

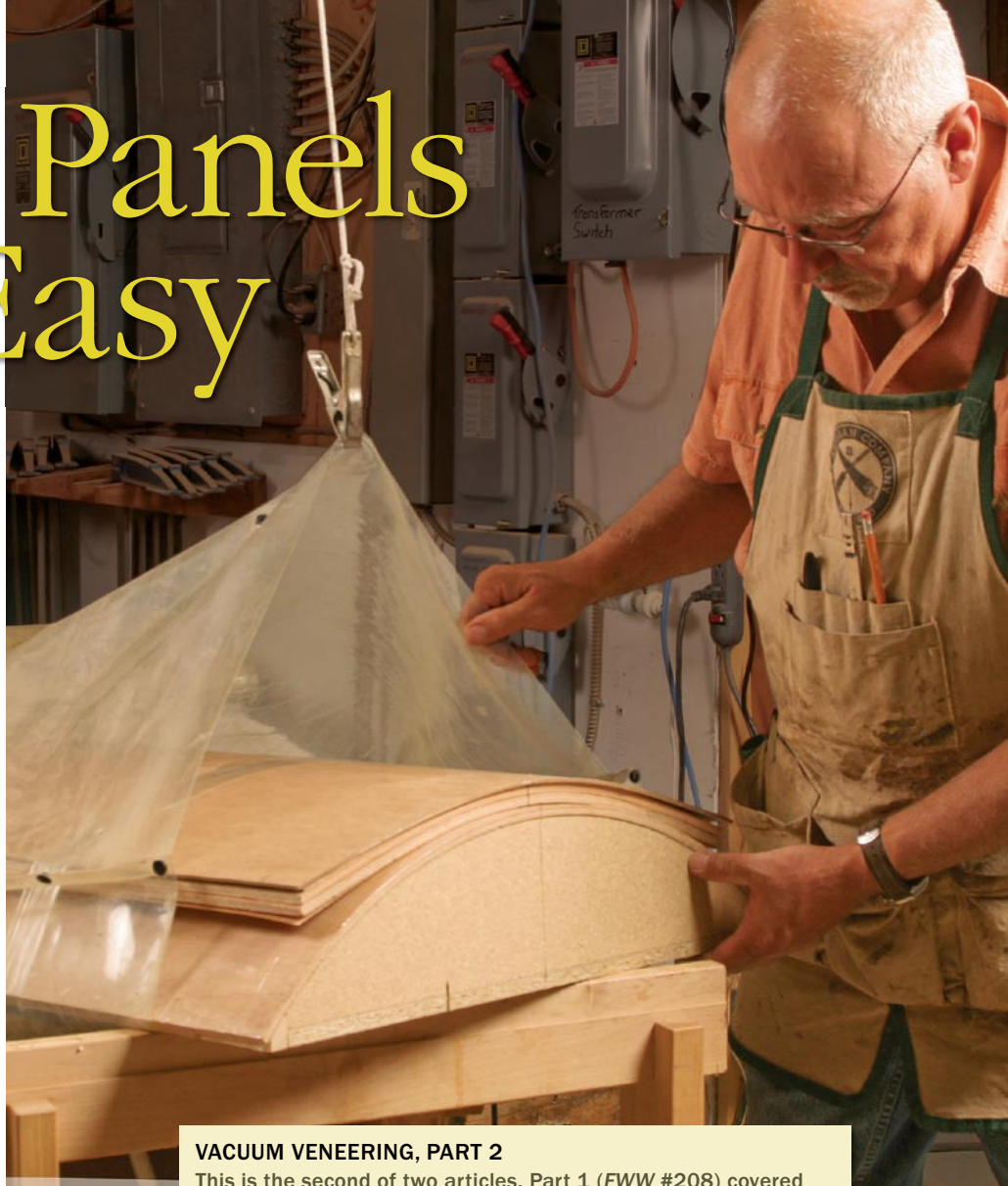
Curved Panels Made Easy

With a vacuum press and 7 tricks, beautiful panels are in the bag

BY MICHAEL C. FORTUNE

Furniture with curved panels stands out from the crowd. But common approaches to making them are imperfect. When made from solid wood, either by shaping thick planks or cooping thin staves, curved panels aren't very stable. You can make a more stable panel by laminating several thin plies between a pair of forms, because the plies are arranged at right angles to one another. However, making the perfectly mated forms is tedious, and distributing pressure evenly across them is not easy.

The answer is a vacuum-bag system. With a vacuum press, you get the stability of a laminated



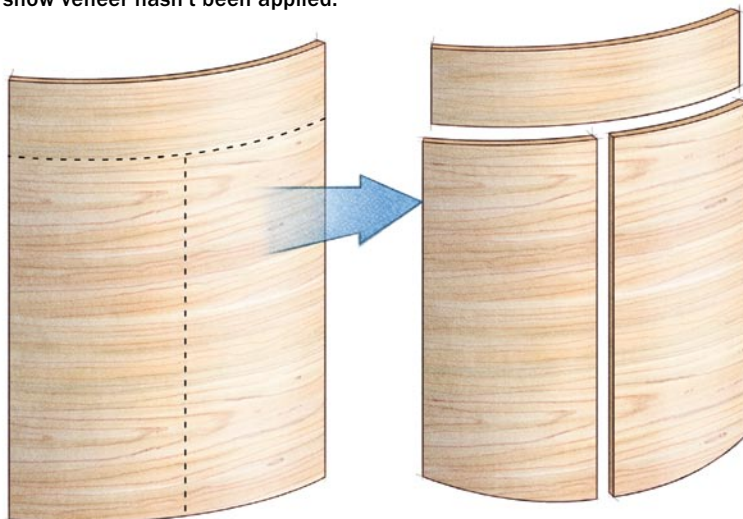
VACUUM VENEERING, PART 2

This is the second of two articles. Part 1 (FWW #208) covered choosing a vacuum-bag system and veneering a flat panel.



First trick: MAKE MULTIPLE PARTS FROM ONE CORE

To simplify the door and drawer panels for this bedside table, Fortune laminated a large core in the vacuum press and then cut out the smaller pieces. Note that the grain on the core runs horizontally because the show veneer hasn't been applied.



Trick 2: USE THE BAG TO MAKE THE FORM

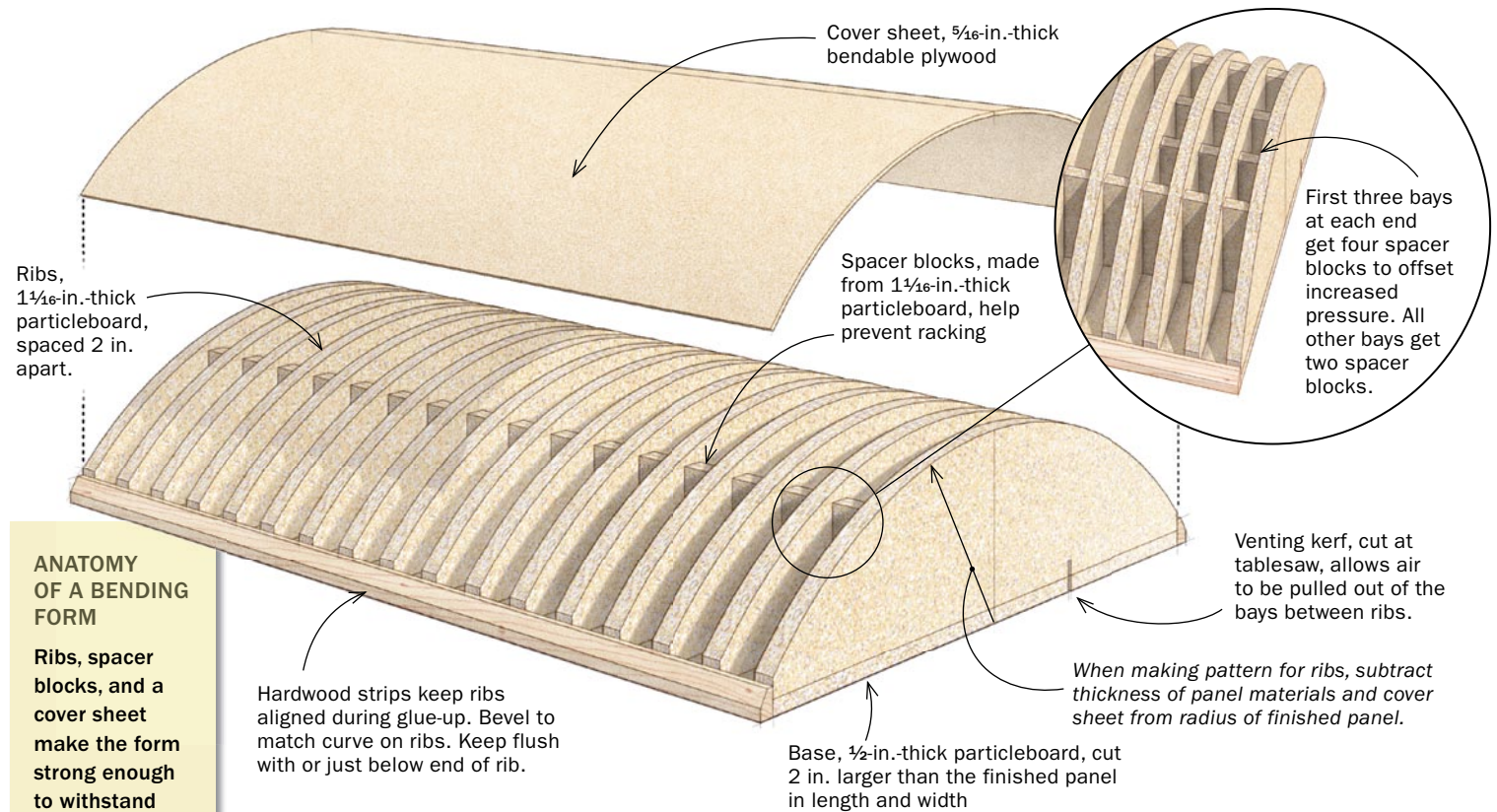
Curved panels require a ribbed bending form, designed to hold its shape under the extreme pressure of the vacuum press. Glue up the entire form at once in the bag to create even pressure and a uniform surface, which is necessary to get a strong bond between the panel plies.



Beveled strips keep ribs aligned on the base. If not held in place on both sides, the ribs will slide out of alignment in the vacuum bag.



Pattern jig creates matching ribs. Fortune cuts his pattern oversize, then adds a fence and some toggle clamps to make routing the ribs quick, safe, and accurate.



ANATOMY OF A BENDING FORM

Ribs, spacer blocks, and a cover sheet make the form strong enough to withstand the vacuum's pressure.

panel but need only one form, and the press applies pressure evenly across the entire panel.

Most of my work is curved, and I've refined my techniques for making the form and panel. My methods are not difficult, and they allow you to pursue exciting design possibilities. I won't cover the basics of buying and setting up a vacuum-bag system. That was covered in Part 1 ("A Vacuum Press Makes Veneering Easy," *FWW* #208).

Simple materials work for most panels

Except for the edge-banding, a laminated curved panel is made up of glue, a core, and show veneer.

Titebond Cold Press for Veneer glue is great for laminating because it remains workable long enough to lay up the panel and get it in the bag. It's also non-toxic, inexpensive, and flexible enough to accommodate the movement of the plies. However, when the show veneers are arranged decoratively, as with parquetry,



Outer ribs come first. *Glued and clamped manually, these prevent the other ribs and spacer blocks from sliding toward the ends of the form.*



Add the inner ribs. *The ribs are 2 in. apart. Spacer blocks hold them perpendicular to the base.*

the pieces are taped together and the grain can run in various directions. In these situations, I use Unibond 800 because its alcohol base greatly reduces the risk of the individual pieces rolling up or moving about.

Bendable plywood (also known as wiggle wood) is usually my first choice for the structural plies. It is extremely flexible: Pieces $\frac{3}{16}$ in. thick can be bent to a radius as tight as 10 in.; $\frac{5}{16}$ -in.-thick pieces bend to a 14-in. radius. This material has three plies: a very thin inner ply sandwiched between two thicker plies. The grain on the outer plies runs in the same direction, which is why bendable plywood is so flexible. But you don't want a floppy panel, so you add structural plies of veneer, laminated at a right angle to the grain direction on the outer plies of the bendable plywood, to lock it in the desired curve and make the panel stable. If the grain on the veneer and bendable plywood ran in the same direction, the panel would look like a potato chip.

However, if the curved panel will be supporting any significant weight, like a chair seat would, use lauan rather than bendable plywood. Lauan isn't as light or flexible, but it is stronger.

Bending form needs to be strong

I use my bending forms to laminate and square the panel core, and to apply show veneer to the outside curve of the panel. Vacuum presses apply tremendous pressure from every direction. To prevent the bending form from collapsing, I make it by gluing a series of ribs, reinforced with spacer blocks, to a flat base, and then covering the ribs with a sheet of bendable plywood. I use $\frac{1}{2}$ -in.-thick particleboard for the base and $1\frac{1}{16}$ -in.-thick particleboard for the ribs and



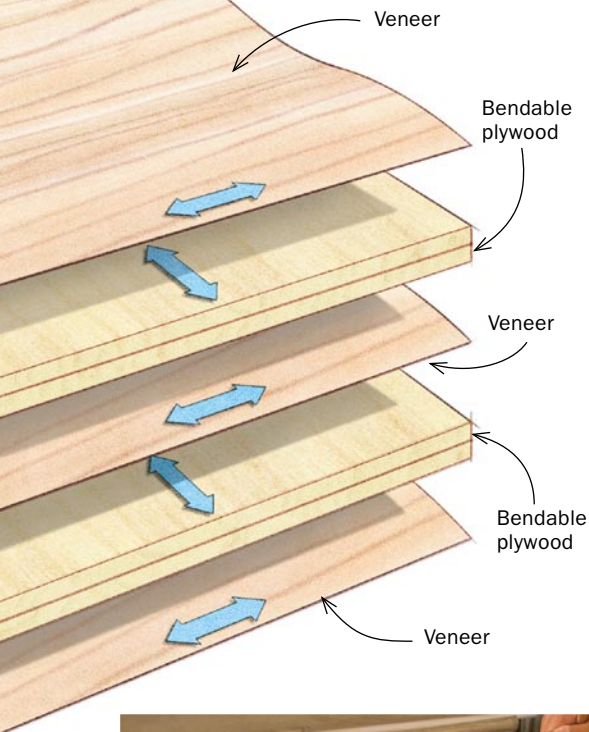
In the bag. *The press applies uniform pressure from all directions, so there won't be any bumps in the form. Leave it in the bag overnight.*



Packing tape keeps the glue off the form. Also, mark a centerline and use it as a reference to align all the plies on the form.

Trick 3: CROSS-GRAIN SANDWICH MAKES A RIGID CORE

Three pieces of veneer run across the grain of the bendable plywood, locking it into the desired curve and stabilizing the core. You'll add the face veneers later.



Spread glue on the plywood only. Moisture in the glue would curl the veneer if applied directly to it. Fortune uses a notched spreader to get a thin, even coat.



Thin caul spreads pressure. A 1/8-in.-thick piece of hardboard keeps the top veneer flat. Cut it oversize to hold plies tight to one another at the edges of the panel.

spacers. To get a panel that is smooth and symmetrical, all of the ribs must be identical, so make a pattern of the curve and then rout the ribs flush to it. Glue a strip of hardwood, beveled to match the curve of the ribs, to either side of the form's base. Then, glue in a rib at each end of the base.

Before gluing on the remaining ribs, use the table-saw to cut a kerf through the base along its length and to one side of the center. This kerf allows air to be pulled out of the form's interior by the vacuum press, ensuring that the ribs and cover sheet receive uniform pressure. Use the vacuum press itself to glue in the remaining ribs, the spacers, and the cover sheet. The press applies even pressure from every direction, producing a smooth and uniform curve—impossible to achieve if you use clamps to glue the ribs in place.

Let the form sit in the bag overnight. When you take it out, draw a centerline down the cover sheet, and then apply clear packing tape over the entire surface to prevent glue from sticking to the form.

Laminate the core and apply the edging

I laminate curved panels in three steps. First, I make the panel's core. Then I band the core's edges with solid hardwood. I apply the show veneers last.

To make a 3/4-in.-thick panel core, you'll need two pieces of 5/16-in.-thick bendable plywood and three pieces of veneer. One piece of veneer is glued between the bendable plywood, the other two to the outside faces. Cut the bendable plywood and veneer about 1 in. oversize in length and width. Mark a centerline on the ends. Spread the glue on the plywood. If you spread glue on the veneer, it will roll up like a



Keep panel core on centerline. Fortune aligns the bendable plywood, veneer, and cover sheet on the form's centerline, holding them in place with packing tape, to ensure that the panel has a symmetrical curve.

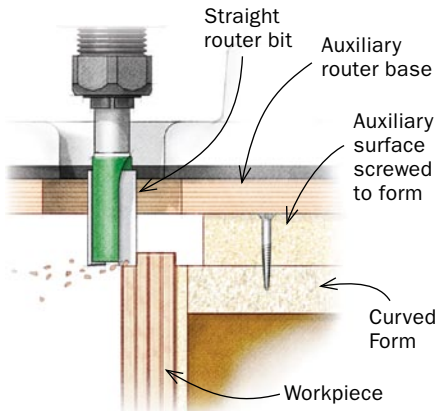
WHERE TO FIND BENDABLE PLYWOOD

Bendable plywood, also known as wiggly wood, flexply, and wacky wood, can be found at local plywood and lumber dealers. If it's not in stock, the dealer should be able to order it for you.



Trick 4: USE THE SAME FORM TO TRIM THE ENDS

Bonus: The bending form becomes a router jig for trimming the curved ends of the core.



Attach an auxiliary surface to the form. Running the router on it allows you to move the panel up past the edge of the form, which in turn keeps the spinning bit from damaging it. To avoid tearout, work around the outside of the panel rather than trimming the full width in one pass. A long auxiliary base helps Fortune balance the router.



Trick 5: DIGITAL GAUGE DIALS IN THE EDGES

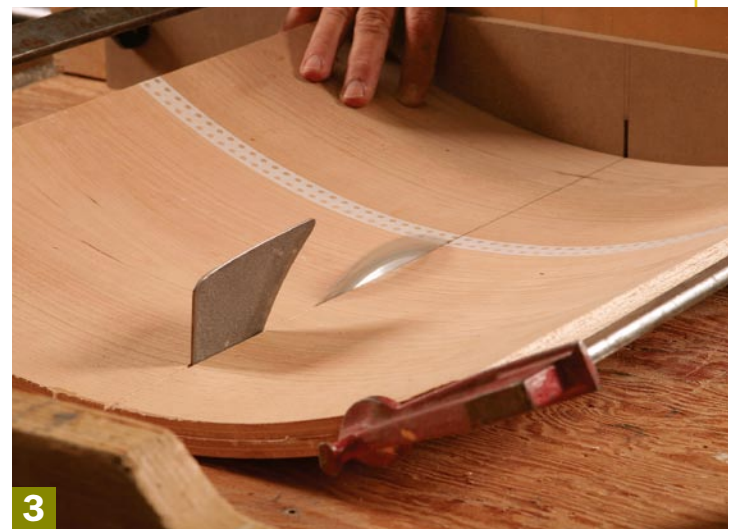
Use a digital angle gauge to ensure the tablesaw cuts are square to the panel's faces.

1 Square edges at the tablesaw.

Fortune uses a Wixey angle gauge to set the edges flat on a crosscut sled (right). The pencil line marks the finished edge of the panel. Support the underside with a block of wood, clamp the panel in place, and make the cut. The edge will be square to the face of the panel.



2 Cut out the drawer front. The safest way to separate the drawer front is at the bandsaw. A steady hand, well-set-up bandsaw, and sharp blade will give a clean and straight edge.

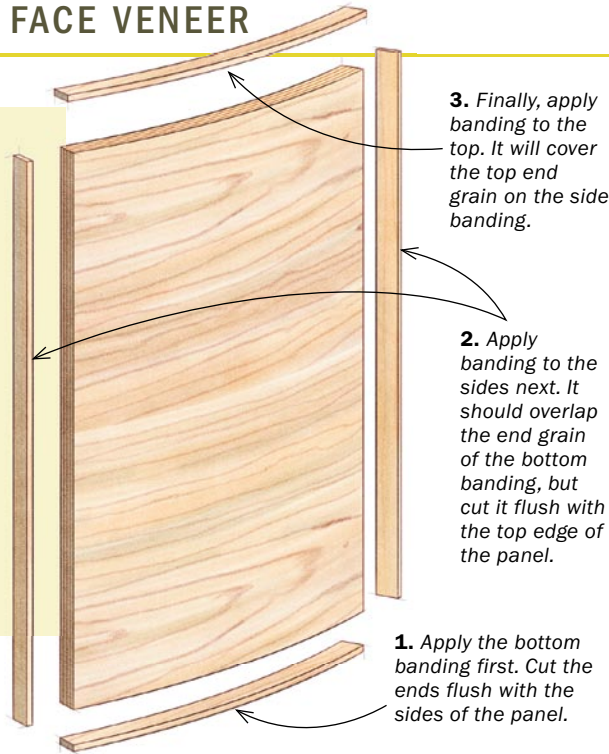


3 Cut the panel to make doors. Fortune again used a Wixey angle gauge, this time straddling the centerline, to adjust the panel so that the cut is square to the faces of the panel.

Trick 6: BAND EDGES BEFORE GLUING ON FACE VENEER

TIP HIDE END GRAIN WITH SMART BANDING

Mitered edge-banding hides its own end grain, but it is tricky to apply. Use butt joints instead, starting with the bottom piece. Unless you go in for a close inspection, the end grain won't be noticeable.



tube. After spreading the glue and stacking the plies, top off everything with a 1/8-in.-thick hardboard cover sheet, 1/4 in. larger all around than the panel core plies. The cover sheet should have a centerline marked on its face and two ends.

Place everything on the form, aligning all the centerlines. Use packing tape to hold the core and cover sheet to the form. Seal everything inside the bag and turn on the vacuum press. As the bag is pulled tight around the form, make sure it doesn't get caught under the panel core. Titebond Cold Press for Veneer glue needs just a few hours in the bag. Unibond 800 should be left in overnight.

After you take the form and panel core out of the bag, let them sit for an hour or two to let any remaining moisture from the glue dissipate. Then square up the panel core. I square the curved ends with a router and the straight edges at the tablesaw.

After the core is square, glue on the edge-banding. I glue on the piece that will be least visible first and the one that will be most visible last, which minimizes the amount of visible end grain. Keep the edging no more than 1/8 in. thick. If it's any thicker, there will be differences in wood movement between the solid-wood

BANDING THE ENDS



Cut out curved banding. In most cases that's all you need, but if the banding will be highly visible, like on the top of a drawer, you can laminate it from thin plies (and rip it into thin strips), so the grain follows the curve. Glue banding on the bottom first, using a caul to apply even pressure across its full width and length. Rout the banding flush. To prevent tearout, start in the middle and work down the curve.



BANDING THE EDGES



Tape instead of clamps. Because the panel is curved, clamping across it can be tricky. Instead, place a caul over the banding and use tape to apply pressure.

Trick 7: FACE VENEERS GO ON ONE AT A TIME

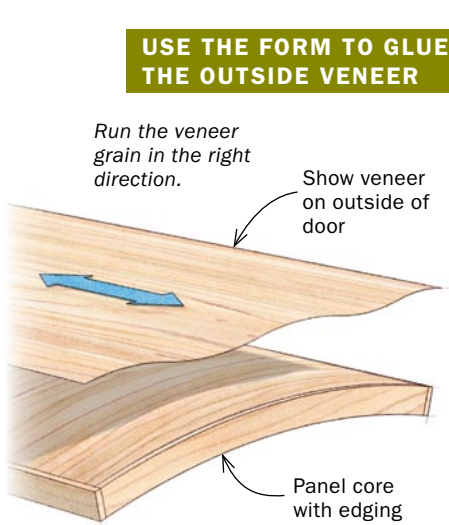
Veneer for the outside of the curve can be done with the form, but for the inside, do away with the form and press the veneer directly to the panel.

USE THE FORM TO GLUE THE OUTSIDE VENEER

Run the veneer grain in the right direction.

Show veneer on outside of door

Panel core with edging



Fence in the panel. The process is much the same as it was for the panel core, but this time nail small fences on each side of the door panel to hold it in place, and use a 1/8-in.-thick hardboard cover sheet.

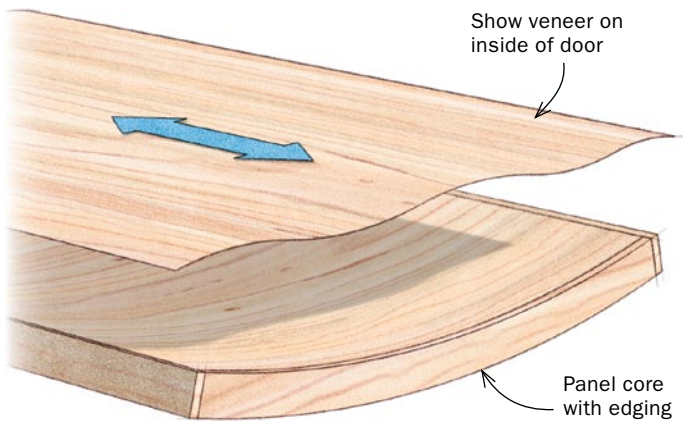


Trim the veneer. Use a utility knife or razor blade to cut away any overhanging veneer. Cut with the grain, and keep the blade angled slightly away from the panel.

NO FORM NEEDED ON INSIDE VENEER

Show veneer on inside of door

Panel core with edging



No form needed. The panel is strong enough to hold its shape while the veneer is pressed into the curve. Tape a cover sheet over the veneer.

banding and the laminated panel, and the glue line between the two will be noticeable.

Apply show veneers one at a time

The show veneers must be applied in two steps. The outside curve can be done using the form, but the inside curve might not match the form perfectly. Any gaps between the inside curve and the form will leave bubbles between the panel core and show veneer. Fortunately, the core is strong enough to hold its shape under the pressure. So you can just flip the panel, concave side up, and the bag will mold the veneer to it. Each show veneer needs about 45 minutes in the bag. After the veneers have been glued in place, chamfer the edges of the panel to hide the glue line between the show veneers and the banding. □

Michael Fortune (www.michaelfortune.com) designs and builds furniture near Peterborough, Ont., Canada.



Create suction without a platen. A piece of gutter guard helps air to escape the bag, and a small block connects to the air hose. The grooves in the bottom of the block provide channels that allow the air to escape. After attaching the press's hose, turn it on. The bag will pull tight around all of the panel's surfaces.