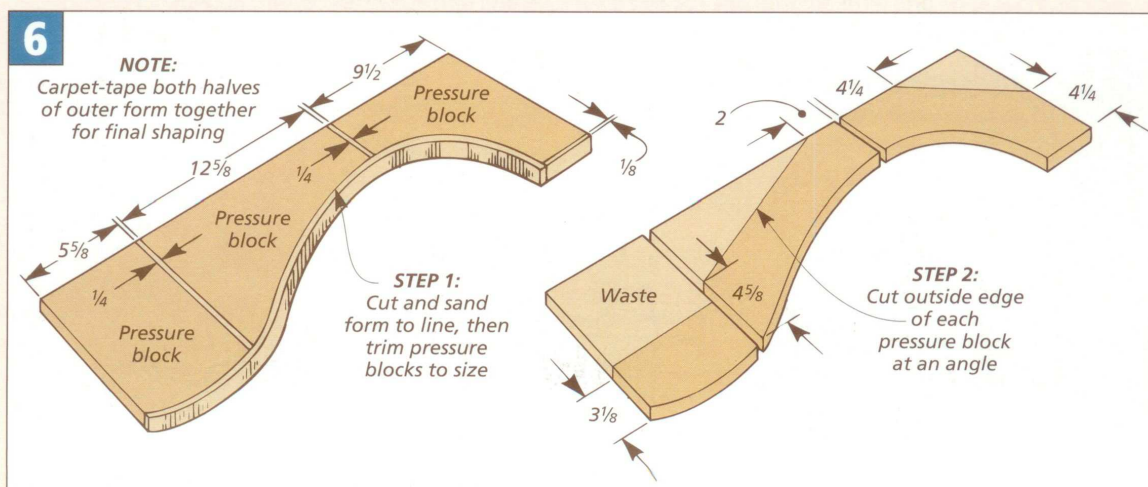
ATTACH INNER FORM. After cutting the base to shape, the inner form is glued and screwed in place. Then to help center the clamping pressure, you'll need to extend the holes into the inner form (Figure 4a).

HANDLE TEMPLATE. To make it easier to lay out the outer form later, the next step is to temporarily carpet tape the handle template to the base, as shown in Figure 4. The template is made by gluing up the two narrow pieces from the inner form that were set aside earlier.

OUTER FORM

Now you can add the outer form. It consists of six pressure blocks that squeeze the strips tight against the inner form. You can see how this works in the photo on page 89. The pressure blocks are made from the waste pieces of the blanks used for the inner form, as shown in Figure 6 below. But don't cut them apart just yet.

Even though the inside edge of each piece is already curved, it won't fit tight against the strips. That's because you have to take the thickness of the strips into account. You'll need to reshape the inside edge so it fits around the strips like a glove.



Start by setting a compass to the combined thickness of the strips. (In my case, this was $1\frac{5}{32}$ ", as illustrated in the Strip Detail drawing on the opposite page.) I cut five extra-long $\frac{3}{32}$ "-thick strips from $\frac{3}{4}$ "-thick stock — four maple strips, and one walnut strip. Then, use the compass to lay out a line on the outer form, as shown in Figure 5.

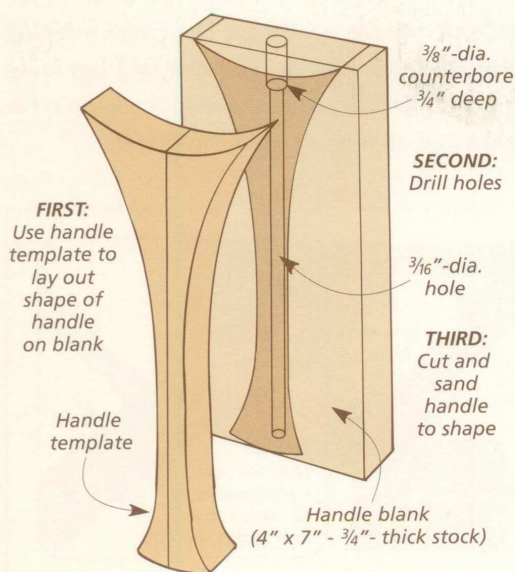
Once you lay out the curve on the outer form, make a cut close to the line and sand the edges smooth, as in Step 1 of Figure 6. After cutting the individual pressure blocks to size, the outside edges are trimmed (Step 2). This way, the pressure applied by the clamps will be directed at right angles to the strips.

VARNISH & WAX. Next, I applied two coats of varnish and a coat of wax to all the parts. This is a good way to keep glue from sticking to the parts of the forms.

GLUE-UP. With the varnish and wax on your forms, you're almost ready to glue up the strips. (I used polyurethane glue for this fishing net because it's waterproof.) But you'll need to have the handle ready before you can glue up the strips.

HANDLE. The handle is made from a piece of $\frac{3}{4}$ "-thick hardwood (walnut), as shown in the drawing below. After using the handle template to lay out the basic shape, a counterbored hole is drilled down the length of the handle for the wrist strap that's added later. (I used a long brad point bit.) Then cut the handle to shape and sand the edges smooth.

The next thing you need to do is glue up the frame. Take a look at the box at right for details on this.

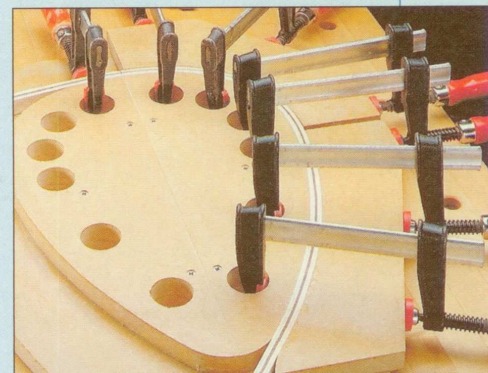


Gluing Up the Frame

1 After applying glue, center the strips and temporarily clamp them to the form. Then bend them around the inner form and clamp the first pressure block in place.



2 Now bend the strips a little more, and add the next pressure block. You may need to reposition the blocks to remove any gaps between the strips.

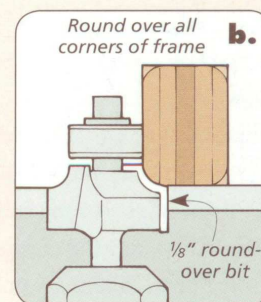
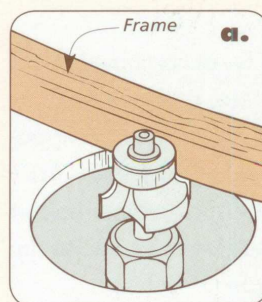
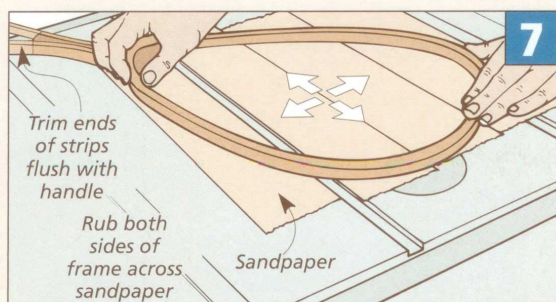


3 After repeating the process for the other side, carefully spread the strips apart, and have a friend fit the handle (with glue on the edges) in place.



4 Adding the last two pressure blocks squeezes the strips tight against the handle. Once all the clamps are in place, allow the glue to dry overnight.





With the net in hand, it's just a matter of attaching it securely to the frame with braided mason's line.

CLEANING UP THE FRAME

Don't be surprised when you remove the frame from the form and it's caked with a thick crust of dried glue. All it needs is a little cleaning and shaping.

TRIM WASTE. But first, you'll want to remove the "tails" on the ends of the strips that extend past the handle, as you can see in Figure 7.

They're simply trimmed and sanded to match the curve on the bottom end of the handle.

SCRAPE. Now you can scrape off the bulk of the dried glue. (I used a paint scraper to do this.) Just be sure you don't bear down too hard and tear the wood fibers.



The rest of the glue can be removed by sanding the frame. An easy way to do this is to put sandpaper on the top of the table saw and rub the frame back and forth, as shown in Figure 7.

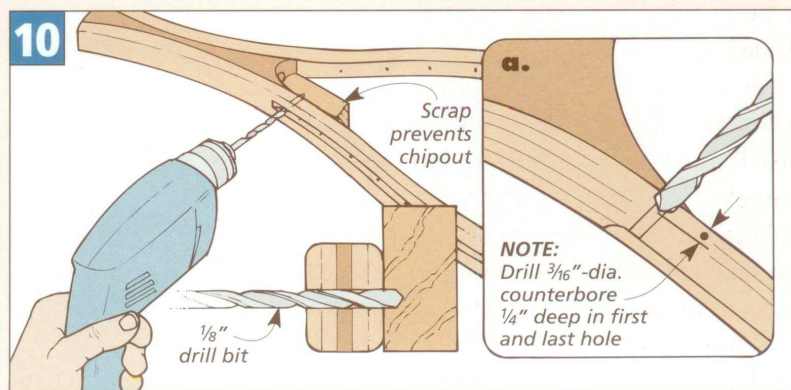
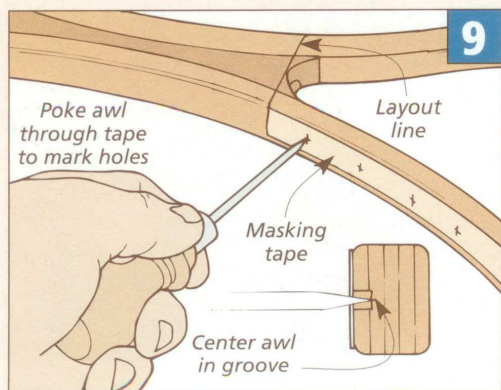
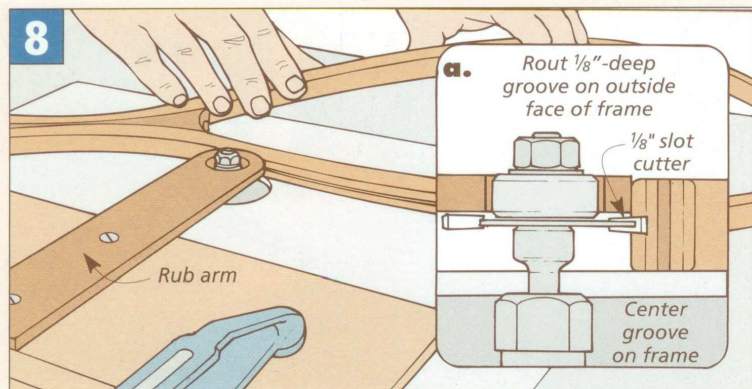
ROUND EDGES. Finally, to soften the sharp edges, I routed a roundover all the way around both sides of the frame. This is shown in Figures 7a and 7b.

ADDING THE NET

With the frame sanded smooth, you're ready to add the net. (I picked up a 14" replacement net at a local sporting goods store.) To attach the net to the frame, you'll need about six feet of mason's line.

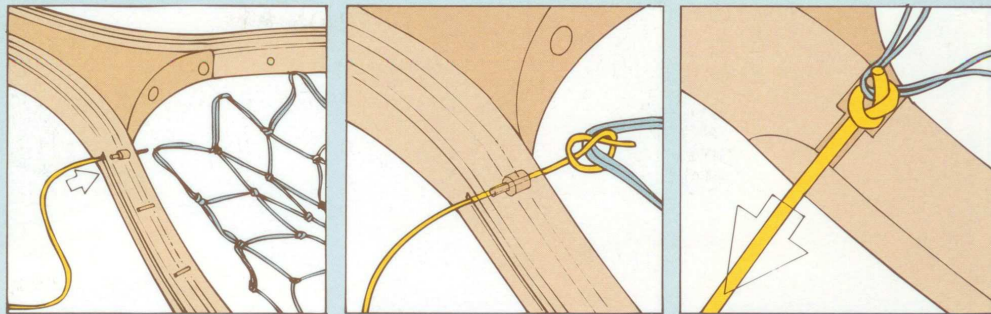
GROOVE. The mason's line fits in a groove that's routed on the outside of the frame, as shown in Figures 8 and 8a. This groove begins and ends at a line that's flush with the bottom of the curved "yoke" on the handle, as you see in Figure 9. To rout the groove, I used a slot cutter and a simple rub arm. You can find more about this technique at WoodsmithSpecials.com.

DRILL HOLES. Finally, drill a series of holes in the frame to secure the net (Figure 10). I used masking tape to lay out the holes. The first and last holes are counterbored to create a recess for a knot in the mason's line, as you can see in Figure 10a.

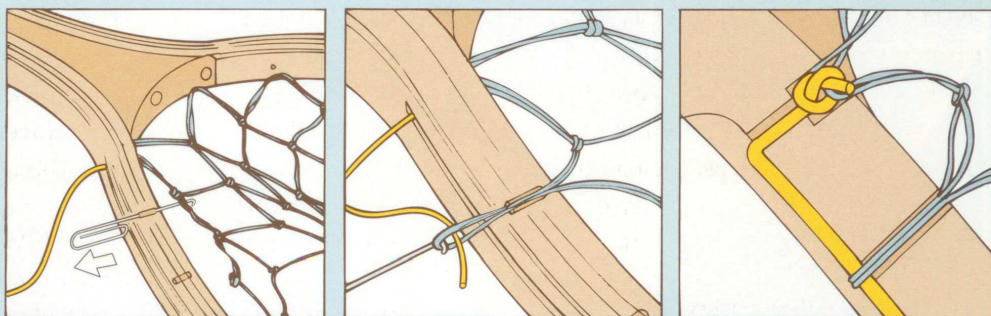


How to: String the Net

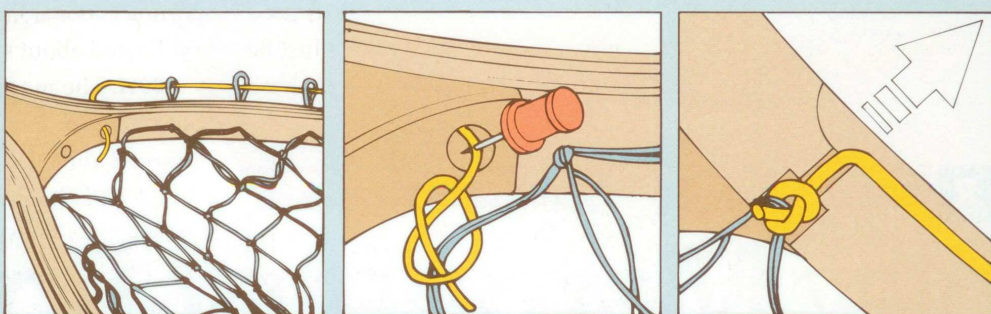
1 To string the net on the frame, start by passing one end of the mason's line through the first hole (see left-hand drawing). After tying it to one of the loops on the fishing net (center), pull on the line to seat the knot in the counterbore (right).



2 The next loop on the net is pulled through the hole in the frame with a paper clip (left). With the loop on the outside, you can weave the free end of the mason's line through the opening (center). Then, simply pull the line and net tight (right).



3 This process is repeated for all the loops except the last one (left). It's tied off as before. But first, pull the mason's line tight and pin it to the frame (center). This way, when you remove the pin, the tension draws the knot into the counterbore (right).

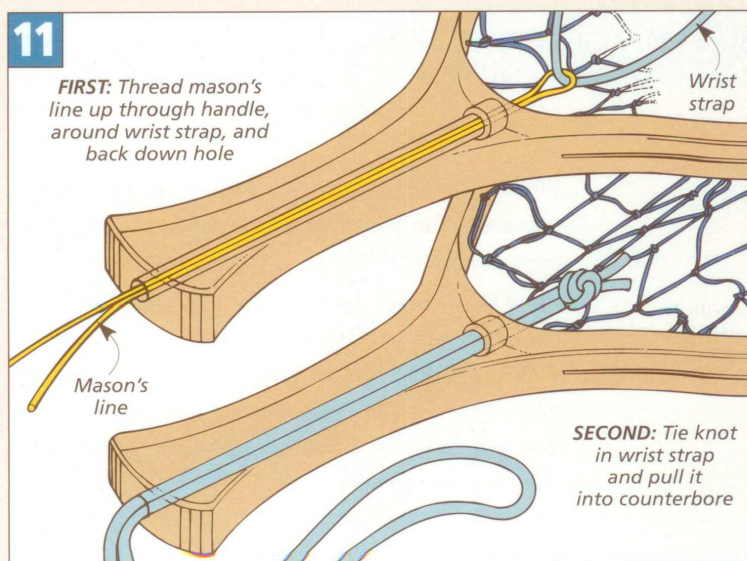


WRIST STRAP

To avoid dropping the net when landing "the big one," I attached a wrist strap to the handle. The wrist strap is just a heavy-duty nylon lace for a hiking boot that passes through the hole you drilled in the handle earlier.

An easy way to thread the wrist strap through the hole is to "fish" it through using a piece of mason's line (Figure 11). Start by feeding the line up through the hole, around the wrist strap, and back down the hole. After tying off the ends of the strap, pull on the line. This will feed the strap through the hole and seat the knot in the counterbore.

At this point, there's just one last thing to do — head to your favorite fishing hole and give it a try.





Inlay Marquetry Box

There are a lot of great details packed into this small project — splined corners, a sliding lid, and of course, the elegant marquetry.

Building small projects, like the inlay marquetry box you see in the photo above, can be a nice change of pace. Although they apply some new techniques, these projects are fairly simple and quick to build. Plus, they can be quite rewarding.

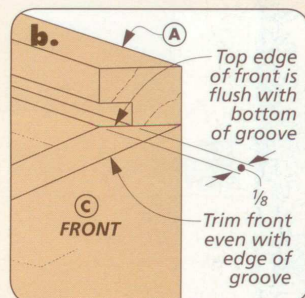
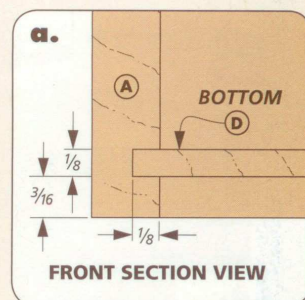
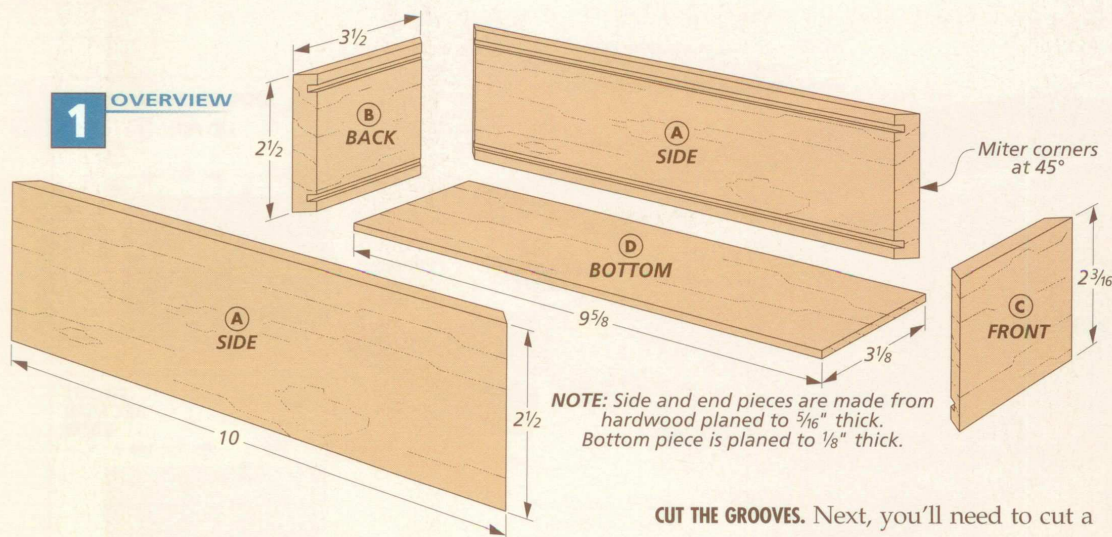
This project is also a good way to use up some of the scrap wood that accumulates in your shop. You can even use a combination of woods to create a totally different look.

Another great thing about building boxes is that it gives you a chance to try new techniques, like the

marquetry I used on the lid. I was able to develop a new skill that may be used on future projects.

You'll find that this marquetry technique is easy to learn — take a look at the article on page 78. All it takes is a scroll saw and a few simple steps to give any project a unique look. If you like working with different kinds of wood, you'll definitely want to give this scroll saw technique a try.

The box itself has interesting features as well, such as splined corners and a sliding lid. The combination of these details makes this a great weekend project.



MATCHED GRAIN BOX SIDES

Building the box is nothing more than making four sides, a bottom, and a sliding top. It's pretty simple, but there are a few things you'll want to consider.

MATCHING THE GRAIN. One way to enhance the look of the box is to make sure the grain pattern runs continuously around all four sides. This may sound difficult, but it's just a simple band saw technique.

Start with a thick blank and resaw it into matching pieces for the box parts, as shown in the box below.

There's one more thing to consider. I cut enough stock to make one extra front piece, which will be used to make the lid pull later on. After resawing, plane the two pieces to $\frac{5}{16}$ " thick. You can find more about planing thin stock online at: WoodsmithSpecials.com.

CUT THE GROOVES. Next, you'll need to cut a couple grooves to hold the lid and bottom (Figures 1a and 1b). A trip to the table saw makes this easy. Set the blade height to $\frac{1}{8}$ " and your rip fence $\frac{3}{16}$ " away from the blade. Then make a pass along the top and bottom of each piece.

NEXT, CUT THE PIECES TO ROUGH SIZE. I cut the smaller back and front pieces before cutting the sides.

MITER THE CORNERS. Then I joined the sides and ends with miter joints. To make these, tilt your table saw blade 45° and miter the pieces to final length.

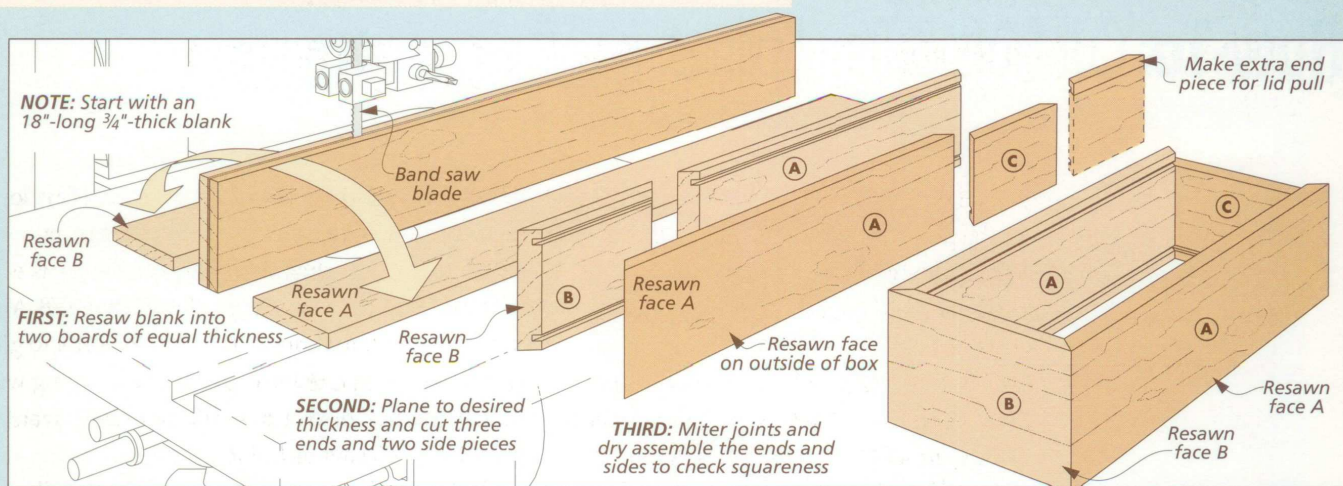
Finally, you'll need to plane a piece of stock to $\frac{1}{8}$ " thick for the bottom of the box, and then cut it to size. Before gluing the box together, trim away the top edge of the front so it's level with the top groove (Figure 1b).

This opening allows the lid to slide in and out.



For tips on planing thin stock, go to our website: WoodsmithSpecials.com

How-To: Continuous Grain Sides & Ends

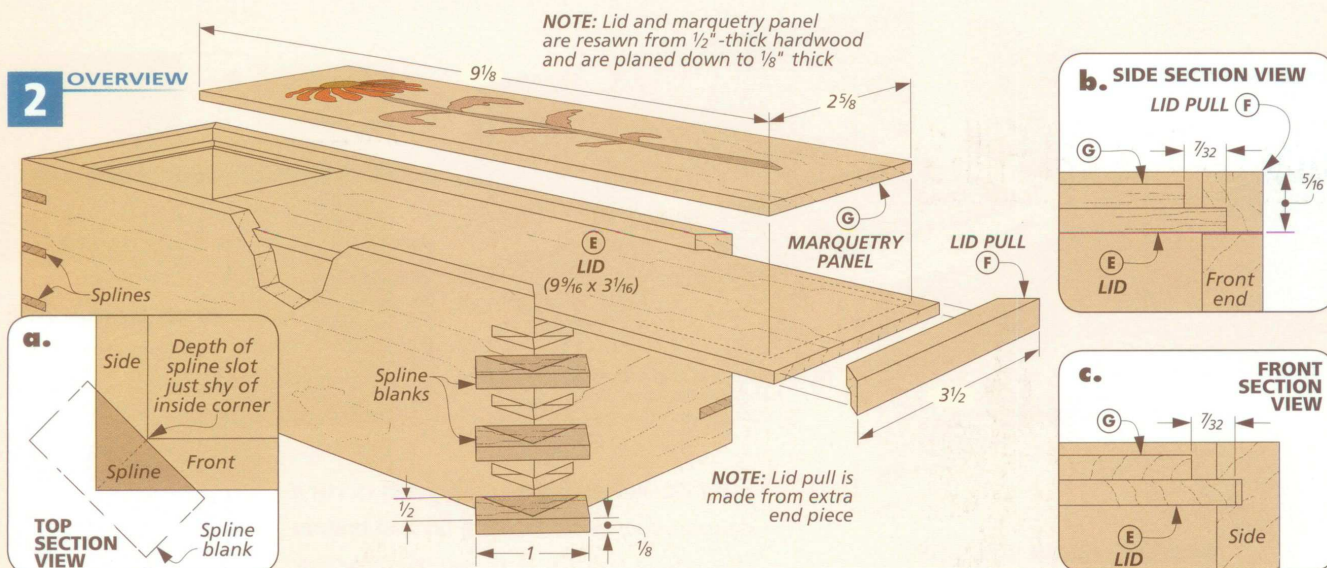


Grain Matching. Begin with a blank a bit longer than the length of one side and two box ends. Use the band saw to resaw it into two pieces that are roughly the same thickness. After planing each

piece to final thickness, mark the two resawn faces for use as the outside faces of the box. Then cut the ends and sides from each of the pieces, complete the joinery, and dry assemble the box.

2

OVERVIEW



ADDING THE SPLINES & LID

To complete the box, you'll need to add some splines to the miter joints. And then you can make a sliding lid to enclose the top of the box.

SPLINES. Adding splines to the miter joints does two things: First, it increases the strength of the miter joints. But the contrasting wood splines also dress up the appearance of the box.

CUT THE SLOTS. To cut the corner slots for the splines, you'll need to build a simple jig, like the one shown in the box below. You can find more about building and using the jig at WoodsmithSpecials.com.

After cutting the slots, you're ready for the easy part — adding the splines. I made the splines from 1/8"-thick walnut. Simply cut the spline pieces 1"-long, and then glue them into each slot. This is shown in Figures 2 and 2a.

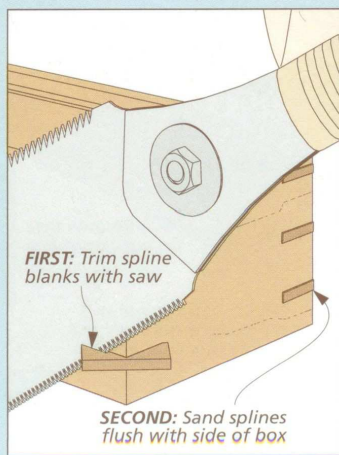
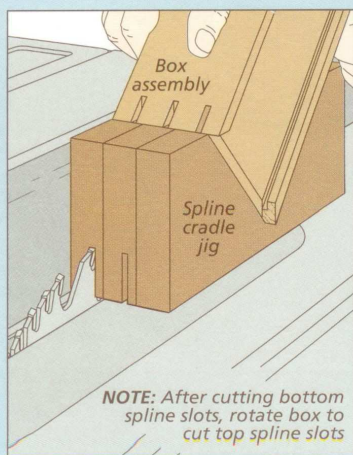
As soon as the glue has dried, you can trim off the waste with a hand saw, as illustrated in the lower right drawing. Then, just sand the splines until they're flush with the sides of the box.

MAKE THE LID. Now you're ready for the two-part lid. The first part is a piece of stock sized to slide easily into the top groove. And then a second panel is attached to the top of the lid (Figure 2c). At this point you can add a marquetry inlay, as shown on page 78.

ADD THE LID PULL. The final thing you'll need to do is make a pull for the lid. The extra front piece I made earlier makes this step easy. All you need to do is trim the top of this front piece off at the bottom of the groove. Then, glue the pull to the end of the lid, as shown in the main drawing and in Figure 2b.

Now just add a few coats of finish, slip the lid into the top groove, and put your decorative box to use.

How-To: Cut Slots & Trim Splines



In order to safely cut the slots for the splines on your table saw, you'll need to make a simple jig. The jig shown at left cradles the corner of the box at a 45° angle, so the slots can be cut on the table saw.

The jig is made from pieces of MDF that are simply glued together. A notch is cut out to hold the corner of the box at the correct angle.

After the slots are cut, you can glue in the hardwood splines. You'll want to trim them slightly proud with a hand saw so you don't scratch the box. Then, just sand them flush with the sides.

Bonus: Optional Full-Size Marquetry Patterns



Project Sources

MAIL ORDER SOURCES

Rockler
800-279-4441
rockler.com

Woodcraft, Inc.
800-225-1153
woodcraft.com

Lee Valley
800-871-8158
leevalley.com

Inlay Product World
877-464-6529
inlays.com

Constantine's
800-443-9667
constantines.com

Amazon.com

Most of the supplies and hardware items you need to build the projects in *Weekend Woodworking* are readily available at hardware stores and home centers. The following items, however, may be difficult to find locally — you can order them from the sources provided in the margin.

DESKTOP PICTURE FRAMES

If you're making a mitered frame (like the project found on page 26) out of softwood, simple mechanical fasteners provide a quick way to reinforce the miter joints. Tack plates and corrugated nails are available at many hardware stores. And you can find chevrons from the sources listed in the margin.

MIRRORED COAT RACK

Flush-mount hanging clips from *Rockler* (29975) make the mirrored coat rack on page 34 easy to hang on a wall. The Craftsman-style hooks featured in this project are no longer available, but *Lee Valley* carries a similar style. Try the traditional, oil-rubbed bronze double hook (00W85.22).

MAGAZINE BOXES

The only hardware items needed for the magazine boxes on page 58 are the brass card file pulls. They can be found at your local hardware store or at *Amazon.com*. Note: You'll have to switch to shorter screws to accommodate the 1/4"-thick panels used in the boxes.

ROUTER BIT CABINET

To keep the router bits in your shop organized, you can build the storage cabinet shown on page 66. The hardware needed to build the project includes two 5/16" round magnetic catches with screws, two 1 1/16" x 1 1/4" butt hinges with woodscrews, and a 3/4" birch knob. You may also want to order some 1/4" i.d. nylon sleeves to hold your 1/4" shank router bits.

ROUTED BOWLS

With a router, templates, and the right bit, you can make a variety of bowls (page 84). I used a 1/2" shank, 1 1/4"-dia. bowl and tray bit with top bearing made by CMT. I ordered mine from *Woodcraft* (823066). You can also purchase

this bit from other sources using CMT part number 851.502.11B.

You'll also need a collet extension for your router. You can get this from *Amazon.com* (CMT part number 796.001.00).

To get a smooth surface on the inside of the bowls, I used the 3"-dia. *Tim Skilton Premium Sanding Pad* (68Z25.32) from *Lee Valley*. You'll also need 180- and 220-grit *New Wave* sanding disks (68Z63.31V and 68Z63.31X), also from *Lee Valley*. Their unique, wavy edges conform to the inside of the bowls without gouging.

INLAY MARQUETRY BOX

You won't need anything in way of hardware to build the marquetry box on page 94. But you will need wood for the inlay blanks if you don't have enough scrap pieces. A number of different wood species in a variety of thicknesses can be found at *Inlay Product World* or *Constantine's* (see left margin).

essential techniques

a look inside

QUICK TIPS & TECHNIQUES FOR WEEKEND PROJECTS.

You might think that woodworking takes years to learn. But inside this book, you'll find a dozen foolproof woodworking techniques that can be mastered in almost no time at all. From pocket screw joinery, to box joints, to template routing, these are techniques you can learn in a weekend and use for a lifetime. Then, to put your newly acquired skills to good use, we'll show you how to build some practical, attractive projects you can use all around your home.



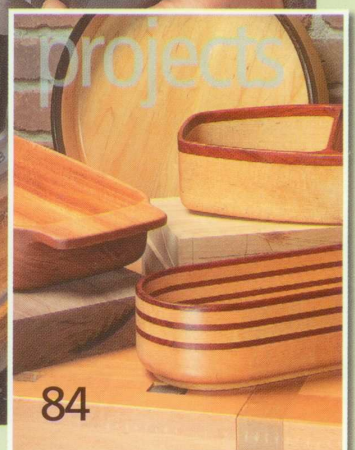
projects

advanced techniques



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projects