Secrets to a Perfect Mitered Box

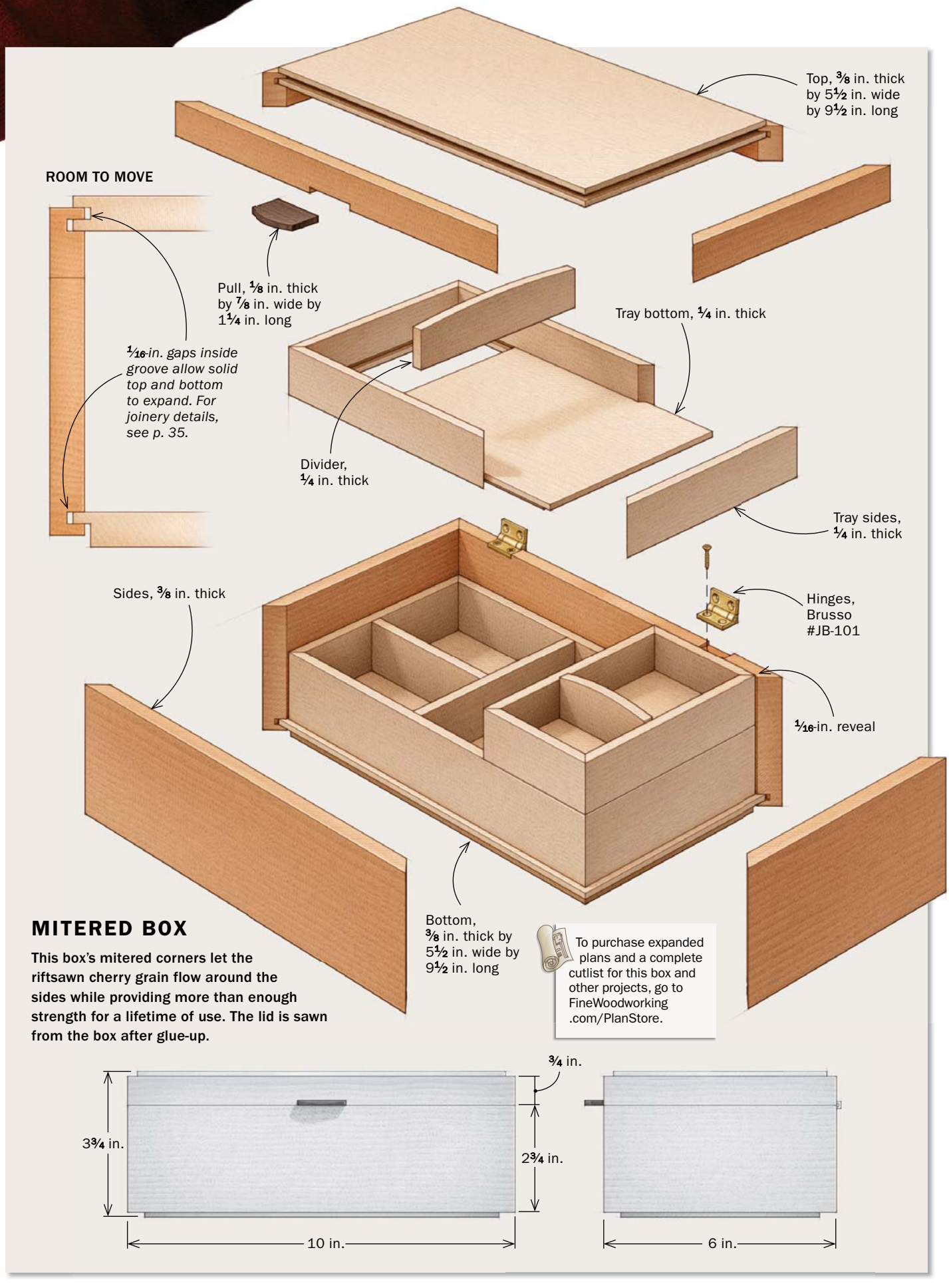
How to create a seamless grain match and gap-free joints

BY MATT KENNEY

It's not hard to make a box, but it is difficult to make a beautiful one. Mistakes are hard to hide on such a small piece, and even the tiniest ones stand out more than on a larger piece of furniture. For a box to truly sing, every detail—from the proportions to the quality of the joinery, from the wood's color to the pattern and size of its grain—must be flawless.

This box is a good example. It's well proportioned, with clean lines, tight joints, and grain lines that meet perfectly at all four corners. I also picked complementary rather than contrasting woods. For the outside,

Photo, this page: John Tetreault



Drawings: Christopher Mills

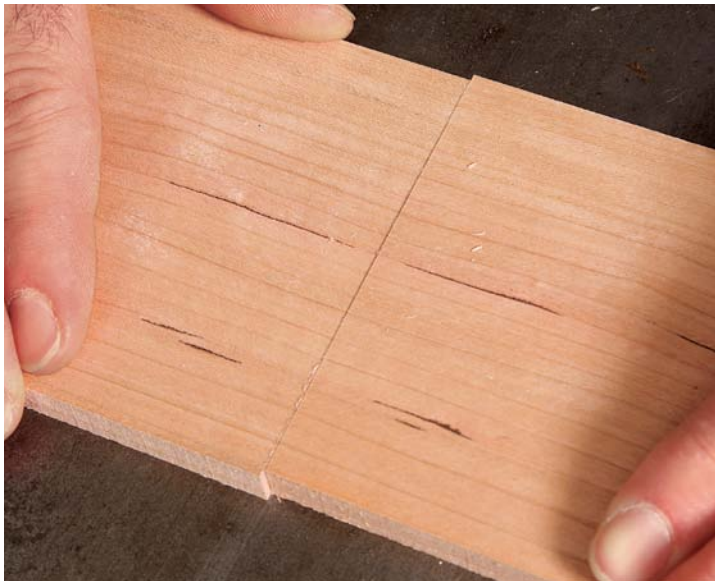
RESAW FOR A PERFECT MATCH

The match begins. *Joint one face of the 5/4 board. Put the jointed face against the fence and resaw it into two ½-in.-thick pieces. Keep track of the inside and outside faces.*

I chose riftsawn cherry to take advantage of its warm, earthy color and straight, tight grain. I used quartersawn spruce, which also has an arrow-straight grain pattern, for the top and bottom. The straight, tight grain lines work well on a piece of this size. For the pull, I decided on cocobolo with a rich brown color and visible grain that make it pop from the rest of the box.

The top itself is grooved around its edges, with its bottom lip fitting a groove in the sides. This configuration gives the top a tight fit and also reduces its visual thickness. After final assembly, the lid is cut away from the box using the bandsaw.

The box bottom is rabbeted to fit a groove in the sides and is left proud at the bottom to create a nice shadow line.



Slide to align the grain. *After jointing the inside, resawn faces, butt the two boards together with the jointed faces up (above). Slide them up and down until the grain aligns across the pieces (below).*

Remove the overhang. *With the grain aligned, the boards will overhang each other (left). Set up the tablesaw to remove the overhang from the bottom of one board. Then cut both boards to uniform width, referencing their bottoms against the fence.*

Photos, except where noted: Dillon Ryan

The interior features two levels of stacked, mitered trays. These were built using the same technique as the rest of the box.

Plan the grain carefully

To get the four-corner match, start by resawing a 5/4 cherry board into two ½-in.-thick pieces. The board should be a few inches longer than the box's final dimensions and about ¼ in. wider. The outside faces of the thick board become the inside of the box, and the freshly sawn faces become the outside. One end and the front come from one board, and the other end and the back come from the second board.

Joint the resawn faces and plane them to 1/32 in. over final thickness, removing material only from the inside faces of the box.

At this point, the grain match at the corners where the two different boards meet will be close, but not perfect. Here's how I dial it in. Lay the boards down, outside faces up, so that they butt against one another end to end. Shift one board up and down until its grain lines up with the other (see bottom left photo, opposite). One board will end up lower than the other. Trim the bottom of that board so that the bottom edges on both pieces align. Next, rip both pieces to final width, placing the bottom edges against the rip fence. Once the pieces are mitered, the grain should wrap around the box perfectly.

Cut grooves for the top and bottom

Both the top and bottom are housed in grooves. I cut them at the tablesaw, using a 24-tpi, flat-top-grind rip blade, which has a ⅛-in. kerf. Each groove is 3/16 in. deep and ⅛ in. from the edge.

Once the box sides are grooved, the only task left at the tablesaw is to run a groove along the edges of the dimensioned top, and to rabbet the bottom. The top comes first, as the fence and blade are already set to the right position. With the inside face of the top against the fence, cut the groove around the top's perimeter.

Finally, rabbet the box bottom using a dado set in the tablesaw.

The secret to seamless miters

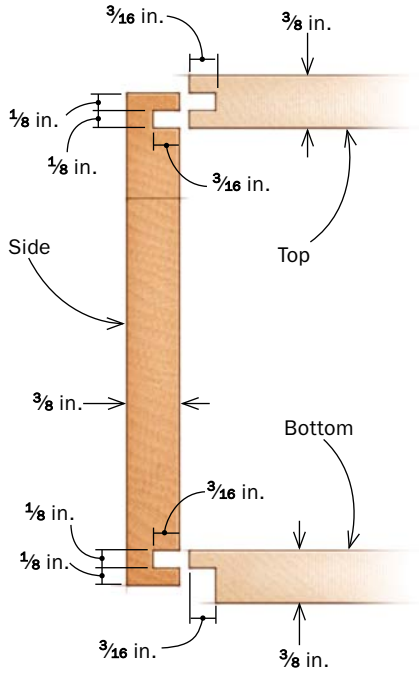
As simple a joint as a single miter is, it can be infuriating to get right. After cutting them by hand and machine a dozen different ways, I've settled on a method that gives perfect results. I cut them in two

FIT THE TOP AND BOTTOM

Cut grooves for the top and bottom. *Each groove is 3/16 in. deep by ⅛ in. wide, ⅛ in. from the edge. Use a featherboard and a push stick to ensure consistency.*

Groove the top. *With the same settings used to cut the grooves in the box sides, cut a groove around the edge of the box top. It's critical to keep the inside face of the top against the fence to ensure the two grooves mesh perfectly.*

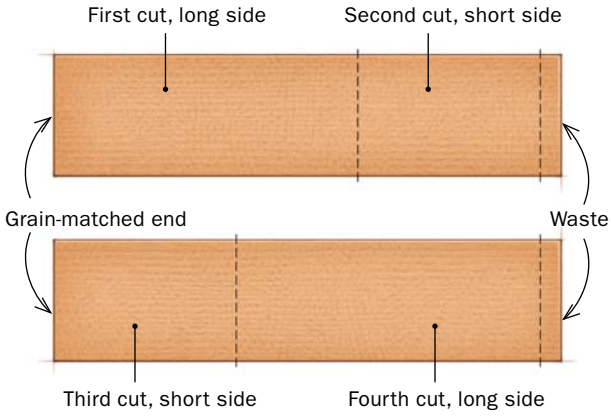
GROOVES AND TONGUES



Cut the tongue. *The bottom is rabbeted at the tablesaw to fit the grooves in the sides. Kenney uses a dado set and an auxiliary fence clamped just above the blade.*

CROSSCUT TO SIZE

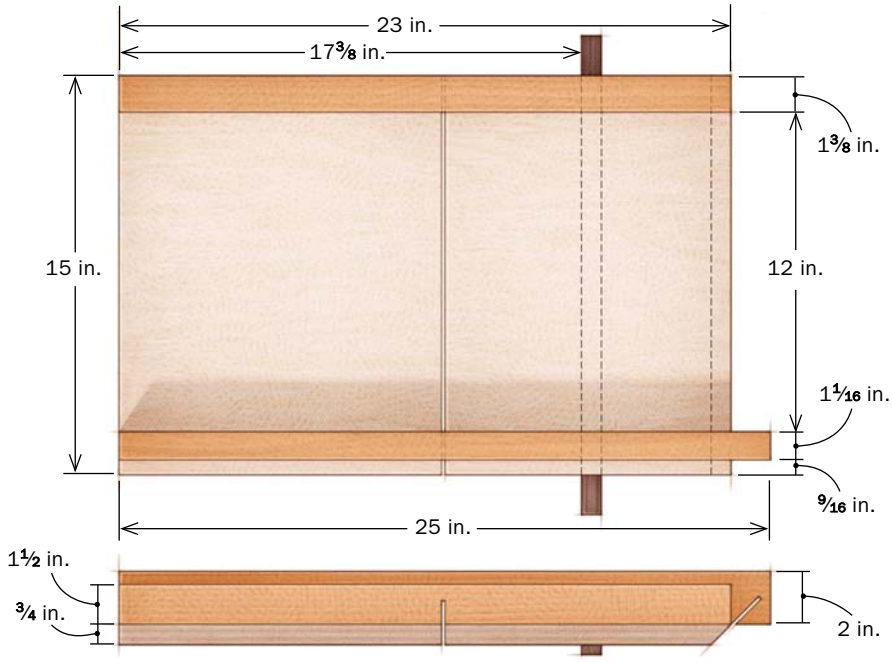
Start with a long side. *With a stop block clamped to the sled's fence, cut the first long side to length, keeping the matched grain against the stop. Leave this stop in place to cut the second long side later.*



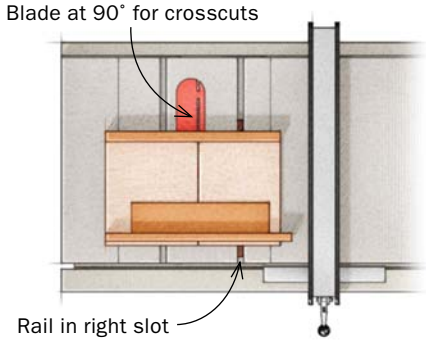
Follow with the short. *With a second stop block in place, crosscut the short piece, keeping the previously cut end against the stop. Cut the second board in the opposite order—short piece first—starting with the matched end against the stop.*

A SLED FOR CROSSCUTS AND MITERS

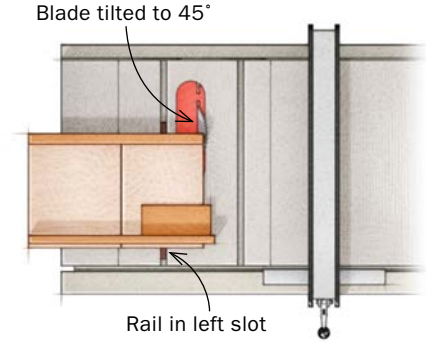
Kenney uses a single sled for both square and mitered crosscuts. The key is a single rail that can be used in either miter-gauge slot. He has a right-tilt saw; those with left-tilt saws should reverse the sides of the sled.



RIGHT SLOT FOR SQUARE CUTS



LEFT SLOT FOR MITERS



steps at the tablesaw with a sled that crosscuts and miters (see p. 36).

Begin by crosscutting the sides to final length using a stop block to ensure that parallel parts are the same length. The two boards will each yield one long and one short side. It's important to cut each board starting from the matched end to make sure the grain stays matched around the box.

Set up a stop block for the long side and put the matched end of one board against the stop. Cut the first long piece and then set up another stop to cut the short side of that board (keep the first stop in place). Use the same stop to cut the short side of the next board, placing the matched grain end against the stop. Finally, remove the stop for the short sides and cut the last long piece.

To cut the miters, tilt the blade to 45°, put the sled in the opposite miter slot, and cut a kerf in the sled fence. Set a short side on the sled and move it up until the top corner of the end is right next to the kerf. Clamp a stop block against the other end. When you make the cut, the blade will cut the miter, but won't shorten the side, which will preserve the grain match. After making the first cut, turn the side end for end and cut the second miter. Repeat for the second short side and then miter the long sides in the same way, moving the stop block as needed.

The box sides are now mitered at 45° and the components are all set for glue-up. Any inside surface should be sanded or planed and finished before moving on.

Streamlined glue-up

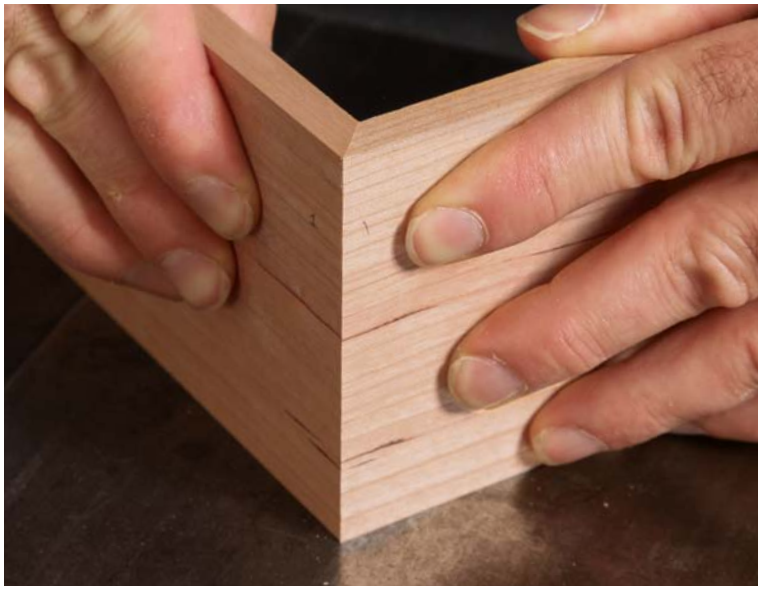
Gluing up end-grain miters on a box like this can pose some interesting issues, such as how to keep the end grain from soaking up the glue and starving the joint, or how to accurately keep pressure on all four miters while keeping the joints square.

To help avoid glue starvation, coat all of the joints with glue size using a small brush and let it dry before assembly. Glue size is a mixture of equal parts yellow glue and water that saturates and clogs the end grain. Let it dry for two hours before gluing up the box. Now, a full-strength glue spread won't wick into the end-grain fibers, and the resulting joint will be solid.

The best way to clamp a mitered box while keeping it square is with painter's tape. Lay out all four sides, miters faceup and touching, with the top and the bottom pieces within reach. Put tape on one

Bring it to the kerf. *A zero-clearance sled lets you line up the already sized box side with the kerf, no measuring required. Just be sure that the inside of the box is facedown and the upper edge is lined up just right, then clamp down a stop block to keep things in place.*

Let the waste fall. *The shopmade sled makes it easy to get a perfect miter, and the waste falls clear of the blade.*



No gap, guaranteed. *Kenney's method of cutting for length and then cutting the miter yields perfectly aligned grain across a tight miter.*

Sized end grain. *To help seal the end grain and ensure a good bond at final glue-up, apply glue size, a 50/50 water and Titebond II mix, to the mitered ends. This will fill the end grain and help avoid a glue-starved joint.*

side of the joint with enough overhang for the mating piece. With the mating piece vertical, press the mitered points together, then lay the piece flat. Now when the joint closes, the tape will stretch, keeping the joint tight and in line while the glue dries.

After the glue has dried, head to the bandsaw to cut the lid from the body. Smooth the cut surfaces by rubbing them on a piece of sandpaper that's flat on your tablesaw's table. This keeps all of the cut edges in the same plane for a seamless fit.

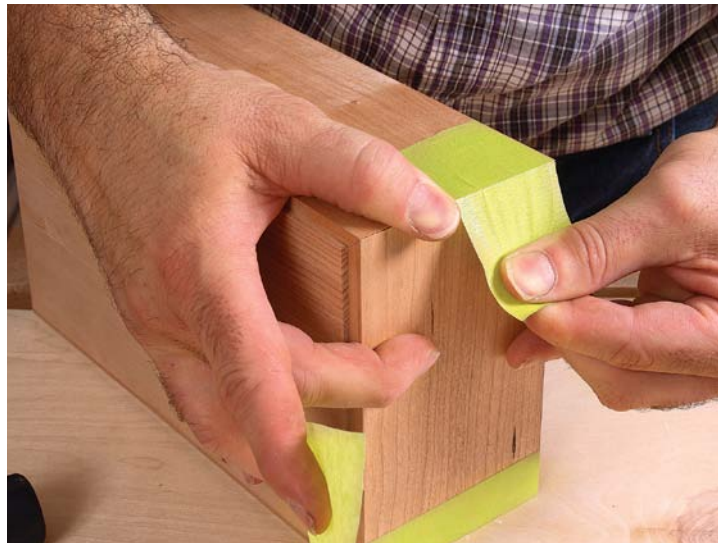
Hinge mortises are easily done

I rout the hinge mortises with a small plunge router, a bearing-guided pattern bit, and a shopmade jig. The jig has two parts: an MDF template with a notch the size of a hinge leaf and a fence that registers against

Clamping without the clamps. *Once the glue size has properly cured, painter's tape clamps the box together. With tape on a piece laid flat on the bench, place the point of the other piece's mitered edge directly onto the tape. Keeping the two miter tips tight together, lay the piece flat. This ensures the tape will be stretched over the joint, applying even pressure.*

Get to the glue. *With all the box sides taped and placed inside-face-up on the bench, carefully spread glue over all the miters except the open ends.*

Ready to be sealed. *Place the top and bottom in the grooves in the sides and fold the sides around them. Before closing the final corner, apply glue to the miter faces there.*



Stretch it tight. *To get some clamping pressure on the last corner, Kenney stretches tape over the miter.*

the side of the box. The fence fits into a groove on either face of the template, so it can be used for all four mortises.

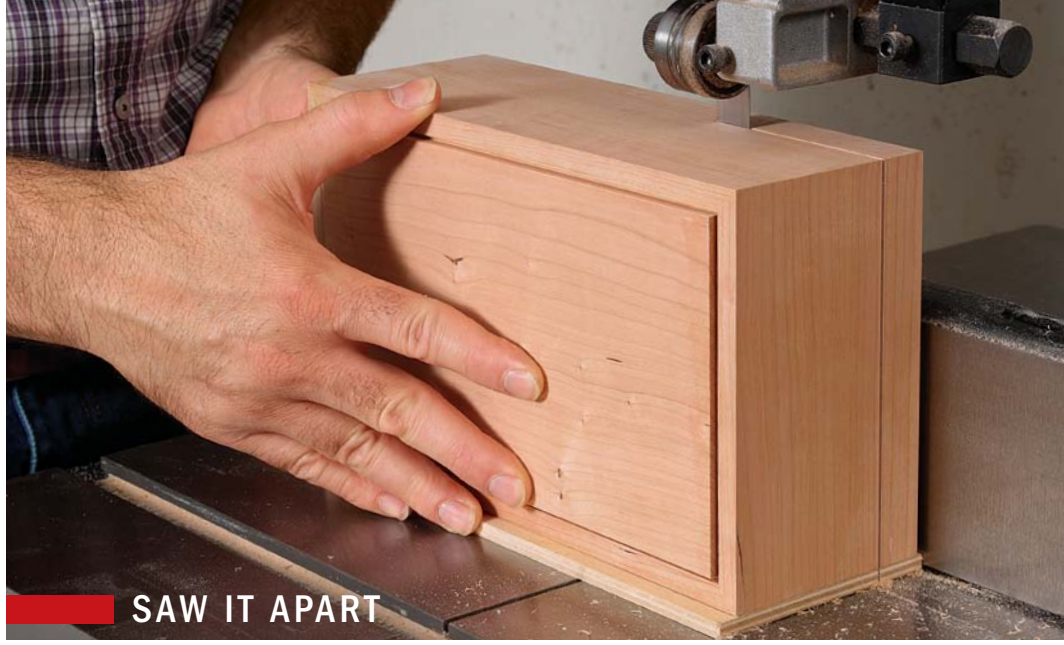
To set the router bit's cut depth, put the template on a flat surface such as your tablesaw. With the router on top, plunge the bit through the notch in the jig until it touches the table. Then put a hinge leaf on the depth stop and lower the depth stop rod onto the hinge leaf. Once locked in, this will give you the perfect depth.

To cut each mortise, simply clamp the jig to the box and rout. While the jig is still in place, use a chisel to square up the mortise corners. Repeat for the other three mortises, moving the fence when switching sides. All that's left is to install the hinges.

The finish is in sight

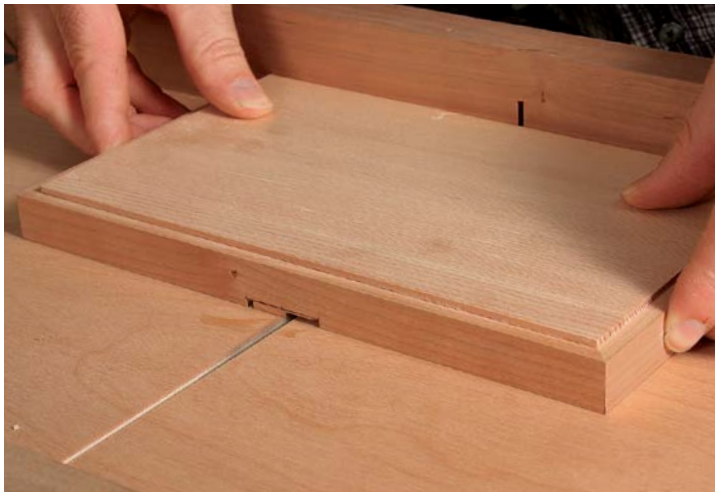
I don't like my boxes to have a thick film finish, so I use a simple finish that's half Zinsser SealCoat, half denatured alcohol. This gives the box a low-luster finish that retains the true color and feel of the wood. It dries in 5 to 10 minutes. Wipe on a coat with a clean piece of old T-shirt and let it dry. Then wet-sand it with P600-grit wet-or-dry sandpaper and mineral spirits to even out the surface. After the mineral spirits have dried, wipe on a second coat of the shellac. When dry, rub it out with Liberon ultrafine steel wool, blow off the steel-wool dust with compressed air, and apply a coat of wax for an even sheen. □

Matt Kenney is a senior editor at FWW.



Off with the top. *Saw apart the box at the bandsaw. Its thin blade minimizes loss of material and gives a tighter match from the lid to the body. Kenney uses the Wood Slicer from Highland Hardware, which is designed for resawing. A piece of thin plywood under the box helps prevent tearout.*

Smooth out the cut. *To clean up the machine marks, rub the freshly cut surfaces on a sheet of 180-grit sandpaper on the tablesaw table. To preserve the grain match, apply even pressure and take off only as much as needed.*



Notching the lid. *Notch the lid for the pull at the tablesaw using a standard crosscut sled. Cut the stopped sides first, then knock out the waste by slowly moving the lid side-to-side over the blade, advancing until the notch is clean and even.*

Perfectly fit pull. *Kenney cuts the cocobolo pull and trims it with a handplane to get a slight friction fit. He leaves it slightly thick, glues it in using cyanoacrylate glue, and planes it flush using a block plane.*