Frame-and-Panel Doors

Five steps to building a door that will last for generations

BY LONNIE BIRD





here's probably no design element with broader appeal than the frame-and-panel. It's a traditional favorite for doors, such as on this heirloom spice box (above), and for wall paneling and case work. And for good reason—the frame-and-panel covers a broad expanse with only a negligible amount of seasonal wood movement. As the panel expands and contracts, it floats within the confines of the rail-and-stile frame, which helps keep the panel flat.

Frame-and-panel doors are relatively easy to construct, but it can be tricky to get the proportions right. A door with the wrong proportions can ruin a piece of furniture. The door must be proportionate to the entire piece; the frame-and-panel parts must be proportionate to each other; and the stiles and rails must be proportionate to the door as well as to each other. Sometimes, though, I make the bottom rail slightly wider to give it more visual weight. To determine the correct proportions quickly, I begin with a drawing that relies on the golden rectangle, in which the ratio of length to width is 1 to 1.618 (see "A Guide to Good Design" on pp. 48-51). But I make the final judgment with my eyes.

Although flat panels work well, I prefer a raised-panel door, which has beveled edges and a raised appearance in the center. This design catches light and creates an interesting shadowline.

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MAKE RAILS AND STILES FIRST

LAY OUT THE MORTISES A PAIR AT A TIME



Tandem layout. By clamping the stiles together, you can lay out joinery faster and more accurately. When scribing mortise marks, use a marking gauge with a chiseled point to define the sides of a mortise accurately.



When making a frame-and-panel door, I start with the rails and stiles. Straight-grain stock provides strength and resists warping. The rails are dimensioned to size; the stiles are milled to the correct thickness and width but are left long for cleaner assembly. Leaving ears (extra length) on the stiles makes it easier to dry-fit the piece because you can use a mallet to put it together and tap it apart without denting the finished frame. After glue-up, the ears can be trimmed off on the tablesaw.

At this stage, mark all of the faces of the parts and the height of the door, then work your way inward to locate the mortises. Next, use a marking gauge to mark the mortise widths and then mark the tenon shoulders on the rails. A mortise-and-tenon joint will hold when dry-assembled. Once glued up and secured with a wood pin, the joint will last for years. When cutting mortise-andtenons, I find it easier to cut the mortise first, then fit the tenon to its mate. Simply drill a row of holes and square the sides with a chisel. It's most important that the walls of your mortise be square to the adjacent sides and parallel to the opposing walls.



Steady the work. Clamp a makeshift fence to the drill-press table when boring out mortises, to register the stock and keep the bit from rotating the work. To prevent the bit from wandering, leave small spaces between the holes.



Clean out the mortise. With the stile clamped on edge, use the flat side of the chisel to chop out most of the mortise walls.



Pare the walls. The walls of each mortise must be square to their adjacent faces to ensure a good fit.

2 CUT TENONS ON THE TABLESAW



Use the tablesaw's fence as a stop. Install a ³/₄-in. dado set and adjust it to a cutting depth of ¹/₄ in. Use a miter gauge to make two or three crosscuts, until the end of the tenon rides against the fence.



Use caution when cutting shoulders. If the shoulder is deep, lower the dado blades and begin with shallow passes before making full-height cuts using the miter gauge.



As with the mortise, there are several methods for sawing the tenon. The tablesaw with a dado set is a good option. You also can cut surprisingly accurate tenons with a well-tuned band-saw. A backsaw is a great choice, too.

Like the mortises, the tenon faces also must be square and parallel. That is less of a concern when using the tablesaw, but be careful about dado adjustment. By raising the dado blades just a bit too high, you can overcut the tenons easily, leaving them too thin to fit well. To avoid this, err on the waste side of the layout mark and trim the face of the tenon with a shoulder plane to achieve a friction fit with the mortise.

3 ROUT GROOVES TO HOLD THE PANEL



Cut stopped grooves on the stiles. Hold the end of the stile firmly against the fence, and pivot the workpiece into the rotating bit.

Keep the front face of the stile up. The panel groove is offset from the center, so be sure to keep all parts properly oriented.





Once the joints have been cut, the next step is to cut a groove in the stiles and rails to accept the panel. Choose a bit that will cut standard $\frac{1}{4}$ -in. grooves. Set the cutter to a height that is slightly offset from the center to accommodate the raised panel. Adjust the fence to cut a groove about $\frac{5}{26}$ in. deep to allow for expansion of the panel.

The grooves in the rails are cut all the way along the inside edges. The grooves in the stiles are stopped at the mortises. To cut a groove in a stile, pivot it into the cutter where the mortise has been cut. Rout along the inside edge and conclude at the opposite mortise.

4 MILL THE RAISED PANEL



Use a panel-raising bit to rout the panel. Proceed slowly to avoid tearout, especially when cutting end grain.



With the frame still dry-assembled and clamped, measure the distance between the frame members and add $\frac{1}{2}$ in.; this will leave about $\frac{1}{26}$ in. on all sides to allow for panel expansion. To prevent rattling, the panel should be snug but not too tight in the frame.

When selecting stock for the panel, I always use one wide board. The door panel is an eye-catching area, and glued-up stock is just too distracting. To find the most attractive area on the figured plank, position the dry-assembled frame on the stock and use it as a window to get a perfect picture of how the panel will appear within the frame.

The next step is to mill the panel and bevel the edges (see the photo and drawings above).

Set the fence to make a $\frac{3}{4}$ -in. cut using a panel-raising bit. When using a router table, two or three passes are needed to get the correct depth without tearout. Once the shallow cuts have been made, the router-table fence can be moved back to expose $1\frac{1}{4}$ in. of the panel bit. It will cut a panel that appears 1 in. wide with a $\frac{1}{4}$ -in. lip (edge) that rides in the groove.

ASSEMBLE THE DOOR





Dry-fit it. Fit one rail and stile first, then put the panel in place (above) and fit the remaining rail and stile. This order lowers the risk of tearing out the panel corners. Next, make sure the frame is square. With a square on the flat side of the panel, simply tap the long end of a stile (left). Once the glue has set, the stile ends can be trimmed flush with the rails.

Once the panel has been made, the door is ready for assembly. It's always a good idea to perform a dry run, which gives you an opportunity to check the final fit and make adjustments before the glue is applied.

During final assembly, make certain that you clamp the door together on a flat surface; otherwise, you may inadvertently glue a twist into the door. Apply glue sparingly to the mortise walls and to the faces of the tenons. If the joints fit well, they will not require much glue. You'll need to work neatly, or the excess can squeeze out and glue the panel in place. Once the glue has dried, carefully trim the door and fit it to the opening in your case work.