

Clean and Contemporary Floating Shelves

Torsion box and angle brackets make them light, strong, and simple to assemble

BY TONY O'MALLEY



Wall shelves are traditionally mounted with wooden brackets or corbels. Eliminating these will give you a modern, uncluttered look, but the trick becomes how to mount the shelves. While simple hardware kits may work for shallow shelves, say 6 in. or less, they're fussy to align, and I don't trust them for bigger, heavier applications. So I take an approach that's more reliable: a torsion-box shelf that conceals angle brackets screwed to a mounting ledger.

The first key is to make the shelves as lightweight as possible. This is where torsion-box construction comes in. A torsion box is a grid of core material with a thin skin glued to each face. A hollow-core door is a common example. Because of the counterbalancing forces of the two





EASY-TO-MAKE DESIGN

With torsion-box construction, these shelves look good, stay flat, and can be built and installed in a weekend.

6-in. angle brackets screwed to ledger and gapped away from blocking

Ledger, 1 in. thick by 1 7/8 in. wide by 42 1/4 in. long

Ledger gets slightly shortened to give extra room when fitting.

Solid-wood edging, 3/4 in. thick

3/4-in. plywood for shelf faces

Top of brackets flush with top of ledger

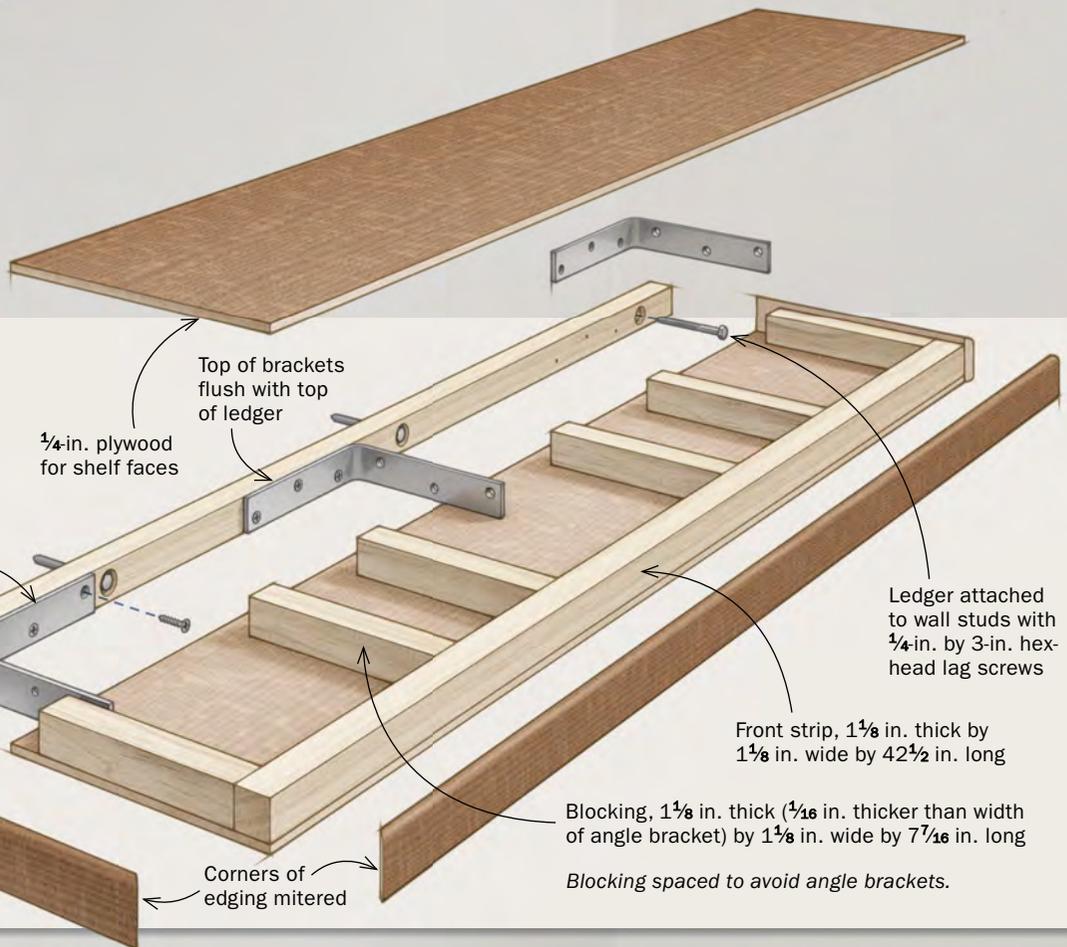
Ledger attached to wall studs with 3/4-in. by 3-in. hex-head lag screws

Front strip, 1 1/8 in. thick by 1 1/8 in. wide by 42 1/2 in. long

Blocking, 1 1/8 in. thick (1/16 in. thicker than width of angle bracket) by 1 1/8 in. wide by 7 7/16 in. long

Blocking spaced to avoid angle brackets.

Corners of edging mitered



Start with the skeleton

Mark stud locations. For strength, it's best that you secure the shelf to studs. Use a stud finder to locate the studs and mark the locations with low-stick tape. Then hold the ledger against the wall and transfer the marks. These are where you'll drive lag bolts to secure the strip to the wall.



Screw angle brackets to the rear ledger. O'Malley uses 1-in. screws, making sure to place the brackets clear of the stud locations and end blocking.



skins glued to the same internal grid, a torsion box can be remarkably light and yet exceptionally strong, even with little or no joinery between the grid members. An added benefit of this construction is that a torsion box, if made properly, will be perfectly flat and stay that way. And importantly for these shelves, the interior is mostly hollow, allowing for a support system beefier and more adaptable than the store-bought shelf hardware I mentioned earlier. I use standard angle brackets screwed to a wooden ledger and position the grid to allow the shelf to slide over the ledger assembly once the latter is secured to the wall. This system will work with shelves of any length, as well as larger mantels.

Tack front strip to the blocking. Clamp the front strip to the rear ledger assembly to see where to place the blocking. 18-ga. pin nails are all the joinery you need here because the shelf's skin will be glued to the frame, creating a very rigid structure.



Add the skins



Glue and tack plywood skins to the top and bottom. Make the skins overwide and long so you can flush them up later. Add glue to the blocking and front strip only. Attach the skins with 23-ga. pin nails at the corners to prevent them from moving as you handle the assembly and, later, when you clamp it up.



Wax ledge before inserting into shelf. O'Malley likes to have the ledger assembly in place when gluing the skins to the core, so he wipes on a layer of wax in case any glue creeps onto it.



I used poplar for the core, skinned it top and bottom with $\frac{1}{4}$ -in.-thick quartersawn oak plywood, and edged the assembly with solid oak, also quartersawn.

Torsion box makes for good bones

The width of the metal brackets determines the thickness of the grid stock, so have the brackets on hand before you begin. Mill the ledger, front strip, and blocking slightly beefier than the angle brackets. I used 6-in. angle brackets here. They are slightly over 1 in. wide, so I made this shelf's poplar grid pieces $1\frac{1}{8}$ in. thick.

Attaching the ledger securely to the wall is critical. The ledger determines both how strong your shelf will be and how you'll organize the inside of the torsion box, so lay out the attachment points for it early



Clamp using flat cauls. To distribute clamping pressure and ensure the shelf is flat, O'Malley uses a flat torsion box for the bottom caul and two pieces of $\frac{3}{4}$ -in. plywood for the top. Using cauls about the same width as the shelf makes it easier to get clamps along both sides of the assembly.

Trim to size



Flush up the front. Use a bottom-bearing, flush-trimming bit to make the front edges of the skins perfectly in line with the front strip. Finish by hand-sanding.



Rip the shelf to width. This guarantees the front and back edges are parallel. Be sure to remove the ledger assembly first.



Cut to length. This ensures the ends are square, which will make adding the mitered edge-banding easier. Blue tape helps to limit chipout.



Shortened ledger gives wiggle room at installation. You want a little room for lateral adjustment, so trim $\frac{1}{8}$ in. or so off each end of the ledger.

on. While you can use toggle bolts or other anchors, screwing the ledger directly to wood studs is best. So locate the studs and mark them on the ledger. I planned the shelf length to hit three studs. On shorter shelves, two is adequate.

With the stud locations marked on the ledger, attach the angle brackets to it, flush to the top edge.

The placement of the angle brackets on the ledger dictates the layout of the blocking, which gets nailed to the front strip. Make the blocking pieces at least a little bit longer than the brackets to keep the shelf from bottoming out on the brackets. With 6-in. brackets, like I use here, I'm comfortable building a shelf up to 11 in.

wide. For wider shelves, I'd step up to an 8-in. angle bracket—which also results in a thicker shelf because the angle brackets are wider.

Thin skin adds rigidity

The $\frac{1}{4}$ -in.-thick plywood top and bottom skins are next. Glue these pieces on before attaching the mitered edging. At this stage, the skins should be about $\frac{1}{8}$ in. over their final width and length. This extra material leaves a cleanup allowance that you'll trim flush later. If the wall isn't flat where you're attaching the shelf, add another $\frac{1}{4}$ in. to the width of the skin and let it overhang the back of the ledger to allow for scribing.

In addition to a bunch of clamps, use wide, stout, flat cauls to distribute clamp-

Apply the edging



Start by gluing on the end edging. After applying glue, O'Malley tapes the end pieces in place so they don't slide around when he aligns the cauls and clamps. Thick cauls, which help distribute clamping pressure, are faced with packing tape to make sure no glue sticks to them.

ing pressure and keep the assembly flat. I use a portable bench plank—another torsion box—as a caul on the bottom and two pieces of $\frac{3}{4}$ -in. plywood on top. When the glue is dry, countersink the brads and then clean up the shelf's front edge with a sanding block or flush-trimming bit. Next, rip the back edges on the tablesaw. Square up the shelf's ends there too.

Now you can tackle the edging. Mill solid stock $\frac{1}{4}$ in. thick and about $\frac{1}{16}$ in. wider than the shelf is thick to leave yourself a cleanup allowance. I made the edging as thin as is practical to avoid interfering with the quartersawn pattern on the plywood's faces.

To make the edging strips even less evident, I miter them where they meet. I use a zero-clearance plywood fence on my miter saw when cutting thin stock like this. After spreading glue on both end strips, hold them in place with masking tape as you position the long clamps. To protect the strips and distribute clamping pressure, I use cauls covered with clear packaging tape, which keeps them from sticking to the edging. Then miter and attach the front piece of edging.

After letting the glue dry, carefully plane and sand the edging flush with the veneer. (I also sometimes use a flush-trim router, but there's a risk of tearout depending on the trim's grain.) To wrap things up, I rout a $\frac{1}{4}$ -in. radius on the edges.



Lift and clamp. Elevating the assembly on extra blocking, along with the thick cauls, provides for even clamping pressure. You want to see a thin bead of squeeze-out around the joint.



Now for the front. Again, use tape and cauls to help with the glue-up. Orienting the shelf faceup lets you use the bench as a clamping surface. Keep an eye on both miters to ensure neither has opened.



Flush up the edging. Remove the bulk of the waste with a small handplane or block plane before finishing with sandpaper. Take care not to blow out the miters or damage the plywood's thin face veneer.

Install on the wall



Check for level side to side. For now, attach the ledger to the wall using only the center lag screw. This lets you adjust for level from side to side before driving the rest of the screws.



And then level front to back. If the shelf's significantly out of level, loosen the screws a little and slide a fine tapered shim near each to fix it.

What to do if your wall's not flat. To make the back of the shelf sit flush against a wavy wall, O'Malley registers a flat face of a sharp pencil against the wall while transferring its top and bottom contour to the shelf. He then uses a block plane to shave to that line.



Hidden screws for security. Lock the shelf to the ledger with a small screw at each end. You want this to be hidden, so drive it through the bottom face.



Hanging the shelf

With the shelf built, it's time to mount it, being sure to keep it level from side to side and front to back. For strength, I recommend using lag screws, counterboring the ledger to slightly recess the heads. However, you should use the appropriate fasteners for your wall material—for example, Tapcon screws on masonry walls.

Slide the shelf onto the ledger assembly and check the fit along the wall. If your walls are crooked and you need to scribe the back of the shelf, now's the time.

To secure the shelves in place, I drive a couple of small, well-placed, hidden screws into the ledger strip from the bottom along the back edge. A few brads would work just as well. □

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