

Engineering a

How to build a case that will stay square and

A solid-wood chest of drawers is one of the great feats of furniture design, providing square, stable pockets for drawers while accommodating big swings in seasonal humidity and the resulting swelling and shrinking of every component.

For me, success means drawers you can close easily by pushing on just one corner in any season, from the muggiest summer to the driest winter. Achieving this lofty goal is the culmination of many thoughtful decisions and careful steps throughout the designing and building process. I've been studying and refining traditional construction for almost 40 years, and here I'll show you the best ways I know to make the chest itself. In the next issue, I'll finish the story, showing you how to make drawers just as efficiently, and fit them precisely to their openings.

Drawers go into tables, boxes, and more, but I'll focus here on a traditional chest of drawers with solid-wood sides. Master that, and the others are easy. I'll stick to the most common design, one with



Size drawers wisely

Part of determining the overall dimensions of a chest is mapping out the sizes and proportions of the drawers. This has everything to do with how the drawers will perform.

HEIGHT

All solid-wood drawers shrink and expand top to bottom, across the grain. If they are more than 7 in. or 8 in. high, and sized to accommodate even moderate swings in humidity, they will have large gaps at their tops when the humidity is low. These large gaps not only look bad, but they will also cause the drawer to tip forward and jam when opened.

WIDTH

Drawers that are more than twice as wide as they are deep are prone to jamming. Even closer tolerances and more care will be needed when fitting these. Narrower drawers are much more forgiving in their fit, and work better.

Chest of Drawers

stable through the seasons

BY GERALD CURRY

an overhanging top and a flat front, but I'll give options for two types of base treatments. These construction approaches will work for chests of many sizes and styles, from traditional to contemporary.

The basic idea

With solid-wood sides, tops, and bottoms, a fine chest of drawers presents two major challenges. The first is the obvious back-to-front shrinking and swelling of the case. Second, because the inside is closed off to air circulation, wide panels tend to cup inward or outward from uneven moisture exchange, potentially pinching the drawers.

The main challenge is creating the drawer pocket. The big issue here is how to install the drawer runners, which run front to back (creating a cross-grain

situation). Their length won't change much, since wood hardly expands or contracts in that direction, but the depth of the case will change significantly—moving up to $\frac{3}{8}$ in. on a typical chest at different times of the year. Traditional woodworkers dealt with this in a variety of ways, but I use web frames, a 20th-century innovation, to solve the problem.

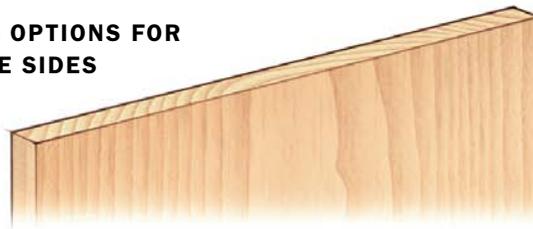
As for the case itself, one construction approach will fit the majority of your needs. On the most common type of case, with an overhanging top and a separate, bracket-style base, I use sub-rails at the top of the case and half-blind dovetails to join a solid bottom to the sides. However, if you want the case sides to extend seamlessly to the floor, forming the feet, you won't be able to attach the case bottom with standard dovetails. In this case, I use sliding dovetails, which stabilize the sides and strengthen the feet.

Gerald Curry is a professional furniture maker in Union, Maine.

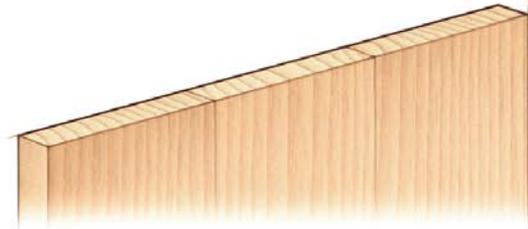
Wood selection matters

A chest of drawers is a deep cabinet, with wide pieces that will expand and contract considerably. But if you follow the methods for case construction shown in this article, you'll head off most wood-movement problems. Nevertheless, the wood species you use are also very important. For more on wood movement, see A Closer Look on p. 82.

TWO OPTIONS FOR CASE SIDES



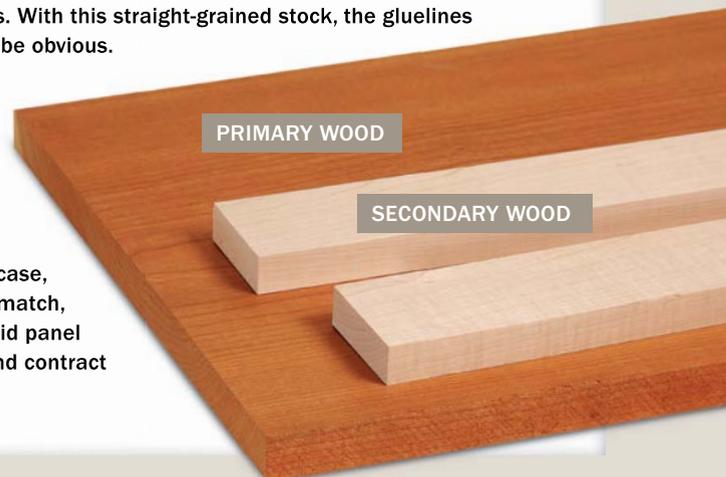
Use single, wide boards if possible for the sides and top of a case. These usually have a combination of flatsawn grain in the middle and rift-to-quartersawn near the edges, giving them a nice combination of attractive grain and stability.



For increased stability, you could go with all quartersawn wood. You won't find a single quartersawn board wide enough to make a chest side, but you can glue up several pieces. With this straight-grained stock, the gluelines won't be obvious.

USE SECONDARY WOODS BUT MATCH THE SHRINK RATE

Not all parts of a chest are visible. So to save some money, and also boost performance, you should consider making some parts from secondary woods. For the web frames, choose something durable and straight-grained, like ash, red oak, or soft maple. Poplar is OK, too, but drawers slide better on harder woods. For the big panels that form the case, however, the shrinkage rate of secondary and primary woods needs to match, at least roughly, or you risk the case side cracking. For example, the solid panel that forms the bottom is mostly secondary wood, and should expand and contract similarly to the sides and top of the case.



Case construction

There are several ways to attach a top to a chest of drawers, but I prefer to use subrails (right). This array not only lets you attach the top along its front and back edges but also at the center point of the sides, which keeps the top flat and keeps the sides from cupping inward or outward. At the bottom of the case, the construction approach varies depending on the look I want. The two methods shown below prevent the sides from cupping and help the feet withstand decades of dragging over bumpy floors.

Use subrails at the top

Like many woodworkers before me, I dovetail rails onto the top of the sides, and run kickers front to back to keep the top drawers from tipping downward when they are pulled out. The kickers are tenoned into the rails, but the tenons get no glue at all, neither front nor back, and the middle few inches of the kicker are glued and screwed to the case sides. None of the attachment holes need to be elongated to allow for wood movement. In fact, the center holes shouldn't be, so they can do their job, stabilizing the case sides.

Screw through center of kicker into top.

Screw through rails to attach top.



Two choices for bases

On a traditional chest, the bottom of the case connects to the sides with half-blind dovetails (near right). The base of the cabinet is a separate unit, attached after the case is assembled.

If you want the case sides to extend seamlessly to the floor, for a more contemporary look, you'll need to attach the case bottom another way (far right). The best method is to slide a wide panel made from the secondary wood into a long, tapered sliding dovetail. The tapered joint is self-tightening and much easier to assemble than a straight sliding dovetail, which tends to seize up on wide workpieces. Some of you might be hesitant to try it, but a tapered dovetail isn't that hard to execute, and its strength is unmatched. For a tutorial on cutting the joint, see Martin Milkovits's article in *FWW* #194 ("Quick, Sturdy Bookcase"). Last, I insert a rail at the front, just like the drawer rails above it, made of the primary wood and attached with short sliding dovetails.

However, if you are not yet ready to add a tapered slider to your arsenal, I've included an alternative approach that uses dados. It won't grip the center of the case sides quite as firmly, but it will stop them from cupping inward and pinching the drawers.

Classic bracket base

The most common way to handle the base of a chest of drawers is with a separate bracket base, fitted and attached after the case is assembled. The bracket feet can be traditional or contemporary.

Case sides, primary wood, 3/4 in. to 13/16 in. thick, typically 14 in. to 18 in. wide

Half-blind dovetails

Bottom, part secondary, part primary wood, 3/4 in. to 13/16 in. thick

Splined miter

Cut and assemble feet before gluing to frame.

Mortise-and-tenon joint

Top edge of frame is 1/8 in. to 1/4 in. proud of case.

Elongate back holes to allow movement of case bottom.

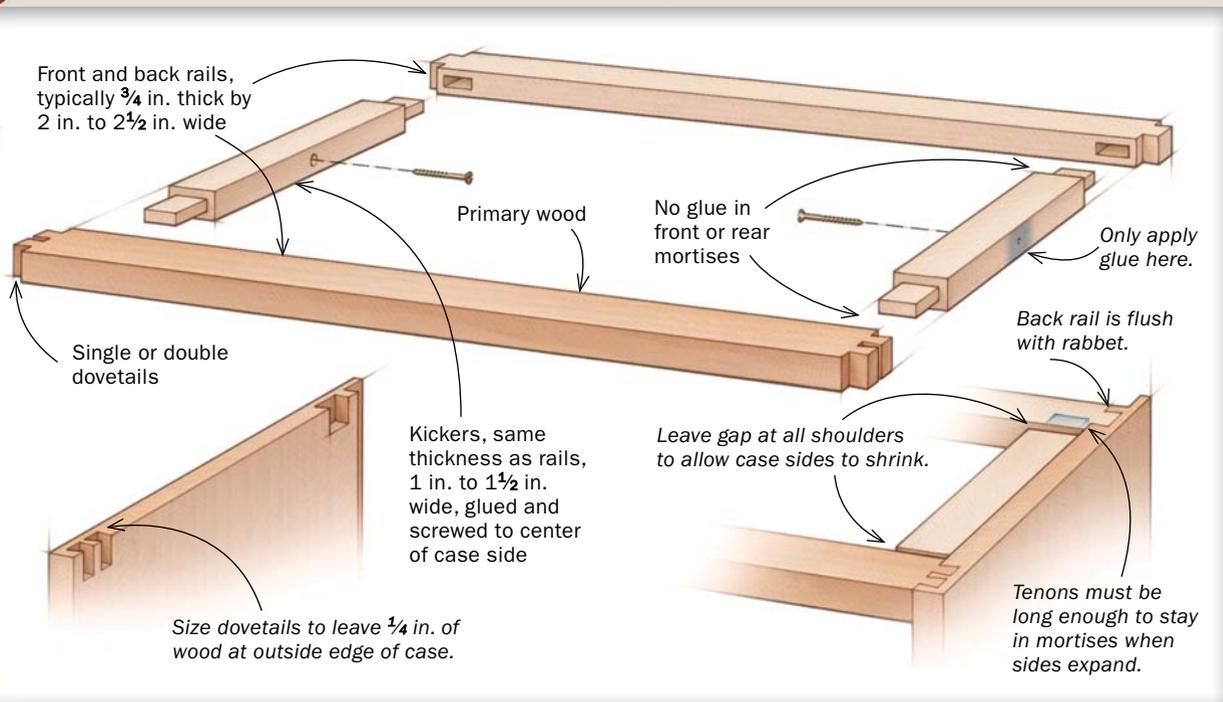
Glue together before milling.

Screw frame to case bottom after feet are attached.

Mold edges of frame before attaching feet.

CONTEMPORARY FEET

TRADITIONAL FEET

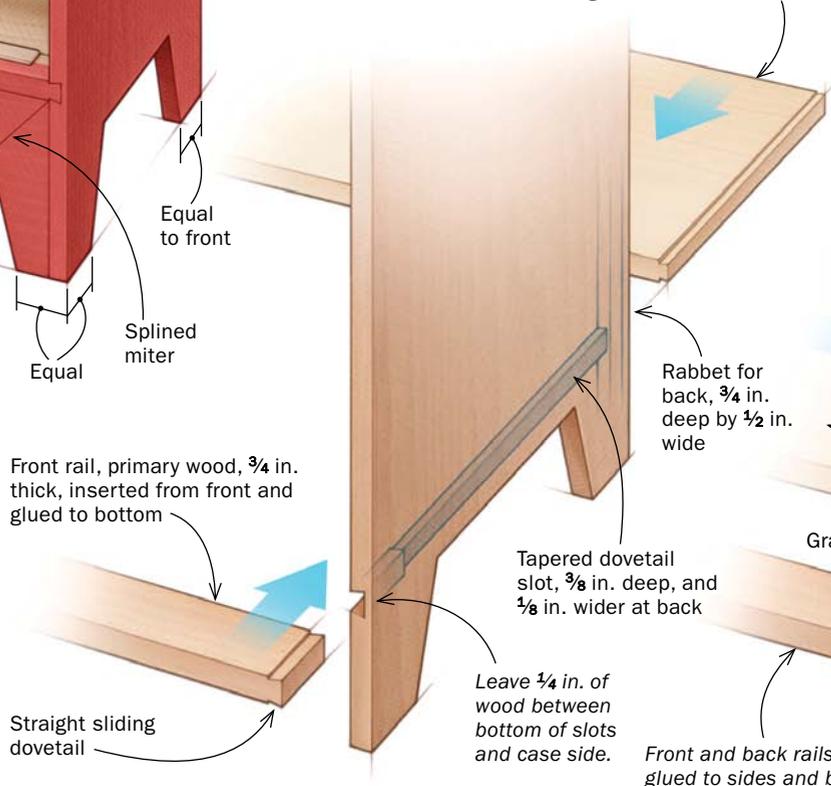


Sides that go to the floor

In this case, half-blind dovetails can't be used to attach the bottom. Curry recommends tapered sliding dovetails there. But dadoses will work, too.

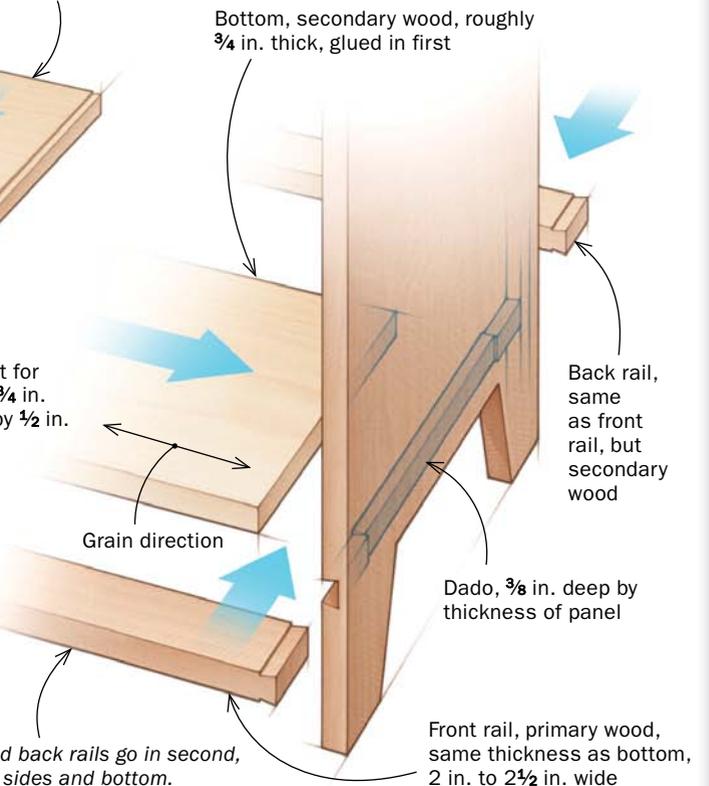
OPTION 1: TAPERED SLIDING DOVETAIL IS STRONGEST

Bottom, secondary wood, $\frac{3}{4}$ in. thick, glued in before front rail



OPTION 2: DADO IS A LITTLE EASIER

Bottom, secondary wood, roughly $\frac{3}{4}$ in. thick, glued in first



Make perfect pockets for drawers

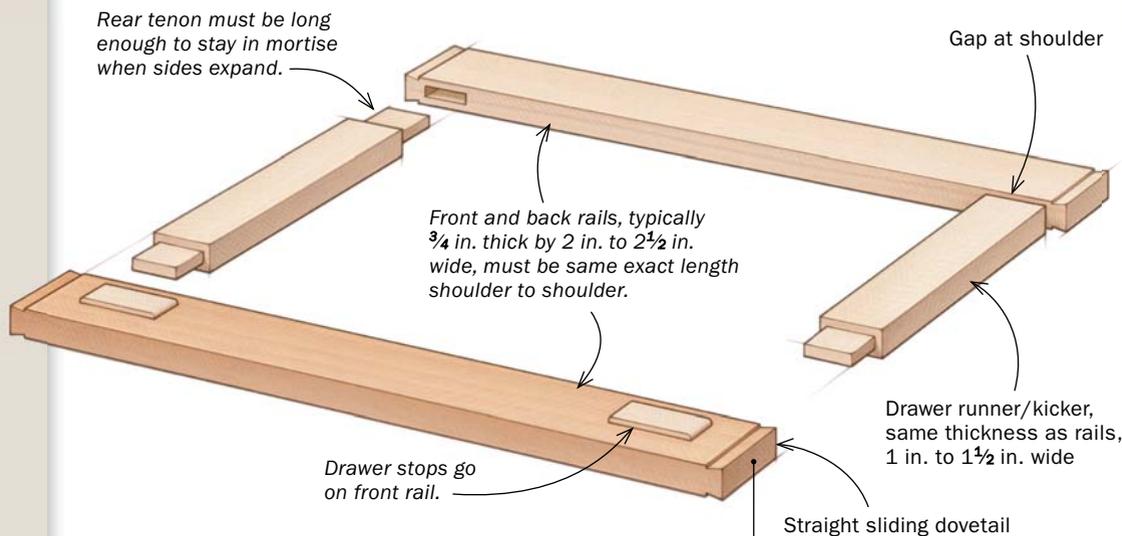
Start with a web frame

Although there are several other good ways to attach runners to a case side, the web frame is my favorite. It accommodates the shrinking and swelling of the case sides, while maintaining a flat, stable pocket for the drawers. The front and back rails keep the front and back dimensions of the opening exactly the same, which is critical for smooth drawer action. Web frames also make it easy to add runners in the center of the case, when you divide a drawer pocket for multiple drawers.

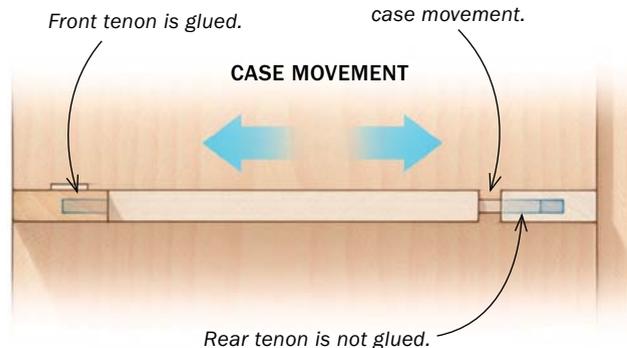
The strongest, most efficient way to attach the rails to the case is with sliding dovetails,

which make glue-up easy and maintain a strong grip on the sides. If you don't want to see the dovetails at the front of the case, you can also attach these rails with double mortise-and-tenons.

The runners must be attached to the rails in such a way as to allow the case sides to shrink and swell. This is done by leaving the rear tenon unglued, with extra room at its shoulder to allow the sides to contract. Also, the tenon must be long enough to stay in its mortise when the case expands. By the way, do not glue the runners to the case sides.

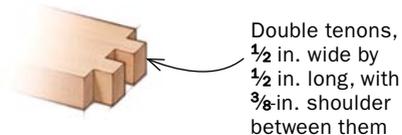


SIDE VIEW



DOUBLE TENON OPTION

To avoid the traditional dovetail look, front and rear rails can be tenoned into the case, but it changes the assembly sequence.



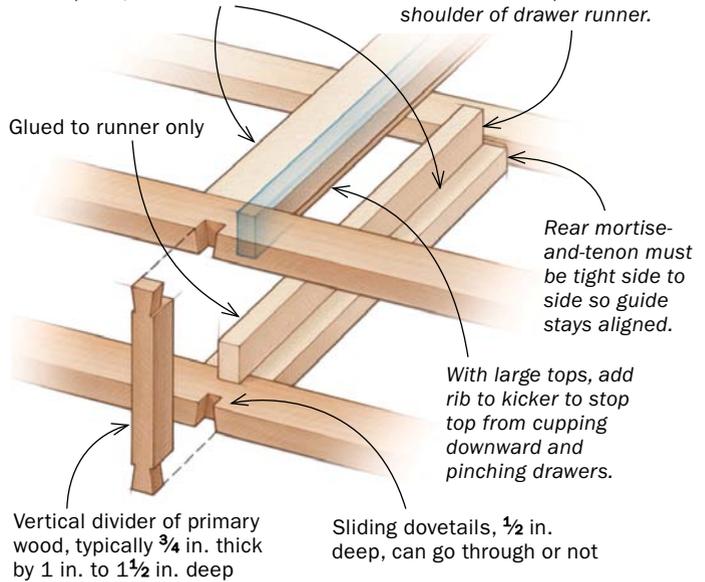
Add vertical dividers

Web frames make it easy to divide a drawer pocket to hold multiple drawers. You'll need an extra drawer runner in the web frame where the vertical divider will be placed. This runner is tenoned into the rails and needs to be wide enough to support both adjacent drawers. A kicker goes in the web frame just above, to keep the drawers from tipping downward. The kickers and runners are glued at the front only, with a gap at the rear.

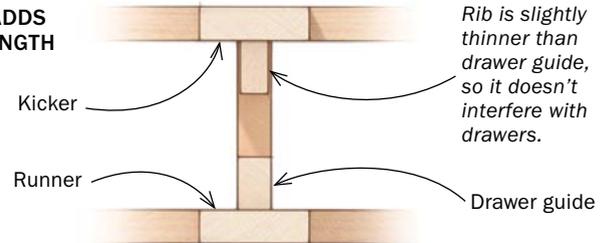
A vertical divider (or dividers, if dividing more than once) is dovetailed into the front rails of the web frames. If you are working in the top row of drawers, the subtop frame just acts like another web frame. A drawer guide is then glued to the center of the runner, aligned with the divider to keep the drawer on track.

Runner below and kicker above are the same thickness as the other frame parts, and 2½ in. wide.

Drawer guide, same thickness as divider by 1 in. tall, overlaps front rail but stops at rear shoulder of drawer runner.



RIB ADDS STRENGTH

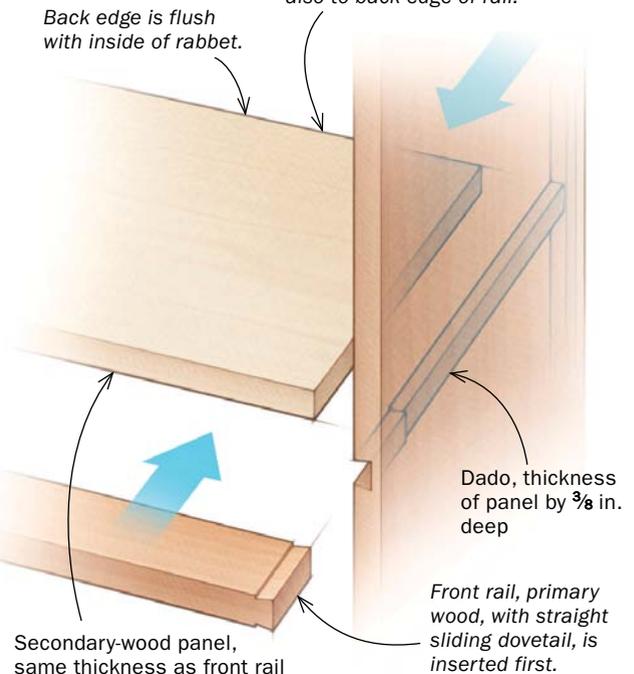


Panel prevents cupping in tall cases

Due to the lack of air circulation inside the case, it's inevitable that there will be uneven moisture exchange. That means that one side of the case parts will be drier than the other at times, causing cupping, which can make drawers stick in place. The top and bottom of the case, if handled as described on p. 32, will constrain that movement. And if the distance between them is roughly 24 in. or less, this will be enough to keep the sides flat. But for taller chests of drawers, you can still get some cupping near the center of the sides. The

web frames will hold the sides in place at the front and back, but the runners don't do much to restrain them in the middle, and it doesn't take much to pinch a well-fit drawer. So for chests with sides that are taller than roughly 2 ft., I recommend replacing one of the central web frames with a solid panel as shown.

Panel is slid into dado after front rail is dry, glued into dado and also to back edge of rail.



Three options for the back

Besides its obvious job—to keep dirt, dust, and critters out of the case—the back also helps to keep the case square. The sides of the case are rabbeted to hold the back while hiding it from view. At the top and bottom of a standard chest, simply leave the case parts short, so they align with the bottom of the rabbet.

If you don't mind the aesthetics of plywood, it makes for a very good back. Attach it with screws so it can be taken off when needed. But for a fine solid-wood case, I prefer a solid-wood back assembled with shiplapped boards. The simplest approach is to use wide boards made from a secondary wood, screwed into rabbets in the sides, and also to the top rail and case bottom. Unless I am making a period piece, I attach the back with brass screws (vs. cut nails).

The wider the boards, the more they help to keep the case square, which means wood stability is important again. That's why I like softer woods for my shiplapped backs, like pine and cedar, or soft hardwoods like butternut, catalpa, or poplar. These are stable, and have more give around the screws. Even so, I elongate the screw holes on wider boards.

If the back of the case will be seen, you can go with a frame-and-panel back. This is the best-looking option, especially when multiple panels are used and laid out in a pleasing design. The panels can be flat or raised, solid or plywood. Again, it's always good to choose a stable wood and/or quartersawn stock for these frame members, and again I use brass screws to attach the back.

If you're making this in the dry season, leave a slight gap between the frame and the rabbet to allow the stiles to swell a bit without blowing out the thin edge of the rabbet.

To avoid the piston effect that happens with well-fitted drawers, when pushing in one drawer tends to push out another, I often put a simple vent somewhere in the back of the case, usually near the bottom.

Plywood

Simple and strong, if not elegant

Rabbet matches plywood thickness.



BACK DETAIL

Case side

Back rail is flush with rabbet.

Back

Attach with brass screws.

Back rail

Shiplapped boards

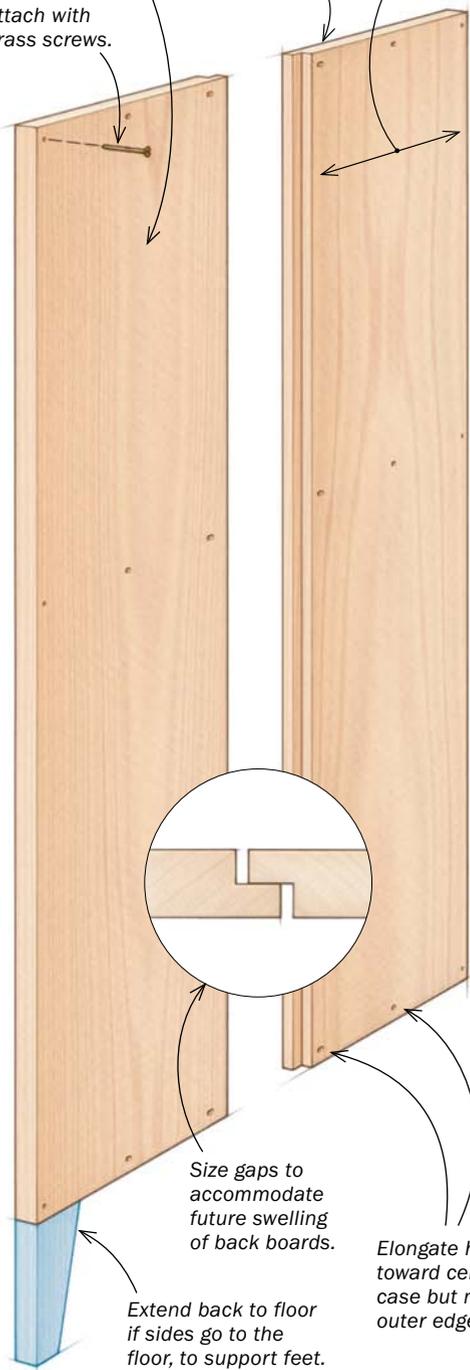
Historically correct, and easy to do

Grain can run vertically or horizontally, depending on proportions of the piece.

$\frac{3}{4}$ in. thick

Wider boards add more rigidity to case.

Attach with brass screws.

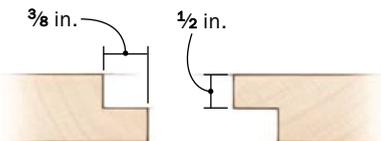


Size gaps to accommodate future swelling of back boards.

Extend back to floor if sides go to the floor, to support feet.

Elongate holes toward center of case but not at outer edges.

SHIPLAP DETAIL



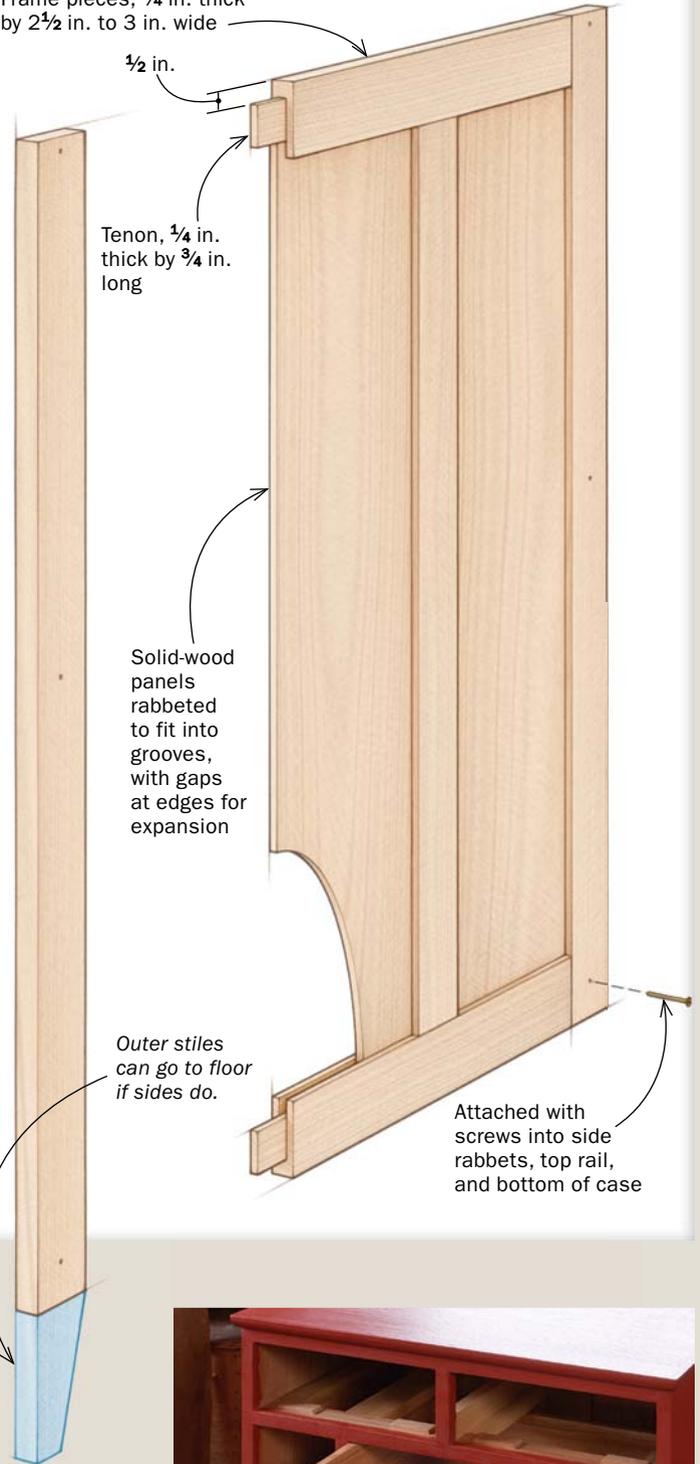
Frame-and-panel

Best combination of looks and strength

Frame pieces, $\frac{3}{4}$ in. thick by $2\frac{1}{2}$ in. to 3 in. wide

$\frac{1}{2}$ in.

Tenon, $\frac{1}{4}$ in. thick by $\frac{3}{4}$ in. long



Solid-wood panels rabbeted to fit into grooves, with gaps at edges for expansion

Outer stiles can go to floor if sides do.

Attached with screws into side rabbets, top rail, and bottom of case

COMING UP

See FWW #242 for Curry's companion article on making sweet-fitting drawers.

