RAISED PANEL DOORS

Use the size and strength of a shaper with Freud's UC-900 cutters to your advantage.

By John English

BEYOND GREAT LOOKS, THERE'S A LOT TO BE SAID FOR FRAME and panel construction. Using short and narrow pieces, especially in glued-up panels, it can be a fairly inexpensive technique. A little play between the frame and the panel also deals with seasonal expansion and contraction, the bane of furniture makers and case builders. Without that play, movement caused by changes in ambient humidity (and, to a lesser extent, temperature) can cause a door or tabletop to crack, warp and generally misbehave.

The majority of kitchen doors are made using this technique, as are large panels in furniture such as the sides of bookcases and entertainment centers. There are several ways to make the parts, from hand tools to table saws and routers, but none is as efficient or reliable as a shaper. The machine is designed to handle large bits more safely than a router, and it has the power to run them. Entry-level shapers are surprisingly affordable, and a machine with two speeds and a ¾" arbor is quite adequate for hobbyists. Professional shops will often have two or three shapers permanently set up to make multiple parts.

The real key is not so much the shaper as the cutters. A well-balanced set, designed with carbide tips and anti-kickback geometry, can reduce a day of routing to a couple of hours of shaping. The cutters are heavy and less likely to vibrate, which means that they are more likely to deliver a cut as smooth as silk.

CUTTER SET

When it comes to shaping doors, several cutters are required. An edge joint cutter creates interlocking joints on the edges of boards, so they can be glued together to form panels. Cope and stick cutters create profiles on the ends of horizontal parts and the inside edges of the frame members, respectively. Also, many door styles require an edge treatment either for aesthetic reasons or so that the door can fit into a face frame on a cabinet.

While cutters have long been available to the cabinetmaking industry as packaged sets, in recent years the declining cost of carbide (combined with new manufacturing techniques) has made such sets much more affordable. Industry leaders such as Amana Tools, MLCS, CMT, Grizzly, Freeborn and Freud all offer variations, with some of the less expensive models using a single cutterhead and a number of profiled inserts. The heavier, high-end versions are one-piece, dedicated tools, such as the Freud raised panel set of cutters used here **(Fig. 1)**.

The set I'll be using is the Freud UC-900 which is available in a variety of configurations. What changes is the raised panel profile. Shown here is a traditional profile, which is one of the largest available (4 5/16" diameter), and it looks like a stretched out ogee. The set includes everything needed to make vertical stiles and horizontal rails, and an optional edge treatment for doors (a door lip cutter). The last cutter in the set is an edge joint cutter. With a diameter of 2 7/8" and a carbide height of 5/32", this cutter mills an interlocking glue joint profile along the edges of two boards, so that they fit together perfectly when being assembled into panels. And that's where door construction begins, with the panel.

1 **FREUD UC-900**

MAKING A PANEL

In the Freud set, the edge joint cutter is the key to flat panels. However, before it can be used the individual boards that make up a panel must be flat and straight. Dressing stock begins with jointing one face of each board, and then planing the other. Jointing ensures that one face is perfectly flat, and a thickness planer pares the other face parallel to it. If there is a bow in a board and it is not jointed first, the planer will just deliver a bowed board that is the same thickness throughout its length. For standard 3/4" thick raised panels, plane the stock to 13/16" for now. After dressing the two faces of each board, joint one edge and then rip the second edge parallel to the jointed edge. Crosscut all parts of the panel about 6" longer than their finished size. The extra length is included because, after the glue is dry, the panel can be planed down to its final 3/4" dimension, and any snipped ends will have to be trimmed at that time.

Shaper cutters should be installed as low on the arbor as possible **(Fig. 2)**. This helps to eliminate any opportunity for flex (wobble) in the arbor. Note that it is much safer to use a shaper where the work is above the cutter, rather than below. The potential for kickback is significantly reduced and fingers are safer too, because the wood in effect becomes a sort of traveling guard. A hold-down **(Fig. 3)** is vital on a shaper, when making straight passes. The motor is very powerful and an

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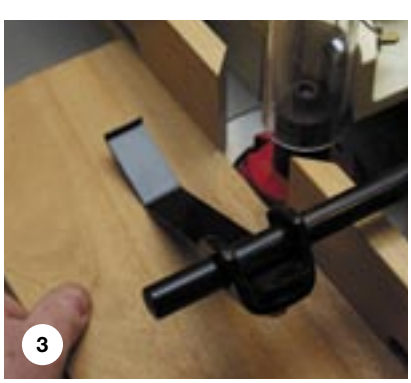

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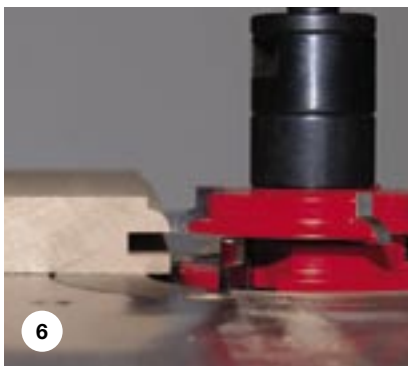
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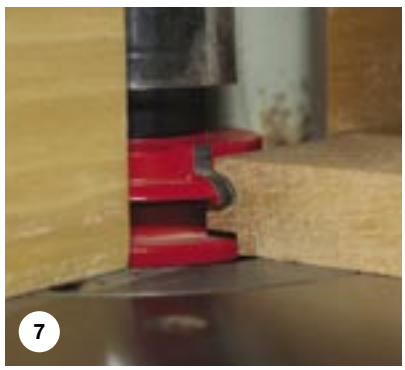
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improperly fed workpiece can kick back violently in the blink of an eye. While a ¾" arbor is preferable, Freud includes adapters so that all of these cutters can be used on a ½" spindle.

The edge joint cutter creates a reversible joint. That means that a single cutter makes both profiles for the joint. Simply run both edges through the shaper, and then flip one part end-for-end to lock it into the other **(Fig. 4)**.

There are two adjustments that control the cut. The first of these is the position of the fence. The cut should barely kiss the edge of the work, removing as little stock as possible while still milling the complete profile. Using this cutter in most species, the cut can be made in a single pass. Some very dense species may require two incremental passes, with the fence being adjusted between them. Feed the work at a rate where the cutter shows no signs of stress (notable resistance, or a change in the sound). Feeding too slowly can burn the edge on some species, which isn't disastrous with this joint as it is entirely concealed after assembly. However, burn marks can polish a surface, which means that the glue can't penetrate into the exposed fibers, so it's obviously not recommended.

If burning is a problem on carbide-tipped shaper cutters (or router bits), it is most often due to a buildup of resins on the sides and trailing edges of the tips. Carbide holds an edge a remarkably long time, and many woodworkers send their bits and blades to the sharpener long before they are due. Remove the pitch with lacquer thinner (some folks prefer soaking in a solution of baking soda), and a cutter will probably surprise you. Cleaning, rather than sharpening, also maintains the balance.

The second adjustment on the edge joint cutter is height. Test the setup by running some scrap stock that is exactly the same thickness as the work, and move the cutter up or down until a perfect match is made. When the match is perfect, apply glue and clamps, and set the panel aside to dry while you build the frame for it.

STILES AND RAILS

A raised panel resides in a frame that is composed of two stiles (uprights) and two rails (horizontal members). The frame parts can be plain, but most often they are decorated with a profile on the front edge where they meet the panel. Behind this profile is the ¼" wide groove for the panel.

The Freud shaper set cuts the groove and the decorative profile simultaneously, using two stacked cutters. After installing them, set the fence and the height, and then mill the first 6" or so of a long piece of stock that is exactly the same thickness as your stile and rail material **(Fig. 5)**. Something about 3" wide and a couple of feet long is appropriate. Crosscut the milled part from the board and retain it: this is your pattern.

Where a stile meets a rail, the end of the rail must be coped (cut to match the profile of the stile). This is done with another pair of stacked cutters. Use your pattern board (also called a template) to visually set the height of the cutters **(Fig. 6)**, then mill both ends of each rail **(Fig. 7)**. This is done with the help of a miter gauge, with a piece of scrap to back up the cuts and reduce (or eliminate) tearout.

With all of the rail ends milled, it's time to switch back to the stile cutters and mill the inside edge of each stile and rail. Setup is quick and easy using the pattern board. Make sure the adjustable fences are as close to the cutter as they can safely be, and use hold-downs and push sticks to keep your fingers away from the cutters. By milling the edges of the stiles (with the grain) after machining the ends of the rails (across the grain), you will reduce tearout.

In the Freud door set, four very thin metal shims are provided. These can be used between the stacked cutters if a micro-adjustment is required for a perfect fit.

RAISING A PANEL

Whenever possible, a panel should be shaped face down, with the cutterhead below it **(Fig. 8)**. Despite some manufacturer's claims to the contrary, many cabinetmakers believe that it is bad practice to run a part between the cutter and the table. It is, they say, akin to running work between a bit and the fence on a router table, which is an invitation to kickback. Note also in the photograph that the hold-down is a piece of scrap clamped to the fences. This is a safety measure designed to catch the panel, should it be thrown upward by this large cutter. Use the miter gauge to machine the ends of the panel first **(Fig. 9)**, making the cut in several incremental passes. Removing this much stock in one pass would be too much strain on the cutter, and on most shaper arbors. There will be a little tearout on the trailing edge of the panel, but this will be removed when the sides are milled.

With the ends of the panel raised, and before machining the sides, stick some masking tape on the shaper tabletop to mark the locations of the backs of the fences. Then move the fences forward so that only about ¼" of the cutter profile is revealed. Make a pass on each side of the panel (with the grain), then move the fences back another ¼" or so for the next pass. Continue in this vein until the fences reach the masking tape. Make sure the fences line up properly with each other each time they are locked.

The stiles and rails are milled before the panel is raised, because the grooves in these parts are predetermined at ¼" width, and this can't be changed. However, when the panel is being raised, there is some room to maneuver. Moving the fence forward or back a little changes the profile, and thereby the thickness of the panel where it enters the groove. Experiment for a perfect fit.

One point worth noting with the Freud set (and many others share this) is that the glue joint shows up when the panel is raised **(Fig. 10)**. Matching the color and grain of the stock can reduce the visual impact of the joint. Staining also has a strong impact.

ASSEMBLING THE FRAME AND PANEL

Dry-fit all the parts frequently throughout the milling process. It's a good idea to pre-finish panels before assembly, because they will shrink and expand over the years. Applying stain and finish after assembly means that a small, unfinished area will eventually show up around the edge during a periodical shrinkage (usually in winter).

Space Balls® have been around a few years, and they are specifically designed for frame and panel construction. These small foam balls are very inexpensive, and eight or 10 are used in each assembly **(Fig. 11)**. They position the panel evenly in the frame, stop it from rattling, absorb the panel's expansion by compressing, and expand themselves when the panel shrinks.

After applying glue to the corners of the frame (don't glue the panel as it needs to be able to move), measure diagonally from opposite corners to make sure the frame is square as you tighten the clamps. The diagonal measurements should be identical. Check also that your assembly is flat.

EDGE TREATMENT

The Freud UC-900 door set comes with one final cutter, a door edge treatment. This cutter mills a quarter-round profile on the front edge of the glued-up and trimmed door, and simultaneously creates a small rabbet on the back **(Fig. 12)**. This rabbet allows the door to sit into the cabinet face frame: the back half of the door is inset, while the front half is overlaid on the face frame. A slight angle on the rabbet ensures an easy fit. This decorative treatment


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has the added advantage of creating a fairly tight seal on cabinet doors, reducing dust.

Test the setup of the bit on scrap that is the exact same thickness as your stile and rail stock, before milling the edge **(Fig. 13)**. Note that in the back of most doors, the panel will be shy of the frame. Professional cabinet shops often have a selection of ⅛" thick inserts available, so the panel doesn't drop unexpectedly as it crosses the edge of the table. Another solution is to add a temporary addition to the tabletop, making it large enough to support the entire door. Whichever way you decide to go, mill the ends first (across the grain), and then the sides (with the grain).

FINAL THOUGHTS

Making doors with a shaper is a great idea if there are more than a couple of doors required. It takes quite a bit of time to set up a shaper, so economies of scale come into play. The more doors that are made with each setup, the better. Other options such as a vertical panel raising bit in a large router table may be quicker for one, or even two doors. However, shapers produce a smoother, more finished and more chatter-free cut than any other milling method. The power of the motor also means that fewer incremental cuts (passes) are required. Quality cutters such as the Freud UC-900 door set come with thick carbide for long life, and they are designed with anti-kickback features that reduce inherent risks. Having a single manufacturer provide all of the cutters ensures a better fit, and being able to buy the UC-900 set with different panel profiles offers some level of customization.

Dust collection is essential with a shaper. Because of its aggressive cutting ability, the machine produces vast quantities of shavings. Large panel raising cutters require slower speeds than the smaller stile and rail ones, so a two-speed shaper is pretty much essential. With such a wide tool (the EC-210 profile is just about 5" in diameter) a ½" arbor is undersized. The manufacturer makes it for a ¾" arbor and, even though they supply adapters for ½" spindles, this is one case where Tim "The Toolman" Taylor's philosophy holds true. Bigger is better.

—John English has written or co-authored four woodworking and how-to books, and publishes Woodezine, *an online woodworking magazine.*